

# SIPROTEC

## Distributed Busbar/ Breaker Failure Protection 7SS522 V4.7 7SS523 V3.3 7SS525 V3.3

Manual

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Preface

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# Preface

## Purpose of this Manual

This manual describes the functions, operation, installation, and commissioning of the complete SIPROTEC 7SS52 V4 distributed busbar and breaker failure protection system. In particular, you will find:

- Information on configuration of the system → Chapter 4, page 67
- Description of the system functions and their setting options → Chapter 5, page 113
- Information on control during operation → Chapter 6, page 239
- Information on installation and commissioning → Chapter 7, page 285
- Overview of technical data → Chapter 9, page 343
- and a compilation of the most important information for the experienced user → Chapter A.1, page 368

The SIPROTEC 4 System Description /1/ deals in a general way with the management, configuration, parameterization, operation, installation and commissioning of a SIPROTEC 4 system.

## Target Audience

Protection engineers, commissioners, persons who are involved in setting, testing and maintenance of protection, automation, and control devices, as well as operation personnel in electrical plants and power stations.

## Scope

This manual is valid for the complete SIPROTEC 7SS52 V4 distributed busbar and breaker failure protection system, firmware version 4.7. The system comprises the central unit 7SS522 V4.7 and the bay units 7SS523 V3.3 and 7SS525 V3.3. The complete system will be referred to in the manual as 7SS52 V4.

## Indication of Conformity



This product complies with the directive of the Council of the European Communities on the approximation of the laws of the Member States relating to electromagnetic compatibility (EMC Council Directive 2004/108/EC) and concerning electrical equipment for use within specified voltage limits (Low-voltage directive 2006/95 EC).

This conformity is proved by tests conducted by Siemens AG in accordance with the Council Directive in agreement with the generic standards EN 61000-6-2 and EN 61000-6-4 for EMC directive, and with the standard EN 60255-5 and EN 60255-27 for the low-voltage directive.

The device has been designed and produced for industrial use.

The product conforms with the international standards of IEC 60255 and the German standard VDE 0435.

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**Additional Standards**

IEEE Std C37.90 (see Chapter 9 "Technical Data")

**Additional Support**

For questions about the system, contact your Siemens sales partner.

**Support**

Our Customer Support Center provides a 24-hour service.

Siemens AG  
Customer Support Center  
Humboldtstrasse 59  
90459 Nuremberg  
Germany

E-mail: [support.energy@siemens.com](mailto:support.energy@siemens.com)

**Training Courses**

Inquiries regarding individual training courses should be addressed to our Training Center:

|                          |  |
|--------------------------|--|
| Siemens AG               | Phone: +49 (911) 433-7415  |
| Siemens Power Academy TD | Fax: +49 (911) 433-7929  |
| Humboldtstrasse 59       | E-mail: <a href="mailto:poweracademy@siemens.com">poweracademy@siemens.com</a>           |
| 90459 Nuremberg          | Internet: <a href="http://www.siemens.com/poweracademy">www.siemens.com/poweracademy</a> |
| Germany                  |  |

**Notes on Safety**

This document is not a complete index of all safety measures required for operation of the equipment (module, device). However, it comprises important information that must be noted for purposes of personal safety, as well as in order to avoid material damage. Information is highlighted and illustrated as follows according to the degree of danger:

**DANGER**

means that death or severe injury **will** result if the measures specified are not taken.

- Comply with all instructions, in order to avoid death or severe injuries.
- 

**WARNING**

means that death or severe injury **may** result if the measures specified are not taken.

- Comply with all instructions, in order to avoid death or severe injuries.
- 

**CAUTION**

means that or medium-severe or slight injuries **can** occur if the specified measures are not taken.

- Comply with all instructions, in order to avoid moderate or minor injuries.
- 

**NOTICE**

means that property damage **can** result if the measures specified are not taken.

- Comply with all instructions, in order to avoid property damage.
- 

**NOTE**

Important information about the product, product handling or a certain section of the documentation, which must be given particular attention.

---

**Qualified  
Electrical  
Engineering  
Personnel**

Only qualified electrical engineering personnel may commission and operate the equipment (module, device) described in this document. Qualified electrical engineering personnel in the sense of this manual are people who can demonstrate technical qualifications as electrical technicians. These persons may commission, isolate, ground and label devices, systems and circuits according to the standards of safety engineering.

**Proper Use**

The equipment (device, module) may be used only for such applications as set out in the catalogs and the technical description, and only in combination with third-party equipment recommended and approved by Siemens.


Problem-free and safe operation of the product depends on the following:

- Proper transport
- Proper storage, setup, and installation
- Proper operation and maintenance

When electrical equipment is operated, hazardous voltages are inevitably present in certain parts. If proper action is not taken, death, severe injury or property damage can result:

- The equipment must be grounded at the grounding terminal before any connections are made
- All circuit components connected to the power supply may be subject to dangerous voltage
- Hazardous voltages may be present in equipment even after the supply voltage has been disconnected (capacitors can still be charged)
- Operation of equipment with exposed current-transformer circuits is prohibited. Before disconnecting the equipment, ensure that the current-transformer circuits are short-circuited
- The limiting values stated in the document must not be exceeded. This must also be considered during testing and commissioning

**Used Symbols on Device**

| No. | Symbol  | Description  |
|-----|---|--|
| 1   |  | Direct current, IEC 60417-5031                                 |
| 2   |  | Alternating current, IEC 60417-5032                            |
| 3   |  | Direct and alternating current, IEC 60417-5033                 |
| 4   |  | Earth (ground) terminal, IEC 60417-5017                        |
| 5   |  | Protective conductor terminal, IEC 60417-5019                  |
| 6   |  | Caution, risk of electric shock                                |
| 7   |  | Caution, risk of danger, ISO 7000-0434                         |
| 8   |  | Protective Insulation, IEC 60417-5172, Safety Class II devices |
| 9   |  | Guideline 2002/96/EC for electrical and electronic devices     |
| 10  |  | Guideline for the Eurasian Market                              |

## Typographic and Symbol Conventions

The following text formats are used when literal information from the device or to the device appear in the text flow:

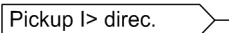
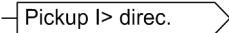
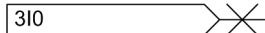
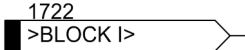
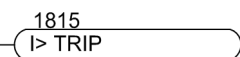
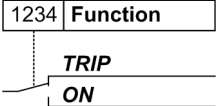
**Parameter names**, i.e. designators of configuration or function parameters, which may appear word-for-word in the display of the device or on the screen of a personal computer (with DIGSI), are marked in bold letters of a monospace type style.

**Parameter options**, i.e. possible settings of text parameters, which may appear word-for-word in the display of the device or on the screen of a personal computer (with DIGSI), are written in italic style, additionally. This applies also for options in menus.

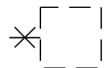

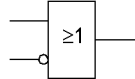
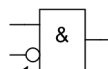
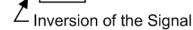
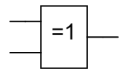
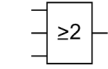
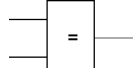
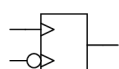

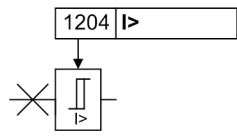
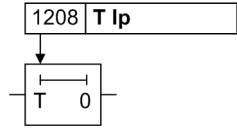
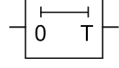
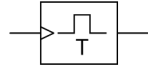
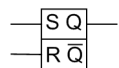




“Annunciations”, i.e. designators for information, which may be output by the relay or required from other devices or from the switch gear, are marked in a monospace type style in quotes.

Deviations may be permitted in drawings when the type of designator can be obviously derived from the illustration.

The following symbols are used in drawings:

|   |  |
|---|--|
|    | Device-internal logical input signal   |
|    | Device-internal logical output signal  |
|    | Internal input signal of an analog quantity  |
|  | External binary input signal with number<br>(binary input, input indication)           |
|  | External binary output signal with number<br>(device indication)                       |
|  | Example of a parameter switch designated with the<br>address and the possible settings |

Besides these, graphical symbols are used according to IEC 60 617–12 and IEC 60 617–13 or symbols derived from these standards. The most frequent symbols are the following:

|  |  |
|--|--|
| <br>     | <p>Reset input</p> <p>Input signal of an analogue quantity</p>   |
|   | <p>OR-combination of input values</p>  |
| <br>     | <p>AND-combination of input values</p>   |
|   | <p>Exclusive–OR gate: output is active, if only <b>one</b> of the inputs is active</p>                             |
|   | <p>2-of-3-combination of input values</p>  |
|   | <p>Coincidence: output is active if <b>both</b> inputs are active or inactive at the same time</p>                 |
|    | <p>Dynamic input signals (edge–triggered) above with positive, below with negative edge</p>                        |
|   | <p>Formation of one analogue output signal from a number of analogue input signals</p>                             |
|   | <p>Limit value stage with parameter address and parameter name</p>   |
|   | <p>Timer (pickup delay T adjustable) with parameter address and parameter name</p>                                 |
|   | <p>Timer (dropout delay T, non-adjustable)</p>   |
|   | <p>Edge-controlled time stage with effective time T</p>  |
|   | <p>Static memory (RS-flipflop) with setting input (S), resetting input (R), output (Q) and inverted output (Q)</p> |
| <br> | <p>Circuit breaker (open and closed)</p>   |
| <br> | <p>Disconnecter (open and closed)</p>  |



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# Introduction

# 1

This chapter introduces the SIPROTEC 7SS52 V4 distributed busbar and breaker failure protection. An overview of the device is presented in its application, characteristics, and scope of functions.

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## 1.1 Overall Operation

The SIPROTEC 7SS52 V4 distributed busbar and breaker failure protection consists of compact bay units which are connected to the central unit by fiber-optic cables. Figure 1-1, page 23 shows the basic structure of the protection system.

All tasks from acquisition of the measured values up to the commands to the circuit breakers are exclusively processed in a digital manner.

In the bay units the feeder or coupler currents are measured time-synchronized, digitalized, preprocessed and transmitted to the central unit via the fast serial port. The input nominal current can be 1 or 5 A depending on the main current transformer design. A full galvanic and low-capacitive isolation of the measuring inputs is provided by transducers. Suppression of disturbances is achieved by filters which are optimized for the measured value processing with regard to bandwidth and processing speed.

### Bay units

The bay units can be parameterized and operated either directly or from the central unit. Chapter 6.1, page 240 summarizes the operator options during operation.

The bay units capture the disconnecter positions and bay-related binary signals, process functions of the breaker failure protection and fulfil auto diagnosis tasks.

Heavy-duty command relays take the protection system's trip commands directly to the circuit breakers. Marshallable alarm relays and indicators (LEDs, LC display, DIGSI communication software) allow event indication. In addition operational measured values are displayed.

For the marshalling of disconnecter positions, command relays, alarm relays and allocatable binary inputs the DIGSI communication software is used.

Optionally, the bay units can be equipped with a backup protection function (definite-time, inverse-time) including breaker failure protection.

### Central unit

The central unit reads in time-synchronized measured currents from the connected bay units and processes them together with binary information from the protection functions (differential protection, breaker failure protection). The central unit transmits the results of the calculations cyclically to the bay units, which perform logical combinations of the results.

Freely marshallable alarm relays and LED displays are provided for signalling. They are marshalled with the DIGSI communication software.

The central unit manages all configuration and setting data for the busbar and breaker failure protection functions. Communication is possible via the serial port by means of a PC utilizing a current version of the DIGSI communication software. With DIGSI V4.6 the central unit - but not the bay unit - can also be operated via IEC 61850 with the optional EN100 module. Indications, parameters and measured values are visualized in the display or in DIGSI. In addition the program can read out fault data from the protection device and analyze it.

The central unit and bay units contain power supply modules for a reliable power supply on different voltage ranges.

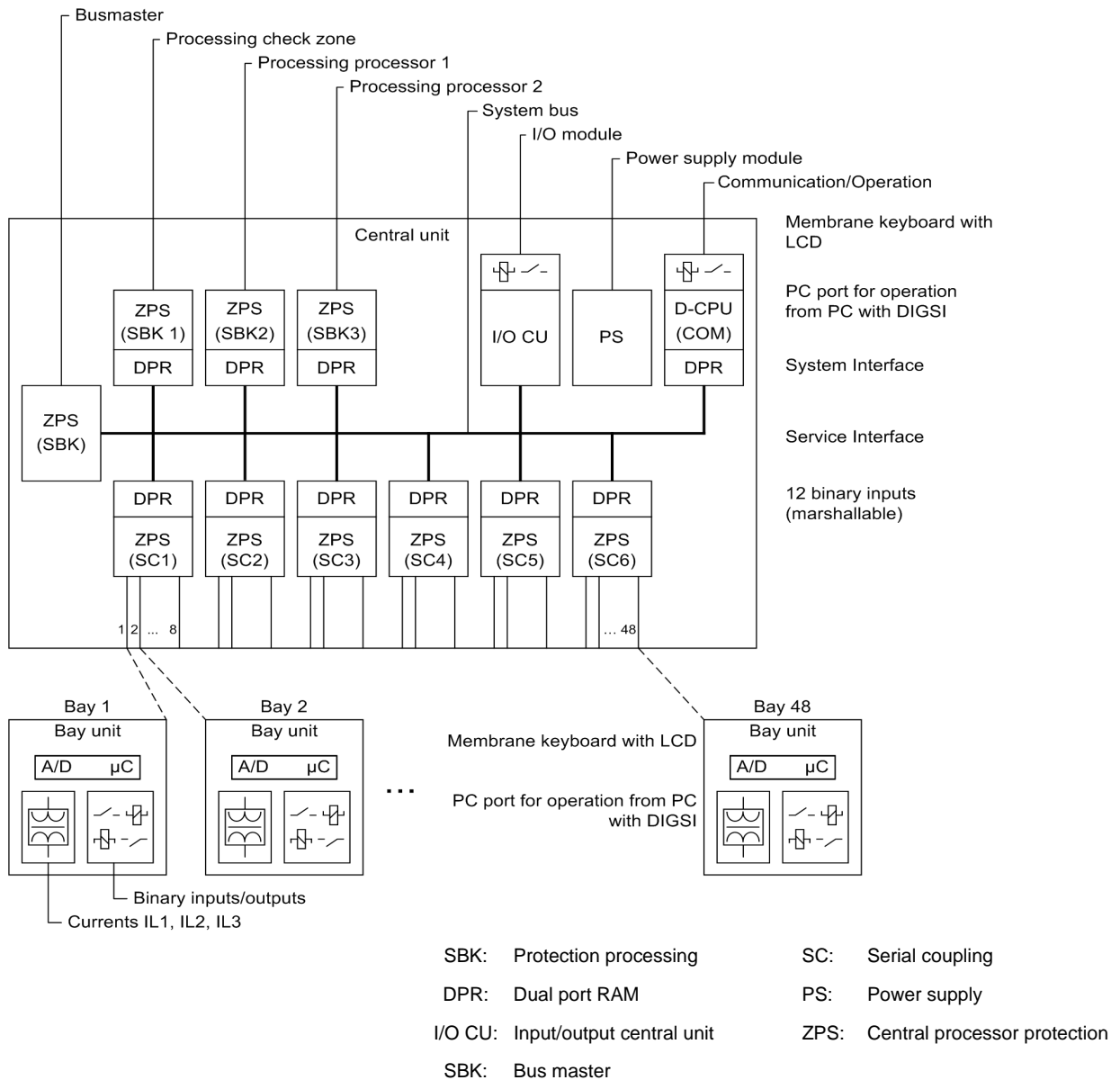


Figure 1-1 General view of the configuration of the protection system

## 1.2 Applications

### Application

The SIPROTEC 7SS52 V4 distributed busbar and breaker failure protection is a selective, reliable and fast protection for busbar short-circuits and circuit-breaker failures in medium-voltage, high-voltage and extra high-voltage switching stations. It is suitable for almost all busbar configurations.

The busbar protection uses a phase-selective measuring principle.

The protection system consists of a central unit (CU) and up to 48 bay units (BU) connected by fiber-optic (FO) cables. The latter can be located in the vicinity of the bays (distributed) but also together with the CU in cubicles (centralized).

### Use and scope of functions

The protection can be used with all types of switchgear with either conventional or linearized CTs.

The modular design facilitates extensions or modifications of the protection system in conformity with the switchgear design.

The 7SS52 V4 is designed for 12 selective bus zones and 12 bus coupler (auxiliary bus) sections. These are sections which serve exclusively for coupling of the bus zones. They do not have any feeders. The busbar configuration can include up to 48 sectionalizing disconnectors and 16 bus couplers with one bay unit or 8 bus couplers with two bay units.

By virtue of the universal disconnector replica, the SIPROTEC 7SS52 V4 distributed busbar and breaker failure protection can be matched with different busbar configurations in the design phase.

Compensation of different current transformer ratios is achieved by parameter setting. Interposing current transformers are thus no more required.

A busbar short-circuit is detected by evaluating the differential current and the stabilizing current. Appropriate measures ensure correct performance even for extreme CT saturation (requested current transmission time  $\geq 2$  ms for stability in the case of external faults and  $\geq 3$  ms for tripping).

The integrated circuit breaker failure protection (CBF) can be operated in five modes, selectable per bay (see Chapter 5.3.5.2, page 146):

- I $\gt$  query (1-stage CBF)
- TRIP repetition with overcurrent detection I $\gt$  (2-stage CBF)
- Unbalancing (1-stage CBF)
- TRIP repetition with following unbalancing (2-stage CBF)
- Single-pole or three-pole start by external CBF and tripping via the disconnector replica

In addition, the integrated circuit breaker failure protection provides two operating modes that can be set in parallel to the other five modes (see Chapter 5.3.5.2, page 146):

- Low-current operating mode without/with TRIP repetition
- Pulse mode



The overcurrent-time protection is a back-up protection function of the bay unit and includes the following functions (see Chapter 5.16, page 216):

- Phase-selective high-set stage ( $I_{>>}$ )
- High-set stage for the earth current ( $IE_{>>}$ )
- Phase-selective overcurrent stage with definite time or inverse time characteristic ( $I_{>}$  /  $I_p$ )
- Overcurrent stage for the earth current with definite time or inverse time characteristic ( $IE_{>}$  /  $IE_p$ )

Back-up protection function, can work without the central unit

Separate circuit breaker failure protection

### 1.3 Features

- Powerful multiprocessor system
- Completely digital measured value processing and control, from the acquisition and digitizing of measured values, recognition of the disconnecter status and processing of the CB failure protection signals up to the trip decisions for the circuit-breaker
- Graphical station planning with the DIGSI communication software
- Easy station configuration with the DIGSI communication software
- Easy centralized operation of bay units from the central unit using DIGSI, or local menu-guided operation via integrated keypad and display panel
- Battery-buffered storage of fault events as well as instantaneous values for fault recording
- Complete galvanic and disturbance-free isolation between the internal processing circuits of central unit and bay units and the measuring and auxiliary supply circuits of the station by virtue of screened measuring transducers, binary input and output modules and DC converters
- Disturbance-free and fast data transmission from and to the bay units by fiber-optic links
- Complete scope of functions for the selective protection of multiple busbar systems
- Central administration of the disconnecter states
- Continuous monitoring of measured values as well as of hardware and software of the unit
- Comprehensive self-monitoring provides for fast signaling of unit failures
- Communication via electrical or optical interfaces and use of the DIGSI communication software for planning, parameterization and for indication and fault record analysis
- Communication check via Web browser
- Control center link of the central unit as per IEC 60870-5-103 and IEC 61850

- Output of indications to
  - Control center
  - LEDs
  - Binary outputs of the central unit
- Commissioning support by measuring and display functions, and output of indications to a control center as well as to LEDs and outputs of the central unit.

**Busbar protection**

The digital busbar protection contains the following functions:

- Evaluation of the differential current in conjunction with through-current stabilisation (Figure 1-2, page 27)
- Trip decision based on 3 independent measurements. 2 measurements are based on busbar configuration, and the third measurement considers all busbar sections independent of the disconnecter replica (check zone).
- Fast tripping (typical trip time 15 ms)
- Busbar protection with up to 12 bus zones (BZ), 12 bus coupler (auxiliary bus) sections (AB) and up to 48 bay units
- Protection of systems with up to quintuple busbars (including transfer busbars)
- Stabilisation against spurious tripping in case of external faults and CT saturation
- Zone-selective and phase-selective blocking of the busbar protection by the differential current monitor
- Selective blocking of the bus section in case of
  - Disconnector faults
  - Bay faults (bay unit, FO cable)
  - Measured value error
  - Response of the zero crossing supervision
- Characteristics for check zone and bus-selective zones can be set independently from each other
  - Normal pick-up characteristic (Figure 1-2, page 27)
  - Sensitive characteristic (Figure 1-3, page 27)
- Matching to different CT ratios without interposing matching transformers
- Selective clearance of short-circuits even on the bypass bus with signal transmission to the remote end
- Detection and disconnection of short-circuits in the coupler bay between current transformers and circuit-breaker based on current measurement and selective unbalance
- Detection and disconnection of short-circuits between current transformers and circuit-breaker of a line by end fault protection

- Circuit breaker failure protection (CBF), selectable per bay, for low-current faults in the variants
  - $I >$  query (1-stage CBF)
  - TRIP repetition with overcurrent detection  $I >$  (2-stage CBF)
  - Unbalancing (1-stage CBF)
  - TRIP repetition with following unbalancing (2-stage CBF)
  - Single-pole or three-pole start by external breaker failure protection and tripping via the disconnecter replica
- Direct operation of the circuit breaker by the bay unit
- Direct tripping of busbar sections via binary inputs of the central unit

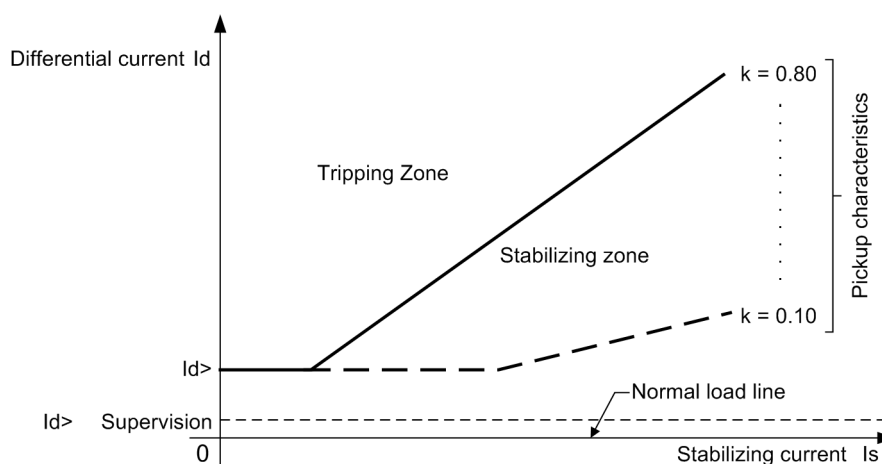


Figure 1-2 Pick-up characteristics of the busbar and breaker failure protection (unbalancing)

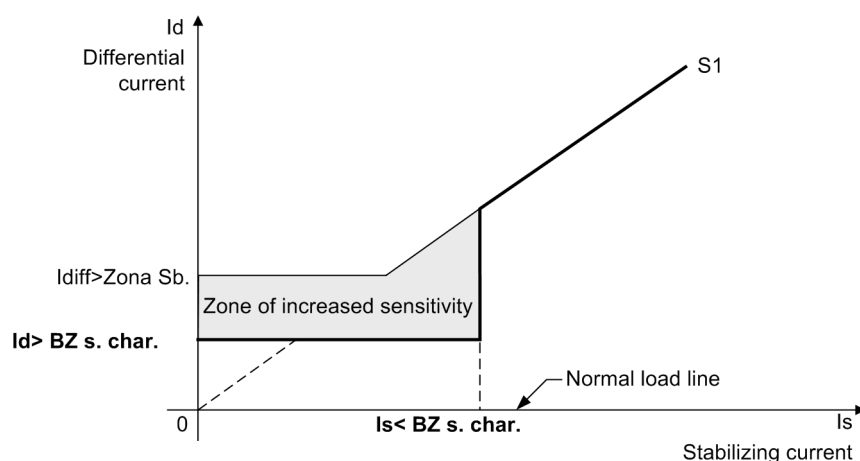


Figure 1-3 Sensitive characteristic

## Breaker failure protection

The integrated circuit breaker failure protection (CBF) contains the following functions:

- In case of a busbar short-circuit, a breaker failure is detected by comparison of current thresholds.
- In all operating modes of the circuit breaker failure protection, a bay-selective command is output by the bay units to trip the circuit breaker at the remote end (transfer trip command).
- The external breaker failure protection can be started for one phase or for three phases.
- The breaker failure protection can be started on 1 channel or, for extra reliability, on 2 channels. Both settings can be combined with a monitoring feature.
- Reduced response times in case of a circuit breaker malfunction
- Query of the circuit breaker position in case of low-current faults
- The circuit breaker failure protection function can be deactivated for test purposes.

The following modes are available for the circuit breaker failure protection:

- **I> query:**  
After initiation by a TRIP command from the feeder protection, the 7SS52 V4 checks the feeder current. If the measured current stays above the set threshold after a set time has elapsed, the 7SS52 V4 issues zone-selective TRIP commands in the bays considering the disconnecter replica.
- **TRIP repetition with subsequent I> query:**  
When initiated by a TRIP command from the feeder protection, the 7SS52 V4 issues a second TRIP command to the circuit breaker of the initiating feeder after a set time delay. In case this second TRIP command is also unsuccessful, tripping as per mode I>query is effected.
- **Unbalancing:**  
After initiation by a TRIP command from the feeder protection, the 7SS52 V4 system checks the feeder current. If the measured current stays above the set threshold after a set time has elapsed, the polarity of the current in this feeder is inverted by the 7SS52 V4 (unbalancing).
- **TRIP repetition with subsequent unbalancing:**  
When initiated by a TRIP command from the feeder protection, the 7SS52 V4 issues a second TRIP command to the circuit breaker of the initiating feeder after a set time delay. In case this second TRIP command is also unsuccessful, tripping as per mode Unbalancing is effected.
- **TRIP by external CBF:**  
Where a separate circuit breaker failure protection is provided, the 7SS52 V4 can generate zone-selective feeder trip commands utilizing the integrated disconnecter replica.
- **TRIP repetition with subsequent unbalancing with pulse trigger or I>query:**  
This mode should be used when the CBF is triggered by the remote station. The function is triggered by a trip command from the feeder protection at the remote feeder terminal. The further proceeding is described in the modes TRIP repetition with subsequent unbalancing and I>query.
- **Low-current CBF:**  
This mode outputs a TRIP command even in the case of low-current faults (e.g. tripping by Buchholz protection). After a settable time the circuit breaker position is queried. A TRIP repetition also takes place with a low-current operating mode.

- End fault protection** This mode detects short-circuits between the current transformers and the circuit breaker and generates the necessary commands to disconnect the faulted line.
- Overcurrent protection** The overcurrent protection of the bay unit is independent of the busbar protection function and of the central unit. The overcurrent protection comprises the following functions (Chapter 5.16, page 216):
- High-set stage I>> with separate fault detection in each phase
  - High-set stage IE>>
  - Definite time overcurrent stage I> with separate fault detection in each phase OR
  - Inverse time overcurrent stage Ip with separate fault detection in each phase
  - Definite time earth current stage IE> OR
  - Inverse time earth current stage IEP
  - Setting of different current/time characteristics for phase and earth currents is possible.
  - With inverse time O/C protection: three standardized characteristics are selectable for phase currents and earth currents.
  - The CBF function remains active even in case of central unit failure or with the bay unit out of service.
- Disconnecter replica** The disconnector replica is common for the busbar protection and the circuit-breaker failure protection function. The disconnector replica comprises the following functions:
- Management of up to 48 bay units, 12 bus zones and 12 bus coupler sections:  
The protection system is suitable for configurations up to quintuple busbars. Combibus operation is possible. Up to 16 couplers can be configured with one bay unit, and up to 8 couplers with 2 bay units. These can be bus couplers or/and sectionalizing disconnectors.
  - Disconnector running time supervision
  - Integrated storage of disconnector status on loss of DC supply:  
The disconnector replica allows to allocate to the disconnectors their positions prior to the DC supply failure. It is also possible to allocate to all disconnectors of this feeder the position CLOSED. The allocation of NOT OPEN = CLOSED eliminates the necessity of calibrated disconnector auxiliary contacts. Also, it ensures stable functioning of the protection even in case of a wire break.
  - Graphical planning of the station configuration with the DIGSI communication software
  - Visualization of disconnector positions by LEDs on the bay units
- Trip output / Trip reset** The signal processing is distinguished by the following characteristics:
- Feeder-selective TRIP command by the bay units
  - Feeder-selective selectable overcurrent release of the TRIP command
  - Extension of busbar TRIP signal for set time
  - Current-controlled reset of TRIP signal

|                                       |  |
|---------------------------------------|--|
| <b>Fault recording</b>                | <p>During a fault event, the instantaneous values of the measured values are stored at intervals of 1 ms at 50 Hz and 0.83 ms at 60 Hz respectively in a buffer of the central unit or of the bay units. The central unit calculates from the instantaneous values the differential and restraint currents of each phase for all busbar sections and the check zone. The bay units calculate from the instantaneous values the currents and the binary tracks.</p> <p>After starting the fault recording, the fault data are stored in a range from max. 500 ms before the TRIP command to max. 500 ms after it. The central units can store up to 8 faults with a maximum of 80 fault events each, and each bay unit can store 8 faults with a maximum of 100 fault events each. Where more events are generated, the oldest are overwritten in the order of their generation. Fault recording is started, for instance, by a busbar short circuit, by a binary input or through DIGSI.</p> <p>The fault data can be read out to a PC and evaluated by the DIGSI communication software. The fault record data buffer SIPROTEC 7SS52 V4 is protected against data loss in case of power failures.</p> |
| <b>Relays, LEDs and binary inputs</b> | <p>All inputs and outputs are freely marshallable.</p> <p>Each LED or relay can be allocated to more than one event; likewise, events can be marshalled more than one LED or relay.</p>  |
| <b>of the central unit</b>            | <p>12 binary inputs are available to control the functions of the central unit (e.g. clock synchronization, LED reset).</p> <p>16 alarm relays and 32 LED in the central unit can be allocated to various functions for user-specific output and indication.</p>   |
| <b>of the bay unit</b>                | <p>The bay units are the interface link to the station.</p> <p>Each bay unit 7SS523 has</p> <ul style="list-style-type: none"><li>• 4 command relays with each 2 NO contacts</li><li>• 1 command relay with 1 NO contact</li><li>• 1 command relay with 1 NO contact</li><li>• 1 alarm relay with 2 NC contacts (device failure, not marshallable)</li></ul> <p>The functional allocation of the outputs can be marshalled with the DIGSI communication software.</p> <p>20 freely marshallable binary inputs are available for control functions or state recognition.</p> <p>16 binary inputs can be marshalled to various functions, such as recognition of the disconnector states.</p>  |

Each bay unit 7SS525 has

- 3 command relays with each 2 NO contacts
- 2 command relay with 1 NO contact
- 1 command relay with 1 NO contact
- 1 alarm relay with 1 NC contact (device failure, not marshallable)

The functional allocation of the outputs can be marshalled with the DIGSI communication software.

10 freely marshallable binary inputs are available for control functions or state recognition.

1 LED is freely allocable.

### Measuring and testing functions

The SIPROTEC 7SS52 V4 distributed busbar and circuit breaker failure provides a variety of measuring and testing functions to assist during commissioning and maintenance. These functions are:

- Display of the feeder currents per phase in each bay unit and in the central unit. In addition the data are available at the serial port for visualization in the DIGSI software.
- Phase-selective and zone-selective calculation of differential and stabilizing currents. Display in the DIGSI software through the serial PC port. In addition, the data are visualized per phase, per bus zone, and for the checkzone, in the display of the central unit. The display of the bay unit shows only the data for the check zone.
- Monitoring of the zone-selective and phase-selective differential currents with zone-selective blocking or alarm output
- Monitoring of the zone-selective and phase-selective differential currents with zone-selective blocking or alarm output
- Phase-selective trip test including control of the feeder circuit breaker (through DIGSI, bay unit display or binary input)
- Bay out of service  
Removal of one bay from the busbar protection processing via central unit or bay unit, e.g during maintenance works.
- Revision mode  
The disconnecter replica of one bay is retained by the central and the bay unit with the protection function remaining active.
- Cyclic test of measured value acquisition, measured value processing and trip circuit test including the coils of the command relays
- Manual blocking  
Blocking of the circuit breaker failure protection, the XMZ and the backup breaker failure protection and of the TRIP commands.

|                                     |   |
|-------------------------------------|---|
| <b>Event buffer in central unit</b> | <p>The SIPROTEC 7SS52 V4 distributed busbar and circuit breaker failure protection supplies battery-buffered data for the analysis of faults as well as for operational events.</p> <p>Up to 200 operational events and 80 fault events with real-time information are stored in a circulating buffer in the central unit.</p> <p>Operational events include switching operations, protection status indications, disconnecter status irregularities and monitoring functions.</p> <p>Fault events include trip signals in the event of busbar short-circuits, circuit-breaker failure and transfer trip.</p>   |
| <b>Event buffer in bay unit</b>     | <p>Up to 50 operational events and 100 fault events per fault.</p>  |
| <b>Self monitoring</b>              | <p>Hardware and software are continuously monitored; irregularities are recognized instantly and annunciated.</p> <p>A high degree of security and availability is achieved by the continuous monitoring of:</p> <ul style="list-style-type: none"><li>• Disconnecter statuses</li><li>• Trip circuits</li><li>• Measured current circuits</li><li>• Measured value transformations</li><li>• Supply voltages</li><li>• Program memories</li><li>• Program processing</li><li>• Discharge degree of battery (central unit and bay unit)</li></ul> <p>For diagnosis purposes in the event of device failures, a battery-buffered dedicated data memory is available in the central unit.</p> |
| <b>Clock control</b>                | <ul style="list-style-type: none"><li>• Central unit<ul style="list-style-type: none"><li>– Battery-buffered time with 1 ms resolution</li><li>– Time set by entry of current data</li><li>– Synchronization of the central unit via binary input or system port (synchronization signal DCF77, IRIG B by satellite receiver)</li><li>– IEC 60870-5-103 and IEC 61850</li></ul></li><li>• Bay unit<ul style="list-style-type: none"><li>– Battery-buffered time with 1 ms resolution</li><li>– Clock synchronization by central unit in intervals of 1 minute</li><li>– Local clock setting possible as well</li></ul></li></ul>  |
| <b>Battery-buffered functions</b>   | <p>The central unit and the bay units are equipped with buffer batteries to ensure that LED states, date and time, operational and fault events as well as fault records are maintained in case of an auxiliary power failure.</p>  |



# Design and Connection System

# 2

This chapter describes the design of the central unit and the bay units that constitute the SIPROTEC 7SS52 V4 distributed busbar and breaker failure protection. It explains what housing versions are possible and what connection methods are used.

|     |                   |    |
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## 2.0 General

The SIPROTEC 7SS52 V4 distributed busbar and breaker failure protection is comprised of:

- Central unit
- Bay units
- Data links (fiber-optic cables)

Prefabricated fiber optic cables with double-end ST plug connectors are used for the data exchange.

They can be delivered with specific anti-rodent protection for outdoor installation. Indoor cables may be used for centralized configuration of the bay units.

### **Power supply**

The modules in the bay unit and central unit are powered by powerful power supply units. For the range required for your specific input voltage, please refer to the selection and ordering data in the Table A-1, page 368.

### **Bonding power failure**

Short dips or failures of the supply voltage up to 50 ms, which may occur due to short-circuits in the DC supply system of the station, are compensated by a DC storage capacitor (for nominal voltages  $\geq 60$  V).

## 2.1 Central Unit

The central unit is installed in an ES902 C (SIPAC) subrack.

On account of the modular design, different variants and degrees of expansion can be coordinated with the station configuration.

### 2.1.1 Front View

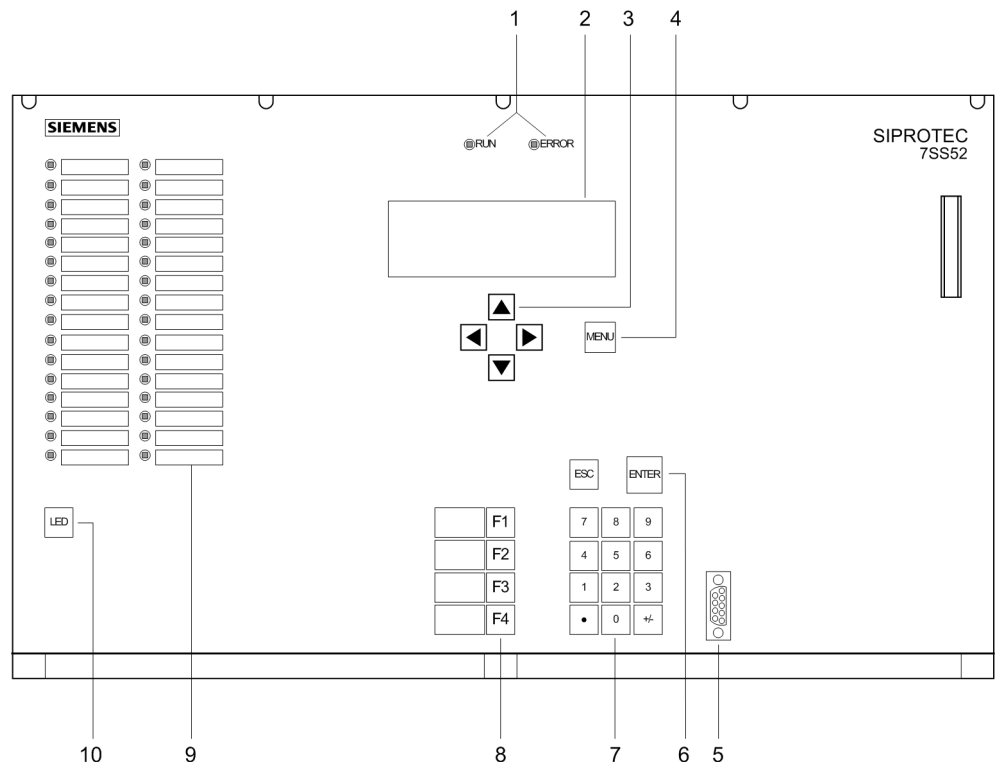


Figure 2-1 Front view of the central unit

- 1 LEDs for the indication of operating states
- 2 LCD for textual display of process and device information
- 3 Navigation keys for moving through the operating tree
- 4 MENU key for calling up the main menu
- 5 9-pole female sub D connector for connecting a PC running DIGSI
- 6 ENTER for confirmation of changes or for acknowledging information displayed in the LCD  
ESC key to move up one level
- 7 Numeric keypad for entering numeric values

- 8 Function keys:  
 F1 Alarm list  
 F2 Operational events  
 F3 Measured values  
 F4 Last fault
- 9 freely parameterizable LEDs for display of process or device information. Next to the LEDs, there is a labeling strip for labeling of the function of each LED.
- 10 LED key for testing and resetting the LEDs

### 2.1.2 Modules and Submodules

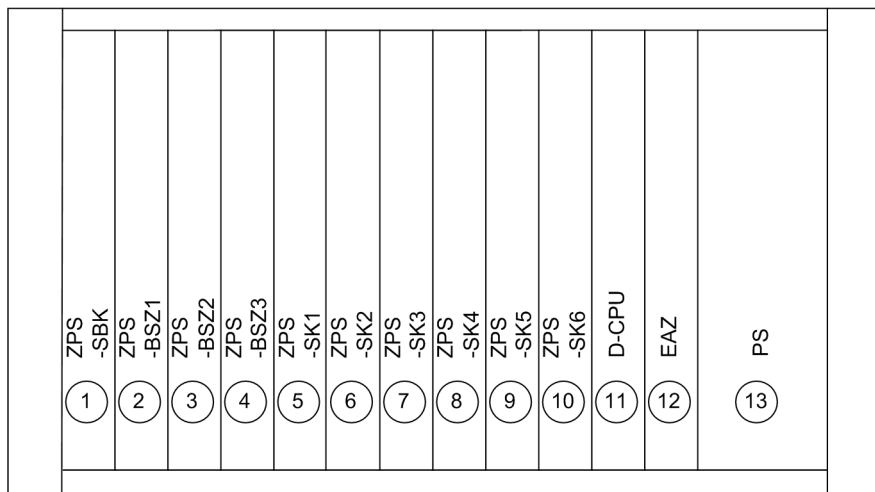


Figure 2-2 Module arrangement in the central unit

**Power supply module (SV)**

The power supply (SV) has a width of 2 or 4 standard mounting spaces. Each of the other units has a width of 2 standard mounting spaces.

**Communication module (D-CPU)**

The communication module (D-CPU) is used for communication between the central unit and the DIGSI software. It also offers a control center interface, a service port and 5 binary inputs. An electrical and optical EN100 module for the communication via IEC 61850 is optionally available.

**Input/output module (EAZ)**

The I/O module (EAZ) comprises 16 alarm relays.

---

|                                 |   |
|---------------------------------|---|
| <b>Processor modules (ZPS)</b>  | <p>The 4 processor modules (ZPS-SBK; ZPS-BSZ1 to ZPS-BSZ3) provide the protection functions.</p> <p>Another 1 to 6 modules (depending on the system configuration) are used for communication with the interfaces (ZPS-SK1 to ZPS-SK6) to ensure the data exchange with the bay units. Each module can exchange data with up to 8 bay units.</p> <p>There are different ZPS-modules (ZPS and ZPS2). The ZPS2-module may only be used with a firmware V4.61 or higher. The mixed use (ZPS/ZPS2-modules) is allowed. From release 7SS522... /HH and higher the ZPS2-module is supplied generally.</p> |
| <b>Fiber-optic module (LMZ)</b> | <p>For each ZPS-SK-module there is an electrical/optical signal converter module (LMZ, with 8 optical interfaces each), fitted on the device's rear side. The receiver and transmitter connection points per bay unit are consecutively numbered on the central unit's rear plate.</p>  |
| <b>Terminal blocks</b>          | <p>On the rear side of the central unit, terminal blocks are provided for the external electrical connection of the power supply module (SV), the I/O module (EAZ) and the communication module (D-CPU). For each electrical connection point, there is one screw-type and one snap-in connector for the station wiring. The terminal blocks are identified according to their position in a coordinate system. The connections inside a block are numbered from left to right, see the example in Figure 2-6, page 42.</p>   |

### 2.1.3 Design

|                                |  |
|--------------------------------|--|
| <b>Subrack ES902 C (SIPAC)</b> | <p>The subrack ES902 C (SIPAC) consists of an aluminium frame covered from all sides by metal plates. The front and the rear plate are hinged and can be opened downwards for easy servicing.</p> <p>The dimensions of the housing can be in Figure 9-2, page 362.</p> |
|--------------------------------|--|

## 2.2 Bay Unit

The bay units are available in a 7XP20 housing for panel flush mounting and cubicle mounting, or in a housing for panel surface mounting for bay unit 7SS523.

### 2.2.1 Front View

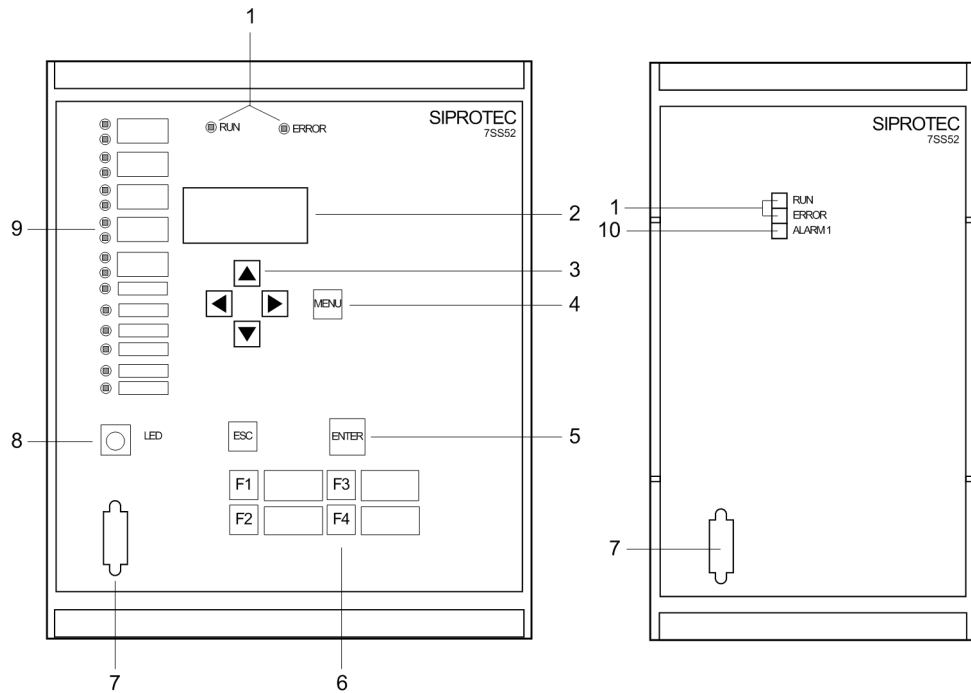


Figure 2-3 Front view of the bay unit 7SS523 and 7SS525

- 1 LEDs for the indication of operating states
- 2 LCD for textual display of process and device information
- 3 Navigation keys for moving through the operating tree
- 4 MENU key: no function
- 5 ENTER key:  
for confirmation of inputs,  
for entering the next level, or  
for switching between ordering code (MLFB) and operational measured values  
ESC key to move up one level
- 6 Function keys:  
F1 Direct access to the operating tree for changing the mode  
F2 Starts the circuit breaker test  
F3: Direct access to the operating tree for switching the revision function  
F4: Transformer polarity reversal
- 7 9-pole female sub D connector for connecting a PC running DIGSI

- 8 LED key for testing and resetting the LEDs and for display of operational measured values in 4-line mode
- 9 Freely parameterizable LEDs for display of process or device information. Next to the LEDs, there is a labeling strip for labeling of the function of each LED.
- 10 Freely parameterizable LED.

## 2.2.2 Modules and Submodules

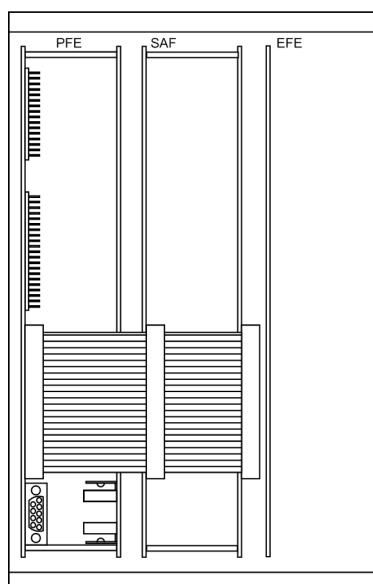


Figure 2-4 Module arrangement in the bay unit 7SS523

|                                     |  |
|-------------------------------------|--|
| <b>PFE module</b>                   | In the PFE module the firmware is located and processed; it also contains the current transformers and the measured value acquisition function.  |
| <b>SAF module</b>                   | The SAF module contains the power supply and the alarm and trip relays.  |
| <b>EFE module</b>                   | The EFE contains the binary inputs and receives indications (e.g. from disconnectors and circuit breakers).  |
| <b>Heavy-duty current terminals</b> | The heavy-duty current terminals automatically short-circuit the current transformer when the module is withdrawn.   |
| <b>Plug-in modules</b>              | The plug-in modules are identified according to their position in a coordinate system. The connections inside a module are numbered consecutively from left to right (viewed from the rear), see example in Figure 2-9, page 44. |

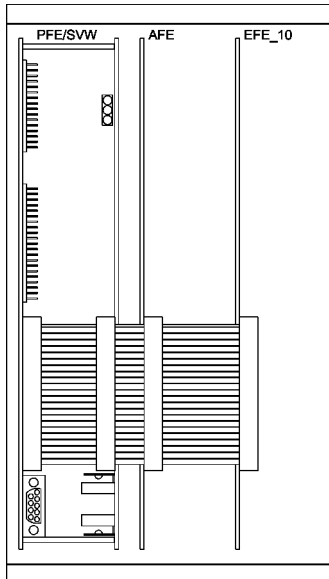


Figure 2-5 Module arrangement in the bay unit 7SS525

- PFE/SVW module**      In the PFE/SVW module the firmware is located and processed; it also contains the power supply, the current transformers and the measured value acquisition function.
  
- AFE module**              The AFE module contains the alarm and trip relays.
  
- EFE\_10 module**          The EFE\_10 contains the binary inputs and receives indications (e.g. from disconnectors and circuit breakers).
  
- Heavy-duty current terminals**      The heavy-duty current terminals automatically short-circuit the current transformer when the module is withdrawn.
  
- Plug-in modules**          The plug-in modules are identified according to their position in a coordinate system. The connections inside a module are numbered consecutively from left to right (viewed from the rear), see example in Figure 2-9, page 44.



## 2.2.3 Design

### 2.2.3.1 Panel Surface Mounting

For panel surface mounting, only possible for device 7SS523, the bay units are delivered in casings type 7XP20. The front plate is hinged and can be pulled out with a plastic tab and swung to the left for easy servicing.

All signals including the auxiliary voltage are connected to two-tier terminals. In each tier the terminals are numbered from left to right (Figure 2-8, page 43).

For the fiber-optic interface, 2 ST connectors are provided at the bottom of the device next to the terminal strip.

Earthing screws are provided at the left side of the housing.

The dimensions of the housing can be in Figure 9-5, page 364.

### 2.2.3.2 Panel Flush Mounting or Cubicle Mounting

For panel flush mounting or cubicle mounting the bay units are delivered in casings type 7XP20. With the bay unit 7SS523 the front plate is hinged and can be pulled out with a plastic tab and swung to the left for easy servicing. With the bay unit 7SS525 the front plate can be removed.

All signals including the auxiliary voltage are connected to terminal blocks on the rear plate. For each electrical connection point, there is one screw-type and one snap-in connector for the station wiring.

For the fiber-optic interface, 2 ST connectors are provided at the rear of the device next to the terminal strip.

An earthing screw is provided at the back of the housing.

The dimensions of the housing can be in Figure 9-6, page 365.

## 2.3 Connection Method

### 2.3.1 Location of Device Connections

#### Central unit

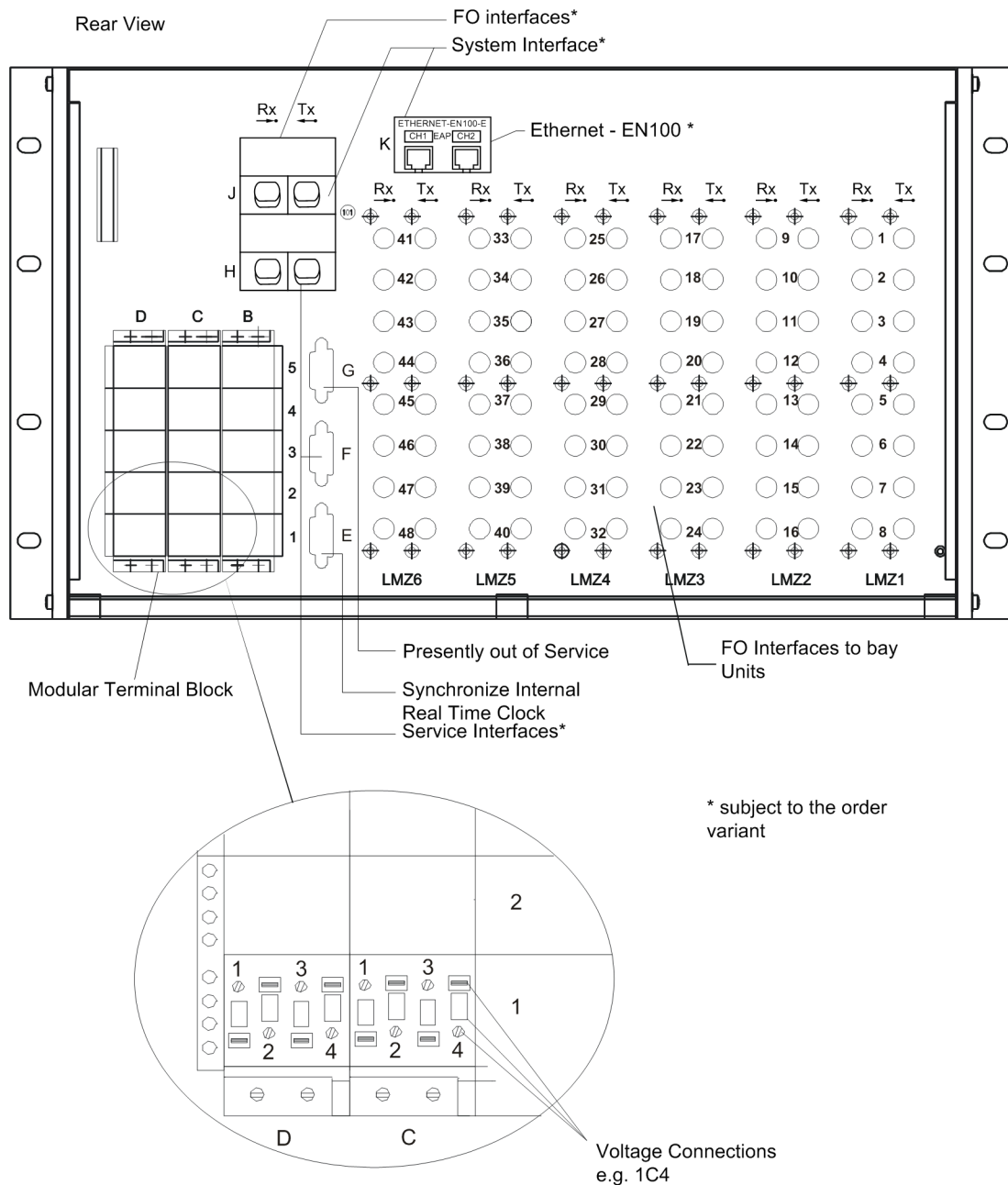


Figure 2-6 Device connections on central unit

Optional EN100-O+ connection at the bottom side of the central unit

Provide free space of 20 cm below because of the bending radius of the optical fiber.  
If an EN100-O+ is available, loosen the screw and remove the transceivers from the cages before dragging the D-CPU.

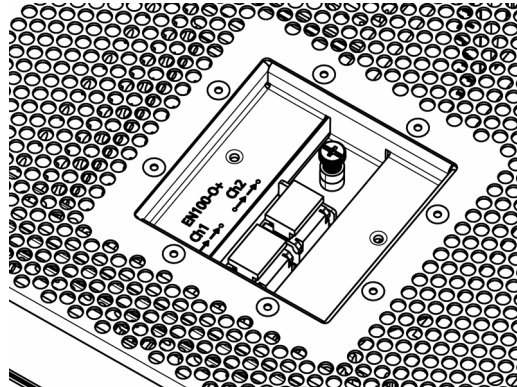


Bild 2-7 EN100-O+ connection

**Bay unit  
Panel surface  
mounting**

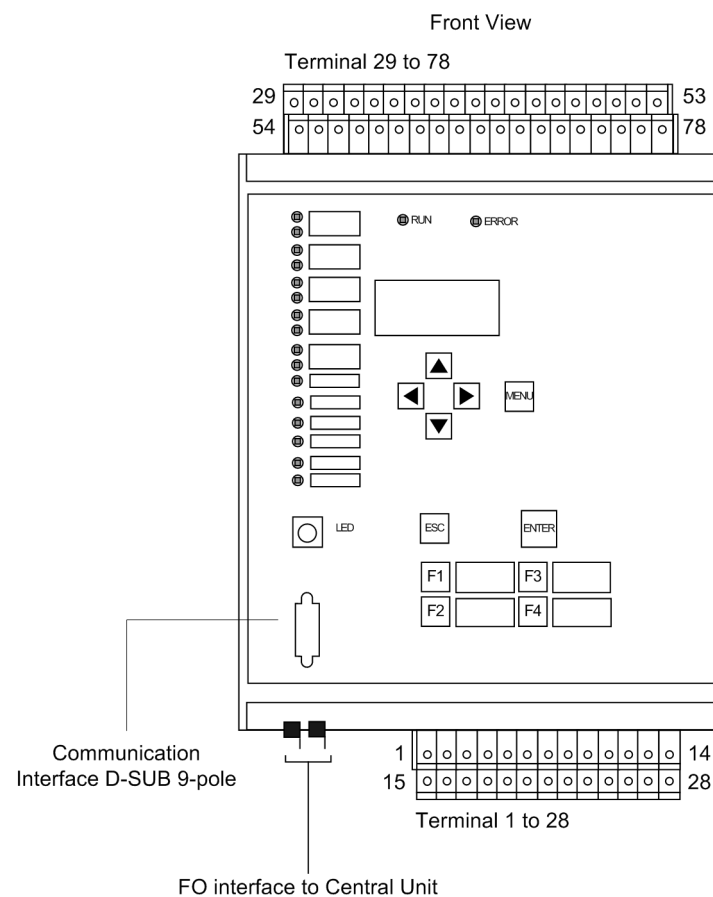


Figure 2-8 Device connections on bay unit 7SS523 for panel surface mounting

**7SS523 bay unit  
Panel flush mounting or  
cubicle mounting**

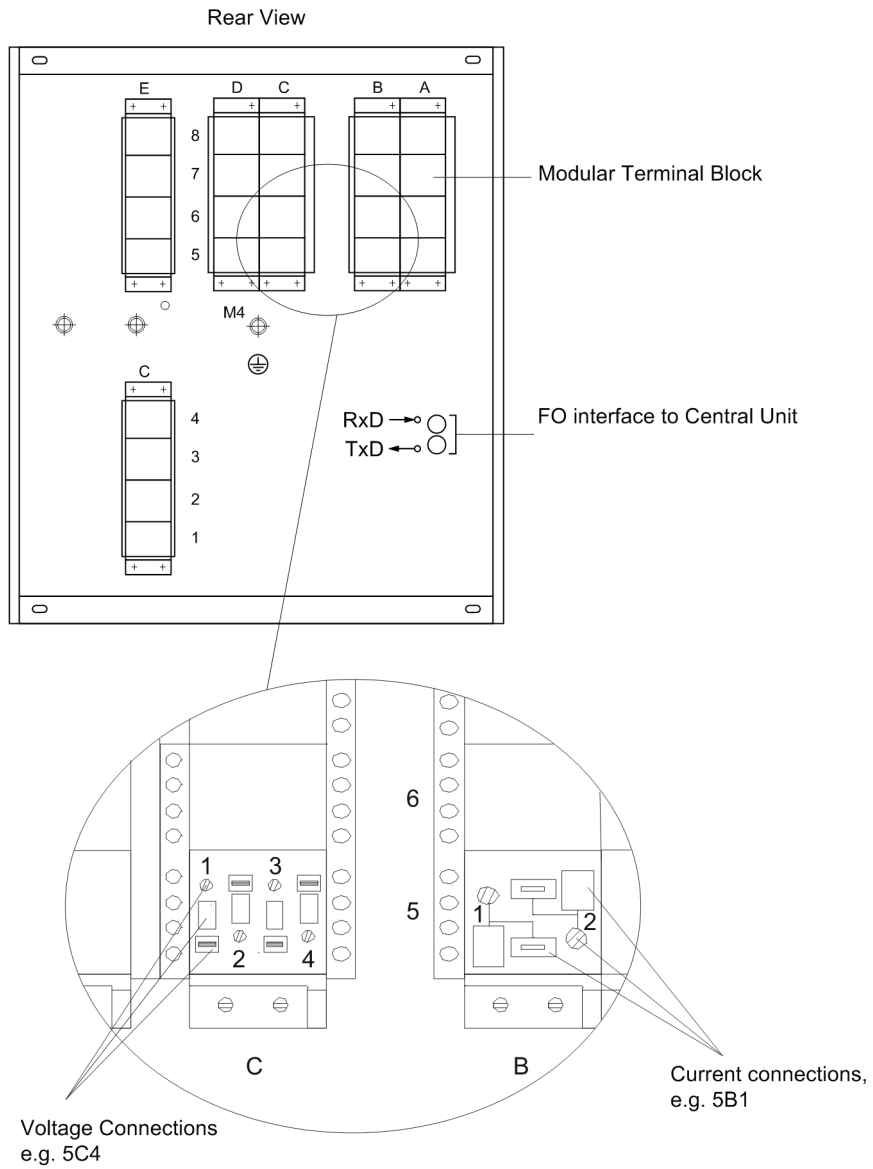


Figure 2-9 Device connections on bay unit for panel flush mounting or cubicle mounting

**7SS525 bay unit  
Panel flush  
mounting or  
cubicle mounting**

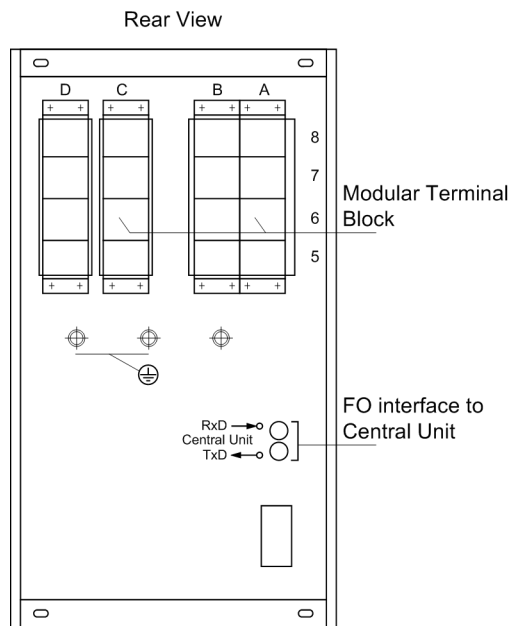


Figure 2-10 Device connections on bay unit 7SS525

**2.3.2 Device Connections**

Table 2-1 Overview of device connections

| Variant  | Current connections  | Voltage connections   | FO connections  |
|--|--|---|---|
| <b>Central unit</b>  |  | Screw connection for max. 1.5 mm <sup>2</sup> max. torque value 0.8 Nm or 7.1 in-lb and Double leaf-spring-crimp contact for max. 1.5 mm <sup>2</sup> | Integrated ST connector for FO connection, glass fiber 62.5 μm/125 μm FO duplex outdoor cable or FO duplex indoor cable<br><br>EN100-O+: Duplex-LC connector for FO connection, Multimode-FO (G50/125 μm or G62.5/125 μm) |
| <b>Bay unit<br/>Panel surface<br/>mounting</b>                         | Screw-type terminals for stranded wires with max. 4 mm <sup>2</sup> max. torque value 1.2 Nm or 10.6 in-lb or for solid wires with max. 7 mm <sup>2</sup> max. torque value 1.2 Nm or 10.6 in-lb |   | Integrated ST connector for FO connection, glass fiber 62.5 μm/125 μm   |
| <b>Bay unit<br/>Panel flush mount-<br/>ing or<br/>cubicle mounting</b> | Screw connection for max. 4 mm <sup>2</sup> and Double leaf-spring-crimp contact for max. 2.5 mm <sup>2</sup>  | Screw connection for max. 1.5 mm <sup>2</sup> max. torque value 0.8 Nm or 7.1 in-lb and Double leaf-spring-crimp contact for max. 1.5 mm <sup>2</sup> | Integrated ST connector for FO connection, glass fiber 62.5 μm/125 μm   |

### 2.3.2.1 Screw-Type Terminals

**Connection** The voltage connections of the central unit and the voltage and current connections of the bay units have screw terminals. For assignment of the terminals, please refer to the Figures A-3, page 376 and A-5, page 379 in the Appendix.

**Connection method** Use copper conductors only!  
 You can use solid conductors or stranded conductors with end sleeves.  
 You can use end sleeves with plastic collar (acc. to DIN 46228 P. 1) that have a cross-section between 0.5 mm<sup>2</sup> and 4 mm<sup>2</sup> (equivalent to AWG 20 to 12) and a length up to:

| Conductor<br>cross-section                                      | Length (without collar) |
|---|-------------------------|
| 0.5 mm <sup>2</sup>   | 10 mm                   |
| 0.75 mm <sup>2</sup> and 1 mm <sup>2</sup>                      | 12 mm                   |
| 1.5 mm <sup>2</sup> ; 2.5 mm <sup>2</sup> and 4 mm <sup>2</sup> | 18 mm                   |

**Tools** Use a screwdriver for slot-head screws size 6 × 1.  
 Use a crimping tool for end sleeves between 0.5 mm<sup>2</sup> and 6 mm<sup>2</sup> (equivalent to AWG 20 to 10) with or without plastic collar.

### 2.3.2.2 Double Leaf-Spring-Crimp Contacts

**Connection** The voltage connections of the central unit and the voltage and current connections of the bay units have double leaf-spring-crimp contacts. For assignment of the terminals, please refer to the Figures A-3, page 376 and A-5, page 379 in the Appendix.

**Connection method (current terminals)** Use copper conductors only!  
 Use stranded conductors with a cross-section between 1.5 mm<sup>2</sup> and 2.5 mm<sup>2</sup>.  
 Use double leaf-spring-crimp contacts type L with 2 snap lugs that match the selected conductor cross-sections.

**Connection method (voltage terminals)** Use copper conductors only!  
 Use stranded conductors with a cross-section between 0.5 mm<sup>2</sup> and 1 mm<sup>2</sup>.  
 Use double leaf-spring-crimp contacts that match the selected conductor cross-sections.

**Tools** Use a crimping tool for the double leaf-spring-crimp contacts.

### 2.3.2.3 D-SUB Female Connectors

|                          |   |
|--------------------------|---|
| <b>Connectors</b>        | <p>The serial ports of the central unit and of the bay units have 9-pole D-SUB female connectors. The serial ports include:</p> <ul style="list-style-type: none"> <li>• the PC port at the front of the central unit and the bay unit</li> <li>• the service port at the back of the central unit</li> <li>• the system port at the back of the central unit</li> <li>• the clock synchronization interface at the back of the central unit</li> </ul> <p>For assignment of the connectors, please refer to the Figures A-3, page 376 and A-5, page 379 in the Appendix.</p> |
| <b>Connection method</b> | <p>You can use any standard 9-pole D-SUB plug connectors per MIL-C-24308 and DIN 41652.</p> <p>Depending on the device version, the pin assignment is the same as for an RS232 or RS485 port.</p> <p>You can use for connection e.g. a 5-strand, shielded interface cable.</p>  |
| <b>Tools</b>             | <p>No tools are required for connection the interface cables.</p>   |

### 2.3.2.4 Fiber-Optic Cable Connections

|                          |   |                               |
|--------------------------|---|-------------------------------|
| <b>Central unit</b>      | <p>Depending on the variant ordered, the service and the system port on the rear of the central unit may have additional fiber-optic connections (Figure 2-6, page 42).</p> <p>Moreover, the central unit is connected with the bay units by fiber-optic cables. The bay unit connectors are located on the back of the central unit (Figure 2-6, page 42).</p> |                               |
| <b>Bay units</b>         | <p>Depending on the mounting variant, the fiber-optic interface to the central unit is located on the bottom (Figure 2-8, page 43) or the rear (Figure 2-9, page 44) of the bay unit. For assignment of the connectors, please refer to Figure A-4, page 377 in the Appendix.</p>   |                               |
| <b>Connection method</b> | FO connector type:  | ST connector                  |
|                          | Use fiber type:   | Multimode FO, G62.5 μm/125 μm |
|                          | for wave length:  | λ approx. 820 nm              |



**NOTE**

The bending radius of the available FO cables may not be smaller than 200 mm for outdoor cables and 80 mm for indoor cables.

If you use other fiber types than those recommended above, please make sure to observe the manufacturer's specifications.

### 2.3.2.5 EN100 module Ethernet (IEC 61850)

The IEC 61850 is a manufacturer- and device-independent communication protocol. The data transmission between PC and SIPROTEC 4 device thus becomes much faster than via the system interface. This protocol is available for most of the SIPROTEC 4 devices such as e.g. 7SS522 as of version V4.6. For a detailed description, please refer to the manual Ethernet & IEC 61850 Start Up /6/.

#### Ethernet connection

8-pin RJ45 connectors (100Base-T in acc. with IEEE 802.3) serve as connections for the wired Ethernet100 interfaces.

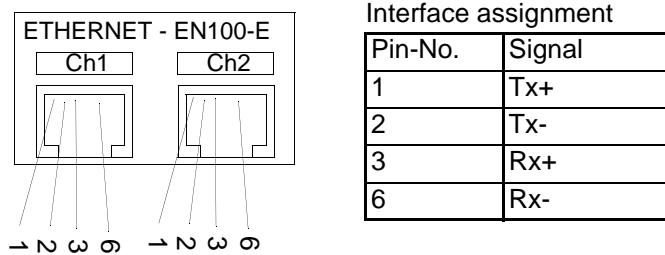


Figure 2-11 Ethernet connection

Connector type: RJ45 connector in acc. with IEEE 802

Lines: 150 W STP (shielded twisted-pair)

#### Ethernet optical (Duplex-LC)

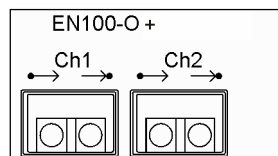


Bild 2-12 Ethernet connection optical

FO connector type: Duplex-LC

Use fiber type: Multimode FO, G50 μm/125 μm or G62.5 μm/125 μm

Transmission distance: max. 2 km

for wave length: λ = 1270 nm to 1380 nm

For a detailed description, please refer to the manual Ethernet Module EN100 for IEC 61850 with electrical/optical 100 MBit Interface /7/.



## Getting Started

This chapter describes the first steps that you should take after receiving your SIPROTEC 7SS52 V4 system.

After unpacking, please check whether the version and rated data match your requirements. Match the rated control voltages of the system components to your station conditions and insert the buffer batteries.

Next, set up the communication between the central unit and the bay units. For an electrical check, you can now navigate in the user interface without any measured values. You can also connect the system to a PC and operate it from the computer using the DIGSI software. In the last section you will find hints on what to observe for a long-term storage of the system.

|     |   |    |
|-----|---|----|
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| 3.2 | Environmental Protection Hints  | 50 |
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### 3.1 Unpacking and Repacking

The protection system is packaged at the factory to meet the requirements of IEC 60255-21.

- ❑ Unpack and pack the devices with normal care, without using force, and with appropriate tools.
- ❑ Visually check the device immediately upon arrival for correct mechanical condition.
- ❑ Please observe the instruction leaflet and any other documentation that may be part of the delivery.
- ❑ Check also that the accessories included in the delivery are complete.  
(Table A-7, page 372).

You can use the transport packing in the same manner for further shipment. Storage packaging alone, for individual devices, is not sufficient for shipping. If you use other packaging, make sure that the shock requirements under IEC 60255-21-1 Class 2 and IEC 60255-21-2 Class 1 are met.



#### NOTE

The device must be in the final operating area for a minimum of two hours before the power source is first applied. This time allows the device to attain temperature equilibrium, and dampness and condensation to be avoided.

---

### 3.2 Environmental Protection Hints

#### Disposal of Old Equipment and Batteries (Applicable only for European Union and Countries with a Recycling System)

The disposal of our products and possible recycling of their components after decommissioning has to be carried out by an accredited recycling company, or the products/components must be taken to applicable collection points. Such disposal activities must comply with all local laws, guidelines and environmental specifications of the country in which the disposal is done. For the European Union the sustainable disposal of electronic scrap is defined in the respective regulation for "waste electrical and electronic equipment" (WEEE).



The crossed-out wheellie bin on the products, packaging and/or accompanying documents means that used electrical and electronic products and batteries must not be mixed with normal house-hold waste.

**According to national legislation, penalties may be charged for incorrect disposal of such waste.**

By disposing of these products correctly you will help to save valuable resources and prevent any potential negative effects on human health and the environment.

**NOTE**

Our products and batteries must not be disposed of as household waste. For disposing batteries it is necessary to observe the local national/international directives.

---

**REACH/RoHS Declaration**

You can find our current REACH/RoHS declarations at:

<https://www.siemens.com/global/en/home/products/energy/ecotransparency/ecotransparency-downloads.html>

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**NOTE**

You can find more information about activities and programs to protect the climate at the EcoTransparency website:

<https://www.siemens.com/global/en/home/products/energy/ecotransparency.html>

---

### 3.3 Checking the Rated Data

First of all, check the complete ordering code (MLFB) of the system to ensure that the version delivered complies with the required rated data and functions.

The complete ordering code can be found on the rating plates on the back of the housings. The meaning of its digits is shown in Appendix Chapter A.1, page 368. The most important point is the matching of the rated device data to the station ratings, such as rated auxiliary voltage and rated currents of the CTs. This information is also found on the rating plate.

### 3.4 Matching the Control Voltage for the Binary Inputs and Inserting the Buffer Battery

#### Control voltage

---



#### WARNING

Only one jumper may be fitted per binary input.

---

When delivered, the binary inputs of the EAZ and D-CPU modules in the central unit, and the EFE or EFE\_10 modules in the bay units, are configured for 220 V rated control voltage.

For each binary input, different switching thresholds can be selected. This is done on the central unit by means of 3 jumpers on the EAZ module and 4 jumpers on the D-CPU module, and in the bay units by 3 jumpers each on the EFE or EFE\_10 modules.

#### Central unit

---



#### WARNING

Dangerous voltages may be present inside the device!

Make sure to switch the auxiliary voltage off before opening the front panel.

---

To change the rated control voltages of the binary inputs in the central unit:

- ❑ Open the front panel. The location of the EAZ and D-CPU module is shown in Figure 2-2, page 36.
- ❑ Remove the front plug connectors X3, X4, X5 on the D-CPU module (Figure 3-2, page 54).
- ❑ Press down the locking bolt of the modules at the bottom guide rail.
- ❑ Use the extraction handle (included in the delivery) to pull out the module.
- ❑ Change the rated control voltages for the binary inputs of the EAZ module as desired by relocating the jumpers (shown in Figure 3-1, page 53 and Table 3-1, page 53).
- ❑ Change the rated control voltages for the binary inputs of the D-CPU module by relocating the jumpers (shown in Figure 3-2, page 54 and Table 3-2, page 54).

To insert the buffer battery into the central unit:

- ❑ Press the battery firmly into its snap-in holder (see Figure 3-2, page 54) on the D-CPU module. **Observe the correct battery polarity!**

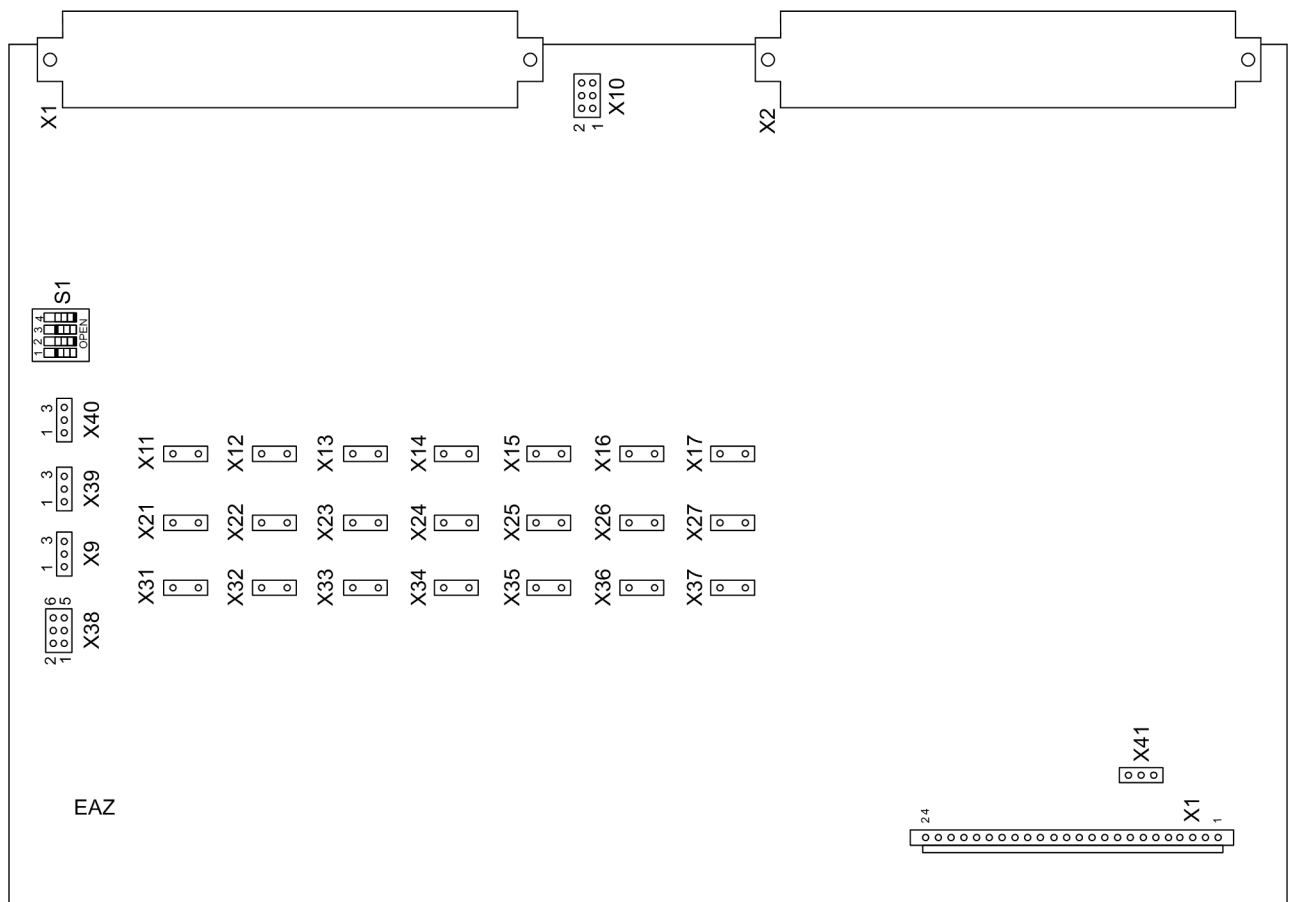


Figure 3-1 Location of the jumpers on the EAZ module (central unit)

Table 3-1 Control voltage for the binary inputs on the EAZ (central unit) in relation to the fitted jumper

| Name   | Control voltage setting |      |       |       |
|--|-------------------------|------|-------|-------|
|  | 24 V                    | 60 V | 110 V | 220 V |
| BI1 to BI5 (on the D-CPU module, Table 3-2, page 54) |                         |      |       |       |
| BI6  | X31                     | X21  | X11   | -     |
| BI7  | X32                     | X22  | X12   | -     |
| BI8  | X33                     | X23  | X13   | -     |
| BI9  | X34                     | X24  | X14   | -     |
| BI10   | X35                     | X25  | X15   | -     |
| BI11   | X36                     | X26  | X16   | -     |
| BI12   | X37                     | X27  | X17   | -     |

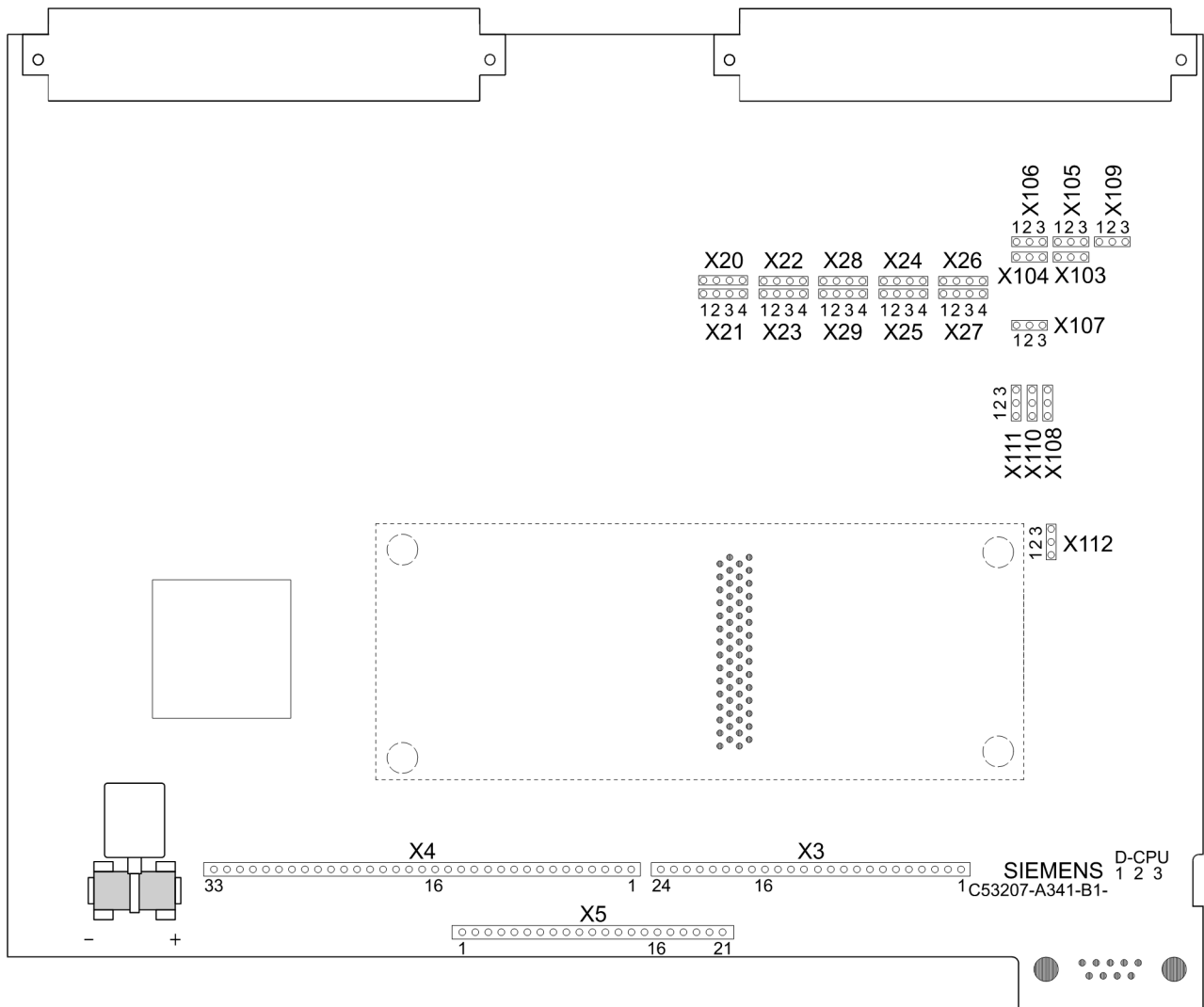


Figure 3-2 Location of the jumpers and the buffer battery on the D-CPU module (central unit)

Table 3-2 Control voltage for the binary inputs on the D-CPU module (central unit) in relation to the fitted jumper

| Connector | Binary inputs | Jumper  |      |       |       |
|-----------|---------------|---|------|-------|-------|
|           |               | 24 V  | 60 V | 110 V | 220 V |
| X20, X21  | BI1           | 1, 1  | 2, 2 | 3, 3  | 4, 4  |
| X22, X23  | BI2           | 1, 1  | 2, 2 | 3, 3  | 4, 4  |
| X24, X25  | BI3           | 1, 1  | 2, 2 | 3, 3  | 4, 4  |
| X26, X27  | BI4           | 1, 1  | 2, 2 | 3, 3  | 4, 4  |
| X28, X29  | BI5           | 1, 1  | 2, 2 | 3, 3  | 4, 4  |
|           |               | BI6 to BI12 (on the EAZ module, Table 3-1, page 53) |      |       |       |

Bay unit 7SS523



**WARNING**

Dangerous voltages may be present inside the device!  
 Make sure to switch the auxiliary voltage off before opening the front panel.

To change the rated control voltages of the binary inputs in a bay unit:

- ❑ Open the front panel. The location of the EFE module is shown in Figure 2-4, page 39.
- ❑ Remove the plug connector X1 to the front plate on the EFE module (Figure 3-3, page 55) and pull out the module.
- ❑ Change the rated control voltages of the binary inputs to the desired settings, see Figure 3-3, page 55 and Table 3-3, page 56.

To insert the buffer battery into the bay unit:

- ❑ Press the battery firmly into its snap-in holder (see Figure 2-4, page 39) on the PFE module. **Observe the correct battery polarity!** The polarity is marked on the back of the board.

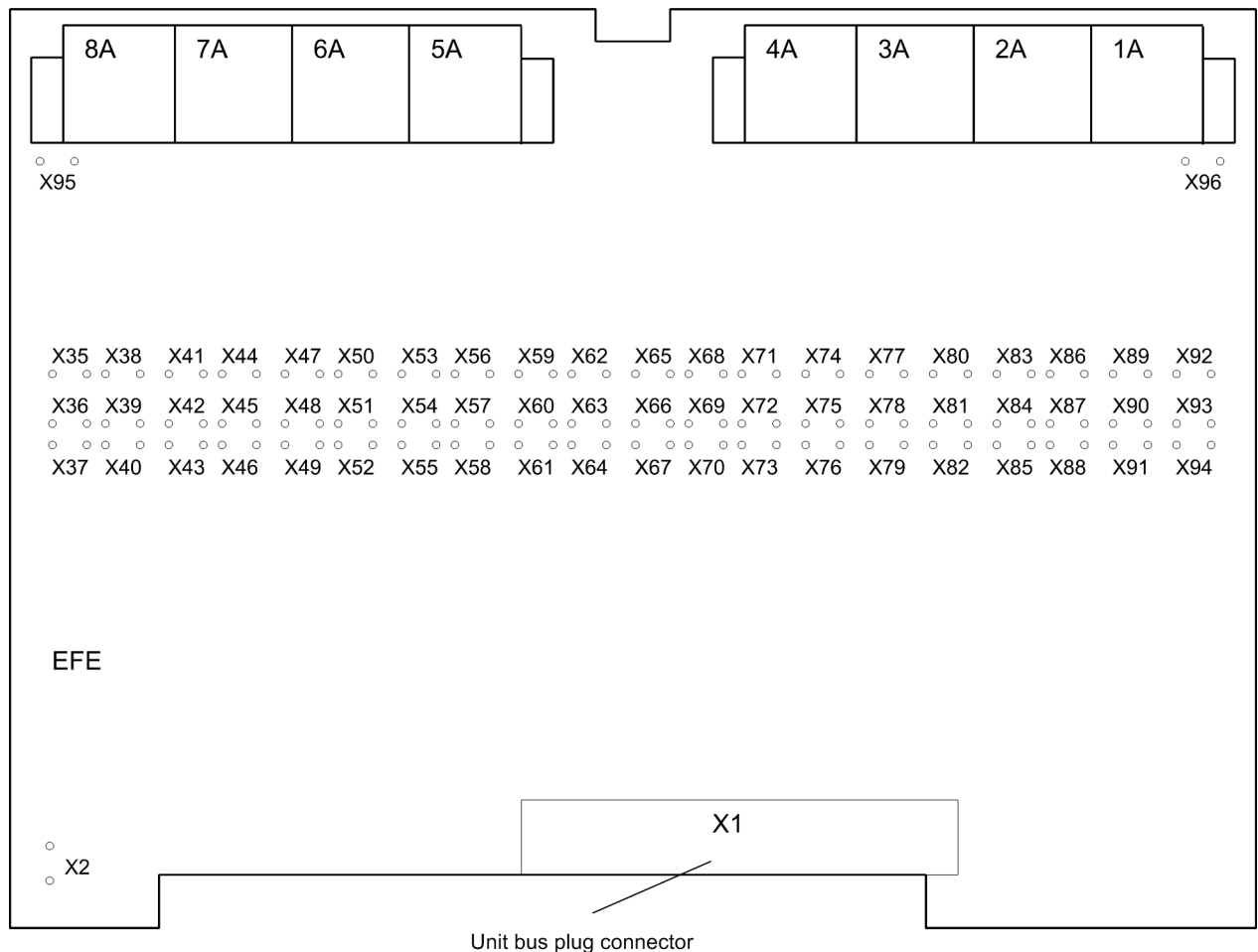


Figure 3-3 Location of the jumpers on the EFE module (bay unit 7SS523)

Table 3-3 Control voltage for the binary inputs on the EFE (bay unit) in relation to the fitted jumper

| Name  | Control voltage setting |      |       |       |
|-------|-------------------------|------|-------|-------|
|       | 24 V                    | 60 V | 110 V | 220 V |
| BI 1  | X37                     | X36  | X35   | -     |
| BI 2  | X40                     | X39  | X38   | -     |
| BI 3  | X43                     | X42  | X41   | -     |
| BI 4  | X46                     | X45  | X44   | -     |
| BI 5  | X49                     | X48  | X47   | -     |
| BI 6  | X52                     | X51  | X50   | -     |
| BI 7  | X55                     | X54  | X53   | -     |
| BI 8  | X58                     | X57  | X56   | -     |
| BI 9  | X61                     | X60  | X59   | -     |
| BI 10 | X64                     | X63  | X62   | -     |
| BI 11 | X67                     | X66  | X65   | -     |
| BI 12 | X70                     | X69  | X68   | -     |
| BI 13 | X73                     | X72  | X71   | -     |
| BI 14 | X76                     | X75  | X74   | -     |
| BI 15 | X79                     | X78  | X77   | -     |
| BI 16 | X82                     | X81  | X80   | -     |
| BI 17 | X85                     | X84  | X83   | -     |
| BI 18 | X88                     | X87  | X86   | -     |
| BI 19 | X91                     | X90  | X89   | -     |
| BI 20 | X94                     | X93  | X92   | -     |



Bay unit 7SS525



**WARNING**

Dangerous voltages may be present inside the device!  
 Make sure to switch the auxiliary voltage off before opening the front panel.

To change the rated control voltages of the binary inputs in a bay unit:

- ❑ Open the front panel. The location of the EFE\_10 module is shown in Figure 2-5, page 40.
- ❑ Remove the plug connector X1 to the front plate on the EFE\_10 module (Figure 3-4, page 57) and pull out the module.
- ❑ Change the rated control voltages of the binary inputs to the desired settings, see Figure 3-4, page 57 and Table 3-4, page 58.

To insert the buffer battery into the bay unit:

- ❑ Press the battery firmly into its snap-in holder (see Figure 2-5, page 40) on the PFE/SVW module. **Observe the correct battery polarity!** The polarity is marked on the back of the board.

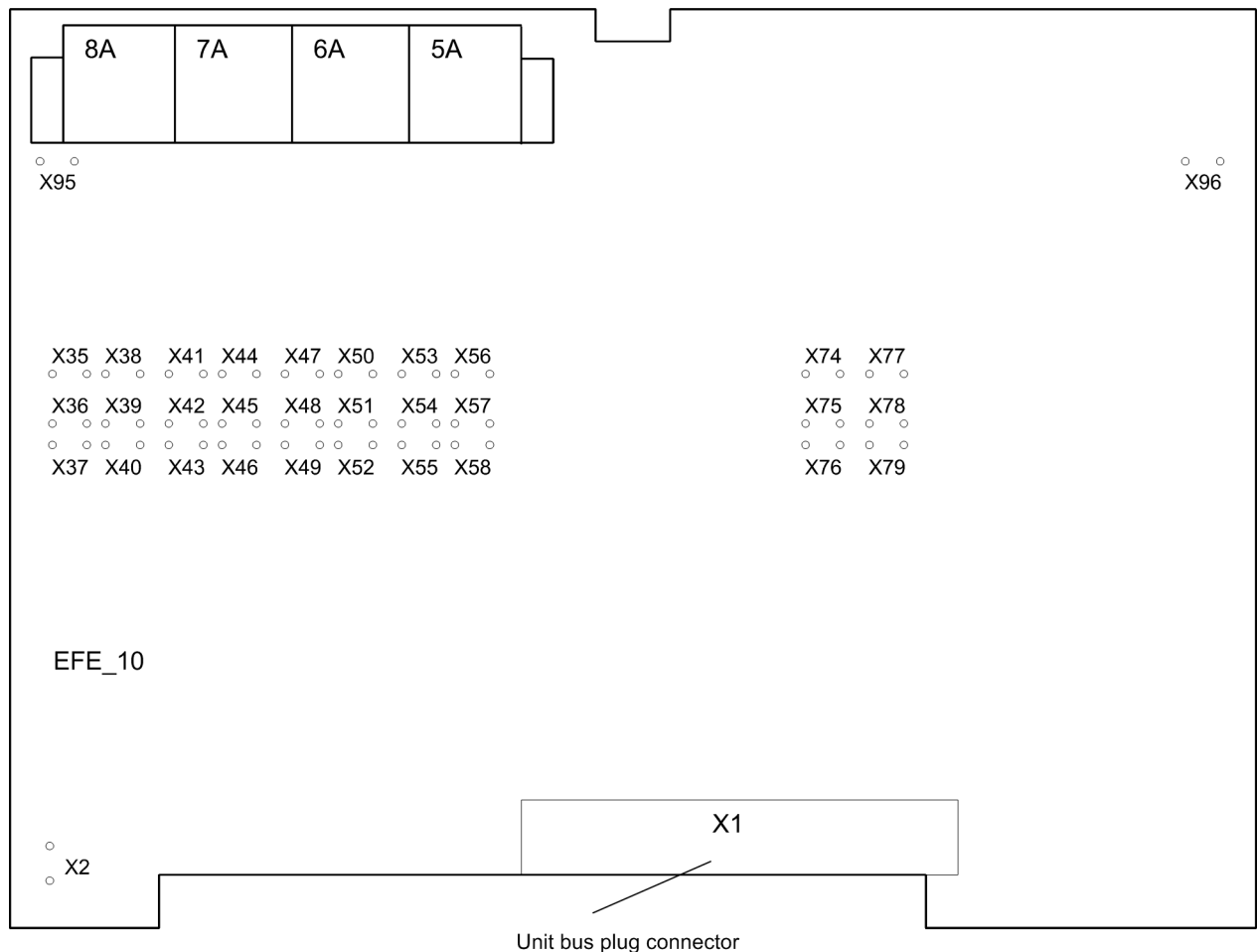


Figure 3-4 Location of the jumpers on the EFE\_10 module (bay unit 7SS525)

Table 3-4 Control voltage for the binary inputs on the EFE\_10 (bay unit) in relation to the fitted jumper

| Name  | Control voltage setting |      |       |       |
|-------|-------------------------|------|-------|-------|
|       | 24 V                    | 60 V | 110 V | 220 V |
| BI 1  | X37                     | X36  | X35   | -     |
| BI 2  | X40                     | X39  | X38   | -     |
| BI 3  | X43                     | X42  | X41   | -     |
| BI 4  | X46                     | X45  | X44   | -     |
| BI 5  | X49                     | X48  | X47   | -     |
| BI 6  | X52                     | X51  | X50   | -     |
| BI 7  | X55                     | X54  | X53   | -     |
| BI 8  | X58                     | X57  | X56   | -     |
| BI 9  | X76                     | X75  | X74   | -     |
| BI 10 | X79                     | X78  | X77   | -     |

## 3.5 Electrical Checks

Make sure that the operating conditions are compliant with VDE0100 and VDE0105 Part 1.

The devices should have been in the final operating area for a minimum of two hours before the power source is first applied. This time allows the device to attain temperature equilibrium, and dampness and condensation to be avoided.



### WARNING

The following inspection steps are performed in the presence of dangerous voltages. Only appropriately qualified personnel familiar with and adhering to safety requirements and precautionary measures may perform these steps.

---

For a first electrical check of the 7SS52 V4, it is sufficient to ensure safe earthing and to apply the auxiliary voltage:

- ❑ Connect the earthing of the devices with the protective earthing of the location. In the version for panel flush mounting, the earthing screws are on the back of the devices, in the version for panel surface mounting a terminal is provided for earthing.
- ❑ Connect the auxiliary voltage to the device inputs via a switch or a miniature circuit breaker. Verify that the supply voltage has the correct magnitude and polarity. Refer to the overview diagrams in the Chapter A.3, page 376.
- ❑ Close the protective switch or miniature circuit breaker to apply the auxiliary voltage.
- ❑ The green LED on the front panel must light after no more than 0.5 s, and the red LED must be off after no more than 10 s.
- ❑ After no more than 15 s the startup indications (showing the complete ordering number, the implemented firmware version and the boot system) disappear, and the default display appears. Depending on the default marshalling, some LEDs may already be on.

## 3.6 Setting up the Communication between the Central Unit and the Bay Unit

The 7SS52 V4 makes it possible to configure, parameterize and operate your station centrally from one PC connected to the central unit and running the DIGSI software. A prerequisite for this is that the central unit can communicate with the bay units.

To set up the communication between the central unit and the bay units:

- Connect the central unit with the bay units by fiber-optic cables. For detailed information on connector and cable designs, please refer to Chapter 2.3.2, page 45.
- Match the setting of the substation address, the feeder address and the device address in each bay unit to the settings in the DIGSI Manager. You can either set the addresses on the operator panel of the bay unit (see Chapter 3.7.3, page 62), or initialise the bay units with the DIGSI software. For details on initializing the bay units using DIGSI, please refer to the SIPROTEC System Description /1/.

## 3.7 Operation of SIPROTEC Devices from the Operator Panel

In addition to operating your station with the DIGSI software (see Chapter 6, page 239), the 7SS52 V4 allows you to operate the central unit and the bay units 7SS523 locally from the user interface on the device.

### 3.7.1 User Interface

The following sections describe succinctly in a few typical operations how to navigate the user interface from the integrated operator panel. The illustrations of the examples show each menu completely. The display on the device shows only 4 lines at a time.

### 3.7.2 Navigating the Operating Tree of the Display

The user interface of the central unit and the bay unit is composed of a hierarchically structured operating tree which is navigated by means of the navigation keys and the keys: **MENU** (only in the central unit), **ENTER** and **ESC**.

#### Central unit

- With the device ready for operation, press first the key **MENU**, to enter the **MAIN MENU**.
- Next, select with the navigation keys **▼** or **▲** a menu item and press the navigation key **▶** to enter the submenu.
- Go on moving in the same way through the operating tree until you have reached the information you are looking for.
- To move back one level, press the navigation key **◀**.
- To move back menu item, press the navigation key **▲**.
- By pressing again the key **MENU** or by repeatedly pressing the key **ESC** you return to the **MAIN MENU**.

#### Bay unit

- Select a menu item directly with the navigation keys **▼** or **▲** and press the navigation key **▶** to enter the submenu.
- Go on moving in the same way through the operating tree until you have reached the information you are looking for.
- To move back one level, press the navigation key **◀**.
- To move back menu item, press the navigation key **▲**.
- By pressing the key **ESC** you return to the next higher level.

### 3.7.3 Setting Addresses in the Bay Unit

For communication of the bay unit with DIGSI or via the system interface, the substation address, the feeder address and the device address in each bay unit must be set to match the corresponding IEC addresses in the DIGSI Manager. You can for this initialize the bay units with the DIGSI software or, as an alternative, set the addresses on the operator panel of the bay unit.

To set the device address on the operator panel of a bay unit:



#### NOTE

The parameter **7201 DEVICE ADD.** is only displayed with the bay unit running in stand-alone mode.

- ❑ Use the navigation keys ▲ or ▼ to navigate to the menu item **7200 PC/SYSTEM INTERFACES**, and the navigation key ► to go on to the submenu for the parameter **7201 DEVICE ADD.** (see Figure 3-5, page 63).
- ❑ Press the **ENTER** key and enter the password **F3F1F3F1F3F1**.
- ❑ Confirm with the **ENTER** key. The password is accepted, and the message **Passw. accepted** appears in the display.
- ❑ Confirm 2 more times with the **ENTER** key. The display now changes into edit mode.
- ❑ Set the correct device address using the ► or the ◀ key.
- ❑ Press the **ENTER** key.
- ❑ Use the navigation keys ▲ or ▼ to navigate to the menu item **END OF CODEWORD OPERATION**.
- ❑ Press the **F1** key. The message **SAVE NEW SETTINGS** appears.
- ❑ Press the **F1** key again. The message **NEW SETTINGS SAVED** appears and the device reset. The device address that you have entered is now accepted and stored.

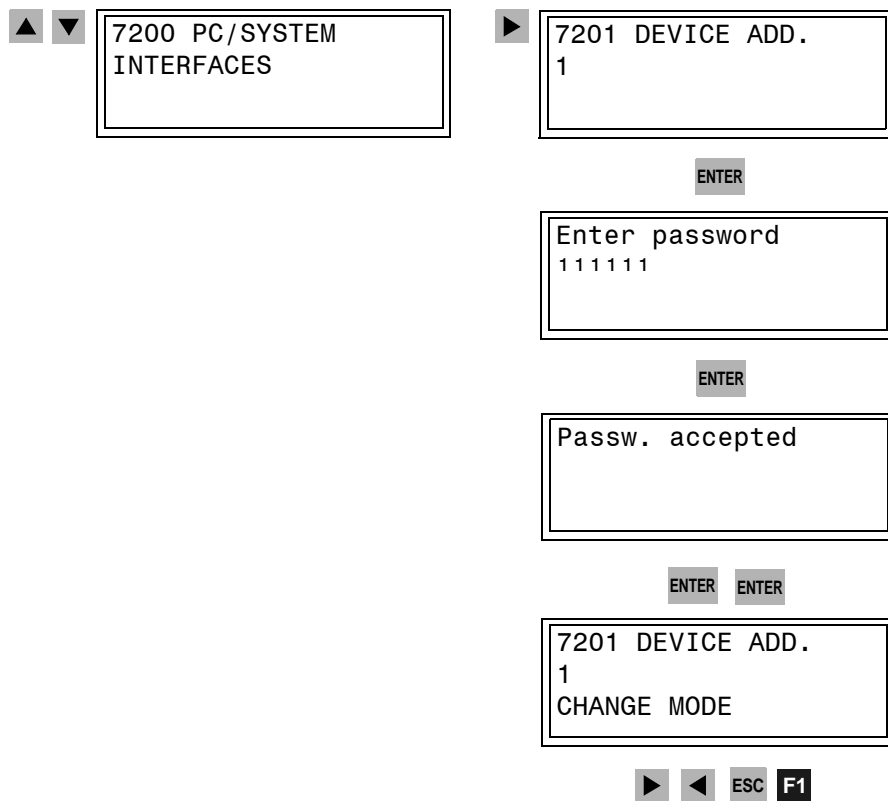


Figure 3-5 Operator menu for setting the device address in the bay units

To change the substation address or the feeder address from the operator panel of the bay unit, go to the parameters **7202 FEEDER ADD.** (feeder address) or to **7203 SUBST. ADD.** (substation address) and proceed as described above.

### 3.7.4 Adjusting the Display Contrast



**NOTE**

The factory setting of the contrast for the integrated LC display can only be changed in the central unit.

A higher contrast, for instance, makes the display more easily readable when viewed from a flat angle. Do not change the default setting by more than 1 or 2 steps, since with the contrast set too low or too high it may become impossible to read the display and thus to operate the central unit.

Proceed as follows:

- ❑ Using the navigation keys, select **MAIN MENU** → **PARAMETERS** → **SETUP/ EXTRAS** → **Contrast**
- ❑ Press the **ENTER** key. The current setting appears in a text box, with a blinking text insertion cursor.
- ❑ Overwrite the setting using the numeric keys. A higher numeric value means a higher contrast and thus a darker image.
- ❑ Confirm your change with the **ENTER** key.

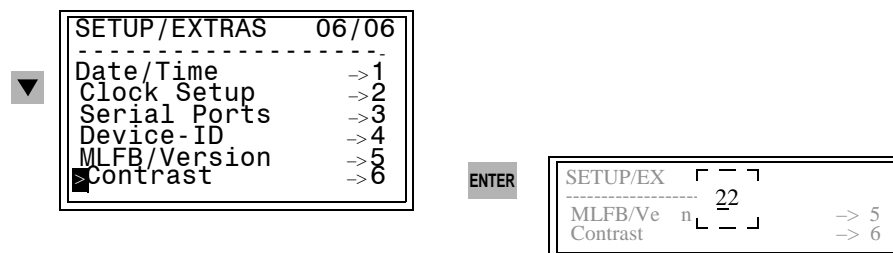


Figure 3-6 Operator menu for setting the display contrast



## 3.8 Storage

If parts of the system are not used immediately, they can be stored after verification of the rated data. The following storage conditions should be observed:

- SIPROTEC devices and associated assemblies should be stored in a dry and clean place, For storage of devices or related spare modules the applicable temperature range is between  $-25\text{ }^{\circ}\text{C}$  and  $+70\text{ }^{\circ}\text{C}$  ( $-13\text{ }^{\circ}\text{F}$  to  $+158\text{ }^{\circ}\text{F}$ ) (Chapter 9.2.17, page 359).
- To avoid premature aging of the electrolyte capacitors in the power supply, a temperature range of  $+10\text{ }^{\circ}\text{C}$  to  $+35\text{ }^{\circ}\text{C}$  ( $+50\text{ }^{\circ}\text{F}$  to  $+95\text{ }^{\circ}\text{F}$ ) is recommended for storage.
- The relative humidity must not lead to condensation or ice buildup.
- If the system is to be stored for an extended period of time, the components (bay units and central unit power supply unit) should be connected to auxiliary voltage for one or two days approximately every two years to regenerate the electrolytic capacitors in the power supply. The same procedure should be followed before installing these devices. Under extreme climatic conditions (tropics), preheating is achieved at the same time, and condensation is prevented.
- The device should be in the final operating area for a minimum of two hours before the power source is first applied. This time allows the device to attain temperature equilibrium, and dampness and condensation to be avoided.



# Configuration

# 4

This chapter describes how to use DIGSI to configure the SIPROTEC 7SS52 V4 distributed busbar and breaker failure protection on your PC.

First you must create central units and bay units in DIGSI Manager. Then open the central unit in the DIGSI Manager and start the DIGSI Plant Configuration. As next step you will use the DIGSI Plant Configuration to draw and parameterize a complete substation. And last but not least you will assign the bay units to the substation.

After that you can open the configured substation chart in the DIGSI Plant Visualization. The Plant Visualization gives an on-line overview of the current measured values (restraint currents, differential currents, feeder currents) and of the current status of the switchgear. Chapter 6.6, page 279 will tell you how to handle the Plant Visualization.

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## 4.1 Creating a Project

When configuring with DIGSI you must first create a new project.

To create a new project you must:

- Start DIGSI Manager.
- Open the dialog box **File** → **New**.
- Specify the project name and its filing location.

The project window will open upon that.

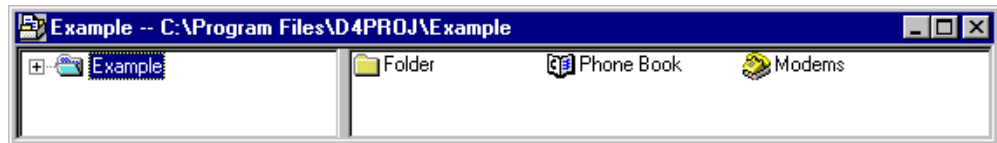


Figure 4-1 Project window after the creation of a new project

## 4.2 Inserting Central Unit / Bay Units

In the next step you will insert the **central unit** and the **bay units** into the structure of the project.

To insert the **central unit** into the project structure you must:

- Open the context menu in the project window of DIGSI Manager and open the Device Catalog.

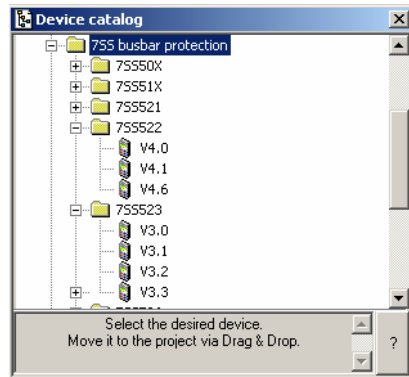


Figure 4-2 Device Catalog

- Switch to the directory **7SS522** in the Device Catalog and drag the object **V4.7** for the version, the left mouse button depressed, to the desired position within the project structure. After you have released the left mouse button, the dialog box **Properties - SIPROTEC 4 device** opens with the tab **MLFB**. In this tab you can specify the model of the central unit by selecting the corresponding order number (MLFB).

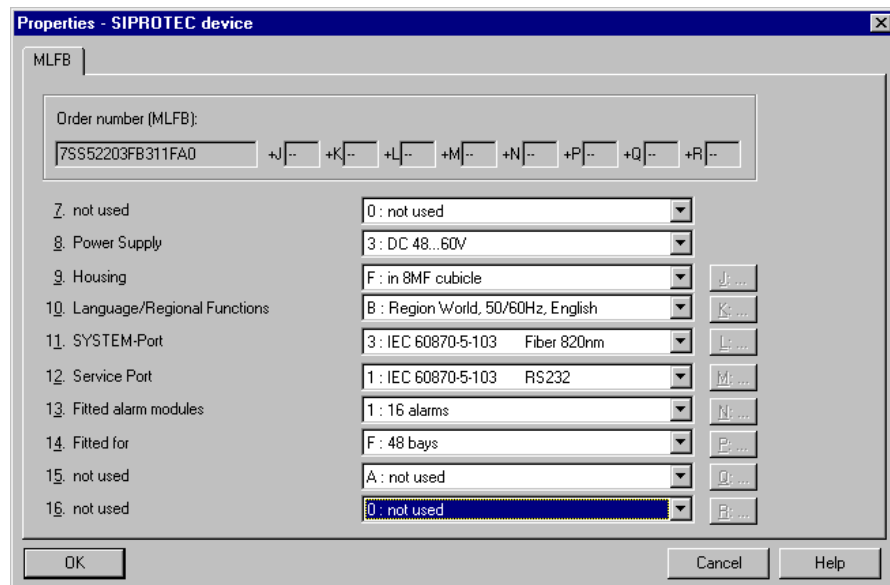


Figure 4-3 Dialog box **Properties - SIPROTEC 4 device**, Tab **MLFB**

To insert the **bay units** into the project structure you must:

- Switch to the directory **7SS523** or **7SS525** in the Device Catalog and drag the object **V3.3** for the version, the left mouse button depressed, to the desired position within the project structure. This object represents a **bay unit**. After you have released the left mouse button, the dialog box **Properties - SIPROTEC 3 device** opens with the tab **MLFB**. In this tab you can specify the model of the bay unit by selecting the corresponding order number (MLFB). Repeat the procedure until you have inserted all desired bay units into the project structure.

## 4.3 Plant Configuration

In the last section you have created central units and bay units in DIGSI Manager. This will be the basis for you to configure the substation in the next step. The DIGSI Plant Configuration is used for the configuration.

The DIGSI Plant Configuration is a tool which enables you to compile all information items required by the central unit. First you will create a graphic model of the substation. You do so by drawing busbars and lines in a chart and add disconnecter switches, circuit breakers and transformers. Afterwards you will assign the individual components to bays and bay units via dialog boxes. Your entries will be saved in the setting group and together with it they are transmitted to the central unit (see Chapter 4.8, page 111).

In the next step you will assign the bay units you have created in the DIGSI Plant Configuration to the bay units created in the Device Manager (see Chapter 4.5, page 93).

### 4.3.1 How to Proceed

The next paragraphs will depict the basic procedure by the example of the configuration of a double busbar with bus coupler.

In order to draw and parameterize the substation you must:

- Start the **DIGSI Plant Configuration** (Chapter 4.3.2, page 72).



#### NOTE

Standard bays such as bus couplers and feeder bays are already available as **Typicals**. You can find Typical and Templates in the folder **SSTypicals**. The DIGSI Plant Configuration interprets the data correctly.

- Insert **Typicals** anywhere you need them in the chart (Chapter 4.3.9, page 84).
- Draw the required **busbars** and name them (Chapter 4.3.3, page 74).
- Insert **bay names** to define the required bays (Chapter 4.3.4, page 76).
- Insert **dynamic elements** of the libraries into the substation chart (Chapter 4.3.5, page 78).
- **Link** the dynamic elements with the busbars. Use lines and connections for this purpose (Chapter 4.3.6, page 80).
- Insert **static text** e.g., for comments (Chapter 4.3.8, page 83).
- Create **Typicals** for frequently used substation components and insert them into the chart where needed (Chapter 4.3.9, page 84).
- **Save** the substation chart and **exit** the DIGSI Plant Configuration (Chapter 4.3.10, page 84).

We will illustrate the configuration by the example of a double busbar with bus coupler.

### 4.3.2 Starting the Plant Configuration

To start the DIGSI Plant configuration you must:

- ❑ Select the **central unit 7SS522** in the project window of DIGSI Manager and open the context menu via right mouse click. Apply the command **Open object**. The **Open device** dialog box opens. You can also open the dialog box by double-clicking the **central unit 7SS522**.

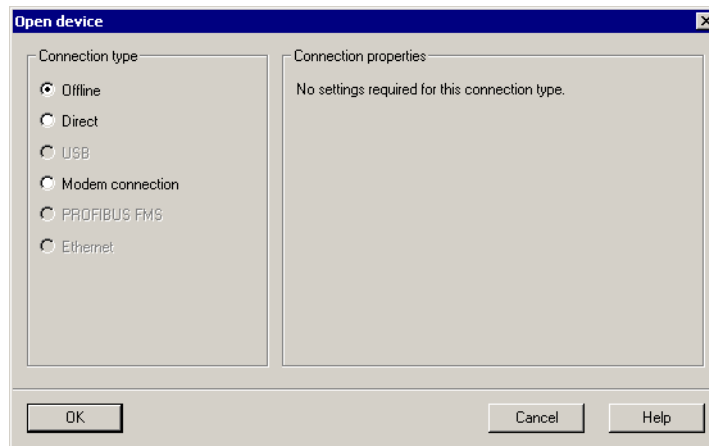


Figure 4-4 **Open Device** dialog box

- ❑ Select the connection type and confirm with **OK**. The DIGSI Device Configuration opens.
- ❑ Unfold the directory **Settings** in the function selection of the DIGSI Device Configuration and select the object **Substation configuration**.

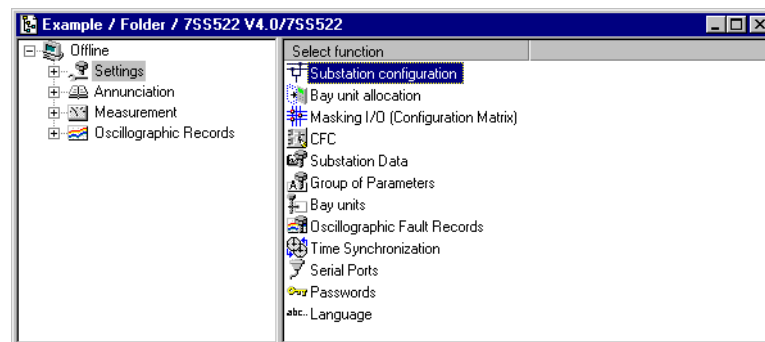


Figure 4-5 Start screen of the DIGSI Device Configuration

- ❑ Right-click the object to open the context menu and apply the command **Open object**. The DIGSI Plant Configuration opens. You can also open the DIGSI Plant Configuration by double-clicking the object **Substation configuration**.



**NOTE**

The Plant Configuration and the Plant Visualization cannot run simultaneously. Close the Plant Visualization before you start the Plant Configuration.

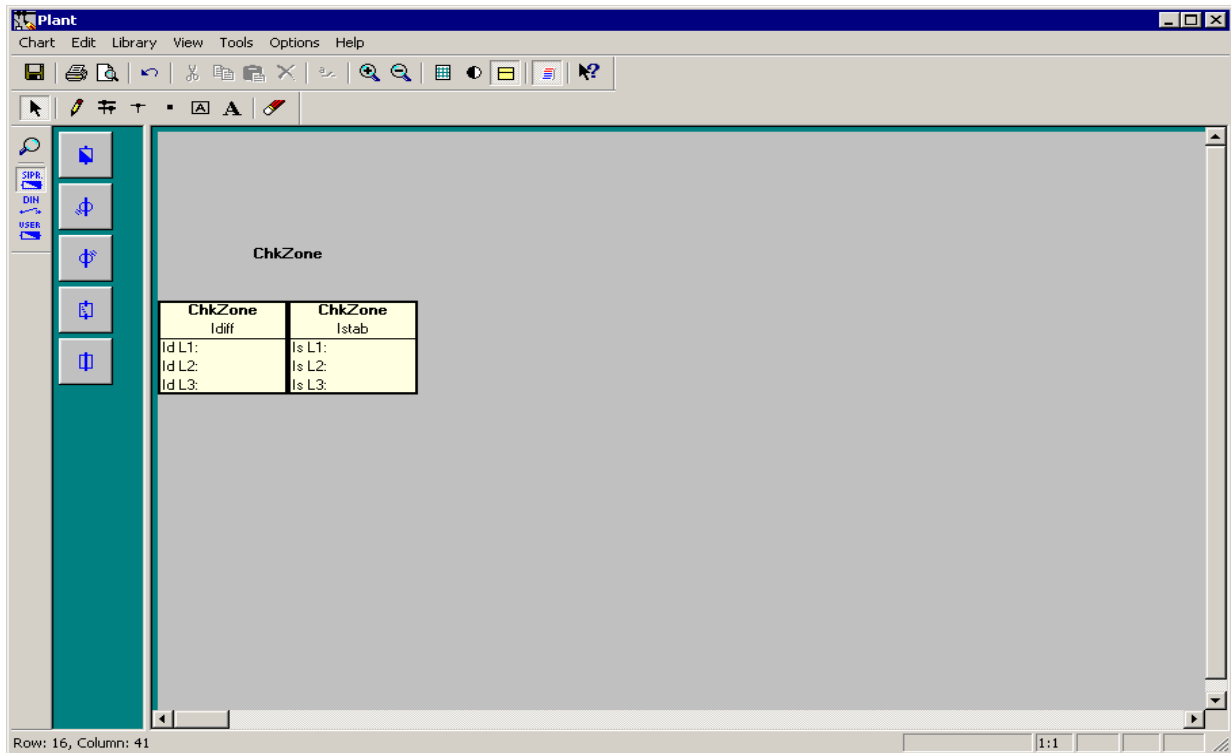


Figure 4-6 Start screen of the DIGSI Plant Configuration

**NOTE**

For a detailed instruction on how to use the DIGSI Plant Configuration, please refer to the corresponding on-line help. The following paragraphs describe the basic method for drawing and parameterizing a substation.

### 4.3.3 Drawing Busbars


Busbars can be drawn into the substation chart in vertical or horizontal direction. A busbar can also be a combination of vertical and horizontal lines. For this purpose place the starting point of the busbar you want to draw on the end point of an existing busbar. The two lines will merge to form a single busbar. Thus you can draw e.g., U-shaped busbars. Busbars can also be T-shaped. For this purpose place the starting point of the busbar you want to draw on an already existing busbar. Again the two lines will merge to form a single busbar. A connection will be inserted automatically in the junction point of the two busbars.




#### NOTE

You can use templates for drawing a new chart. Some templates are installed on your computer together with DIGSI. You can also save your own charts as templates. You will find further information in the on-line help of the DIGSI Plant Configuration.

To draw a busbar you must:

- Click **Tools** → **Draw busbar**. Alternatively, you can click the  button on the toolbar.
- Click the place in the chart which is to be the starting point of the busbar. Hold the mouse button pressed down.
- Draw the mouse pointer, the mouse button depressed, to the position that will mark the end point of the busbar. Release the mouse button.

To modify the length of a busbar you must:

- Click **Tools** → **Select** on the menu bar. Alternatively, you can click the  button on the toolbar.
- Click on the starting point or on the end point of the corresponding busbar and hold the mouse button depressed.
- Move the mouse pointer, the mouse button depressed, in horizontal or vertical direction depending on the orientation of the busbar. Release the mouse button.



#### NOTE

You delete a busbar by making its starting point and end point coincident. You can thus also erase busbar segments that are open at one end.

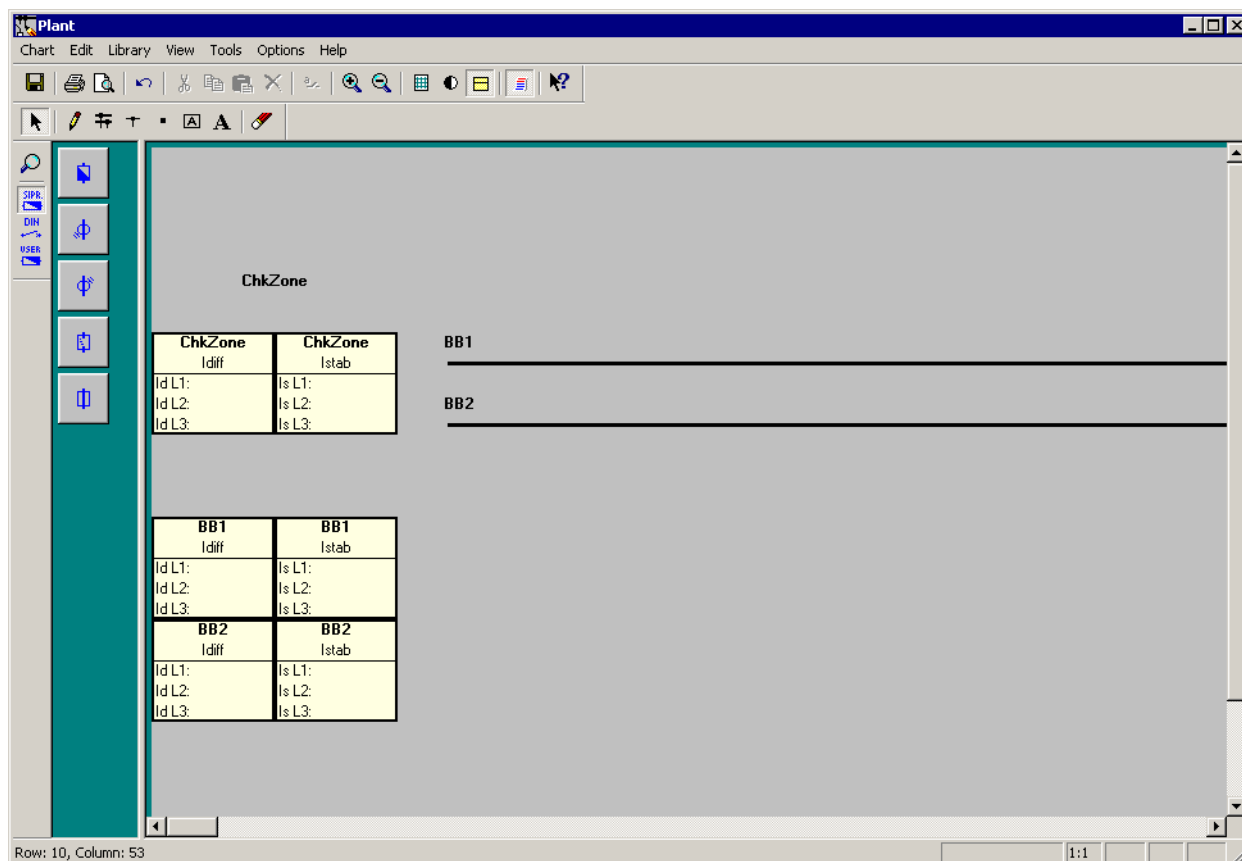
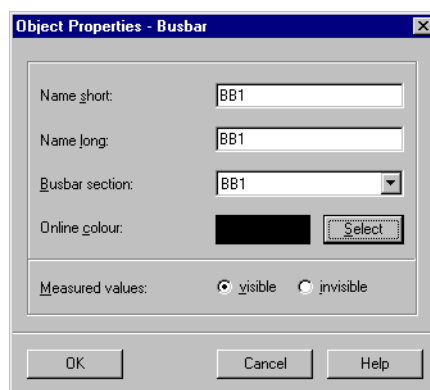


Figure 4-7 DIGSI Plant Configuration, Drawing busbars - Example

To name the busbar you must:

- Right-click the busbar. Click **Object properties** in the context menu. The dialog box **Object Properties - Busbar** opens.

Figure 4-8 Dialog box **Object Properties - Busbar**

- Enter a busbar name of not more than 4 characters into the box **Name short**. This name will be used to characterize the associated information in the Configuration Matrix.


- Enter a busbar name of not more than 8 characters into the box **Name long**. This name will be displayed as movable text within the chart. The long name will also show in the measured value boxes of the busbar.
- Select one of the 12 busbar sections (BB01 to BB12) or bus coupler sections (TB01 to TB12) from the box **Busbar section**.
- Click **Select** to choose the on-line colour of the busbar. The Plant Visualization will show the attachment of the feeders and measuring systems to the corresponding busbar in the colour you specify here.
- Click **OK** to apply the settings and to close the dialog box.

Bus coupler zones are bus zones which are used exclusively for connecting bus zones and which have no feeder bays. In most cases they occur in connection with bus couplers. An example is given in Figure 4-16, page 88 (BS1, BS2).

### 4.3.4 Defining Bays

Disconnectors, transformers and circuit breakers must be assigned to a certain bay. A bay in the substation chart is represented by a bay name. First you insert a wildcard for the bay name. Next you specify a short name and a long name for the bay name.

To insert a wildcard for the bay name you must:

- Click **Tools** → **Insert Bay Name** on the menu bar. Alternatively, you can click the  button on the toolbar.
- Click the position on the substation chart where you wish to insert the bay name. A wildcard in the form of an asterisk is inserted. Click on the desired positions to insert further wildcards for bay names.



#### NOTE

After you have released the mouse button, the program verifies whether the wildcard superposes other elements. If this is the case, you will receive a corresponding message and the wildcard will not be inserted into the substation chart.

To specify the short text and long text for a bay name you must:

- Right-click the wildcard in question. Click **Object properties** in the context menu. Or you can double-click the wildcard. Both methods will open the dialog box **Object properties - Bay Name**.

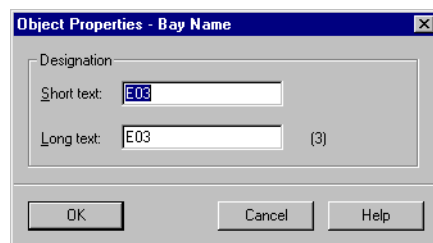


Figure 4-9 Dialog box **Object Properties - Bay Name**

- ❑ Enter a bay name of not more than 4 characters into the box **Short text**. This name will be used to characterize the associated information in the Configuration Matrix.
- ❑ Enter a bay name of not more than eight characters into the box **Long text**. This name will be displayed as movable text within the chart of the substation. The long text will also be displayed in the measured value box of a transformer which is assigned to that bay. As you can give identical names to different bays, each long text is complemented by an automatically assigned number.
- ❑ Click **OK** to apply the settings and to close the dialog box.

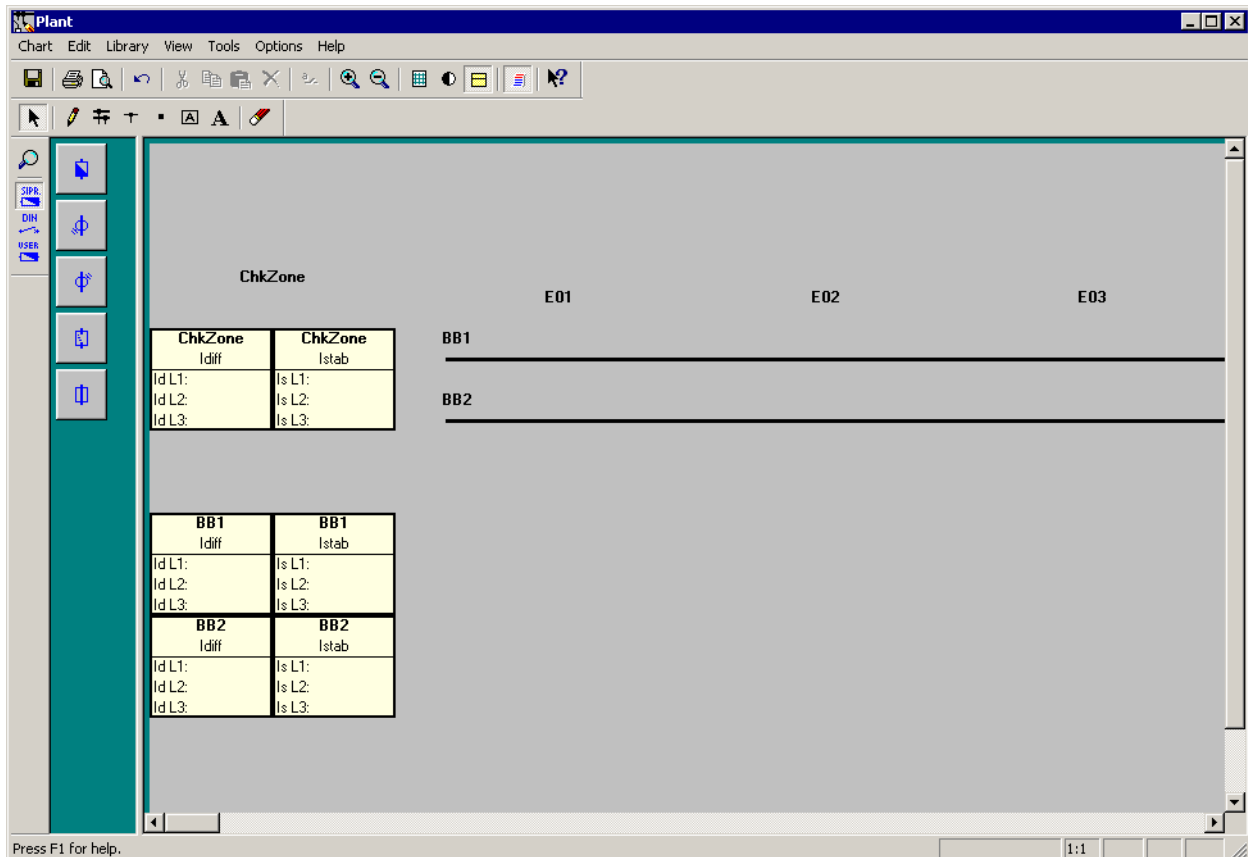


Figure 4-10 DIGSI Plant Configuration, Defining bays - Example

### 4.3.5 Inserting Dynamic Elements

Static and dynamic elements are inserted into the chart from libraries. Dynamic elements such as disconnectors, circuit breakers and transformers usually have several possible states. Each state is represented by a separate symbol.

Static and dynamic elements are filed in different libraries. The following three libraries exist: **DIN**, **SIPROTEC** and **User-defined**.

To insert a dynamic library element you must:

- Open the dialog box **Select Library** via the menu item **Library > Select Library** and select a dynamic library.
- Select the element in the library you wish to insert in the substation chart.
- Click the position on the substation chart where you wish to insert the element. The element you have selected in the library will be pasted in the specified location. To insert additional elements of the same type into the chart, click the places where you wish to insert them.



#### NOTE

After you have released the mouse button, the program verifies whether the element superposes other dynamic elements. If this is the case, you will receive a corresponding message and the new element will not be inserted into the substation chart.

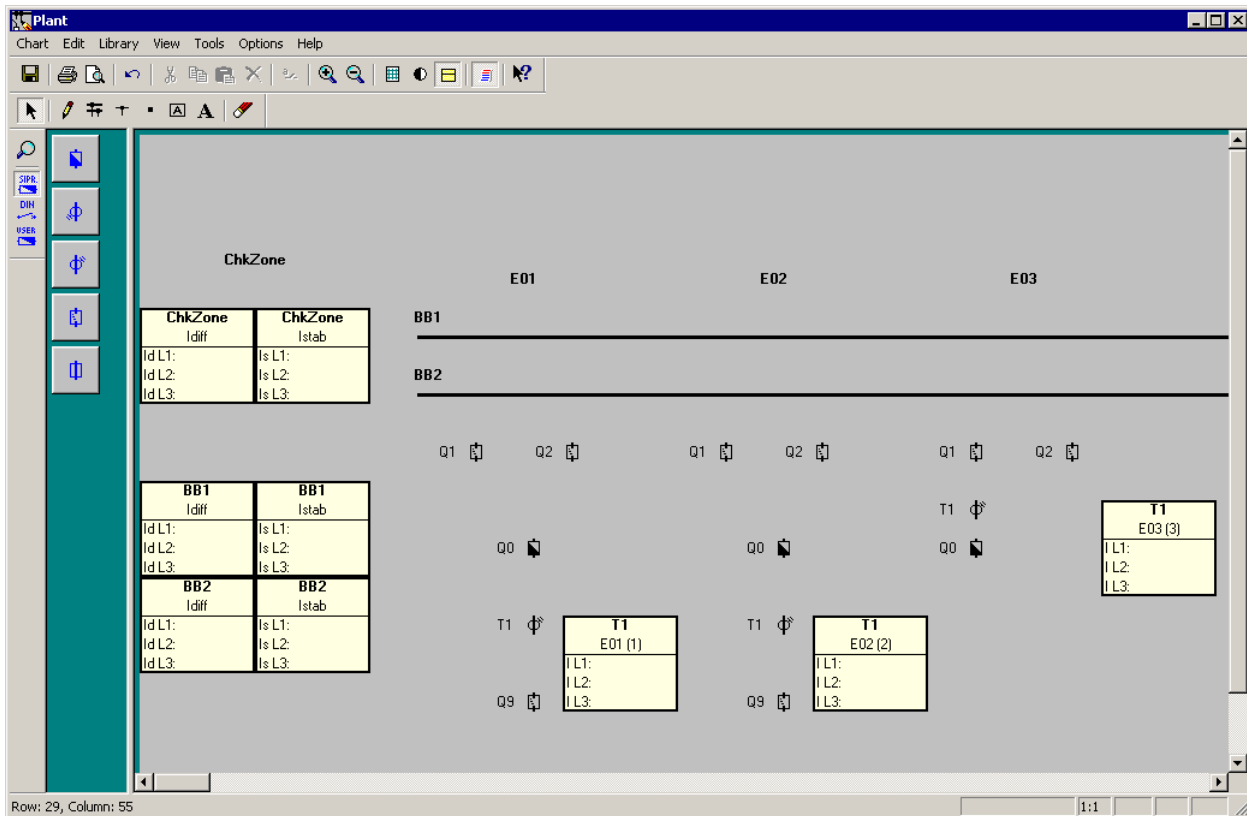


Figure 4-11 DIGSI Plant Configuration - Inserting dynamic elements - Example

Disconnectors, transformers and circuit breakers have properties whose values must be set individually.

To specify the property values of a dynamic element you must:

- Right-click a single element. Click **Object properties** in the context menu. A properties dialog opens for the selected element.
- Make the required settings.
- Click **OK** to apply the settings and to close the dialog box.



**NOTE**

Further information on setting the element property values can be found in the on-line help of the DIGSI Plant Configuration.

---


## 4.3.6 Connecting Dynamic Elements to the Busbars

Dynamic elements can be connected to busbars via lines.


### 4.3.6.1 Inserting Lines

Lines can connect elements such as disconnectors, transformers, circuit breakers and lines with each other and to a busbar. Lines can be drawn into the substation chart in vertical or horizontal direction. A line can also be a combination of vertical and horizontal lines. For this purpose you place the starting point of the line you want to draw on the end point of an existing line. Unlike busbars the individual line segments cannot be merged to a single line. They can still be edited individually. Lines may also be linked in T-shape. For this purpose place the starting point of the line you want to draw on an already existing line. A connection will be inserted automatically in the junction point of the two lines.

To draw a line you must:

- ❑ Click **Tools** → **Draw Line**. Alternatively, you can click the  button on the toolbar.
- ❑ Click the place in the chart which is to be the starting point of the line. Hold the mouse button pressed down.
- ❑ Draw the mouse pointer, the mouse button depressed, to the position that will mark the end point of the line. Release the mouse button.

To modify the length of a line you must:

- ❑ Click **Tools** → **Select** on the menu bar. Alternatively, you can click the  button on the chart toolbar.
- ❑ Click on the starting point or on the end point of the corresponding line and hold the mouse button depressed.
- ❑ Move the mouse pointer, the mouse button depressed, in horizontal or vertical direction depending on the orientation of the line. Release the mouse button.



#### NOTE

A line is deleted by making its starting point and end point coincident.


---



### 4.3.6.2 Inserting a Connection

Lines or busbars that cross in the chart are not yet connected electrically. To this end you must insert an additional connection in the junction point. Such a connection is indicated by a small square. By manually adding a connection each line is separated into two autonomous lines. When you draw lines and busbars so that they meet as a T, a connection will be automatically inserted in the junction point. Unlike the manual insertion an automatically added connection does not split lines and busbars.

To insert a connection you must:

- Click **Tools** → **Insert Connection** on the menu bar. Alternatively, you can click the  button on the toolbar.
- In the chart click on the position of a busbar or line where you wish to insert a connection.

To delete a manually added connection you must:

- Draw a new busbar across the connected busbar sections if you want to delete the connection between two busbars. The connection and the busbar on the right-hand side or the lower of the two busbars is deleted.
- Draw a new line across the connected line sections if you want to delete the connection between two lines. The connection and the line on the right-hand side or the lower of the two lines is deleted.

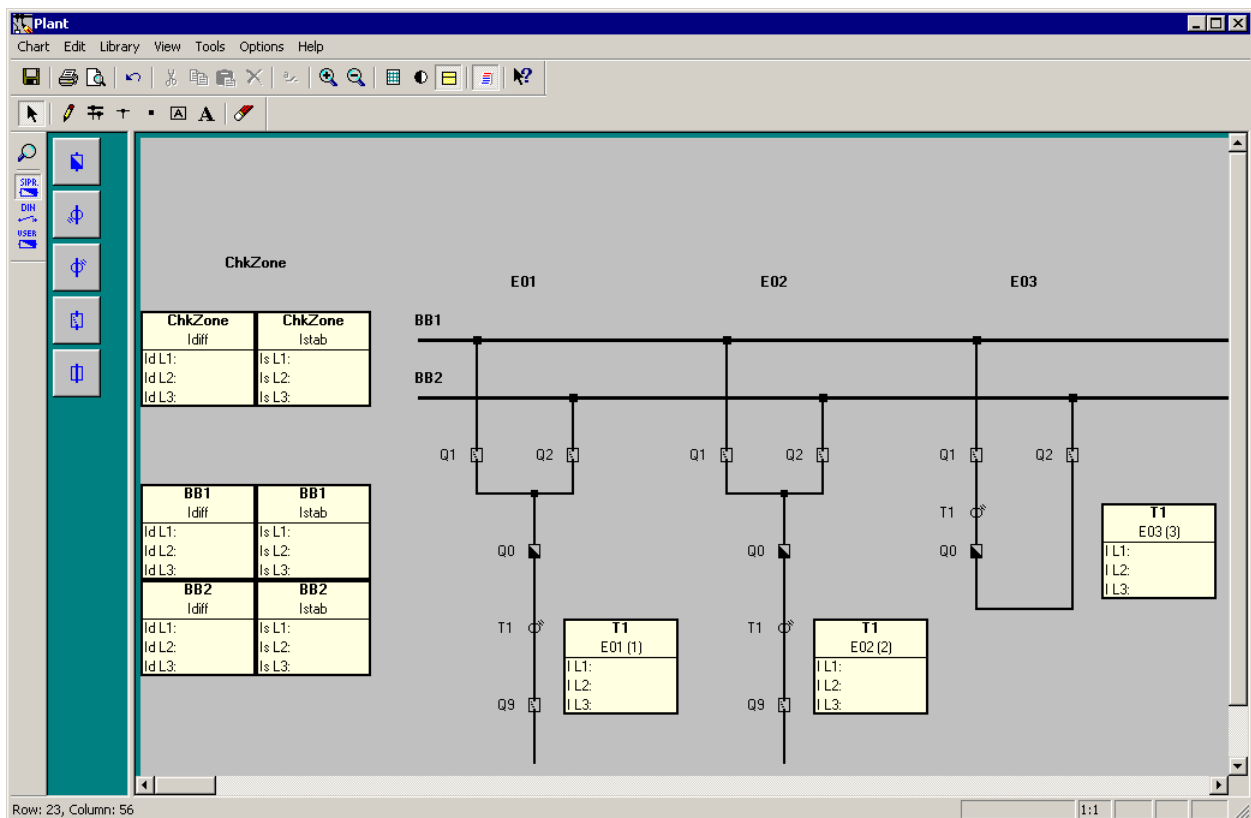


Figure 4-12 DIGSI Plant Configuration - Inserting lines and connections - Example

### 4.3.7 Normalized Current

Normally, the configuration tool determines the so-called normalized current automatically by searching for the current transformer with the highest primary nominal current when you exit the configuration. All parameters with the dimension I/I<sub>no</sub> refer to this reference value. You can select any other normalized current in the configuration tool under **Tools** → **Set Reference Value**. When exiting the configuration you can choose between the calculated value or the one you have defined in the dialog **Specifying a reference value** (Figure 4-13, page 82). A lower value allows you for example to increase the sensitivity of the differential current supervision because it has a lower setting limit of 5% I/I<sub>no</sub>.

The normalized current which you define here may not exceed 5 times the value of the configured maximum rated transformer current.

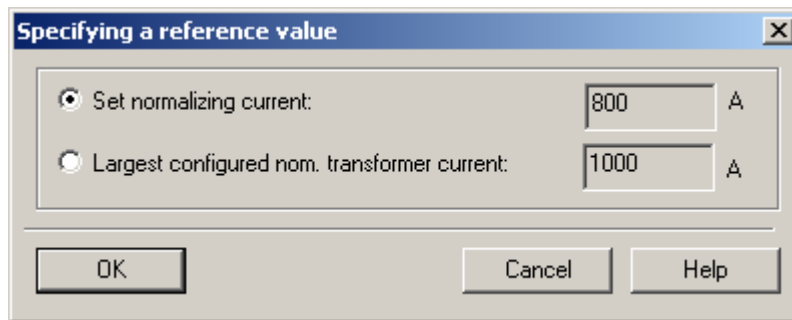


Figure 4-13 Select Reference Value

### 4.3.8 Inserting Static Text

You can use static text to give additional short information within the chart. A static text may be composed of not more than twenty characters.

To insert static text you must:

- ❑ Click **Tools**→**Insert Text**. Alternatively, you can click the **A** button on the chart toolbar.
- ❑ Click the position on the substation chart where you wish to insert the text. A text input box opens.
- ❑ Write the desired text into this box. That finished click the green check mark to the right of the text box. The text will be placed left-aligned to the selected insertion point.

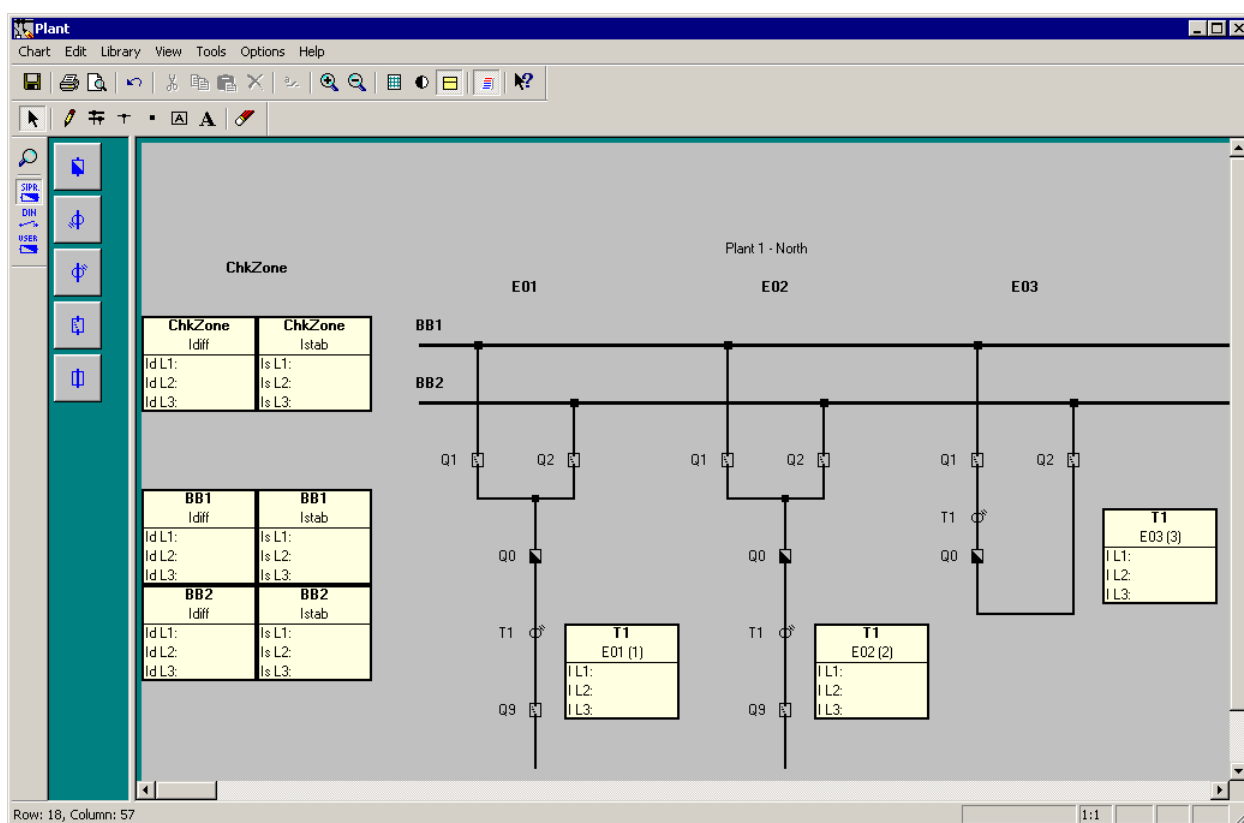


Figure 4-14 DIGSI Plant Configuration - Inserting static text - Example

### 4.3.9 Creating and Inserting Typical.

An arrangement of different elements in the substation chart can be saved as a so-called Typical. This Typical may then be inserted anywhere else in the substation chart or into other charts.



#### NOTE

Unlike a Typical a Template represents an entire substation chart which may be composed of Typicals. Templates may also be saved for reuse.

To save elements as Typical you must:

- Select all elements in the chart you wish to save together as Typical.
- Click **Edit** → **Save Graphic/Typical as** on the menu bar. The **Save as** dialog box opens.
- Enter a name for the Typical file. A Typical file has the extension **.sst**.
- Select the location where you want to save the Typical file.
- Click **OK** to apply the settings and to close the dialog box. The elements are saved to a file in the form of a Typical.


To insert a Typical you must:

- Click **Edit** → **Insert Graphic/Typical from** on the menu bar. The **Open** dialog box pops up.
- Select the drive of the Typical file from the **Browse** drop-down list box.
- Select a folder in the drop-down list box. You will find the supplied template files in the folder **SSTypicals**.
- All available files with the extension **.sst** are displayed in the box. Select the name of the Typical file you wish to open.
- Click **OK** to open the Typical file and to close the dialog box.
- Left-click into the chart to insert the Typical.

### 4.3.10 Saving the Substation Chart

You must explicitly save the modifications you have made to a chart.

To save the changes in the active chart you must:

- Click **Chart** → **Save** on the menu bar.
- Alternatively, you can click the  button on the Standard toolbar.

## 4.4 Configuration Notes

The 7SS52 V4 can be applied for the protection of busbar configurations with quintuple busbars as a maximum and up to 48 feeders.

- When configuring the up to 12 busbar sections and 12 bus coupler sections you will determine the description, busbar section number and colour for the individual busbar sections (BB01 to BB12) or bus coupler sections (TB01 to TB12). The evaluation report allows you to check the parameter assignments of the plant configuration (see Figure 4-37, page 111).



### NOTE

A feeder bay must include at least one disconnecter, one current transformer and one circuit breaker (if end fault protection is used).

A coupler must include at least two disconnecters and one current transformer.

- 
- 2-bay bus couplers must be parameterized to bay units with successive numbers (Figure 7-1, page 290).
  - In 2-bay-couplers you can configure one or two current transformers (Chapter 7.1.3.2, page 289 and Chapter 7.1.3.3, page 289).
  - In the 2 bay coupling, the circuit breaker disconnects the bay assignment. You can configure the disconnecters on one side of the circuit breaker in one bay unit and the disconnecters on the other side of the circuit breaker in the other bay unit.
  - For each bay unit you may configure not more than one transfer bus disconnecter. Transfer bus operation is only possible with transfer bus disconnectors of different bay units.
  - Only switchgear or current transformers of the same bay may be assigned to a bay unit. Except sectionalising disconnectors.



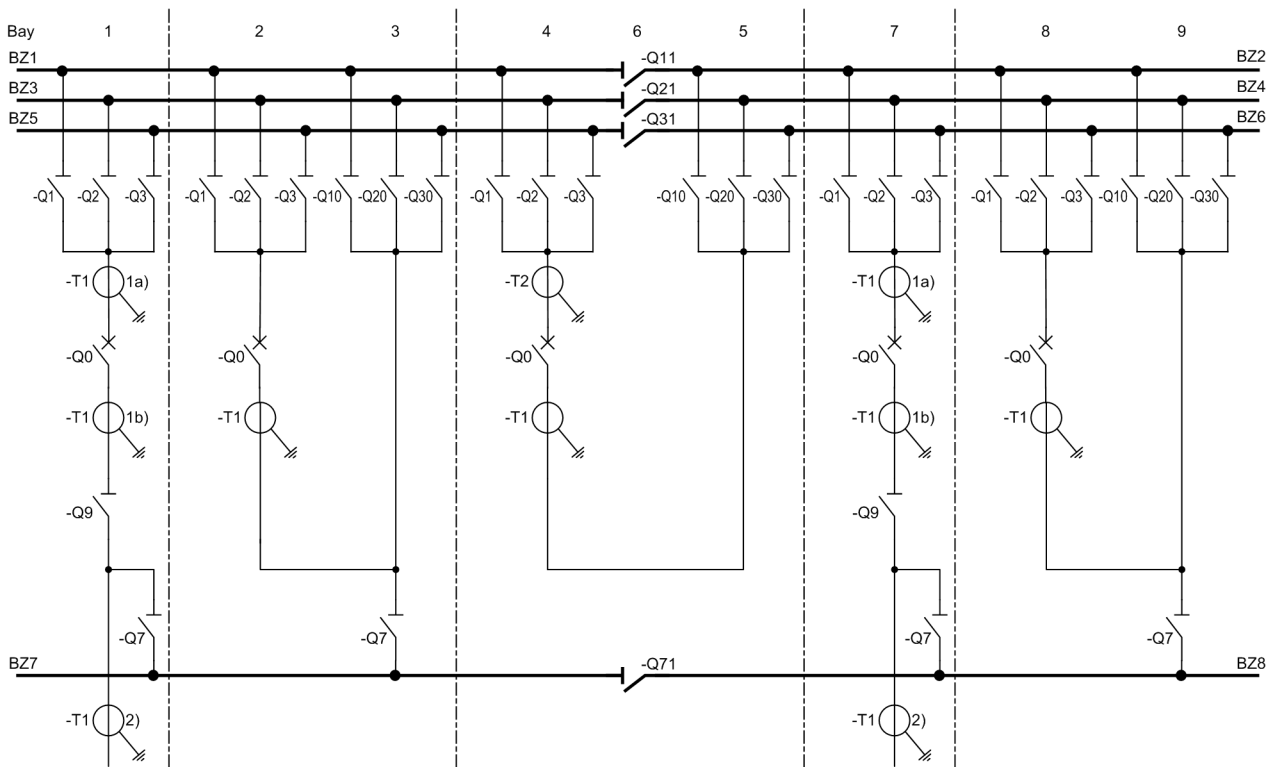
### NOTE

Gaps in the configuration (e.g. reserve bays) are allowed.

---

An example of a triple busbar with transfer busbars is shown in Figure 4-15, page 86. The corresponding configuration data are collected in Table 4-1, page 87.

An example of a double busbar with a combination busbar is shown in Figure 4-16, page 88. The corresponding configuration data are collected in Table 4-2, page 88.



- 1a) bus side current transformer (referred to Q7), in the direction of the busbar (referred to Q0)
- 1b) bus side current transformer (referred to Q7), in the direction of the line (referred to Q0)
- 2) line inside current transformer (referred to Q7)

Figure 4-15 Triple busbar with transfer busbar

Table 4-1 Configuration for a triple busbar with transfer busbar

| Bay: (XX) | Bay: Type            | CT LOC  |
|-----------|----------------------|---|
| 01        | Feeder bay           | 1a) Bus side t. bus<br>1b) Bus side t. line<br>2) line side |
| 02        | 2-bay coupler        | Bus side t. line  |
| 03        | 2-bay coupler        | non existent  |
| 04        | 2-bay coupler        | Bus side t. line  |
| 05        | 2-bay coupler        | Bus side t. line  |
| 06        | Section disconnecter | non existent  |
| 07        | Feeder bay           | 1a) Bus side t. bus<br>1b) Bus side t. line<br>2) line side |
| 08        | 2-bay coupler        | Bus side t. line  |
| 09        | 2-bay coupler        | non existent  |

- 1a) bus side current transformer (referred to Q7), in the direction of the busbar (referred to Q0)
- 1b) bus side current transformer (referred to Q7), in the direction of the line (referred to Q0)
- 2) line side current transformer (referred to Q7)

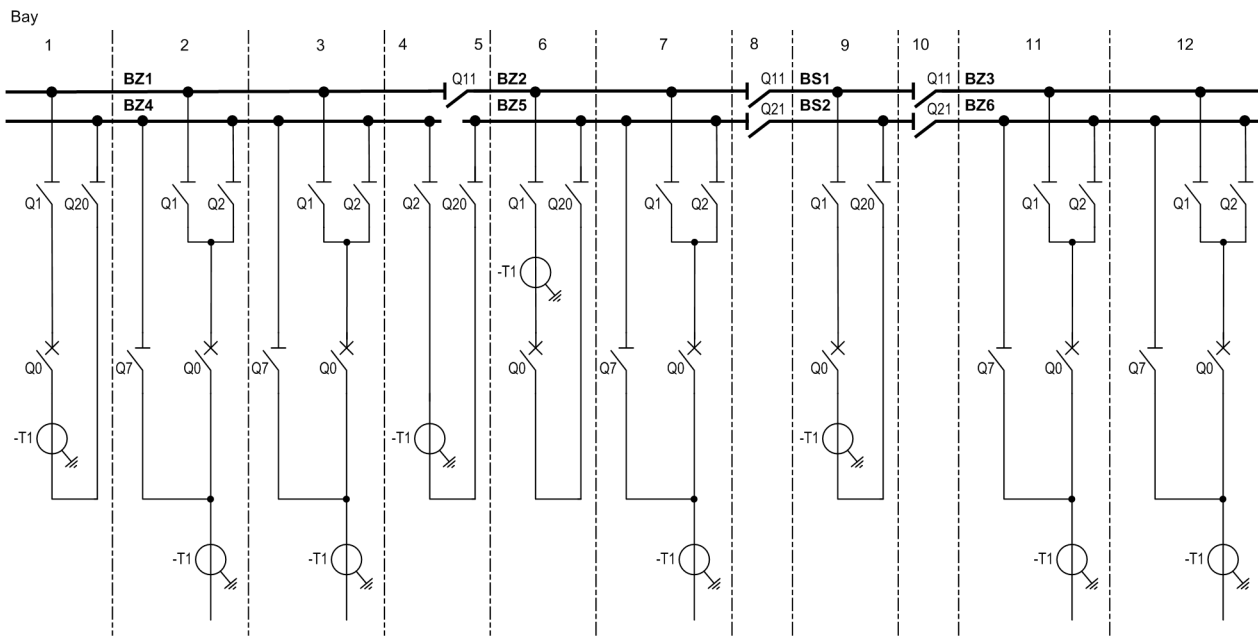


Figure 4-16 Double busbar with combi-bus

Table 4-2 Configuration of a double busbar with combi-bus

| Bay: (xx) | Bay Type             | CT LOC           |
|-----------|----------------------|------------------|
| 01        | 1-bay coupler        | Bus side t. line |
| 02        | Feeder bay           | line side        |
| 03        | Feeder bay           | line side        |
| 04        | 1-bay coupler w/o CB | Bus side t. bus  |
| 05        | Section disconnecter | non existent     |
| 06        | 1-bay coupler        | Bus side t. bus  |
| 07        | Feeder bay           | line side        |
| 08        | Section disconnecter | non existent     |
| 09        | 1-bay coupler        | Bus side t. line |
| 10        | Section disconnecter | non existent     |
| 11        | Feeder bay           | line side        |
| 12        | Feeder bay           | line side        |



---

|                                    |  |
|------------------------------------|--|
| <b>Bay types</b>                   | In the DIGSI Plant Configuration you may configure the feeders as 1-bay-coupler, 2-bay-coupler, feeder bay or sectionalizer.   |
| <b>Reserve bays</b>                | Reserve bays may be provided for in the configuration; they may be assigned any number that corresponds to their actual location. DIGSI configures the corresponding bay to <i>not existent</i> , if it has been drawn in the Plant Configuration but is not assigned in the "Bay unit allocation".  |
| <b>Hardware design</b>             | Depending on the size of the plant, the hardware design of the central unit can be adapted in steps of 8 connections for bay units.  |
| <b>Station configuration</b>       | <p>One bay unit is allocated to each feeder bay and each sectionalizer. The station configuration can include up to 16 bus couplers and 48 sectionalizers.</p> <p>Accordingly, bus couplers may be assigned one or two bay units depending on the number of primary components.</p>  |
| <b>Bus couplers</b>                | For further explanations about connection and setting of the bus coupler bays please refer to Chapter 7.1.3, page 288.   |
| <b>Disconnecter</b>                | <p>Up to 5 disconnecters can be connected to each bay unit. Transferbus disconnecters must be marked correspondingly in the Object Properties.</p> <p>For each disconnector one auxiliary contact for recognition of the OPEN position and one auxiliary contact for recognition of the CLOSED position is wired to the bay unit.</p> <p>The binary inputs BI1 to BI10 of bay unit 7SS523 have default allocations (refer to Chapter A.15, page 429) which can however be changed. Bay unit 7SS525 with BI1 to BI4.</p> <p>The disconnecters in the individual bus zones are assigned via the bus zone number.</p> |
| <b>Sectionalizing disconnector</b> | Disconnecters 1 to 5 can be used as sectionalizing disconnector too. If the bay unit has exclusively sectionalizing disconnecters the type "sectionalizing disconnector" is assigned to the bay unit. A maximum of 48 sectionalizers can be configured per substation.   |
| <b>CTs</b>                         | To include the transfer or combi-bus in the protection system, the CTs in the feeder bays (Figure 4-16, page 88) must be located on the line side, and the protection function must be released in <b>PROT TR BUS (5401 / CU)</b> .  |

**CT location**

The DIGSI Plant Configuration evaluates the CT location for the end fault protection and for stations with transfer busbars. The settings mean in this context:

- *busside towards busbar* means that the transformer is located between the circuit breaker and the busbar disconnector (Figure 4-15, page 86, 1a)
- *busside towards line* means that the transformer is located upstream of the feeder disconnector, i.e. between the circuit breaker and the feeder disconnector (refer to Figure 4-15, page 86, 1b)
- *line side* means that the transformer is located downstream of the feeder disconnector (Figure 4-15, page 86, 2).

For the end fault protection, the position of the current transformer relative to the circuit breaker is important (position 1 a or 1b and 2 respectively). For the behaviour or the protection in bypass operation, the position of the current transformer relative to the transfer busbar disconnector is important (position 1a and 1b respectively or 2).

In "2-bay couplers", CT is only assigned to one bay unit (Figure 4-17, page 90 and Figure 4-18, page 91).

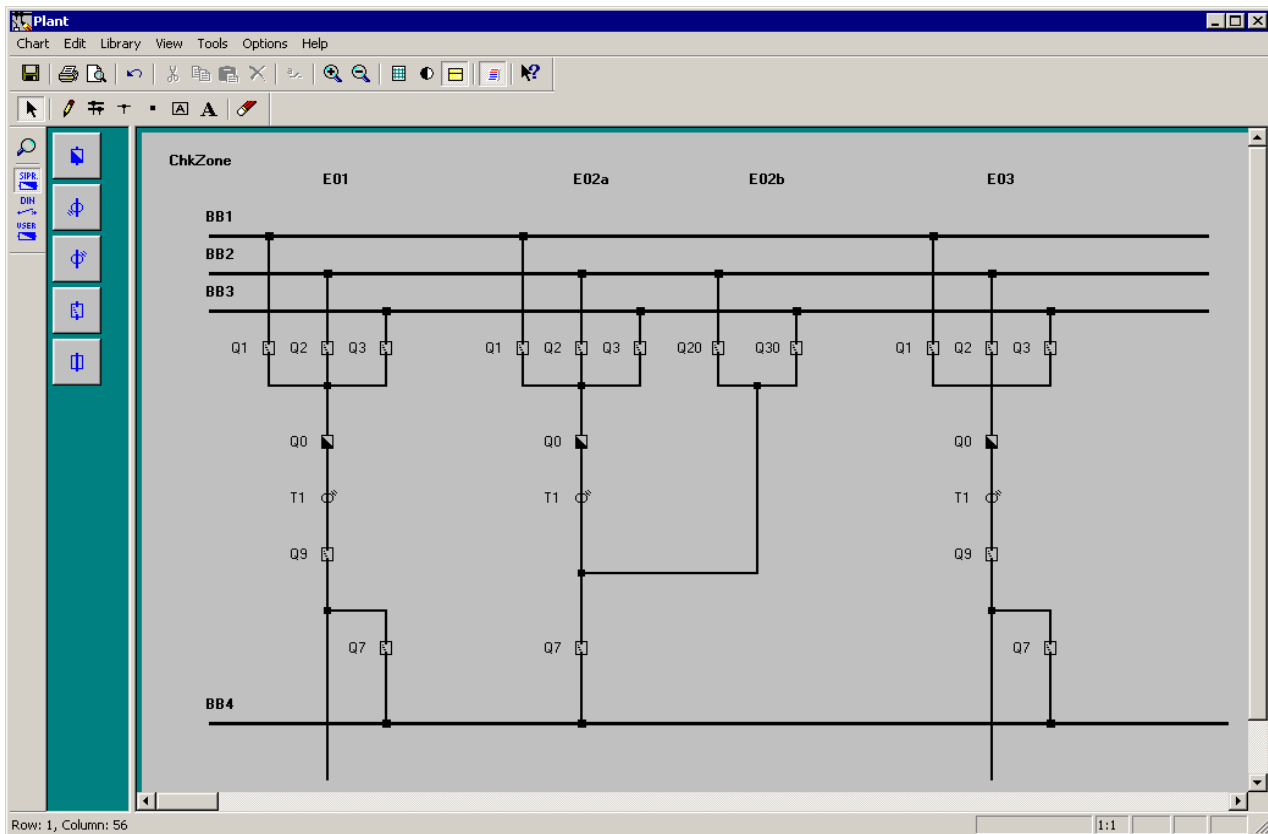


Figure 4-17 Example for the configuration of a 2-bay coupler with one CT

| Bay  | Bay unit |
|------|----------|
| E01  | BU 1     |
| E02a | BU 2     |
| E02b | BU 3     |
| E03  | BU 4     |

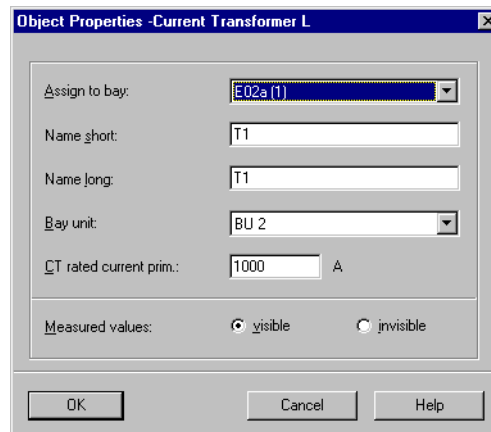


Figure 4-18 Object properties of the transformer T1 from the example given in Figure 4-17, page 90

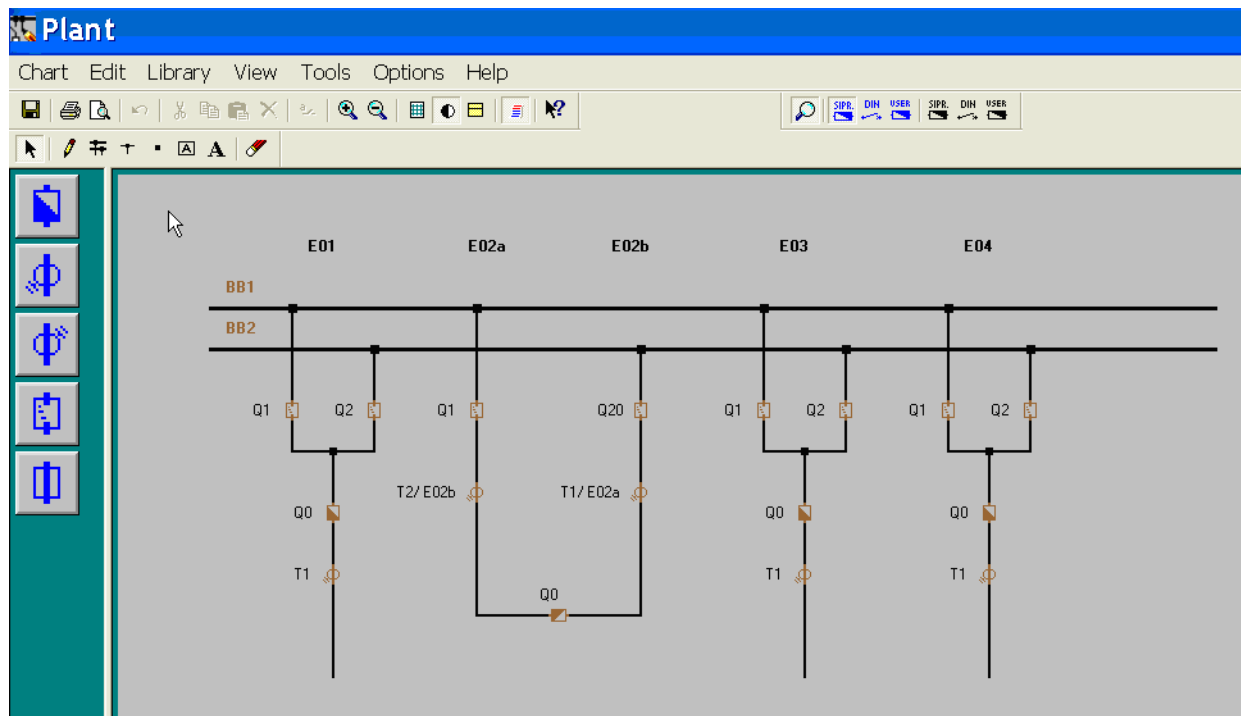


Figure 4-19 Example for the configuration of a 2-bay coupler with two CTs

| Bay  | Bay unit |
|------|----------|
| E01  | BU 1     |
| E02a | BU 2     |
| E02b | BU 3     |
| E03  | BU 4     |
| E04  | BU 5     |

Please note the crosswise assignment of the transformers.

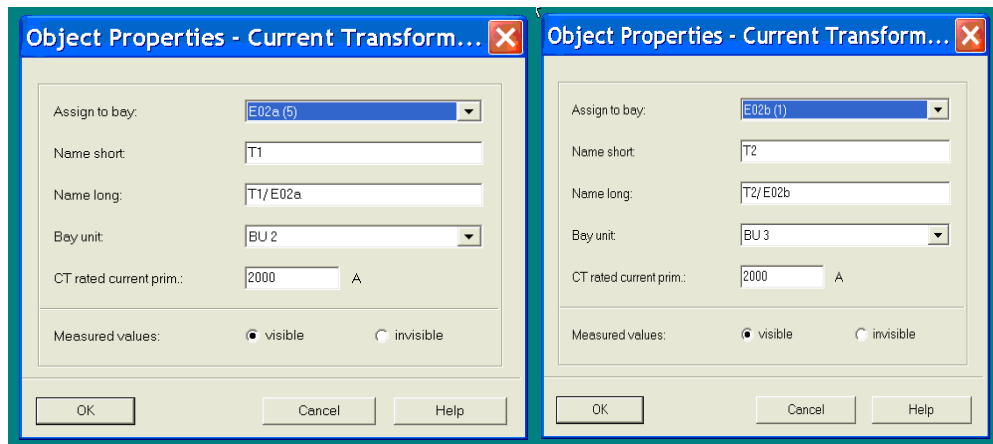


Figure 4-20 Object properties of the transformer from the example given in Figure 4-19, page 91

## 4.5 Assigning Bay Units

In the previous step you have drawn and parameterized your entire substation with the DIGSI Plant Configuration. Thus you have also configured bay units. Subsequently you must assign these bay units to the bay units in the Device Manager (see Chapter 4.2, page 69). Then you will be able to open the configured chart of the substation in the Plant Visualization and there you will see the present changes of the measured values and switch states. Furthermore, the central unit will not start without the assignment of the bay units.

To assign bay units you must:

- Open the folder **Settings** in the DIGSI Device Configuration and select the function **Bay unit allocation**.

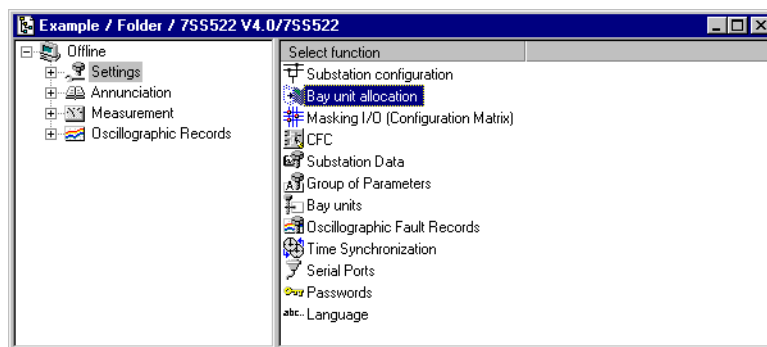


Figure 4-21 DIGSI Device Configuration - The folder Settings

- Right-click the object to open the context menu and apply the command **Open object**. You can also double-click the function **Bay unit allocation**. The **Bay unit assignment** dialog box opens. The left column is a list of all bay units configured with the DIGSI Plant Configuration.

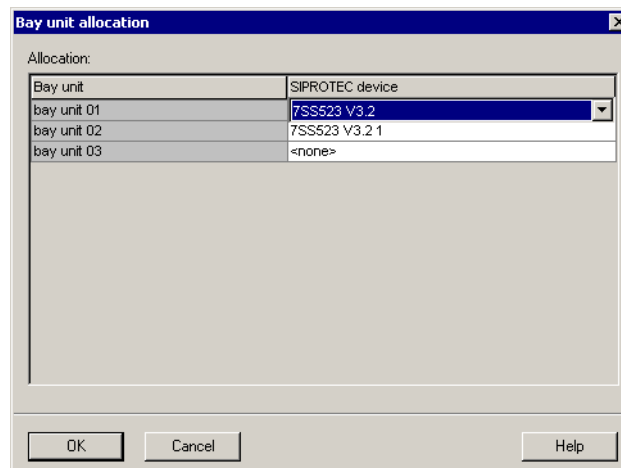


Figure 4-22 DIGSI Device Configuration - Dialog box for **Bay unit assignment**

- ❑ Assign the created bay units in the right column to the configured bay units. In each row of the right column select a bay unit you have created in the Device Manager from the drop-down list. Bay units that are already assigned will not appear in the drop-down list. If there are not enough bay units available, you must create new ones in the device manager (see Chapter 4.2, page 69).



**NOTE**

You can print the assignment of the bay units via the menu **File** → **Print**. The printout contains the number (1 to 48), the configured virtual bay unit and the physically existing bay unit created in the Device Manager.

---

## 4.6 Marshalling

In the previous step you have assigned the configured bay units to the bay units created in the Device Manager.

Next you will allocate information items to the input and output components of 7SS52 V4 such as binary inputs and binary outputs or LEDs. Information items can be indications and measured values.

You will not only determine the allocation itself but also the type of the allocation. An indication may for example be allocated to an LED in latched or unlatched mode. Also user-defined logic function can be the source of and the destination for information items. The assignment of information items to sources and destinations is called marshalling.

### 4.6.1 Marshalling Information Items of the Central Unit

#### 4.6.1.1 Allocable Information

##### Binary inputs

The D-CPU communication module features 5 binary inputs (BI 1 to 5).

The EAZ input/output module features 7 binary inputs (BI 6 to 12).

The binary inputs are freely allocable. They can be activated with or without voltage.



#### NOTE

Allocate the indication ">Sens. charact." (**FNo. 10478 / CU**) for the sensitive characteristic to the binary input 1 to 5 since these binary inputs process by 1 ms to 2 ms faster than the binary inputs 6 to 12.

Event data and binary input data are pre-allocated (see Table A-22, page 429).

The Chapter A.9, page 406 gives an overview of all possible indications with their function number (**FNo.**).

##### Binary outputs and LED indicators

The central unit features 16 alarm relays and 32 LED indicators.

Any number of annunciations can be marshalled to a binary output (group annunciation). The most common group annunciations with their own function number are already available in the system (see Chapter A.11, page 422).

Group annunciations that are not available by default are created by allocating the different function numbers to a relay and/or to an LED. Existing allocations may have to be deleted beforehand.

Each annunciation may be allocated to up to 10 relays or LEDs.

The presetting of the signal relays and of the LEDs is identical upon delivery and can be looked up in the tables A-23, page 429 and A-24, page 430.

The Chapter A.9, page 406 gives an overview of all possible indications with their function number (**FNo.**).

### 4.6.1.2 Marshalling

To marshal information items of the central unit via the Configuration Matrix you must:



#### NOTE

Bay units can only be allocated if they have been “instanciated” by the assignment of library elements (see Chapter 4.3.5, page 78) and by saving the substation chart Chapter 4.3.10, page 84.

#### Opening the Configuration Matrix

- Open the central unit in DIGSI Manager.
- In the function selection of the DIGSI Device Configuration right-click the object **Masking I/O (Configuration Matrix)**. Click **Open object** in the context menu. Or double-click the object. Both methods will open the Configuration Matrix.

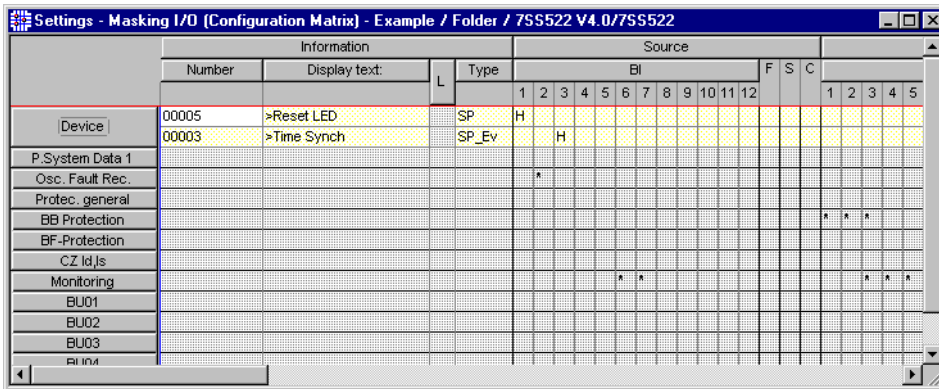


Figure 4-23 Partial view of the Configuration Matrix

#### Changing the view

- Maximize the Configuration Matrix
- In the toolbar select the option **Indications and commands only** from the left of the two drop-down list boxes.
- From the right drop-down list box of the toolbar select the option **Configured Information**.
- Click **View** → **Expand** → **All** on the menu bar. Double-click the command button **Long text** on the upper bar of the Configuration Matrix to hide this column.

For a detailed description, please refer to the SIPROTEC System Description /1/, and to the DIGSI on-line help.

Information of the type **Indications** and **Commands**, allocated to one source and /or destination, are now displayed depending on the selected filter. You will recognize an allocation by the character in the intersecting cell of an information row and of a source or destination column. Such characters will be called tags (flags) in the following.

Information items are row-wise comprised to groups. The group is indicated by the command buttons on the left border of the Configuration Matrix. These command buttons are also called group buttons.



**Changing Allocations**

- ❑ Right-click the cell containing a tag (flag). The context menu shows you all tags with their meaning which are possible for this combination of the information with the source or the destination. You will always be offered the tag **\_ (not configured)**.
- ❑ Click this entry in the context menu. The cell is now empty.
- ❑ To find out whether an allocation is possible, place the mouse pointer on the intersecting cell of the information row and the source or destination column. If the mouse pointer turns into a prohibitive sign, you cannot allocate the information to the selected destination or source. If the mouse pointer does not change, you can allocate the information.

**Inserting information items**

The Configuration Matrix contains several predefined information items. They can be complemented by user-defined information items. You can insert such user-defined information items into the Configuration Matrix by using the Information Catalog.

- ❑ Click **Insert → Information** or **View → Information Catalog** on the menu bar. The Information Catalog opens.

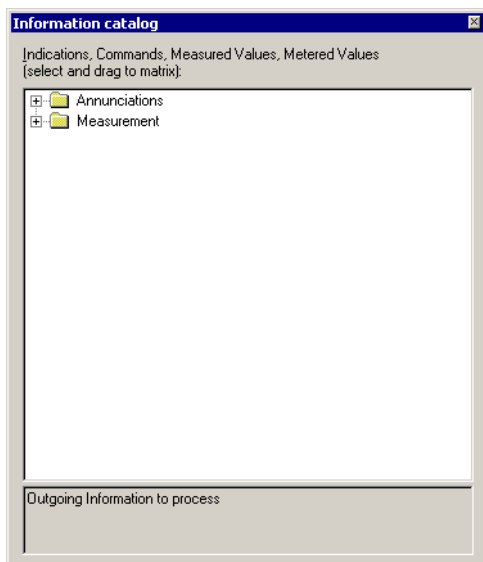


Figure 4-24 Information Catalog

The Information Catalog is basically structured like the tree view of the DIGSI 4 Device Configuration. Click the plus sign before a folder or double-click a folder symbol to access a lower hierarchy level within the catalog structure.

- ❑ Double click in succession on **Annunciations** and **Single Point Indications**.
- ❑ Select the name of an information item.
- ❑ Drag the information item out of the **Information Catalog** onto a group button on the left border of the Configuration Matrix. After you have released the mouse button, a new information item is inserted into the corresponding group.

## 4.6.2 Marshalling Bay Unit Information

### 4.6.2.1 Allocable Information

#### Binary inputs

The bay unit 7SS523 features 20 binary inputs which are designated **BINARY INPUT 1** to **BINARY INPUT 20**, bay unit 7SS525 features 10 binary inputs.

The binary inputs are marshalled in the address block **6100/BU**. It can be selected for each binary input function whether it is to operate as make circuit or as break circuit.

A - Make Circuit:

The input acts as a make-contact element meaning that the control voltage at the input terminal activates the allocated function;

R - Break circuit

The input acts as a break-contact element meaning that the control voltage at the input terminals resets the function, the function is active without control voltage.



#### NOTE

Marshalling a logic function to 2 or more binary inputs is not supported (no interconnection). A logic function must be allocated to one binary input.

It is, however, possible to allocate different functions to one binary input.

---

Table A-26, page 432 and Table A-31, page 435 shows the default assignment of the binary inputs upon delivery.

Chapter A.10, page 416 gives an overview of the allocable input functions with their function numbers (**FNo.**).

#### Signal relay

The bay unit has a freely allocable signalling output labelled SIGNAL RELAY 1. The allocation is made under **6201/BU**.

Several logic signalling functions (up to 20) can be marshalled to the signal output.

Indications starting with ">" are the direct checkbacks of the binary inputs and are identical to them. They appear for as long as the corresponding binary input is active.

The default setting of the signal relay is "Bay o of Serv." (**FNo. 7640/BU**).

Chapter A.10, page 416 contains the complete list of all possible signalling function with the function numbers (**FNo.**).

#### LED indicators

The bay unit 7SS523 features 18 LEDs for optical event indication.

There are 16 LEDs which are freely allocable labelled LED 1 to LED 16.

It is possible to assign several indications to each LED and also one indication to several LEDs.

Besides the specification of the logic function it is indicated whether the indication is in latched mode "m" or in unlatched mode "nm".

The ex-factory setting of the LEDs can be looked up in Table A-30, page 434.

The default setting of the LEDs 1 to 16 can be displayed upon selection and can also be modified.

The allocable signalling functions can be looked up in Chapter A.10, page 416 and match the signal relay functions.

**Trip relay**

The bay unit features 5 trip relays which are labelled TRIP RELAY 1 to 5.

Several functions can be marshalled to each trip relay. Also each logic function can be allocated to several trip relays.

The trip relays are preferably designed for the output of the TRIP command and of the transfer trip command. Depending on the plant specification and requirements they can also be used as additional signal relays.

The default functions of the device upon delivery are comprised in Table A-29, page 433 and Table A-33, page 436.

The functions stated in Chapter A.10, page 416 can also be marshalled to the trip relays.

**4.6.2.2 Marshalling**

Unlike the central unit the bay units are marshalled via dialog boxes and not via a configuration matrix.

To perform allocations for a bay unit you must:

- Open the bay unit in DIGSI Manager.
- Open the dialog box **Marshalling**.

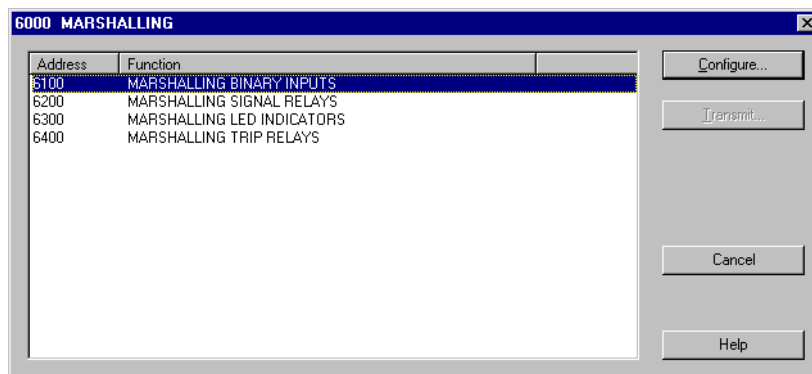


Figure 4-25 Marshalling the bay units - the dialog box Marshalling

- In this dialog box you will first select a group of physical components, for example **binary inputs**. For this purpose, select the corresponding designation in the Function column. Subsequently click **Configure....** A second dialog box opens. It shows the names of all individual components of the selected group.

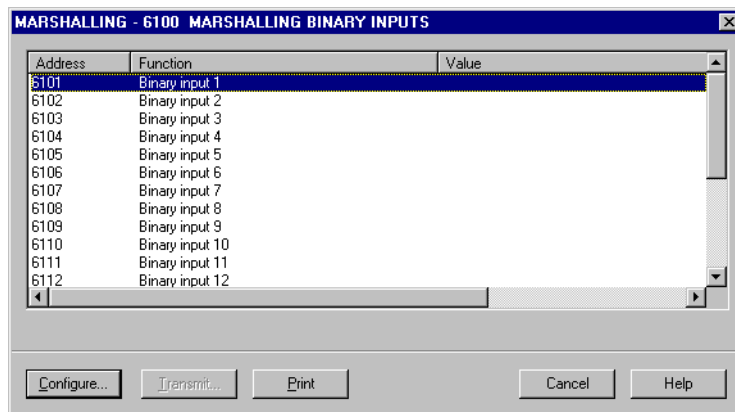


Figure 4-26 Marshalling the bay units - the dialog box Marshalling

- Now select the name of the component to which you want to allocate one or several indications. Subsequently click **Configure....** A third dialog box opens. It gives an overview of how many indications of the selected component can basically be allocated and which indications are already marshalled. The display texts of these indications are shown in the column Status. Those allocating positions that are still empty are in the same column marked with the entry Not allocated.

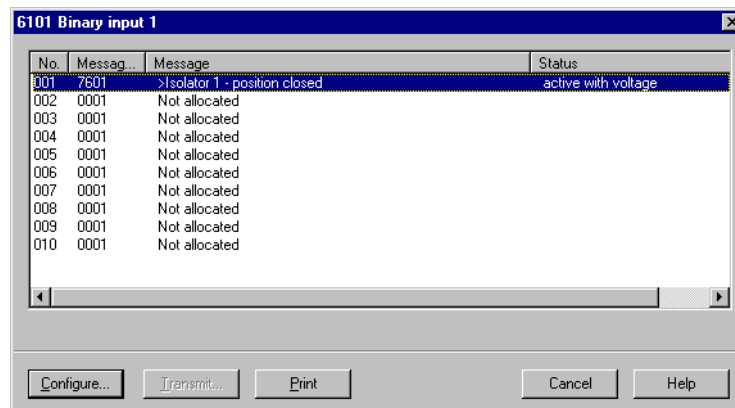


Figure 4-27 Marshalling the bay units - the dialog box Binary input 1

- To allocate a further message select one of the entries marked Not allocated. To modify an existing allocation select the display text of the marshalled message. Subsequently click **Configure....** Another dialog box opens. It offers you the selection of the display texts of all indications which can be marshalled to this component.

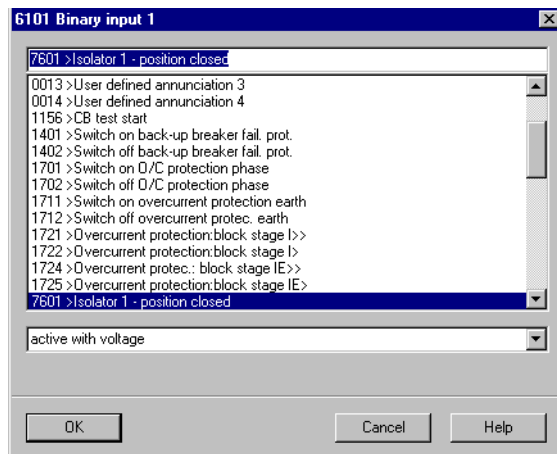


Figure 4-28 Marshalling the bay units - dialog box 6101 Binary input 1

- ❑ In the selection box select the display text of the messages you wish to assign to the selected component. If this component is a binary input or an LED, you must select an additional indication from the drop-down list box. Subsequently click **OK**. The active dialog box closes and you return to the previous dialog box. The display of the allocated messages is updated according to your selection.
- ❑ Repeat the procedure to perform further allocations. When you have made all allocations for the current component click **Close**. The active dialog box closes and you return to the previous dialog box.
- ❑ You can now select a further component if needed. If not, click **Close**. The active dialog box closes and you return to the dialog box **Marshalling**.
- ❑ You can now select a further component group for configuration. To finish the process, click **Close**. Next you will be prompted whether to save the modified settings to files. Click **Yes** to save the data. Click **No** to discard the changes. To neither save nor discard the modified settings click **Cancel**. In this case the dialog box **Marshalling** remains opened.

## 4.7 Settings

After you have used the Configuration Matrix to assign sources and destinations to the information items, you can configure the settings.

For detailed information on how to parameterize SIPROTEC 4 devices, please read the SIPROTEC System Description, /1/.

The settings of certain functions (see Chapter 5.10, page 205 and following sections) can only be configured for the bay units (PC linked to central unit or bay unit). The procedure is almost identical to the method for SIPROTEC 4 device described below. For further information on how to parameterize SIPROTEC 3 devices, please refer to the HTML on-line help of the DIGSI Device Configuration for SIPROTEC 3 devices.

### Changing setting values

To change a setting value you must:

- ❑ Double-click the object **Setting Group**. The dialog box **Setting Group** is displayed. It gives an overview of protection functions. The individual function designations are displayed with a function number.
- ❑ Select for example the entry **Power System Data** and click **Settings**. The dialog box **Power System Data** opens. It enables you to set all parameters of this function.
- ❑ Change the value of a **text parameter**. For this purpose click in the corresponding box in the column Value. A drop-down list box opens from which you select the new setting.
- ❑ Subsequently, change the value of a **decimal parameter**. For this purpose click in the corresponding box in the column Value. The mouse cursors changes into an input cursor. Now you can enter the new numerical value. The unit of a value is assigned automatically.
- ❑ Click **OK**. The dialog box **Power System Data** is closed. Afterwards close the dialog box **Setting Group** by clicking **OK**.

### Apply settings

- ❑ To apply the changes to the setting values click **Apply**. This command button is active when at least one setting value has been changed. The dialog box remains opened.
- ❑ If, however, you click **OK**, the values are applied and the dialog box closes. In both cases the values are stored in the memory of the computer. The setting values are **not yet** saved to the setting group. If you want to know how to save your settings, please refer to the device manual DIGSI Device Configuration, Chapter 5.2, page 138.

### Transmitting setting values to the device

When you are working **Online**, the command button **DIGSI → Device** is active if you have at least changed one setting value.

- ❑ Click **DIGSI → Device**, to transfer the changed settings to 7SS52 V4. The detailed procedure of transmitting setting values are described in the device manual DIGSI Device Configuration, Chapter 5.2, page 138.

## 4.7.1 Serial Ports

The central unit of 7SS52 V4 features one or more serial ports: one operating interface integrated in the front panel, also called PC port, and one rear service port and system port for connection to a control center. Communication via this port is subject to certain agreements concerning the device identification, the transmission format and the transmission rate.

These ports are configured via the DIGSI communication software. Click **Settings** on the navigation window. Then click **Serial ports** in the data window and enter your specific data into the dialog box that opens (Figure 4-29, page 103). Depending on the model of the device, the dialog box has different tabs with setting options for the corresponding interface parameters which you can access successively by mouse click.

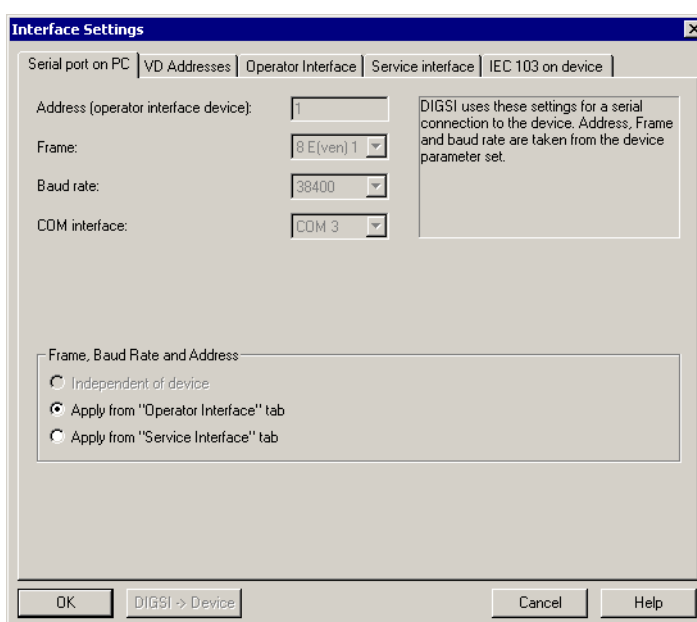


Figure 4-29 DIGSI, settings of the PC port

### Serial PC port

Indicate on the first tab sheet (**Serial port on PC**) the communication port of your PC connected to 7SS52 V4 (**COM 1** or **COM 2** etc.). You do not have to enter manually the settings for the data format and for the baudrate. You can take over the values from the tab **Operator interface** or, if available, from the tab **Service interface**. In doing so DIGSI reads out important settings directly from the interface and the corresponding boxes are grayed (see Figure 4-29, page 103). Or you can enter individual values at the option **Independent of device**.

### PC Port and service port

The tab sheets **Operator interface** and **Service interface** provide setting options for the data format, the baudrate and also for the IEC link address and maximum message gap (example given in Figure 4-30, page 104).

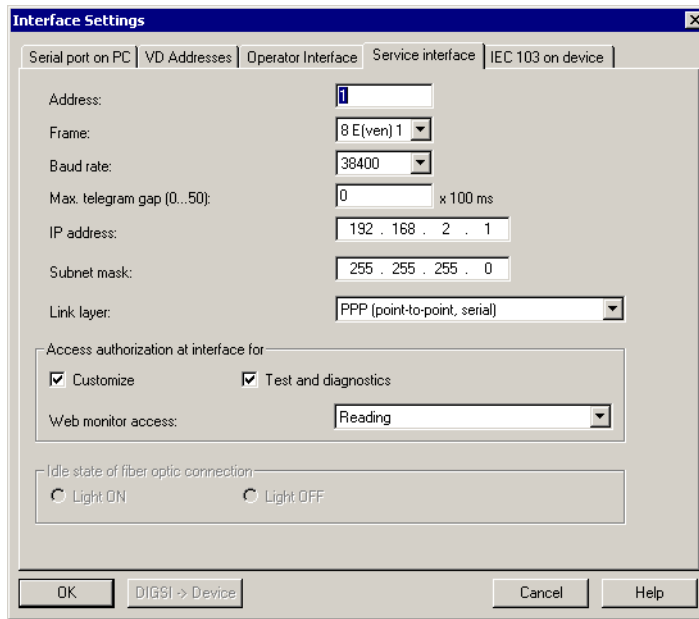


Figure 4-30 DIGSI, setting options of the service port – Example

Within an IEC bus, a unique IEC address must be assigned to each SIPROTEC 4 device. A total of 254 IEC addresses are available for each IEC bus. Enter the **IEC link address** of this device into the Address box.

The maximum message gap must only be entered if the device is to communicate via one of the ports by means of a modem. The specified time is the admissible maximum duration of transmission gaps during message transfer. Transmission gaps occur during modem operation and are caused by data compression, fault correction and differing baudrate. If the transmission quality between the modems is good, we recommend the setting **1.0** s. If modem connections are poor you should increase this value.

High values slow down communication in case of transmission errors. If a PC is connected directly, the **Max. message gap** can be set to **0.0** s.



**NOTENOTE**

Do not use the PC port for the communication via modem!  
For the communication via modem use the service port.

**Other ports**

In the other tabs you can enter your specific settings and addresses for device identification or check the values set by default. The device address is used by the control center to unambiguously identify each device. It must be unique for each device as otherwise it cannot be assigned in the overall system. For further information on the port setting, please read the SIPROTEC System Description, /1/.



### Idle state of fibre optic connection

The idle state of fibre optic connection is set to “Light OFF” by default. You can change the setting for the idle state in the tab of the interface settings (see Figure 4-31, page 105).

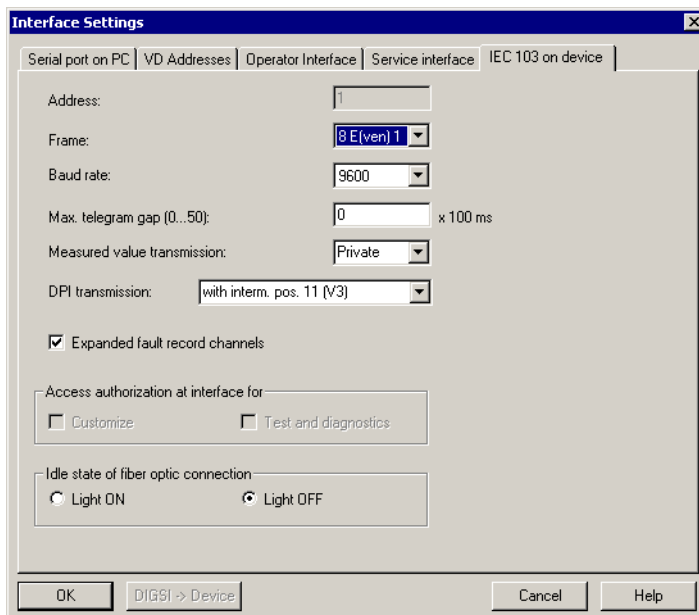


Figure 4-31 Settings for a fibre optic interface

### Retrieving and modifying the port settings via the operator panel

The most important port settings can be read out and some of them also modified via the operator panel of the actual device. You can access the screen for setting the ports from the **MAIN MENU** via **Parameter** → **Setup/Extras** → **Serial ports**.

Below the heading of the menu (**Serial Ports**) you can select the PC port, the system port and the service port via the arrow key **▼**. Press the **▶** key to access the sub-menu of each port. The display and the option of parameterizing directly at the device are identical for the PC port and for the service port. We will take the example of the PC port (Figure 4-32, page 105).

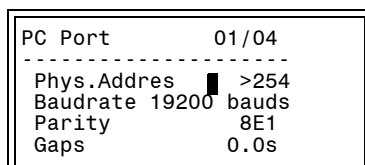


Figure 4-32 Reading and setting the PC port via the operator panel of the device.

The type of the port(s) depends on the device model and variant and may also miss entirely. While it is possible to modify the data of the PC port and the service port at the device, the data of the system port(s) can only be read out at the device. In addition to the parameters already mentioned for the PC port and the service port, the idle state for fibre optic connection can be read out here (see Figure 4-33, page 106). In case of a wired interface you will read “not existent” here.

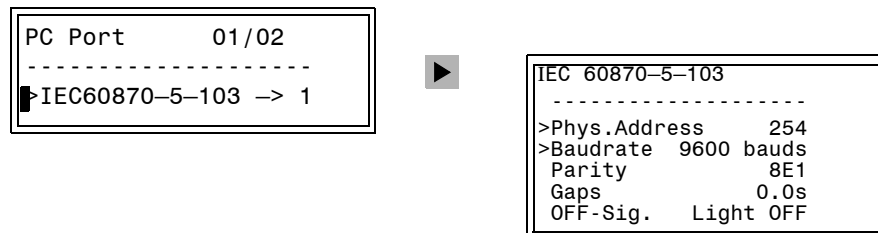


Figure 4-33 Reading out the setting values of the IEC 60870 port in the operator panel of the device

### Bay units

To enable correct communication of the PC and the bay units via the system port, some interface settings may have to be verified or changed.

To verify or change the settings for the PC port and for the system port you must:

- ❑ Right-click **Configuration** in the list view. Click **Configure** in the context menu. You can also double-click **Configuration**. Both methods will open the dialog box **Operating System Configuration**.
- ❑ In the column **Function** select the entry **PC AND SYSTEM INTERFACES**. Subsequently click **Configure**. A second dialog box opens. It shows the names of all parameters together with an address and the currently set value.
- ❑ Select a parameter to change its value and then click **Configure**. A third dialog box opens. It offers you possible values for the selected parameter.
- ❑ Select the desired value. Subsequently click **OK**. The current dialog box closes and you return to the previous dialog box. The display in the column **Value** is updated according to your selection.
- ❑ Repeat the procedure for further parameters. Click **Close** to finish the procedure. The current dialog box closes and you return to the dialog box **Operating System Configuration**.
- ❑ Click **Close**. Next you will be prompted whether to save the modified settings to files. Click **Yes** to save the data. Click **No** to discard the changes. To neither save nor discard the modified settings click **Cancel**. In this case the dialog box **Operating System Configuration** remains opened.



### NOTE

If you change the device address of a bay unit, you must reassign the bay unit in the DIGSI Device Manager (see Chapter 4.5, page 93) to enable the configured substation chart to be opened in the Plant Visualization and there to display the latest changes of the measured values and switch states.

## 4.7.2 Date/Clock Management

The integrated date/clock management enables the exact timely assignment of events e.g., those in the operational annunciations and fault annunciations or in the lists of the minimum/maximum values. The time can be influenced by

- the internal clock RTC (Real Time Clock),
- external synchronisation sources (DCF77, IRIG B, SyncBox, IEC 60870-5-103, IEC 60850),
- external minute pulses via binary input.



### NOTE

Upon delivery of the device the internal clock RTC is always set by default as synchronisation source, regardless of whether the device is equipped with a system port or not. If the time synchronisation is to be accomplished by an external source, you must select the latter.

### Time synchronization

You find the parameters for the clock management in DIGSI at **Settings** → **Time Synchronization** (Figure 4-34, page 107).

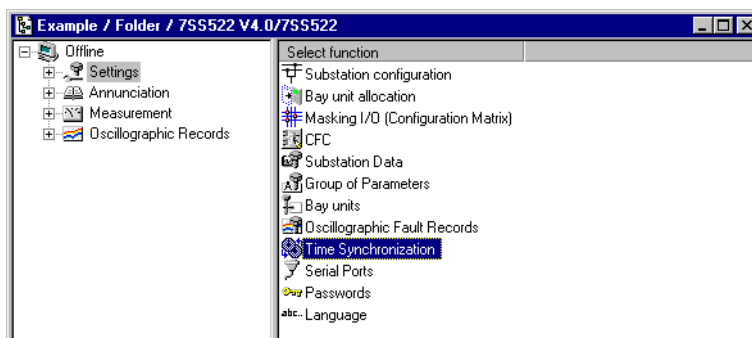


Figure 4-34 The window Settings in DIGSI – Example

Double-click **Time Synchronization**. The **Time Synchronization & Time Format** dialog box opens (Figure 4-35, page 108).

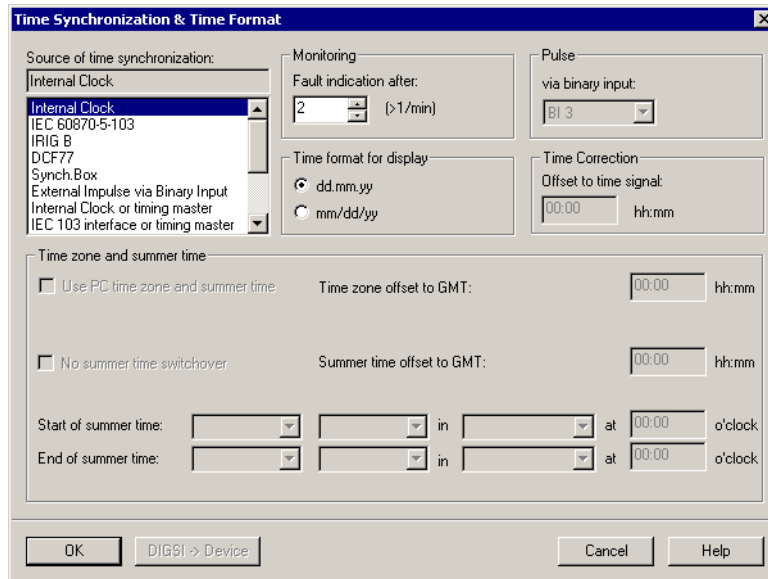


Figure 4-35 Time Synchronization & Time Format dialog box in DIGSI – Example

Specify here the factors for influencing the internal clock management. You can choose between the following operating modes:

Table 4-3 Operating modes of the clock management

| No. | Operating mode                           | Comments  |
|-----|--|---|
| 1   | <b>Internal Clock</b>                    | Internal synchronization via RTC (default)                    |
| 2   | <b>IEC 60870-5-103</b>                   | External synchronization via IEC 60870-5-103–system interface |
| 3   | <b>Time signal IRIG B</b>                | External synchronization via IRIG B                           |
| 4   | <b>Time signal DCF77</b>                 | External synchronization via the time signal DCF77            |
| 5   | <b>Time signal Sync. Box</b>             | External synchronization via the time signal SIMEAS-Synch.Box |
| 6   | <b>External Impulse via Binary Input</b> | External synchronization with impulse via binary input        |
| 7   | <b>NTP (IEC 61850)</b>                   | External synchronization via system interface (IEC 61850)     |

Due to the internal buffer battery the RTC continues to run even when the auxiliary voltage is switched off temporarily. RTC is always the first synchronization source for the internal clock management when the device is switched on or after a failure of the auxiliary voltage regardless of the set operating mode.

In the operating mode **Internal Clock** the internal clock management uses only RTC as the synchronization source. It can also be changed manually. The manual setting of date and time is described in Chapter 6.3.7, page 269.

If one of the external operating modes is selected, only the parameterized synchronization source will be used. If it fails, the internal clock will continue in unsynchronized mode.

If the time synchronization is to be accomplished via the control center, the option **IEC 60870-5-103** or **NTP (IEC 61850)** must be selected (Figure 4-35, page 108).

For the operating modes with time signal (radio clock) you must observe that it may take up to 3 minutes after the start or return of the reception until the received time has been safely decoded. Only then will the internal clock management be synchronized.

For the time signal IRIG B the year must be set manually as this standard does not include a year number.



#### NOTE

If you have by mistake entered a year smaller than "1991" for IRIG B, the year will be set to "1991" during the first synchronization.

If the synchronization takes place by external pulse via binary input: From 30 seconds on the time will be rounded up to zero of the next minute when the positive pulse edge arrives. If the seconds have not yet reached 30, they are rounded off to zero of the previous minute. The signal is not monitored, each pulse takes immediate effect on the clock management.

#### Synchronization offset

The parameter **Synchronization offset (Offset to time signal)** can be used to adapt the synchronization time delivered by the radio clock receiver to the local time (time zone). The adjustable maximum offset is:  $\pm 23 \text{ h } 59 \text{ min} = \pm 1439 \text{ min}$ .

#### Fault indication after tolerance time

The tolerance time for faults (**Fault indication after**) indicates how long a cyclic synchronization may be missing until the time is considered faulted.

An external or internal synchronization is usually performed in minute intervals. (The synchronization by external pulse via binary input is an exception. Its pulse may arrive in intervals of several minutes). Therefore, this parameter must always be at least 2 minutes. If the conditions for reception are unfavourable for the radio clock, the transition to the state "error" can be further delayed.

#### Changing the operating mode

When changing the operating mode, the corresponding hardware will switch to the other synchronization source after one second at latest. The cyclic synchronization is thus first interrupted and the clock is considered faulted, as is the case for a start, until the new synchronization source takes effect.

If the synchronization offset is changed in the operating modes with time signal and if the year is changed in the operating mode IRIG B, the cyclic synchronization will not be lost but a time step will occur. When the offset is changed to the "switching" minute, the time value is displayed with "Clock SyncError on" without the synchronization offset and afterwards with "Clock SyncError off" with the synchronization offset.

**Operational indications of the clock management**

After the indication "Clock SyncError on" a time step must be expected. This indication is triggered if:

- a synchronization fault has lasted for longer than the above mentioned tolerance time or by changing the operating mode.
- a time step is anticipated afterwards; the message is displayed with the time *before* the step.

The message "Clock SyncError off" is triggered if:

- the synchronization has taken effect again (e.g. after faulted reception or radio clock reception);
- immediately after a time step; this message is displayed with the time *after* the step, so that conclusions can be drawn as to the magnitude of the step.

**Time format**

Either the European time format (DD.MM.YYYY) or the US format (MM/DD/YYYY) can be specified for the device display.

## 4.8 Concluding the Configuration

Conclude the configuration by using a report to verify the allocation of the parameters and transmit the parameters to the central unit or to the bay units.

To view a report when exiting the Plant Configuration you must:

- Click **Options** → **Customize...** on the menu bar of the DIGSI Plant Configuration. The window Customize opens.

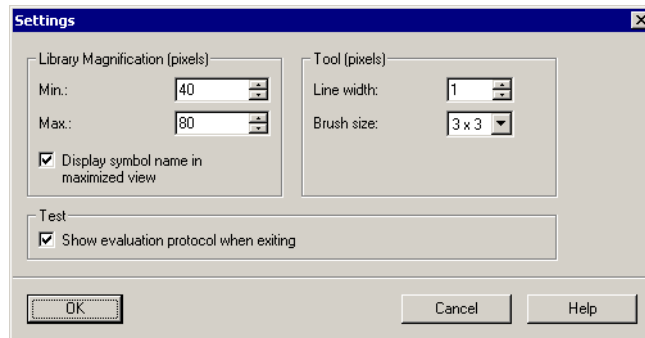


Figure 4-36 Customize window – Example

- Mark the checkbox **Show evaluation protocol when exiting**.
- Subsequently click **OK**. The evaluation protocol (report) (Figure 4-37, page 111) opens when you exit the Plant Configuration.

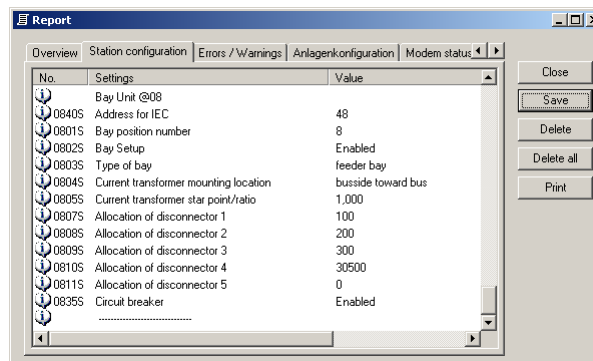


Figure 4-37 Evaluation protocol (report) when exiting the configuration – Example

**Allocation of disconnector**

The evaluation protocol (report) shows the allocation of disconnectors as a coded value. The explanation is given in the following Table.

Table 4-4 Allocation of disconnector

| Value       | Allocation of disconnector                                       |
|-------------|--|
| 0           | disconnector not existent  |
| 100...1200  | BB disconnector or "sect. disconnector left side" on BB01...BB12 |
| 5100...6200 | BB disconnector or "sect. disconnector left side" on TB01...TB12 |
| +1...12     | "sect. disconnector right side" on BB01...BB12                   |
| +51...62    | "sect. disconnector right side" on TB01...TB12                   |
| +10000      | left disconnector of 1-bay-coupler                               |
| +20000      | right disconnector of 1-bay-coupler                              |
| +5000       | line disconnector  |
| +30000      | transferbus/combined bus disconnector                            |
| +100000     | disconnector always closed                                       |

To transmit the modified settings to the central units or to the bay units:



**NOTE**

If you have created new bays on your own in the DIGSI Plant Configuration, you must check whether the report is correct.

- If you are transmitting the parameters for the first time, you must initialize 7SS52 V4. If you want to know more on this topic, please read the SIPROTEC 4 System Description /1/.
- If 7SS52 V4 has already been initialized, click **Device** on the menu bar and then the menu item **DIGSI** → **Device**. You will be prompted to enter password No. 7 (parameter set). After you have entered the password and confirmed it with **OK**, the data will be transmitted and take effect when the transmission to the central unit or the bay units is completed.



# Functions

# 5

This chapter explains the various functions of the SIPROTEC 7SS52 V4 distributed busbar and breaker failure protection. It shows the setting possibilities for each function in maximum configuration. It also gives information and - where required - formulae for determination of the setting values.

Unless otherwise specified, all settings are made on the central unit by means of the DIGSI communication software.

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## 5.1 Busbar Protection

The busbar protection represents the main function of the 7SS52 V4. It is characterized by a high measurement accuracy and flexible matching to the existing station configurations. It is supplemented by a series of ancillary functions.

The measurement methods described here below apply for the bus zone-selective protection as well as for the check zone.

### 5.1.1 Mode of operation

#### 5.1.1.1 Basic Principle

The measurement method relies on Kirchhoff's current law.

This law states that the vectorial sum of all currents flowing into a closed area must be zero. This law applies, in the first instance, to DC current. It applies to AC current for instantaneous values. Thus, the sum of the currents in all feeders of a busbar must be zero at any instant in time.

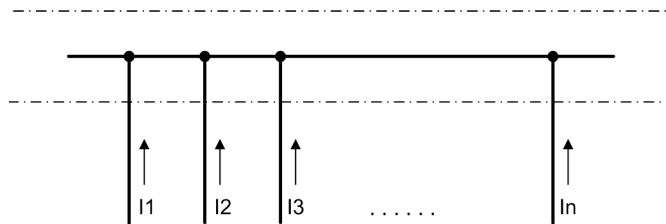


Figure 5-1 Busbar with n feeders

Assuming that the currents  $I_1, I_2, I_3$  to  $I_n$  flow in the feeders (Figure 5-1, page 114) connected to the busbar, the following equation applies in the healthy condition. A uniform orientation of the currents is assumed; the currents flowing towards the busbar are defined as positive, and the currents flowing away from the busbar as negative.

$$I_1 + I_2 + I_3 \dots + I_n = 0 \tag{1}$$

If this equation is not fulfilled, there must be some other – impermissible – path through which a current flows. This means that there is a fault in the busbar region.

This law is superior, as the basis for busbar protection, to any other known way of measurement. A single quantity characterizes faulty conditions. This quantity is the sum of currents. It can be formed at any time. The current sum used for evaluation is available at any instant without interruption. The current sum stays at zero, unless there – due to a fault – another path whose current is not measured.

The above considerations apply strictly to the primary conditions in a high-voltage switching station. Protection systems, however, cannot carry out direct measurements of currents in high-voltage systems. Protection equipment measurement systems are connected through current transformers. The current transformers reproduce on their secondary side the currents flowing in the station. The currents are scaled down according to the transformation ratio of the CTs while retaining the same phase relation. Furthermore, the current transformers can keep dangerous high voltages away from

the protection system, since their secondary circuits are isolated from the high-voltage system and their shielding windings are earthed.

The current transformers are an essential part of the whole protection. Their characteristics are an important factor for the correct operation of the protection. Their physical locations mark the limits of the protection zone covered by the protection system.

The current transformers transform the primary currents flowing in the station ( $I_{\text{prim.}}$ ) proportionally into secondary currents ( $I_{\text{sek.}}$ ). As a result, the following equation applies for the busbar protection in the fault-free condition:

$$I_{1 \text{ sec.}} \cdot n_1 + I_{2 \text{ sec.}} \cdot n_2 + I_{3 \text{ sec.}} \cdot n_3 \dots + I_{n \text{ sec.}} \cdot n_n = 0 \quad (2)$$

$n_1, n_2, n_3 \dots n_n$  are the CT transformation ratios and

$I_{1 \text{ sec.}}, I_{2 \text{ sec.}} \dots I_{n \text{ sec.}}$  are the secondary currents.

In order to be able to process currents from bays with different transformers on the busbar level, all currents must refer to the same CT transformation ratio. For this reason, a current standardisation is carried out in the bay unit.

In the plant configuration, the specification of the reference current of the system is defined as the reference value as a basis by specification of the reference current of the system. To calculate the standardisation factor for each current, all CT transformation ratios in the equation (2) have to be divided by this reference current.

Such a busbar protection would certainly detect any short-circuit inside the protection zone. However, since transformation errors of the current transformers are unavoidable to some degree, it would also be liable to cause spurious tripping as a result of an external short-circuit. Such an error might be, for instance, a close-up fault on one of the feeder bays. The current flowing into the short-circuit is shared on the infeed side by several bays. The current transformers in the infeeding bays carry only a fraction of the total fault current while the current transformer in the faulted feeder bay carries the full current in its primary winding. If the fault current is very high, this set of current transformers may therefore be saturated, so tending to deliver only a fraction of the actual current on the secondary side while the rest of the current transformers, due to the distribution of currents among several bays, perform properly. Although the sum of the currents is zero on the primary side, the sum of the currents in equation 2 is now no longer zero.

In differential protection systems for busbars and similar objects, this difficulty is countered by employment of the so-called stabilisation (restraining) devices.

If the short-circuit does not occur at the voltage peak of the cycle, a DC component is initially superimposed on the short-circuit current. This DC component decays according to an exponential function with a time constant  $\tau = L / R$  of the source impedance. Time constants  $\tau$  of approximately 60 ms are frequently encountered in high-voltage systems. 100 ms and more may be reached in the vicinity of large generators.

Several measures - some of which are already known from the conventional protection - have been introduced into the measuring system of the 7SS52 V4 busbar protection to cope with these problems. They supplement the basic principle of monitoring the summation (differential) current. The 7SS52 V4 busbar protection has thus a maximum degree of security against spurious operation for external short-circuits. At the same time, it ensures that in the event of internal short-circuits a tripping signal is initiated within the very short time of less than a half-cycle.

The measuring circuit of the 7SS52 V4 is characterized by the following features:

- Basic principle:  
Monitoring the sum of the currents as the tripping quantity
- Measures taken to guard against the disturbing influences due to current-transformer saturation:
  - Stabilisation (against large through currents)
  - Separate evaluation of each half-wave (particularly effective against DC components)
- Measures taken to obtain short tripping times:  
Separate evaluation of the current transformer currents during the first milliseconds after the occurrence of a fault (anticipating the current transformer saturation).

### 5.1.1.2 Algorithm with Instantaneous Values

#### Stabilisation

The stabilisation reduces the influence on the measurement of transformation inaccuracies in the various feeders to such a degree that spurious behaviour of the protection system is prevented. The differential protection forms both the vectorial sum of the CT secondary currents, which acts in the operating sense, and the arithmetic sum of those quantities, which has a restraining effect.

The stabilizing (restraint) current thus obtained is additionally smoothed by the software (Figure 5-2, page 116) to ensure stability even in cases of extreme saturation.

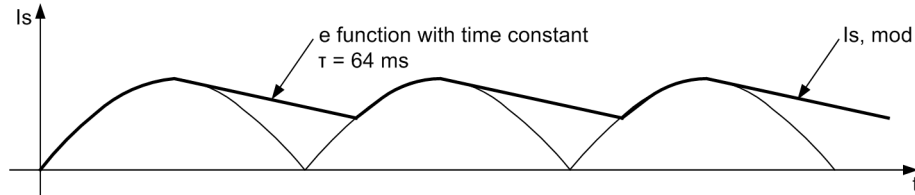


Figure 5-2 Formation of the stabilizing (restraint) current

#### Characteristic

The operating conditions for the busbar protection vary considerably between one plant and the other, as do the setup and the switching possibilities of the individual stations. For instance, the range between the lowest and the highest currents to be expected in case of a short-circuit is different for each plant. Another important factor are the data and burdens of the CTs available for connecting the protection system. Finally, the treatment of the starpoint in the high-voltage system has some importance for the design and setting of the protection. For all these reasons, the busbar protection system has to offer a high degree of flexibility.

The standard characteristic is determined by the two settable parameters "Stabilisation factor k" and "Differential current limit Id>".

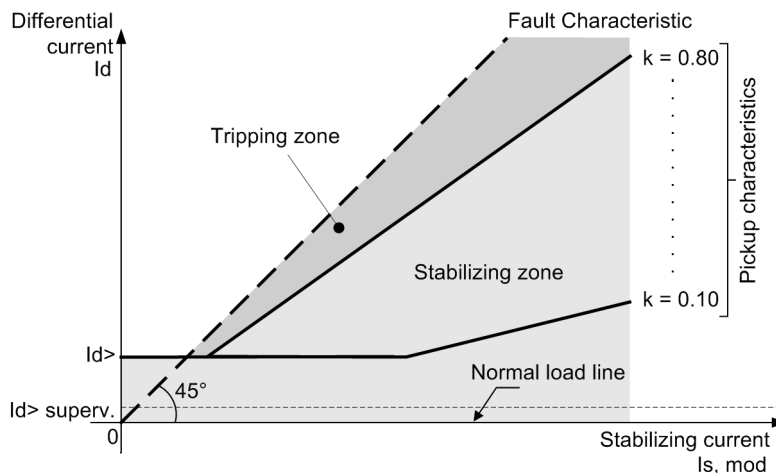


Figure 5-3 Standard characteristic

The vectorial sum  $I_d$  as the tripping quantity

$$I_d = | I_1 + I_2 \dots + I_n |$$

is counterbalanced by the restraining quantity  $I_s$

$$I_s = | I_1 | + | I_2 | \dots + | I_n |$$

which is the arithmetic sum of the magnitudes of each current.

The criterion for a short-circuit on the busbar is thus:

$$I_d > k \cdot I_{s, \text{mod}}$$

The modified stabilizing quantity  $I_{s, \text{mod}}$  is derived from  $I_s$  and is illustrated in Figure 5-2, page 116.

**Standard characteristic**

Figure 5-3, page 117 illustrates the characteristic of a stabilized (restrained) differential protection system. In the diagram, the abscissa represents the sum  $I_{s, \text{mod}}$  of the magnitudes of all quantities flowing through the busbar while the vectorial sum  $I_d$  is plotted as the ordinate. Both axes use rated current as the unit and both have the same scale. If a short-circuit occurs on the busbars whereby the same phase relation applies to all infeeding currents,  $I_d$  is equal to  $I_s$ . The fault characteristic is a straight line inclined at  $45^\circ$ .

Any difference in phase relation of the fault currents leads to a (practically insignificant) lowering of the fault characteristic. Since in fault-free operation  $I_d$  is approximately zero, the x-axis may be referred to as the normal load line. The stabilizing factors can be selected in a range of  $k = 0.10$  to  $0.80$  for the bus zone-specific busbar protection or  $k = 0.00$  to  $0.80$  for the check zone. The factors are represented as three straight lines with corresponding gradient and form the operating characteristic. The differential protection system determines whether the total of all currents supplied by the current transformers represents a point in the diagram above or below the set characteristic line. If the point lies above that line, tripping is initiated.

**Sensitive characteristic**

Low-current busbar faults, such as high-resistance earth faults, require a higher tripping characteristic sensitivity for busbar protection and breaker failure protection. These more sensitive characteristics have their own parameters. The stabilizing factor is identical with the standard tripping characteristic.

The marshallable binary input ">Sens. charact." (FNo. 10478/CU) in the central unit allows to switch over between the characteristics.

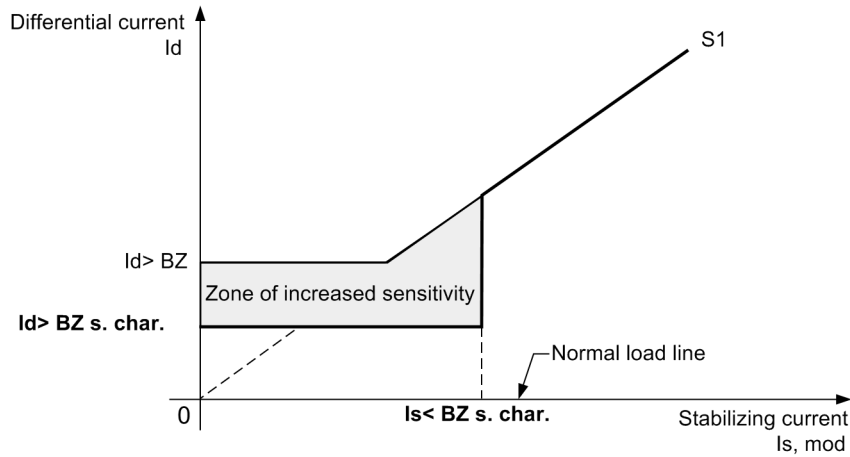


Figure 5-4 Sensitive characteristic

**Superv. s. char**

The parameter **Superv. s. char** (6321A/CU) is used to activate the supervision of the binary input.

After elapse of the 15 s active signal supervision time, the alarm "Dist. BI s. char." (FNo. 10509) is output, and the further processing of the binary input is blocked. After this, the standard characteristic is used again.

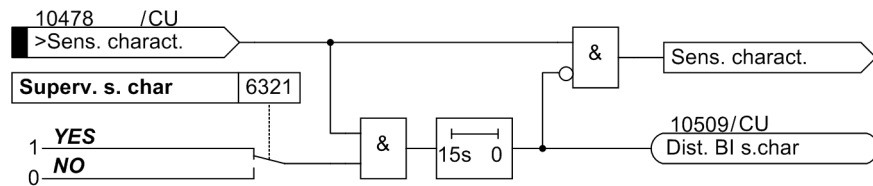


Figure 5-5 Supervision of binary input for sensitive characteristic

### 5.1.1.3 Separate Evaluation of Half-Cycles

At the instant a short-circuit occurs, the current is usually not symmetrical about the zero line. The peak values of the two half cycles differ to an extent which depends on the time instant on the cycle when the short-circuit began. The short-circuit current contains a DC component. This DC component decays according to an exponential function with a time constant  $\tau = L / R$  of the source impedance. Time constants  $\tau$  of approximately 60 ms are frequently encountered in high-voltage systems. 100 ms and more may be reached in the vicinity of large generators.

Such DC components make it substantially more difficult for the current transformers to perform their function of transformation since such components increasingly polarize the iron core.

Figure 5-6, page 121 illustrates the condition in the extreme case of an initially fully offset short-circuit current. An additional problem in this case is remanence of the current transformer under consideration (remanence, for instance after an auto-reclosure), which is presumed to be present in this case.

Figure 5-6, page 121 a) depicts the initially fully offset current. The DC component at the beginning is equal to the peak value of the short-circuit AC current and decays at the rate of  $\tau = 64$  ms. The current flows through the current transformer which, under the conditions assumed to be present, would just be able to carry the AC current without saturation if the AC current and thus the magnetic flux in the iron core were not offset. However, on account of the superimposed DC component and the unfavorable magnetic flux at the instant of short-circuit inception, the current transformer will be saturated after about 6 ms. The magnetic flux cannot rise any more. The current transformer no longer delivers current on the secondary side. Only after the zero-crossing of the current is transmission to the secondary side again possible on account of the opposite current direction. After that, the currents shown in the figure below the axis are correctly transformed. However, the current transformer is only able to transform the current above the axis to an extent that the current/time area is equal to that of the preceding half-cycle below the axis.

Figure 5-6, page 121 b) illustrates the formation of the measured value according to the measurement algorithm employed assuming that the current flows into an external short-circuit beyond the protected zone. The current thus flows through at least two current transformers. One of them is assumed to be able to give a correct replica of the current whereas the other exhibits a behaviour as under

Figure 5-6, page 121 a). With the stabilizing factor  $k = 0.65$  a tripping condition occurs about 8 ms after inception of the short-circuit. This condition persists for about 4 ms before the restraint prevails again. The reversed current after zero current crossing does not make itself felt in the tripping sense since correct transformation is present. The second half-wave, however, again brings about a tripping condition which again lasts for about 4 ms. Due to the continuing decay of the DC component, the previously saturated current transformer recovers its ability for transformation. The tripping differential current  $I_d$  subsequently does not reach the magnitude of the stabilizing current  $k \times I_{s,mod}$ .

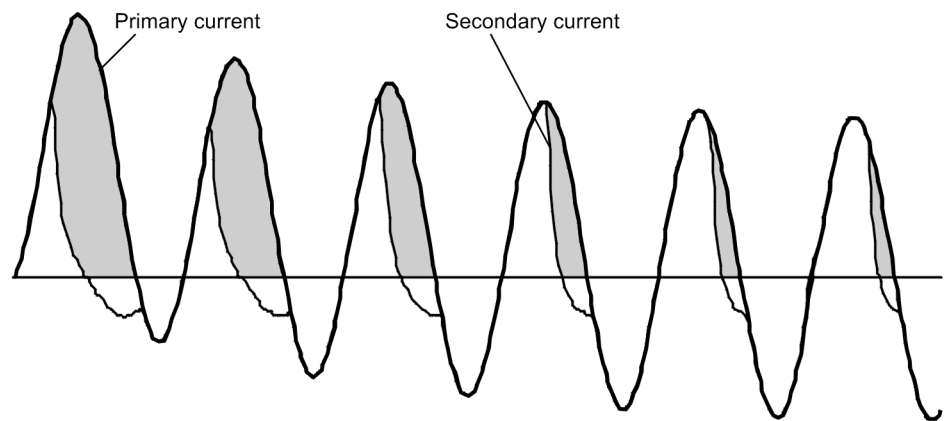
Figure 5-6, page 121 c) illustrates the formation of the measured value on the following assumption: The current flows into a short-circuit within the protection zone via a current transformer. The current transformer shows the behaviour illustrated in Figure 5-6, page 121 a). The stabilisation factor  $k$  is again assumed to be 0.65. In this case the tripping differential current  $I_d$  prevails right from the beginning of the short circuit. But since the current transformer saturates, the tripping quantity disappears after 6 ms. The opposite half-cycle will have no tripping effect. As the process proceeds, the current will set up a tripping condition in the opposite half-cycles of the measuring circuit as well.

A comparison of the measured values in cases b (external short-circuit) and c (internal short-circuit) shows, besides a temporary similarity, two essential discriminating features:

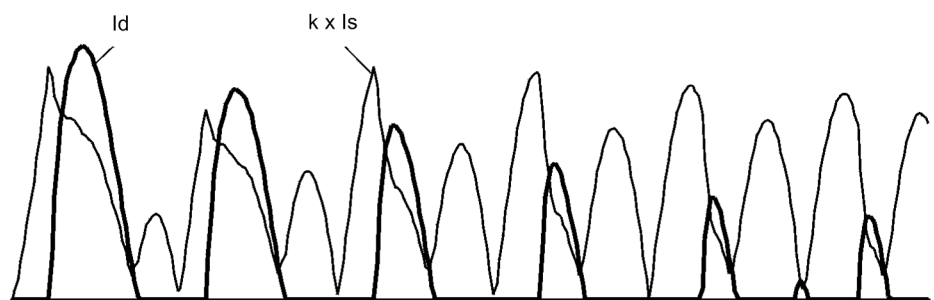
- After a few cycles the DC component has largely decayed. Each half-wave, i.e. the current in both directions, delivers a correct measured value according to the fault location.
- At the inception of the short-circuit – usually at least for a quarter of a cycle – the correct measured value is formed according to the fault location.

These two facts are utilized by the SIPROTEC 7SS52 V4 distributed busbar and breaker failure protection to distinguish between external and internal short-circuits. They are particularly valuable when large short-circuit currents and DC components severely saturate the current transformers forcing the protection to operate under severely aggravated conditions.

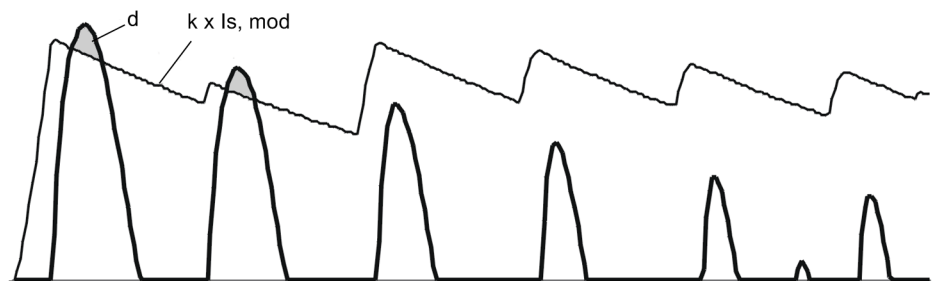




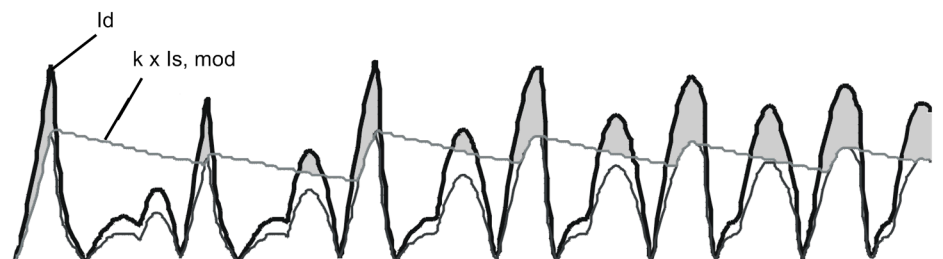
a) Primary and secondary current of a CT



b1) Formation of measured values for an external short-circuit



b2) Formation of measured values for an external short-circuit - with smoothed stabilizing current



c) Formation of measured currents for an internal short-circuit

Figure 5-6 CT currents and measured values in the event of an initially fully offset fault current; DC component decaying with  $\tau = 64 \text{ ms}$

A sophisticated combination of the above two distinguishing features stabilizes the operating characteristics of the SIPROTEC 7SS52 V4 distributed busbar and breaker failure protection even under extremely difficult conditions, namely:

- high degree of stability even during current transformer saturation
- short tripping times for internal short-circuits
- correct behaviour and proper response to evolving faults

At first glance, the stability in the event of external short-circuits appears to be jeopardized by the current conditions shown in Figure 5-6, page 121 b). The tripping quantity markedly exceeds the restraining quantity on two occasions.

However, the logic included in the 7SS52 V4 ensures stability even in this case and reliably prevents overfunctioning.

#### 5.1.1.4 Evaluation of the Initial Values

For normal load currents, the magnetic flux in the current transformer's iron circuit is relatively small. It is of the order of, at most, a few percent of that value at which the iron saturation begins. The current transformers must have an overcurrent factor which is sufficiently high to ensure the proper behaviour of the associated relay equipment during large short-circuits currents.

Since the magnetic flux under normal conditions is low, a certain time will elapse after short-circuit inception before the magnetic flux in the iron core reaches the saturation level. This is true even under extreme conditions such as a very large short-circuit current or a large DC component with a long time constant.

This process will typically last from a quarter-cycle to a half-cycle in both conventional current transformers with a closed iron core and in linearized current transformers with an air gap in their cores.

The current transformers transform accurately according to ratio before saturation. Therefore the secondary currents delivered during the first milliseconds after inception of a short-circuit has the most conclusive information.

For this reason, the SIPROTEC 7SS52 V4 distributed busbar and breaker failure protection has a software logic which detects the inception of a short-circuit from the currents and determines whether an external or internal short-circuit is present.

To do so, it determines the differential quotient  $dl_s / dt$  of the stabilizing magnitude and compares it to a set threshold.

When that threshold is exceeded, the characteristic condition (Figure 5-3, page 117) is checked. If the tripping condition is fulfilled, the protection trips after one measurement ("1-out-of-1") within 3 ms. If it is not, two measurements are performed ("2-out-of-2") and a trip initiated in the presence of an internal fault.

If the measured result indicates an external fault, the "1-out-of-1" mode remains blocked for 150 ms.

### 5.1.1.5 Algorithm with Filtered Values

The protection logic eliminates any DC components in the differential current by calculating its fundamental wave. This increases the accuracy in the case of relatively small, offset differential currents and reduces the protection tripping times.

The value of the differential current fundamental wave is determined by means of sine and cosine filters. The stabilizing current is calculated on the basis of the summated rectified mean values of the feeder currents.

This part of the algorithm makes also use of the characteristics described in Chapter 5.1.1.2, page 116. The filter algorithm operates in parallel to the instantaneous values algorithm, so that both algorithms can initiate a trip independently of one another. In the presence of an external fault, the filter algorithm is blocked for 150 ms by the instantaneous values algorithm to avoid the risk of spurious tripping in case of highly saturated differential currents (see also Figure 5-11, page 126).

### 5.1.1.6 Cross stabilisation

In 3-pole enclosed gas-insulated switchgears, a high 1-pole fault current can induce considerable error currents in the secondary windings of the adjacent transformers. These error currents can simulate an internal fault. In order to avoid a tripping of the busbar protection an optional function "cross stabilisation" is provided. The basic principle of cross stabilisation is to use a high current in one phase - which occurs e.g. in case of an external short-circuit - for stabilisation of the other phases. The parameters **CrossStabFac BZ (6105A/CU)** and **CrossStabFac CZ (6107A/CU)** are used to set the degree of stabilisation. You can set cross stabilisation for all busbar zones and for the check zone.

The indication "CrossStab BZ Lx" or "CrossStab CZ Lx" (**FNo.10511/CU ... FNo.10516/CU**) is output when the cross stabilisation function has picked up and thus prevented undesired tripping. In addition a fault record is triggered for a detailed analysis of the event.

### 5.1.1.7 Additional criterion for tripping

One binary input ">AddCr BBtripLx" (**FNo.10498 /CU ... FNo.10500/CU**) per phase in the central unit allows a phase-selective release of the tripping. The release is valid for the selective measuring systems and the check zone and is a prerequisite for the TRIP transfer to the bay units concerned. The additional criterion works independently of the measured value algorithm of the busbar protection. It acts only on trips by the busbar protection, and not on the breaker failure protection.

The parameter **Add. crit. (6120A/CU)** is used to set whether an additional criterion will be evaluated. If you set **existent**, the additional criterion is evaluated. In this case, the configuration matrix provides in the busbar protection the binary inputs ">AddCr BBtripLx" (**FNo.10498/CU ... FNo.10500/CU**) and in the supervision the alarms "No AddCrit. Lx" (**FNo.10503/CU ... FNo.10505/CU**).

The parameter **Superv. A.crit. (6319A/CU)** is used to set the operating mode for the supervision of binary inputs for the additional criterion; see Figure 5-7, page 124 .

- a - **OFF** (OFF)
- b - **alarm only** (alarm without prot. blocking)
- c - **blocking** (protection blocking during the disturbance)

After a supervision time of 15 s, the phase-selective alarms "Dist.AddCrit.Lx" (**FNo.10506/CU ... FNo.10508/CU**) will be generated.

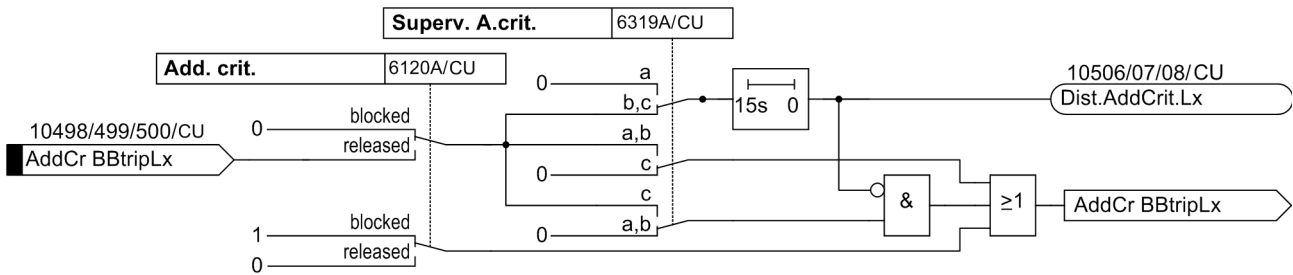


Figure 5-7 Binary inputs for additional criterion

The alarms "No AddCrit. Lx" (FNo.10503/CU ... FNo.10505/CU) have a delay of 150 ms from the busbar TRIP.

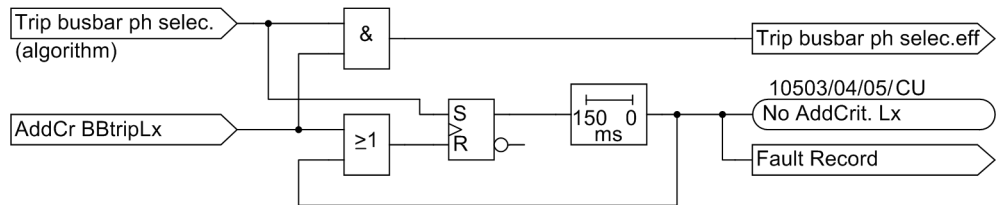


Figure 5-8 Logic of additional criterion

### 5.1.1.8 Summary of the Measuring Method

The measuring method of the busbar protection can be summarized as follows:

Tripping occurs when

- $I_d > \text{set limit}$  and
- $I_d > k \times I_{s,mod}$  and
- release from "1-out-of-1", "2-out-of-2" or filter algorithm

The measuring method is illustrated in Figures 5-9, page 125, 5-10, page 125 and 5-11, page 126.

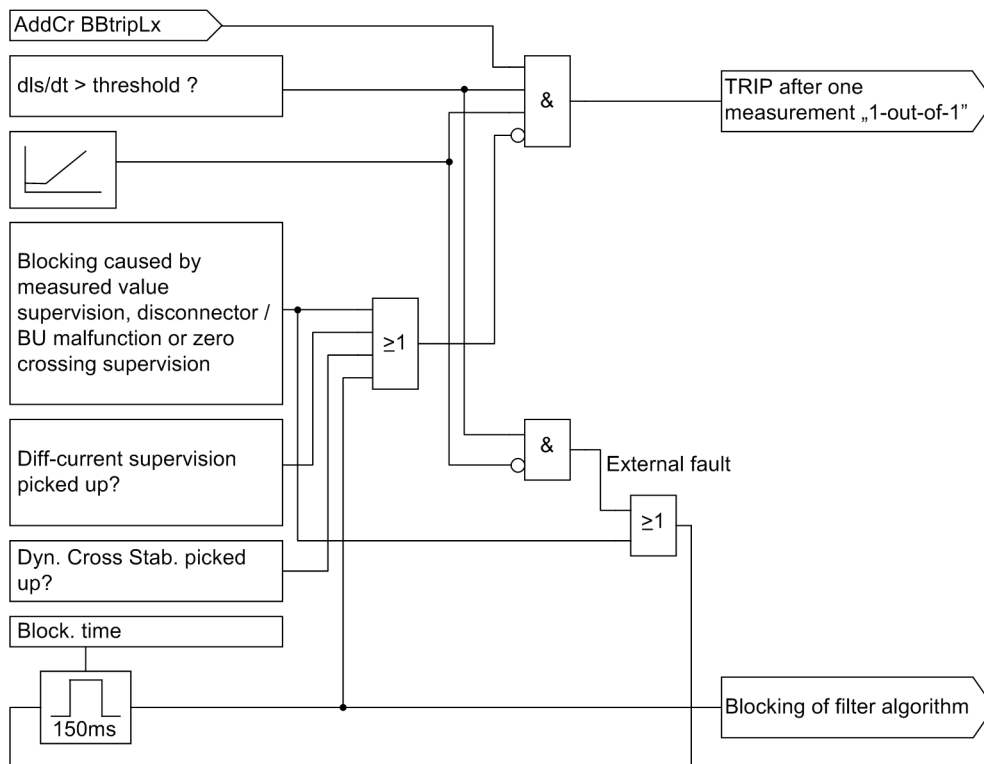
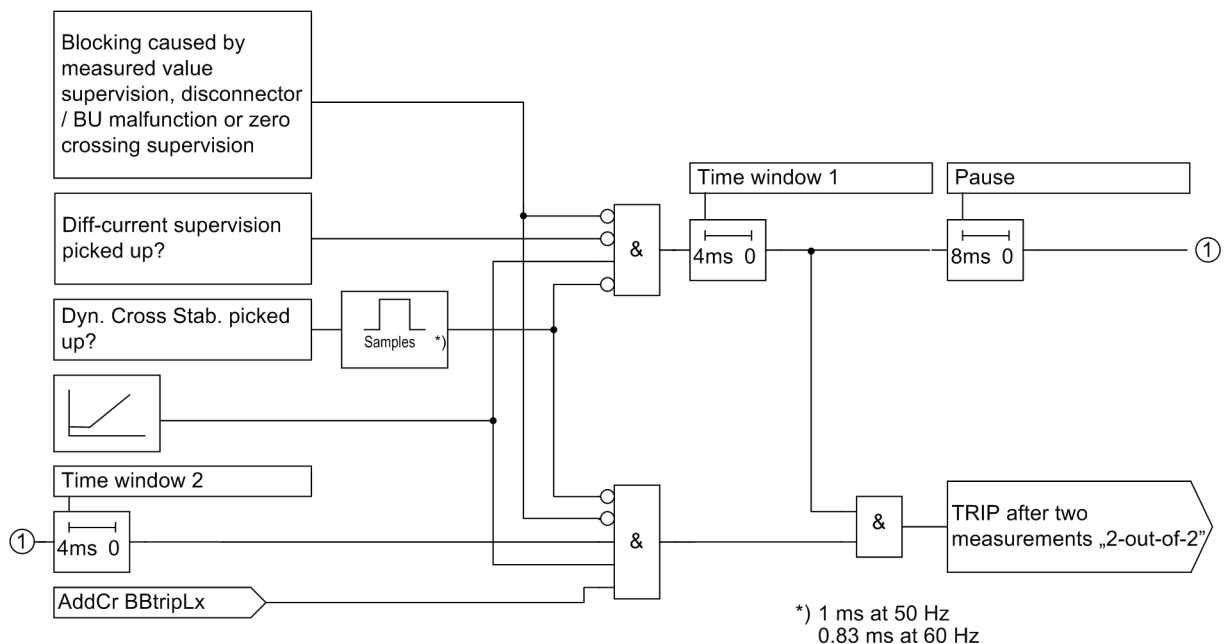


Figure 5-9 TRIP following 1-out-of-1 evaluation



\*) 1 ms at 50 Hz  
0.83 ms at 60 Hz

Figure 5-10 TRIP following 2-out-of-2 evaluation

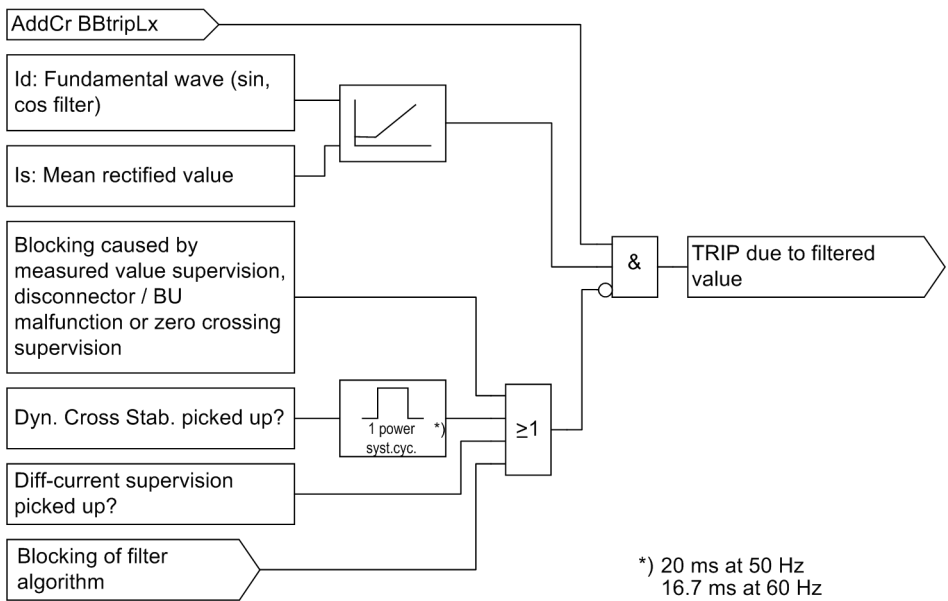


Figure 5-11 TRIP due to filtered value

### 5.1.2 Disconnecter Replica

The allocation of the feeders to the bus zones is automatically determined by the position of the disconnectors.

Only the OPEN position is evaluated for the allocation of the feeders to the busbars. Therefore, no special demands such as adjustment are made on the disconnector auxiliary contacts. The CLOSED position is only used for the disconnector status supervision (disconnector malfunction, disconnector intermediate position).

For the determination of the disconnector runtime the status changes of the two indications "Disconnector OPEN" and "Disconnector CLOSED" are used. Therefore, a true replica of the disconnector runtime can be obtained if you use limit switches as they are typical e.g. for control systems.

The assignment of a coupler bay to the relevant bus zones is only carried out when at least one disconnector is activated on both sides of the coupler (left and right side of the circuit breaker). An operational current flow is only then possible. This ensures that, with the closing of the first disconnector and a short-circuit in the coupler area, the busbar feeding the fault is immediately tripped independent of the fault location and the current position of the circuit breaker.

#### Preferential treatment

If two busbars are solidly linked via the disconnectors of one feeder (bus shunt by disconnectors), all feeders which are connected to the linked busbars are allocated to a preferred busbar protection measuring system. In any case, the bus zone with the lowest configured number is considered to be preferred. The currents of the coupler bay are not taken into account in the measuring.

Figure 5-12, page 127 shows the basic connection scheme.

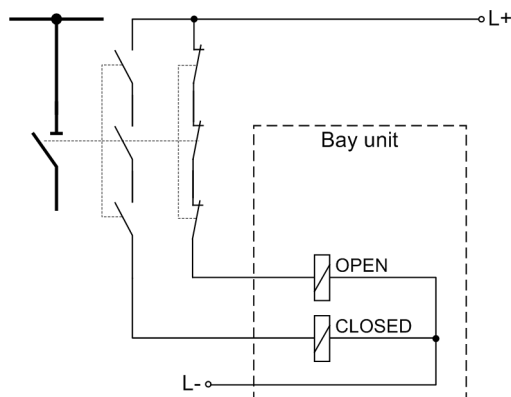


Figure 5-12 Disconnector status indication

It is advantageous to connect the three auxiliary contacts of the position feedback "Closed" or "Open" in series. This ensures that a disconnector will only be considered open if all the three poles are open. In any other case the disconnector will be processed as closed.

The disconnector states of each feeder are indicated in the bay units 7SS523 by red or green LEDs. The preselection can be seen in Table A-30, page 434.

The disconnector replica of the entire plant can be visualized in graphic form using the DIGSI Plant Visualization.

**Recognition of the feeder disconnector status**

With parallel lines, due to the short-circuit current, a current can be induced in the switched-off and earthed line, which is processed as differential current in the busbar protection without Q9. (Figure 5-13, page 127). The protection sees a current in the zero sequence system of the earthed feeder.

Integrating the feeder disconnector (Q9) into the disconnector logic prevents spurious tripping by the 7SS52 V4.

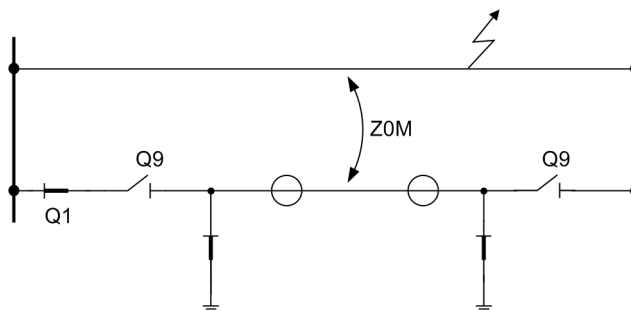


Figure 5-13 Parallel feeders

The 7SS52 V4 is configured to identify a disconnector automatically as a line disconnector.

If a disconnector is configured as line disconnector, the feeder bay will only be allocated to a bus zone if both the corresponding bus disconnector and the feeder disconnector are closed.

### 5.1.3 Bus Coupler Variants

Most large busbar configurations are divided into different zones which constitute autonomous subsystems– called zones or measuring systems – that can be selectively protected. The subsystems are connected by bus couplers so that the configuration can assume all required operating states. Depending on the number of current transformers and the type of switching element, a bus coupler can have different design variants. The bus coupler variants are automatically recognized by the DIGSI Plant Configuration. The admissible types of bus couplers are shown below.

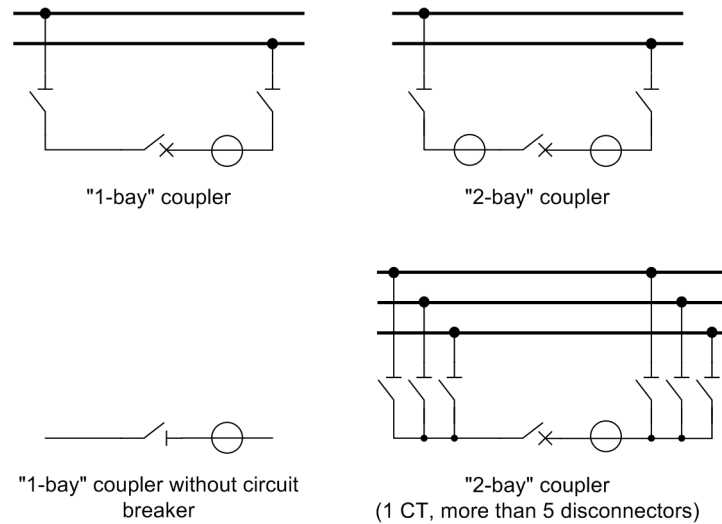


Figure 5-14 Examples of bus coupler variants

#### 5.1.3.1 Bus Couplers with One Current Transformer

Bus couplers with circuit breaker and one current transformer (Figure 5-14, page 128) are the most common variant. The low cost of this economical solution is offset by the disadvantage of a delayed trip of the faulted subsystem if a fault occurs in the dead zone with the coupler closed. The "dead zone" is understood to be the bus zone between the circuit breaker and the current transformer. With the coupler open, the detection of the circuit breaker status ensures selective tripping without delay.

**1-bay coupler** In the 7SS52 V4 protection system, one bay unit is needed for this type of bus coupler.

#### 5.1.3.2 Bus Couplers with Two Current Transformers

Bus couplers can also have two current transformers, one on each side of the circuit breaker. The allocation of the currents to the subsystems overlaps in that case (Figure 5-14, page 128). The advantage of this design is that in case of a fault between the two current transformers both subsystems are tripped promptly, but not selectively. With the coupler open, the evaluation of the circuit breaker status ensures selective and undelayed tripping for this coupler variant as well.

**2-bay coupler** In the 7SS52 V4 protection system, two bay units are needed for this type of bus coupler. For the connection of the bay units, please refer to Chapter 7.1.3.1, page 288.



### 5.1.3.3 Bus Couplers without Circuit Breaker

Bus zones are sometimes not connected by circuit breakers but by switch-disconnectors (Figure 5-14, page 128). In order to determine nevertheless the affected zone in case of fault, the current is measured at the coupling point and the indication "TrfTrip \$03" (**FNo. 177.1332/CU**) is generated. However, tripping always affects both coupled busbar sections.

### 5.1.3.4 Bus Couplers with more than 5 disconnectors

Each bay unit can handle up to 5 disconnectors. If a coupler comprises more than 5 disconnectors, two bay units are needed even in configurations with only one current transformer. For the connection of the bay units, please refer to Chapter 7.1.3.3, page 289.

### 5.1.3.5 Combi-Coupler

The arrangement of the different switchgear elements is usually free and subject mainly to the operational requirements. Sporadically, the switching elements such as circuit breaker, current transformer and disconnector are used doubly, either as bus coupler or as switchgear bay.

This special operation of the bus coupler bay is possible due to a combined bus coupler parameter **Combi-Coupler (XX06A/CU)** in the configuration of the bay units. It is valid for all bus coupler types with circuit breakers. In two-bay couplings, it is effective per bay.

The presetting is **No**, the bus coupler acts as described in the introduction.

With the configuration **Yes** and in the coupled state (disconnector closed on both sides), there are also no differences.

If disconnectors are closed only on one side of the bus coupler in this configuration, the current is assigned to the corresponding busbar and the check zone (Q1 or Q2 at Figure 5-15, page 129). The bus coupler behaves like a switchgear bay. The protected zone ends behind the current transformer. An extension of the protected zone or an increased selectivity can be achieved via the end fault protection.

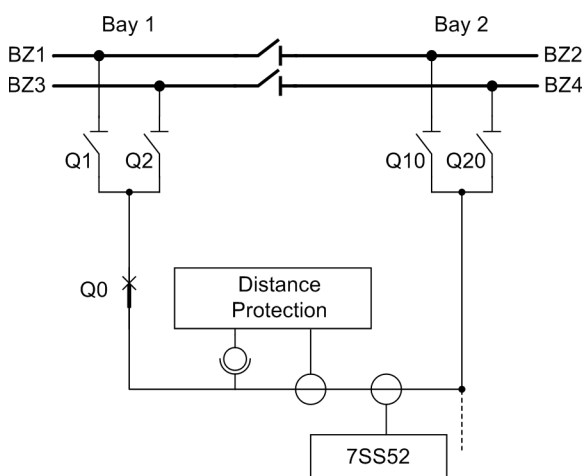


Figure 5-15 Operation of a bus coupler as switchgear bay

The protected zone ends at the current transformer. All electrical elements including the disconnectors Q10 and Q20 are part of the line.

Configuration note: The dotted part must not be displayed with Digsil

### 5.1.3.6 Transfer Busbars

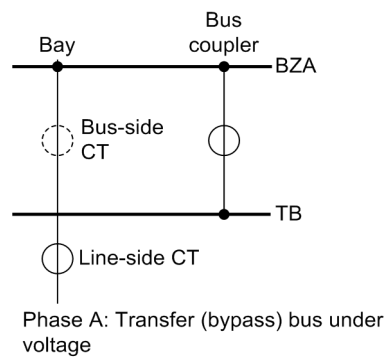
In the case of line side transformers, the transfer busbar can be protected selectively. For this, configure **PROT TR BUS (5401 / CU)** with **Yes**. Any case of a fault will cause the tripping of the bypass breaker (coupler) and a transfer trip signal to trip the circuit breaker at the remote end of the line.

During transfer operation, the line circuit breaker in the feeder which is located on the bypass busbar is replaced by the line circuit breaker of the bus coupler. Monitoring of the disconnector states in the feeder and coupling bays ensures that this happens only after the bus or feeder disconnector had been opened.

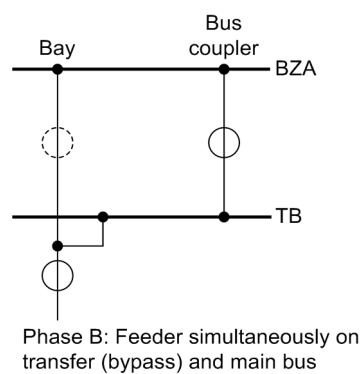
Up to the final bypass operation, intermediate switching positions occur. The allocation of the respective feeder to the bus zone during this time depends on the current transformer location (bus side or line side).

Figure 4-15, page 86 shows a plant configuration with transfer bus. Figure 5-16, page 131 summarizes the busbar allocation of the feeders.

Normally the check zone measurement does not require any disconnector status information. For checkzone measurement, the current of the coupler must be considered if a feeder with bus side current transformer is connected to the transfer busbar (see Chapter 5.1.3.7, page 132) or if with line side current transformers no transfer busbar protection is required (configure parameter **PROT TR BUS (5401 / CU)** with **No**).

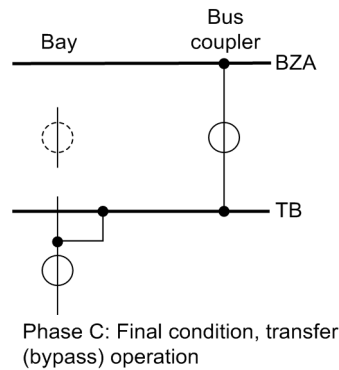


| PROT TR<br>BUS<br>(5401/CU) | Meas.<br>system |  | BZA                  | TB               | Check<br>zone   |
|-----------------------------|-----------------|--|----------------------|------------------|-----------------|
|                             | Bay/<br>CT      |  |                      |                  |                 |
| Yes                         | Line side       |  | Feeder,<br>bus coup. | Bus<br>coupler   | Feeder          |
|                             | Bus side        |  | Feeder,<br>bus coup. | Bus<br>coupler   | Feeder          |
| No                          | Line side       |  | Feeder,<br>bus coup. | unpro-<br>tected | Feeder,<br>Coup |
|                             | Bus side        |  | Feeder,<br>bus coup. | unpro-<br>tected | Feeder,<br>Coup |



| PROT TR<br>BUS<br>(5401/CU) | Meas.<br>system |  | BZA                  | TB                           | Check<br>zone   |
|-----------------------------|-----------------|--|----------------------|------------------------------|-----------------|
|                             | Bay/<br>CT      |  |                      |                              |                 |
| Yes                         | Line side       |  | Feeder               | connect.<br>to BZA           | Feeder          |
|                             | Bus side        |  | Feeder,<br>bus coup. | no <sup>1)</sup><br>protect. | Feeder,<br>Coup |
| No                          | Line side       |  | Feeder               | connect.<br>to BZA           | Feeder          |
|                             | Bus side        |  | Feeder,<br>bus coup. | unpro-<br>tected             | Feeder,<br>Coup |

<sup>1)</sup> The current being fed by the feeder or into the feeder cannot be measured.



| PROT TR<br>BUS<br>(5401/CU) | Meas.<br>system |  | BZA     | TB                           | Check-<br>zone |
|-----------------------------|-----------------|--|---------|------------------------------|----------------|
|                             | Bay/<br>CT      |  |         |                              |                |
| Yes                         | Line side       |  | coupler | Feeder,<br>Coup.             | Feeder         |
|                             | Bus side        |  | coupler | no <sup>1)</sup><br>protect. | Bus<br>coupler |
| No                          | Line side       |  | coupler | connect.<br>to BZA           | Bus<br>coupler |
|                             | Bus side        |  | coupler | unpro-<br>tected             | Bus<br>coupler |

<sup>1)</sup> The current being fed by the feeder or into the feeder cannot be measured.

Figure 5-16 Switching states in bypass operation (Feeder and bus coupler on the same bus zone)

### 5.1.3.7 Transfer Busbar With Bus Side Transformers

If the protection of the transfer busbar is impossible because of bus side transformers, **PROT TR BUS (5401 / CU)** is to be configured with **No**. Then, only the Q7 on the bus coupler side is required to start the transfer operation. With the Q7 installed, the protected zone ends at the last coupling transformer (T1). All plant components beyond the last coupler CT are now outside the protected zone of the busbar protection. Therefore, the protected zone of the check zone also has to be transferred into the coupler (T1).

The following figure shows the correction of the check zone with an unprotected transfer busbar.

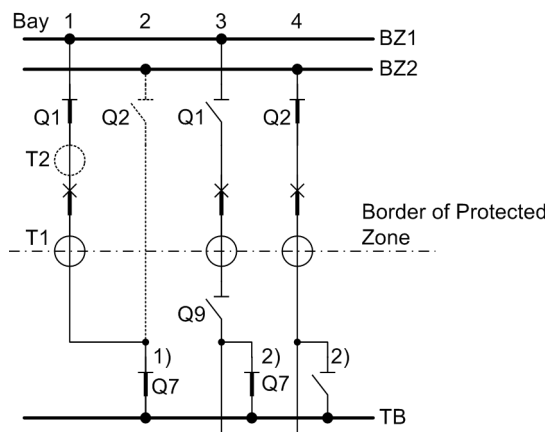


Figure 5-17 Transfer operation without transfer busbar protection

- 1) configured and detected
- 2) existing but not configured

### 5.1.3.8 Special Cases of Transfer Busbar Operation

#### Transfer Busbar Operation with Several Feeders

The transfer operation is usually established for one feeder. For this, a feeder is connected to the transfer / combination busbar via the coupler. To ensure a flexible operational management, also several feeders and couplers can be connected simultaneously to the transfer / combination busbar. The protection behavior depends on the assembly position of the current transformers. If all the feeders involved possess line side transformers, the transfer / combination busbar can be protected selectively. Otherwise, the protected zone ends at the current transformer of the coupler or at the feeder transformer.

## 5.1.4 Setting Notes

### STAB FAC:BZ

The **STAB FAC:BZ (6101 / CU)** is used to match the stabilizing factor for the bus zone-selective protection (common for all buses) to the service conditions.

A high setting provides for more stability against faults outside the protection system but reduces the sensitivity for detecting busbar faults.

The stabilizing factor should therefore be set as low as possible and as high as necessary.

Two aspects are of major importance for selecting the stabilizing factor **STAB FAC:BZ (6101 / CU)**:

- Type of current transformers: "lineared" or "iron-cored".  
Iron-cored CTs transmit the DC component without any noticeable reduction, whereas linearized transformers substantially reduce the DC component.
- The burdening factor  $K_b$  of the current transformers  
This factor is calculated from the maximum continuous short-circuit current  $I_{sc\ max}$  and the current  $I_{sat}$  at which CT saturation begins:

$$K_b = I_{sc\ max} / I_{sat}$$

The saturation current  $I_{sat}$  can be calculated from the rated current  $I_{pn}$  and the effective factor of the symmetrical rated short-circuit current  $K'_{ssc}$  (which used to be called operational overcurrent factor  $n'$ )

$$I_{sat} = I_{pn} * K'_{ssc}$$

$I_{pn}$  = primary rated current

The factor  $K'_{ssc}$  can be calculated from the data and the actual burden of the current transformers:

$$K'_{ssc} = (R_{ct} + R_b) / (R_{ct} + R'_b) * K_{ssc}$$

with  $R'_b = R_l + R_{relay}$

$R_{ct}$  = secondary winding resistance (75 °C)

$R_b$  = resistive rated burden

$R'_b$  = connected burden

$R_l$  = line resistance

$R_{relay}$  = protection burden

$K'_{ssc}$  = factor of the symmetrical rated short-circuit current

For burden factors  $K_b < 2$ , a k-factor of 0.6 is sufficient. For  $K_b \geq 2$ , the minimum k-factor is:

$$k > \frac{K_b}{4\sqrt{K_b - 1}} \quad \text{with } K_b \geq 2$$

A 20 % safety margin should be added to thus calculated k-factor.

The basis for this formula is summarized in the Chapter A.2, page 375.

The CT with the highest burden factor  $K_b$  must be the basis for selecting the factor  $k$ .

**Sens. charact.** The parameter **Sens. charact. (6320A/CU)** is used to match the busbar and breaker failure protection to the system conditions and to the treatment of the star-point. An explanation of the standard characteristic and of the sensitive characteristic is given on page 117.

With the setting **blocked** always the standard characteristic is used.

With the setting **released** the measuring system switches to the more sensitive characteristic in the presence of a 1-pole fault. This characteristic has a lower diff-current threshold, which is set with the parameters **Id> BZ s. char. (6109A/CU)** or **Id> CZ s. char. (6111A/CU)**, and a stabilizing current threshold which is set with the parameters **Is< BZ s. char. (6108A/CU)** or **Is< CZ s. char. (6110A/CU)**.

The setting **released** enables also the marshalling of the binary input annunciation for characteristic switchover ">Sens. charact." (**FNo. 10478/CU**).

The setting **released** enables also the marshalling of the binary input annunciation for characteristic switchover ">Sens. charact." (**FNo. 10478/CU**).

**Superv. S. char** The parameter **Superv. S. char (6321A/CU)** is used to activate the supervision of the binary input.

**Id> BZ** The parameter **Id> BZ (6102/CU)** is used to set the threshold for the bus zone-selective protection in the presence of small fault current.

For pickup and tripping of the protection, only those normalized currents  $I_d$  are considered which exceed the diff-current threshold set in the parameter **Id> BZ (6102/CU)**. A current below this threshold causes the pickup to drop off.

To calculate the highest permissible setting, determine first the smallest fault current to be expected in case of a busbar short-circuit. The set value should have an extra response margin of about 20%.

The lowest permitted setting is  $I_{\max \text{ feeder}} + 30\%$ .

$$1.3 I_{\max \text{ feeder}} < \mathbf{Id> BZ} < 0.8 I_{\text{SC min}}$$

**Id> BZ s. char.** The parameter **Id> BZ s. char. (6109A/CU)** is used to set the diff-current threshold  $I_s/I_{n0}$  for the bus zone-selective protection.

This parameter is only displayed if the parameter **Sens. charact. (6320A/CU)** is **released**.

Where due to low infeed conditions or to the type of starpoint earthing earth fault currents do not exceed the normal load range, the threshold must be set to less than nominal value. A separate characteristic is provided for such cases. It should be noted, however, that with this setting the failure of one current transformer in combination with a high load can lead to a trip of the busbar. Additional criteria are required in such cases to ensure sufficient stability. Such a criterion may be, for instance, additional release by a feeder protection device through detection of the offset voltage.

To calculate the highest permissible setting, determine first the smallest fault current to be expected in case of a busbar short-circuit. The set value should have an extra response margin of about 20%.

**Is< BZ s. char.** The parameter **Is< BZ s. char. (6108A/CU)** is used to set the stabilizing current threshold  $I_S/I_{n0}$  for the bus zone-selective protection.

This parameter is only displayed if the parameter **Sens. charact. (6320A/CU)** is **released**.

The setting of the parameter **Is< BZ s. char. (6108A/CU)** depends on the maximum stabilizing current to be expected and on the behaviour of the CTs.

$$\mathbf{Is< BZ s. char.} = 1.2 * (I_{\max \text{ load}} + I_{EF})$$

$I_{\max \text{ load}}$  = sum of the values of all load currents flowing in and out

**STAB FAC:CZ** The parameter **STAB FAC:CZ (6103/CU)** is used to match the stabilizing factor for the check zone to the service conditions. For single busbars, please refer to the setting hints for the parameter **STAB FAC:BZ (6101/CU)**.

For multiple busbars, a stabilizing factor of 0.5 is recommended. This helps to prevent overstabilisation due to the load currents of bus zones which are not involved in the fault.

**Id> CZ** The parameter **Id> CZ (6104/CU)** is used to set the threshold for the sensitivity of the check zone in the presence of small fault currents.

For pickup and tripping of the protection, only those normalized currents  $I_d$  are considered which exceed the diff-current threshold set in the parameter **Id> CZ (6104/CU)**. A current below this threshold causes the pickup to drop off.

To calculate the highest permissible setting, determine first the smallest fault current to be expected in case of a busbar short-circuit. The set value should have an extra response margin of about 20%.

The smallest permissible setting is  $I_{\max \text{ feeder}} + 30\%$ .

$$1.3 I_{\max \text{ feeder}} < \mathbf{Id> CZ} < 0.8 I_{\text{SC min}}$$

**Id> CZ s. char.** The parameter **Id> CZ s. char. (6111A/CU)** is used to set the diff-current threshold  $I_d/I_{n0}$  for the check zone measuring system.

This parameter is only displayed if the parameter **Sens. charact. (6320A/CU)** is **released**.

Siemens recommends to set the parameter **Id> CZ s. char. (6111A/CU)** to 70% of the smallest fault current to be expected.

**Is< CZ s. char.** The parameter **Is< CZ s. char. (6110A/CU)** is used to set the stabilizing current threshold  $I_S/I_{n0}$  for the check zone measuring system.

This parameter is only displayed if the parameter **Sens. charact. (6320A/CU)** is **released**.

Due to the special treatment of the stabilizing current of the check zone, the parameter **Is< CZ s. char. (6110A/CU)** is to be set to the value

$$\mathbf{Is< CZ s. char.} = 1.2 * 0.5 * I_{\max \text{ load}}$$

- CrossStabFac BZ**  
**CrossStabFac CZ**     The parameters **CrossStabFac BZ (6105A/CU)** and **CrossStabFac CZ (6107A/CU)** are only available with the ordering option "with cross stabilisation". They are used to set the stabilisation factor for cross stabilisation of all busbar zones and of the check zone. This value is defined in dependence on the substation conditions. We recommend to use the default setting of 0.4. The recommended value of 0.4 normally provides the best possible balance between stability against influences on the transformers and sensitivity for internal faults. A higher factor improves the stability but reduces the sensitivity.
- Add. crit.**     The parameter **Add. crit. (6120A/CU)** is used to activate the additional criterion for evaluation of the binary inputs; to do so, it must be set to **existent**. If you set **nonexistent**, the additional criterion is not taken into account.
- Superv. A.crit.**     The **Superv. A.crit. (6319A/CU)** parameter is used to set the system response for supervision of the binary input for the additional criterion.  
The setting **OFF** deactivates the supervision.  
The setting **alarm only** generates the alarms "Dist.AddCrit.Lx" (**FNo. 10506/CU ... FNo. 10508/CU**) but does not block the protection function.  
The setting **blocking** leads to phase-selective blocking of the protection for the duration of the disturbance.



## 5.1.5 Settings for the Central Unit

| Addr. | Setting Title   | Setting Options               | Default Setting | Comments  |
|-------|-----------------|-------------------------------|-----------------|---|
| 106A  | Combi-Coupler   | YES<br>NO                     | NO              | Combi-Coupler                                     |
| 6101  | STAB FAC:BZ     | 0.10 .. 0.80                  | 0.65            | Stabilising factor - selective                    |
| 6102  | Id> BZ          | 0.20 .. 4.00 I/Ino            | 1.00 I/Ino      | Diff-current threshold - selective                |
| 6103  | STAB FAC:CZ     | 0.00 .. 0.80                  | 0.50            | Stabilising factor - check zone                   |
| 6104  | Id> CZ          | 0.20 .. 4.00 I/Ino            | 1.00 I/Ino      | Diff-current threshold - check zone               |
| 6105A | CrossStabFac BZ | 0.00 .. 1.00                  | 0.40            | Cross stabilisation factor - BZ                   |
| 6107A | CrossStabFac CZ | 0.00 .. 1.00                  | 0.40            | Cross stabilisation factor - CZ                   |
| 6108A | Is< BZ s. char. | 0.00 .. 25.00 I/Ino           | 5.00 I/Ino      | Stabilising current threshold - BZ - sens. char.  |
| 6109A | Id> BZ s. char. | 0.05 .. 4.00 I/Ino            | 0.25 I/Ino      | Diff-current threshold - selective - sens. char.  |
| 6110A | Is< CZ s. char. | 0.00 .. 25.00 I/Ino           | 4.50 I/Ino      | Stabilising current threshold - CZ - sens. char.  |
| 6111A | Id> CZ s. char. | 0.05 .. 4.00 I/Ino            | 0.25 I/Ino      | Diff-current threshold - check zone - sens. char. |
| 6120A | Add. crit.      | existent<br>nonexistent       | nonexistent     | Additional criterion for tripping                 |
| 6319A | Superv. A.crit. | OFF<br>alarm only<br>blocking | OFF             | Supervision BI add. criterion                     |
| 6320A | Sens. charact.  | released<br>blocked           | blocked         | Sensitive characteristic switchover               |
| 6321A | Superv. S. char | NO<br>YES                     | YES             | Supervision BI sensitive characteristic           |

## 5.2 Check Zone

### 5.2.1 Mode of operation

The measuring system for the check zone detects a short-circuit in all bays, regardless of the disconnecter status.

In some special cases, disconnecter status must however be considered for the check zone.

If the stabilizing current is calculated in the same manner as for the bus zone-specific busbar protection, overstabilisation results in multiple busbar systems. This overstabilisation is caused by those bays which are not connected to the faulty busbar.

To avoid overstabilisation, the stabilizing current is calculated as follows:

$\Sigma |I_p|$  = sum of the magnitudes of the currents which flow in the direction of the busbar

$\Sigma |I_n|$  = sum of the magnitudes of the currents which flow away from the busbar

$I_{stab}$  = lesser of the above two sums

By forming the stabilizing current in this manner, only half of the total through-flowing load current acts as stabilizing current.

The short-circuit current does not stabilize the "check zone" and only acts as differential current.

This procedure is illustrated in Figure 5-18, page 138 and in the equations below.

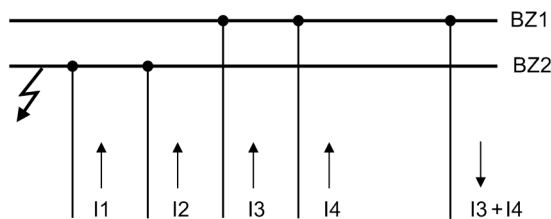


Figure 5-18 Treatment of the stabilizing current for the check zone

$$I_d = |I_1 + I_2 + I_3 + I_4 - I_3 - I_4| = |I_1 + I_2|$$

Stabilizing current without special treatment:

$$I_s = |I_1| + |I_2| + |I_3| + |I_4| + |I_3 + I_4|$$

The load currents  $I_3$  and  $I_4$  are considered twice in the stabilizing current. This leads to overstabilisation.

Special treatment of the stabilizing current results in the following conditions:

$$\Sigma |I_p| = |I_1| + |I_2| + |I_3| + |I_4|$$

$$\Sigma |I_n| = |I_3 + I_4|$$

$$I_s = \Sigma |I_n| = |I_3 + I_4| \quad (= \text{is equal to half the magnitude of the load current})$$

This stabilizing current is modified for evaluation of the characteristic as mentioned in Chapter 5.1.1.2, page 116.

Due to the phase angle differences between short-circuit current and load currents differences may occur in the formation of the sums.

## 5.2.2 Setting Notes

The check zone has its own characteristics, which can be set with the parameters **STAB FAC:CZ (6103/CU)**, **Id> CZ (6104/CU)**, **Id> CZ s. char. (6111A/CU)** and **Is< CZ s. char. (6110A/CU)** (Chapter 5.1.4, page 133).

## 5.2.3 Settings for the Central Unit

| Addr. | Setting Title   | Setting Options     | Default Setting | Comments                                       |
|-------|-----------------|---------------------|-----------------|--|
| 6103  | StAB FAC:CZ     | 0.00 .. 0.80        | 0.50            | Stabilising factor check zone                  |
| 6104  | Id> CZ          | 0.20 .. 4.00 I/Ino  | 1.00 I/Ino      | Diff-current threshold - check zone            |
| 6110A | Is< CZ s. char. | 0.00 .. 25.00 I/Ino | 4.50 I/Ino      | Stabilising current threshold - CZ sens. char. |
| 6111A | Id> CZ s. char. | 0.05 .. 4.00 I/Ino  | 0.25 I/Ino      | Diff-current threshold - CZ sens. char.        |

### 5.3 Circuit Breaker Failure Protection

The circuit breaker failure protection (CBF) function in the SIPROTEC 7SS52 V4 distributed busbar and breaker failure protection detects a failure of the circuit breaker either in the event of a feeder short-circuit or a busbar short-circuit.

- In the event of a feeder short-circuit, a breaker failure leads to selective isolation of the bus zone to which the feeder with the defective breaker is allocated. In addition a transfer trip (intertrip) signal is issued in order to trip the remote feeder terminal, too. The available operating modes are described in Chapter 5.3.5.2, page 146. Each mode can be set selectively for each bay. Thus the function can be matched optimally to existing conditions (type of bay, short-circuit currents etc.).
- In the event of a circuit breaker failure with a busbar short-circuit, the infeed from the remote feeder terminal has to be interrupted. For this purpose the 7SS52 V4 issues a transfer trip signal.

#### 5.3.1 Characteristics for the Circuit Breaker Failure Protection

**Standard characteristic**

The BZ unbalanced mode has two separate parameter sets, one for the standard characteristic and one for the sensitive characteristic. Figure 5-19, page 140, shows the characteristics and the setting parameters.

**Sensitive characteristic**

Low-current faults are detected with more sensitive tripping characteristics for breaker failure. For these more sensitive characteristics the parameters **I> BF s. char. (XX19A/CU)** and **Is< BF s. char. (6202A/CU)** apply. The stabilizing factor is identical with the standard characteristic. The marshallable binary input ">Sens. charact." (**FNo. 10478/CU**) in the central unit allows to switch over between characteristics, provided that the parameter **Sens. charact. (6320A/CU)** is set to **released**. Figure 5-19, page 140, shows the characteristics and the setting parameters.

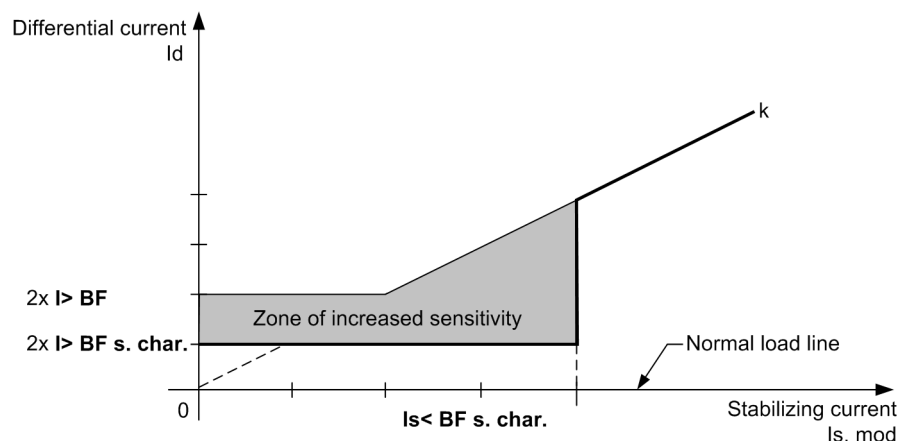


Figure 5-19 Characteristics of the breaker failure protection

### 5.3.2 Setting Notes

**I> BF** The parameter **I> BF (118/CU)** is used to set the threshold  $I_d/I_n$  at which the protection detects a breaker failure and/or resets a TRIP command.

Siemens recommends to set this parameter to about 50 % of the smallest short-circuit current to be expected.



#### NOTE

Please note that the limit value **I> BF** must not be set smaller than the limit value **Id> SUPERV BZ (6308/CU)**. Otherwise, there is a risk of spurious tripping if there is an operational differential current (e.g. fault in transformer circuit) and a binary input of the breaker failure protection is activated simultaneously.



#### NOTE

This parameter is also used for the functions “**End Fault Protection**” (Chapter 5.4, page 162) and “**Current-Controlled TRIP Reset**” (Chapter 5.9.1, page 195).

#### **STAB FAC:BF**

The parameter **STAB FAC:BF (6201/CU)** is used to match the stabilizing factor for the selective breaker failure protection and the check zone to the service conditions. A setting value of 0.25 is recommended for the stabilisation against current transformer errors.

This parameter is only relevant for the modes **BZ unbalance** and **trip rep/unbal**. These modes are set with the parameter **BF OP MODE (XX15/CU)** (Chapter 5.3.6, page 156).

#### **I> BF s. char.**

The parameter **I> BF s. char. (XX19A/CU)** is used to set the threshold value  $I_d/I_n$  for the sensitive characteristic at which the protection function detects a breaker failure, or at which a TRIP command is reset.



#### NOTE

This parameter is also used for the functions “**End Fault Protection**” (Chapter 5.4, page 162), “**Current-Controlled TRIP Reset**” (Chapter 5.9.1, page 195).

#### **Is< BF s. char.**

The parameter **Is< BF s. char. (6202A/CU)** is used to set the stabilisation current  $I_s/I_{n0}$  for the sensitive characteristic of the breaker failure protection.

The setting of the parameter depends on the maximum stabilizing current to be expected and on the behaviour of the CTs.

This parameter is only displayed if the parameter **Sens. charact. (6320A/CU)** is set to **released**.

With setting **0.00** the characteristic will not be used.

### 5.3.3 Settings for the Central Unit

| Addr. | Setting Title   | Setting Options     | Default Setting | Comments   |
|-------|-----------------|---------------------|-----------------|--|
| 118   | I> BF           | 0.10 .. 2.00 I / In | 0.50 I / In     | Current threshold for BF                         |
| 119A  | I> BF s. char.  | 0.05 .. 2.00 I / In | 0.25 I / In     | Current threshold for BF - sens. char.           |
| 6201  | STAB FAC:BF     | 0.00 .. 0.80        | 0.50            | Stabilising factor BF protection                 |
| 6202A | Is< BF s. char. | 0.00 .. 25.00 I/In  | 5.00 I/Ino      | Stabilising current threshold - BF - sens. char. |

### 5.3.4 List of Information from the Central Unit

| FNo.  | Alarm           | Comments                         |
|-------|-----------------|----------------------------------|
| 10478 | >Sens. charact. | >Sensitive characteristic active |

### 5.3.5 Bay-Specific Functions (BU)

All parameters of the breaker failure protection function can be set separately for each feeder. Thus the function can be matched to different types of bays (e.g. line, transformer) or short-circuit conditions (e.g. low-current faults).

#### 5.3.5.1 Triggering and Releasing the Breaker Failure Protection

The parameter **BF BI MODE (XX14/CU)** is used to specify whether the breaker failure protection function will be triggered exclusively by the feeder-selective binary input (1-channel) or only after evaluation of a second binary input ("**>CBF release**" (**FNo. 7615/BU**) or "**>CBF rel.3p.**" (**FNo. 7622/BU**)) (2-channel). Normally the function is released by pickup of the feeder protection. Triggering by 2 channels gives the breaker failure protection extra reliability. Together with every TRIP command, a transfer trip is generated.

Apart from triggering and releasing, there is also the pulse mode for breaker failure protection. For more information on the pulse mode, please refer to page 150 and Figure 5-25, page 148.

If a binary input for triggering the breaker failure protection ("**>CBF L1**" (**FNo. 7611/BU**), "**>CBF L2**" (**FNo. 7612/BU**), "**>CBF L3**" (**FNo. 7613/BU**) or "**>CBF 3-pole**" (**FNo. 7621/BU**)) is activated erroneously, a feeder current above the threshold for the breaker failure protection is apt to cause a spurious trip of the busbar.

The following monitoring measures can be taken to detect this kind of errors in time:

- If a triggering signal is present for more than 15 s, the faulty binary input is blocked and the annunciation "**BF Dist\$00 Lx**" (**FNo. 176.1091, 176.1092, 176.1093/CU**) or "**BF Dist\$00 3P**" (**FNo. 176.1094/CU**) is output.
- If the release signal for the breaker failure protection is present for longer than the time set in the parameter **T-BF rel sup (XX27/CU)**, the breaker failure protection is blocked and the annunciation "**BFrelDi\$00 1P**" (**FNo. 176.1101/CU**) or "**BFrelDi\$00 3P**" (**FNo. 176.1102/CU**) is output. As long as the release signal is present, the breaker failure protection of this feeder is blocked.
- If a 1-pole or 3-pole triggering signal is present but no release signal arrives within a settable time **T-BF 2chan (128/CU)**, the breaker failure protection is selectively blocked and the annunciation "**BF Dist\$00 Lx**" (**FNo. 176.1091, 176.1092, 176.1093/CU**) or "**BF Dist\$00 3P**" (**FNo. 176.1094/CU**) is output.

If the time monitoring of the impulse binary signal of the breaker failure protection picks up, the following alarm "**BF ImpDis \$00**" (**FNo. 176.1104.xx**) and the general fault alarm "**BF Imp Dist. G**" (**FNo. 10437**) is output by the central unit.

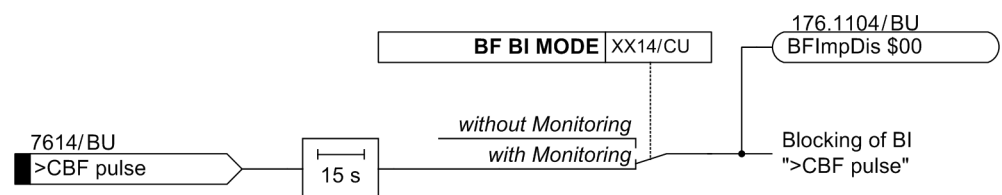


Figure 5-20 Monitoring the binary input for breaker failure pulse mode

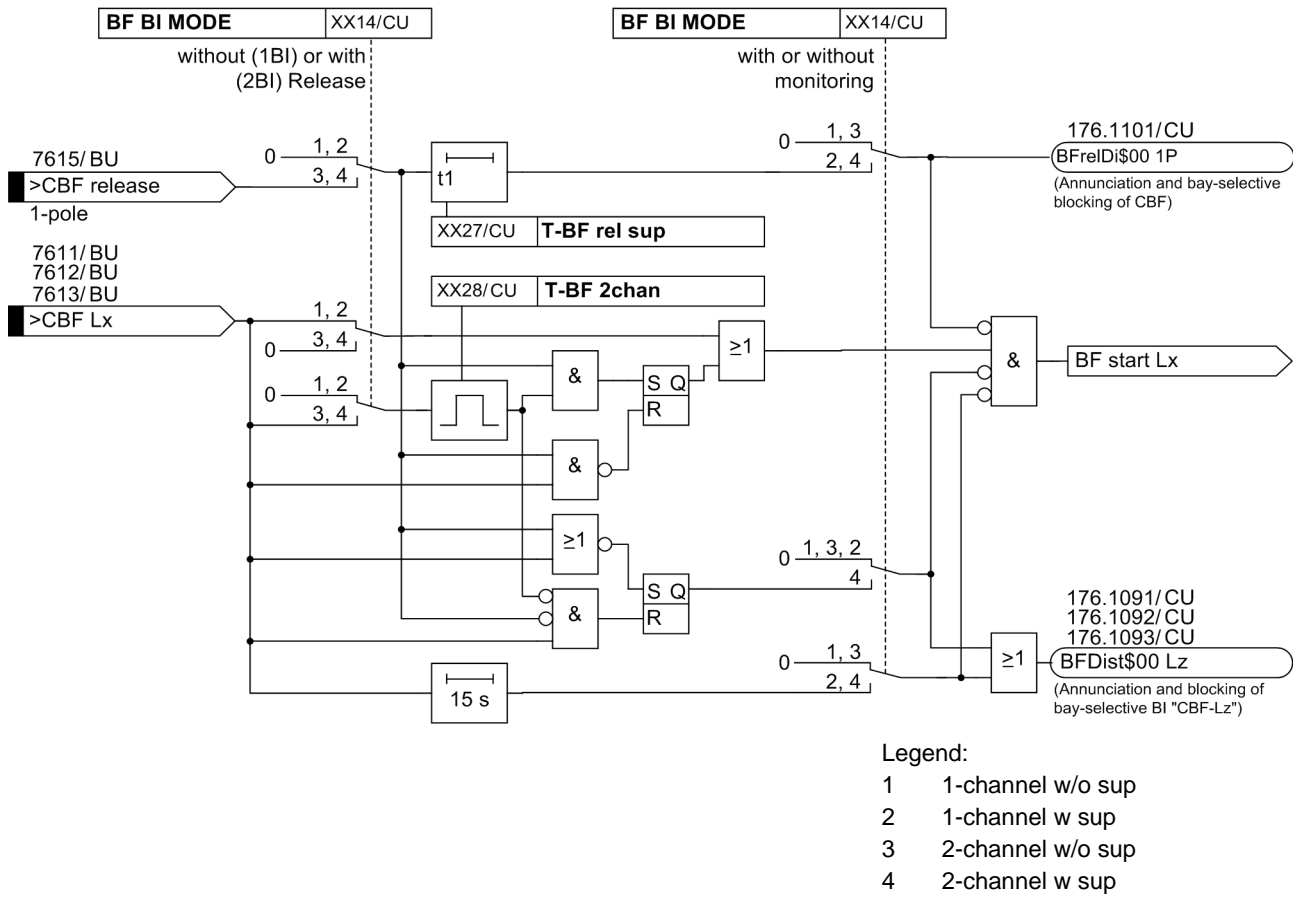


Figure 5-21 Breaker failure protection start and supervision - 1-pole



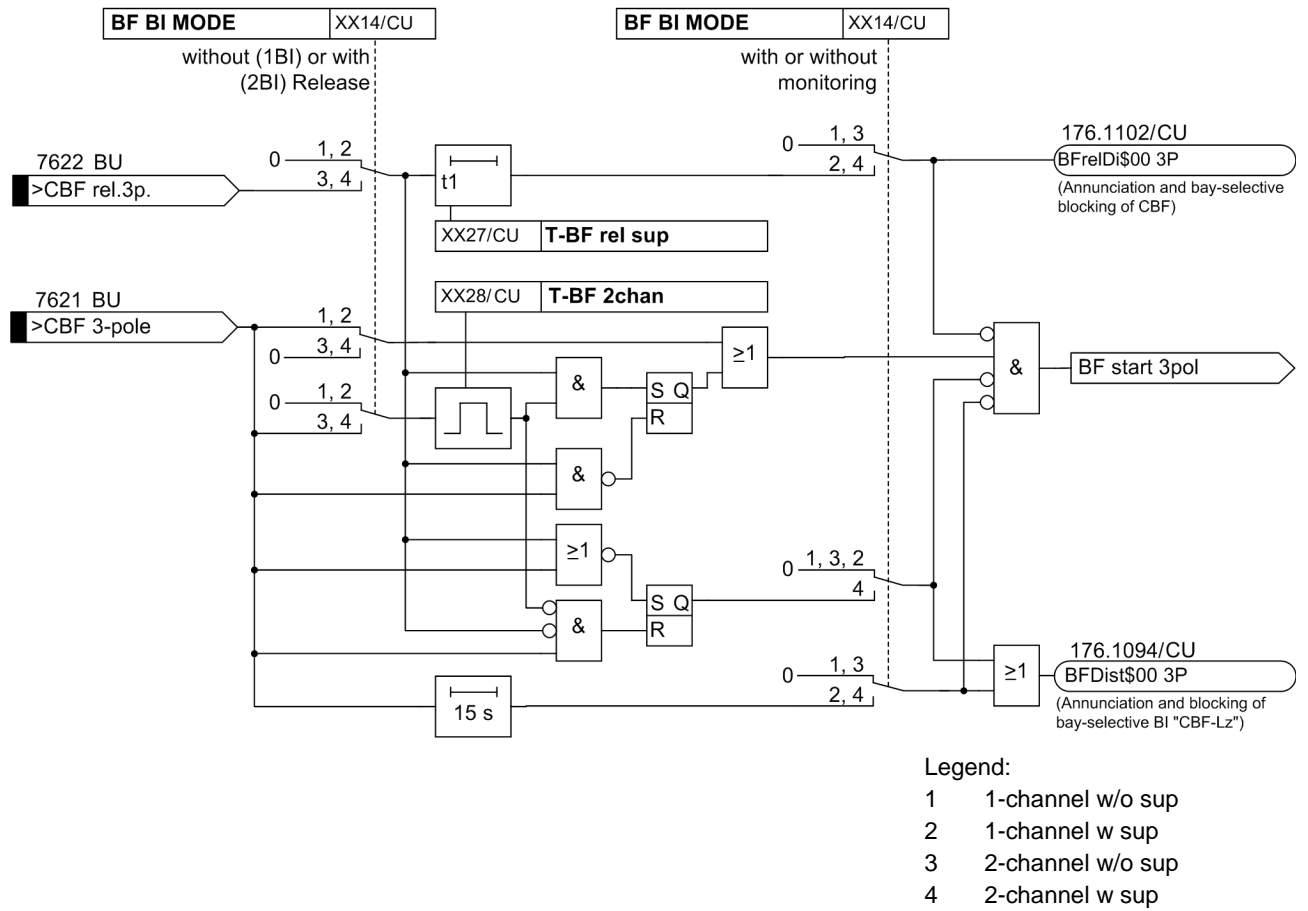


Figure 5-22 Breaker failure protection start and supervision - 3-pole

### 5.3.5.2 Circuit Breaker Failure Protection during a Feeder Short-Circuit

In the event of a breaker failure following a feeder short-circuit, the fault current must be interrupted by isolating the bus zone to which the affected feeder is allocated. The breaker failure protection of the SIPROTEC 7SS52 V4 distributed busbar and breaker failure protection is triggered by the TRIP command from the feeder protection. This command can be detected for one phase with the binary inputs ">CBF Lx" (FNo. 7611, 7612, 7613/BU) or for three phases with the binary input ">CBF 3-pole" (FNo. 7621/BU) in the bay unit.

#### BF OP MODE

How the 7SS52 V4 protection system reacts after this depends on the breaker failure protection mode, which is set with the parameter **BF OP MODE (XX15/CU)**. It is set individually for each feeder.

The following modes are available for the circuit breaker failure protection (CBF):

- I> query (1-stage CBF)
- TRIP repetition with overcurrent detection I> (2-stage CBF)
- Unbalancing (1-stage CBF)
- TRIP repetition with following unbalancing (2-stage CBF)
- TRIP by external CBF

#### 2-stage CBF

In the 2-stage CBF operating modes, a second bay-selective TRIP command is output by the bay unit after the delay **T-TRIP repeat (XX25/CU)** has elapsed to provide in any case for a trip of the circuit breaker. This can be useful, for instance, if the circuit breaker has a second trip coil or a control circuit that is separate from the bay protection. The affected bus zone is not disconnected until a second, unsuccessful TRIP attempt has been made. A prerequisite for a TRIP repeat is that the circuit breaker is ready for operation. That means a binary input ">CB not ready" (FNo. 7619/BU) is not active.

#### Initiation by feeder protection

In feeders with a double set of protection devices (main/back-up protection), the CBF protection can be initiated both phase-selectively and 3-phase by the main or back-up protection equipment. To do so, the binary inputs ">CBF Lx" (FNo. 7611, 7612, 7613/BU) and/or ">CBF 3-pole" (FNo. 7621/BU) must be marshalled accordingly. The CBF protection is started by the first signal that is detected.

#### Circuit breaker failure delay times

If a single-pole fault evolves to a multi-pole short-circuit before the delay set with the parameter **T-BF-1P (XX20/CU)** has elapsed, the running process is aborted and a delay time is started which is set with the parameter **T-BF-mP (XX21/CU)**.

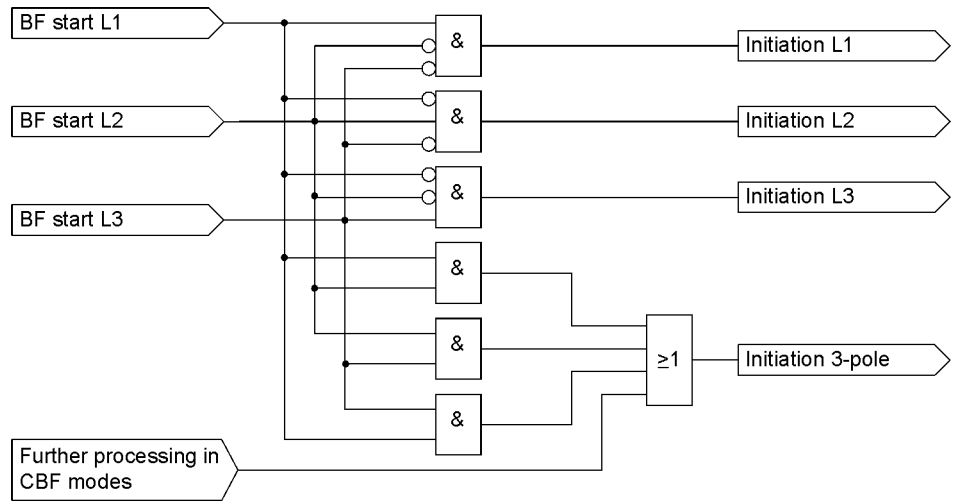


Figure 5-23 Triggers by binary inputs

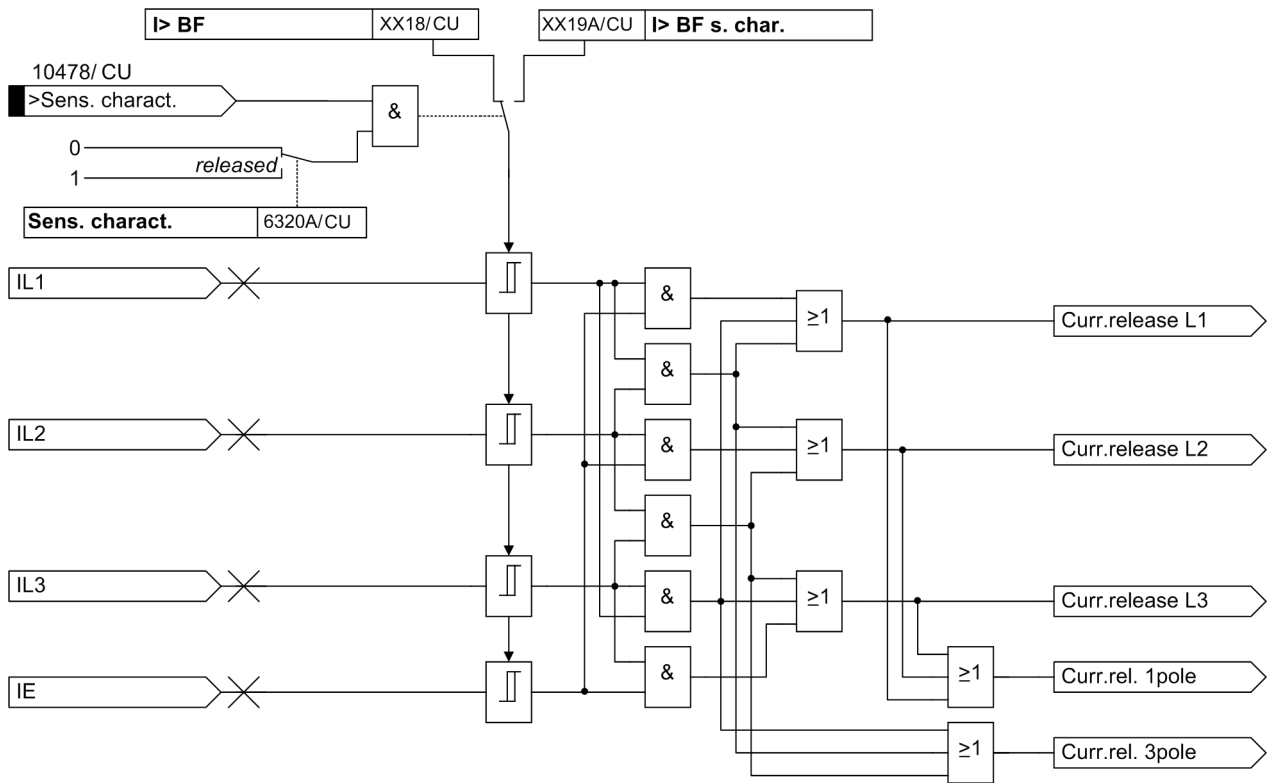
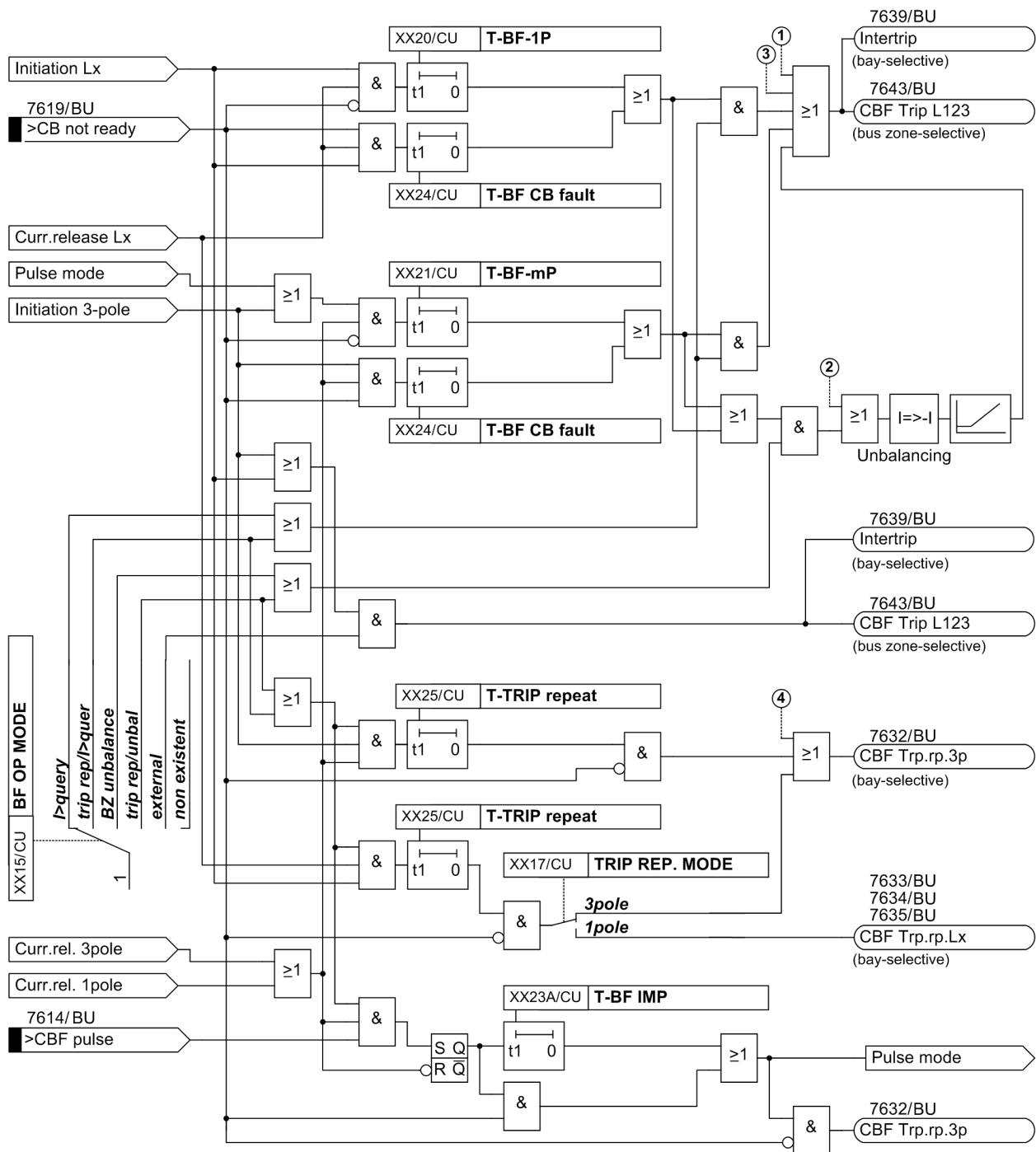


Figure 5-24 Logic of the current check of the breaker failure protection



Continuation for (1) and (2) see Figure 5-53, page 235

Continuation for (3) and (4) see Figure 5-27, page 152

Figure 5-25 Breaker failure protection logic - operating modes

**I>query**

The circuit breaker failure protection (CBF) function is initiated by the TRIP command from the feeder protection.

If the operating mode **I>query** is set with the parameter **BF OP MODE (XX15/CU)**, the feeder current is monitored for exceeding the threshold set with the parameter **I> BF (XX18/CU)** or **I> BF s. char. (XX19A/CU)** (Figure 5-24, page 147). A feeder current above this threshold starts the delay time set with the parameter **T-BF-1P (X X20/CU)** or **T-BF-mP (XX21/CU)**.

If the feeder current is still above the threshold after this delay has elapsed, the central unit issues a 3-pole TRIP command to isolate the bus zone. In the case of a circuit breaker failure, the alarms "Trip Lx CZ" (**FNo. 10457/CU, 10458/CU, 10459/CU**), "Trip BF G" (**10436/CU**), "Device trip G" (**FNo. 10445/CU**) "Fault rec. run." (**FNo. 30053/CU**), "Trip BF \$03 Lx" (**177.1352.\$03/CU, 177.1353.\$03/CU, 177.1354.\$03/CU**), "Trip \$03 G" (**177.1341.\$03/CU**), "Trip Lx G" (**FNo. 10446/CU, 10447/CU, 10448/CU**), "TrnsfTrip \$00" (**176.1082.\$00/CU**) and the group alarm "Transf. Trip G" (**10433/CU**) will be issued.

**trip rep/I>quer**

If the operating mode **trip rep/I>quer** is set with the parameter **BF OP MODE (XX15/CU)**, the current is monitored for exceeding the threshold set with the parameter **I> BF (XX18/CU)** or **I> BF s. char. (XX19A/CU)**. A current above this threshold starts the delay time for the TRIP repetition, which is set with the parameter **T-TRIP repeat (XX25/CU)**.

If this release criterion is fulfilled for all of the delay time for the TRIP repetition, the bay unit issues a 1-pole or 3-pole TRIP command to the local circuit breaker.

A single-pole TRIP repetition is generated on condition that the feeder current in the CBF-initiating phase and at least one of the other currents (phase or ground current) exceed the adjustable threshold (ILx & IE) set with the parameter **I> BF (XX18/CU)** or **I> BF s. char. (XX19A/CU)**. For this purpose, set the parameter **TRIP REP. MODE (XX17/CU)** to **1pole**. The TRIP repetition is always three-polar if the feeder current exceeds in at least 2 phases the value set with the parameters **I> BF (XX18/CU)** or **I> BF s. char. (XX19A/CU)**.

If the circuit breaker trips correctly, the initiation and thus the CBF function is cleared.

If the CBF initiation persists, the time delay of the CBF - set with the parameter **T-BF-1P (XX20/CU)** or **T-BF-mP (XX21/CU)** - elapses. In conformity with the current disconnecter replica, all feeders are tripped which are allocated to the bus zone of the CBF initiating bay unit.

A further condition is that the current threshold, which can be set individually for each feeder with the parameter **I> BF (XX18/CU)**, is exceeded during the total time period.

**BZ unbalance**

If the operating mode **BZ unbalance** is set with the parameter **BF OP MODE (XX15/CU)**, the system checks whether the TRIP command of the feeder protection has initiated the CBF function ">CBF Lx" (**FNo. 7611, 7612, 7613/BU**) or ">CBF 3-pole" (**FNo. 7621/BU**). If the criterion for this is fulfilled, a delay time is started which is set with the parameter **T-BF-1P (XX20/CU)** or **T-BF-mP (XX21/CU)**.

If the CBF initiation and the relevant necessary current flow criterion (current release) are active for all of the delay time, the polarity of the feeder current in the protection algorithm is changed ("unbalancing").

If the TRIP criterion and the current sensor criterion are fulfilled, the central unit issues a three-phase TRIP command to all feeders of the affected bus zone. The principle of "unbalancing" is depicted in Figure 5-26, page 150. Unbalancing causes a differential current of twice the magnitude of the current in the CBF initiating feeder.

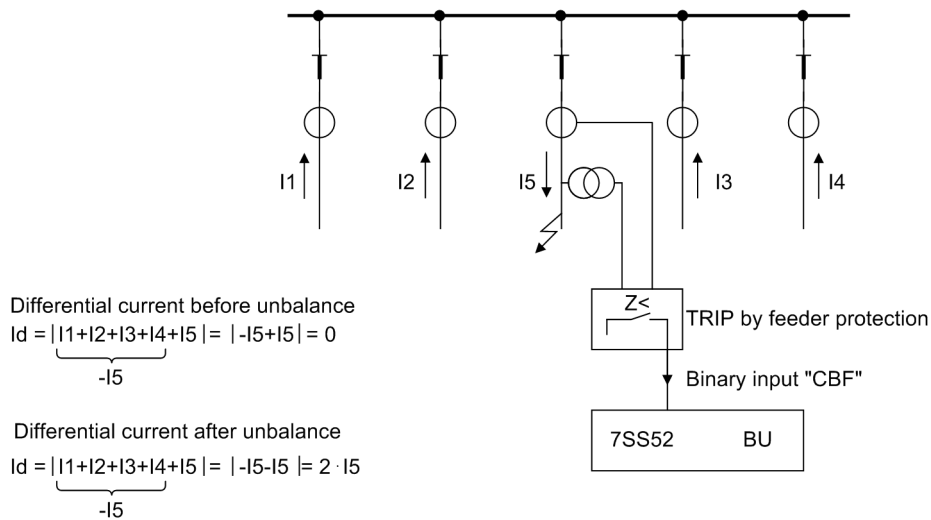


Figure 5-26 Principle of unbalancing for the circuit breaker failure protection

The **BZ unbalance** mode has 2 separate parameter sets, one for the normally sensitive characteristic and another for the more sensitive characteristic. This sensitive characteristic is released via a binary input of the central unit, together with the sensitive characteristic for busbar protection. Figure 5-19, page 140 shows the characteristics and the settings.

This operating mode yields the following essential advantages:

Extremely short dropout times due to the use of instantaneous values.

For the clearing time of the feeder protection no special requirements need to be met. Even with a longer clearing time, there is no danger of spurious tripping since the circuit breaker has interrupted the current and a differential current is not formed by the unbalancing.

**trip rep/unbal**

If the operating mode **trip rep/unbal** is set with the parameter **BF OP MODE (XX15/CU)**, this mode also uses the "unbalancing". Before all feeders of the bus zone with the CBF initiating bay unit are tripped three-pole, the TRIP command is repeated as in the mode **trip rep/I>quer**.

**Initiation by external CBF**

If the operating mode **external** is set with the parameter **BF OP MODE (XX15/CU)**, the breaker failure is detected by an external device. On activation of the configured binary inputs of the bay unit ">CBF Lx" (**FNo. 7611, 7612, 7613/BU**) or ">CBF 3-pole" (**FNo. 7621/BU**), the protection system trips without delay the busbar to which the bay with the faulted circuit breaker is connected. The central unit evaluates for this the disconnecter replica.

**NOTE**

In this operating mode, always work with breaker failure protection triggering and releasing (2 BI) since there is no further protection by a current check (refer to Chapter 5.3.5.1, page 143).

**Low-current mode**

In the presence of low-current faults (e.g. trip by the Buchholz protection of the transformer), the necessary threshold for a current-controlled mode may not be reached. Therefore, it is not ensured that the circuit breaker failure protection is activated.

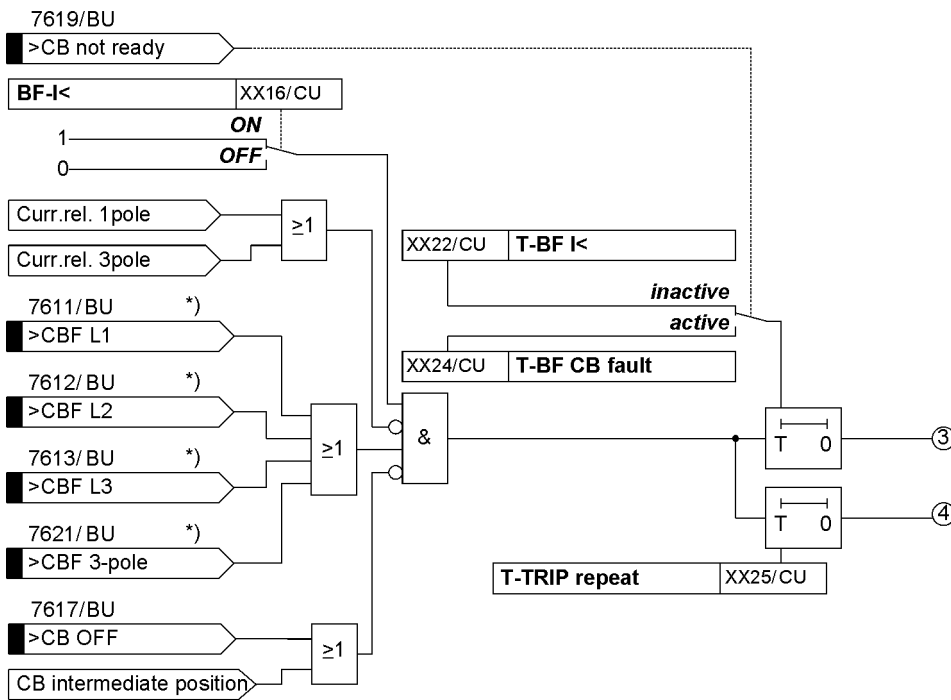
The low-current mode **BF I< (XX16/CU)** ensures that circuit breaker failure protection is provided nevertheless. After a set time **T-BF I< (XX22/CU)** has elapsed, and if the circuit breaker is closed, a busbar TRIP command for the affected bus zone is issued.

If the feeder current exceeds this one with the parameter **I> BF (XX18/CU)** adjusted limiting value, the low-current mode is blocked. Logic of the current release see Figure 5-24, page 147.

With the operating modes **non existent** and **external**, to be set with the parameter **BF OP MODE (XX15/CU)**, this function has no influence. For more information on the operating modes, please refer to the setting notes in Chapter 5.3.6, page 156.

As with other operating modes of the breaker failure protection, the tripping consists of two stages, i.e. a first stage as "TRIP repetition" on the local breaker and a second stage for the tripping of the busbar. The parameter **T-TRIP repeat (XX25/CU)**, which is also used for the current-controlled stages of the breaker failure protection, is used in the central unit to delay the first stage.

The following figure shows the logic of the low-current operating mode of the breaker failure protection:



\*) Release inputs not shown

Continuation for (3) and (4) see Figure 5-25, page 148

Figure 5-27 Low-current mode

**Pulse mode**

In the operating mode "**Pulse mode**", the circuit breaker failure protection is initiated by the opposite end of the line. It operates independently of the CBF function proper if the binary input ">CBF pu1s" (**FNo. 7614/BU**) is allocated accordingly. The "**Pulse mode**" only operates with the following modes:

- TRIP repetition/Unbalancing
- TRIP repetition/l> query:

The pulse mode is reserved for special applications. This operating mode may be used if initiation of the CBF cannot be given by the corresponding feeder protection (e.g. delayed fault recognition; feeder protection inoperative). In these specific cases the CBF can be initiated by the protection at the remote end via a binary input ">CBF pu1s" (**FNo. 7614/BU**) of the bay unit.

The devices for transmission provide a signal (pulse) of variable duration. The minimum signal duration of the binary input at the bay unit has to be 20 ms, the maximum is 15 s. If the time monitoring of the impulse binary signal of the breaker failure protection picks up, the following alarm "BF ImpDis \$00" (**FNo. 176.1104.xx**) and the general fault alarm "BF Imp Dist. G" (**FNo. 10437**) is issued by the central unit.

As soon as the delay time set with the parameter **T - BF IMP (XX23A/CU)** has elapsed and a current release signal (single or three-pole) is available, a feeder-selective, three-pole TRIP command is issued. If the TRIP command does not result in clearing the protection function, the second stage is started after a delay time has elapsed and if the current criteria are met.



### 5.3.5.3 Circuit Breaker Failure Protection for Busbar Faults

While the busbar short-circuit is to be eliminated, a circuit-breaker failure may occur, too. In this case, the current must be interrupted from the remote end (Figure 5-28, page 153).

The 7SS52 detects the breaker failure and allows a shorter tripping time by the trip signal sent to the opposite line end. If signal transmission equipment is used, the current can be interrupted faster since signal transmission equipment trips the circuit breaker at the remote end as soon as the delay time set with the parameter **T - BF - mP (XX21 / CU)** has elapsed.

On issuing a TRIP command, the so-called "internal Circuit Breaker Failure Protection" will be started. The currents are monitored in all feeders which are to be tripped. If the current persists above the feeder-selective threshold set with the parameter **I > BF (XX18/CU)** after the delay time has elapsed, the corresponding bay unit issues a transfer trip command (Figure 5-29, page 154).

In the case of a circuit breaker failure, the alarm "TrnsfTrip \$00" (**176.1082.\$00/CU**) and the group alarm "Transf. Trip G BU" (**10433/CU**) will be issued.

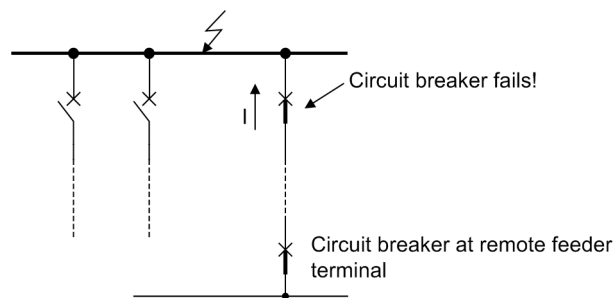


Figure 5-28 Circuit breaker failure during a busbar fault

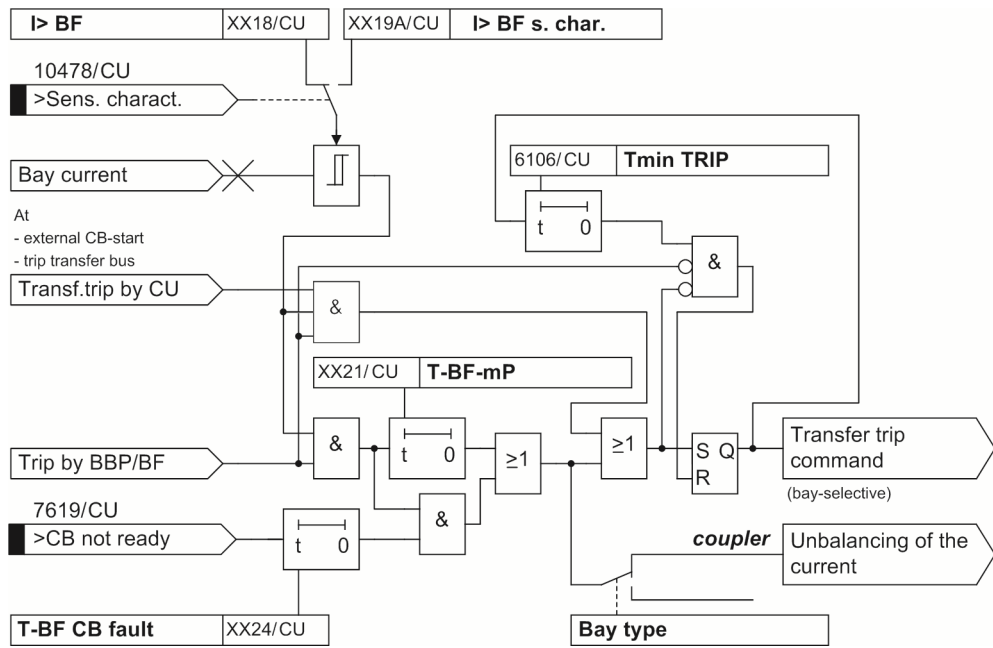


Figure 5-29 Circuit Breaker Failure Protection for Busbar Faults

### 5.3.5.4 Failure of the Bus Coupler Circuit Breaker

If a busbar short-circuit occurs with the bus coupler closed (Figure 5-30, page 155), a TRIP command is issued to all related feeders of this zone and to the coupling bay units. (1)

Thus bus zone BZ A is isolated and the healthy bus zone BZ B stays in service.

In the event of a failure of the bus coupler circuit breaker, the busbar protection has to disconnect bus zone BZ B, too. Therefore with the tripping signal to the bus zone BZ A the so-called "internal Circuit Breaker Failure Protection" will be started.

If the current keeps on flowing in a coupler unit after the time set in parameter **T-BF-mP (XX21/ CU)** has elapsed, the coupler current will be unbalanced.

If the setting values of the coupler bay unit(s) **I> BF (XX18/ CU)** or **I> BF s. char. (XX19A/ CU)** are exceeded, the tripping criterion is fulfilled for busbar BZ B as well, and the faulted line is definitely tripped. (2)

In the case of a breaker failure of the circuit breaker in the bus coupler bay, the alarms "TRIP BF G" (10436/ CU), "TRIP BF \$03 Lx" (177.1352.\$03/ CU, 177.1353.\$03/ CU, 177.1354.\$03/ CU), "TRIP \$03 G" (177.1341.\$03/ CU), "TranfTrip \$00" (176.1082.\$00/ CU), "TRIP BBP G" (FNo. 10449), "TRIP \$03 Lx" (177.1342.\$03/ CU, 177.1343.\$03/ CU, 177.1344.\$03/ CU), and the group alarm "Transf. Trip G" (10433/ CU) are issued.

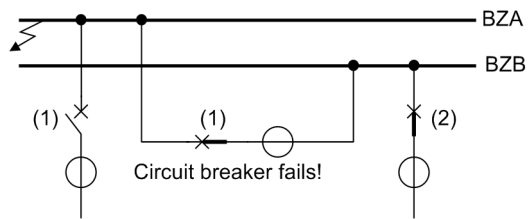


Figure 5-30 Fault on bus zone BZ A and failure of the bus coupler circuit breaker

### 5.3.5.5 Circuit Breaker Not Ready

For the detection of malfunctions in the tripping mechanism of the feeder circuit breaker, the bay unit is provided with a binary input ">CB not ready" (**FNo. 7619/BU**). If a breaker failure occurs while a signal is present at this binary input, the breaker failure protection uses the delay time **T-BF CB fault (XX24/CU)** instead of the time set with the parameters **T-BF-1P (XX20/CU)** and **T-BF-mP (XX21/CU)**. No TRIP repetition is performed (exception: low-current mode).

With the parameter **T-BF CB fault (XX24/CU)**, the delay time of the breaker failure protection can be reduced.

A TRIP command from the bay unit issues at the same time a transfer trip command to trip the remote end (Figure 5-25, page 148).

### 5.3.6 Setting Notes

#### BF BI MODE

The parameter **BF BI MODE (XX14/CU)** is used to select the supervision mode for initiation of the breaker failure protection.

With setting **1-ch w/o sup**, the breaker failure protection will be initiated only by the feeder-selective binary input, without time supervision.

With setting **1-ch w sup**, the breaker failure protection will be initiated only by the feeder-selective binary input, with time supervision.

With setting **2-ch w/o sup**, the breaker failure protection will be initiated after evaluation of an additional binary input ("CBF release"), without time supervision.

With setting **2-ch w sup**, the breaker failure protection will be initiated after evaluation of an additional binary input ("CBF release"), with time supervision.

For testing purposes, Siemens recommends to set this parameter to **1-ch w/o sup** or **2-ch w/o sup**.



#### NOTE

The operating modes "**... without supervision**" are recommended for test purposes only.

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#### BF OP MODE

The parameter **BF OP MODE (XX15/CU)** is used to select the operating mode for the breaker failure protection in the bay unit. The parameter setting depends on the protection concept in use.

With setting **non existent** the breaker failure protection will be deactivated.

With setting **I>query** the I> query mode is activated.

With setting **trip rep/I>quer** the TRIP repetition with subsequent I> query mode is activated.

With setting **BZ unbalance** the unbalancing mode is activated.

With setting **trip rep/unbal** the TRIP repetition with subsequent unbalancing mode is activated.

With setting **external** the breaker failure protection will be provided by an external device.



#### NOTE

With the mode **I> Query** the dropout time (measuring window) of the breaker failure protection of 25 ms must be considered for setting the times **T-BF-1P (XX20/CU)** and **T-BF-mP (XX12/CU)**.

With the mode **BZ Unbalance** the dropout time is 2 ms and need not be taken into consideration for setting the times **T-BF-1P (XX20/CU)** and **T-BF-mP (XX21/CU)**.

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- BF I<** The parameter **BF I< (XX16/CU)** is used to activate and deactivate the low-current mode.
- With setting **ON** the low-current mode is activated.
- With setting **OFF** the low-current mode is deactivated.
- The low-current mode can be used together with the following settings:
- **BF BI MODE (XX14/CU)** with and without supervision
  - **BF OP MODE (XX15/CU)** Breaker failure operating mode, in the settings:
    - I> query
    - TRIP repetition/I> query:
    - Unbalancing
    - TRIP repetition/Unbalancing
- The low-current mode cannot be used together with the following setting **external** of the parameter **BF OP MODE (XX15/CU)**.
- TRIP REP. MODE** The parameter **TRIP REP. MODE (XX17/CU)** is used to select the operating mode for TRIP repetition with 1-pole initiation.
- With setting **1pole**, a single-pole TRIP repetition will be generated in the case of a single-pole start. The feeder current of the initiating phase and at least one of the other currents (phase or ground current) must exceed for this the threshold **I> BF (XX18/CU)** or **I> BF s. char. (XX19A/CU)** (ILx & IE).
- With setting **3pole** a 3-pole TRIP repetition will be generated in this case. The feeder current of the initiating phase and at least one of the other currents (phase or ground current) must exceed for this the threshold **I> BF s. char. (XX19A/CU)** (ILx & IE). Precondition for a TRIP repetition is a circuit-breaker, which is ready for operation, i.e. a non-active binary input ">CB not ready" (**FNo. 7619/BU**)(exception: low-current mode).
- T-BF-1P** The parameter **T-BF-1P (XX20/CU)** is used to delay for 1-pole faults the TRIP command and the transfer trip signal issued by the breaker failure protection.
- It is recommended for the single-stage breaker failure protection to set this parameter to twice the circuit breaker trip time.
- With two-stage breaker failure protection two time stages pick up: **T-TRIP repeat (XX25/CU)** and **T-BF-1P (XX20/CU)**.
- The tripping of the affected bus zone takes place after the second stage has been processed. The parameter **T-BF-1P (XX20/CU)** is then to be set higher than the sum of the delay times set with parameters **T-TRIP repeat (XX25/CU)** and the time the circuit breaker requires for tripping in order to avoid premature or unnecessary tripping of the bus zone.

|                      |  |
|----------------------|--|
| <b>T-BF-mP</b>       | <p>The parameter <b>T-BF-mP (XX21/CU)</b> is used to delay for multipole faults the TRIP command and the transfer trip signal issued by the breaker failure protection.</p> <p>It is recommended for the single-stage breaker failure protection to set this parameter to twice the circuit breaker trip time.</p> <p>With two-stage breaker failure protection two time stages pick up: <b>T-TRIP repeat (XX25/CU)</b> and <b>T-BF-mP (XX21/CU)</b>.</p> <p>The tripping of the affected bus zone takes place after the second stage has been processed. The parameter <b>T-BF-mP (XX21/CU)</b> is then to be set higher than the sum of the delay times set with parameters <b>T-TRIP repeat (XX25/CU)</b> and the time the circuit breaker requires for tripping in order to avoid premature or unnecessary tripping of the bus zone.</p> |
| <b>T-BF I&lt;</b>    | <p>The parameter <b>T-BF I&lt; (XX22/CU)</b> is used to delay for the "low-current" mode the TRIP command and the transfer trip signal issued by the breaker failure protection.</p>   |
| <b>T-BF IMP</b>      | <p>The parameter <b>T-BF IMP (XX23A/CU)</b> is used to delay for pulse mode the feeder-selective TRIP repetition issued by the breaker failure protection.</p>   |
| <b>T-BF CB fault</b> | <p>The parameter <b>T-BF CB fault (XX24/CU)</b> is used to delay the TRIP command and the transfer trip signal. These are issued by the breaker failure protection if a circuit breaker malfunction is detected in this feeder.</p>  |
| <b>T-TRIP repeat</b> | <p>The parameter <b>T-TRIP repeat (XX25/CU)</b> is used to delay the feeder-selective repetition of the TRIP command issued by the breaker failure protection.</p> <p>The time for the TRIP repetition must be set to less than the delay times for the breaker failure protection <b>T-BF-1P (XX20/CU)</b>, <b>T-BF-mP (XX21/CU)</b> and for the pulse mode <b>T-BF IMP (XX23A/CU)</b>.</p>   |
| <b>T-BF rel sup</b>  | <p>If the parameter <b>BF BI MODE (XX14/CU)</b> is set to <b>with supervision</b>, the the parameter <b>T-BF rel sup (XX27/CU)</b> is used to set the time for supervising the duration of the CBF release signal.</p>   |
| <b>T-BF 2chan</b>    | <p>The parameter <b>T-BF 2chan (XX28/CU)</b> is used to set the supervision delay during which, counting from the initiation moment, the release signals for the breaker failure protection must be issued.</p>  |



**NOTE**

Many of the above parameters are also used for other functions, such as "Monitoring" or for the description of the "Bay Unit" (Chapter 5.10, page 205).

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### 5.3.7 Settings for the Central Unit

| Addr. | Setting Title  | Setting Options  | Default Setting | Comments                                 |
|-------|----------------|--|-----------------|--|
| 114   | BF BI MODE     | 1-ch w/o sup<br>1-ch w sup<br>2-ch w/o sup<br>2-ch w sup                                 | 1-ch w sup      | Binary input mode / supervision BF       |
| 115   | BF OP MODE     | non existent<br>external<br>BZ unbalance<br>trip rep/unbal<br>l>query<br>trip rep/l>quer | BZ unbalance    | Operation mode BF                        |
| 116   | BF I<          | ON<br>OFF  | OFF             | Low-current mode BF                      |
| 117   | TRIP REP. MODE | 1pole<br>3pole   | 1pole           | TRIP repeat mode                         |
| 118   | l> BF          | 0.10 .. 2.00 I / In  | 0.50 I / In     | Current threshold for BF                 |
| 119A  | l> BF s. char. | 0.05 .. 2.00 I / In  | 0.25 I / In     | Current threshold for BF - sens. char.   |
| 120   | T-BF-1P        | 0.05 .. 10.00 s  | 0.25 s          | Time delay for BF with 1-pole faults     |
| 121   | T-BF-mP        | 0.05 .. 10.00 s  | 0.25 s          | Time delay for BF with multi-pole faults |
| 122   | T-BF I<        | 0.05 .. 10.00 s  | 0.25 s          | Time delay for BF low current mode       |
| 123A  | T-BF IMP       | 0.05 .. 10.00 s  | 0.50 s          | Time delay for BF pulse mode             |
| 124   | T-BF CB fault  | 0.00 .. 10.00 s  | 0.10 s          | Time delay BF after CB fault             |
| 125   | T-TRIP repeat  | 0.00 .. 10.00 s  | 0.12 s          | Time delay for TRIP repeat               |
| 127   | T-BF rel sup   | 0.02 .. 15.00 s  | 15.00 s         | Supervision bin. input BF-release        |
| 128   | T-BF 2chan     | 0.06 .. 1.00 s   | 0.06 s          | Supervision time BF start / release      |
| 6106  | Tmin TRIP      | 0.01 .. 32.00 s  | 0.15 s          | Minimum duration of TRIP command         |
| 6320A | Sens. charact. | released<br>blocked  | blocked         | Sensitive characteristic switchover      |

### 5.3.8 List of Information from the Central Unit

\$00, ..., \$03 are variables which will be automatically replaced by  
 \$00 Number of the bay unit (e.g. \$00 = BU@01)  
 \$01 Bay name  
 \$02 Name of the switching element (e.g. disconnector or circuit breaker)  
 \$03 Name of the bus zone

| FNo.     | Alarm           | Comments                              |
|----------|-----------------|---------------------------------------|
| 10433    | Transf. Trip G  | Breaker Failure/Transfer Trip (g.a.)  |
| 10436    | TRIP BF G       | Trip command BF (group alarm)         |
| 10437    | BF Imp Dist. G  | Disturbance BF impulse input (g.a.)   |
| 10445    | Device trip G   | Device Trip (group alarm)             |
| 10446    | Trip L1 G       | Trip command L1 (group alarm)         |
| 10449    | Trip BBP G      | Trip command BBP (group alarm)        |
| 10457    | Trip L1 CZ      | Trip command L1 check zone            |
| 10458    | Trip L2 CZ      | Trip command L2 check zone            |
| 10459    | Trip L3 CZ      | Trip command L3 check zone            |
| 10478    | >Sens. charact. | >Sensitive characteristic active      |
| 176.1082 | TransfTrip \$00 | Breaker failure/Transfer trip \$00    |
| 176.1091 | BF Dist\$00 L1  | Disturbance BF input \$00 L1          |
| 176.1092 | BF Dist\$00 L2  | Disturbance BF input \$00 L2          |
| 176.1093 | BF Dist\$00 L3  | Disturbance BF input \$00 L3          |
| 176.1094 | BF Dist\$00 3P  | Disturbance BF input \$00 3pole       |
| 176.1101 | BFrelDi\$00 1P  | Disturbance BF release input \$00 1P  |
| 176.1102 | BFrelDi\$00 3P  | Disturbance BF release input \$00 3P  |
| 176.1104 | BF ImpDis \$00  | Disturbance BF pulse input \$00       |
| 176.1171 | 15V-superv \$00 | 15V supply supervision \$00           |
| 176.1172 | 5V-superv \$00  | 5V supply supervision \$00            |
| 176.1173 | 0V-superv \$00  | 0V supply supervision \$00            |
| 176.1175 | MeasInSup \$00  | Measured value supervision I-SUM \$00 |
| 177.1341 | Trip \$03 G     | Trip command for \$03 (group alarm)   |
| 177.1342 | Trip \$03 L1    | Trip command for \$03 L1              |
| 177.1343 | Trip \$03 L2    | Trip command for \$03 L2              |
| 177.1344 | Trip \$03 L3    | Trip command for \$03 L3              |
| 177.1352 | Trip BF \$03 L1 | Trip command BF for \$03 phase L1     |
| 177.1353 | Trip BF \$03 L2 | Trip command BF for \$03 phase L2     |
| 177.1354 | Trip BF \$03 L3 | Trip command BF for \$03 phase L3     |



### 5.3.9 List of Information from the Bay Unit

| FNo. | Alarm         | Comments                                |
|------|---------------|---|
| 7611 | >CBF L1       | >Circuit breaker failure start phase L1 |
| 7612 | >CBF L2       | >Circuit breaker failure start phase L2 |
| 7613 | >CBF L3       | >Circuit breaker failure start phase L3 |
| 7614 | >CBF puls     | >Circuit breaker failure pulse          |
| 7615 | >CBF release  | >Circuit breaker failure release        |
| 7617 | >CB OFF       | >Circuit breaker open                   |
| 7619 | >CB not ready | >Circuit breaker not ready              |
| 7621 | >CBF 3-pole   | >Circuit breaker failure start 3-pole   |
| 7622 | >CBF rel.3p.  | >Circuit breaker failure release 3-pole |
| 7632 | CBF Trp.rp.3p | CBF protection: Trip repeat phase L123  |
| 7633 | CBF Trp.rp.L1 | CBF protection: Trip repeat phase L1    |
| 7634 | CBF Trp.rp.L2 | CBF protection: Trip repeat phase L2    |
| 7635 | CBF Trp.rp.L3 | CBF protection: Trip repeat phase L3    |
| 7639 | Intertrip     | Intertrip                               |
| 7643 | CBF TRIP L123 | CBF protection: Trip L123               |

## 5.4 End Fault Protection

The function of the end fault protection is to protect the zone between the current transformer and the circuit breaker when the circuit breaker is open.

### 5.4.1 End Fault Protection in the Feeder

#### Bus-side current transformers

With bus-side current transformers (Figure 5-31, page 163, 1a) the zone protected by the busbar protection is normally delimited by the location of the current transformer. The end fault protection allows to extend this zone as far as the circuit breaker. In case of a fault the busbar protection can issue a trip command in very short time. Without end fault protection, the feeder protection would detect a fault, but issue no trip command. The fault could only be cleared by the circuit breaker failure protection functions, with the resulting time delay.

#### Line-side current transformers

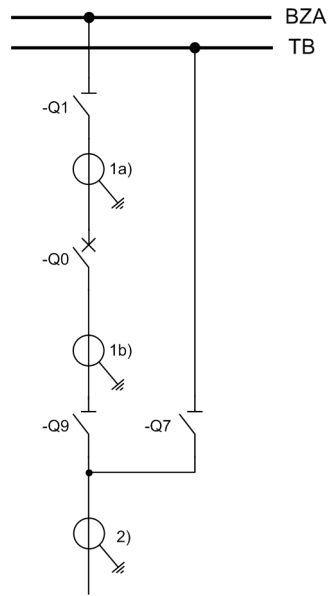
With line-side current transformers (Figure 5-31, page 163, 1b) and 2), the end fault protection helps to avoid an overfunction of the busbar protection. If a data transmission feature is provided, it can also issue a transfer trip command to the circuit breaker at the remote end "End - Flt. Trip" (**FNo. 7644/BU**). The feeder protection would interpret such a situation as a fault in reverse direction and trip with the resulting delay. Without any transmission channels, the fault is only cleared with a distance-dependent time offset by the remote end.

The logic of the end fault protection is shown in Figure 5-32, page 163. A prerequisite for activating the end fault protection is that the circuit breaker is open ("**>CB OFF**" (**FNo. 7617/BU**) marshalled to a binary input). Before the circuit breaker is closed and the feeder current is integrated into the busbar measurement again, the end fault protection must be blocked. Therefore the leading information of the **CB CLOSE** command is evaluated ("**>CB man.close**" (**FNo. 7618/BU**) marshalled to a binary input).

The end fault protection is blocked if the monitoring of the switching status feedback (Chapter 5.5.1.10, page 178) has detected a fault.

This function is only available for the bay type "feeder bay"; it can be activated and deactivated per feeder with the parameter **End Fault Prot (XX29/CU)**.

The alarm "Op EFP \$00" (**FNo. 176.1370/CU**) is output when the end fault protection trips.



CT location:  
 1a) bus side (relating to Q7) current transformers, busbar side (relating to Q0)  
 1b) bus side (relating to Q7) current transformers, line side (relating to Q0)  
 2) line-side current transformers (relating to Q7)

Figure 5-31 Possible CT locations

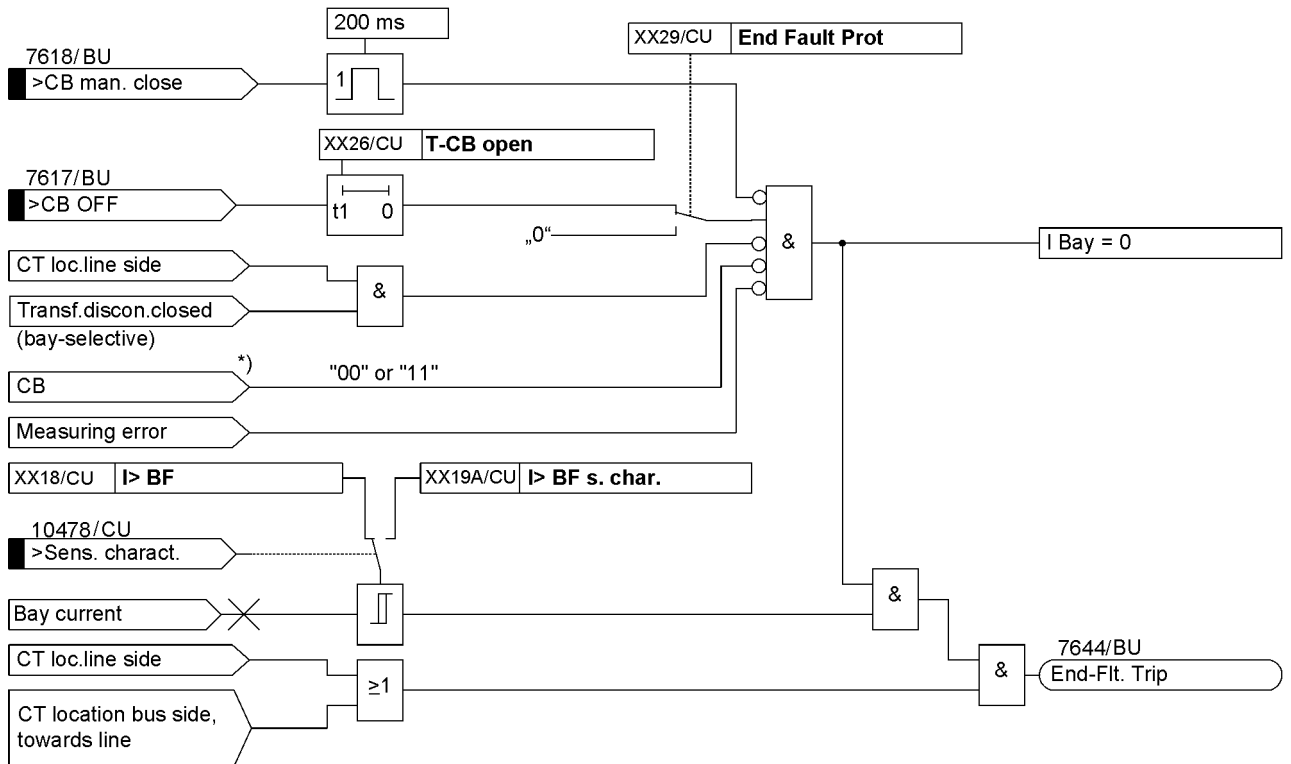


Figure 5-32 End fault protection

### 5.4.2 Protection with fault in the "Dead Zone" of the Bus Coupler

Normally, the current transformer is the boundary of the protected zone (measuring range). The zone between the current transformer and the circuit breaker is known as the "Dead Zone". You can achieve an improved behavior of protection through detection of the circuit-breaker position when the circuit breaker is open. In this case, the protected zone is extended by the dead zone due to device-internal measures.

With a closed circuit breaker, the protection behavior is first the same as without detection of the position.

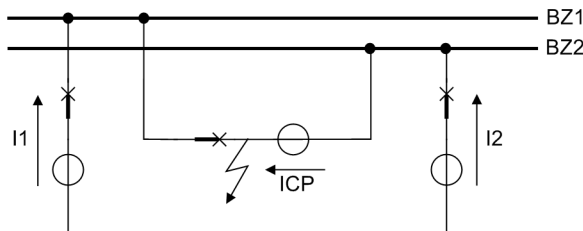


Figure 5-33 Fault in the dead zone of the bus coupler

#### 5.4.2.1 Without detection of the circuit-breaker position

##### Bus coupler with one current transformer

First of all, the busbar BZ1 (Figure 5-33, page 164) is switched off. The fault current is not yet interrupted, though, since the short-circuit is still being fed from BZ2. Busbar BZ2 must be switched off, too. For this purpose, the coupler current will be manipulated (unbalanced) device-internally after the delay time of the breaker failure protection settable with parameter **T - BF - mP (XX21 / CU)** has elapsed. Such unbalancing leads to the tripping of the BZ2 busbar that is feeding the fault and, hence, to the final fault clearing.

##### Bus coupler with two current transformers

If the bus coupler bay is equipped with two transformers, the two busbars BZ1 and BZ2 will be switched off without delay, since the fault is located in the overlapping protected area of both zones.

#### 5.4.2.2 With detection of the circuit-breaker position, circuit breaker open

With the circuit breaker open, the device-internal treatment of the coupler current immediately and selectively switches off the busbar feeding the fault and interrupts the fault current, irrespective of the number of current transformers.

##### Delayed recognition

The position of the circuit breaker is detected by means of the circuit breaker auxiliary contact. Processing of the circuit breaker OPEN status must not start until the main contacts have opened. **T - CB open (XX26 / CU)** can be used to set a time delay, if necessary.

### 5.4.2.3 With detection of the circuit-breaker position, circuit breaker closed

#### Bus coupler with one current transformer

First of all, busbar BZ1 (Figure 5-33, page 164) is switched off, which does not interrupt the fault current, though. The circuit breaker opens and is detected by the busbar protection through its position indication. There, the coupler current is manipulated (set to zero) device-internally. Such unbalancing leads to the tripping of all of the associated circuit breakers of the BZ2 busbar and, hence, to the final fault clearing. The detection of the circuit-breaker position leads to a reduction of the fault-clearing time compared to Chapter 5.4.2.1, page 164.

#### Bus coupler with two current transformers

If the bus coupler bay is equipped with two transformers, the two busbars BZ1 and BZ2 will be switched off without delay, since the fault is located in the overlapping protected area of both zones. The detection of the circuit-breaker position does not provide any advantage compared to Chapter 5.4.2.1, page 164.

### 5.4.2.4 CLOSE Command of the Bus Coupler Circuit Breaker

If the bus coupler circuit breaker is open, the current of the coupler bay is set to zero for the protection of bus zones BZA and BZB (Figure 5-34, page 165).

If the bus coupler circuit breaker is closed onto a short-circuit in bus zone BZB, the protection trip may be faster than the circuit breaker status processing. This may cause spurious tripping of the healthy bus zone BZA. To avoid this, a leading contact for closing the circuit breaker integrates the current of the coupler current transformer into the protection algorithm.

The circuit breaker position must be detected by the binary input ">CB man.close" (**FNo. 7618/BU**).

As soon as an active signal is detected at the binary input, a time delay of 200 ms is started. After the expiration of this time delay, the auxiliary contact of the circuit breaker must no longer be in the OPEN position.

The leading recognition of the coupler CT current has to be ensured for all possible applications of the CLOSE command. Possible applications may include:

- Manual closing control by control-discrepancy switch
- Possibly remote control of the bus coupler circuit breaker by telecontrol or substation control systems
- Reclosing by an automatic reclosing device

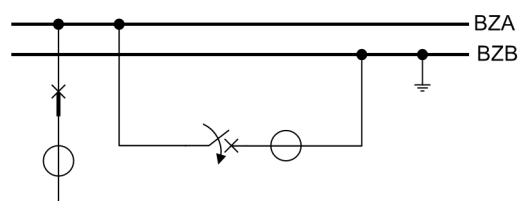


Figure 5-34 Switching onto an earthed busbar

### 5.4.3 Setting Notes

**T-CB open**                    The parameter **T-CB open (XX26/ CU)** is used to delay processing of the circuit breaker OPEN status for special treatment of the coupler currents and for the end fault protection.

**End Fault Prot**            If the bay is configured as a feeder, the parameter **End Fault Prot (XX29/ CU)** is used to activate and deactivate the end fault protection. For coupler bays the setting of this parameter is not relevant.

### 5.4.4 Settings for the Central Unit

| Addr. | Setting Title  | Setting Options     | Default Setting | Comments                                 |
|-------|----------------|---------------------|-----------------|--|
| 118   | I> BF          | 0.10 .. 2.00 I / In | 0.50 I / In     | Current threshold for BF                 |
| 119A  | I> BF s. char. | 0.05 .. 2.00 I / In | 0.25 I / In     | Current threshold for BF - sens. char.   |
| 120   | T-BF-1P        | 0.05 .. 10.00 s     | 0.25 s          | Time delay for BF with 1-pole fault      |
| 121   | T-BF-mP        | 0.05 .. 10.00 s     | 0.25 s          | Time delay for BF with multi-pole faults |
| 125   | T-TRIP repeat  | 0.00 .. 10.00 s     | 0.12 s          | Time delay for TRIP repeat               |
| 126   | T-CB open      | 0.00 .. 10.00 s     | 0.00 s          | Time delay for CB open                   |
| 129   | End Fault Prot | ON<br>OFF           | OFF             | End fault protection                     |

### 5.4.5 List of Information from the Central Unit

| FNo.     | Alarm           | Comments                          |
|----------|-----------------|-----------------------------------|
| 10477    | CZ release      | Check zone released               |
| 10478    | >Sens. charact. | >Sensitive characteristic active  |
| 176.1370 | Op EFP \$00     | Operate end fault protection \$00 |

### 5.4.6 List of Information from the Bay Unit

| FNo. | Alarm         | Comments                              |
|------|---------------|---------------------------------------|
| 7617 | >CB OFF       | >Circuit breaker open                 |
| 7618 | >CB man.close | >Circuit breaker manual close         |
| 7623 | >CB ON        | >Circuit breaker closed               |
| 7644 | End-Flt. Trip | End fault protection: Trip phase L123 |

## 5.5 Supervisory Functions

The 7SS52 V4 protection system incorporates comprehensive self-monitoring functions which cover both the hardware and the software. This guarantees a high availability and security against overfunctioning and underfunctioning as well as low demand on maintenance.

### 5.5.1 Functional Description

The entire protection system is cyclically monitored from the measuring inputs through the data communication between central unit and bay units up to the trip relay coils.

Time monitoring functions (watchdogs) continuously check the program sequences of each processor module. Failure of a processor or malfunctions in the program sequence cause an automatic reset of the processor system.

Additional plausibility checks and program runtime checks ensure that program processing errors are reliably detected. Such errors also lead to a processor reset and a system restart.

After three unsuccessful restarts, the complete protection system automatically removes itself from service. In case of a malfunction in the central unit, the readiness relays 1 and 2 on the input/output module (EAZ) drop off and, being equipped with NC contacts, generate a live status annunciation "Dev.operative" (**FNo. 00051/CU**).

Each bay unit has moreover its own NC contacts which generate a live status annunciation "Dev.operative" (**FNo. 51/BU**).

In these cases the red "ERROR" LED shines on the front panel of the central unit or of the affected bay unit.

#### 5.5.1.1 Zone-Selective Blocking

In the case of external or internal faults and malfunctions of the 7SS52 protection system only those protection zones, and if necessary only single phases, which have been effected will be blocked so that the healthy portion of the system can continue to operate.



#### CAUTION

In the presence of a fault in a feeder which is in operation or a measuring error, the feeder current is not available for the check zone measuring system either. In such cases the release signal for tripping by the check zone measuring system is artificially generated so that in case of a busbar fault the necessary tripping conditions are fulfilled. The check zone is released with a delay adjustable via the parameter **T-Idiff SUPERV. (6307/CU)** and is documented with the alarm "CZ release" (**FNo. 10477/CU**).

As selective blocking does not offer the additional security provided by the check zone, the cause of the fault should be eliminated as promptly as possible.

---

**Bay unit failure**

All serial links between the bay unit and the central unit are continuously monitored in the central unit. A failure or disturbance of an operating bay unit leads to the output of an alarm but not to a system reset. The same is true for a failure or disturbance of the link between bay unit and central unit.

If the connection fails the protection zone, to which the bay unit is switched, is blocked.

**Measured value Supervision**

The analog inputs of the bay unit are cyclically monitored (Chapter 5.5.1.3, page 169). The measured value supervision consists of the offset monitoring and the current sum monitoring. Furthermore, the measured values read in with gain 1 and 16 are checked for plausibility to each other. If one of these errors occurs, the protection is immediately and selectively blocked and the error is signalled. If the error has been present longer than 1 s, the blocking is permanent and can only be reset with a warm restart.

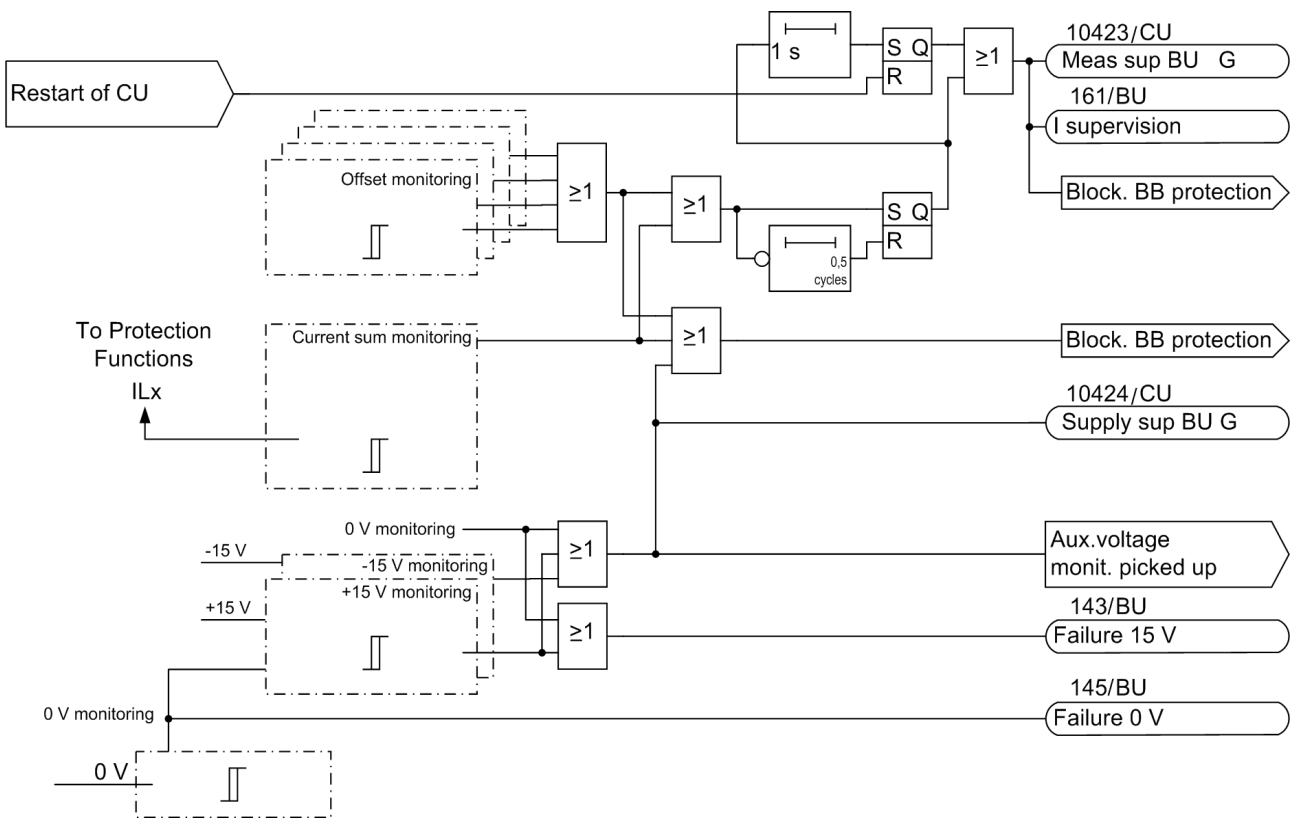


Figure 5-35 Simplified logic of the monitoring function

**Disconnecter malfunction**

Disconnecters are monitored with regard to runtime, disconnector status plausibility and auxiliary voltage. A disconnector malfunction with the parameter **DCO Malfunc** (**6302/CU**) set to **blocking** causes a blocking of only the protection zone to which the feeder with the faulty disconnector is connected.



### 5.5.1.2 Auxiliary and Reference Voltages

The bay unit processor monitors the reference voltages of the measured value detection, as well as the supply voltages. The protection is suspended if the voltages deviate outside an allowable range the blocking is selective; the deviation is reported after three scanning cycles "15V-superv \$00" (**FNo. 176.1171/CU**), "5V-superv \$00" (**FNo. 176.1172/CU**), "0V-superv \$00" (**FNo. 176.1173/CU**) (Figure 5-35, page 168).

The auxiliary voltages in the central unit are monitored by the converters themselves. Faults are annunciated "15V-superv CU" (**FNo. 10420/CU**), "24V-superv CU" (**FNo. 10421/CU**). Failure or disconnection of the auxiliary voltage automatically takes the affected device out of service. This status is annunciated via an NC contact. Transient auxiliary voltage dips of  $\leq 50$  ms will not influence the unit. A failure of the auxiliary voltage in a bay unit results in a selective blocking of the protection system.

### 5.5.1.3 Measured Value Supervision

The analog input circuits of the bay unit are cyclically monitored from the input transducers up to the digitalization. This is done by forming the current sum and executing the following plausibility check:

$$\Delta I = I_{L1} + I_{L2} + I_{L3} + I_E$$

$$\Sigma |I| = |I_{L1}| + |I_{L2}| + |I_{L3}| + |I_E|$$

The measured value monitoring picks up if

$$|\Delta I| > 0.2 I/I_N \text{ and}$$

$$|\Delta I| > k \cdot \Sigma |I|$$

with  $k = 0.125$  (stabilizing factor)

The pick-up characteristic is shown in Figure 5-36, page 170.

If the supervision detects that the measured values are not plausible, the analog measuring circuits are assumed to be faulty, the measured value cycle is accordingly marked and the calculation of the protection algorithms blocked for this cycle. If the fault prevails longer than 1 s time, the protection system is selectively blocked if the bay unit is connected to any busbar and an annunciation "MeasInSup \$00" (**FNo. 176.1175/CU**) and the group alarm "I supervision" (**FNo. 161/BU**) and "Meas sup BU G" (**FNo. 10423/CU**) are output.

The blocking can only be reset with a warm restart (Figure 5-35, page 168).

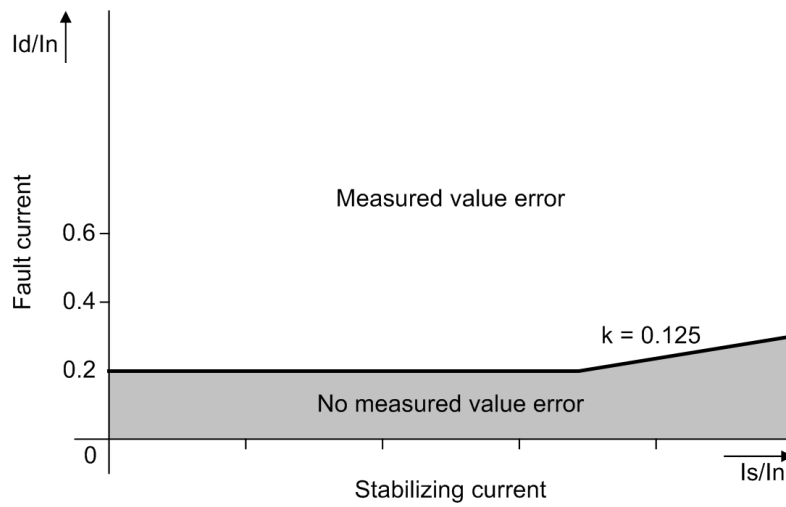


Figure 5-36 Characteristic for measured value monitoring

**Memory supervision**

The memory modules of the central unit and the bay units are periodically tested for faults.

- A checksum is formed for the program memory (Flash EPROM) during start-up and cyclically during operation.
- For the RAM, a data pattern is written during start-up and read again. Write and read results are compared.
- For the parameter and configuration data memory (EEPROM), the checksum of the stored quantities is formed and compared with the checksum calculated during each new writing process.
- For the dual-port RAM of the slave modules, the stored parameters and configuration data are compared with the data on the master module.

**5.5.1.4 Output Trip Supervision**

The output trip channels of the bay unit are controlled via two trip channels and one release channel. The trip output channels are checked in connection with the cyclic protection test (Chapter 5.5.1.7, page 171).

**5.5.1.5 Battery Monitoring**

The central unit and the bay units are equipped with buffer batteries to ensure that LED states, date and time, operational and fault events as well as fault records are maintained in case of an auxiliary power failure. As soon as the battery voltage drops below a certain threshold, an alarm "Batt. superv CU" (FNo. 10422/CU) or "BattSuperv \$00" (FNo. 176.1174/CU) is output.

### 5.5.1.6 Supervision in Maintenance Mode

#### Disconnecter supervision

While a bay is in maintenance, settable with the parameter **Bay status (XX12/CU)**, there is no monitoring of the disconnector status checkback signals, nor a plausibility check.

### 5.5.1.7 Cyclic Test

#### Central unit

As part of the self-diagnostics, the protection functionality is checked on the basis of the disconnector replica. The cyclic test in faultless operation includes the unbalancing of a current of a connected bay unit. The reaction of the bay unit is monitored. As this test is treated like a real fault and uses the same transmission links for measured values and TRIP commands, it yields utmost security and reliability.

This test does not influence the protection functions.

The test is performed only if there is no pickup of the protection.

On detecting a failure, the identical test routine is repeated twice. After this a reset is performed.

If the fault remains, the device is blocked.

Read out the fault buffer of the central unit and contact the manufacturer.



#### NOTE

If a bay unit is connected to the central unit but not included in the configuration, this results in continual coming and going of the alarm "Fail Com.CU" (**FNo. 7650/BU**) in a 5 sec cycle.

#### Bay unit

In the bay units, the trip command circuits are monitored additionally.

The following alarms may come up:

- Group alarm: "Flt autotest G" (**FNo. 10429/CU**)
- Single alarm: "Flt aut \$00" (**FNo. 176.1190/CU**)

The following indications provide more detailed information on the bay unit concerned.

"Relay control circuit flt.,trip possib." (**FNo. 7689/BU**)

"Relay1 control circuit flt.,no trip pos" (**FNo. 7691/BU**)

"Relay2 control circuit flt.,no trip pos" (**FNo. 7692/BU**)

"Relay3 control circuit flt.,no trip pos" (**FNo. 7693/BU**)

"Relay4 control circuit flt.,no trip pos" (**FNo. 7694/BU**)

"Relay5 control circuit flt.,no trip pos" (**FNo. 7695/BU**)

With the alarm "Relay control circuit flt., trip possib." (**FNo. 7689/BU**) operation is still possible with reduced safety.

With the alarm "Relay1 control circuit flt., no trip pos" (**FNo. 7691/BU ... 7695/BU**) no tripping is possible anymore.

You should replace the bay unit concerned.

### 5.5.1.8 Supervision of External Current Transformer Circuits

Interruptions or short circuits in the secondary circuits of the main current transformers, as well as errors in the connections or in the configuration of the busbar protection, are systematically detected and reported by the system. It evaluates for this purpose the differential currents which are formed in the protection processor modules ZPS-BSZ1 to ZPS-BSZ3.

#### Differential current supervision

The differential current of each measuring system is individually monitored. Under no-fault conditions, the differential current of each measuring system is approximately zero. If no feeders are assigned to a measuring system, the differential current and the stabilizing current are set to zero. The differential current supervision picks up if the mean value of the differential current exceeds a certain threshold within an interval set with the parameter **T-Idiff SUPERV (6307/CU)**. This threshold can be set individually for the check zone with the parameter **Id> SUPERV CZ (6309/CU)**, and for the selective protection with the parameter **Id> SUPERV BZ (6308/CU)**.

If the differential current falls below the threshold before the set time, the time delay is restarted if it occurs again.

The differential current supervision can be activated and deactivated with the parameter **DIFF SUPERV (6306/CU)**. The annunciation "Superv.Idif off" (**FNo. 10510/CU**) is output.

The blocking is reset by operator input "**Reset Id-Block**" or via binary input ">Reset Id-Block" (**BI FNo. 6/CU**) in the central unit.

In case of a pickup of the differential current supervision, the reaction can be set individually for the check zone (with the parameter **DIF SUP mode CZ (6311/CU)**) and for the selective protection (with the parameter **DIF SUP mode BZ (6310/CU)**). The following alarms are generated:

- Group alarms (selective):
  - "Id-sup BZ G" (**FNo. 10415/CU**),
  - "Id-sup BZ L1 G" (**FNo. 10416/CU**),
  - "Id-sup BZ L2 G" (**FNo. 10417/CU**),
  - "Id-sup BZ L3 G" (**FNo. 10418/CU**),
  - "Id-sup \$03 G" (**FNo. 177.1331/CU**)
- Group alarms (check zone):
  - "Id-sup CZ G" (**FNo. 10410/CU**),
- Single alarms (selective, module ZPS-BSZ2):
  - "Id-supL1-2 \$03" (**FNo. 177.1321/CU**),
  - "Id-supL2-2 \$03" (**FNo. 177.1322/CU**),
  - "Id-supL3-2 \$03" (**FNo. 177.1323/CU**),
- Single alarms (selective, module ZPS-BSZ3):
  - "Id-supL1-3 \$03" (**FNo. 177.1326/CU**),
  - "Id-supL2-3 \$03" (**FNo. 177.1327/CU**),
  - "Id-supL3-3 \$03" (**FNo. 177.1328/CU**),
- Single alarms (check zone):
  - "Id-sup CZ L1" (**FNo. 10411/CU**),
  - "Id-sup CZ L2" (**FNo. 10412/CU**),
  - "Id-sup CZ L3" (**FNo. 10413/CU**),

**Zero current supervision for Linearized CTs**

Linearized current transformers have bigger angle errors than conventional iron-core current transformers. The secondary current then lags behind the primary current. In the event of a short-circuit, the CB interrupts the primary current near current zero. The secondary current, however, continues to flow and decays according to an e-function. The angle error and the time constant depend mainly of the protection burden. The angle error increases and the time constant decreases with increasing burden.

The busbar protection cannot distinguish this current from a differential current. At first, erroneous tripping is prevented by the stabilizing current. The stabilizing current decays according to an e-function with a time constant of 64 ms. The zero current monitoring prevents spurious tripping after the stabilizing current has decayed. If the zero crossings of the current do not recur at the latest after 32 ms ( $f_N = 50$  Hz) or 27 ms ( $f_N = 60$  Hz), the measuring system detects a DC current and issues a selective blocking command to the protection "Block ZeroCross" (**FNo. 10444/CU**). The blocking is maintained until the current drops below the zero current monitoring threshold again.

The zero current monitoring can be activated and deactivated with the parameter **ZERO CR SUPERV (6312A/CU)**.

**5.5.1.9 Disconnecter Status Supervision****Disconnecter statuses**

The disconnector positions "OPEN", "CLOSED", "Intermediate Position" are issued in the following indications in function of the status (**FNo. 176.1110/CU**), (**FNo. 176.1115/CU**), (**FNo. 176.1120/CU**), (**FNo. 176.1125/CU**) and (**FNo. 176.1130/CU**). Here, 1-1 disturbance position and 0-0 running position are assigned to "intermediate position".

**Disconnecter running status**

If an disconnector changes position, for instance from the OPEN position, it needs a certain time (disconnecter running time) to reach the other position. During this running time, the disconnector is considered to be in the CLOSED position. If after a set disconnector running time **DCO TIME (6301/CU)** no checkback signal is given, the disconnector supervision assumes faulty status and an alarm is created per disconnector ("FltR \$01 \$02" (**FNo. 176.1122/CU**); e.g. for disconnector 3 in bay Fxx). In addition, the indication "Dco flt alarm" (**FNo. 10425/CU**) is issued.

**Behavior in the case of an disturbed disconnector**

The parameter **DCO ST 1/1 (6304/CU)** is used to specify whether the disconnector status is assumed to be "CLOSED" or the "old disconnector status" if the disconnector is in disturbed position ("OPEN" and "CLOSED" at the same time). The disconnector will be reported as faulty after the time set in parameter **DCO TIME (6301/CU)** has elapsed indicating "FltP \$01 \$02" (**FNo. 176.1113/CU**), (**FNo. 176.1118/CU**), (**FNo. 176.1123/CU**), (**FNo. 176.1128/CU**) and (**FNo. 176.1133/CU**). In addition, the indication "Dco flt alarm" (**FNo. 10425/CU**) is issued.

**Auxiliary voltage supply failure**

Usually, the disconnecter auxiliary voltage is sub-fused in each bay. If this auxiliary voltage is missing, then all the disconnectors in this bay display the bit pattern 0/0 (neither OPEN nor CLOSED). The indication "Bay DC fail G" (**FNo. 10426/CU**) and "Dco flt alarm" (**FNo. 10425/CU**) are output. In order to prevent erroneous annunciations, there is always a short delay of 500 ms for the response and the signalling of auxiliary voltage failure. For the distinction of disconnecter faults, at least two disconnectors are to be monitored. By cross-checking with the other disconnector positions, this fault condition can be detected. The disconnectors are either assigned the old positions or are considered to be CLOSED. The type of treatment can be set with the parameter **DCO DC FAIL (6303/CU)**.

**Wire break**

In the event of short-circuits in the feeders, the busbar protection remains stable even with a wire break on the checkback signal lines for the disconnector status. In that case the disconnector is considered to be CLOSED.

However, the so-called preferential treatment can lead to unselective tripping if all of the following conditions apply:

- Wire break in the checkback signal line for the disconnector status
- Disconnector is in OPEN position
- Fault on one busbar
- Second disconnector of the feeder is in CLOSED position

Non-selective tripping can be prevented by additional measures. Such measures could be, for instance, interlocking of the TRIP command with the integrated overcurrent query or monitoring the pick-up of the feeder protection.

Wire breaks are annunciated in the central unit as disconnector malfunction status individually for each feeder ("FltR \$01 \$02" (**FNo. 176.1122/CU**); e.g. \$02 for disconnector 3).

The meaning of the disconnecter status indications is shown in the following table.

Table 5-1 Disconnecter status indications

| Disconnecter status indication (binary input) |      | Meaning  | Reaction  | Alarm  |
|---|------|--|---|--|
| CLOSED  | OPEN |  |   |  |
| 1   | 0    | Disconnecter CLOSED  | Disconnecter CLOSED   | "\$01 \$02" (FNo. 176.1110/CU) "CLOSED" *)   |
| 0   | 1    | Disconnecter OPEN  | Disconnecter OPEN   | "\$01 \$02" (FNo. 176.1110/CU) "OPEN" *)   |
| 1   | 1    | Disconnecter disturbed position  | new disconnecter status according to setting 6304 / CU  | "\$01 \$02" (FNo. 176.1110/CU) "intermediate pos." *),<br>"FltP\$01 \$02" (FNo. 176.1113/CU) and<br>"Dco flt pos G" (FNo. 10428/CU),<br>"Dco flt alarm" (FNo. 10425/BU)  |
| 0   | 0    | Disconnecter intermediate position:<br>– runtime<br>– wire break<br><br>– no auxiliary voltage | new disconnecter status CLOSED<br><br>new disconnecter status according to setting 6303 / CU (see "Auxiliary voltage supply failure", page 174) | "\$01 \$02" (FNo. 176.1110/CU) "intermediate pos." *),<br>"FltR \$01\$02" (FNo. 176.1112/CU),<br>"Dco flt run G" (FNo. 10427/CU),<br>"Dco flt alarm" (FNo. 176.10425/CU),<br>"BayDCfail \$00" (FNo. 176.1134/CU),<br>"Bay DC fail G" (FNo. 10426/CU),<br>"Dco flt alarm" (FNo. 10425/CU) |

\*) The values such as "CLOSED", "OPEN" and "intermediate position" of the alarm (FNo. 176.1110/CU) are variable.

Depending on the disconnecter, the alarm is generated via FNo. 176.1110/CU, 176.1115/CU, 176.1120/CU, 176.1125/CU or 176.1130/CU.

Due to an disconnecter fault indicated with "Bay DC fail G" (FNo. 10426/CU), "Dco flt run G" (FNo. 10427/CU) or "Dco flt pos G" (FNo. 10428/CU) the indication "Dco flt alarm" (FNo. 10425/CU) is issued. This one is replaced by the indication "DcoProhib/fault" (FNo. 10470/CU) when the disconnecter fault is acknowledged.

While a bay is in the mode "out of service" or "maintenance", there is no monitoring of the disconnecter status checkback signals, nor a plausibility check.

#### Reset of disconnecter alarms

Depending on the setting of the parameter **DCO Malfunct (6302 / CU)**, several types of behaviour of the blocking are possible, see the following figures.

The function is reset with the control "**Reset DcoMalB1**" or by the binary input ">Reset DcoMalB1" (BI FNo. 7 / CU) in the central unit.

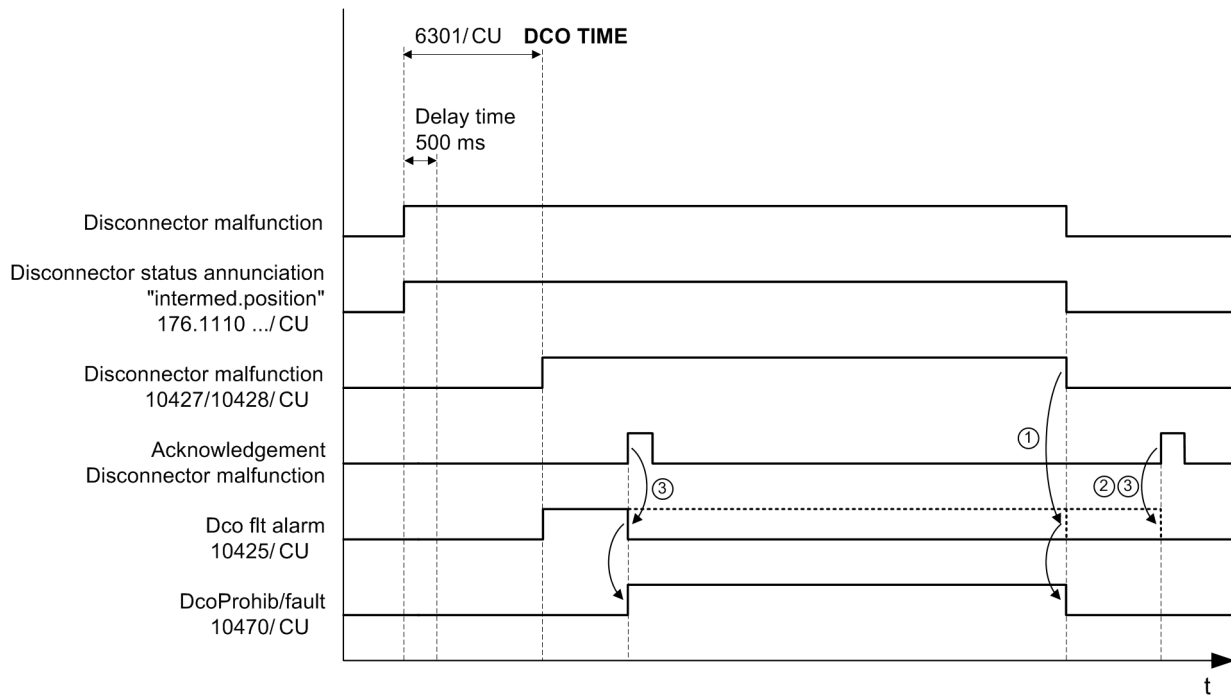


Figure 5-37 Alarms and commands in the case of a disconnector malfunction

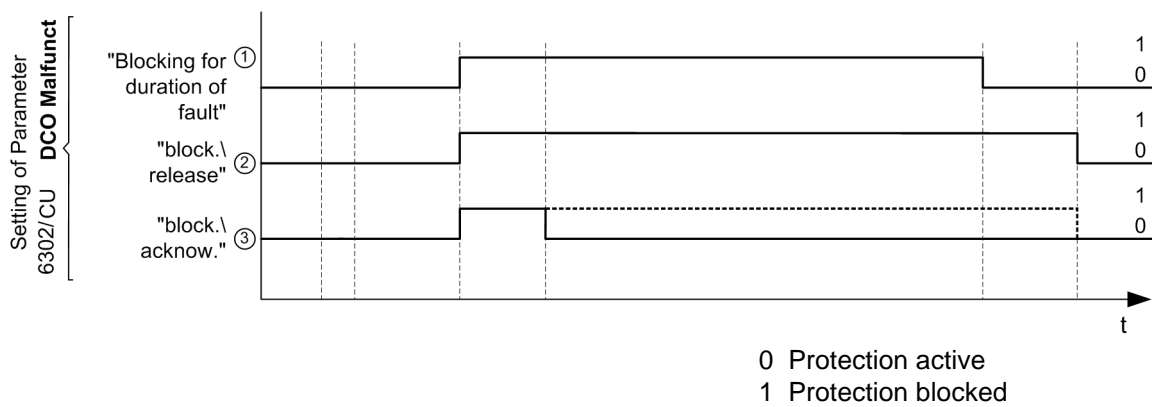


Figure 5-38 Blocking behavior in the case of a disconnector runtime error or disturbance position

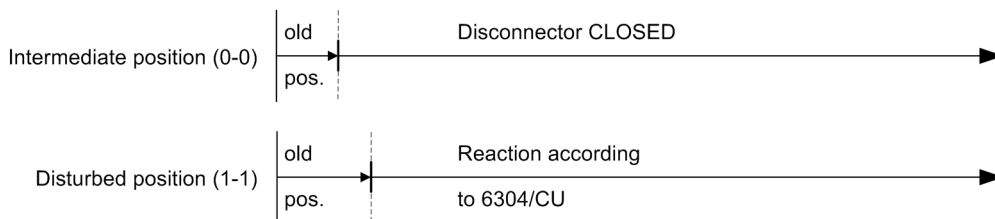


Figure 5-39 Disconnector treatment



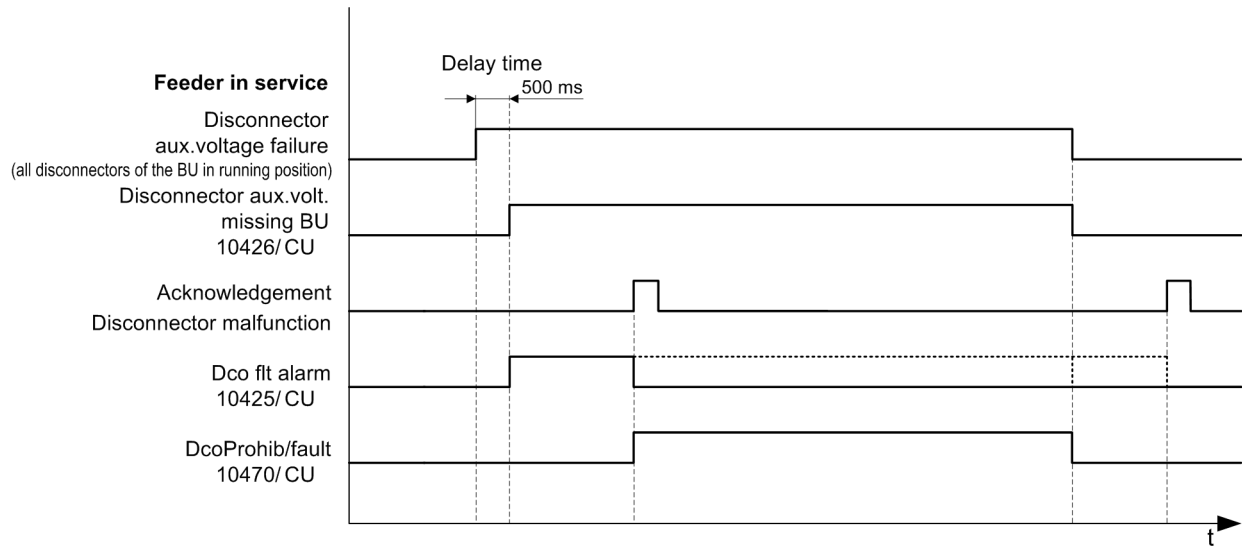
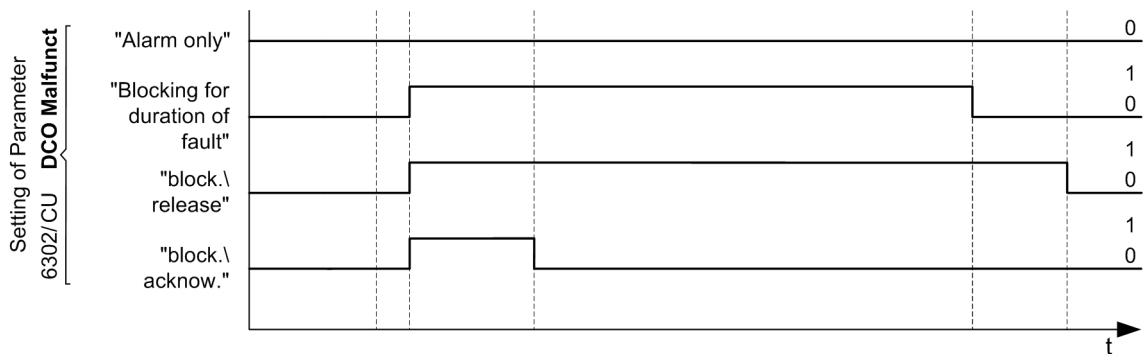


Figure 5-40 Alarms and commands in the case of an auxiliary voltage failure



Note: Blocking will only be performed if the bay suffering an disconnector auxiliary voltage failure is assigned to a busbar.

0 Protection active  
1 Protection blocked

Figure 5-41 Behavior in the case of an auxiliary voltage failure

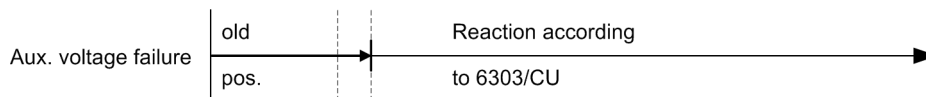


Figure 5-42 Disconnector treatment

With each disconnector in running position, a 200 ms supervision time is started. If a "running position" is detected for all configured disconnectors of a bay unit, an auxiliary-voltage failure is presumed.

A delay time of 500 ms is provided for the coordination of a "maintenance mode" with following auxiliary-voltage switch-off.

### 5.5.1.10 Supervisory of Circuit Breaker

Interrogation of the feeder circuit breaker is required for the end fault protection function (Chapter 5.4, page 162) and for low-current circuit breaker failure protection mode (Chapter 5.3.5.2, page 146).

Three circuit breaker signals can be recognized:

- CB in CLOSED position (CB CLOSED)
- CB in OPEN position (CB OPEN)
- Circuit breaker CLOSE control command (CB CLOSE command)

The circuit breaker status is recognized by marshalling it to binary inputs of the bay unit. For safety reasons, we recommend an external logic link for phase-selective circuit breaker auxiliary contacts. The final position of the circuit breaker is only recognized (Figure 5-43, page 178) if all three auxiliary contacts are closed.

If the CLOSED and OPEN position is continuously implausible for a longer period than set in the parameter **CB SUP TIME (6315 / CU)**, this leads to a fault annunciation (Table 5-2, page 179).

The setting of the runtime monitoring of the circuit breaker with the parameter **CB SUP TIME (6315 / CU)** serves for a better adaptation of the sequences to the switching operations (e.g. single-pole AR).

The duration of the CLOSE command is separately monitored because false information at the binary input would cause a deterioration of the end fault protection (Chapter 5.4.1, page 162) and/or of the function "Protection in the dead zone of the bus coupler" (Chapter 5.4.2, page 164).

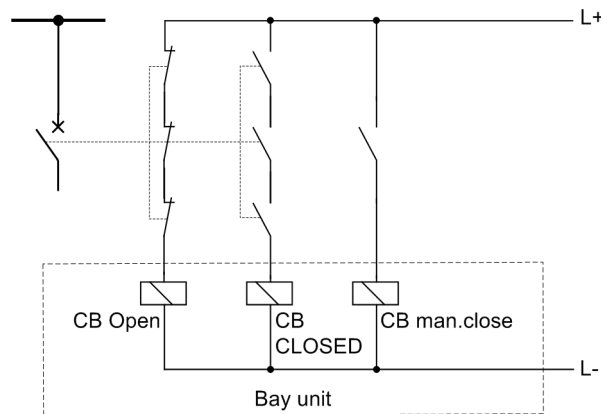


Figure 5-43 Interrogation of circuit breaker

Table 5-2 Protection response and alarms related to the circuit breaker status

| Circuit breaker status indication (Binary input) |      | Meaning   | Protection response             |   | Alarm                            |
|--|------|---|---------------------------------|---|----------------------------------|
| CLOSED   | OPEN |   | End fault protection, dead zone | Breaker failure protection - low-current mode |                                  |
| 1  | 0    | CB closed   | blocked instantaneously         | effective                                     | CB (FNo. 176.1135/CU) closed     |
| 0  | 1    | CB open   | effective                       | Detection CB open                             | CB (FNo. 176.1135/CU) open       |
| 0  | 0    | Runtime or CB fault<br>- intermediate position<br>- runtime error | blocked instantaneously         | effective/<br>blocked <sup>1)</sup>           | "CB fault"<br>(FNo. 176.1136/CU) |
| 1  | 1    | - disturbed position  | blocked instantaneously         | Detection CB open/<br>blocked <sup>1)</sup>   | "CB fault"<br>(FNo. 176.1136/CU) |

<sup>1)</sup> Blocking after expiry of the supervision time CB SUP TIME (6315/CU)

5.5.1.11 Overview of the Supervisory Functions

Table 5-3 Summary of the supervisory functions

| Monitoring  | Possible cause and response  |
|---|--|
| Auxiliary voltage supervision   | Failure of the DC-DC converter output voltages<br>Blocking of protection and alarm   |
| BU: (0 V) <sub>Digit</sub><br>(15 V) <sub>Digit</sub><br><br>CU: 15 V<br>24 V   | "0V-superv \$00" (FNo. 176.1173/CU)<br>"5V-superv \$00" (FNo. 176.1172/CU)<br>"15V-superv \$00" (FNo. 176.1171/CU)<br>Failure of the 5 V voltage causes reset of the device failure annunciation and thus blocks the device completely.<br>"15V-superv CU" (FNo. 10420/CU)<br>"24V-superv CU" (FNo. 10421/CU)<br>Failure of the 15 V or 24 V voltage of the central unit does not block the protection.          |
| Measured value monitoring BU<br><br>$ \Delta I  > 0.2 \cdot I/I_N$<br>$ \Delta I  > 0.125 \cdot \Sigma  I $   | Internal device error in measured value acquisition<br>Blocking of protection and alarm<br>"MeasInSup \$00" (FNo. 176.1175/CU)<br>"Meas sup BU G" (FNo. 10423/CU)  |
| Cyclic monitoring of the memories (BU, CU)  | A fault buffer entry is made and a restart carried out. After two unsuccessful attempts the protection is blocked.   |
| Permanent monitoring of the program flow by means of watchdog (BU, CU)  | A fault buffer entry is made and a restart carried out. After two unsuccessful attempts the protection is blocked.   |
| Differential current supervision<br>• Bus zone-selective protection<br>$ \Sigma I  > Id > \text{SUPERV BZ (6308/CU)}$<br>for $T > T-Idiff \text{ SUPERV (6307/CU)}$<br><br>• Check zone, all except bus coupler<br>$ \Sigma I  > Id > \text{SUPERV CZ (6309/CU)}$<br>for $T > T-Idiff \text{ SUPERV (6307/CU)}$ | Current transformer circuit faulty<br>Bus zone-selective blocking<br>if the parameter <b>DIF SUP mode BZ (6310/CU)</b> is set to blocking, otherwise only alarm<br>"IdSup Lz-y \$03" (FNo. 177.1321, 177.1322, 177.1323, 177.1326, 177.1327, 177.1328/CU)<br>Blocking if the parameter <b>DIF SUP mode CZ (6311/CU)</b> is set to blocking, otherwise only alarm<br>"Id-Sup CZ Lz" (FNo. 10411, 10412, 10413/CU) |
| Monitoring of disconnecter status<br>• Running position<br>Disconnecter OPEN/CLOSED = 0/0<br>for $T > DCO \text{ TIME (6301/CU)}$<br><br>• Auxiliary voltage supply failure<br>All disconnecter positions of one bay = 0/0<br>• Implausible disconnecter status<br>Disconnecter OPEN/CLOSED = 1/1               | Wire break or intermediate status<br>Alarm "FltR \$01 \$02" (FNo. 176.1112, 176.1117, 176.1122, 176.1127, 176.1132/CU)<br>Feeder aux. voltage MCB tripped<br>Alarm "BayDC fail \$00" (FNo. 176.1134/CU)<br>Alarm "FltP \$01 \$02" (FNo. 176.1113, 176.1118, 176.1123, 176.1128, 176.1133/CU)   |

| Monitoring   | Possible cause and response   |
|--|---|
| Cyclic check of the data transmission links (FO) between central unit and bay unit   | Bus zone-selective blocking - if a bay unit is connected to a busbar - and alarm after two recognitions of a transmission error. Otherwise, only release of the check zone. "Fail Com.CU" (FNo. 7650/BU)<br>If a bay unit is connected to the central unit but not included in the configuration, this results in continual coming and going of the alarm "Fail Com.CU" (FNo. 7650/BU) in a 5 sec cycle.  |
| Monitoring of ">CBF Lx", ">CBF 3-pole" for T > 15 s<br><br>">CBF Lx", ">CBF 3-pole" and ">CBF release", ">release 3-pole" for T > T-BF 2chan (XX28/CU)<br><br>">CBF release", ">release 3-pole" for T > T-BF re1 sup (XX27/CU)<br><br>">B.U.CBF Lx", ">B.U.CBF 3-pole" for T = B.U.CBF-T (3912/BU) + 5 s (but min. 15 s) | Alarm and blocking of the binary input of the affected feeder "BF Dist\$00 LZ" (FNo. 176.1091, 176.1092, 176.1093/CU) or "BF Dist\$00 3P" (FNo. 176.1094/CU); Supervision picks up if a signal is present at the BI BF-phase for the time T > 15s; Supervision picks up if both BI BF-phase and BI BF release do not arrive within the time window T = limit;<br>Alarm and blocking of CBF "BFre1Di\$00 1P" (FNo. 176.1101/CU) or "BFre1Di\$00 3P" (FNo. 176.1102/CU) |
| Cyclic test with simulation of a fault current and monitoring of the entire signal processing from the digitised measured values to the feedback from the bay unit. Cyclic test of the trip relays including the coils   | A fault buffer entry is made and a restart carried out. After two unsuccessful attempts the protection is blocked. The group alarms "Flt aut \$00" (FNo. 176.1190/CU) and "Flt autotest G" (FNo. 10429/CU) are output as well as specific alarms for each single relay "TR flt, Trp.po" (FNo. 7689/BU) and "TRxflt, Trp.np" (FNo. 7691-7695/BU).  |
| Zero current monitoring  | Monitoring is done phase-selectively and the alarm "Block ZeroCross" (FNo. 10444/CU) is generated.  |
| Battery monitoring of central units and bay units  | Alarm is generated for the bay unit with "BattSuperv \$00" (FNo. 176.1174/CU) and for the central unit with "Batt. superv CU" (FNo. 10422/CU) and group alarm "Err PROT ACTIVE" (FNo. 10475/CU)   |
| Cyclic monitoring of the parameter/configuration data of the central units and bay units   | A fault buffer entry is made and a restart carried out. After two unsuccessful attempts the protection is blocked.  |
| Monitoring of CB-feedback no plausible state CB OPEN/CLOSED = 0/0 or 1/1   | Alarm: "CB fault" (FNo. 176.1136/CU) undelayed blocking of the end fault protection and delayed blocking of the low-current mode of the breaker failure protection.   |

| Monitoring   | Possible cause and response   |
|--|---|
| Supervision of the CB CLOSE command for impermissible duration | After expiry of the <b>CB SUP TIME (6315 / CU)</b> the alarm: "CB fault" ( <b>FNo. 176.1136 / CU</b> ) is output and the end fault protection is blocked. |

### 5.5.2 Setting Notes

- DIFF SUPERV** The parameter **DIFF SUPERV (6306 / CU)** is used to activate and deactivate the differential current supervision.
- With setting **ON** the differential current supervision will be activated. In normal mode the differential current supervision must remain ON.
- With setting **OFF** the differential current supervision will be deactivated. The differential current supervision may be deactivated for testing (e.g. for establishing the characteristic).
- T-Idiff SUPERV** The parameter **T-Idiff SUPERV (6307 / CU)** is used to set the delay time for blocking or alarm after a pickup of the differential current supervision.
- Id> SUPERV BZ** The parameter **Id> SUPERV BZ (6308 / CU)** is used to set the threshold I/Ino for selective differential current supervision.
- Id> SUPERV CZ** The parameter **Id> SUPERV CZ (6309 / CU)** is used to set the threshold I/Ino for differential current supervision in the check zone.
- The monitoring limit value should be set as low as possible, generally to the double maximum differential current in fault-free condition. Please note that due to the fault characteristic of the current transformers, there usually occur more severe faults under weak-infeed conditions than under rated load.
- DIF SUP mode BZ** The parameter **DIF SUP mode BZ (6310 / CU)** is used to set the response of the protection after pickup of the differential current supervision.
- With setting **alarm only** a pickup of the differential current supervision causes only an alarm and not a blocking of the protection.
- With setting **blocking** the protection will be phase- and zone-selective blocked for the duration of the malfunction.
- With setting **block. / release** the blocking of the affected phase and zone is treated as with **blocking**. It differs from the setting **blocking** in that the protection is released by an operator input "Reset Id-Block" or a binary input ">Reset Id-Block" (**BI FNo. 6 / CU**) as soon as the malfunction is eliminated.
- DIF SUP mode CZ** The parameter **DIF SUP mode CZ (6311 / CU)** is used to set the response of the protection after pickup of the differential current supervision.
- With setting **alarm only** a pickup of the differential current supervision causes only an alarm and not a blocking of the protection. You should select this setting if you want to set the protection to maximum selectivity.
- With setting **blocking** the protection will be blocked for the duration of the malfunction.

If a malfunction occurs in the check zone, the corresponding phase of the protection is blocked completely. The blocking is released as soon as the value that initiated it drops below the pickup threshold.

With setting **block./release** the blocking of the affected phase and zone is treated as with **blocking**. It differs from the setting **blocking** in that the protection is released by an operator input "**Reset Id-Block**" or via a binary input ">Reset Id-Block" (**BI FNo. 6/CU**) as soon as the malfunction is eliminated.

#### ZERO CR SUPERV

When an external fault is tripped by an external protection device, linearized current transformers with TPZ cores may carry during the demagnetizing phase a DC component that mimicks a fault in the protection zone.

In order to avoid spurious tripping, the differential current may be monitored for the presence of a pure DC component. For this purpose the zero crossing supervision **ZERO CR SUPERV (6312A/CU)** must be activated.

With setting **ON** the zero crossing supervision will be activated.

With setting **OFF** the zero crossing supervision will be deactivated.

#### I> ZERO CR

The parameter **I> ZERO CR (6313A/CU)** is used to set the threshold of the differential current for the zero crossing supervision.

Set this limit value to 50% of the corresponding limit value for the differential current in the parameters **Id> BZ (6102/CU)** and **Id> CZ (6104/CU)**, or **Id> BZ s. char. (6109A/CU)** or **Id> CZ s. char. (6111A/CU)**, using the sensitive characteristic.

The DC component monitoring is performed for each measuring system. The differential current of the selective protection zones is compared with the set threshold.

If the zero crossings of the current do not recur at the latest after 32 ms ( $f_N = 50$  Hz) or 27 ms ( $f_N = 60$  Hz), the measuring system assumes a DC current and issues a selective blocking command to the protection. The blocking is maintained until the current drops below the threshold again.

#### CB supervision time

Use parameter **CB SUP TIME (6315/CU)** to set the threshold for the circuit breaker runtime. If no final position checkback signal is received for the circuit breaker after this time, the protection assumes this circuit breaker to be faulty and issues an alarm.

This threshold is determined by the longest circuit breaker runtime to be expected.

#### DCO TIME

The parameter **DCO TIME (6301/CU)** is used to set the threshold for the disconnecter runtime monitoring. If no final position checkback signal is received for a disconnecter after this time, the protection assumes the disconnecter to be faulty and issues an alarm.

This threshold is determined by the longest disconnecter runtime to be expected.

#### DCO DC FAIL

The parameter **DCO DC FAIL (6303/CU)** is used to choose the disconnecter status which will be assumed by the disconnecter replica if the auxiliary voltage for the disconnecter status checkback signal has failed.

With setting **OLD** the old status will be assumed.

With setting **ON** the disconnecter will be assumed to be CLOSED.

**DCO ST 1/1**

The parameter **DCO ST 1/1 (6304/CU)** is used to choose the disconnector status which will be assumed if the checkback signal is not plausible (at the same time OPEN and CLOSED).

With setting **OLD** the old status will be assumed.

With setting **ON** the disconnector will be assumed to be CLOSED.

**DCO Malfunct**

The parameter **DCO Malfunct (6302/CU)** is used to select the response of the protection to disconnector malfunctions (runtime or plausibility error, auxiliary voltage failure).

With setting **alarm only** disconnector malfunctions will only lead to the output of an alarm. The protection will not be blocked.

With setting **blocking** disconnector malfunctions will lead to the output of an alarm and to a blocking of the protection system. The blocking is automatically cleared as soon as the disconnector malfunction has been eliminated.

With setting **block. /release** disconnector malfunctions will lead to the output of an alarm and to a blocking of the protection system. The blocking will be maintained until the malfunction has been eliminated and the blocking has been selectively reset by the operator input "**Reset DcoMalB1**" or via the binary input ">Reset DcoMalB1" (**BI FNo. 7/CU**).

With setting **block. /acknow.** disconnector malfunctions will lead to the output of an alarm and to a blocking of the protection system. The blocking will be cancelled even if the malfunction persists if it has been selectively reset by the operator input "**Reset DcoMalB1**" or via the binary input ">Reset DcoMalB1" (**BI FNo. 7/CU**). In this case a warning "DcoProhib/fault" (**FNo. 10470/CU**) will be output.

The entry in the operational event buffer will reflect the actual presence of the disconnector malfunction.



### 5.5.3 Settings for the Central Unit

| Addr. | Setting Title   | Setting Options  | Default Setting | Comments                                    |
|-------|-----------------|--|-----------------|---|
| 112   | Bay status      | out of service<br>in service<br>maintenance                | in service      | Bay status                                  |
| 127   | T-BF rel sup    | 0.02 .. 15.00 sec  | 15.00 sec       | Supervision bin. input<br>BF-release        |
| 128   | T-BF 2chan      | 0.06 .. 1.00 sec   | 0.06 sec        | Supervision time BF start /<br>release      |
| 6102  | Id> BZ          | 0.20 .. 4.00 I/Ino   | 1.00 I/Ino      | Diff-current threshold - selective          |
| 6104  | Id> CZ          | 0.20 .. 4.00 I/Ino   | 1.00 I/Ino      | Diff-current threshold -<br>check zone      |
| 6109A | Id> BZ s. char. | 0.05 .. 4.00 I/Ino   | 0.25 I/Ino      | Diff-current threshold - BZ sens.<br>char.  |
| 6111A | Id> CZ s. char. | 0.05 .. 4.00 I/Ino   | 0.25 I/Ino      | Diff-current threshold - CZ sens.<br>char.  |
| 6312A | ZERO CR SUPERV  | ON<br>OFF  | Ein             | Zero crossing supervision                   |
| 6301  | DCO TIME        | 1.00 .. 180.00 sec   | 7.00 sec        | Limit value disconnecter time               |
| 6302  | DCO Malfunct    | alarm only<br>blocking<br>block./release<br>block./acknow. | alarm only      | Reaction on disconnecter mal-<br>function   |
| 6303  | DCO DC FAIL     | OLD<br>ON  | OLD             | Treatment disconnecter status<br>on DC fail |
| 6304  | DCO ST 1/1      | OLD<br>ON  | OLD             | Treatment disconn. status not<br>plausible  |
| 6306  | DIFF SUPERV     | ON<br>OFF  | ON              | Differential current supervision            |
| 6307  | T-Idiff SUPERV  | 1.00 .. 10.00 sec  | 2.00 sec        | Time delay for diff-current<br>supervision  |
| 6308  | Id> SUPERV BZ   | 0.05 .. 0.80 I/Ino   | 0.10 I/Ino      | Limit value diff-current<br>supervision -BZ |
| 6309  | Id> SUPERV CZ   | 0.05 .. 0.80 I/Ino   | 0.10 I/Ino      | Limit value diff-current<br>supervision -CZ |
| 6310  | DIF SUP mode BZ | alarm only<br>blocking<br>block./release                   | blocking        | Diff-current supervision<br>mode -BZ        |
| 6311  | DIF SUP mode CZ | alarm only<br>blocking<br>block./release                   | alarm only      | Diff-current supervision<br>mode -CZ        |
| 6315  | CB SUP TIME     | 1.00 .. 180.00 sec   | 7.00 sec        | CB supervision time                         |

### 5.5.4 List of Information from the Central Unit

| FNo.     | Alarm           | Comments                                     |
|----------|-----------------|--|
| 10410    | Id-sup CZ G     | Diff-current superv. CZ (group alarm)        |
| 10411    | Id-sup CZ L1    | Diff-current supervision Check Zone L1       |
| 10412    | Id-sup CZ L2    | Diff-current supervision Check Zone L2       |
| 10413    | Id-sup CZ L3    | Diff-current supervision Check Zone L3       |
| 10415    | Id-sup BZ G     | Diff-current superv. BZ (group alarm)        |
| 10416    | Id-sup BZ L1 G  | Diff-current superv. BZ L1 (group alarm)     |
| 10417    | Id-sup BZ L2 G  | Diff-current superv. BZ L2 (group alarm)     |
| 10418    | Id-sup BZ L3 G  | Diff-current superv. BZ L3 (group alarm)     |
| 10420    | 15 V-superv CU  | 15 V supply supervision central unit         |
| 10421    | 24 V-superv CU  | 24 V supply supervision central unit         |
| 10422    | Batt. superv CU | Battery supervision central unit             |
| 10423    | Meas sup BU G   | Measured value superv. BU (group alarm)      |
| 10424    | Supply sup BU G | Supply voltage superv. BU (group alarm)      |
| 10425    | Dco flt alarm   | Disconnecter fault alarm                     |
| 10426    | Bay DC fail G   | Failure of disconnecter aux. voltage (g. a.) |
| 10427    | Dco flt run G   | Disconnecter fault: run time (group alarm)   |
| 10428    | Dco flt pos G   | Disconnecter position faulty (group alarm)   |
| 10429    | Flt autotest G  | Failure in auto testing (group alarm)        |
| 10444    | Block ZeroCross | Blocking by supervision zero crossing        |
| 10470    | DcoProhib/fault | Disconn. oper. prohibited (dco.fault)        |
| 176.1091 | BF Dist\$00 L1  | Disturbance BF input \$00 L1                 |
| 176.1092 | BF Dist\$00 L2  | Disturbance BF input \$00 L2                 |
| 176.1093 | BF Dist\$00 L3  | Disturbance BF input \$00 L3                 |
| 176.1094 | BF Dist\$00 3P  | Disturbance BF input \$00 3pole              |
| 176.1101 | BFreIDi\$00 1P  | Disturbance BF release input \$00 1P         |
| 176.1102 | BFreIDi\$00 3P  | Disturbance BF release input \$00 3P         |
| 176.1104 | BF ImpDis \$00  | Disturbance BF pulse input \$00              |
| 176.1110 | \$01 \$02       | \$01 disconnecter \$02                       |
| 176.1112 | FltR \$01 \$02  | Fault: run time \$01 disconn. \$02           |
| 176.1113 | FltP \$01 \$02  | Fault: dist. pos. \$01 disconn. \$02         |
| 176.1117 | FltR \$01 \$02  | Fault: run time \$01 disconn. \$02           |
| 176.1118 | FltP \$01 \$02  | Fault: dist. pos. \$01 disconn. \$02         |
| 176.1122 | FltR \$01 \$02  | Fault: run time \$01 disconn. \$02           |

| <b>FNo.</b> | <b>Alarm</b>    | <b>Comments</b>                       |
|-------------|-----------------|---------------------------------------|
| 176.1123    | FltP \$01 \$02  | Fault: dist. pos. \$01 disconn. \$02  |
| 176.1127    | FltR \$01 \$02  | Fault: run time \$01 disconn. \$02    |
| 176.1128    | FltP \$01 \$02  | Fault: dist. pos. \$01 disconn. \$02  |
| 176.1133    | FltP \$01 \$02  | Fault: dist. pos. \$01 disconn. \$02  |
| 176.1171    | 15V-superv \$00 | 15V supply supervision \$00           |
| 176.1172    | 5V-superv \$00  | 5V supply supervision \$00            |
| 176.1173    | 0V-superv \$00  | 0V supply supervision \$00            |
| 176.1174    | BattSuperv \$00 | Battery supervision \$00              |
| 176.1175    | MeasInSup \$00  | Measured value supervision I-SUM \$00 |
| 176.1190    | Flt aut \$00    | Failure in automatic testing \$00     |
| 177.1321    | Id-supL1-2 \$03 | Id-sup \$03 L1-2                      |
| 177.1322    | Id-supL2-2 \$03 | Id-sup \$03 L2-2                      |
| 177.1323    | Id-supL3-2 \$03 | Id-sup \$03 L3-2                      |
| 177.1326    | Id-supL1-3 \$03 | Id-sup \$03 L1-3                      |
| 177.1327    | Id-supL2-3 \$03 | Id-sup \$03 L2-3                      |
| 177.1328    | Id-supL3-3 \$03 | Id-sup \$03 L3-3                      |
| 177.1331    | Id-sup \$03 G   | Id-sup \$03 G                         |

### 5.5.5 List of Information from the Bay Unit

| <b>FNo.</b> | <b>Alarm</b>  | <b>Comments</b>                         |
|-------------|---------------|---|
| 51          | Device OK     | Device is Operational and Protecting    |
| 143         | Failure 15V   | Failure of internal 15 VDC power supply |
| 145         | Failure 0V    | Failure of internal 0 VDC power supply  |
| 161         | I supervision | Measured value supervision of currents  |
| 7650        | Fail Com.CU   | Failure in communication w.Central Unit |

## 5.6 Oscillographic Fault Recording

### 5.6.1 Mode of operation




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**NOTE**

A description of the bay unit's fault recording function is provided in Chapter 5.13, page 210.  
 Reading out of oscillographic fault recording data is described in Chapter 6.2.3, page 251.

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During a fault event, the instantaneous measured values are stored at intervals of 1 ms ( $f_N = 50$  Hz) and 833  $\mu$ s ( $f_N = 60$  Hz) in a buffer of the central unit.

A fault record is initiated by

- a trip from an internal protection function,
- a binary input with the annunciation ">Trig.Wave.Cap." marshalled to it, or
- a test fault record request entered via
  - DIGSI or
  - the central unit front panel.

Oscillographic fault recording covers the differential and restraint currents of each phase for all bus zones and the check zone.

After initiation of the fault recording, the data are stored in a range from max. 500 ms before the TRIP command to max. 500 ms after it. The period for the fault recording is max. 5s. Up to 8 fault records can be viewed in the central unit. New fault records are always entered in the fault record data buffer. As soon as the fault record data buffer is full, new fault data overwrite the older data. Fault recording is initiated, for instance, by a busbar short-circuit, by binary input 2 marshalled to ">Trig.Wave.Cap." (**FNo. 4 / CU**) or by the parameter **ReleasFltRecBuf. (8300 / CU)**.

The data can be read out to a PC and evaluated by the DIGSI communication software.

The fault record data buffer SIPROTEC 7SS52 V4 is protected against data loss in case of power failures.

## 5.6.2 Setting Notes

|                        |  |
|------------------------|--|
| <b>fault rec mode</b>  | <p>The parameter <b>fault rec mode (6401A/CU)</b> is used to specify the conditions under which oscillographic fault records will be stored.</p> <p>With setting <b>global storage, initiation by CU</b>, fault records will be stored in the central unit and in all bay units if one storage criterion is fulfilled in the central unit. On pickup of the backup protection, the fault records are stored locally. This is the most common setting.</p> <p>With setting <b>global storage, local initiation</b>, fault records will be stored in the central unit and in all bay units if one storage criterion is fulfilled in the central unit or in any of the bay units. The storage criterion is set with the parameter <b>INITIATION (7402/BU)</b> in the bay unit (Chapter 5.13.2, page 210).</p> <p>With setting <b>local storage, local initiation</b>, fault records will be stored in the central unit and in the bay unit in which one storage criterion is fulfilled. The storage criterion is set with the parameter <b>INITIATION (7402/BU)</b> in the bay unit (Chapter 5.13.2, page 210).</p> |
| <b>MAX. LENGTH</b>     | <p>The parameter <b>MAX. LENGTH (6404/CU)</b> is used to set the maximum time available for one fault record.</p>  |
| <b>PRE. TRIG. TIME</b> | <p>The parameter <b>PRE. TRIG. TIME (6405/CU)</b> is used to set the pre-trigger time for fault recording. The pre-trigger time starts at the specified time before the storage criterion for fault record storage is fulfilled.</p>   |
| <b>POST REC. TIME</b>  | <p>The parameter <b>POST REC. TIME (6406/CU)</b> is used to set the post-fault time for fault recording. The post-fault time begins as soon as the storage criterion for fault record storage has disappeared.</p>   |
| <b>BinIn CAPT.TIME</b> | <p>The parameter <b>BinIn CAPT.TIME (6407/CU)</b> is used to set the capture time of the oscillographic fault record when the fault recording is initiated from DIGSI, from the central unit front panel or through a binary input. To set the capture time to infinite, enter "oo". Even so the capture time cannot exceed the time set with the parameter <b>MAX. LENGTH (6404/CU)</b>, which specifies the maximum available length of a fault recording.</p>   |

### 5.6.3 Settings for the Central Unit

| Addr. | Setting Title   | Setting Options   | Default Setting                  | Comments                                 |
|-------|-----------------|---|----------------------------------|--|
| 6401A | fault rec mode  | global storage, local initiation<br>global storage, initiation by CU<br>local storage, local initiation | global storage, initiation by CU | Mode of fault recording                  |
| 6404  | MAX. LENGTH     | 0.30 .. 5.00 sec  | 2.00 sec                         | Max. length of a Waveform Capture Record |
| 6405  | PRE. TRIG. TIME | 0.05 .. 0.50 sec  | 0.20 sec                         | Captured Waveform Prior to Trigger       |
| 6406  | POST REC. TIME  | 0.05 .. 0.50 sec  | 0.20 sec                         | Captured Waveform after Event            |
| 6407  | BinIn CAPT.TIME | 0.10 .. 5.00 sec; ∞   | 0.40 sec                         | Capture Time via Binary Input            |

### 5.6.4 Settings of the Bay Unit

| Addr. | Parameters | Setting Options                                      | Default Settings | Comments                                    |
|-------|------------|--|------------------|---|
| 7402  | INITIATION | STORAGE BY FD.<br>STORAGE BY TRIP<br>START WITH TRIP | STORAGE BY FD.   | Start/storage criterion for fault recording |

### 5.6.5 List of Information from the Central Unit

| FNo. | Alarm           | Comments                  |
|------|-----------------|---------------------------|
| 4    | >Trig.Wave.Cap. | >Trigger Waveform Capture |

## 5.7 Device

### 5.7.1 Mode of operation

This section summarizes those annunciations which are not associated with any protection function.

### 5.7.2 Setting notes

**T0 IV-Bit** Use parameter **T0 IV-Bit T103 (5299A/CU)** to set the time that may elapse at the maximum until reception of the synchronization pulse with external synchronization.

### 5.7.3 Annunciations

|                       |   |
|-----------------------|---|
| <b>Reset Device</b>   | Annunciation: The device has performed a start-up.<br>Relevant information: On  |
| <b>Initial start</b>  | Annunciation: The device has performed an initial restart. All buffers have been reset. The parameter settings are unaffected.<br>(Information supplied with the Reset Device annunciation)<br>Relevant information: On   |
| <b>Resume</b>         | Annunciation: The device has performed a restart. Only internal buffers have been reset. Operational event, fault events, fault records and the parameter settings are unaffected.<br>(Information supplied with the Reset Device annunciation)<br>Relevant information: On   |
| <b>Device OK</b>      | Annunciation: Device is operational and protecting.<br>With this annunciation, the readiness relay picks up, and the Error LED goes out.<br>Relevant information: On  |
| <b>Setting Calc.</b>  | Annunciation: Setting calculation is running.<br>Relevant information: On, the function is occupied by the parameter setting process.<br>Relevant information: Off, the function has been released again.   |
| <b>Settings Check</b> | Annunciation: the device is checking the new parameters (on-line parameter setting).<br>Relevant information: On, check has begun.<br>Relevant information: Off, the test is completed, i.e. the device is either operative again, or the new parameters have been saved in a non-volatile memory, or no settings check is running. |

|                         |   |
|-------------------------|---|
| <b>Level-2 change</b>   | <p>This annunciation is output as “On” as soon as the parameter set loaded with DIGSI has been changed by an on-line parameter setting and the device is operating with the new parameters.</p> <p>The annunciation is “Off” as long as the parameter set loaded with DIGSI is not changed, or output as “Off” again after a parameter set has been completely reloaded and the device is operating with these parameters.</p> <p>The event log information of this annunciation (On/Off) is maintained in case of an initial or restart.</p> <p>Relevant information: On, parameter changes on-line from the device or through a parameter setting command.</p> <p>Relevant information: Off, parameter set completely reloaded.</p> |
| <b>Reset LED</b>        | <p>Acknowledgement that LEDs were reset.</p> <p>Relevant information: On</p>  |
| <b>Test mode</b>        | <p>This operating mode is used for device tests during commissioning or maintenance. In test mode, all information in monitoring direction is marked with the UBF test bit. This ensures that events caused by testing do not trigger undesirable reactions (acoustic alarms, derived commands and annunciations) in higher-level system components (DIGSI). This operating mode can be activated and deactivated with a tagging command on site or via DIGSI.</p> <p>Relevant information: On/Off</p>  |
| <b>DataStop</b>         | <p>Data transmission stop for annunciations, metered and measured values.</p> <p>With data transmission stop on, all information in monitoring direction is marked with the Transmission block bit. The actual transmission blocking is performed in the control center.</p> <p>Relevant information: On/Off</p>  |
| <b>HWTTestMod</b>       | <p>Hardware test mode</p> <p>This operating mode is turned on by DIGSI when the user activates in commissioning mode functions such as setting of binary inputs, setting of output relays, setting of annunciations. DIGSI turns the hardware test mode off when the commissioning mode is left.</p> <p>After the Off command, the annunciation “Hardware test Off” is output, and an initial restart of the device is initiated after 5 seconds.</p> <p>Relevant information: On/Off</p>   |
| <b>Time Synch</b>       | <p>Input for the external minute pulse.</p> <p>Relevant information (fleeting): On</p>  |
| <b>Synch-Clock</b>      | <p>Reset following a clock synchronization.</p> <p>Relevant information (fleeting): On</p>  |
| <b>DayLight SavTime</b> | <p>Annunciation: Device switched over to daylight saving time.</p> <p>Relevant information: On, the date/time management has received a request for time synchronization with daylight saving time.</p> <p>Relevant information: Off, the date/time management has received a time synchronization command without daylight saving time.</p>  |



|                        |  |
|------------------------|--|
| <b>Clock SyncError</b> | Annunciation: Clock synchronization error.<br>Relevant information: On, no synchronization received within parameterized tolerance time.<br>Relevant information: Off, synchronization received again.   |
| <b>Event Lost</b>      | Annunciation: Not all annunciations generated by the device could be stored in the buffer. The cause is probably a buffer overflow.<br>Relevant information (fleeting): On   |
| <b>Flag lost</b>       | Annunciation: Not all annunciations generated by the device which are defined as fault record flags could be stored in the buffer. The cause is probably a buffer overflow.<br>Relevant information: On  |
| <b>UnlockDT</b>        | The interlocking of this flag with binary input ">Data Stop" ( <b>FNo. 16/ CU</b> ) is generated via CFC. The flag UnlockDT (Unlock data transmission via BI) has the following meaning: A data transmission stop which has been initiated via binary input may only be reset again by binary input.<br>Relevant information: On/Off |

#### 5.7.4 Settings for the Central Unit

| Addr. | Parameter      | Setting Options | Default Setting | Comments            |
|-------|----------------|-----------------|-----------------|---------------------|
| 5299A | TO IV-Bit T103 | 0 .. 1,500 min  | 1,380 min       | Timeout IV-Bit T103 |

#### 5.7.5 List of Information from the Central Unit

| FNo. | Alarm     | Comments                |
|------|-----------|-------------------------|
| 16   | >DataStop | >Stop data transmission |

## 5.8 Power System Data

### 5.8.1 Mode of operation

The SIPROTEC 7SS52 V4 distributed busbar and breaker failure protection needs the data of the power system to match its functions to these data.

### 5.8.2 Setting Notes

**FREQUENCY** The parameter **FREQUENCY (5104 / CU)** is used to set the rated system frequency.



**NOTE**

The parameter **FREQUENCY (7899 / BU)** can only be set with the bay unit running in stand-alone mode.

The value entered in the central unit for the parameter **FREQUENCY (5104 / CU)** is not changed by this.

With the bay unit linked to the central unit, the setting of this parameter is transmitted from the central unit to the bay units. The local setting in the bay units is overwritten.

The default setting of **50 Hz** need only be changed in power systems with a rated frequency of **60 Hz**.



**NOTE**

A device version with a rated frequency of 16.7 Hz is available under a separate ordering code (MLFB).

### 5.8.3 Settings for the Central Unit

| Addr. | Setting Title | Setting Options | Default Setting | Comments          |
|-------|---------------|-----------------|-----------------|-------------------|
| 5104  | FREQUENCY     | 50 Hz<br>60 Hz  | 50 Hz           | Nominal frequency |

### 5.8.4 Settings of the Bay Unit

| Addr. | Parameters | Setting Options | Default Settings | Comments               |
|-------|------------|-----------------|------------------|------------------------|
| 7899  | FREQUENCY  | 50 Hz<br>60 Hz  | 50 Hz            | Rated system frequency |

## 5.9 Protection General

This section summarizes general information required by the SIPROTEC 7SS52 V4 distributed busbar and breaker failure protection.

### 5.9.1 Current-Controlled TRIP Reset

For a reset of the TRIP command, it must be ensured that the tripped circuit breaker has actually been opened and that the trip circuit of the bay unit has been interrupted by the circuit breaker auxiliary contact.

If the trip relay interrupts the tripping current prematurely, its contacts are overloaded and destroyed.

A TRIP command from the busbar protection is only transmitted to the circuit breaker of the faulted feeder if the feeder current exceeds the current threshold for TRIP release **I>TRIP (XX13/CU)**.

#### Minimum duration of TRIP command

The relays for the TRIP command and the transfer trip command are reset if after the time **T<sub>min</sub> TRIP (6106/CU)** the feeder current drops below the threshold **I> BF (XX18/CU)** or **I> BF s. char. (XX19A/CU)**.

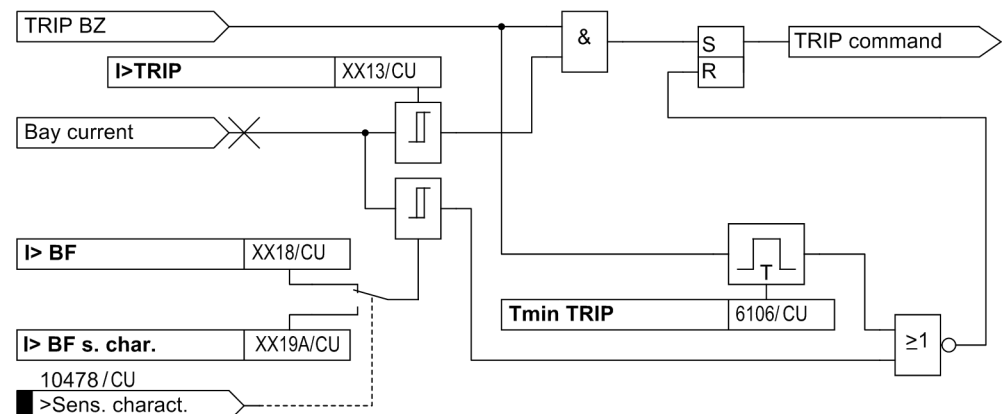


Figure 5-44 Minimum duration of TRIP command

### 5.9.2 Local Control of the Bay Unit

If you want to ensure that the operating status of the bay units set with the parameter **Bay status (XX12/CU)** and the function keys **F1** and **F4** cannot be changed in the bay units, you can block the local control of the bay units with the parameter **CTRL REL BU (6318/CU)**.

The setting **blocked** moreover has the effect that all functions for operating the bay units which require the entry of a codeword are blocked. In such cases, the message "unauthorised" is displayed.

### 5.9.3 Operating States "Bay Out of Service", "Maintenance Mode"

The parameter **Bay status (XX12/ CU)** is used to select the operating status of the bay unit.

#### Bay out of service / in service

The allocation of a feeder current to a selective measuring system (= bus zone) takes place due to the disconnecter image ("disconnecter replica"). The service function "bay out of service" causes that this allocation is cancelled. In 2-bay couplers, this status is automatically assumed for both coupler bay units. For this purpose, the busbar and feeder disconnectors of the affected bay unit are processed as being open in the internal disconnecter replica. The positions of the sectionalizing switch-disconnectors are still acquired. If the bay unit is not available for the central unit, the old position of the sectionalizing switch-disconnector is retained.

Further the disconnecter supervision of the bay and resulting messages are blocked. Even if all disconnectors of a feeder are open, the allocation of the feeder to the check zone (=disconnecter-independent measuring system) remains however, as long as the bay unit is switched on.



#### CAUTION

Switching a bay unit into the condition "Bay out of service" requires that the feeder is actually primary out of operation, i.e. no current flow can take place in the feeder.

---

The service function "Bay out of service" can naturally be used, if for the test of the feeder protection, which uses the same transducer core, a test current will be injected. If for example a busside disconnecter remains closed and only the circuit breaker and the line side disconnecter (without being monitored by the bus bar protection) are open, a test current would be assigned to a measuring system.

With "Bay out of service" a processing of this test current (by the selective measuring systems) and thereby a possible false tripping is prevented. That test current remains in the check zone measuring system and may lead to a pick up of the "differential current supervision of the check zone". Therefore it is recommended to set the reaction on a pick up of the "differential current supervision of the check zone" to "alarm only".

Additionally, the binary inputs for the breaker failure protection are no longer processed. An inadvertent tripping of a busbar, e.g. in the operating mode "**external**", (**XX15/ CU**), is thus prevented.

"Bay out of service" represents thus a precautionary measure for the bus bar protection with secondary work in the bay and no test function of the bus bar protection, particularly the bay unit.

A bay unit in condition "Bay out of service" is to be left switched on if possible. The safety function of the check zone is thus still available. Switching off is only necessary with defect of the bay unit or the optical fiber connection. The bay is thus taken out of the protection completely and resulting annunciations or blockings prevented. As preparation the feeder has to be switched off primary and be faded out by "Bay out of service" from the bus bar protection. If the switching off happens without previous "Bay out of service", a blocking according to the selected settings of the bus bar protection takes place.



## CAUTION

Bus bar protection with transfer bus

The transfer bus condition is characterized by the status:

Line disconnector Q9 open, respectively all bus bar disconnectors open and transfer bus disconnector Q7 closed.

If the feeder is in transfer busbar operation, the feeder must not be put "out of service".

### Maintenance mode

During disconnector revisions the feedback does not correspond to the switching status of the disconnectors (e.g. with maintenance of the auxiliary contacts or switched off power supply for disconnector position signal).

In such a case, the existing disconnector status is frozen during maintenance and maintained until the maintenance function is finished. The start of the maintenance mode and the switching off of the disconnector status indication are usually done simultaneously. To prevent erroneous annunciations, there is a short delay of 0.5 s for the responses and the signalling of auxiliary voltage failure. The protection function, however, remains fully operational. It is also possible to exclude individual switchgear of a bay unit from the maintenance mode via the parameters **Maint. Dco** or **Maint. CB (XX51A/CU to XX56A/CU)**.

The main points to observe for maintenance mode are:

- In 2-bay couplers, maintenance must be selected for one coupler bay only.
- To ensure a selective functioning of the protection, the disconnector status must not be changed during maintenance mode; this is because the individual protection zones are managed on the basis of the frozen disconnector replica.
- The circuit breaker monitoring and the disconnector status monitoring are closed.
- A warning annunciation "DcoProhib/Maint" (**FNo. 10471 / CU**) is output throughout the maintenance work.

### 5.9.4 Overcurrent-Controlled TRIP command

The SIPROTEC 7SS52 V4 distributed busbar and breaker failure protection provides the possibility, in the event of a busbar short-circuit, to disconnect only those feeders which carry currents exceeding a set level. This threshold can be set individually for each bay with the parameter **I>TRIP (XX13 / CU)** (Figure 5-44, page 195).

### 5.9.5 Feeder-Selective Trip Release

The 7SS52 provides the possibility, in the event of a busbar short-circuit, to trip only those feeders for which an additional external criterion is fulfilled. Such a TRIP command release can be provided, for instance, by a pickup of the feeder protection.

The TRIP release must be marshalled to a binary output ">TRIP release" (FNo. 7616/BU) in the bay unit.

In the event of a busbar TRIP the breaker failure protection time delay (CBF time delay) is started. If TRIP release is not given within the CBF time delay, no trip command is generated and the status "missing TRIP release" is indicated for the feeder concerned.

The missing "TRIP release" does not influence the internal CBF processing.

### 5.9.6 Testing the Tripping Circuits and the Circuit Breakers

You can test the tripping circuits and the circuit breakers under live conditions by initiating a CB test trip from the bay unit. The CB test live trip can be performed with DIGSI or directly from the bay unit operator panel.

The following conditions must be met:

- The required test trip commands have been marshalled to the trip relays during configuration.
- The feeder current must not exceed the threshold set in I> MAN TRIP (6316/CU).

As Figure 5-45, page 198 shows, the circuit breaker test live trip can be initiated from the bay unit by one of the following:

- Pressing function key F2 (3-phase),
- via binary input ">CB Test" (FNo. 1156/BU) (3-phase),
- with the parameter CB TEST LIVE TRIP (4400/BU) (1-/3-phase).

The CB test trip command is cancelled after a fixed time of 2 s.

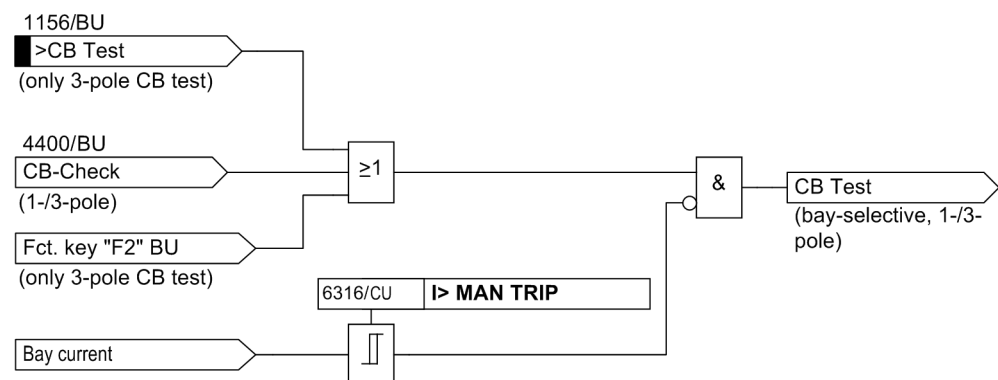


Figure 5-45 CB test live trip function

### 5.9.7 Busbar Tripping via an External Signal

Apart from the tripping of bus zones by the busbar protection itself, there is the option of tripping individual bus zones via an external signal. With enclosed switchgear, for example, the output signal of a so-called arc barrier can be coupled in the central unit via a binary input and be used to trip the faulty zone. For safety reasons the processing is carried out via one binary input per bus zone ">external trip \$03" (FNo. 177.1360.xx/CU) with an additional common release via another binary input ">TRIP-Release" (FNo. 10487/CU).

As confirmation message follows "Trip Bl \$03" (FNo. 177.1363.xx) and as group alarms "Device Trip G" (FNo. 10445), "Trip BBP G" (FNo. 10449) and "Trip \$03 G" (FNo. 177.1341.xx). "Trip Lx CZ" (FNo. 10457/CU, 10458/CU, 10459/CU) will be issued with every tripping command. In this, xx or \$03 indicates the bus zone.

The binary inputs of the active signals are monitored individually. An alarm is generated in the event of an excess for more than 15 s.

The monitoring time between triggering and release is set with the parameter **T-TRIP-Rel sup** (6317/CU).

If the protection picks up, the following alarm is generated: "extTripDist\$03" (FNo. 177.1361.xx/CU), the group alarm "ext.TripRelDist" (FNo. 10486/CU) and the further processing of the binary input is blocked.

If the conditions for tripping via an external signal are not fulfilled, the system generates the alarm "TripRelDist\$03" (FNo. 177.1362.xx/CU).

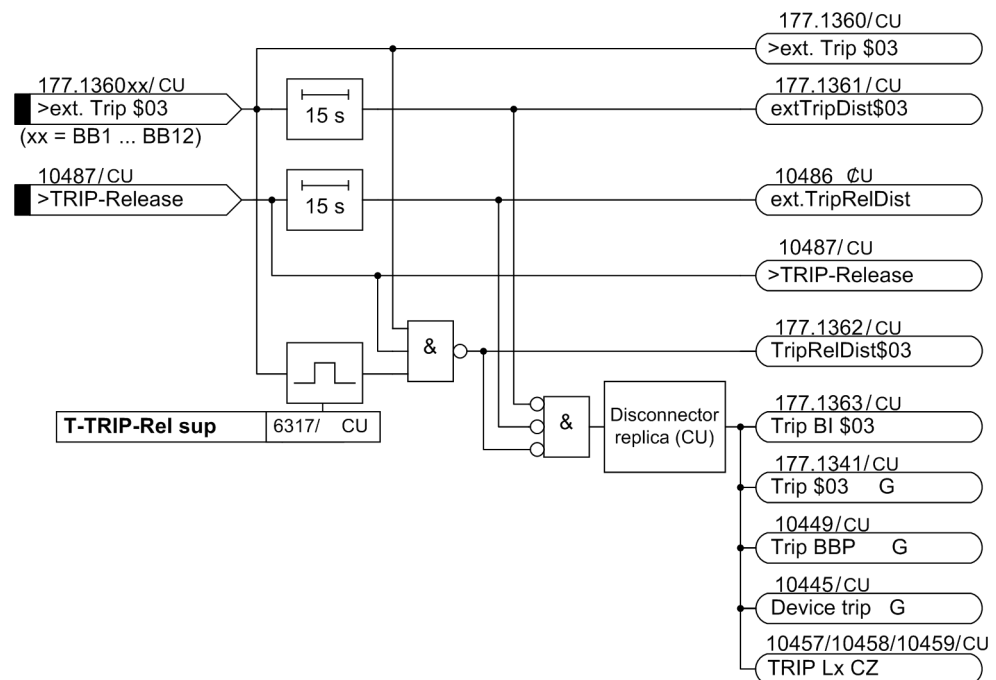


Figure 5-46 Logic of Busbar Tripping by External Signal

### 5.9.8 Setting Notes

#### Tmin TRIP

The parameter **Tmin TRIP (6106/CU)** is used to set the minimum time that must elapse before the TRIP command is reset. This time is started with the output of a TRIP command.

In general, a TRIP command is reset via the current flow control (see Chapter 5.9.1, page 195). If non-energized feeders, e.g. radial feeders, are tripped without any feedback, a safe reset of the TRIP command to the circuit breaker trip coil can instead be ensured with the parameter **Tmin TRIP (6106/CU)**. The setting must be higher than the maximum circuit breaker closing time.



#### NOTE

The parameter **T TRIP (1141/BU)** can only be set with the bay unit running in stand-alone mode. If the bay unit is connected with the central unit, the setting of this parameter is overwritten by the central unit **Tmin TRIP (6106/CU)**.

With the bay unit linked to the central unit, the setting of this parameter is transmitted from the central unit to the bay units. The local setting in the bay units is overwritten.

#### Local control of BU

The parameter **CTRL REL BU (6318/CU)** is used to release or block changes of the bay unit parameter **Bay status (XX12/CU)** locally on the bay units. This applies to the feeder settings **out of service**, **in service** and **maintenance**. It affects also the possibility to change the operating status by means of the function keys on the bay unit operator panel.

With setting **released**, changes of the bay unit parameter **Bay status (XX12/CU)** from the bay units is released.

With setting **blocked**, changes to the bay unit parameter **Bay status (XX12/CU)** locally from the bay units are blocked. Attempts to take a bay unit locally out of service are rejected as "NOT PERMITTED".

The setting **blocked** moreover has the effect that all functions for operating the bay units which require the entry of a codeword are blocked. In such cases, the message "unauthorised" is displayed.

#### PROT TR BUS

The parameter **PROT TR BUS (5401/CU)** is used to activate and deactivate the selective protection of a transfer busbar. The basic setting is **YES**.

With setting **YES** the protection of the transfer busbar will be on. This setting only makes sense in configurations with external current transformers.

With setting **NO** the protection of the transfer busbar will be off.

#### Test mode SK

The parameter **Test mode SK (5108A/CU)** is used to activate and deactivate the test mode for the ZPS-SK module (Chapter 8.2.4, page 326). Siemens recommends to block all TRIP commands.

With test mode **ON**, the protection is blocked.



**Language BU**

The parameter **Language BU (5111 / CU)** is used to select the UI language of the bay units. The language of the annunciations displayed in the central unit is set via the configuration of the central unit. If the bay unit is operated without a central unit, the language is set locally via a parameter (**7101 / BU**).

With the setting **German**, the menus in the bay unit display and the parameters and annunciations in DIGSI are displayed in German.

With the setting **English, French, Italian, Russian** or **Spanish** the menus in the bay unit display and the parameters and annunciations in DIGSI are displayed in the selected language.

Independent of the above mentioned remarks on the device operation, for DIGSI, the language settings of the DIGSI Device Manager apply.

**I> MAN TRIP**

The parameter **I> MAN TRIP (6316 / CU)** is used to set the threshold of the feeder current for the circuit breaker test. The feeder current that is allowed to flow during the test must be less than this threshold. Thus, an unintentional tripping of a feeder in operation can be prevented.

**I>TRIP**

The parameter **I>TRIP (XX13 / CU)** is used to set the threshold of the feeder current for the trip release.

The setting of the parameter depends on the lowest short-circuit current to be expected.

A TRIP command will be performed selectively for each feeder as soon as the feeder current exceeds this threshold. The set value refers to the rated CT current. If you set a feeder to **0**, this feeder will be tripped without an I>query.

**Bay status**

The parameter **Bay status (XX12 / CU)** is used to select the operating status of the bay unit.

With setting **in service** the bay unit will be in service.

With setting **out of service** the bay unit will be out of service.

With setting **maintenance** the bay unit will be in maintenance mode. In that, the disconnector replica is frozen in this operating state.

**NOTE**

The setting of the bay status can only be changed back at the unit where it was first set. Possible are, for example, binary inputs, control panel or settings via DIGSI.

---

### 5.9.9 Settings for the Central Unit

| Addr. | Setting Title  | Setting Options  | Default Settings | Comments                                    |
|-------|----------------|--|------------------|---|
| 112   | Bay status     | out of service<br>in service<br>maintenance  | in service       | Bay status                                  |
| 113   | I> TRIP        | 0.00..25.00 I / In   | 0.00 I / In      | Current threshold for TRIP re-<br>lease     |
| 115   | BF OP MODE     | non existent<br>external<br>BZ unbalance<br>trip rep/unbal<br>I>query<br>trip rep/I>quer | BZ unbalance     | Operation mode BF                           |
| 118   | I> BF          | 0.10..2.00 I / In  | 0.50 I / In      | Current threshold for BF                    |
| 119A  | I> BF s. char. | 0.05..2.00 I / In  | 0.25 I / In      | Current threshold for BF - sens.<br>char.   |
| 151A  | Maint. Dco1    | YES<br>NO  | YES              | Maintenance for disconnecter 1              |
| 156A  | Maint. CB      | YES<br>NO  | YES              | Maintenance for CB                          |
| 5401  | PROT TR BUS    | YES<br>NO  | YES              | Selective protection for transfer<br>busbar |
| 5108A | Test mode SK   | OFF<br>ON  | OFF              | Test mode for module SK                     |
| 5111  | Language BU    | German<br>English<br>French<br>Spanish<br>Italian<br>Russian                             | English          | Language of bay units                       |
| 6106  | Tmin TRIP      | 0.01.. 32.00 s   | 0.15 s           | Minimum duration of TRIP com-<br>mand       |
| 6316  | I> MAN TRIP    | 0.00 .. 2.50 I/In; ∞   | 0.05 I/In        | Limit value for circuit breaker<br>test     |
| 6317  | T-TRIP-Rel sup | 0.06 .. 1.00 s   | 0.06 s           | Supervision bin. input TRIP-Re-<br>lease    |
| 6318  | CTRL REL BU    | released<br>blocked  | released         | Control release for bay units               |

### 5.9.10 List of Information from the Central Unit

\$00, ..., \$03 are variables which will be automatically replaced on entry in the event buffer by  
 \$00 Number of the bay unit  
 \$01 Bay name  
 \$02 Name of the switching element (e.g. disconnecter or circuit breaker)  
 \$03 Name of the bus zone

| FNo.     | Alarm           | Comments                                    |
|----------|-----------------|---|
| 10445    | Device trip G   | Device Trip (group alarm)                   |
| 10449    | Trip BBP G      | Trip command BBP (group alarm)              |
| 10471    | DcoProhib G     | Disconnecter oper. prohibited (group alarm) |
| 10478    | >Sens. charact. | >Sensitive characteristic active            |
| 10486    | ext.TripRelDist | Disturbance ext. trip release               |
| 10487    | >TRIP-Release   | >Release for external trip command          |
| 176.1135 | \$01 \$02       | \$01 circuit breaker \$02                   |
| 177.1341 | Trip \$03 G     | Trip command for \$03 (group alarm)         |
| 177.1360 | >ext. Trip \$03 | >external trip \$03                         |
| 177.1361 | extTripDist\$03 | Disturbance ext. trip input \$03            |
| 177.1362 | TripRelDist\$03 | Disturbance trip command release \$03       |
| 177.1363 | Trip BI \$03    | Trip command by BI for \$03                 |

### 5.9.11 Settings for the Bay Unit

| Addr. | Setting Title | Setting Options   | Default Setting | Comments                            |
|-------|---------------|---|-----------------|-------------------------------------|
| 128   | T-BF 2chan    | 0.06 .. 1.00 s  | 0.06 s          | Supervision time BF start / release |
| 1141  | T TRIP        | 0.01..32.00 s   | 0.15 s          | Minimum trip command duration       |
| 7101  | LANGUAGE      | DEUTSCH<br>ENGLISH<br>FRANCAIS<br>ESPANOL<br>ITALIANO<br>PYCCK. | ENGLISH         | Operating language                  |

### 5.9.12 List of Information from the Bay Unit

| <b>FNo.</b> | <b>Alarm</b>  | <b>Comments</b>                    |
|-------------|---------------|------------------------------------|
| 1156        | >CB test      | >CB test start                     |
| 1174        | CB in Test    | Circuit breaker test in progress   |
| 1181        | CB Test Trip  | Circuit breaker test: General trip |
| 7616        | >TRIP release | >Trip release                      |

## 5.10 Bay Unit

### 5.10.1 Functional Description

For the functional description of feeder-specific parameters, please refer to the chapters:

- **Circuit Breaker Failure Protection** (Chapter 5.3, page 140)
  - **Characteristics for the Circuit Breaker Failure Protection** (Chapter 5.3.1, page 140)
  - **Operating States "Bay Out of Service", "Maintenance Mode"** (Chapter 5.9.3, page 196)
  - **Triggering and Releasing the Breaker Failure Protection** (Chapter 5.3.5.1, page 143)
  - **Circuit Breaker Failure Protection during a Feeder Short-Circuit** (Chapter 5.3.5.2, page 146)
  - **Circuit Breaker Failure Protection for Busbar Faults** (Chapter 5.3.5.3, page 153)
  - **Failure of the Bus Coupler Circuit Breaker** (Chapter 5.3.5.4, page 154)
  - **Circuit Breaker Not Ready** (Chapter 5.3.5.5, page 155)
- **End Fault Protection** (Chapter 5.4, page 162)
  - **End Fault Protection in the Feeder** (Chapter 5.4.1, page 162)
  - **Protection with fault in the "Dead Zone" of the Bus Coupler** (Chapter 5.4.2, page 164)
- **Protection General** (Chapter 5.9, page 195)
  - **Current-Controlled TRIP Reset** (Chapter 5.9.1, page 195)
  - **Local Control of the Bay Unit** (Chapter 5.9.2, page 195)
  - **Overcurrent-Controlled TRIP command** (Chapter 5.9.4, page 197)

### 5.10.2 Setting Notes



#### NOTE

Parameters that are not stated here have already been described before. For that, please refer to the corresponding cross-references e.g. as above, chapter "**Circuit Breaker Failure Protection**" (Chapter 5.3, page 140).

---

## 5.11 Integrated Operation of the Bay Unit

### 5.11.1 Functional Description

This section summarizes those parameters by which you choose the UI language of the bay unit and specify the measured values to be displayed in the “standby” display.

### 5.11.2 Setting Notes

**LANGUAGE** The parameter **LANGUAGE (7101 / BU)** is used to set the UI language of the bay unit.



**NOTE**

The parameter **LANGUAGE (7101 / BU)** can only be set with the bay unit running in stand-alone mode.

The value entered in the central unit for the parameter **Language BU (5111 / CU)** is not affected by this.

With the bay unit linked to the central unit, the setting of this parameter is transmitted from the central unit to the bay units. The local setting in the bay units is overwritten.

With the setting **German** the menus in the display of the bay unit appear in German.

With the setting **English, French, Spanish, Italian, Russian** the menus in the display of the bay unit appear in the respective target language.

**OPER.1st L.** The parameters **OPER.1st L. (7120 / BU)**, **OPER.2nd L. (7122 / BU)**,  
**OPER.2nd L.** **OPER.3rd L. (7124 / BU)** and **OPER.4th L. (7126 / BU)** are used to select the  
**OPER.3rd L.** measured value which will be displayed in the 1st, 2nd, 3rd and 4th line of the “stand-  
**OPER.4th L.** by” display in 4-line mode.

You can choose from:

- The currents of the three phases IL1, IL2, IL3
- The earth fault current IE
- The differential currents of the three phases IdL1, IdL2, IdL3
- The stabilizing currents of the three phases IsL1, IsL2, IsL3

**OPER.1st L.** The parameters **OPER. 1st L. (7121 / BU)**, **OPER.2nd L. (7123 / BU)**,  
**OPER.2nd L.** **OPER.3rd L. (7125 / BU)** and **OPER.4th L. (7127 / BU)** are used to select the  
**OPER.3rd L.** mode of display for the measured value in the 1st, 2nd, 3rd and 4th line of the “stand-  
**OPER.4th L.** by” display in 4-line mode.

With setting **PRIMARY**, the measured value will be displayed as primary value, i.e. with the unit Ampere (A).

With setting **SECONDARY**, the measured value will be displayed as secondary value, i.e. in percent of the rated current.

With the setting **NORMALIZED**, the measured value will be displayed as normalized value, i.e. referring to the same reference current. The reference current is set in the plant configuration.

### 5.11.3 Settings of the Bay Unit

| Addr. | Setting Title | Setting Options  | Default Settings | Comments  |
|-------|---------------|--|------------------|---|
| 7101  | LANGUAGE      | DEUTSCH<br>ENGLISH<br>FRANCAIS<br>ESPANOL<br>ITALIANO<br>PYCCK.  | ENGLISH          | Operating language  |
| 7120  | OPER.1st L.   | IL1, IL2, IL3, IE<br>I-DIFF. L1, I-DIFF. L2,<br>I-DIFF. L3<br>I-RESTR. L1, I-RESTR. L2,<br>I-RESTR. L3 | IL1              | Display of measured values in the 1st line of the quiescent-state indication in 4-line mode |
| 7121  | OPER.1st L.   | PRIMARY<br>SECONDARY<br>NORMALIZED   | SECONDARY        | Display of measured values in the 1st line as primary or secondary (percent) values         |
| 7122  | OPER.2nd L.   | IL1, IL2, IL3, IE<br>I-DIFF. L1, I-DIFF. L2,<br>I-DIFF. L3<br>I-RESTR. L1, I-RESTR. L2,<br>I-RESTR. L3 | IL2              | Display of measured values in the 2nd line of the quiescent-state indication in 4-line mode |
| 7123  | OPER.2nd L.   | PRIMARY<br>SECONDARY<br>NORMALIZED   | SECONDARY        | Display of measured values in the 2nd line as primary or secondary (percent) values         |
| 7124  | OPER.3rd L.   | IL1, IL2, IL3, IE<br>I-DIFF. L1, I-DIFF. L2,<br>I-DIFF. L3<br>I-RESTR. L1, I-RESTR. L2,<br>I-RESTR. L3 | IL3              | Display of measured values in the 3rd line of the quiescent-state indication in 4-line mode |
| 7125  | OPER.3rd L.   | PRIMARY<br>SECONDARY<br>NORMALIZED   | SECONDARY        | Display of measured values in the 3rd line as primary or secondary (percent) values         |
| 7126  | OPER.4th L.   | IL1, IL2, IL3, IE<br>I-DIFF. L1, I-DIFF. L2,<br>I-DIFF. L3<br>I-RESTR. L1, I-RESTR. L2,<br>I-RESTR. L3 | IE               | Display of measured values in the 4th line of the quiescent-state indication in 4-line mode |
| 7127  | OPER.4th L.   | PRIMARY<br>SECONDARY<br>NORMALIZED   | SECONDARY        | Display of measured values in the 4th line as primary or secondary (percent) values         |

## 5.12 PC Port of the Bay Unit

### 5.12.1 Functional Description

The device is equipped with an operating interface integrated in the front panel, the so-called PC port. Communication through this port is subject to certain agreements concerning the transmission formation and the transmission rate.

The data entered must match the connected device.

### 5.12.2 Setting Notes

- FUNCT. TYP** With the parameter **FUNCT. TYPE (7208/BU)** you set the compatible functions type for the transmission of your device with IEC61870-5-103.  
The function type 160 (definite time mode) must be selected for the bay units.
- PC INTERF.** The parameter **PC INTERF. (7211/BU)** is used to select the format for transmitting data from the front port (PC port) to the device connected to it.  
With setting **DIGSI V3**, the data are transmitted in a format which is used by DIGSI V3.  
With setting **ASCII**, the data are transmitted in ASCII format.
- PC BAUDRATE** The parameter **PC BAUDRATE (7215/BU)** is used to select the rate at which data will be transmitted from the front port (PC port) to the device connected to it.  
With setting **1200, 2400, 4800, 9600** or **19200 BAUD**, the data will be transmitted at the selected rate.
- PC PARITY** The parameter **PC PARITY (7216/BU)** is used to select the parity for transmission of data from the front port (PC port) to the device connected to it.  
With setting **DIGSI V3**, the data are transmitted with a parity used by DIGSI V3.  
With setting **No parity, 2 stopbits**, data are transmitted without parity and with 2 stop bits.  
With setting **No parity, 1 stopbit**, data are transmitted without parity and with one stop bit.
- SYS SUPV.T** Use parameter **SYS SUPV.T (7233/BU)** to set the supervision time of the device system interface.  
The time set must be longer than the auto polling by the control system.



### 5.12.3 Settings of the Bay Unit

| Addr. | Parameters  | Setting Options  | Default Settings | Comments                                   |
|-------|-------------|--|------------------|--|
| 7208  | FUNCT. TYPE | 1 .. 254   | 160              | Function type in accordance with VDEW/ZVEI |
| 7211  | PC INTERF.  | DIGSI V3<br>ASCII  | DIGSI V3         | Data format                                |
| 7215  | PC BAUDRATE | 1200 Baud<br>2400 Baud<br>4800 Baud<br>9600 Baud<br>19200 Baud | 9600 Baud        | Transmission rate for PC point             |
| 7216  | PC PARITY   | DIGSI V3<br>No parity, 2 stopbits<br>No parity, 1 stopbit      | DIGSI V3         | Parity of transmission telegrams           |
| 7233  | SYS SUBV.T  | 1.. 600 s ; +*   | 120 s            | Supervision time for system interface      |

## 5.13 Fault Recording in the Bay Unit ("Local Fault Recording")

### 5.13.1 Functional Description




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**NOTE**

A description of the central unit's fault recording function is provided in Chapter 5.6, page 188.  
 Reading out of oscillographic fault recording data is described in Chapter 6.2.3, page 251.

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The instantaneous measured values are stored at intervals of 1 ms ( $f_N = 50$  Hz) and 833  $\mu$ s ( $f_N = 60$  Hz) in a buffer of the bay unit. The instantaneous currents are measured for each phase.

A fault record is initiated by

- a protection or trip from an internal protection function,
- a start from DIGSI, from the central unit front panel or via a binary input with the annunciation ">Trig.Wave.Cap." marshalled to it.

A total of 5 s max is available in the bay unit for oscillographic fault recording. This interval allows to store up to 8 fault records.

New fault records are always entered in the fault record data buffer. The oldest fault record data are overwritten by the new data.

An oscillographic record can be triggered by a change in status of a binary input, or by an input at the integrated keypad, or through the PC port.

### 5.13.2 Setting Notes

**INITIATION**

The parameter **INITIATION (7402/BU)** is used to set the reference instance and the storage criterion for fault recording.

With setting **STORAGE BY FD.** the storage criterion is defined to be the fault detection by the device. The reference instant for fault recording is the fault detection by the device.

With setting **STORAGE BY TRIP** the storage criterion is defined to be the device trip. The reference instant for fault recording is the fault detection by the device.

With setting **START WITH TRIP** the storage criterion is defined to be the device trip. The reference instant for fault recording is the device trip.

**T-MAX**

The parameter **T-MAX (7410/BU)** is used to set the maximum time period available for one fault record.

**T - PRE** The parameter **T - PRE (7411 / BU)** is used to set the pre-trigger time for starting the fault recording. The pre-trigger time starts at the specified time before the storage criterion for fault record storage is fulfilled. The storage criterion is selected with the parameter **INITIATION (7402 / BU)**.

**T - POST** The parameter **T - POST (7412 / BU)** is used to set the post-fault time for stopping the fault recording. The post-fault time begins as soon as the stop criterion for fault record storage is fulfilled.

**T - BINARY IN** The parameter **T - BINARY IN (7431 / BU)** is used to set the storage time when fault recording is initiated via a binary input. The total storage time is the sum of this parameter plus the pre-trigger and the post-fault time. With this parameter set to infinite, the fault recording runs for as long as the binary input is energized. It cannot, however, run for longer than the maximum storage time. To set the parameter to infinite, increment the value for this parameter with the arrow keys until the symbol "∞" appears.

**T - KEYBOARD** The parameter **T - KEYBOARD (7432 / BU)** is used to set the storage time when fault recording is initiated from the membrane keyboard on the operator panel.

### 5.13.3 Settings of the Bay Unit

| Addr. | Parameters  | Setting Options                                      | Default Settings | Comments  |
|-------|-------------|--|------------------|---|
| 7402  | INITIATION  | STORAGE BY FD.<br>STORAGE BY TRIP<br>START WITH TRIP | STORAGE BY TRIP  | Start/storage criterion for fault recording   |
| 7410  | T-MAX       | 0.30 .. 5.00 s                                       | 2.00 s           | Maximum time period available for one fault record                                    |
| 7411  | T-PRE       | 0.05 .. 0.50 s                                       | 0.20 s           | Pre-trigger time for fault recording  |
| 7412  | T-POST      | 0.05 .. 0.50 s                                       | 0.20 s           | Post-fault time for stopping the fault recording after the fault criterion disappears |
| 7431  | T-BINARY IN | 0.10 .. 5.00 s<br>infinite                           | 0.40 s           | Storage time when fault recording is initiated via a binary input                     |
| 7432  | T-KEYBOARD  | 0.10 .. 5.00 s                                       | 0.40 s           | Storage time when fault recording is initiated via the membrane keyboard              |

## 5.14 Scope of Protective Functions in the Bay Unit

### 5.14.1 Functional Description

An optional overcurrent protection is provided as a backup protection in the bay units. This protection works independently of the busbar protection function and remains active even if the link to the central unit is interrupted or if the bay unit is set with the parameter **Bay status (XX12/CU)** to bay **out of service**. The overcurrent protection function is described in Chapter 5.16, page 216.

The overcurrent protection can be set to either a definite time or an inverse time characteristic. This section summarizes those parameters which select the functions for treating the phase and earth currents.

In this case the bay units need the specification of the rated system frequency.

### 5.14.2 Setting Notes

- CHARAC. PH**      The parameter **CHARAC. PH (7812/BU)** is used to set the characteristic for the phase currents of the overcurrent protection.
- With setting **DEFINITE TIME**, a definite time characteristic will be used for the phase current overcurrent protection (Chapter 5.16.1, page 216).
- With setting **INVERSE TIME**, an inverse time characteristic will be used for the phase current overcurrent protection (Chapter 5.16.1, page 216).
- CHARAC. E**      The parameter **CHARAC. E (7815/BU)** is used to set the characteristic for the earth currents of the overcurrent protection.
- With setting **DEFINITE TIME**, a definite time characteristic will be used for the earth current overcurrent protection (Chapter 5.16.1, page 216).
- With setting **INVERSE TIME**, an inverse time characteristic will be used for the earth current overcurrent protection (Chapter 5.16.1, page 216).
- FREQUENCY**      The parameter **FREQUENCY (7899/BU)** is used to set the rated system frequency.



#### NOTE

The parameter **FREQUENCY (7899/BU)** can only be set with the bay unit running in stand-alone mode.

The value entered in the central unit for the parameter **FREQUENCY (5104/CU)** is not affected by this.

With the bay unit linked to the central unit, the setting of this parameter is transmitted from the central unit to the bay units. The local setting in the bay units is overwritten.

---

The default setting of **50 Hz** need only be changed in power systems with a rated frequency of **60 Hz**.

### 5.14.3 Settings of the Central Unit

| Addr. | Setting Title | Setting Options                             | Default Settings | Comments          |
|-------|---------------|---|------------------|-------------------|
| 112   | Bay status    | out of service<br>in service<br>maintenance | in service       | Bay status        |
| 5104  | FREQUENCY     | 50 Hz<br>60 Hz                              | 50 Hz            | Nominal frequency |

### 5.14.4 Settings of the Bay Unit

| Addr. | Setting Title | Setting Options               | Default Settings | Comments  |
|-------|---------------|-------------------------------|------------------|---|
| 7812  | CHARAC. PH    | Definite time<br>INVERSE TIME | Definite time    | O/C protection characteristic for phase currents    |
| 7815  | CHARAC. E     | DEFINITE TIME<br>INVERSE TIME | DEFINITE TIME    | O/C protection characteristic for the earth current |
| 7899  | FREQUENCY     | 50 Hz<br>60 Hz                | 50 Hz            | Rated system frequency                              |

## 5.15 Power System Data of the Bay Unit

### 5.15.1 Functional Description

With the bay unit running in stand-alone mode, the user can set the current transformer starpoint and the minimum time which must elapse before the TRIP command is reset.

### 5.15.2 Setting Notes

**CT STARPNT** The parameter **CT STARPNT (1101/BU)** is used to select the orientation of the CT starpoint. The reference point is the current transformer itself.



**NOTE**

The parameter **CT STARPNT (1101/BU)** can only be set with the bay unit running in stand-alone mode. As long as there is a connection with the central unit, the parameters **(1101/BU, 1105/BU, 1141/BU)** are managed and set by the CU and are therefore hidden in DIGSI and in the LCD.

The parameter settings in the central unit are not affected by this.

With the bay unit linked to the central unit, the setting of this parameter is transmitted from the central unit to the bay units. The local setting in the bay units is overwritten.

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With setting **TOWARDS LINE**, the CT starpoint is oriented towards the line.

With setting **TOWARDS BUSBAR**, the CT starpoint is oriented towards the busbar.

**In PRIMARY** With the parameter **In PRIMARY (1105/BU)** you inform the device of the primary rated CT current .



**NOTE**

The parameter **In PRIMARY (1105/BU)** can only be set with the bay unit running in stand-alone mode.

The parameter settings in the central unit are not affected by this.

With the bay unit linked to the central unit, the setting of this parameter is transmitted from the central unit to the bay units. The local setting in the bay units is overwritten.

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**T TRIP**

The parameter **T TRIP (1141 / BU)** is used to set the minimum time which must elapse before the TRIP command is reset. This time is started with the output of a TRIP command.

**NOTE**

The parameter **T TRIP (1141 / BU)** can only be set with the bay unit running in stand-alone mode.

The value entered in the central unit for the parameter **Tmin TRIP (6106 / CU)** is not affected by this.

With the bay unit linked to the central unit, the setting of this parameter is transmitted from the central unit to the bay units. The local setting in the bay units is overwritten.

**5.15.3 Settings of the Central Unit**

| Addr. | Setting Title | Setting Options   | Default Settings | Comments                         |
|-------|---------------|-------------------|------------------|----------------------------------|
| 5104  | FREQUENCY     | 50 Hz<br>60 Hz    | 50 Hz            | Nominal frequency                |
| 6106  | Tmin TRIP     | 0.01 .. 32.00 sec | 0.15 sec         | Minimum duration of TRIP command |

**5.15.4 Settings of the Bay Unit**

| Addr. | Setting Title | Setting Options                | Default Settings | Comments                          |
|-------|---------------|--------------------------------|------------------|-----------------------------------|
| 1101  | CT STARPNT    | TOWARDS LINE<br>TOWARDS BUSBAR | TOWARDS LINE     | Current transformer polarity lies |
| 1105  | In PRIMARY    | 10 .. 50000 A                  | 400 A            | Primary rated current             |
| 1141  | T TRIP        | 0.01 .. 32.00 sec              | 0.15 sec         | Minimum TRIP command duration     |

## 5.16 Overcurrent Protection in the Bay Unit

### 5.16.1 Functional Description

An optional overcurrent protection is provided as a backup protection in the bay units of the distributed busbar and breaker failure protection SIPROTEC 7SS52 V4. This protection works independently of the busbar protection function and remains active even if the link to the central unit is interrupted or if the bay unit is set with the parameter **Bay status (XX12/BU)** to bay **out of service**.

The overcurrent protection function can be activated and deactivated for phase currents and earth current separately by the parameters **O/C PHASES (1201/BU)** or **O/C EARTH (1501/BU)**. Likewise, the associated parameters can be set separately for phase currents and earth current.

The overcurrent protection function can be blocked from the central unit as well as from the bay unit (Figure 5-50, page 232). Additionally, individual function elements can be blocked selectively via the binary inputs of the bay unit (Figure 5-47, page 217 and Figure 5-48, page 218).

The overcurrent protection can be set to either a definite time or an inverse time characteristic. For the inverse time characteristic of the overcurrent stage there are three types according to IEC 255-3 (Figure 9-1, page 352):

- Normal inverse, acc. to IEC 255-3 (type A)
- Very inverse, acc. to IEC 255-3 (type B)
- Extremely inverse, acc. to IEC 255-3 (type C)

The characteristic is set with the parameters **CHARAC. PH (7812/BU)** for the overcurrent stage of the phase currents, and **CHARAC. E (7815/BU)** for the overcurrent stage of the earth current. The characteristic of the inverse-time O/C protection is selected with the parameter **CHARACTER. (1211/BU)** or **(1511/BU)**.

The selected overcurrent characteristic curve can be superimposed by a high-set stage **I>> (1202/BU)** or **IE>> (1502/BU)** that works always with a current-independent command time. The principle of the overcurrent protection for phase currents and earth current is shown in Figures 5-47, page 217 and 5-48, page 218.

All stages can be set individually and independently of one another. For the selection of threshold values and delay times, the interaction of the bay unit with the busbar protection should be considered.

If a circuit breaker is manually closed onto a fault current, it can be re-opened immediately. It is possible to override the delay time for either the overcurrent stages with the parameters **MAN. CLOSE (1221/BU)** or **(1521/BU)**, or for the high-set current stages with the binary input ">CB man. c.l ose" (**FNo. 7618/BU**). In that case an undelayed trip command is issued if a fault is detected on the respective stage.



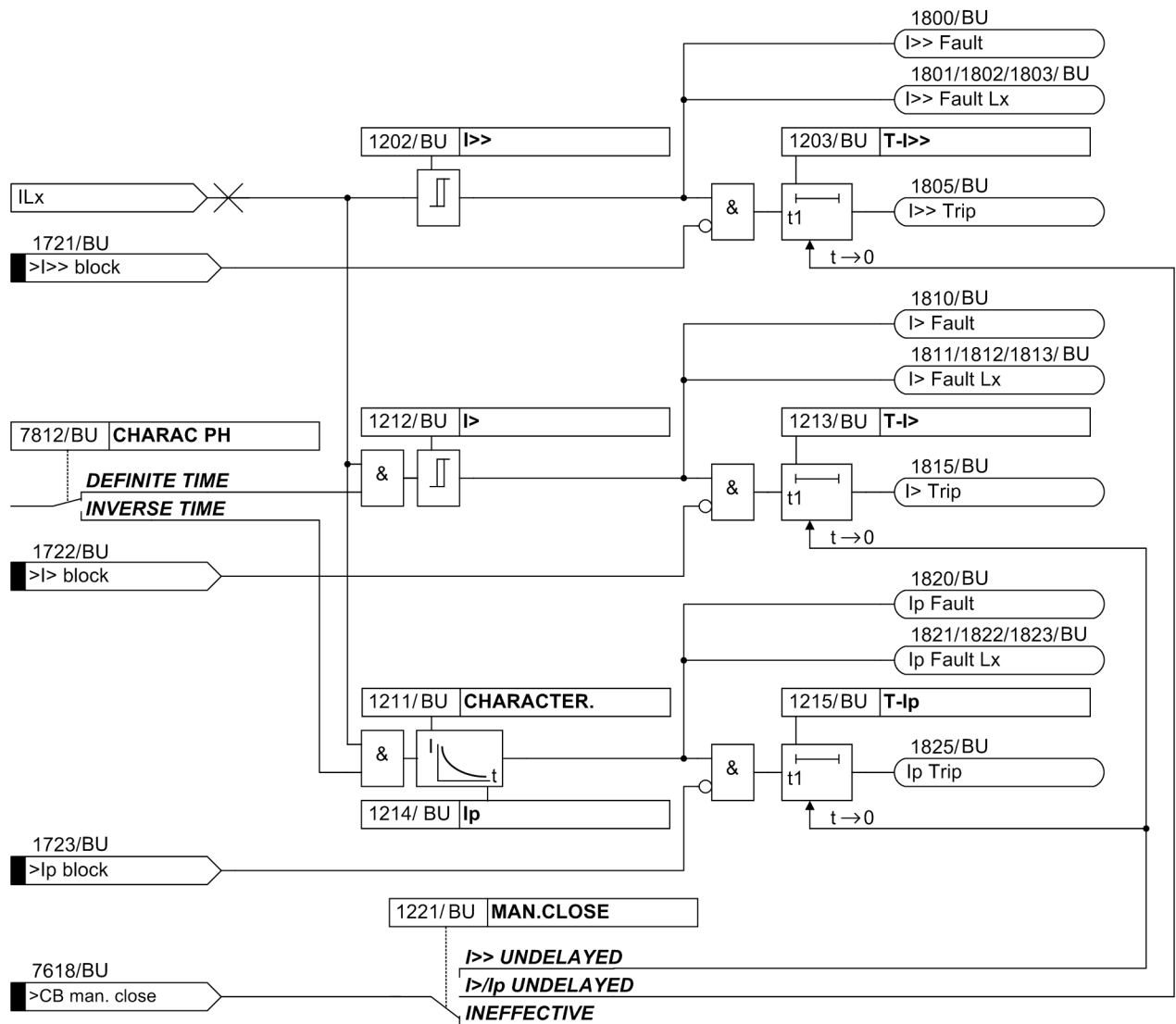


Figure 5-47 O/C protection for phase currents

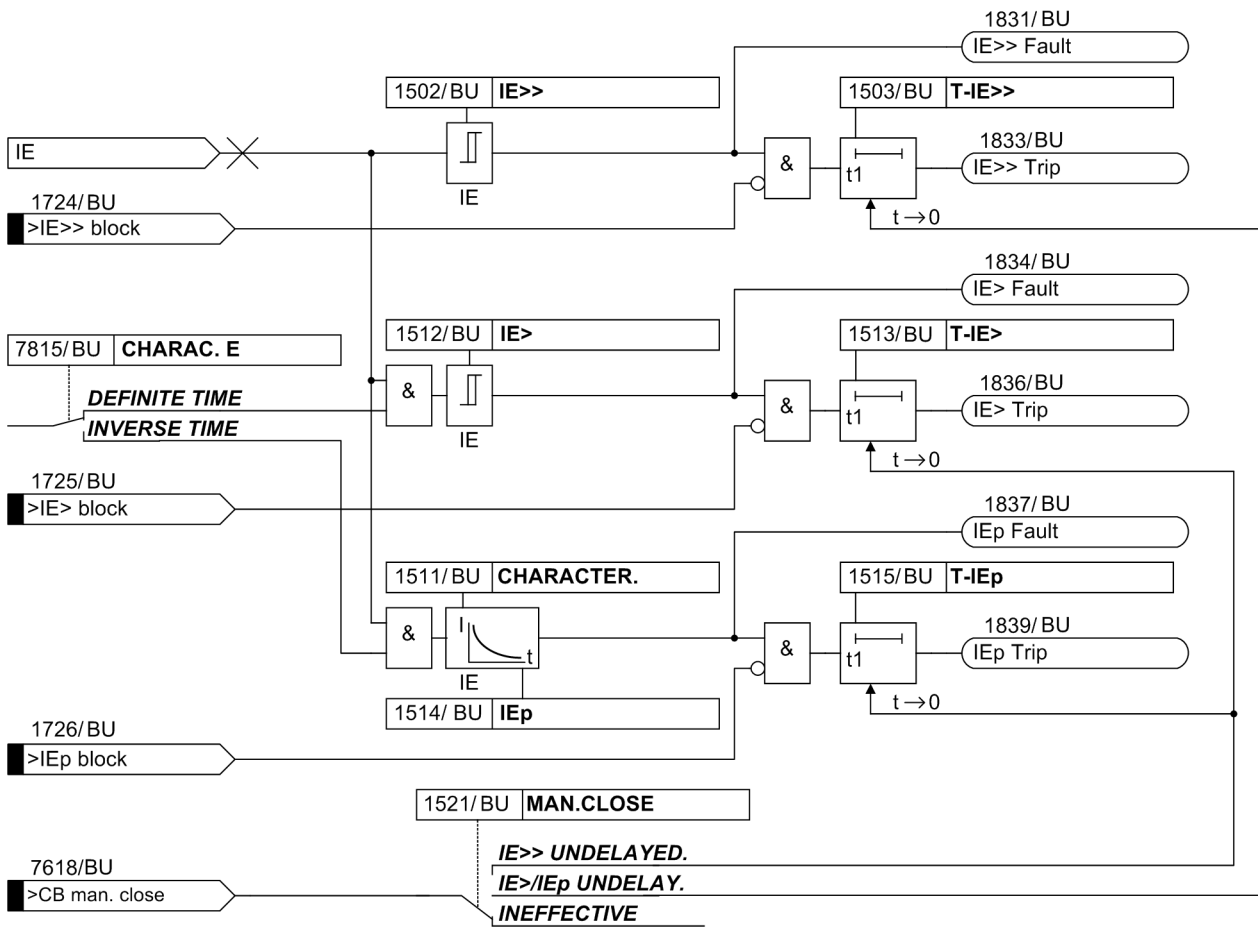


Figure 5-48 O/C protection for the earth current

**Definite-time over-current protection**

For the overcurrent stage and/or the high-set current stage, thresholds for the phase current can be set with the parameters **I>** (1212/BU) or **I>>** (1202/BU) respectively. Each phase current is compared individually with these thresholds, and a phase-selective signal is issued if these thresholds are exceeded. After the corresponding delay times **TI>** (1213/BU) or **TI>>** (1203/BU) respectively have elapsed, the TRIP command is issued. The TRIP command is available individually for the overcurrent and for the high-set stage.

For the earth fault stages, the thresholds for the phase currents are set with the parameters **IE>** (1512/BU) or **IE>>** (1502/BU) respectively. The earth fault is compared with the thresholds. As soon as one of these thresholds is exceeded, the delay time **TIE>** (1513/BU) or **TIE>>** (1503/BU) respectively is started. After this delay has elapsed, a TRIP command is issued.

**Inverse-time overcurrent protection**

For the overcurrent and the high-set stage, thresholds for the phase current can be set with the parameters **Ip** (1214/BU) or **I>>** (1202/BU) respectively. Each phase current is compared individually with these thresholds. For both stages, the thresholds for the earth current can be set with the parameters **IEp** (1514/BU) or **IE>>** (1502/BU) respectively. The earth fault is compared with the thresholds. If the **Ip** or the **IEp** threshold is exceeded, the time to trip is calculated and started. The time to trip is calculated on the basis of the flowing fault current, and depends on the selected trip time multiplier. The time multiplier is set with the parameters **TIp** (1215/BU) or **TIEp** (1515/BU) respectively.

If the thresholds for the high-set stage of the phase or earth current are exceeded, a TRIP command is always issued as soon as the current-independent trip time has elapsed. This happens regardless of the tripping characteristic set for **Ip** and/or **IEp**.

In inverse-time overcurrent protection, the parameters **RMS FORMAT** (1216/BU) or (1516/BU) respectively are used to specify whether the currents will be evaluated as r.m.s. values, or on the basis of their fundamental wave obtained by means of digital filtering.

**5.16.2 Setting Notes****O/C PHASES**

The parameter **O/C PHASES** (1201/BU) is used to activate and deactivate the O/C protection for the phase currents.

With setting **ON**, the O/C protection for the phase currents is active.

With setting **OFF**, the O/C protection for the phase currents is deactivated.

**I>>**

In a first step, the high-set stage **I>>** is set (1202/BU to 1206/BU). This stage is often used for current grading before high impedances such as transformers, motors or generators. The high-set current stage **I>>** is always a definite time stage, regardless of the tripping characteristic set for the **I>** stage. It is set such that it picks up on short-circuits into this impedance.

All set times are pure delay times which do not include the operating times of the protection (measuring time, dropout time). If the **I>>** stage is not required, the time **TI>>** (1203/BU) is set to infinite.

The parameter **I>>** (1202/BU) is used to the threshold for the phase currents in the high-set stage (definite-time).

- TI>>** The parameter **TI>>** (**1203/BU**) is used to set the trip time delay for tripping of the high-set current stage (definite-time). The delay time is started when the threshold for the phase currents is exceeded. This threshold is set with the parameter **I>>** (**1202/BU**).
- MEAS.REPET** The parameter **MEAS.REPET** (**1206/BU**) is used to select whether a repetition of the measurement will be performed for the phase currents in the high-set stage.
- With setting **YES** the measurement of the phase currents in the high-set stage will be repeated.
- With setting **NO** the measurement of the phase currents in the high-set stage will not be repeated.
- CHARACTER.** The parameter **CHARACTER.** (**1211/BU**) is used to select the characteristic of the inverse-time O/C protection for the phase currents.
- This parameter is only displayed if the parameter **CHARAC. PH** (**7812/BU**) is set to **INVERSE TIME**.
- With setting **NORMAL INVERSE**, a characteristic according to IEC 255-3 (type A) will be used.
- With setting **VERY INVERSE**, a characteristic according to IEC 255-3 (type B) will be used.
- With setting **EXTREMELY INVERSE**, a characteristic according to IEC 255-3 (type C) will be used.
- I>** **I>** (**1212/BU**) and **TI>** (**1213/BU**) are only relevant for the definite time mode (**CHARAC. PH = DEFINITE TIME** (**7812/BU**), Chapter 5.14, page 212). For the setting of the overcurrent stage **I>** the most relevant factor to be considered is the maximum operating current that can occur. A pick-up caused by overload must be excluded, since, in this mode, the device operates as fault protection with correspondingly short tripping times and not as overload protection.
- If the **I>** stage is not required, the time **TI>** (**1213/BU**) is set to infinite.
- The parameter **I>** (**1212/BU**) is used to set the threshold for the phase currents in the overcurrent stage.
- This parameter is only displayed if the parameter **CHARAC. PH** (**7812/BU**) is set to **DEFINITE TIME**.
- TI>** The parameter **TI>** (**1213/BU**) is used to set the trip time delay for tripping of the overcurrent stage. The delay time is started when the threshold for the phase currents is exceeded. This threshold is set with the parameter **I>** (**1212/BU**).
- This parameter is only displayed if the parameter **CHARAC. PH** (**7812/BU**) is set to **DEFINITE TIME**.
- Ip** **Ip** (**1214/BU**) and **TIp** (**1215/BU**) are only relevant for the inverse-time characteristics (**CHARAC. PH = DEFINITE TIME** (**7812/BU**), (Chapter 5.14, page 212). Please note that in accordance to IEC regulations a safety factor of about 1.1 has been included between the pick-up value and the setting value. This means that a pickup will only occur if a current of about 1.1 times of the setting value is present.
- If the **Ip** stage is not needed, the time **TIp** is set to infinite. With setting **0** the protection trips after the inherent operating time.

The parameter **Ip (1214/BU)** is used to set the threshold for the phase currents in the overcurrent stage of the inverse-time O/C protection.

This parameter is only displayed if the parameter **CHARAC. PH (7812/BU)** is set to **INVERSE TIME**.

**TIp**

The parameter **TIp (1215/BU)** is used to set the trip time delay (time multiplier) for the overcurrent stage of the inverse-time O/C protection.

This parameter is only displayed if the parameter **CHARAC. PH (7812/BU)** is set to **INVERSE TIME**.

**RMS FORMAT**

The parameter **RMS FORMAT (1216/BU)** is used to select the format in which the currents will be evaluated for the current calculation of the overcurrent stage.

This parameter is only displayed if the parameter **CHARAC. PH (7812/BU)** is set to **INVERSE TIME**.

With setting **FUNDAMENTAL** the fundamental wave of the currents will be evaluated.

With setting **TRUE RMS** the r.m.s. value of the currents will be evaluated.

**MAN. CLOSE**

The parameter **MAN. CLOSE (1221/BU)** is used to set whether the trip time delay for the overcurrent or high-set current stage for the phase currents will be overridden if the circuit breaker is manually closed.

With setting **I>> UNDELAYED** the delay time set with the parameter **TI>> (1203/BU)** will be disregarded.

With setting **I> /Ip UNDELAYED.** the delay time set with the parameter **TI> (1213/BU)** will be disregarded.

With setting **INEFFECTIVE** the delay times set with the parameters **TI>> (1203/BU)** or **TI> (1213/BU)** respectively are not disregarded.

**O/C EARTH**

The parameter **O/C EARTH (1501/BU)** is used to activate and deactivate the O/C protection for the earth current.

With setting **ON**, the O/C protection for the earth current is active.

With setting **OFF**, the O/C protection for the earth current is deactivated.

**IE>>**

In a first step, the high-set stage **IE>>** is set (**1502/BU** to **1506/BU**). For the settings, similar factors as for the stages **I>>** and **I>** have to be considered. If the **IE>>** stage is not needed, the time **TIE>> (1503/BU)** is set to infinite.

The parameter **IE>> (1502/BU)** is used to set the threshold for the earth current in the high-set stage (definite-time).

**TIE>>**

The parameter **TIE>> (1503/BU)** is used to set the trip time delay for tripping of the high-set current stage (definite-time). The delay time is started when the threshold for the earth current is exceeded. This threshold is set with the parameter **IE>> (1502/BU)**.

- MEAS . REPET**            The parameter **MEAS . REPET (1506/BU)** is used to select whether a repetition of the measurement will be performed for the earth current in the high-set stage.
- With setting **YES** the measurement of the earth current in the high-set current stage will be repeated.
- With setting **NO** the measurement of the earth current in the high-set current stage will not be repeated.
- 
- CHARACTER.**            The parameter **CHARACTER. (1511/BU)** is used to select the characteristic of the inverse-time O/C protection for the earth current.
- This parameter is only displayed if the parameter **CHARAC. E (7815/BU)** is set to **INVERSE TIME**.
- With setting **NORMAL INVERSE**, a characteristic according to IEC 255-3 (type A) will be used.
- With setting **VERY INVERSE**, a characteristic according to IEC 255-3 (type B) will be used.
- With setting **EXTREMELY INVERS**, a characteristic according to IEC 255-3 (type C) will be used.
- 
- IE>**                      For earth faults the pickup values and delay times can be set individually. This allows to use a different grading with shorter delays for earth faults. **IE> (1512/BU)** and **TIE> (1513/BU)** are only relevant for the definite-time mode (**CHARAC. E = DEFINITE TIME (7815/BU)**, Chapter 5.14, page 212). For setting the overcurrent stage **IE>** the most relevant factor to be considered is the lowest earth fault current that can occur.
- If the **IE>** stage for earth faults is not to be active at all, the delay time **TIE> (1513/BU)** can be set to infinite.
- The parameter **IE> (1512/BU)** is used to the threshold for the earth current in the overcurrent stage.
- This parameter is only displayed if the parameter **CHARAC. E (7815/BU)** is set to **DEFINITE TIME**.
- 
- TIE>**                      The parameter **TIE> (1513/BU)** is used to set the trip time delay for tripping of the overcurrent stage. The delay time is started when the threshold for the earth current is exceeded. This threshold is set with the parameter **IE> (1512/BU)**.
- This parameter is only displayed if the parameter **CHARAC. E (7815/BU)** is set to **DEFINITE TIME**.
- 
- IEp**                      **IEp (1514/BU)** and **TIEp (1515/BU)** are only relevant for the inverse-time characteristics (**CHARAC. E = DEFINITE TIME (7815/BU)**, Chapter 5.14, page 212). This allows to use a different grading with shorter delays for earth faults. Please note that in accordance to IEC regulations a safety factor of about 1.1 has been included between the pick-up value and the setting value. This means that a pickup will only occur if a current of about 1.1 times of the setting value is present. If the **IEp** stage for earth is not to be active at all, the delay time **TIEp** can be set to infinite.
- If the  $I_{Ep}$  stage is not needed at all, the time **TIEp** is set to infinite. With setting **0** the protection trips after the inherent operating time.
- The parameter **IEp (1514/BU)** is used to set the threshold for the earth current in the overcurrent stage of the inverse-time O/C protection.

This parameter is only displayed if the parameter **CHARAC. E (7815/BU)** is set to **IN-VERSE TIME**.

**TIEp**

The parameter **TIEp (1515/BU)** is used to set the trip time delay (time multiplier) for the overcurrent stage of the inverse-time O/C protection.

This parameter is only displayed if the parameter **CHARAC. E (7815/BU)** is set to **IN-VERSE TIME**.

**RMS FORMAT**

The parameter **RMS FORMAT (1516/BU)** is used to select the format in which the currents will be evaluated for the current calculation of the overcurrent stage.

This parameter is only displayed if the parameter **CHARAC. E (7815/BU)** is set to **IN-VERSE TIME**.

With setting **FUNDAMENTAL** the fundamental wave of the currents will be evaluated.

With setting **TRUE RMS** the r.m.s. value of the currents will be evaluated.

**MAN. CLOSE**

The parameter **MAN. CLOSE (1521/BU)** is used to set whether the trip time delay for the overcurrent or high-set current stage for the earth current will be overridden if the circuit breaker is manually closed.

With setting **IE>> UNDELAYED** the delay time set with the parameter **TIE>> (1503/BU)** will be disregarded.

With setting **IE> / IEp UNDELAYED**, the delay time set with the parameter **TIE> (1513/BU)** will be disregarded.

With setting **INEFFECTIVE** the delay times set with the parameters **TIE>> (1503/BU)** or **TIE> (1513/BU)** respectively are not disregarded.

### 5.16.3 Settings of the Bay Unit

| Addr. | Setting Title   | Setting Options  | Default Settings    | Comments   |
|-------|-----------------|--|---------------------|--|
| 1201  | O/C PHASES      | ON<br>OFF  | ON                  | O/C protection for phase currents  |
| 1202  | I>>             | 0.05 .. 25.00 I <sub>N</sub>                                 | 2.00 I <sub>N</sub> | Pick-up value of the high-set stage I>>  |
| 1203  | TI>>            | 0.00 .. 60.00 s; +*  | 0.10 s              | Trip time delay of the high-set stage for phase currents                               |
| 1206  | MEAS.REPET      | YES<br>NO  | NO                  | Option to set a measurement repetition   |
| 1211  | CHARACTER.      | NORMAL INVERSE<br>VERY INVERSE<br>EXTREMELY INVERS           | NORMAL IN-<br>VERSE | Tripping characteristic for the phase current  |
| 1212  | I>              | 0.05 .. 25.00 I <sub>N</sub>                                 | 1.00 I <sub>N</sub> | Pick-up value of the overcurrent stage I>  |
| 1213  | TI>             | 0.00 .. 60.00 s; +*<br>infinite                              | 0.50 s              | Trip time delay of the overcurrent stage I>  |
| 1214  | I <sub>p</sub>  | 0.10 .. 4.00 I <sub>N</sub>                                  | 1.00 I <sub>N</sub> | Pick-up value of the overcurrent stage I <sub>p</sub> for the phase currents           |
| 1215  | TI <sub>p</sub> | 0.05 .. 10.00 s<br>0; +*                                     | 0.50 s              | Time multiplier for phase currents   |
| 1216  | RMS FORMAT      | FUNDAMENTAL<br>TRUE RMS                                      | FUNDAMENTAL         | RMS format for inverse time O/C protection   |
| 1221  | MAN.CLOSE       | I>> UNDELAYED<br>I> /I <sub>p</sub> UNDELAYED<br>INEFFECTIVE | I>> UNDELAYED       | Overcurrent stage valid for phase currents when the circuit breaker is manually closed |
| 1501  | O/C EARTH       | ON<br>OFF  | ON                  | O/C protection for the earth current   |
| 1502  | IE>>            | 0.05 .. 25.00 I <sub>N</sub>                                 | 0.50 I <sub>N</sub> | Pick-up value of the earth current for the high-set stage                              |
| 1503  | TIE>>           | 0.00 .. 60.00 s; +*  | 0.50 s              | Trip time delay of the high-set current stage for the earth current                    |
| 1506  | MEAS.REPET      | YES<br>NO  | NO                  | Option to set a measurement repetition   |
| 1511  | CHARACTER.      | NORMAL INVERSE<br>VERY INVERSE<br>EXTREMELY INVERS           | NORMAL IN-<br>VERSE | Tripping characteristic for the earth current  |
| 1512  | IE>             | 0.05 .. 25.00 I <sub>N</sub>                                 | 0.20 I <sub>N</sub> | Pick-up value of the earth current for the overcurrent stage                           |
| 1513  | TIE>            | 0.00 .. 60.00 s; +*  | 0.50 s              | Trip time delay of the overcurrent stage for the earth current                         |
| 1514  | IE <sub>p</sub> | 0.10 .. 4.00 I <sub>N</sub>                                  | 0.10 I <sub>N</sub> | Pick-up value of the overcurrent stage IE <sub>p</sub> for the earth current           |



| Addr. | Setting Title | Setting Options                                     | Default Settings | Comments  |
|-------|---------------|---|------------------|---|
| 1515  | TIEp          | 0.05 .. 10.00 s<br>0; +*                            | 0.50 s           | Time multiplier for earth current   |
| 1516  | RMS FORMAT    | FUNDAMENTAL<br>TRUE RMS                             | FUNDAMENTAL      | RMS format of the earth current for inverse time O/C protection                       |
| 1521  | MAN.CLOSE     | IE>> UNDELAYED<br>IE> /IEp UNDELAYED<br>INEFFECTIVE | IE>> UNDELAYED   | Overcurrent stage valid for earth current when the circuit breaker is manually closed |
| 7812  | CHARAC. PH    | SCOPE OF FUNCTIONS                                  | DEFINITE TIME    | Characteristic O/C protection phases  |
| 7815  | CHARAK. E     | SCOPE OF FUNCTIONS                                  | DEFINITE TIME    | Characteristic O/C protection earth   |

#### 5.16.4 List of Information from the Bay Unit

| FNo. | Alarm         | Comments                                  |
|------|---------------|---|
| 1721 | >I>> block    | >Overcurrent protection: block stage I>>  |
| 1722 | >I> block     | >Overcurrent protection: block stage I>   |
| 1723 | >Ip block     | >Overcurrent protection: block stage Ip   |
| 1724 | >IE>> block   | >Overcurrent protection: block stage IE>> |
| 1725 | >IE> block    | >Overcurrent protection: block stage IE>  |
| 1726 | >IEp block    | >Overcurrent protection: block stage IEp  |
| 1815 | I > Trip      | O/C protection I> phase trip              |
| 1825 | Ip Trip       | O/C protection Ip phase trip              |
| 1833 | IE>> Trip     | O/C protection IE>> earth trip            |
| 1836 | IE> Trip      | O/C protection IE> earth trip             |
| 1839 | IEp Trip      | O/C protection IEp earth trip             |
| 7618 | >CB man.close | >Circuit breaker manual close             |

## 5.17 User-Defined Annunciations

### 5.17.1 Functional Description

The bay unit possesses four user-defined annunciations "Annuciation1" .. 4 (FNo. 7696/BU, 7697/BU, 7698/BU, 7699/BU) that you can define yourself and assign to signal relays, LEDs or command relays.

Each user-defined annunciation is allocated to a delay time. The delay times are set with the parameters **T-Annunc.1** to **T-Annunc.4** (2801/BU, 2802/BU, 2803/BU, 2804/BU). Each of these four delay times can be started by its own binary input >Annunc. 1 .. 4 (FNo. 11, 12, 13, 14/BU). After the delay time has elapsed and if the parameter "ANNUN1byCU" .. "ANNUN4byCU" (2811/BU, 2812/BU, 2813/BU, 2814/BU) is set to *NO*, the user-defined annunciations "Annunc. 1" .. 4 (FNo. 7696/BU, 7697/BU, 7698/BU, 7699/BU) are issued.

**Input Annunciation Central Unit** In addition, the delayed binary input annunciation ">Annuciation1" .. 4 (FNo. 11, 12, 13, 14/BU) are transferred to the central unit. The associated input annunciation at the central unit is BU "INx \$00" (FNo. 176.1141/BU, FNo. 176.1143/BU, FNo. 176.1145/BU, FNo. 176.1147/BU)

**Output Annunciation Central Unit** In the central unit you can send 4 output annunciations "OUT1 \$00" (FNo. 176.1142/BU, FNo. 176.1144/BU, FNo. 176.1146/BU, FNo. 176.1148/BU) to each bay unit to generate the "Annuciation1" .. 4 (FNo. 7696/BU, 7697/BU, 7698/BU, 7699/BU) .

**Simulation of Binary Input** These annunciation can be used optionally to simulate a binary input annunciation having the meaning specified by parameter **ANN1Fct.No** to **ANN4Fct.No** (2821/BU .. 2824/BU).

**Bay Unit Annunciation to Central Unit** Up to four annunciations available in the bay unit can be transferred to the central unit. For this, use parameters **ANN1Inp.No** to **ANN4Inp.No** (2831/BU, 2832/BU, 2833/BU, 2834/BU) to select the desired annunciation number. Therefore, it is unnecessary to assign the annunciation to the output relay and read it back via binary inputs as user-defined annunciation.

The following figure shows a simplified schematic.

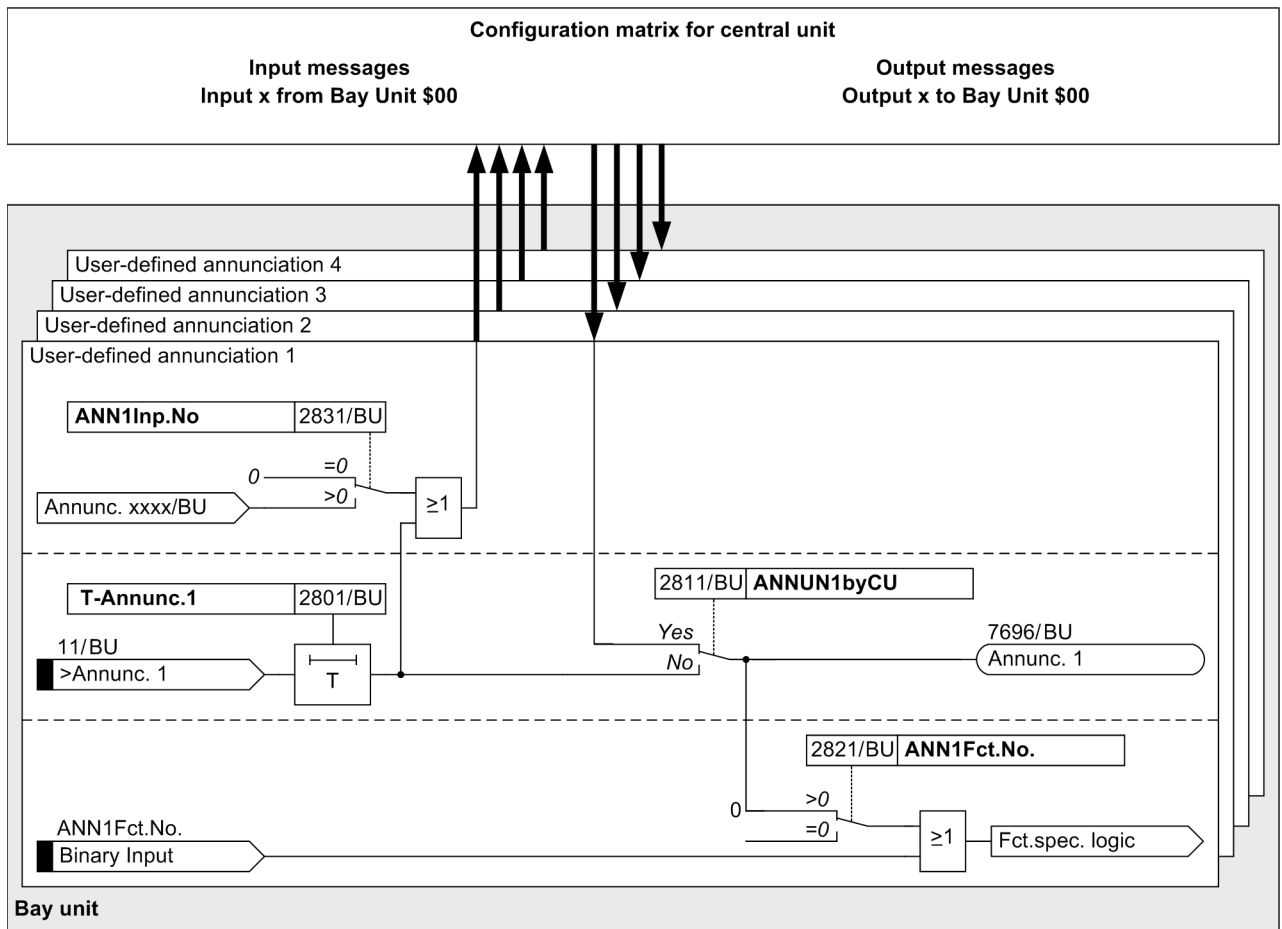


Figure 5-49 User-define annunciations



**NOTE**

Do not interconnect the user-defined logic in such a way that the output annunciation is fed back to the input annunciation again (closed loop). In such a case it may become necessary to interrupt the connection to the central unit to correct the parameterization again.

## 5.17.2 Setting Notes

|  |   |
|--|---|
| <b>T-Annunc.1</b><br><b>T-Annunc.2</b><br><b>T-Annunc.3</b><br><b>T-Annunc.4</b> | The parameters <b>T-Annunc.1 (2801/BU)</b> , <b>T-Annunc.2 (2802/BU)</b> , <b>T-Annunc.3 (2803/BU)</b> and <b>T-Annunc.4 (2804/BU)</b> are used to set the delay times for the user-defined annunciations 1, 2, 3 and 4.  |
| <b>ANN1Inp.No</b><br><b>ANN2Inp.No</b><br><b>ANN3Inp.No</b><br><b>ANN4Inp.No</b> | Use parameters <b>ANN1Inp.No</b> to <b>ANN4Inp.No (2831/BU, 2832/BU, 2833/BU, 2834/BU)</b> to set any annunciation numbers (see Appendix A.10, page 416) that can be transferred to the central unit.                     |
| <b>ANN1Fct.No</b><br><b>ANN2Fct.No</b><br><b>ANN3Fct.No</b><br><b>ANN4Fct.No</b> | Use parameters <b>ANN1Fct.No (2821/BU)</b> , <b>ANN2Fct.No (2822/BU)</b> , <b>ANN3Fct.No (2823/BU)</b> and <b>ANN4Fct.No (2824/BU)</b> to enter the annunciation number of the binary input annunciation to be generated. |

### 5.17.3 Settings of the Bay Unit

| Addr. | Parameters | Setting Options | Default Settings | Comments                                       |
|-------|------------|-----------------|------------------|--|
| 2801  | T-Annunc.1 | 0.00..10.00 s   | 0.00 s           | Delay time for 1st user defined annunciation   |
| 2802  | T-Annunc.2 | 0.00..10.00 s   | 0.00 s           | Delay time for 2nd user defined annunciation   |
| 2803  | T-Annunc.3 | 0.00..10.00 s   | 0.00 s           | Delay time for 3rd user defined annunciation   |
| 2804  | T-Annunc.4 | 0.00..10.00 s   | 0.00 s           | Delay time for 4th user defined annunciation   |
| 2811  | ANNUN1byCU | NO<br>YES       | NO               | Processing of annunciation 1 by central unit   |
| 2812  | ANNUN2byCU | NO<br>YES       | NO               | Processing of annunciation 2 by central unit   |
| 2813  | ANNUN3byCU | NO<br>YES       | NO               | Processing of annunciation 3 by central unit   |
| 2814  | ANNUN4byCU | NO<br>YES       | NO               | Processing of annunciation 4 by central unit   |
| 2821  | ANN1Fct.No | 0..9999         | 0                | Binary input annunciation (Fct.no) by annunc.1 |
| 2822  | ANN2Fct.No | 0..9999         | 0                | Binary input annunciation (Fct.no) by annunc.2 |
| 2823  | ANN3Fct.No | 0..9999         | 0                | Binary input annunciation (Fct.no) by annunc.3 |
| 2824  | ANN4Fct.No | 0..9999         | 0                | Binary input annunciation (Fct.no) by annunc.4 |
| 2831  | ANN1Inp.No | 0..9999         | 0                | Input annunciation (no.) for user logic1       |
| 2832  | ANN2Inp.No | 0..9999         | 0                | Input annunciation (no.) for user logic2       |
| 2833  | ANN3Inp.No | 0..9999         | 0                | Input annunciation (no.) for user logic3       |
| 2834  | ANN4Inp.No | 0..9999         | 0                | Input annunciation (no.) for user logic4       |

### 5.17.4 List of Information from the Bay Unit

| FNo. | Alarm      | Comments                     |
|------|------------|------------------------------|
| 11   | >Annunc. 1 | >User defined annunciation 1 |
| 12   | >Annunc. 2 | >User defined annunciation 2 |
| 13   | >Annunc. 3 | >User defined annunciation 3 |
| 14   | >Annunc. 4 | >User defined annunciation 4 |
| 7696 | Annunc. 1  | User defined annunciation 1  |
| 7697 | Annunc. 2  | User defined annunciation 2  |
| 7698 | Annunc. 3  | User defined annunciation 3  |
| 7699 | Annunc. 4  | User defined annunciation 4  |

## 5.18 Backup Breaker Failure Protection in the Bay Unit

### 5.18.1 Functional Description

If an overcurrent protection function is provided as backup protection in the bay unit, and if the backup breaker failure protection function of the bay unit has been activated with the parameter **BackUp CBF (3901/BU)**, a separate breaker failure protection can be initiated by the bay unit. As an alternative, the binary inputs of the bay unit can be used to activate ">b.u. CBF on" (**FNo. 1401/BU**) and deactivate (">b.u. CBF off" (**FNo. 1402/BU**)) this breaker failure protection function. The annunciation "b.u. CBF act." (**FNo. 1453/BU**) signals that the function is active. With the function turned off, the annunciation "b.u. CBF off" (**FNo. 1451/BU**) will appear. The various blocking options for the backup breaker failure protection are shown in Figure 5-50, page 232 and Figure 5-53, page 235. The backup breaker failure protection works independently of the busbar protection function and remains active even if the link to the central unit is interrupted or if the bay unit is set with the parameter **Bay status (XX12/CU)** to feeder **out of service**.

The breaker failure protection picks up as soon as the O/C protection issues a trip command, and one or more of the 3 phase currents have reached the current threshold. This threshold can be set with the parameter **B.U.CBF-I (3911/BU)**. The TRIP command "b.u. CBF Trip" (**FNo. 1471/BU**) of the breaker failure protection is issued as soon as the delay time **B.U.CBF-T (3912/BU)** has expired. If the pickup of the breaker failure protection is cleared before this time has elapsed, no TRIP command is issued. The pickup is cleared if the current drops below the threshold. If the TRIP command issued by the breaker failure protection does not result in disconnection of a system fault, and if the bay unit is linked with the central unit, the main CBF protection function is initiated after the delay time **T-BF-mP (XX21/CU)** has elapsed. This allows to issue a transfer trip command to all feeders of the faulted bus zone, provided that the tripping conditions for the configured operating mode are fulfilled.

3 binary inputs are provided for phase-selective initiation of the CBF protection, and one binary input for 3-pole initiation. Phase-selective initiation is only possible if exactly one of the phase-selective binary inputs is active. If several phase-selective binary inputs are active, a single-pole start is carried out. Each initiation starts an individual time stage. After this time stage has elapsed, the TRIP command is issued. The delay time is set independently of the type of initiation with the parameter **B.U.CBF-T (3912/BU)** as well. After the TRIP command, the CBF main protection function is initiated, just as in the case of initiation by the overcurrent protection. Please note that the delay time for this is always set with the parameter **T-BF-mP (XX21/CU)**, even if the first initiation was single-phase.

To provide more security when the CBF protection is initiated by binary input, signals at the release inputs are required for a successful initiation. These release inputs are identical with those used for the CBF main protection function. There is one release input for 1-phase initiation, and one release input for 3-phase initiation.



#### NOTE

Release inputs that are not marshalled are disregarded.

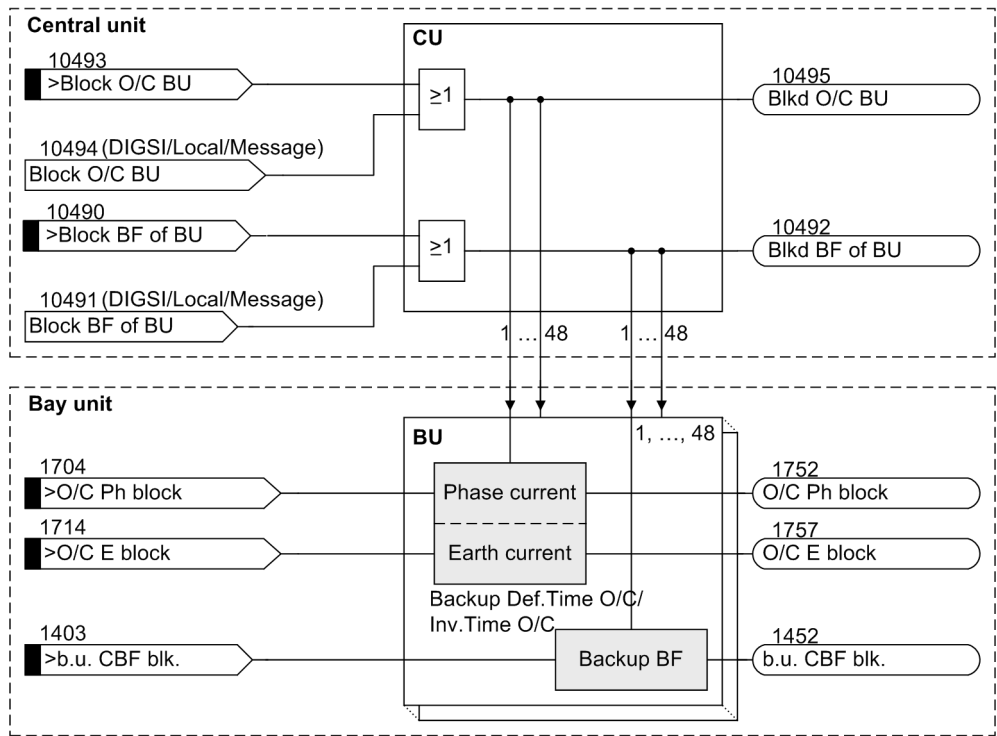


Figure 5-50 Blocking mechanism for the backup breaker failure protection and backup time overcurrent protection



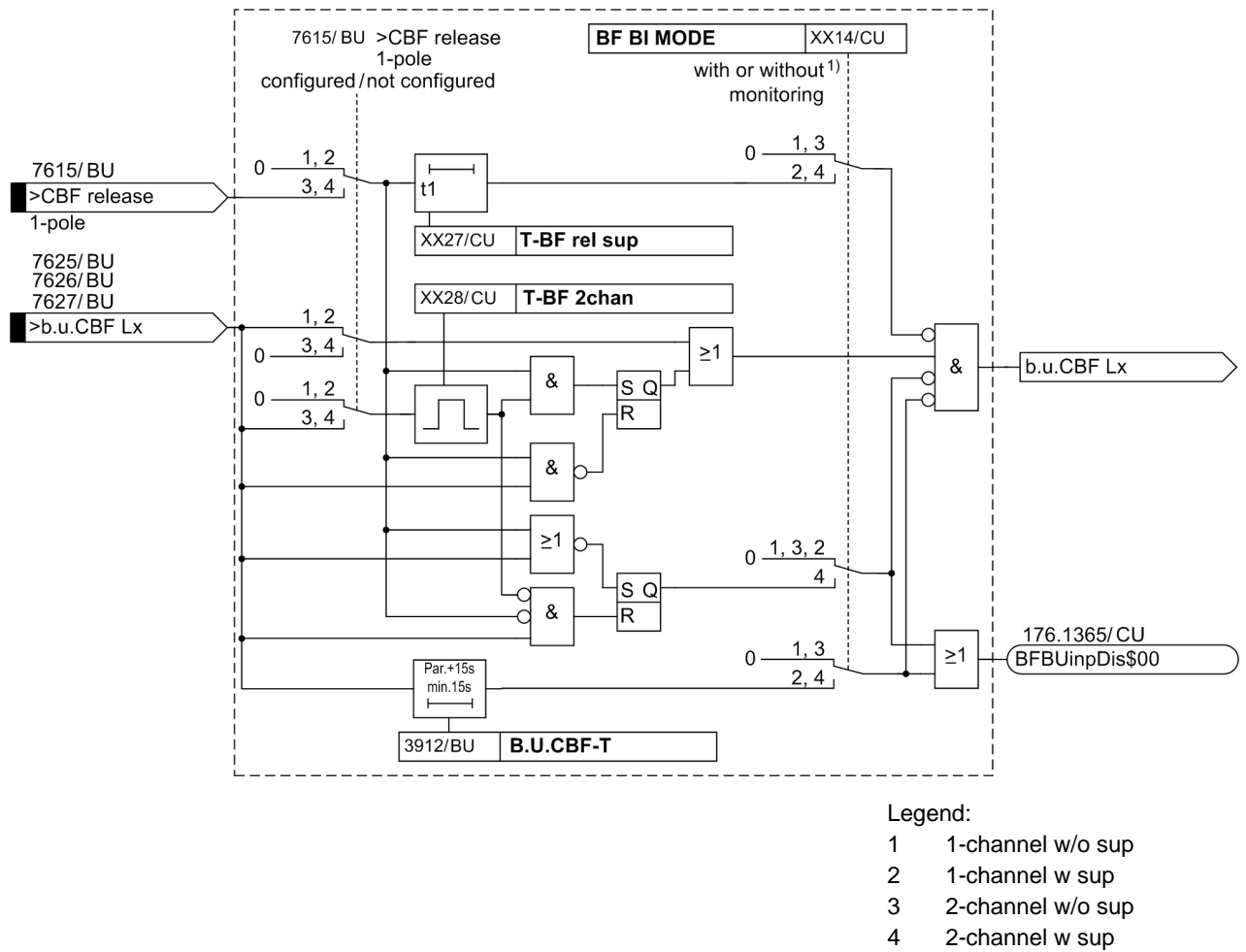


Figure 5-51 Monitoring of the Starting Binary Inputs of the Backup Protection-BFP 1-pole

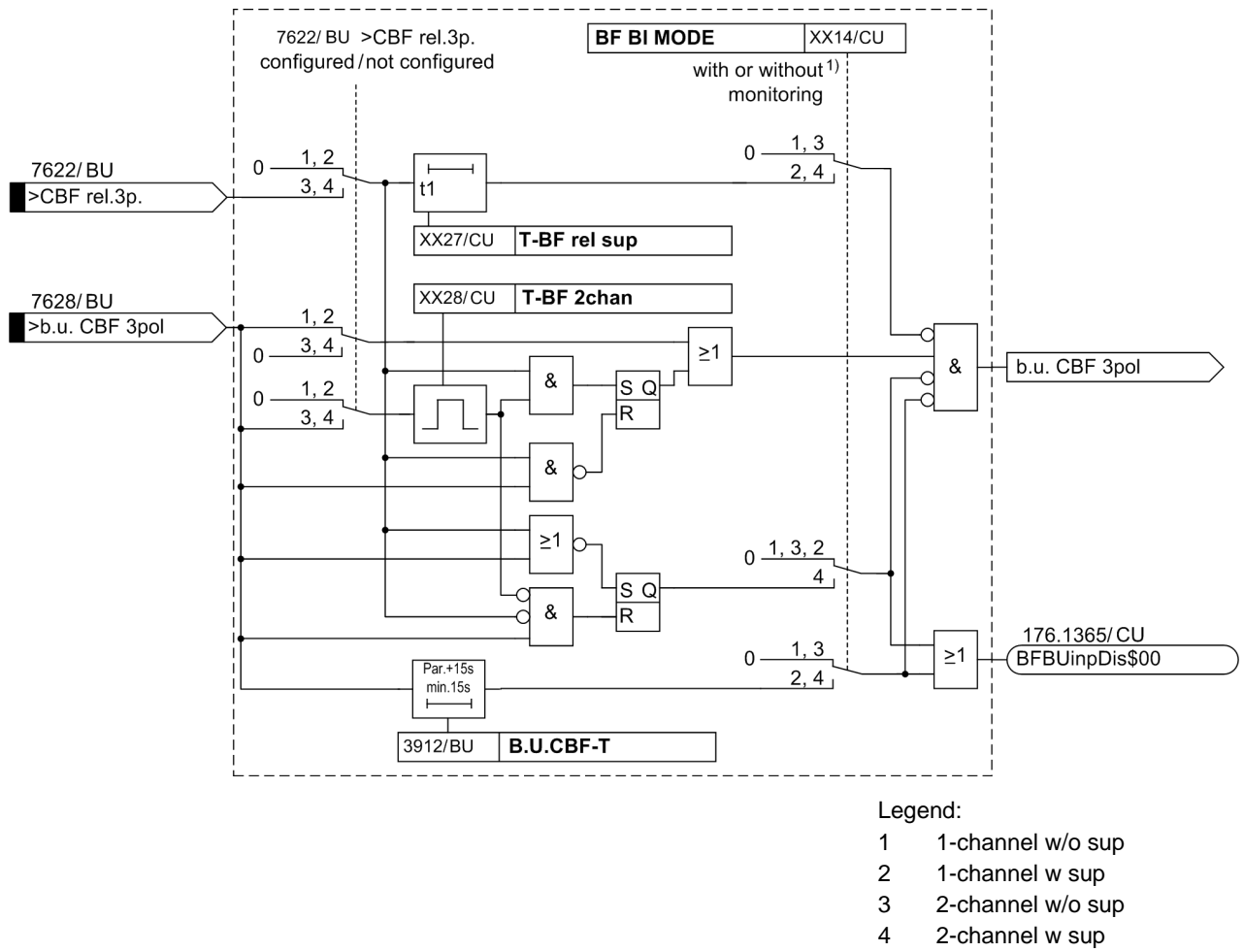
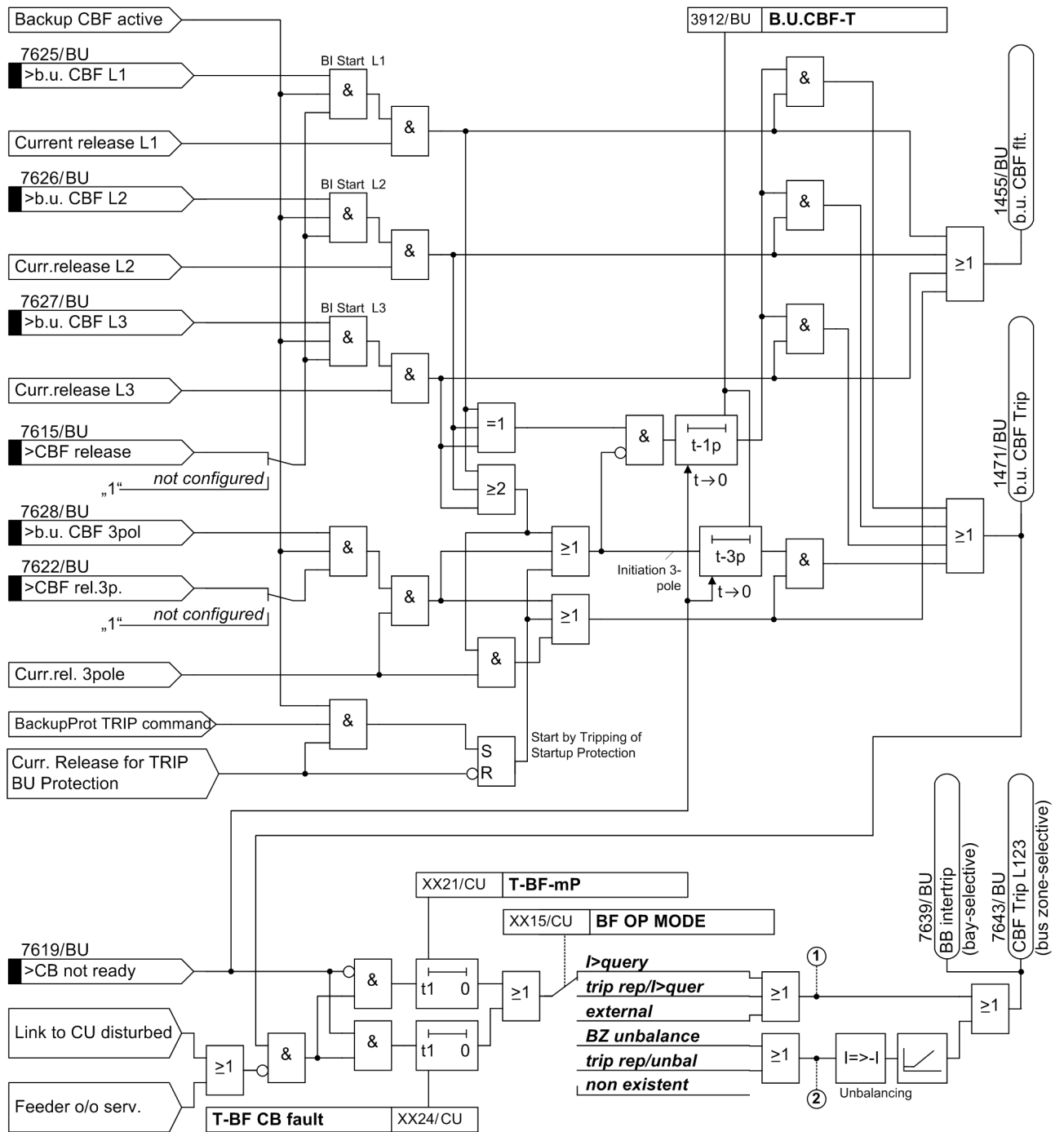


Figure 5-52 Monitoring of the Starting Binary Inputs of the Backup Protection-BFP 3-pole



Continuation for (1) and (2) see Figure 5-25, page 148

Figure 5-53 CBF protection function of the backup protection

## 5.18.2 Setting Notes

- BackUp CBF**                    The parameter **BackUp CBF (3901/BU)** is used to activate and deactivate the breaker failure protection of the bay unit.
- B.U.CBF-I**                    The parameter **B.U.CBF-I (3911/BU)** is used to set the current threshold for the breaker failure protection of the bay unit. In the case of a circuit breaker malfunction, the TRIP repetition of the backup breaker failure protection is zero.
- When setting this parameter, you should also consider the corresponding parameter of the breaker failure protection in the central unit, so that the two protection functions complement each other in a meaningful way. Siemens therefore recommends to match the value in the bay unit to its counterpart in the central unit.
- B.U.CBF-T**                    Use parameter **B.U.CBF-T (3912/BU)** to set the time delay for the feeder-selective TRIP command (TRIP repetition) of the backup breaker failure protection of the bay unit. In the case of a circuit breaker fault the TRIP repetition time delay of the backup CBF is zero. The two time delays for TRIP repetition and CBF trip command start one after the other.
- When setting this parameter, you should also consider the corresponding parameter of the breaker failure protection in the central unit, so that the two protection functions complement each other in a meaningful way. Siemens therefore recommends to match the value in the bay unit to its counterpart in the central unit.

### 5.18.3 Settings of the Central Unit

| Addr. | Setting Title | Setting Options  | Default Settings | Comments                                 |
|-------|---------------|--|------------------|--|
| 114   | BF BI MODE    | 1-ch w/o sup<br>1-ch w sup<br>2-ch w/o sup<br>2-ch w sup                                 | 1-ch w sup       | Binary input mode / supervision BF       |
| 115   | BF OP MODE    | non existent<br>external<br>BZ unbalance<br>trip rep/unbal<br>l>query<br>trip rep/l>quer | BZ unbalance     | Operation mode BF                        |
| 121   | T-BF-mP       | 0.05 .. 10.00 s  | 0.25 s           | Time delay for BF with multi-pole faults |
| 124   | T-BF CB fault | 0.00 .. 10.00 s  | 0.10 s           | Time delay BF after CB fault             |

### 5.18.4 List of Information from the Central Unit

| FNo.  | Alarm           | Comments                                 |
|-------|-----------------|--|
| 10490 | >Block BF of BU | >Blocking back-up breaker fail.prot. BU  |
| 10491 | Block BF of BU  | Blocking back-up breaker fail.prot. BU   |
| 10492 | Blkd BF of BU   | Back-up breaker fail.prot. of BU blocked |
| 10493 | >Block O/C BU   | >Blocking O/C protection of BU           |
| 10494 | Block O/C BU    | Blocking O/C protection of BU            |
| 10495 | Blkd O/C BU     | O/C protection of BU blocked             |

### 5.18.5 Settings of the Bay Unit

| Addr. | Setting Title | Setting Options     | Default Settings | Comments   |
|-------|---------------|---------------------|------------------|--|
| 3901  | BackUp CBF    | ON<br>OFF           | OFF              | State of back-up circuit breaker failure protection function |
| 3911  | B.U.CBF-I     | 0.10 .. 4.00 I/In   | 0.50 I/In        | Current threshold of back-up breaker failure protection      |
| 3912  | B.U.CBF-T     | 0.06 .. 60.00 s; +* | 0.12 s           | Time delay of the back-up breaker failure protection         |

### 5.18.6 List of Information from the Bay Unit

| <b>FNo.</b> | <b>Alarm</b>  | <b>Comments</b>                            |
|-------------|---------------|--|
| 1401        | >b.u. CBF on  | >Switch on back-up breaker fail. prot.     |
| 1402        | >b.u. CBF off | >Switch off back-up breaker fail. prot.    |
| 1403        | >b.u.CBF blk. | >Block back-up breaker failure protect.    |
| 1451        | b.u. CBF off  | Back-up breaker fail.prot. switched off    |
| 1452        | b.u. CBF blk. | Back-up breaker failure prot. blocked      |
| 1453        | b.u. CBF act. | Back-up breaker failure prot. is active    |
| 1455        | b.u. CBF flt. | Back-up breaker fail. protect.: fault det. |
| 1471        | b.u. CBF Trip | Trip by back-up breaker failure prot.      |
| 1704        | >O/C Ph block | >Block overcurrent protection phases       |
| 1714        | >O/C E block  | >Block overcurrent protection earth        |
| 1752        | O/C Ph block  | Overcurrent prot. phase is blocked         |
| 7615        | >CBF release  | >Circuit breaker failure release           |
| 7619        | >CB not ready | >Circuit breaker not ready                 |
| 7625        | >b.u.CBF L1   | >Back-up breaker failure start phase L1    |
| 7626        | >b.u.CBF L2   | >Back-up breaker failure start phase L2    |
| 7627        | >b.u.CBF L3   | >Back-up breaker failure start phase L3    |
| 7628        | >b.u.CBF 3pol | >Back-up breaker failure start 3-pole      |

## Control During Operation

You will learn in this chapter how to monitor and operate the SIPROTEC 7SS52 V4 distributed busbar and breaker failure protection.

You can use the DIGSI Plant Visualization to visually monitor the substation during operation. The Plant Visualization enables the measured values and switch states to be displayed in on-line mode.

During operation you can also

- read out annunciations, operational values, and fault data,
- influence single functions and annunciations.

As a prerequisite the plant must be configured as described in Chapter 4, page 67 and the input and output functions must be allocated.

Please note that the examples given are held in a general context and may deviate in word and in detail from the devices you are using. It is also possible that not all functions are available – depending on the model variant used.

|     |                                   |     |
|-----|-----------------------------------|-----|
| 6.1 | Overview                          | 240 |
| 6.2 | Reading Out Information           | 242 |
| 6.3 | Controlling Device Functions      | 255 |
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## 6.1 Overview

You can use the 7SS52 V4 for the central operation of the bay units. Central operation means that you can employ DIGSI to manage also the bay units via the central unit. The operating options are listed in Table 6-1, page 240.

The central operation of your plant requires a PC with DIGSI installed on it to be connected to the central unit. The connection can be made either via the PC port or via the service port.

Furthermore, DIGSI enables you to connect your PC either directly to the central unit or to a bay unit to handle your components individually. As another option you can operate your components via the operator panel of the device. The bay unit 7SS525 does not have a control panel and can only be operated via DIGSI.

The description of the operating options in this chapter will mainly focus on the central operation using DIGSI. The other operating options will only be mentioned in such exceptional cases where central operation is not possible.

Table 6-1 Overview of the operating options and control options

| Operating option                                      | DIGSI logically to | CU operator panel | BU operator panel | Chapter           |
|---|--------------------|-------------------|-------------------|-------------------|
| Reading out information:                              |                    |                   |                   |                   |
| • Operational events                                  | CU, BU             | X                 | X                 | 6.2.1.1, page 244 |
| • Fault events  | CU, BU             | X                 | X                 | 6.2.1.2, page 246 |
| • General interrogation                               | CU, BU             | –                 | –                 | 6.2.1.4, page 248 |
| • Spontaneous annunciation                            | CU, BU             | –                 | –                 | 6.2.1.5, page 248 |
| • Statistical counters                                | BU                 | –                 | X                 | 6.2.1.6, page 249 |
| Reading out measured values:                          | CU, BU             | X                 | X                 | 6.2.2, page 249   |
| Reading out fault data:                               | CU, BU             | –                 | –                 | 6.2.3, page 251   |
| Controlling device functions:                         |                    |                   |                   |                   |
| • Generate oscillographic record                      | CU, BU             | X                 | X                 | 6.3.1, page 255   |
| • Block TRIP command (also selectively)               | CU, BU             | X                 | X                 | 6.3.2.1, page 256 |
| • Block breaker failure protection (also selectively) | CU, BU             | X                 | X                 | 6.3.2.2, page 260 |
| • Save annunciations                                  | CU, BU             | –                 | –                 | 6.3.3.1, page 263 |
| • Delete annunciations                                | CU, BU             | X                 | X                 | 6.3.3.2, page 264 |
| • Circuit breaker test                                | BU                 | –                 | X                 | 6.3.4, page 265   |
| • Reset blocking of differential current supervision  | CU                 | X                 | –                 | 6.3.5.1, page 267 |
| • Reset blocking of disconnect status supervision     | CU                 | X                 | –                 | 6.3.5.2, page 268 |
| • Busbar blocking - selective                         | –                  | only BI           | –                 | 6.3.2.3, page 262 |
| • Trigger initial start and restart                   | CU                 | –                 | –                 | 6.3.6, page 268   |
| • Read and set date and time                          | CU                 | X                 | X                 | 6.3.7, page 269   |
| Feeder in/out of service                              | CU, BU             | X                 | X                 | 6.4, page 274     |



Table 6-1 Overview of the operating options and control options

| <b>Operating option</b>               | <b>DIGSI logically to</b> | <b>CU operator panel</b> | <b>BU operator panel</b> | <b>Chapter</b>  |
|---------------------------------------|---------------------------|--------------------------|--------------------------|-----------------|
| Maintenance mode                      | CU, BU                    | X                        | X                        | 6.5, page 277   |
| Plant visualization                   | CU                        | –                        | –                        | 6.6, page 279   |
| Current transformer polarity reversal | BU                        | –                        | X                        | 7.5.1, page 317 |

## 6.2 Reading Out Information

The SIPROTEC 7SS52 V4 distributed busbar and breaker failure protection provides the following information for on-site retrieval or readout via DIGSI:

- Annunciations,
- Operational measured values,
- Fault data.

In this chapter we will introduce each of these information types and explain how you can retrieve them, save them to your PC, and acknowledge them.



### NOTE

If the bay unit and central unit are operated via the same COM port, a bay unit can only be opened with DIGSI when the central unit is closed.

---

### 6.2.1 Annunciations

Annunciations give an overview of important fault data, of the function of the protection system and they are a means of controlling functional sequences during test and commissioning. During operation they also give information on switching operations, the states of measured data and on the protection system itself.

The annunciations which are generated in the central unit are divided into annunciation groups and you can access them as follows:

- Annunciations of the central unit and of the bay units are displayed in DIGSI. In this case, the PC is linked to the central unit via the PC port or via the service port.
- Annunciations of individual bay units are displayed via DIGSI. In this case, the PC is linked to the central unit and communicates directly with the bay unit or the PC is connected to a bay unit.
- The annunciations are forwarded to a control center (if available) via the serial system port of the central unit.
- Annunciations are displayed via the display of the central unit or of the bay units.
- Annunciations are indicated via light-emitting diodes (LED) of the central unit or of the bay units.
- Binary outputs (pilot relay/command relay) of the central unit or of the bay units.

The event buffer will be preserved in the event of an auxiliary supply failure if a buffer battery exists.

The appendix contains a complete list of all 7SS52 V4 annunciations with the corresponding information number (**FNo.**). There it is also indicated to which destination each annunciation can be reported. If certain functions are not available for a model with reduced functional scope or if they are configured **disabled**, their annunciations will not be displayed.

No password is required for retrieving annunciations.

## Displaying event buffers with DIGSI

To display event buffers of the **central unit** (PC linked to central unit) proceed as follows:

- Open the central unit in the DIGSI Manager.
- Click the folder **Online** in the navigation window of the DIGSI Device Configuration. This will open the directory containing the operating functions of the device (see Figure 6-1, page 243).
- Double-click **Annunciations**. The function selection now shows the individual event buffers. The individual event buffers will be described in more detail in the following subsections.

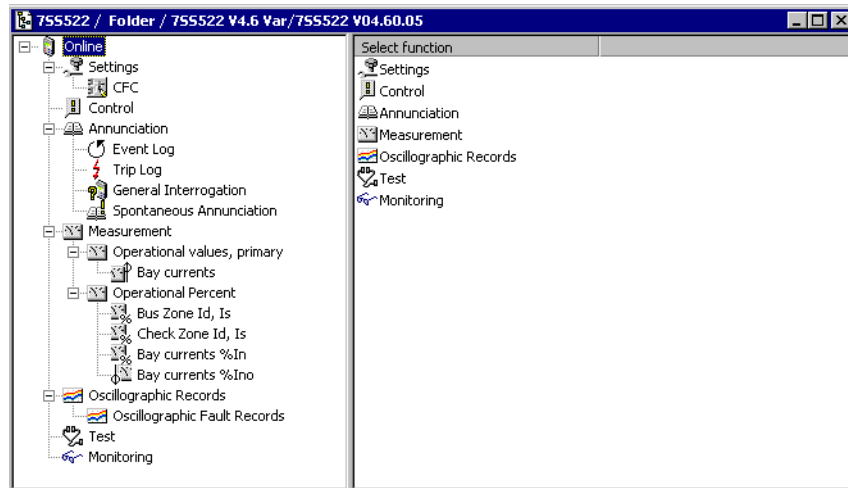


Figure 6-1 Annunciation groups in the DIGSI Device Configuration

To display event buffers of a single **bay unit** (PC linked to central unit or bay unit) proceed as follows:

- Open the corresponding bay unit in the DIGSI Manager.
- Click **Annunciation**. The function selection shows the submenu for Annunciation and Measurement.
- Double-click the entry **Annunciation**. The Select annunciation window shows the individual event buffers. The individual event buffers will be described in more detail in the following subsections.

## Light-emitting diodes on the front panel

The green LED labelled “RUN” lights permanently during normal operation.

The red LED labelled “ERROR” indicates that the processor system has detected an internal error. The device is not ready when the red LED flashes during operation. Chapter 8, page 319 provides information on how to proceed in such a case.

The other LEDs on the device indicate the annunciations which are allocated according to Chapter 4, page 67. After you have allocated the LED, write down its meaning on the labeling strip.

Stored indications for LEDs (e.g., protection trip) can be deleted via the pushbutton **LED** or via DIGSI. This pushbutton serves also as functional check for the LEDs. All LEDs must be lit while you apply this pushbutton.

**Output relays**

Annunciations which are allocated to the potential-free output relays according to Chapter 4, page 67 can be output as latched annunciations. The memories of the output relays can also be reset by applying the **LED** button.

**6.2.1.1 Operational Annunciations**

Operational annunciations are information items which the device produces during operation. Up to 200 operational events (central unit) and up to 50 operational events (bay units) are stored in the device in chronological order. When the maximum capacity of the memory has been reached, the oldest event will be erased.

The appendix contains a tabular list with all available operational events and their explanation. Only the relevant annunciation will be displayed in the concrete situation. It is also indicated whether the annunciation is only coming (C for events) or whether it is coming and going (C/G for states).

**from the PC with DIGSI**



To read out operational events of the **central unit** (PC linked to central unit) proceed as follows:

- Click **Event log**. A list appears in the data window (right section of the window), (Figure 6-2, page 244).

Double-click an entry in the list view. The corresponding contents of the annunciation group is displayed in another window (Figure 6-3, page 245).

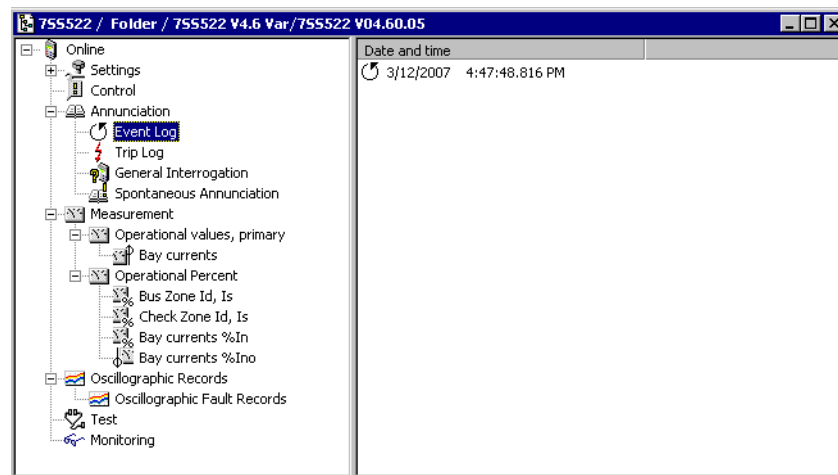


Figure 6-2 Overview of operational events in DIGSI – Example

| Number      | Indication                           | Value | Date and time           | Initiator         | Cause          | State |
|-------------|--------------------------------------|-------|-------------------------|-------------------|----------------|-------|
| 00068       | Reset LED                            | ON    | 13.11.2009 11:01:21.220 | Command Issue...  | Control Issued |       |
| 00068       | Clock Synchronization Error          | ON    | 13.11.2009 11:01:39.810 | Com.Issued=Aut... | Spontaneous    |       |
| 00068       | Clock Synchronization Error          | OFF   | 13.11.2009 11:01:38.007 | Com.Issued=Aut... | Spontaneous    |       |
| 00070       | Setting calculation is running       | ON    | 13.11.2009 11:04:18.509 | Com.Issued=Aut... | Spontaneous    |       |
| 00055       | Reset Device                         | ON    | 13.11.2009 11:04:49.591 | Com.Issued=Aut... | Spontaneous    |       |
| 00067       | Resume                               | ON    | 13.11.2009 11:04:49.591 | Com.Issued=Aut... | Spontaneous    |       |
| 00051       | Device is Operational and Protecting | ON    | 13.11.2009 11:04:49.829 | Com.Issued=Aut... | Spontaneous    |       |
| 176.1110.01 | E01 disconnecter Q1                  | CLOSE | 13.11.2009 11:04:49.829 | Com.Issued=Aut... | Spontaneous    |       |
| 176.1115.01 | E01 disconnecter Q2                  | OPEN  | 13.11.2009 11:04:49.829 | Com.Issued=Aut... | Spontaneous    |       |
| 176.1120.01 | E01 disconnecter Q3                  | OPEN  | 13.11.2009 11:04:49.829 | Com.Issued=Aut... | Spontaneous    |       |
| 176.1125.01 | E01 disconnecter Q7                  | OPEN  | 13.11.2009 11:04:49.829 | Com.Issued=Aut... | Spontaneous    |       |
| 176.1110.02 | E02 disconnecter Q1                  | OPEN  | 13.11.2009 11:04:49.829 | Com.Issued=Aut... | Spontaneous    |       |
| 176.1115.02 | E02 disconnecter Q2                  | OPEN  | 13.11.2009 11:04:49.829 | Com.Issued=Aut... | Spontaneous    |       |
| 176.1125.02 | E02 disconnecter Q70                 | OPEN  | 13.11.2009 11:04:49.829 | Com.Issued=Aut... | Spontaneous    |       |
| 176.1135.01 | E01 circuit breaker Q0               | CLOSE | 13.11.2009 11:04:49.830 | Com.Issued=Aut... | Spontaneous    |       |
| 176.1135.02 | E02 circuit breaker Q0               | CLOSE | 13.11.2009 11:04:49.830 | Com.Issued=Aut... | Spontaneous    |       |
| 176.1174.01 | Battery supervision Bay Unit @01     | ON    | 13.11.2009 11:04:49.830 | Com.Issued=Aut... | Spontaneous    |       |
| 176.1174.02 | Battery supervision Bay Unit @02     | ON    | 13.11.2009 11:04:49.830 | Com.Issued=Aut... | Spontaneous    |       |
| 176.1174.05 | Battery supervision Bay Unit @05     | ON    | 13.11.2009 11:04:49.830 | Com.Issued=Aut... | Spontaneous    |       |
| 176.1174.06 | Battery supervision Bay Unit @06     | ON    | 13.11.2009 11:04:49.830 | Com.Issued=Aut... | Spontaneous    |       |
| 176.1174.07 | Battery supervision Bay Unit @07     | ON    | 13.11.2009 11:04:49.830 | Com.Issued=Aut... | Spontaneous    |       |
| 10420       | 15V supply supervision central unit  | ON    | 13.11.2009 11:04:49.830 | Com.Issued=Aut... | Spontaneous    |       |
| 10421       | 24V supply supervision central unit  | ON    | 13.11.2009 11:04:49.830 | Com.Issued=Aut... | Spontaneous    |       |
| 10475       | Error without protection blocking    | ON    | 13.11.2009 11:04:49.830 | Com.Issued=Aut... | Spontaneous    |       |
| 00068       | Reset LED                            | ON    | 13.11.2009 11:04:52.136 | Command Issue...  | Control Issued |       |
| 00068       | Clock Synchronization Error          | OFF   | 13.11.2009 11:04:52.729 | Com.Issued=Aut... | Spontaneous    |       |

Figure 6-3 Examples of operational annunciations in DIGSI

To display operational events of a single **bay unit** (PC linked to central unit or bay unit) proceed as follows:

- Open the corresponding bay unit in the DIGSI Manager.
- Open the window **Select annunciations** (Figure 6-4, page 245).
- Double-click **Operational annunciations**. The corresponding contents of the operational annunciation is displayed in another window.



#### NOTE

Operational annunciations, fault indications and measured values can also be retrieved via the operator panel of the central unit. If you want to know more, please read the System Description /1/.

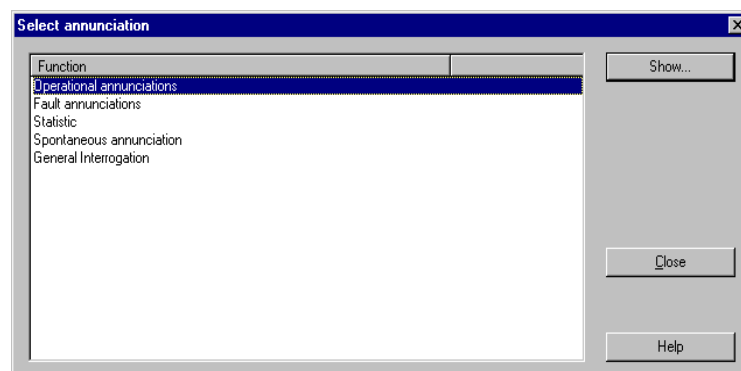


Figure 6-4 Select annunciation window in DIGSI of the bay unit

| No.  | Message                                  | Value  | Date / Time           |
|------|--|--------|-----------------------|
| 0177 | Failure: Battery                         | coming | 01.01.70 00:00:00.186 |
| 0052 | Any protection operative                 | going  | 01.01.70 00:00:00.191 |
| 7650 | Failure in communication w. Central Unit | coming | 01.01.70 00:00:00.569 |
| 0203 | Fault recording data deleted             | coming | 01.01.70 00:00:00.596 |
| 0120 | Operational annunciations invalid        | going  | 01.01.70 00:00:05.793 |
| 7651 | Receiving parameters from Central Unit   | coming | 01.01.70 00:22:50.467 |
| 7650 | Failure in communication w. Central Unit | going  | 01.01.70 00:22:50.963 |
| 7650 | Failure in communication w. Central Unit | coming | 14.02.07 19:08:57.149 |
| 7651 | Receiving parameters from Central Unit   | coming | 14.02.07 21:52:46.003 |
| 7651 | Receiving parameters from Central Unit   | coming | 14.02.07 21:52:52.492 |
| 7650 | Failure in communication w. Central Unit | going  | 14.02.07 21:52:53.456 |
| 0061 | Logging and measuring functions blocked  | coming | 15.02.07 15:09:26.746 |

Figure 6-5 Operational annunciations window DIGSI – Example

### 6.2.1.2 Fault events

#### Spontaneous annunciations

In the event of a fault the display switches automatically over to the spontaneous annunciations display. The first line is assigned to the annunciation “Device trip G” (**FNo. 10445/CU**) and the second line to the annunciation “Transf. Trip G” (**FNo. 10433/CU**). If an annunciation is signaled as coming, it will be displayed in the row reserved for it as shown in Figure 6-6, page 246.

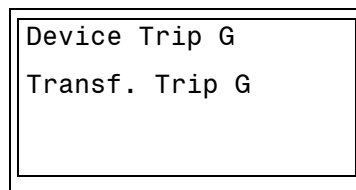


Figure 6-6 Display of spontaneous annunciations on the display of the central unit – Example

Press the **LED** button to acknowledge spontaneous annunciations. Following the acknowledgment you will see the default display.

#### Retrievable annunciations

Fault events in the power system are indicated by “Power System fault” and by the fault number and are stored in the fault event buffer. The oscillographic record (Chapter 6.2.3, page 251) contains detailed information on the behaviour of the power system fault.

You can retrieve the annunciations of the last 8 power system faults of the central unit and of the last 8 power system faults of the bay unit. A power system fault is thus defined that each fault will be considered a power system fault until it is settled beyond doubt.

The central unit can store up to 8 faults with a maximum of 80 fault events each, and each bay unit can store 8 faults with a maximum of 100 fault events each. If more events are generated, the oldest are overwritten in the order of their generation.

The Appendix contains a tabular list with all available fault events and their explanation. Only the relevant annunciations will be displayed in the concrete situation.

from the PC  
with DIGSI



To read out fault events of the **central unit** (PC linked to central unit) proceed as follows:

- Click **Trip log**. The data window shows a list of power system faults.
- Double-click an entry in the list view. The corresponding contents of the power system fault is displayed in another window. The entries are sorted chronologically according to date and time with the most recent event first.

Figure 6-7 Trip log window in DIGSI – Example

To display fault events of a single **bay unit** (PC linked to central unit or bay unit) proceed as follows:

- Open the corresponding bay unit in DIGSI Manager.
- Open the Select annunciations window.
- Double-click **Fault annunciations**. The window with the overview of the fault annunciations appears.
- Double-click an entry in the overview. You can also click an entry and then **Show....** The corresponding contents of the fault event is displayed on another window.

If the bay unit is operated without any central unit, the first fault has the number 900.

### 6.2.1.3 Alarm List

When a bay unit fails, the error LED of the bay unit concerned is lit. Additionally, the corresponding alarm text is registered in the alarm list.



#### NOTE

The alarm list can be called up by pressing the function key **F1** on the central unit.

An alarm is not only issued if a bay unit fails but also if the protection-internal communication fails. For more information on the analysis of the protection-internal communication please refer to Chapter 8.2.4, page 326.

#### 6.2.1.4 General Interrogation

You can use the general interrogation to find out about the current status of the SIPROTEC devices.



#### NOTE

You need DIGSI to read out the results of the general interrogation.

---

from the PC  
with DIGSI



To read out the results of the general interrogation of the **central unit** (PC linked to central unit) proceed as follows:

- Click **General Interrogation**. The right section of the window shows date and time of each general interrogation.
- Double-click an entry in the right section of the window. The **General Interrogation** window opens. It shows all annunciations that are subject to general interrogation with their current value.

To read out the result of the general interrogation of a single **bay unit** (PC linked to central unit or bay unit), proceed as follows:

- Open the corresponding bay unit in the DIGSI Manager.
- Open the Select annunciation window.
- Double-click **General Interrogation**. The corresponding contents of the annunciation subject to general interrogation is displayed on another window.

#### 6.2.1.5 Spontaneous Annunciation

You can use "Spontaneous Annunciations" to view the log file of incoming current annunciations.



#### NOTE

You need DIGSI to read out the spontaneous annunciations.

---

from the PC  
with DIGSI



To read out spontaneous annunciations of the **central unit** (PC linked to central unit) proceed as follows:

- Click **Spontaneous annunciation**. The right section of the window shows date and time of each spontaneous annunciation.
- Double-click an entry in the right section of the window. The **Spontaneous annunciation** window opens. Each new incoming annunciation will appear immediately, i.e. the user does not have to wait for or trigger an update.

To read out spontaneous annunciations of a single **bay unit** (PC linked to central unit or bay unit) proceed as follows:

- Open the corresponding bay unit in the DIGSI Manager.
- Open the Select annunciations window.
- Double-click **Spontaneous annunciation**. The Spontaneous annunciation window appears.



### 6.2.1.6 Statistics



#### NOTE

Statistics annunciations are only available for the bay units.

from the PC  
with DIGSI



To read out statistics annunciations of a single **bay unit** (PC linked to central unit or bay unit) proceed as follows:

- Open the corresponding bay unit in the DIGSI Manager.
- Open the Select annunciation window.
- Double-click **Statistic**. The corresponding contents of the statistics is displayed on another window.

## 6.2.2 Reading Out Measured Values

The processing system determines operational measured values in the background. The operational measured values can be retrieved from the display, read out via the PC port using the PC, or they can be transmitted to a central station via the system port.

No password is required for retrieving the measured values. After a few seconds the values will be updated cyclically.

The possible measured value representation - as primary quantities or referenced to the nominal value - are stated in Table 6-2, page 249.

Table 6-2 Operational Measured Values

| Measured values  |   | primary | I                 | I <sub>N</sub>   |
|--|---|---------|-------------------|------------------|
| I <sub>dL1</sub> , I <sub>dL2</sub> , I <sub>dL3</sub> | Differential currents                               | –       | % I <sub>no</sub> | –                |
| I <sub>sL1</sub> , I <sub>sL2</sub> , I <sub>sL3</sub> | Restraint currents                                  | –       | % I <sub>no</sub> | –                |
| I <sub>L1</sub> , I <sub>L2</sub> , I <sub>L3</sub>    | Feeder currents                                     | A       | % I <sub>no</sub> | % I <sub>n</sub> |
| f <sub>N</sub>   | System frequency<br>(display only in the bay units) | Hz      | –                 | –                |



#### NOTE

The percentages I<sub>no</sub> refer to the normalized currents of the station, the percentages I<sub>N</sub> refer to the respective rated feeder current.

from the PC  
with DIGSI



To retrieve operational measured values of the **central unit** (PC linked to central unit) proceed as follows:

- Click **Measurement**. In the navigation window you can now see the different groups of measured values in the subdirectory of Measurement (Figure 6-1, page 243).

The measured values are subdivided into the following groups and subgroups:

- **Operational values, primary** with  
*Bay currents, primary values*
- **Operational normalized percent** with  
*Bus Zone Id, Is*  
*Check Zone Id, Is*  
*Bay currents, percentage*  
relating to the standard normalized current  $I_{no}$  of the station;
- **Operational percent** with  
*Bus Zone Id, Is*  
*Check Zone Id, Is*  
*Bay currents, percentage*  
relating to the rated feeder current  $I_N$ ;

3 dots (...) are displayed instead of the measured value if a measured value is not available. If a value is indeterminate (e.g.,  $f_N$ , if no current is flowing), 3 dashes (---) are shown. 3 asterisks (\*\*\* ) are displayed in the case of a fault in the bay unit.

- Click the desired measurement group e.g., **Operational values primary**. The next subgroup is shown.
- Click the desired subgroup e.g., **Bay currents, primary values** (Figure 6-1, page 243).
- Double-click an entry in the list view in the right section of the window. The window with the contents of the corresponding measured value group opens (Figure 6-8, page 250).

| Nummer | Messwert           | Wert    |
|--------|--------------------|---------|
| 10401  | IDiffL1 (% I/Ino)= | 1.00 %  |
| 10404  | Istabl1 (% I/Ino)= | 47.80 % |
| 10402  | IDiffL2 (% I/Ino)= | 0.80 %  |
| 10405  | Istabl2 (% I/Ino)= | 48.20 % |
| 10403  | IDiffL3 (% I/Ino)= | 1.00 %  |
| 10406  | Istabl3 (% I/Ino)= | 48.20 % |

Figure 6-8 Metering window DIGSI – Example

To read out operational measured values of a single **bay unit** (PC linked to central unit or bay unit) proceed as follows:

- Open the corresponding bay unit in the DIGSI Manager.
- Click **Annunciations** in the navigation window.
- Double-click **Measurement** in the function selection. The Select measured values window opens (Figure 6-9, page 251).
- Click an entry in the list view and then click **Show....** Upon that the corresponding entry is displayed on another window (Figure 6-10, page 251).

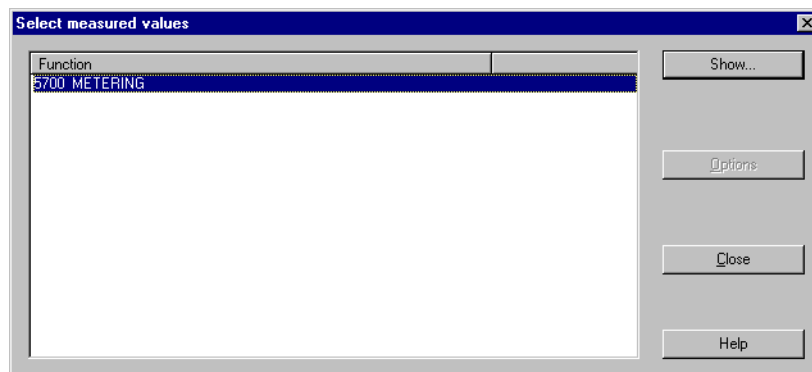


Figure 6-9 Select measured values window in DIGSI

| Par.A... | Text                  | Value     |
|----------|-----------------------|-----------|
| 5701     | Current in phase L1 = | 100.4 %In |
| 5702     | Current in phase L2 = | 100.6 %In |
| 5703     | Current in phase L3 = | 100.4 %In |
| 5704     | Earth current =       | 0.7 %In   |
| 5705     | Current in phase L1 = | 10041.0 A |
| 5706     | Current in phase L2 = | 10064.0 A |
| 5707     | Current in phase L3 = | 10044.0 A |
| 5708     | Earth current =       | 7.0 A     |
| 5709     | Current in phase L1 = | 50.2 %Ino |
| 5710     | Current in phase L2 = | 50.3 %Ino |
| 5711     | Current in phase L3 = | 50.2 %Ino |
| 5712     | Earth current =       | 0.3 %Ino  |

Figure 6-10 Window of the operational measured values DIGSI – Example

### 6.2.3 Reading Out Fault Data

The fault data of the bay units are stored in the bay units and the fault data of the central unit are stored in the central unit. To retrieve and record the fault data from these locations, you need one of the SIGRA programs in addition to DIGSI (optionally available to DIGSI) or the Comtrade Viewer (included in DIGSI).

As a prerequisite for recording the fault data, the corresponding parameters such as the length, the pre-trigger time and the post-fault time of the fault recording must be set according to the Chapters 5.6, page 188 and 5.13, page 210.

from the PC  
with DIGSI



To read out fault data **centrally** (PC linked to central unit) proceed as follows:

- Click **Oscillographic Records** in the navigation window. The subdirectory of the Oscillographic Records now shows the item Oscillographic Fault Records in the navigation window (Figure 6-11, page 252). The list view in the right section of the window gives an overview of all available fault records. The fault records are displayed with the network fault number, a fault record number and date and time. The numbers for network fault and fault record are always identical for 7SS52 V4 and are numbered starting from 1 upwards.

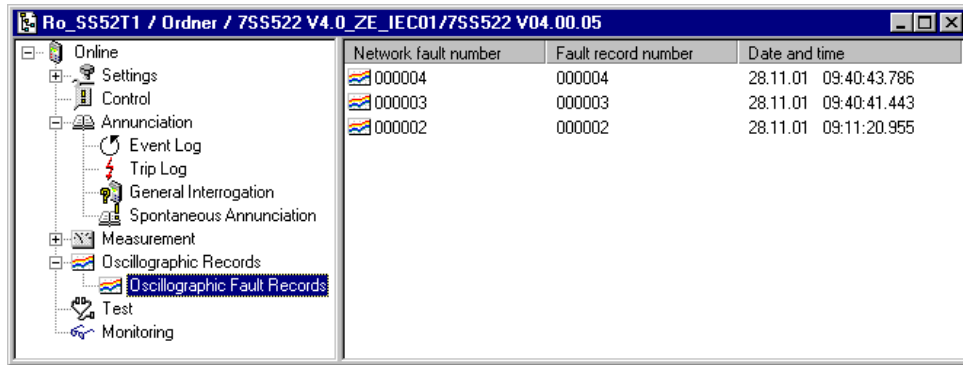


Figure 6-11 Reading out fault data in DIGSI – Example



**NOTE**

When you retrieve the fault data **centralized** via DIGSI, the following fault records will **not** appear in the list view:

- If a local fault record is triggered via the backup protection of a bay unit or by the trip of an external breaker failure protection in a bay unit, it will depend on the setting of the parameter **fault rec mode (6401A/CU)** where additional fault records are created in the system (Chapter 5.6.2, page 189). A system event buffer is always created regardless of this fact. Fault records, which are not transmitted to the central unit, must be retrieved from the bay unit by means of DIGSI.
- Fault records of a bay unit running in stand-alone mode are not transmitted to the central unit and must be retrieved from the bay unit by means of DIGSI. For each system event these fault records are numbered starting from 900 upwards.

- Double-click an entry in the list view in the right section of the window. The window for selecting the oscillographic records opens. The list view gives an overview of all available bay units. They are displayed with the number and the name you have assigned them in DIGSI Manager. The column indicating the status shows whether and how the corresponding bay unit is involved in the fault event.

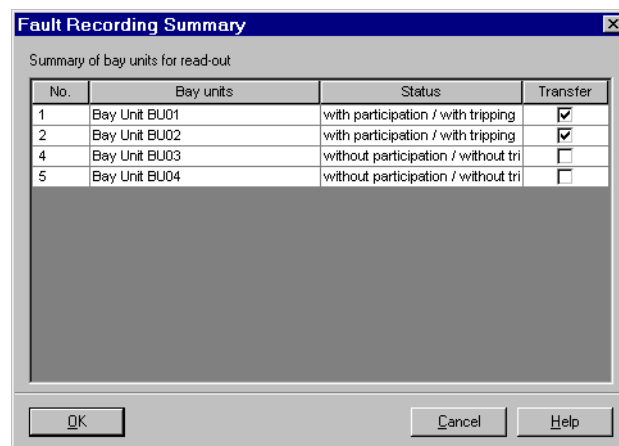


Figure 6-12 Selection of oscillographic records in DIGSI – Example

- In the column **Transfer** activate the checkboxes of the bay units you wish to read out. The checkboxes of the bay units with the states *with participation/ with tripping* and *with participation/ without tripping* are already active. Regardless of whether you have selected bay units for the transmission, the fault data of the central unit are always transmitted.
- Then click **OK**. The fault data are read out and saved. One of the above mentioned programs is started and the fault data are loaded (see also the DIGSI Manual “Operation”, Subsection 8.3.3). SIGRA 4 opens the fault data of the central unit and of the bay units in a window.

The SIGRA 4 system program helps you analyze fault events in the power system. SIGRA 4 processes the data recorded during a fault and presents them graphically. From the recorded measured values it calculates additional measured quantities such as time signals or r.m.s. values which help you evaluate the fault record.

In order to be able to analyze the data on a local PC later on you should proceed as follows:

- Select the relevant fault record in **DIGSI Manager** and call up **Export** from the context menu (right mouse button).
- Enter path and file name and select for **File Type** “COMTRADE-Group [\*.cml]” (Figure 6-13, page 253). In this way, bay names, assignments and scalings will be maintained.
- For repeated editing, open again in SIGRA 4 the file with the extension \*.cml.

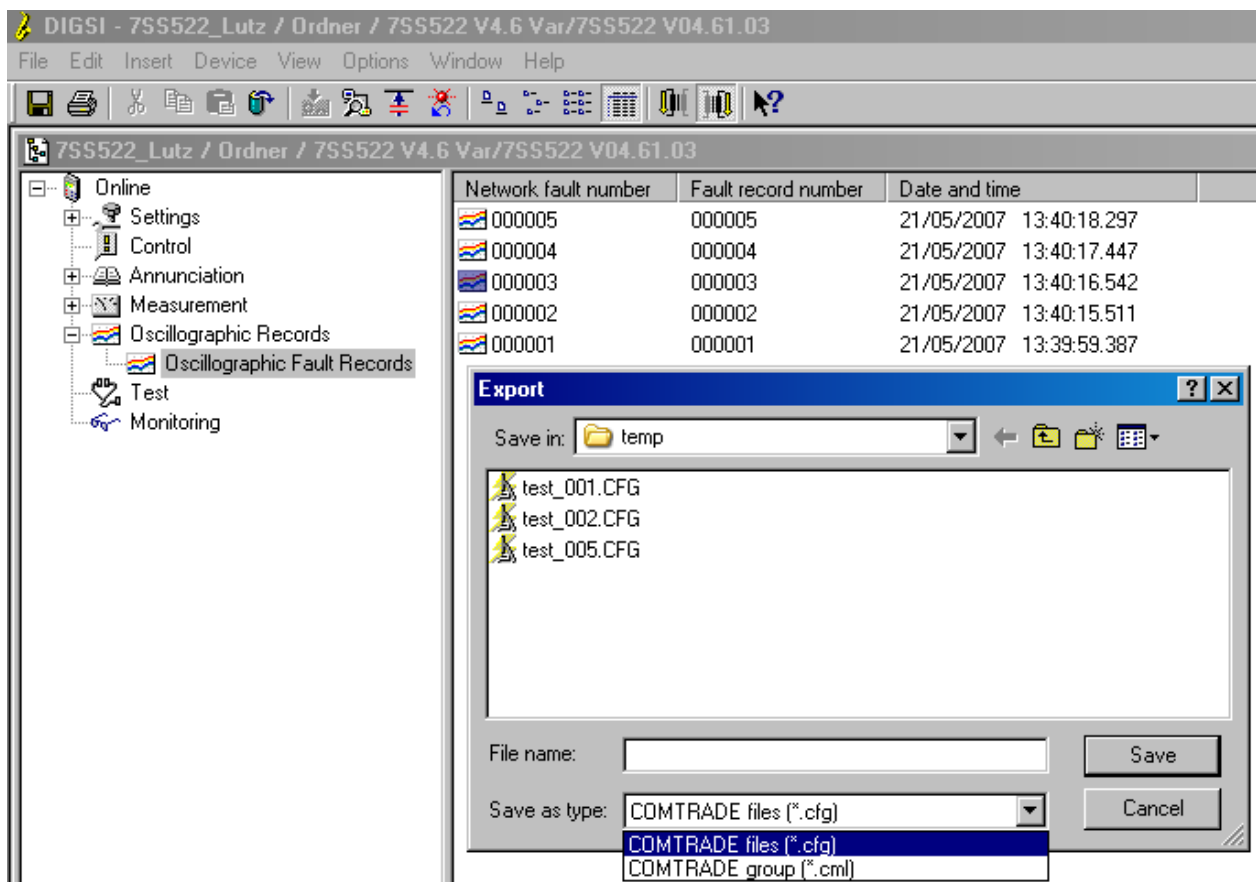


Figure 6-13 Saving the Fault Record

Please read the SIGRA Manual /4/ if you want to know more about the numerous option SIGRA 4 offers.

To retrieve fault data of a single **bay unit** (PC linked to central unit or bay unit) proceed as follows:

- Open the corresponding bay unit in the DIGSI Manager.
- Click **Fault values** in the navigation window.
- Double-click **Fault recording**. The Select fault window opens (Figure 6-14, page 254).
- Click **SIGRA....** The fault data are retrieved and saved. SIGRA opens and the fault data are loaded (see also the DIGSI Manual "Operation", Subsection 8.3.3).

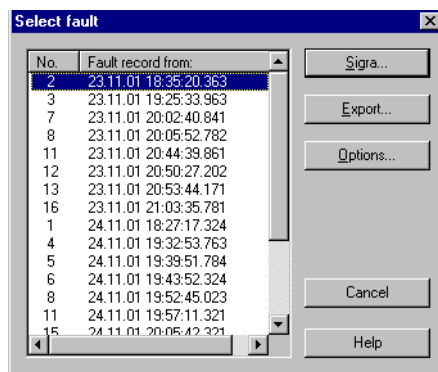


Figure 6-14 Select fault window in DIGSI

## 6.3 Controlling Device Functions

You have several options for interfering with the SIPROTEC 7SS52 V4 distributed busbar and breaker failure protection during operation to influence individual functions and annunciations. This includes

- creating an oscillographic fault record (see Chapter 6.3.1, page 255)
- blocking the TRIP command (see Chapter 6.3.2.1, page 256)
- blocking the breaker failure protection (see Chapter 6.3.2.2, page 260)
- blocking of individual busbar sections (see Chapter 6.3.2.3, page 262)
- saving and erasing annunciations (see Chapter 6.3.3, page 263)
- circuit breaker test (see Chapter 6.3.4, page 265)
- resetting the blocking of the differential current supervision (see Chapter 6.3.5.1, page 267)
- resetting the blocking of the disconnect status supervision (see Chapter 6.3.5.2, page 268)
- triggering an initial start and a restart (see Chapter 6.3.6, page 268)
- reading and setting date/time (see Chapter 6.3.7, page 269)

### 6.3.1 Creating an Oscillographic Record

The oscillographic record is usually triggered by the TRIP command of the busbar protection, of the breaker failure protection or via the tripping of the overcurrent protection and it ends when they are cleared. Not every fault event triggers a fault record (see also Chapter 5.13, page 210).

After starting the fault recording, the data are stored in a range from max. 500 ms before the TRIP command to max. 500 ms after it. When the memory is full, each new fault event overwrites the oldest fault event stored in the device. You can also trigger the fault recording via DIGSI during operation.

**from the PC  
with DIGSI**



To trigger the fault recording at the **central unit** (PC linked to central unit) proceed as follows:

- Open the DIGSI Manager of the central unit.
- Click the folder **Online** in the navigation window of the DIGSI Device Configuration. This will open the directory containing the operating functions of the device.
- Click **Test**. The function selection now shows the individual test functions.
- Double-click **Start Oscillographic Fault Recording**. The fault recording is started.

For further information on the setting of the parameters for fault recording, please read Chapter 5.6, page 188 and Chapter 5.13, page 210.

The data can be read out to a PC and evaluated by the DIGSI communication software (see Chapter 6.2.3, page 251).

To trigger the fault recording of a single **bay unit** (PC linked to central unit or bay unit) proceed as follows:

- ❑ Click **Device** → **Trigger test fault recording...** on the menu bar. The window Fault Record Length opens (Figure 6-15, page 256).
- ❑ Enter the desired fault record length and click **OK**. The fault recording starts. The fault record length must be within the specified limits.

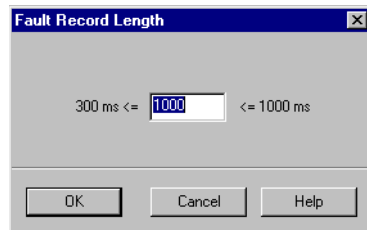


Figure 6-15 Fault Record Length dialog box in DIGSI



#### NOTE

You can also trigger the fault recording via the operator panel of the central unit. If you want to know more on this topic, please read the System Description /1/.

---

## 6.3.2 Blocking

### 6.3.2.1 Blocking the TRIP Command Relays

You can block the TRIP command separately for each busbar section or together for all busbar sections. The TRIP commands of the busbar protection, breaker failure protection and backup definite time overcurrent protection are suppressed.

With the TRIP command blocked all device-internal protection functions (central unit, bay unit) remain active. However, a TRIP command is not initiated i.e., the TRIP command relays K1 ... K5 configured in the bay units are not activated. This is useful e.g., during the commissioning phase.

#### Blocking the TRIP command - entire protection

The blocking of the TRIP command for the entire protection is blocked with the tagging "TRIP blocking" (**FNo. 10441/CU**) or via a binary input ">TRIP blocking" (**FNo. 10440/CU**). The blocking is indicated by the annunciation "TRIP blocked" (**FNo. 10442/CU**).



#### NOTE

If the connection to the central unit is interrupted in the blocked condition, the TRIP command of the backup definite time overcurrent protection remains blocked.

---



**Blocking the TRIP command - busbar-selectively**

The busbar-selective blocking of the TRIP command can be done at the central unit for the connected bay units as well as at the bay units directly via DIGSI, binary input or local operation. The TRIP commands of the busbar protection, breaker failure protection and backup definite time overcurrent protection are suppressed.

Blocking via the central unit is done with "\$03 BlkTrip" (FNo. 177.1337/CU) or a binary input ">Blk Trip \$03" (FNo. 177.1336/CU) and is indicated by the annunciation "\$03 BlkdTrip" (FNo. 177.1338/CU) or "TRIP BZ blkd G" (FNo. 10497/CU). The annunciation "DcoProhib/Maint" (FNo. 10471/CU) is output.

The blocking via the bay unit is done via ">Blk.BB TRIP" (FNo. 7629/BU) or "BLOCKAGE ON?" (FNo. 4201/BU) is indicated by the annunciation "BB TRIP block" (FNo. 7657/BU).

The system will always be reset when the blocking is deactivated, e.g. at the bay unit with "BLOCKAGE OFF?" (FNo. 4202/BU), in order to completely terminate the processes triggered by tests and checks (e.g. CBF).

In the case of a restart or a power failure the tagging "TRIP blocking" is retained. The tagging is erased in the case of an initial start.

The annunciation "DcoProhib G" (FNo. 10471/CU) is output.

**NOTE**

If the connection to the central unit is interrupted in the blocked condition, the TRIP command of the backup definite time overcurrent protection remains blocked.

---

The following figure gives an overview of these function:

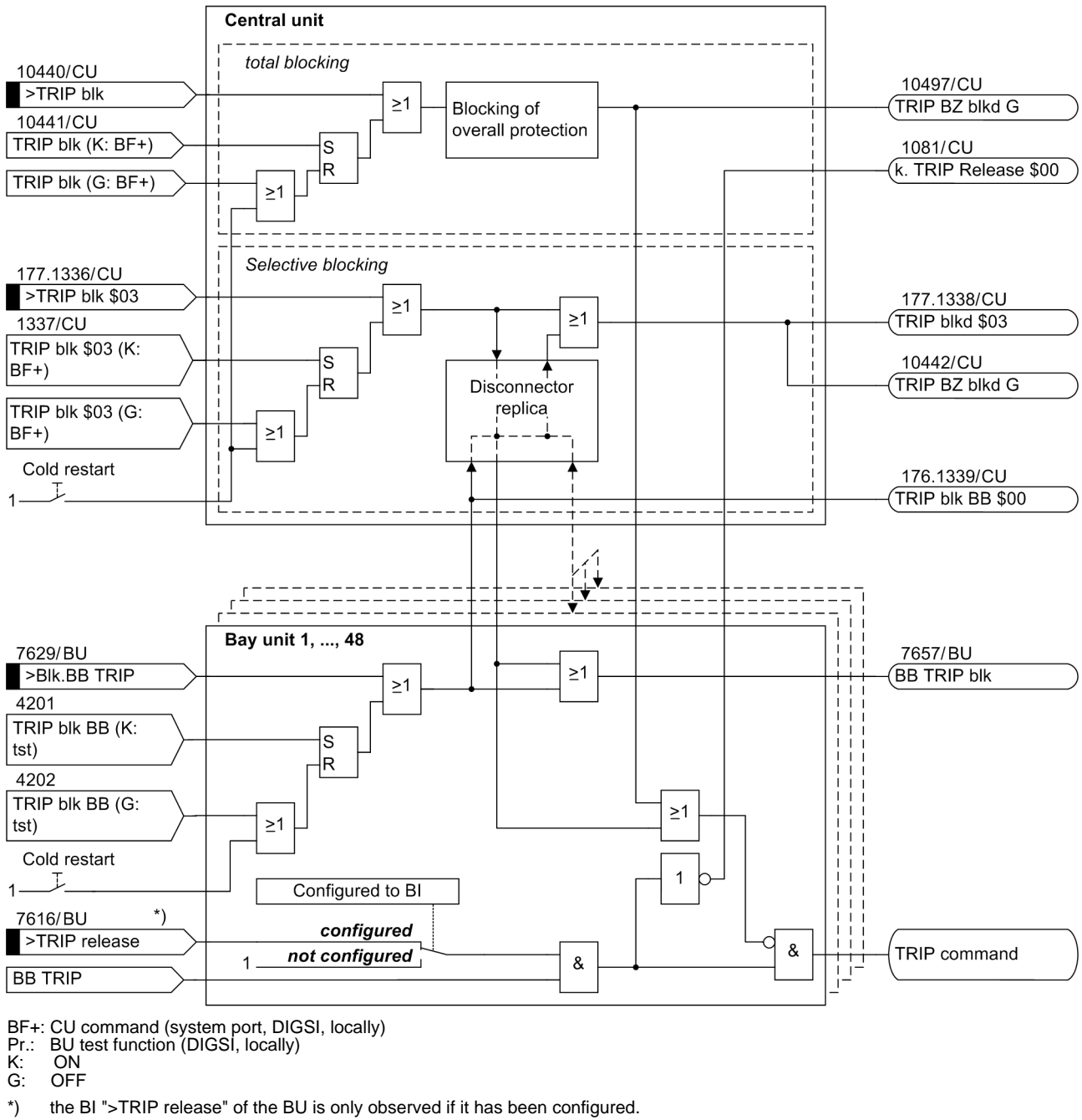


Figure 6-16 Logic for the blocking of the TRIP command

from the PC  
with DIGSI



To block the TRIP command via the **central unit** (PC linked to central unit) proceed as follows:

- ❑ Click **Control** in the navigation window.
- ❑ Double-click **Tagging** in the function selection. The Tagging window opens (see Figure 6-17, page 259).
- ❑ To block the TRIP command, click the command button **ON** in the corresponding row. To reset the blocking of the TRIP command, click the command button **OFF**. Next a security prompt takes place.  
While the Tagging window is opened, there will be no further security prompts when you change the tagging status.
- ❑ Click **Yes** to apply the command. The blocking of the TRIP command can be protected by the password for switching/selecting/updating. If you have activated this password, you will be prompted to enter it before the command is executed since a connection was first established. A dialog box opens for this purpose.
- ❑ Enter the correct password in the box named **Password** and then click **OK**. If the password is wrong, you will receive an error message. When the password is correct, the command will be executed.

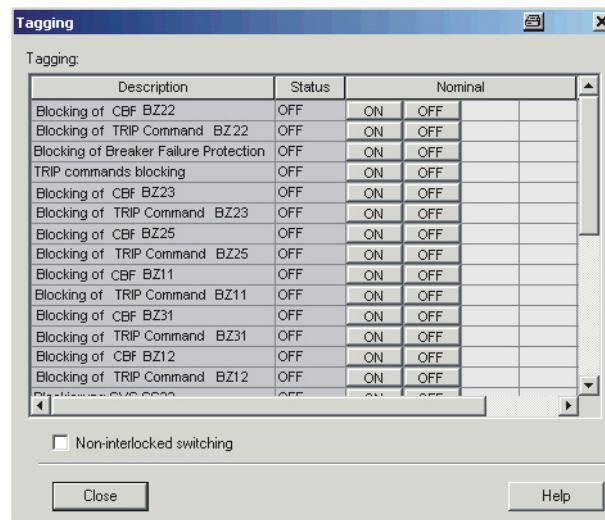


Figure 6-17 Tagging window in DIGSI



#### NOTE

You can also block the TRIP command via the operator panel of the central unit. If you want to know more on this topic, please read the System Description /1/.

### 6.3.2.2 Blocking the Breaker Failure Protection

The external start of the breaker failure protection can be blocked for the entire protection or busbar-selectively. This is useful e.g. during the commissioning phase.

With the external start of the breaker failure protection blocked, all device-internal protection functions (central unit, bay unit) remain active.

#### Blocking Breaker Failure Protection - entire protection

The blocking of the breaker failure protection for the entire protection is blocked via the tagging "Blocking BF" (FNo. 10431 / CU) or via a binary input ">Blocking BF" (FNo. 10430 / CU). The blocking is indicated by the annunciation "TRIP blocked" (FNo. 10432 / CU).

#### Blocking Breaker Failure Protection - busbar-selectively

The busbar-selective blocking of the breaker failure protection can be done at the central unit for the connected bay units as well as at the bay units directly via DIGSI, binary input or local operation.

The blocking via the central unit is done via "BlkBF BB \$00" (FNo. 176.1349 / CU) or via a binary input ">Blk BF \$03" (FNo. 177.1346 / CU) and is indicated by the annunciation "\$03 BlkdBf" (FNo. 177.1348 / CU) or "BF blocked" (FNo. 10432 / CU).

The blocking via the bay unit is done via ">Blk.BF of BB" (FNo. 7690 / BU) or "BLOCKAGE ON?" (FNo. 4301 / BU) and is indicated by the annunciation "BF BZ blkd." (FNo. 7658 / BU).

In the case of a restart or a power failure the tagging "Blocking BF" is retained. The tagging is erased in the case of an initial start.

When blocking exists, changes in the disconnector of the blocked bus section are not permitted. The message "DcoProhib G" (FNo. 10471 / CU) is outputted.



#### CAUTION

The blocking is not "commuted", e.g. in the case of preferring a measuring system during a bus shunt by disconnectors.

---

The following figure gives an overview of these functions:

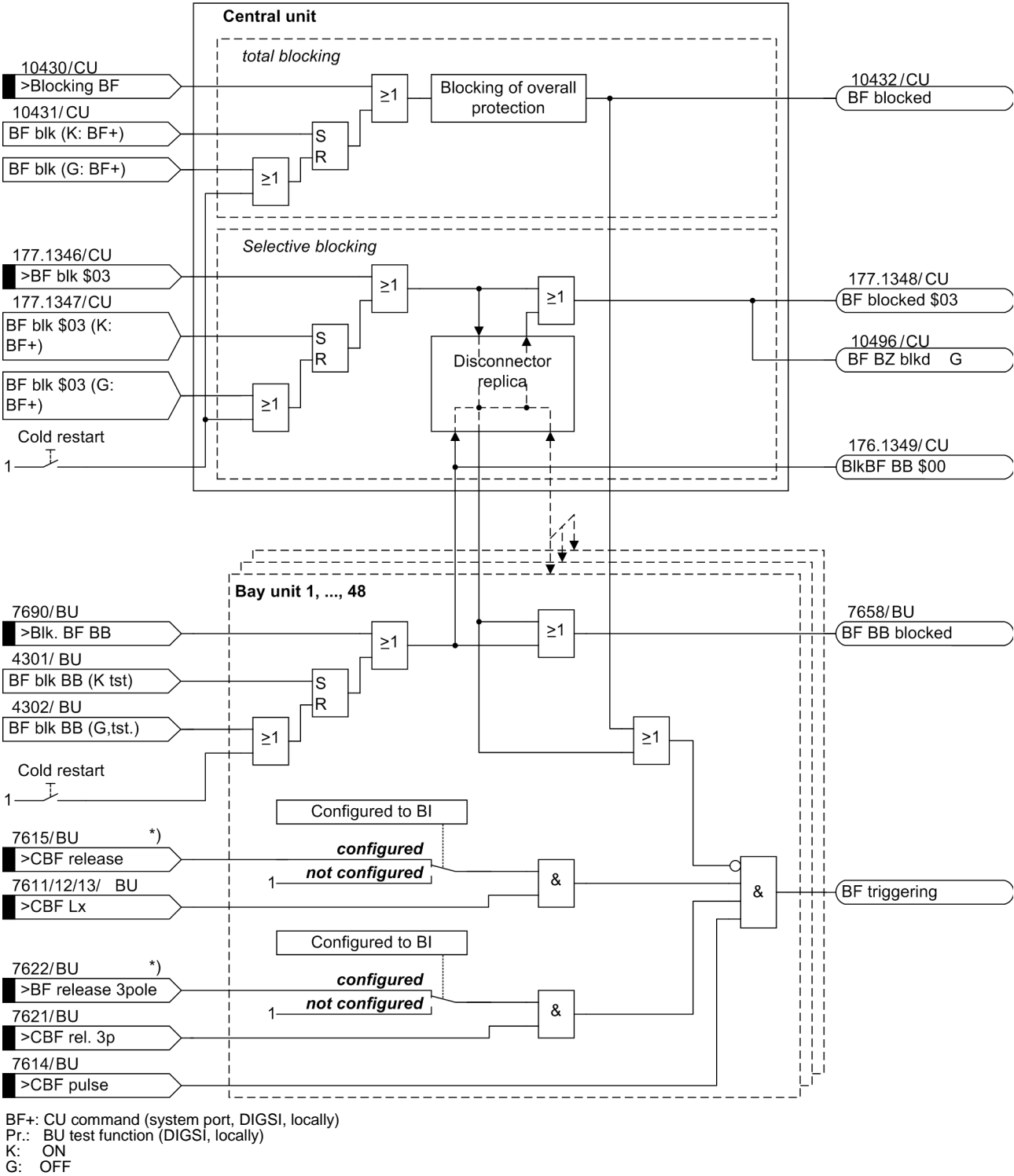


Figure 6-18 Logic for the blocking of the external breaker failure protection tripping

from the PC  
with DIGSI



To block the breaker failure protection via the **central unit** (PC linked to central unit) proceed as follows:

- ❑ Click **Control** in the navigation window.
- ❑ Double-click **Tagging** in the function selection. The Tagging window opens (see Figure 6-17, page 259).
- ❑ To block the breaker failure protection, click the command button **ON** in the corresponding row. To reset the blocking of the breaker failure protection, click the command button **OFF**. Next a security prompt takes place.
- ❑ Click **Yes** to apply the command. The blocking of the TRIP command can be protected by the password for switching/selecting/updating. If you have activated this password, you will be prompted to enter it before the command is first executed after a connection was established. A dialog box opens for this purpose.
- ❑ Enter the correct password in the box named **Password** and then click **OK**. If the password is wrong, you will receive an error message. When the password is correct, the command will be executed.



#### NOTE

You can also block the breaker failure protection via the operator panel of the central unit. If you want to know more on this topic, please read the System Description /1/.

---

### 6.3.2.3 Blocking of Individual Busbar Sections

Individual busbar sections can be blocked for special conditions or for test purposes. To do so, binary inputs of the central unit have to be configured ">Blk \$03" (**FNo. 177.1334 / CU**). The blocking is done for every three phases and is retained beyond a device restart.

The differential protection of respective bus bars is affected by the blocking. All of the self-monitoring functions and the check zones stay active. In case of an error on the blocked bus bar, the tripping of the selective measuring zone is inhibited. The check zone outputs its trip command. The blocking is indicated by the annunciation "\$03 blocked BI" (**FNo. 177.1335 / CU**).



#### CAUTION

The blocking is not "commuted", e.g. in the case of preferring a measuring system during a bus shunt by disconnectors.

---

### 6.3.3 Saving and Deleting Annunciations

Events are stored in the event buffers inside the SIPROTEC device. The same applies for the fault records corresponding to the fault events. Spontaneous indications, to the contrary, are transmitted directly to the computer without buffering in the SIPROTEC device.

Normally, you do not have to erase the event buffer of the device during operation as new events will automatically overwrite the oldest annunciations when there is not enough memory space available. Erasing the buffers may, however, be sensible so that they contain only information of new fault events e.g., following a plant inspection. The buffers are reset separately for the different annunciation groups.



#### NOTE

When deleting fault events also the fault event buffers are cleared and all corresponding counters are reset to zero. If, however, you delete fault records (see subsection 7.1.4), the fault annunciations remain unaffected.

#### 6.3.3.1 Saving Annunciations

from the PC  
with DIGSI

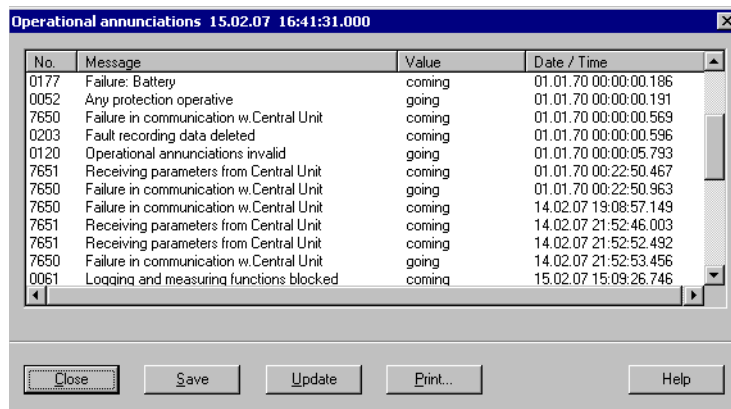


To save annunciations of the **central unit** (PC linked to central unit) proceed as follows:

- Click the desired annunciation group (see Chapter 6.2.1.1, page 244). The corresponding buffer contents of the annunciation group appears in the right window. Fault annunciations are displayed with the number of the network fault and with date and time.
- Double-click the desired entry. The list view of the annunciations is displayed.
- Right-click in the list view to open the context menu and click **Save**. The annunciations are saved. Proceed analogously to save further entries.
- You can also save entire annunciation groups. For this purpose, select the desired annunciation group and click **File** → **Save** on the DIGSI menu bar. Next you see a security prompt demanding whether to save all process data (annunciations and operational measured values). Confirm with **Yes**. DIGSI automatically creates a folder – provided it does not already exist – and saves the desired annunciation group together with the process data to this folder. For more information see also section 9.4 on device operation in the DIGSI Manual.

To save events of a single **bay unit** (PC linked to central unit or bay unit) proceed as follows:

- Open the corresponding bay unit in DIGSI Manager.
- Click the desired annunciation group. The corresponding buffer contents of the annunciation group appears on another window. Fault annunciations are displayed with the number of the network fault and with date and time.
- Double-click the desired entry. The list view of the annunciations is displayed.



| No.  | Message                                 | Value  | Date / Time           |
|------|---|--------|-----------------------|
| 0177 | Failure: Battery                        | coming | 01.01.70 00:00:00.186 |
| 0052 | Any protection operative                | going  | 01.01.70 00:00:00.191 |
| 7650 | Failure in communication w.Central Unit | coming | 01.01.70 00:00:00.569 |
| 0203 | Fault recording data deleted            | coming | 01.01.70 00:00:00.596 |
| 0120 | Operational annunciations invalid       | going  | 01.01.70 00:00:05.793 |
| 7651 | Receiving parameters from Central Unit  | coming | 01.01.70 00:22:50.467 |
| 7650 | Failure in communication w.Central Unit | going  | 01.01.70 00:22:50.963 |
| 7650 | Failure in communication w.Central Unit | coming | 14.02.07 19:08:57.149 |
| 7651 | Receiving parameters from Central Unit  | coming | 14.02.07 21:52:46.003 |
| 7651 | Receiving parameters from Central Unit  | coming | 14.02.07 21:52:52.492 |
| 7650 | Failure in communication w.Central Unit | going  | 14.02.07 21:52:53.456 |
| 0061 | Logging and measuring functions blocked | coming | 15.02.07 15:09:26.746 |

Figure 6-19 Saving annunciations – Example

- ❑ Click **Save**. The annunciations are saved. Proceed analogously to save further entries. You cannot save entire annunciations groups for the bay units as is possible for the central unit.

### 6.3.3.2 Deleting Annunciations

from the PC  
with DIGSI



To delete annunciations of the **central unit** (PC linked to central unit) proceed as follows:

- ❑ Click **Annunciations** in the navigation window.(see e.g. Chapter 6.2.1.1, page 244). The annunciation groups are shown in the function selection.
- ❑ Right-click the desired annunciation group in the navigation window. Click **Delete** in the context menu. Next a security prompt takes place.
- ❑ Click **Yes** to delete the data.



#### NOTE

When deleting fault events the corresponding fault records are also erased. And the counters for the network fault number and the fault record number are reset to zero. If, however, you delete fault records, the fault record numbers and both counters remain unaffected.

To delete annunciations of a single **bay unit** (PC linked to central unit or bay unit) proceed as follows:

- ❑ Open the corresponding bay unit in the DIGSI Manager.
- ❑ Click **Control** in the navigation window and select the entry **General Device Settings** in the function selection. The OTHER OPTIONS window opens.



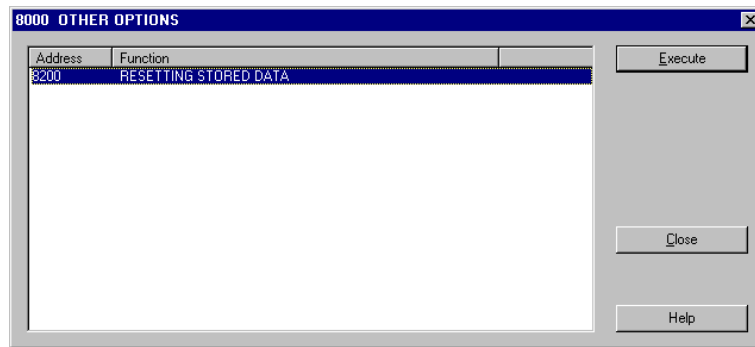


Figure 6-20 Deleting annunciations of a bay unit in DIGSI.

- Click **RESETTING STORED DATA**.
- Click **Execute**. Next a security prompt takes place.
- Click **Yes** to delete the data.

### 6.3.4 Circuit Breaker Test

You can test the trip circuits and circuit breakers during operation by applying an on-off circuit via the corresponding bay unit. You can also use DIGSI to test the circuit breakers or directly via the operator panel of the bay unit.

The following prerequisites must be met:

- The necessary test commands **CB Test L1** to **CB Test L3 (7636/BU to 7638/BU)** have been configured to the command relays.
- The feeder current must not exceed the set limit **I> MAN TRIP (6316/CU)**



## DANGER

A successfully launched test cycle may cause the circuit breaker to close if an external automatic reclosing device exists!

As is shown in Figure 6-21, page 266, the circuit breaker test of the bay unit can be triggered by the following actions:

- by applying the **F2** function key (3-phase),
- via binary input ">CB Test" (**FNo. 1156/BU**) (3-phase),
- via the parameter **CB TEST LIVE TRIP (4400/BU)** (1- and 3-phase).

The command for the circuit breaker test is reset after a fixed time of 2 s.

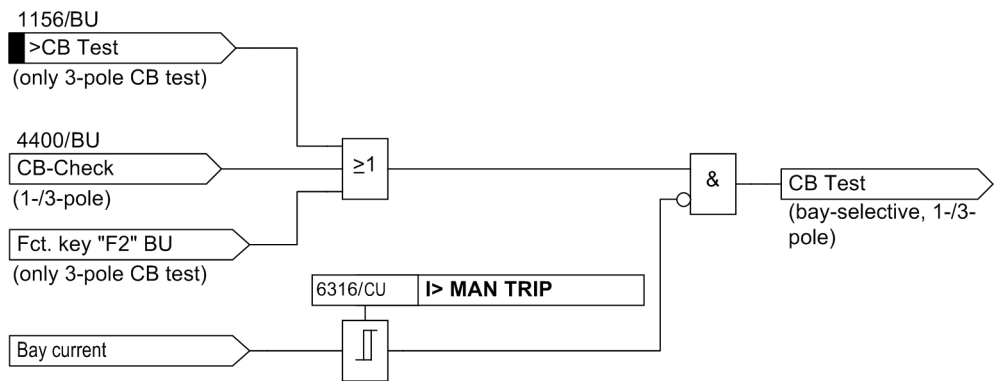


Figure 6-21 Trip test including circuit breaker

from the PC  
with DIGSI



To perform the circuit breaker test with a **bay unit** (PC linked to central unit or bay unit) proceed as follows:

- ❑ Open the corresponding bay unit in DIGSI Manager.
- ❑ Click **Test** in the navigation window and select the entry **Test** in the function selection. The Tests window opens.

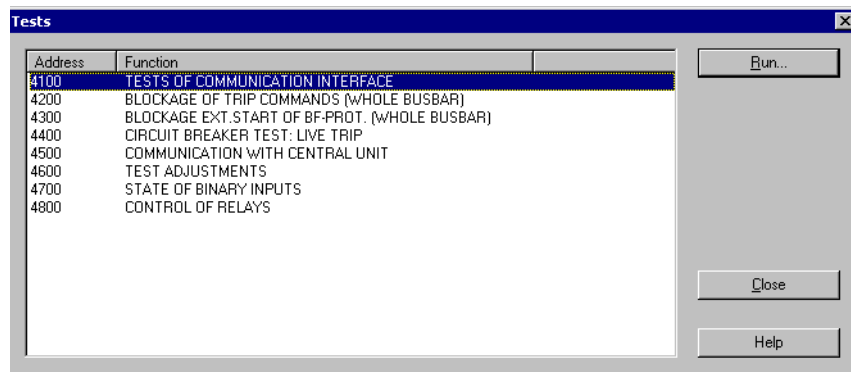


Figure 6-22 Tests window in DIGSI

- ❑ Click the entry **CIRCUIT BREAKER TEST : TRIP COMMAND** and click **Run...** The window **4400 CIRCUIT BREAKER TEST : TRIP COMMAND** opens.

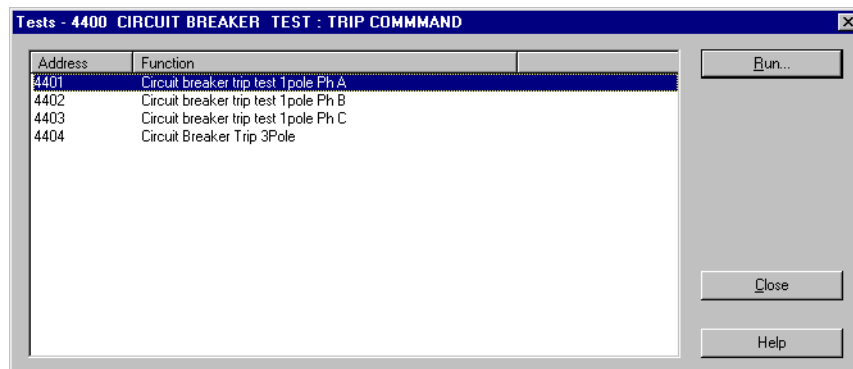


Figure 6-23 Window 4400 CIRCUIT BREAKER TEST : TRIP COMMAND in DIGSI

- Click an entry in the list and click **Run...**
- Enter the correct password in the box named **Password** and then click **OK**. If the password is wrong, you will receive an error message. When the password is correct, the circuit breaker test will be executed.

## 6.3.5 Reset Blocking

### 6.3.5.1 Reset Blocking of Differential Current Supervision

Use the parameters **DIF SUP mode BZ (6310/CU)** and **DIF SUP mode CZ (6311/CU)** to specify the behaviour of the protection for a pick-up of the differential current supervision (Chapter 5.5.1.8, page 172).

The blocking is reset by applying "**Reset Id-Block**" or via binary input ">Reset Id-Block" (**BI-FNo. 6/CU**) in the central unit.

from the PC  
with DIGSI



To reset the blocking of the differential current supervision at the **central unit** (PC linked to central unit) proceed as follows:

- Click **Control** in the navigation window.(see Figure 6-24, page 267).
- Double-click **Reset blocking of diff.-current superv.** in the function selection. The resetting of the blocking can be protected by the password for the parameter set. If you have activated this password, you will be prompted to enter it before the command is executed. A dialog box opens for this purpose.
- Enter the correct password in the box named **Password** and then click **OK**. If the password is wrong, you will receive an error message. When the password is correct, the blocking will be reset.

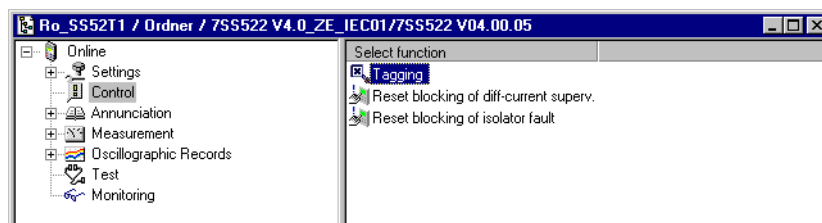


Figure 6-24 Reset blocking of differential current supervision using DIGSI



#### NOTE

If the parameters **DIF SUP mode BZ (6310/CU)** and **DIF SUP mode CZ (6311/CU)** are set to **alarm only**, the function **Reset blocking of diff.-current superv.** is not available.

### 6.3.5.2 Reset Blocking of Disconnecter Fault

Depending on the setting of the parameter **DCO Malfunc (6302/CU)**, there are different options of how the blocking will behave (Chapter 5.5.1.9, page 173).

The function is acknowledged by applying "**Reset DcoMalB1**" or via binary input ">Reset DcoMalB1" (**BI-FNo. 7/CU**) in the central unit.

from the PC  
with DIGSI



To reset the blocking of the disconnecter fault at the **central unit** (PC linked to central unit) proceed as follows:

- ❑ Click **Control** in the navigation window.(see Figure 6-24, page 267).
- ❑ Double-click **Reset blocking of disconnecter fault** in the function selection. The resetting of the blocking can be protected by the password for the parameter set. If you have activated this password you will be prompted to enter it before the command is first executed since a connection was established. A dialog box opens for this purpose.
- ❑ Enter the correct password in the box named **Password** and then click **OK**. If the password is wrong, you will receive an error message. When the password is correct, the blocking will be reset.



#### NOTE

If the parameter **DCO Malfunc (6302/CU)** is set to **alarm only**, the function **Reset blocking of disconnecter fault** is not available.

---

### 6.3.6 Trigger (first) Startup and Restart

In case of a **startup** will be cleared

- fault records
- fault annuciation buffer
- operational event buffer
- alarm list buffer

The device settings are contained in the parameter set and these are not changed in case of a startup.

The **restart**, to the contrary, is equivalent to switching 7SS52 V4 off and on. In case of a **restart** operational annunciations, fault events, fault records, and the setting are retained. Annunciations that are subject to general interrogation are retrieved and the connection to the bay units is re-established.



#### CAUTION

Executing the commands **Startup** will clear all device buffers and oscillographic records. Before startup you may want to back-up the settings and buffer contents by means of the DIGSI Device Configuration.

---

**from the PC  
with DIGSI**

To initiate a startup or a restart of the **central unit** (PC linked to central unit) proceed as follows:

- ❑ Click **Device** → **Startup** or click **Device** → **Restart** on the menu bar.
- ❑ Activating a startup or restart can be protected by the password for testing and diagnostics. If you have activated this password you will be prompted to enter it before one of the two commands will be executed. A dialog box opens for this purpose.
- ❑ Enter the correct password in the box named **Password** and then click **OK**. If the password is wrong, you will receive an error message. When the password is correct, the command will be executed.

### 6.3.7 Read and Set Date / Time

You have already decided in Chapter 4.7.2, page 107 on date and time management whether to set the internal clock and which synchronization source to use. Usually, a plausible time is already displayed during the device start. The time is either set automatically by the connected synchronization source or manually. Until the synchronization takes place and sets a valid time, different time displays may appear on the device. They are as follows:

The bay units are automatically synchronized via the central unit. For the operation without a central unit, the time for the bay units can be set via DIGSI or via local operation.

#### Clock status

Besides the display of date and time also the clock status is indicated. The text of the status display may look as follows for regular states of the time management:

Table 6-3 Clock status

| No. | Status text | Status           |
|-----|-------------|------------------|
| 1   | -- -- -- -- | synchronized     |
| 2   | -- -- -- ST |                  |
| 3   | -- -- ER -- | not synchronized |
| 4   | -- -- ER ST |                  |
| 5   | -- NS ER -- |                  |
| 6   | -- NS -- -- |                  |

The identifiers of the clock status ("status bits") have the following meaning:

|    |                      |   |
|----|----------------------|---|
| NS | Not set              | Clock was not set manually or synchronized after start. If the synchronization is performed via the system port, the transferred time value is marked "invalid" but the cyclical synchronization continues. |
| ER | Error                | There is no cyclic synchronization at present within the scope of the tolerance time (time may jump)  |
| ST | Daylight-saving time | The synchronization time last received has delivered a daylight-saving time bit (Central European Daylight-Saving Time)   |

The status is correct when text no. 1 or text no. 2 according to Table 6-3, page 269 are displayed.

**Time display**

The **DATE/TIME** picture and also all other indications containing date and time may have different time displays. They are determined by the value of the year and the status identifier "not set" and "error". The possible display types and their causes are explained in the following table.

Table 6-4 Display types of date and time

| No. | Display (example) |          | Year           | Error      | Not Set |
|-----|-------------------|----------|----------------|------------|---------|
|     | Date              | Time     |                |            |         |
| 1   | **.**.****        | 15?07:15 | Year = 1990    | irrelevant |         |
| 2   | 04.09.1998        | 15?07:15 | 1990<Year<2090 | Yes        | No      |
| 3   | 04?09.1998        | 15?07:15 |                | Yes        | Yes     |
| 4   | 04.09.1998        | 15:07:15 |                | No         | No      |
| 5   | **?*.****         | 15?07:15 |                | No         | Yes     |

Display type no. 1 occurs if the real-time clock has failed to deliver a valid time during startup. The annunciations in the event buffer have the date 01.01.1990.

Remedy: Set date and time manually (see margin heading "Time management").

Display type no. 2 occurs if the real-time clock has been set but not synchronized. This may happen:

- temporarily during device start,
- during synchronization failure i.e. if the cyclical synchronization was interrupted for longer than the specified tolerance time (**Fault indication after**).

Remedy: If you are using external synchronization, check its function and correct connection.

Display type no. 3 is shown if the real-time clock has delivered a valid time value but the time has not been set manually nor synchronized afterwards.

Remedy: Set date and time manually or wait until the cyclic synchronization takes effect.

Display type no. 4 indicates that the clock is synchronized cyclically according to its operating mode (normal status).

Display type no. 5 occurs if the synchronization takes place via the system port and the transferred time value has been marked "not set".

## Time management

You can modify the clock:

- by manually setting the clock via the integrated operation or via DIGSI,
- by modifying the parameters for the clock management.

You can set date and time manually during operation provided this feature has been enabled in the configuration of the clock management and after you have entered the password no. 5 (single parameters).

You can set the clock in the operating mode **Internal Clock** and also in **External Impulse via Binary Input** mode. The time step involved is indicated via the operational annunciations "Clock SyncError on" and "Clock SyncError off". In the mode **External Impulse via Binary Input** the annunciation "Clock SyncError off" appears as soon as a pulse edge has been received after the time was changed.

In the other operating modes manual setting is only accepted if the synchronization is currently considered faulty i.e., the identifier ST is set in the clock status. This is to avoid time steps. IRIG B is special since it allows the year to be changed at any time. This is accompanied by the annunciations "Clock SyncError on" and "Clock SyncError off", respectively.

The setting of date and time can also be relative ( $\pm 23:59:59$ ) via the **Diff.-time** input panel. This input option must not be confounded with the parameter **Offset** (see chapter 5) which influences the synchronization time of the radio clock receiver.

from the PC  
with DIGSI



To enter date and time at the **central unit** (PC linked to central unit) proceed as follows:

- Click **Device** → **Set Date & Time** (see Figure 6-25, page 271). The dialog box **Set clock & date in device** opens. The displayed values show the actual date and about the actual time. The day is determined automatically from the date and cannot be edited.

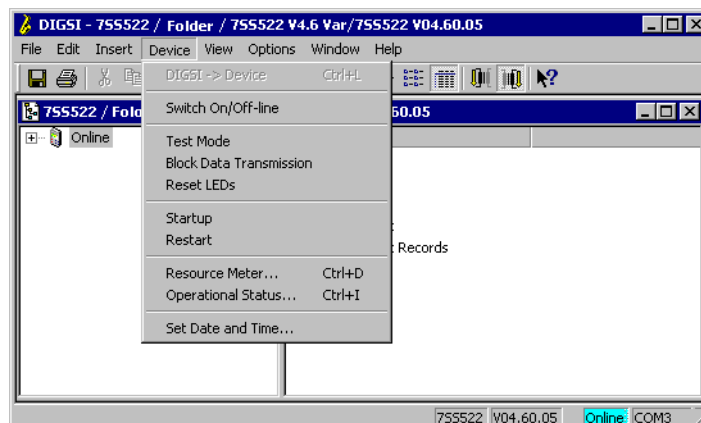


Figure 6-25 Selecting the Set date & time command

- ❑ Enter date and time in the corresponding boxes. Observe the correct notation (see Figure 6-26, page 272).
- ❑ Click **OK** to transfer the specified values into the device. The existing values are modified and the current dialog box closes.

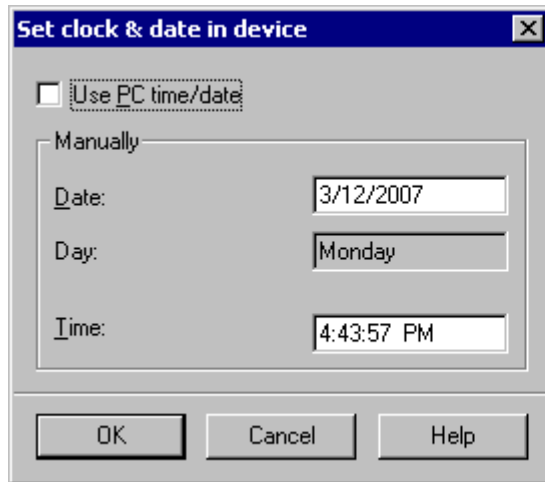


Figure 6-26 Set clock & date in device dialog box

- ❑ If you want to change the time offset or the tolerance time of the clock signal in the event of a fault, click **Settings** (Figure 6-27, page 272). The setting groups are shown in the function selection.

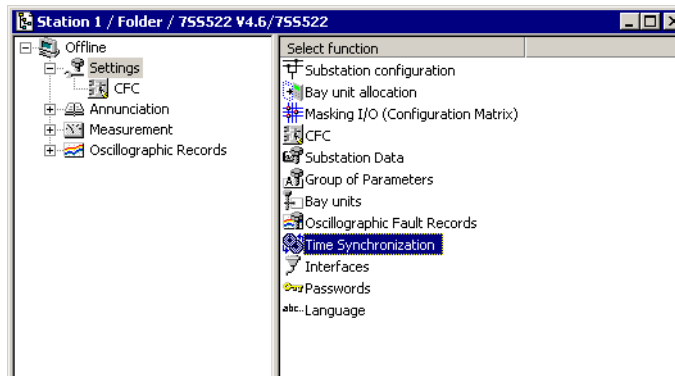


Figure 6-27 Selecting the time synchronization function

Double-click **Time Synchronization**. The Time Synchronization & Time Format dialog box opens (Figure 6-28, page 273).

- ❑ Change the time delay of the annunciation under the heading Monitoring (**Fault indication after:**) and the time offset in the box **Offset to time signal**.



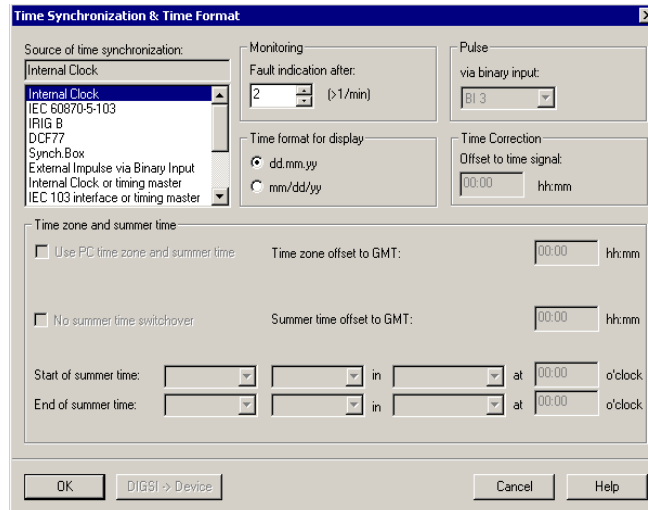


Figure 6-28 Example for Time Synchronization &amp; Time Format dialog box in DIGSI

**NOTE**

Date and time can also be set via the operator panel of the central unit. If you want to know more on this topic, please read the System Description /1/.

## 6.4 Feeder Shutdown and Commissioning

For additional information have a look at Chapter 5.9.3, page 196.

The bay unit can be put into service or shut down

- via DIGSI at the central unit with the parameter **Bay status (XX12/CU)**.
- via the operator panel of the central unit with the parameter **Bay status (XX12/CU)**.
- via the operator panel of the bay unit with the **F1** function key.  
If the feeder has already been shut down, applying the F1 key will put the feeder into service.
- via the operator panel of the bay unit with the parameter **COMMUNICATION CENTRAL UNIT Switching bay out of service (4501/BU)**.
- via the binary input ">Bay o.of ser" (**FNo. 7620/BU**) at the bay unit.



### NOTE

A feeder can only be put into service at the same place where it was shut down. For controlling the function "Bay out of service" on the bay unit, the controls on the bay unit have to be initially enabled on-site via the BU Control parameter **CTRL REL BU (6318/CU)**.

For this purpose, only the corresponding parameter of the executing device is modified. A logic OR operation of the two parameters from the central unit and the bay unit delivers the actual status of the bay unit.

from the PC  
with DIGSI



To shut down a bay for the busbar protection or put it into service at the **central unit** (PC linked to central unit) proceed as follows:

- Click **Settings** in the navigation window. The setting groups are shown in the function selection.
- Double-click **Bay units** in the function selection. The Bay units window opens (Figure 6-29, page 275).
- Double-click the desired bay unit. The window Bay Unit BU 01 opens (Figure 6-30, page 275). You can also click **Customize....**
- To put the bay for the busbar protection out of service, click the tab **General** and select **out of service** from the drop-down list in the right column.
- To put the bay for the busbar protection into service, click the tab **General** and select **in service** from the drop-down list in the right column.
- Click **DIGSI → Device** to transfer the parameter into the device. You can also click **OK** or **Apply** to include the parameter in DIGSI and transfer it into the device later. Click **Device** on the menu bar and then the menu item **DIGSI → Device** to transfer the parameter into the device. You will then be prompted to enter password No. 7 (parameter set). After you have entered the password and confirmed it with **OK**, the data will be transmitted and take effect when the transmission to the central unit or the bay units is finished.

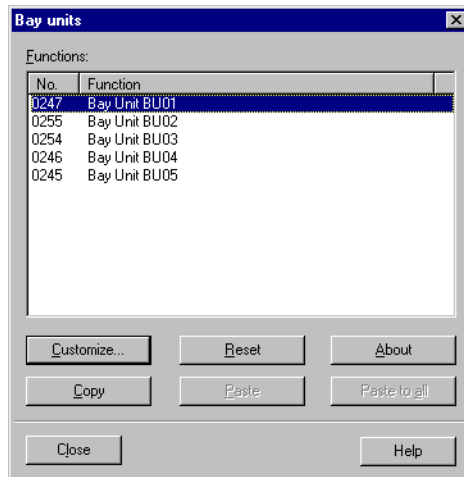


Figure 6-29 Bay units window – Example

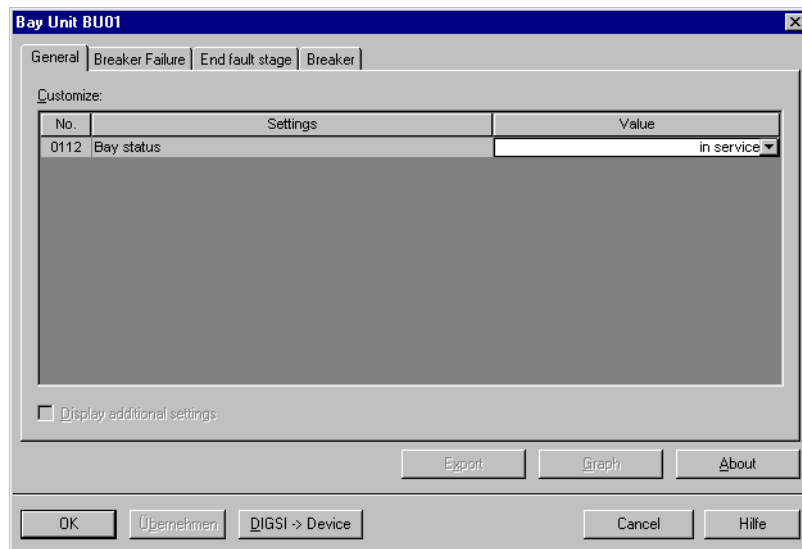


Figure 6-30 Bay status window – Example

To put a single bay for the busbar protection out of or into service at the bay unit (PC linked to central unit or to bay unit) proceed as follows:

- Open the corresponding bay unit in DIGSI Manager.
- Click **Test** in the navigation window.
- Double-click **Test** in the function selection. The Tests window opens (Figure 6-22, page 266).
- Click the entry **COMMUNICATION WITH CENTRAL UNIT** and then click **Run....**. The window "Test - 4500 COMMUNICATION WITH CENTRAL UNIT" opens (Figure 6-31, page 276).

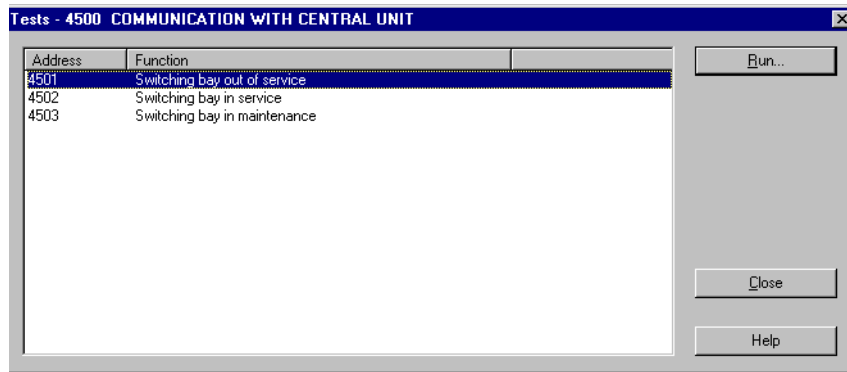


Figure 6-31 Window Test - 4500 COMMUNICATION WITH CENTRAL UNIT

- ❑ To put the bay for the busbar protection out of service, click the function **Switching bay out of service** and click **Run....** Next a password prompt takes place.
- ❑ To take the bay for the busbar protection into service, click the function **Switching bay in service** and click **Run....** Next a password prompt takes place.
- ❑ Enter the correct password in the box named **Password** and then click **OK**. If the password is wrong, you will receive an error message. When the password is correct, the bay will be put out of service.



**NOTE**

A warm restart normally takes place after the reconnection of a branch. During the shutdown, the warm restart is omitted as long as the connection continually exists and if the parameters of the central processing unit and the field unit continue to coincide.

---

## 6.5 Maintenance Mode

For additional information have a look at Chapter 5.9.3, page 196.

The maintenance mode can be performed individually for each feeder as follows:

- via DIGSI at the central unit with the parameter **Bay status (XX12/CU)**.
- via the operator panel of the central unit with the parameter **Bay status (XX12/CU)**.
- via the operator panel of the bay unit with the **F3** function key. If the feeder is already in maintenance mode, applying the F3 key will put the feeder into service.
- via the operator panel of the bay unit with the parameter **Switching bay in maintenance (4503/BU)**.
- via the binary input ">Isol.maint." (**FNo. 7624/BU**) at the bay unit.



### NOTE

The maintenance mode can only be deactivated at the same place where it was activated. For controlling the function "Bay out of service" on the bay unit, the controls on the bay unit have to be initially enabled on-site via the BU Control parameter **CTRL REL BU (6318/CU)**.

from the PC  
with DIGSI



To put a bay unit into maintenance mode at the **central unit** (PC linked to central unit) proceed as follows:

- Click **Settings** in the navigation window. The setting groups are shown in the function selection.
- Double-click **Bay units** in the function selection. The Bay units window opens (Figure 6-29, page 275).
- Double-click the desired bay unit. The window Bay Unit BU01 opens (Figure 6-30, page 275). You can also click **Customize....**
- To put the bay unit to maintenance mode, click the tab **General** and select **in maintenance** from the drop-down list in the right column.
- Click **DIGSI** → **Device** to transfer the parameter into the device.

To put a single **bay unit** into maintenance mode (PC linked to central unit or bay unit) proceed as follows:

- Open the corresponding bay unit in DIGSI Manager.
- Click **Test** in the navigation window.
- Double-click **Test** in the function selection. The Tests window opens (Figure 6-22, page 266).
- Click the entry **COMMUNICATION WITH CENTRAL UNIT** and then click **Run....** The window Test - 4500 COMMUNICATION WITH CENTRAL UNIT opens (Figure 6-31, page 276).
- Click the entry **Switching bay in maintenance** and then click **Run....** Next a password prompt takes place.

- ❑ Enter the correct password in the box named **Password** and then click **OK**. If the password is wrong, you will receive an error message. When the password is correct, the bay will be put into maintenance.

## 6.6 Plant Visualization

### General

The switchgear diagram you have created with the DIGSI Plant Configuration (see Chapter 4.3, page 71) is interpreted and the data set is produced as a result. Furthermore, it serves for the visual monitoring of the substation during operation.

After the Plant Visualization has been started, the current switchgear diagram is loaded and displayed. The Plant Visualization enables an on-line presentation of the measured values, switch states, and assignment to busbars.



### NOTE

For a detailed instruction on how to use the Plant Visualization, please refer to the corresponding on-line help. This section describes the basic method for the visual supervision of a substation.

### DIGSI at the CU



To use DIGSI for starting the Plant Visualization via a PC connected to the central unit, proceed as follows:

- Open the central unit in the DIGSI Manager in on-line mode.
- Click **Monitoring** in the navigation window.
- Double-click **Substation data** in the function selection. The DIGSI plant visualization opens. Alternatively, you can right-click **Substation data** and then select **Open object** in the context menu.

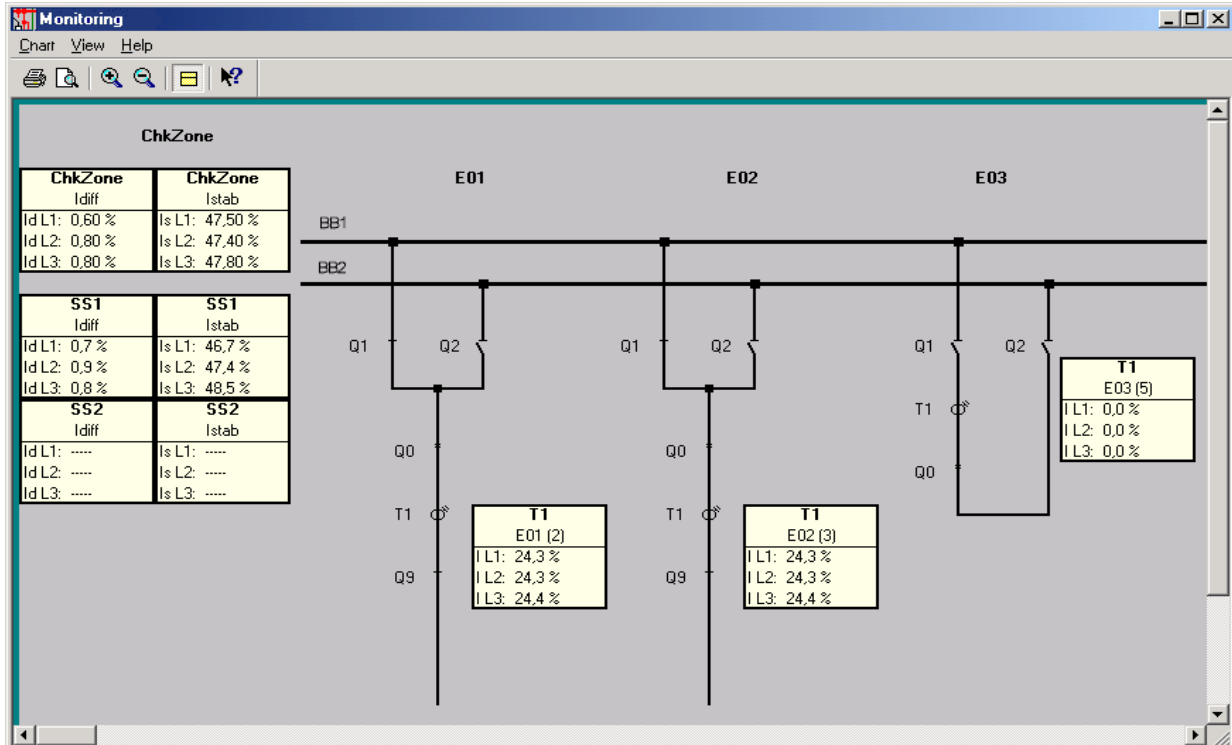


Figure 6-32 Start screen of the module Plant Visualization



**NOTE**

The Plant Configuration and the Plant Visualization cannot run simultaneously. Close the Plant Configuration before you start the Plant Visualization.

**User interface**

After the Plant Visualization has been started, you see the current switchgear diagram in the application window. The structure of the switchgear diagram is static and cannot be modified i.e. clicking into the application window will not have any effect.

The following objects change in dependence of the actual on-site conditions:

- values in the measured value boxes
- status of disconnector switches and circuit breakers
- colours of busbars, lines and disconnector switches
- static object if they are linked to lines or busbars

The following object are not subject to a change in colour:

- text
- measured value boxes
- circuit breakers
- current transformers

**Display of the current switch states**

The current status of disconnector switches and circuit breakers is represented by the corresponding circuit symbols as shown in Figure 6-33, page 280.

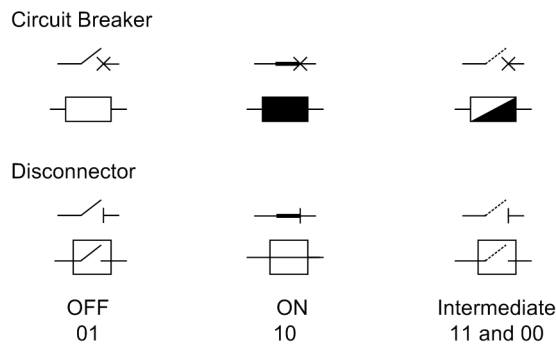


Figure 6-33 Circuit symbols of a circuit breaker



## Display of the measured values

Measured value boxes are displayed for the busbars and current transformers each consisting of three fields (phases L1, L2, L3) of the phase currents and always display the current measured value. The first line of each measured value box shows the name of the busbar or of the current transformer. Measured value boxes for current transformers show the current in percent.



### NOTE

The percentages for the differential and restraint currents are referred to the normalized current (Chapter 4.3.7, page 82) of the base CT. The percentages for the feeder currents refer to the rated transformer current of the corresponding feeder.



### NOTE

In the fault record, the current values are displayed from the protection's point of view, i.e. after the algorithmic processing, for an easier analysis of the protection behaviour. This means that, for example, the stabilisation factor  $k$  in the restraint current is taken into account.

A special feature is the restraint current of the check zone: In the extreme case (busbar fault with all currents directed to the busbar), the resulting restraint current of the check zone is even zero since the current flowing out is zero.

Each bus zone has one measured value box for the 3 differential currents and one for the 3 restraint currents.



### NOTE

The measured value boxes for the bus zones can only be displayed in the Plant Visualization if you have set the measured values to visible in the DIGSI Plant Configuration under the object properties of the busbar.

Further information on setting the object properties can be found in the on-line help of the DIGSI Plant Configuration.





### NOTE


If 2 busbars are connected in case of a bus shunt by disconnectors, only the measured value boxes of the busbar with the higher priority (lower number as BB1, ...) are visible.

The measured value boxes of a current transformer show the actual feeder current and also the long text of the logic group (bay name) to which the transformer is assigned.

You can show or hide the measured value boxes.

To show the measured value boxes:

- Click **View** → **Measured Value Boxes** on the menu bar. Alternatively, you can click the  button on the toolbar. The measured value boxes are displayed as you have specified in the DIGSI Plant Configuration. With the measured value boxes shown, the menu item **View** → **Measured Value Boxes** is checked off and the  command button is active.

To hide the measured value boxes, proceed analogously. With the measured value boxes hidden, the menu item **View** → **Measured Value Boxes** is not checked off and the  command button is not active.

The setting for the display of the measured value boxes is saved and restored after the restart of the Plant Visualization.

**Check zone**

You can also show or hide the measured value boxes for the differential current and for the restraint current of the checkzone. The measured values are displayed as percentages.

**Display of Feeder Statuses**

In the plant visualization, special operating statuses of a feeder are marked by a fault LED. This applies to planned statuses such as "Maintenance" or "Feeder out of Service" or disturbances such as "Intermediate Position of a Disconnecter" or the interruption of the connection between central unit and bay unit.

The occurrence of such a disturbance is marked by an illuminated LED icon located at this feeder.

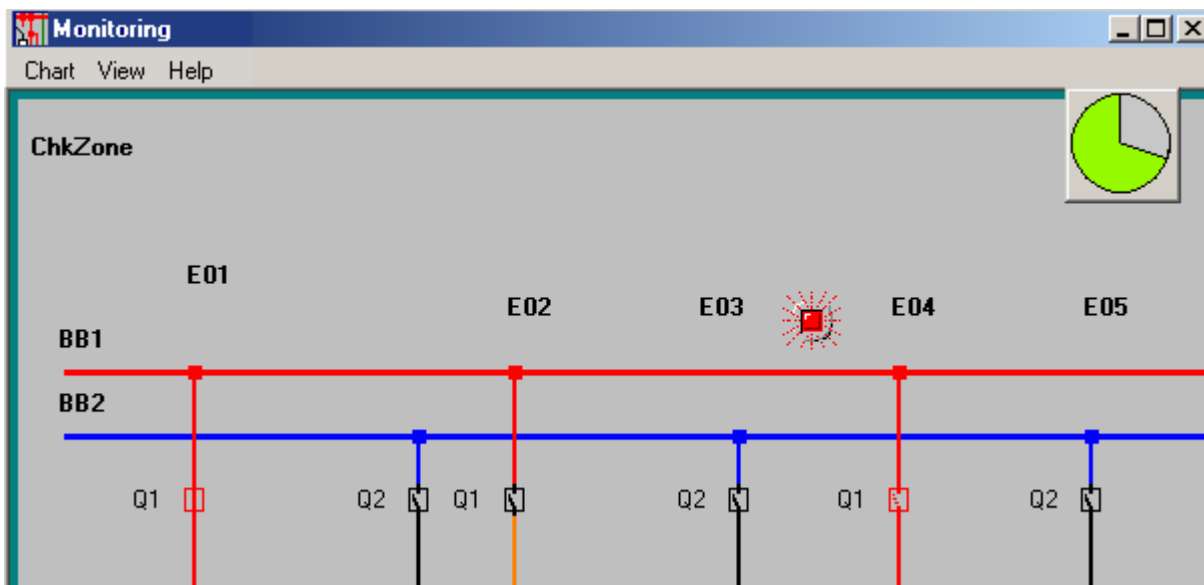


Figure 6-34 Display after Occurrence of Disturbance with Highlighted LED

To show or hide the information list, click on the LED icon which will go out thereby. The display of the LED icon will not be reset until the elimination of the disturbance. You will still find the entire message texts under the DIGSI messages.

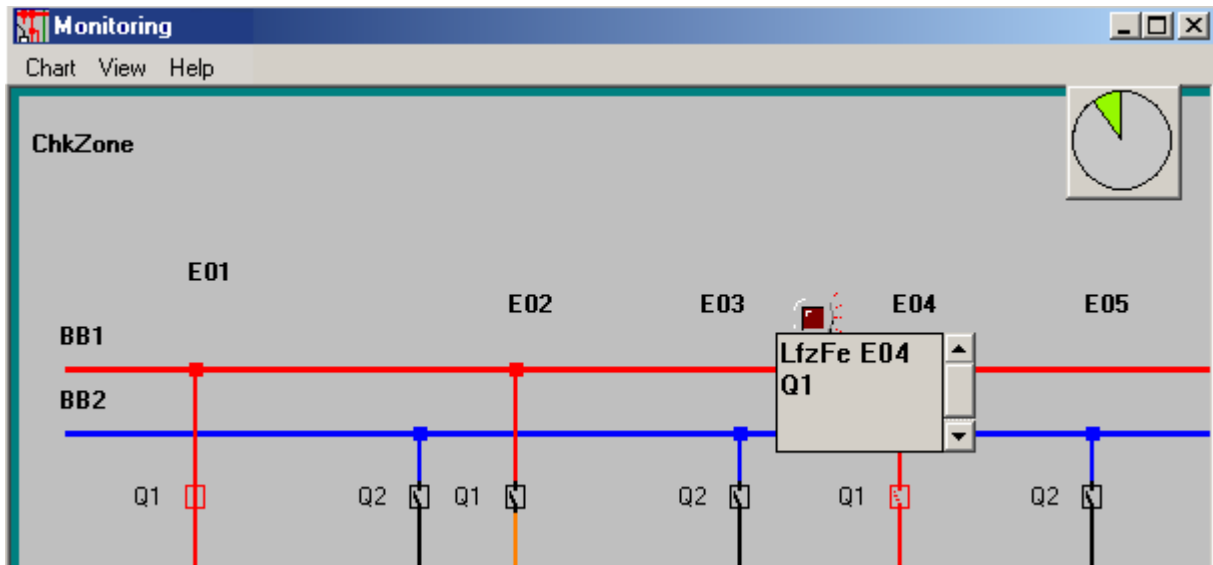


Figure 6-35 LED with Information Window

### UpdatingCycle

The visualization in DIGSI is updated cyclically. The clock displayed in the upper right corner shows the current update status. See Figure 6-35, page 283.

When the circle is entirely filled up at "12 o'clock" the update has been completed.

### Plant View and Protected View

The Plant View corresponds to the actual statuses of the binary inputs CLOSED, OPEN and Intermediate/Running Position. It is visualized directly in the circuit symbols.

The coloration of the zones corresponds to the Protected View and is done at the end of the updating cycles. For example, an disconnector in running position is treated as "CLOSED".

The assignment of the feeders to a relevant busbar is indicated by a certain colour. This means that the line and the switchgear symbols are in the same colour as the corresponding busbar.

When a sectionalizing disconnector is closed or in case of a bus shunt by disconnectors, the busbar section with the lower number (BB, ...) has a higher priority than the busbar section with a higher number (... , TB12) (preference). The busbar section with the higher number takes over the colour of the busbar section with the lower number.

The colour change corresponds to the actual measuring range of the protection. This is possible up to the current transformer or circuit breaker, depending on the positions of the circuit breaker and current transformer. Only the measured value boxes of the busbar with the higher priority will be displayed.

During configuration and having selected an object use the right mouse button in the menu **Object Properties** to determine the colours to be used in the visualization.

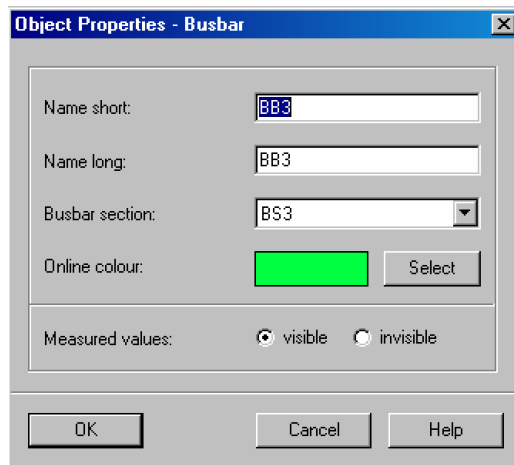


Figure 6-36 Object properties

**Disconnecter Status**

In a case of fault it is helpful for you to be able to analyze the current disconnecter and circuit breaker positions at a later point of time. For this purpose, these data are saved and can be selected in DIGSI under Fault Indications and displayed by double-clicking on the fault number.

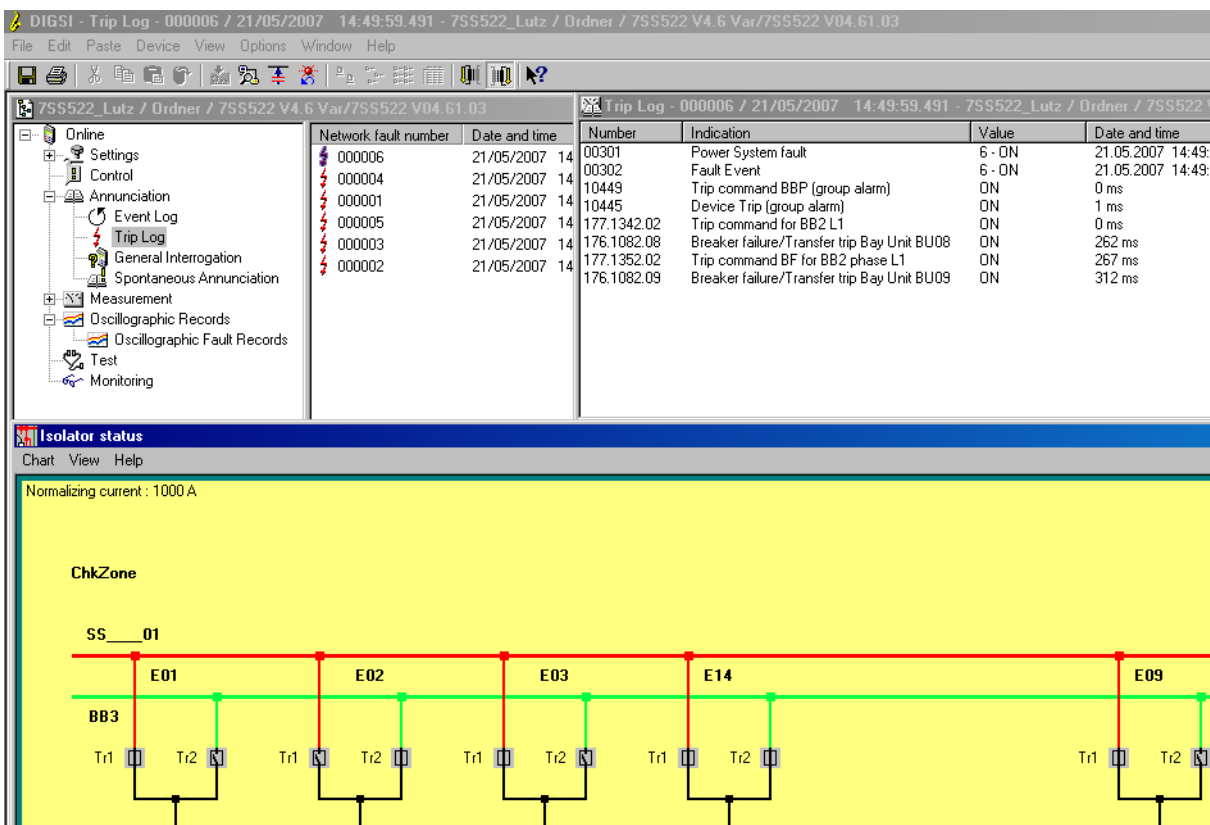


Figure 6-37 Switch Positions for a Case of Fault Displayed Graphically

## Installation and Commissioning

The installation and commissioning may only be made by experienced commission-ers. They have to be familiar with the commissioning of protection and control sys-tems, with the management of power systems and with the relevant safety rules and guidelines.

This chapter tells you how to install and connect the central unit and the bay units of the distributed busbar and beaker failure protection SIPROTEC 7SS52 V4 in addition this chapter tells you which tests with secondary values should be made in order to put the system into operation with primary values.

|     |                                |     |
|-----|--------------------------------|-----|
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## 7.1 Installation and Commissioning

Pay attention to the operating conditions according to VDE 0100/ 5.73 and VDE 0105 part 1/7.83.



### CAUTION

The modules of digital protection equipment contain electrostatically endangered components. These must not be withdrawn or inserted under live conditions! The modules must be handled with care so that any possibility of damage due to static discharges is prevented. Pay attention to the EED regulations (handling of electrostatically endangered devices) when you handle single modules. The modules are not endangered when plugged in.

---



### WARNING

Switch off all poles of the auxiliary voltage of the device at the circuit breaker. Even after the supply voltage has been disconnected or the module has been removed, hazardous voltages may still be present in the device (stored energy in the capacitor)!

---

### 7.1.1 Central Unit

#### Panel flush mounting

- ❑ Mount the subrack ES902c with at least 4 screws on the panel. The fixing flanges at both sides must be in full contact with the surface (Figure 9-2, page 362).
- ❑ Mount a solid low-ohmic and low-inductive operational earthing on the lateral earthing surface. For this earthing strips DIN 72333 Form A are suitable. Connect the strip to the protective earth of the panel.
- ❑ Connect the electric lines via the double-leaf-spring crimp contacts or the screw terminals of the modular terminal blocks on the back of the central unit. Pay attention to the identification of the modular terminal blocks. (Figure 2-6, page 42).
- ❑ Connect the central unit to the bay units by fiber-optic cables. For this, use fiber-optic cables with prefabricated ST plugs. Provide a suitable strain relief. When the fiber-optic cables are connected, the configured order of the bay units must be followed. The connections on the back of the central unit are marked. (Figure 2-6, page 42).

#### Removal of Modules

In general, it is not necessary to remove the ZPS modules. To adjust the pickup voltage of the binary inputs of the EAZ and CPU modules proceed once as follows:

- ❑ Loosen the five screws of the front panel and swing the panel down.
- ❑ Depending on the module, it will be necessary to loosen either the threaded rail (one screw per module) or the plug connectors of the ribbon cable.
- ❑ Remove the plastic strip that serves as shipping brace from underneath the module latches.

- ❑ Pull out the module using the handle provided. Make sure to loosen the module safety locks at the upper and lower rail.
- ❑ For the EAZ module proceed as follows:
  - a. Loosen the ribbon cable
  - b. Push aside alternately upper and lower PCB safety locks and
  - c. Pull out module carefully by hand.
- ❑ If you put the module down, place it on a surface suitable for electrostatically sensitive devices (ESD).

## 7.1.2 Bay Unit

### Panel flush mounting or cubicle mounting

- ❑ Swing the two labeling strips at the housing cover open. That exposes the 4 elongated holes in the mounting bracket.
- ❑ Insert the bay unit into the panel cutout or the cubicle frame and secure it with four mounting screws (see mechanical dimensions in Chapter 9.3.2, page 364 to 366).
- ❑ Connect a solid low-ohmic and low-inductive operational earthing on the lateral earthing surface with at least a M4 screw. For this earthing strips DIN 72333 Form A are suitable. Connect the strip to the protective earth of the panel.
- ❑ Connect the electric lines via the double-leaf-spring crimp contacts or the screw terminals of the modular terminal blocks on the back of the bay unit. Pay attention to the identification of the modular terminal blocks. (Figure 2-9, page 44).
- ❑ Connect the bay units to the central unit by optical fibres. For this, use optical fibres with prefabricated ST plugs. Provide a suitable strain relief.

### Panel surface mounting

- ❑ Mount the bay unit 7SS523 with 4 screws each to the panel (for mechanical dimensions see Chapter 9.3.2, page 364).
- ❑ Connect a solid low-ohmic and low-inductive operational earthing on the lateral earthing surface with at least a M4 screw. For this earthing strips DIN72333 Form A are suitable. Connect the strip to the protective earth of the panel.
- ❑ Connect the electric lines via the screw terminals. You can use solid conductors or stranded conductors with end sleeves.
- ❑ Connect the bay units to the central unit by fiber-optic cables. For this, use fiber-optic cables with prefabricated ST plugs. Provide a suitable strain relief.

### Removal of Modules

- To adjust the pickup voltage of the binary inputs of the EFE or EFE\_10 modules proceed once as follows:
- ❑ Loosen the five screws of the front panel and swing the panel carefully to the side.
  - ❑ Loosen the ribbon cable, push aside alternately the upper and lower PCB safety locks and pull out the module carefully by hand.
  - ❑ If you put the module down, place it on a surface suitable for electrostatically sensitive devices (ESD).

## 7.1.3 General Information on the 2-Bay Bus Coupler

### 7.1.3.1 General

The coupler bay with the type "2-bay"-coupler is implemented with 2 bay units of the 7SS52. This is necessary when the IO capability of the bay unit (one current transformer, five disconnectors) is not sufficient for processing as 1-bay coupler. To ensure that all functions of the coupler operate correctly, it must be ensured that the connection of the measuring inputs, binary inputs and outputs to the bay units comply with certain requirements.

#### Measuring inputs (current transformers)

The currents must be measured by both bay units separately. On couplers with only one set of primary CTs the CT measuring inputs of the two bay units must be connected in series, with 180° phase rotation with respect to each other. The phase rotation is required as only one CT polarity can be set, and the current flows in exactly the opposite direction in the second part of the coupler.

#### Tripping contacts and inter-tripping signals

Tripping contacts and inter-tripping signals must be connected in parallel on both bay units, as each bay unit obtains its own command from the central unit.

#### Circuit breaker auxiliary contact (CB aux)

The so-called "dead zone" (fault between CB and CT) is protected by using the CB aux. When the CB is open, the current in the coupler is set to zero so that the fault immediately appears on the feeding busbar section.

As each of the bay units is separately measuring the currents, the CB aux must be connected in parallel to both bay units.

To provide this functionality, the switching status information "CB open" (>CB OFF) is sufficient. Unwanted tripping due to incorrect switching status feed-back signalling is prevented by the check zone. For increased security, the option to also check the plausibility of the switching state with the feed-back information "CB closed" (>CB ON) via binary input may also be used. For this purpose, the corresponding binary inputs on both bay units must be configured accordingly.

#### CLOSE-command

By means of the binary input "CB manual close" (>CB man. close) the current reversal described above in connection with CB aux is applied immediately - despite the switching state feed-back information still indicating that the CB is open.

This ensures that in the event of delayed opening of the CB aux contact the current appearing will already be allocated to the correct busbar section.

The logic is implemented in each bay unit and must be connected in parallel.

#### Breaker-failure protection / Breaker-failure initiation

Due to the selective current measurement, the binary input for the breaker-failure protection is also selective, i.e. with the operating mode "bus zone unbalance" each bay unit reverses its own current. The binary inputs of both bay units must be connected in parallel.



**Maintenance of bay** This function is applied during disconnector maintenance when the disconnector feedback signals do not correspond with the disconnector switching state (e.g. when testing the auxiliary contacts or when the auxiliary supply for disconnector status signals is switched off).  
The feeder remains in service during this time and consequently is part of the busbar protection measurement.  
"Maintenance of bay" results in a freeze of the current disconnector switching state in this bay. The further disconnector monitoring in this bay and resulting signals are blocked. A signal "Disconnector operation prohibited" is generated.  
The maintenance mode is activated in each bay unit. There is always one binary in out by means of which the corresponding bay unit can switch the maintenance mode for the configured disconnector on or off.  
Individual switchgear (disconnectors, circuit breakers) can be excluded from the maintenance mode by means of a setting parameter.

**Bay out of service** For the function "Bay out of service", the binary inputs of the two bay units are combined by a logical OR, i.e. the connection to one binary input is sufficient.

### 7.1.3.2 2-Bay Bus Coupler With 2 Current Transformers

With a 2-bay bus coupler with 2 current transformers, each bay unit is connected to its corresponding current transformer (usually overlapping).

### 7.1.3.3 2-Bay Bus Coupler With one Current Transformer

If more than 5 disconnectors have to be monitored, in the DIGSI plant Configuration a coupler must also be equipped at the distributed busbar and breaker failure protection SIPROTEC 7SS52 V4 with two bay units. Distribute the disconnectors of the bay to 2 bay units (see also Configuration notes in Chapter 4.4, page 85).

7.1.3.4 Connection

- ❑ If you have couplers with one transformer, connect the current inputs of the bay units in series per phase (Figure 7-1, page 290).
- ❑ Record the disconnector positions according to the configuration via the binary inputs of the single bay units.
- ❑ Connect the TRIP command and transfer trip contacts of both bay units in parallel.
- ❑ In this case also connect further binary input functions (e.g. CBF initiation, CBF release, TRIP release) in parallel.

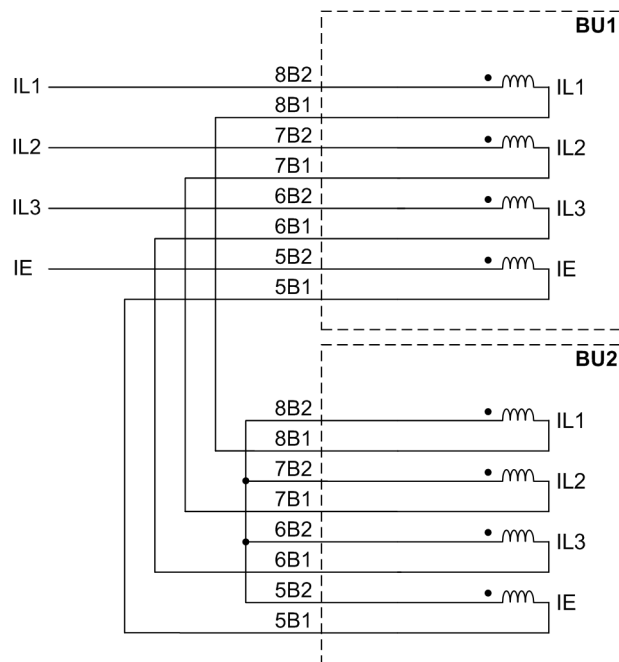


Figure 7-1 Connection of the current inputs of the bay units in bus couplers with only one current transformer.

## 7.2 Checking the Connections

The operational preparations according to Chapter 7.1, page 286 must be completed.



### WARNING

The following inspection steps are performed in the presence of dangerous voltages. Only appropriately qualified personnel familiar with and adhering to safety requirements and precautionary measures may perform these steps.

The connection assignments are shown in Chapter A.3, page 376. The allocating possibilities of the binary inputs and outputs are described in Chapter A.10, page 416.

Before switching the protection system on, check that the following external electrical and optical links are correctly connected.

- Check the continuity and connections of all current transformer circuits against the plant and connection diagrams:
  - Are the current transformers correctly earthed?
  - The polarity of a single phase of a current transformer must be consistent. The polarity of the current transformers of different bay units can be different. But it must correspond to the parameterized polarity in the DIGSI system projection.
  - Is the phase relationship of the current transformers consistent?
- Check the fiber-optic connections between central unit and bay units.



### NOTE

If a bay unit is connected to the central unit but not included in the configuration, this results in continual coming and going of the alarm "Fail Com.CU" (**FNo. 7650/BU**) in a 5 sec cycle.

- Check the tripping lines to the circuit breaker. The auxiliary voltage must not yet be switched on:
- Check the control wiring to and leading from other devices.
- Check the signal circuits.
- Check the auxiliary voltage at the cubicle terminals. Check its polarity and the polarity of the digital input connection.
- Check magnitude of the supply voltage.
- Check whether the binary inputs are set to the correct voltages.
- When the connections are connected correctly, switch on the miniature circuit breaker for the supply voltage.
- If you have already installed the communication between the central unit and the bay units (Chapter 3.6, page 60) load the parameters into the central unit and into the bay units. How to analyze faults in the internal protection communication, can be found in Chapter 8.2.4, page 326. A faulty bay unit appears in the alarm list. The alarm list can be called up by pressing the function key **F1** on the central unit.

After the protection system has run up successfully, the red LED (ERROR) goes out and the green LED (RUN) lights up on the central unit as well as on each connected bay unit.

## 7.3 Commissioning

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### WARNING

Hazardous voltages are present in this electrical equipment during operation. Severe personal injury or property damage can result if the device is not handled properly.

Only qualified personnel shall work on and around this equipment after becoming thoroughly familiar with all warnings and safety notices in this instruction manual as well as with the applicable safety steps, safety regulations, and precautionary measures.

The main points to observe are:

- The device is to be earthed to the substation earth before any other connections are made.
  - Hazardous voltages can exist in the power supply and at the connections to current transformers, voltage transformers, and test circuits.
  - Hazardous voltages can be present in the device even after the power supply voltage has been removed, i.e. capacitors can still be charged.
  - After removing voltage from the power supply, wait a minimum of 10 seconds before re-energizing the power supply. This wait allows the initial conditions to be firmly established before the device is re-energized.
  - The limit values given in Technical Data must not be exceeded, neither during testing nor during commissioning.
- 

When testing the device with secondary test equipment, make sure that no other measurement quantities are connected and that the TRIP command lines and possibly the CLOSE command lines to the circuit breakers are interrupted.

---



### DANGER

The output terminals of the current transformers must be short-circuited on the transformers themselves before the power supply lines to the device are disconnected.

Where a test switch is available that short-circuits automatically the output lines of the current transformer, it will be sufficient to set it to "Test" position, provided that the short-circuiters have been checked in the first place.

---

During the commissioning procedure, switching operations will be carried out. It is assumed for the tests described here that this is possible without danger. Therefore, these tests are not intended for checks during operation

---



### WARNING

Primary tests may only be carried out by qualified persons who are familiar with the commissioning of protection systems, with the management of power systems and the relevant safety rules and guidelines (switching, earthing etc.)

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### 7.3.1 How to Proceed

**NOTE**

This manual cannot take into account all possible aspects of the commissioning procedure. The responsibility for a successful commissioning lies with the person who performs it.

The following sections lead you through the essential steps of the commissioning. We recommend to commission the protection system and all its functions centrally with DIGSI.

**NOTE**

A prerequisite for this is that the plant configuration was made according to Chapter 4.3, page 71.

First, put all feeders out of operation (see Chapter 6.4, page 274). Then commission the bay units one by one.

In DIGSI the configuration of the bus bars, the bay types and the transformer data have to be determined in such a way, that they match the plant data.

- Make the allocations of the binary inputs, relays and LEDs of the central unit according to the settings of your customer.
- Check the current transformer circuits. The check includes the correct wiring, the polarity the transformation ratio and the position of the earthing.
- Check the disconnecter replica. The check includes the correct acquisition of the disconnecter feedbacks in the bay units and the central unit as well as the correspondence with the plant configuration.
- It makes sense to perform this check of the binary inputs and the LEDs of the bay units and the central unit (see Chapter 7.3.3, page 298). The check is made in connection with the feeder protection devices, if possible. Check the functions circuit breaker failure protection, releases and additional functions.
- With the circuit breaker check carry out a function control of the TRIP command and transfer trip contacts of the bay units (see Chapter 6.3.4, page 265). With the circuit breaker check a 1 or 3 pole circuit breaker TRIP command check at the bay units is possible. It is a prerequisite that the set threshold for the feeder current **I> MAN TRIP (6316 / CU)** is not exceeded. Furthermore the functions “CB Test L1, L2, L3” (**FNo. 7636, 7637, 7638 / BU**) must be allocated to the trip contacts. To test the annunciation “transfer TRIP command” allocate, if necessary, one of these functions to the corresponding output relay.
- Carry out a function check of the information of the central unit (see Chapter 7.3.4, page 303).

### 7.3.2 Web Monitor

The Web Monitor makes possible the display of parameters, data and measuring values during installation or during operation. For this it uses Internet technology.

This manual describes functions of the SIPROTEC Web Monitor which are specific for 7SS52 only. The general functions are available in the Help file on DIGSI-CD (as from version DIGSI V4.60).

#### Prerequisites

The Web-Monitor is composed of HTML pages containing Java applets which are stored in the EEPROM of the SIPROTEC 4 device. It is an integral part of the SIPROTEC 4 device firmware and need not be separately installed. All that needs to be created on the operator PC is a long-distance data transmission network used for selection and communication. After the link has been successfully established through the data transmission network, the browser is started and the TCP-IP address of the protection device entered in it. The server address of the device, which is its homepage address, is transmitted to the browser and displayed as an HTML page. This TCP-IP address is set at the front and service interface using DIGSI 4, or directly on the device using the integrated operator interface.

For more help in setting up the Web-Monitor refer to [www.siprotec.de](http://www.siprotec.de) "Applications" "Tips + Tricks".

#### 7.3.2.1 General

It is possible to simultaneously operate DIGSI 4 at the front operator interface via a COM port of the operator PC and the Web-Monitor at a second interface via another COM port of the operating PC (see Figure 7-2, page 294).

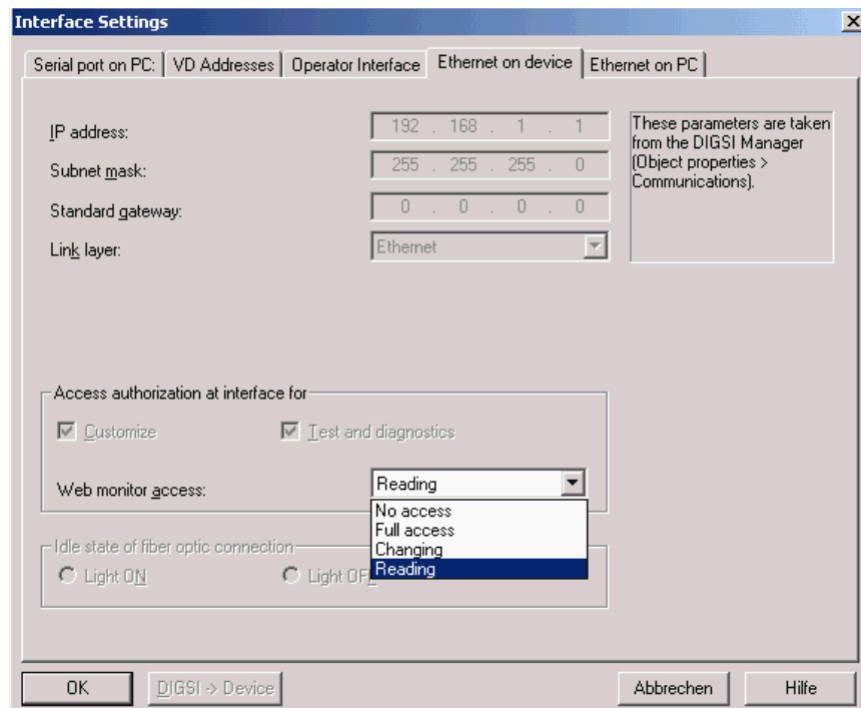


Figure 7-2 Setting the authorization for the Web Monitor for an access via Ethernet interface

### 7.3.2.2 Functions

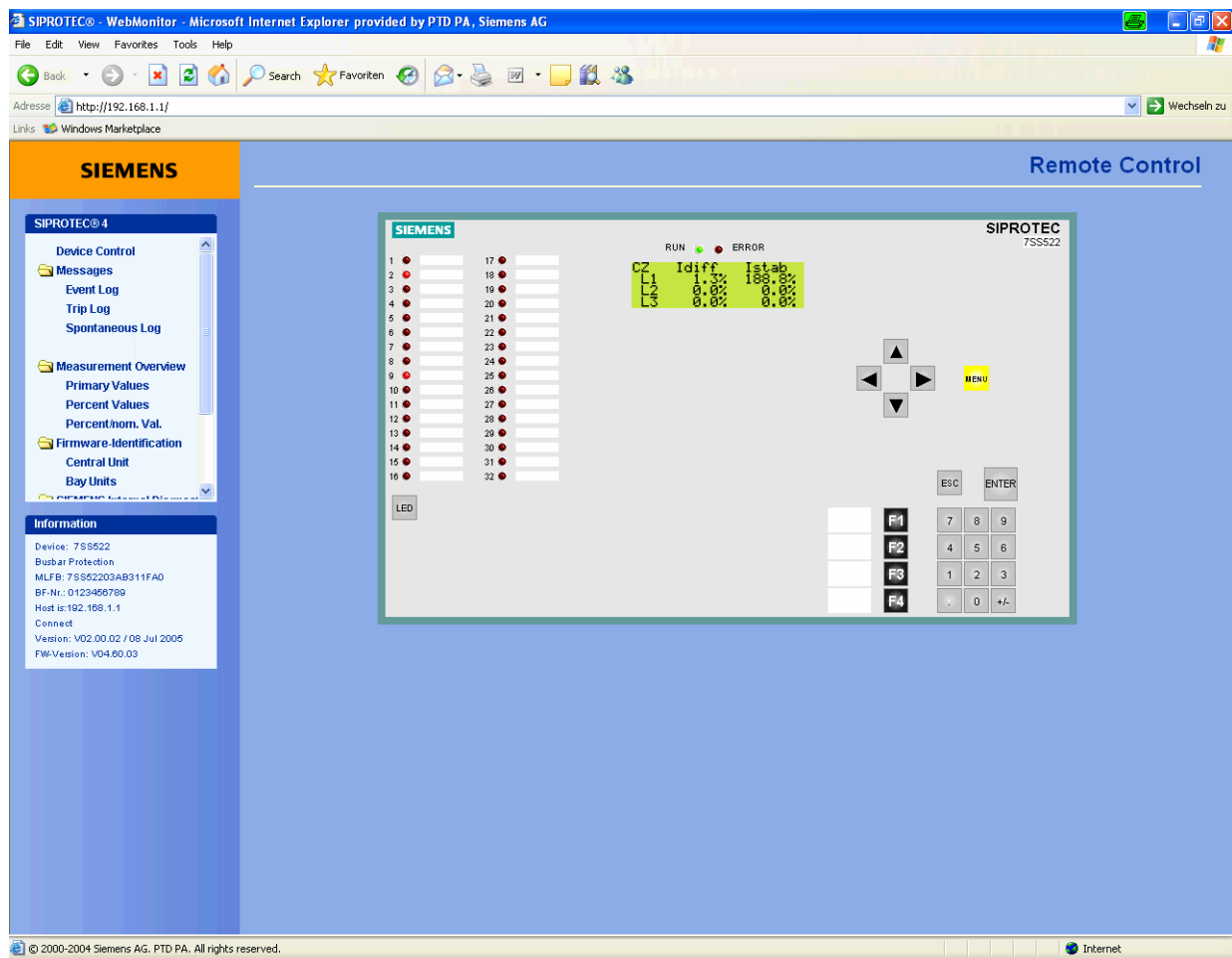


Figure 7-3 Web-monitor - Basic display

The above figure of the device operation view shows a device with its control (keyboard) and display elements (display, LEDs, inscriptions). The device can be operated with the keys shown in the display in the same way as with the sealed keypad on the device.

The Web Monitor for 7SS52 allows you to display the firmware versions of the bay units and of the modules of the central unit. In addition, the HDLC status (HDLC = High Level Data Link Control) of the internal serial interfaces can be called.

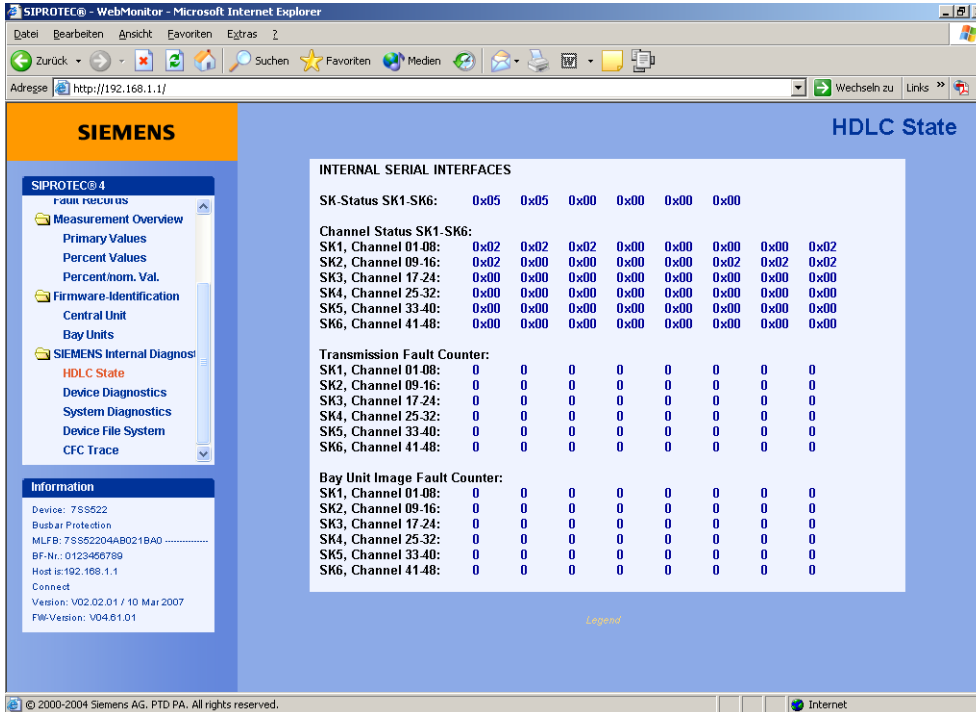


Figure 7-4 Example for the display of the HDLC status of the internal serial interfaces

A description of the values (0x00h ...) shown above can be displayed by clicking on "Legend".



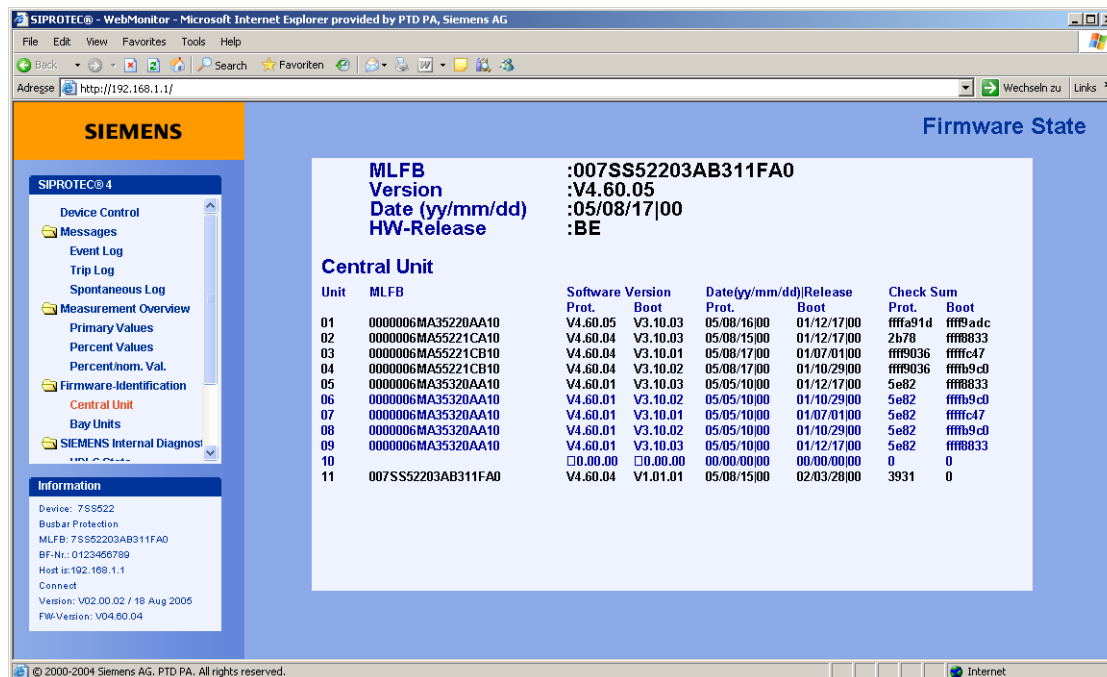


Figure 7-5 Example for the display of the firmware version for the modules of the central unit

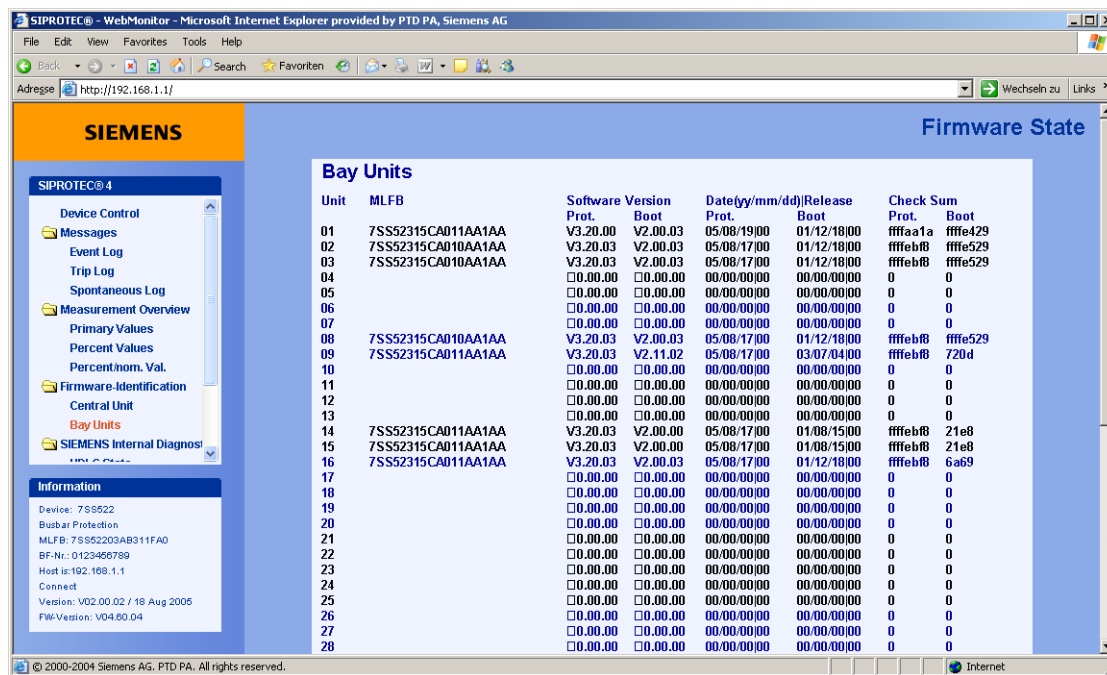


Figure 7-6 Example for the display of the firmware version for the modules of the bay units

### 7.3.3 Checking the Switching States of the binary Inputs/Outputs

With DIGSI you can purposeful selectively control individual binary inputs, output relays and LEDs of the central unit and the bay unit. In this way you can check, e.g. during the commissioning, the correct connections to the system.



#### DANGER

A changing of switching states by means of the test function causes a real change of the operating state at the SIPROTEC device. The switchgear (e.g. circuit breakers) can be switched by this!

---

#### 7.3.3.1 Central Unit

from the PC  
with DIGSI



The hardware test can be made with DIGSI in the operational mode Online:

- Double-click the directory **Online**. The operating functions for this device will appear.
- Click **Test**. The available functions are displayed on the right.
- Double-click in the list **Test device inputs and outputs**. The dialog box with this name is opened (see Figure 7-7, page 299).

Structure of the  
dialog box

The dialog box is divided into three groups: **BI** for binary inputs, **BO** for binary outputs and **LED** for LEDs. On the left of each group is an accordingly labelled panel. By double-clicking these panels you can show or hide the individual information of the selected group.

In the column **Actual** the current status of the particular hardware component is displayed. by symbols The actual states of the binary inputs and outputs are displayed by the symbol of opened and closed switch contact those of the LEDs by a symbol of an dark or shining LED.

The opposite state of each element is displayed in the column **Nominal**. The display is made in plain text.

The column on the far right displays commands or annunciations which are allocated to the particular hardware component.

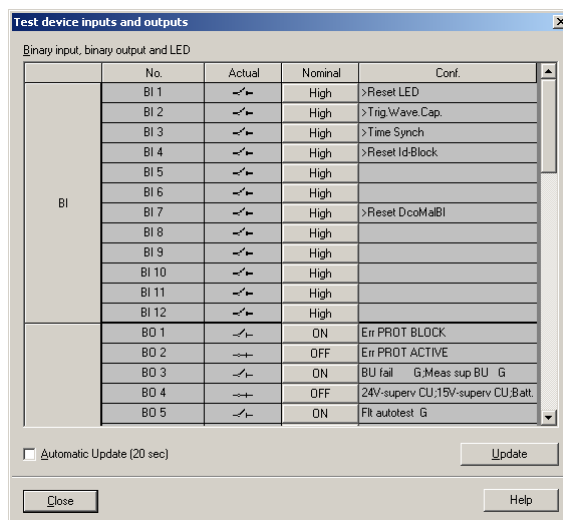


Figure 7-7 Dialog box devices in/outputs – Example

### Changing the operating state

- To change the operating state of a hardware component, click the corresponding panel in the column **Nominal**.

Before executing the first change of the operating state the password No. 6 is demanded (provided that it has been activated). After entering the correct password, the operating state change is executed. Further state changes remain released until the dialog box is closed.

### Testing the output relays

You can energize every single output relay to check the wiring between the output relay of the central unit and the system without having to create the alarm allocated to it. As soon as you have initiated the first state change for any output relay, *all* output relays are disconnected from the functionality of the device and can only be operated by the hardware test function. This means, that e.g. a TRIP command coming from a protection function or a control command from the operator panel to an output relay cannot be executed.

- Make sure that the operations initiated by the output relays can be made without any dangers.
- Test every output relay via the corresponding **Nominal** box of the dialog box.
- Finish the tests (see margin title below “Finishing the process”), so that during further testing no unwanted switching operations are initiated.

### Testing the binary inputs

To check the wiring between the plant and the binary inputs of the central unit, you must create in the plant itself the cause for an external and read out the effect at the device itself.

- ❑ To do so, open the dialog box **Test devices in and outputs** again to view the physical position of the binary input. The password is not yet necessary.
- ❑ Activate in the plant each of the functions which cause an external trip signal at the binary inputs
- ❑ Check the reaction in the **Actual** column of the dialog box. To do so you must update the dialog box. You will find the possibilities below under the margin heading "Updating the display".

If you want to check the effects of a binary input without actual switching operations in the plant, you could do so by controlling individual binary inputs with the hardware test. As soon as you have initiated the first state change for any binary input and have entered the password No. 6, *all* binary inputs are disconnected from the device and can only be operated by the hardware test functions.

- ❑ Finish the testing (see margin heading below "Finishing the process").

### Checking the LEDs

You can check the LED in the same way like the other in/output components. As soon as you have initiated the first state change for any LED, *all* LEDs are disconnected from the functionality of the device and can only be operated by the hardware test function. This means e.g. that no LED is illuminated anymore by a protection function or by pressing the LED reset button.

### Updating the display

During the opening of the dialog box **Test devices in and outputs** the operating states of the hardware components which are current at this time are read in and displayed. An update is made:

- for the particular hardware component, if a command for the change on a other state was successful.
- for all hardware components by clicking the box **Update**,
- for all hardware components by cyclic updating (cycle time is 20 seconds) by highlighting the option **Automatic Update**

### Finishing the process

To finish the process, click **Close** The dialog box is closed. The hardware components are again reset to the original operating state determined by the plant conditions. The device is not ready for operation for a short time during the following start-up.



### CAUTION

Executing the commands **Reset** or **Resume** will clear all device buffers and Oscillographic Records. Before initial start you may want to back-up the settings and buffer contents by means of the DIGSI Device Configuration (see Chapter 6.2, page 242).

---

### 7.3.3.2 Bay Unit

With the bay units, the display of their input/output states or the activation/deactivation of relays can be done via DIGSI or via the integrated operation.

In the operator tree of the bay units, under the tests, the operator addresses for the test sequence are stated, in the block as of 4700 for the binary inputs and as of 4800 for the relay control.

- For the binary inputs, the physical states are stated:  
0: not activated, 1: activated.
- There are two operator addresses per relay for controlling the relays one for the activation, e.g. 4801, and one for the deactivation, e.g. 4802. Entering the password F3F1F3F1F3F1 is required for this function.

#### Operator address

The binary input states (physical states) are displayed by selecting the corresponding operator address and its confirmation.

4700 STATE OF  
BINARY INPUTS

Input sequence for determining the state of binary input 1

|                           |   |
|---------------------------|---|
| 4701 BI1-STATE<br>- SHOW? | Physical state:<br>0: not activated<br>1: activated |
|---------------------------|---|

E key or  
J/Y key ->

4701 BI1-STATE  
0

Input sequence for determining the state of binary input 2

4702 BI2-STATE  
- SHOW?

E key or  
J/Y key ->

|                     |   |
|---------------------|---|
| 4702 BI2-STATE<br>0 | Physical state:<br>0: not activated<br>1: activated |
|---------------------|---|

- The states of the other binary inputs are stated in the operator tree under the addresses 4703 up to 4710 (7SS525) and 4720 (7SS523) respectively.

**Relay control**

After having entered the operator address and its confirmation (E key), the password is requested. After having entered the password, the question for the control of the relay appears again. After having confirmed again with the E key, the action is carried out. If a relay could not be deactivated, for example because an annunciation configured to it is active, this is acknowledged with a negative feedback.

4800 CONTROL OF RELAYS

Input sequence for activating trip relay 1

4801 TRIP RELAY1  
- SWITCH ON?

E key ->

ENTER PASSWORD:

Entry of the password

Password  
F3,F1,F3,F1,F3,F1 ->

4801 TRIP RELAY1  
- SWITCH ON?

E key ->

4801 TRIP RELAY1  
SUCCESSFUL

In the event of a negative feedback: „not successful“

Input sequence for deactivating trip relay 1

4802 TRIP RELAY1  
- DEACTIVATE?

E key ->

ENTER PASSWORD:

Entry of the password

Password  
F3,F1,F3,F1,F3,F1 ->

4802 TRIP RELAY1  
- DEACTIVATE?

E key ->

4802 TRIP RELAY1  
SUCCESSFUL

In the event of a negative feedback: „not successful“

- The operator addresses for the control of the other relays are stored on the subsequent addresses. In the case of an operation via the membrane keyboard, a once entered password is memorized until the address block is left. In the case of an operation via DIGSI, the password has to be entered again for each control action (relay on or off).

### 7.3.4 Testing the System Port

**Preliminary remarks**

If the device has a system port and uses this for communicating with a control center, you can test with the DIGSI device operation whether indications are correctly transmitted. You must avoid to use this test possibility during live operation.



### DANGER

The sending or receiving of annunciations via the system port by means of the test function is a real information exchange between SIPROTEC and the control center. This information would execute the corresponding functions (e.g. follow-up commands) in the control center.

The port test is made in the DIGSI mode Online:

- Double-click the directory **Online**. The operating functions for this device will appear.
- Click **Test**. In the right pane of the picture the available functions appear.
- Double-click in the list **Generate Indications**. The dialog box **Generate Indications** is opened (see Figure 7-8, page 303).

**Structure of the dialog box**

In the column **Indication** the display texts of all indications are displayed which were allocated to the system port in the matrix. In the column **Setpoint status** you determine a value for the indications that shall be tested. Depending on each indication type for this several input boxes are offered (e.g. **ON / OFF**). By clicking on one of the buttons you can select the desired value from the pull-down menu.

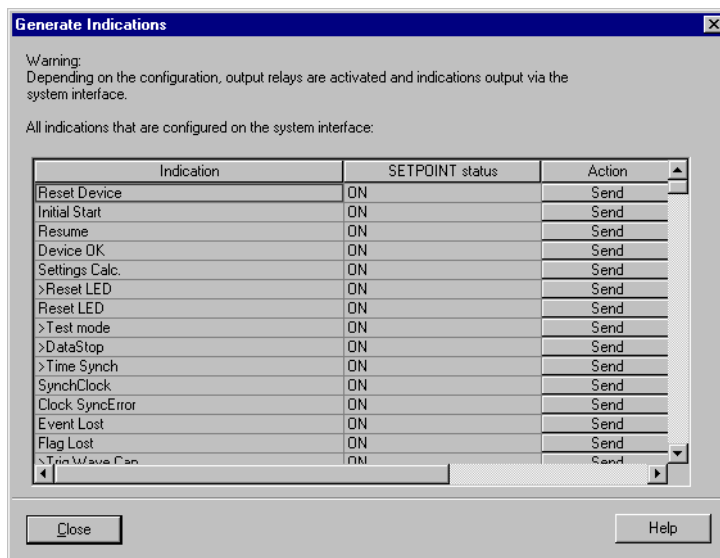


Figure 7-8 Dialog box Testing the system port – Example

**Changing the operating state** By clicking one of the buttons in the column **Action** you will be asked for the password No. 6 (for hardware test menus) After you have entered the password correctly you now can send the indications individually. For this, click the button **Send** in the corresponding line. The corresponding indication is now sent and can be read out both in the operational events of the SIPROTEC device and in the control center of the plant.  
Further tests remain released until the dialog box is closed.

**Test in alarm direction** For all information to be transmitted to the control center, test the offered possibilities in the pull-down menu under **Setpoint status**.

- Make sure that the switching operations which may be caused by the tests, can be made without any dangers.
- Click in the function to be tested send and check whether the corresponding information reaches the control center and possibly shows the expected effect.

**Finishing the process** To finish the test of the system port click **Close**. The dialog box is closed, the device is not ready for operation during the following start-up



**CAUTION**

Executing the commands **Reset** or **Resume** will clear all device buffers and Oscillographic Records. Before initial start you may want to back-up the settings and buffer contents by means of the DIGSI Device Configuration (see Chapter 6.2, page 242).

---

**Test in alarm direction** Information in alarm direction must be given by the control center. The correct reaction in the device has to be checked.



### 7.3.5 Control of the Disconnecter Replica

For test purposes, the disconnector positions of all available feeders can be preset independent of the state of the binary inputs. For this purpose, the system is to be set to test mode via DIGSI. At the beginning of the test mode, the actual binary input positions of the disconnector apply. The setting of the disconnector position during the test mode is made in the dialog box "Generate indications" as desired.

Please pay attention that in DIGSI Device Configuration the operating mode **Online** is prerequisite for the use of these test functions. Using parameter **OutEn BU-TEST (5112A/CU)** you can enable the command output during the test operation via relay. For safety reasons the pre-setting "No", i.e. the relay output, is locked. This ensures that no accidental triggering may occur during the test mode. The parameter **OutEn BU-TEST (5112A/CU)** is only effective during the test mode.

The following disconnector status indications can be generated and transmitted to the protection device:

- OPEN position
- CLOSED position
- Not current (0-0)
- Intermediate position (1-1)

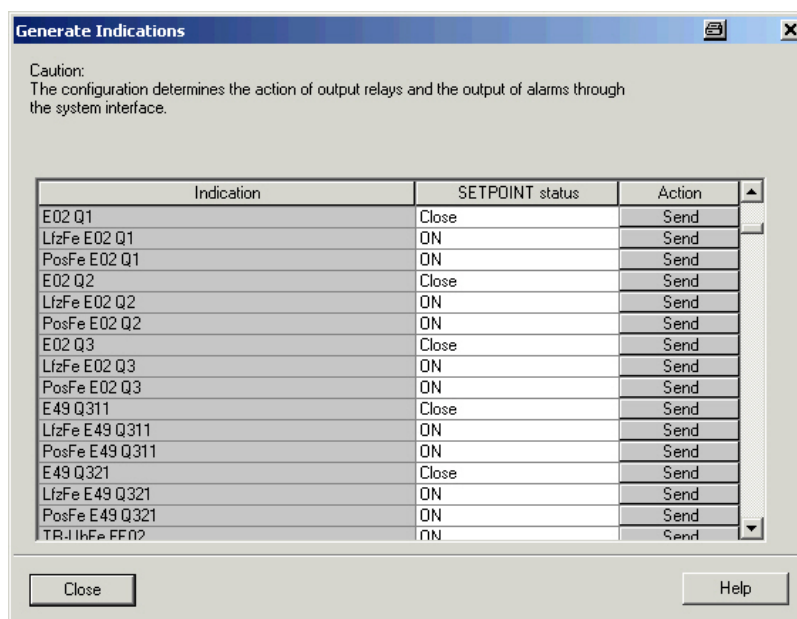



Figure 7-9 Disconnecter status indications

This also opens the "Simulation Mode" (Figure 7-10, page 282) in a dedicated window. You can place this window on top using the icon  Simulation... in the taskbar.

When you "Close" the above window (Figure 7-9, page 281) the window "Simulation Mode" will be closed, too.

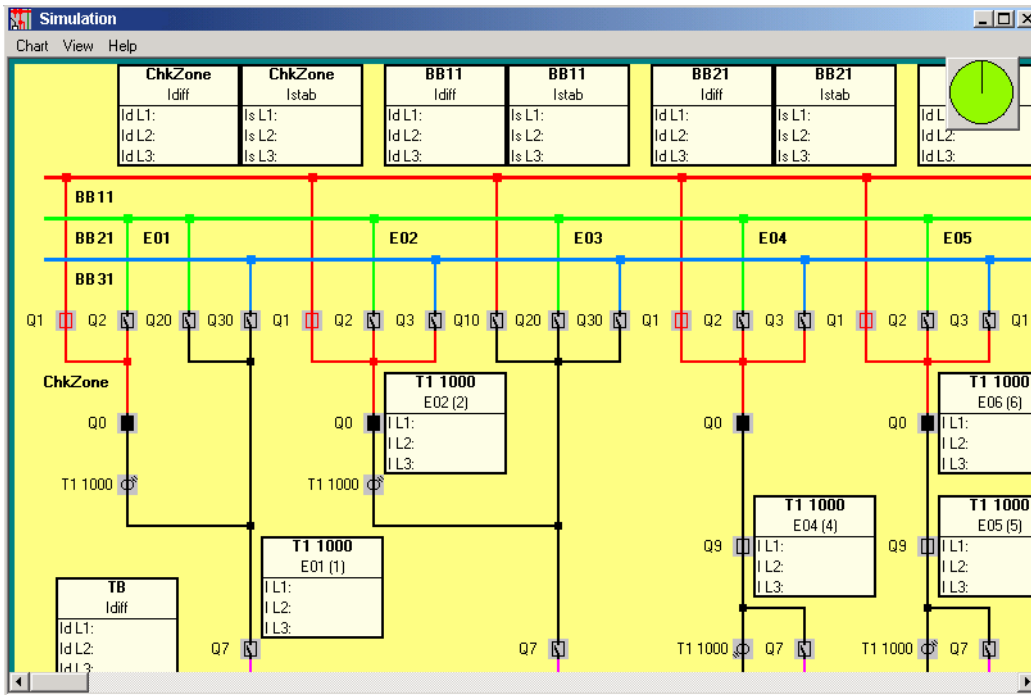


Figure 7-10 Simulation

### 7.3.6 Switching the Test Mode and the Transmission Block On and OFF.

If the central unit is linked to a central control or storage facility you can influence in some of the available protocols the information which are transmitted to the control center (see table "Protocol Dependent Functions" in the Appendix).

When the test **Test mode** is switched on, the annunciations sent by a SIPROTEC4 device to the control center are marked with an additional test bit, so that they can be recognized as not being annunciations of real faults. Furthermore it can be determined by activating the **Transmission block** that no annunciations at all are transmitted via the system port during a test mode.

- To switch on the test mode click in the menu bar DIGSI Device Configuration **Device → Test mode**.
- To activate the transmission block click in the menu bar DIGSI Device Configuration **Device → Transmission Block**.

## 7.4 Checks With Secondary Values

### 7.4.1 General

The operational preparations according to Chapter 7.2, page 291 must be completed.



#### **WARNING**

Hazardous voltages are present in this electrical equipment during operation. Severe personal injury or property damage can result if the device is not handled properly.

Only qualified personnel may work on and around this equipment after becoming thoroughly familiar with all warnings and safety notices in this instruction manual as well as with the applicable safety steps, safety regulations, and precautionary measures.

The main points to observe are:

- The device is to be earthed to the substation earth before any other connections are made.
  - Hazardous voltages can exist in the power supply and at the connections to current transformers, voltage transformers, and test circuits.
  - Hazardous voltages can be present in the device even after the power supply voltage has been removed, i.e. capacitors can still be charged.
  - The limit values given in Chapter 9, page 343 "Technical Data", must not be exceeded, neither during testing nor during commissioning.
- 



#### **DANGER**

The output terminals of the current transformers must be short-circuited on the transformers themselves before the power supply lines to the bay unit are disconnected.

Where a test switch is available that short-circuits automatically the output lines of the current transformer, it will be sufficient to set it to "Test" position, provided that the short-circuiters have been checked in the first place.

---

It is recommended to make the checks with secondary values at the current settings for the protection system. If these are not available make the checks with the default values (Chapter 5, page 113). For the following descriptions of the checks the default values are the basis if not noted differently. As far as it is necessary, for other setting values formulas are given.

Because of the phase-selective measuring principle for the testing two 1-phase, separately controllable current sources are sufficient.

**NOTE**

The measuring accuracy depends on the electric data of the test source used. The accuracy given in Chapter 9, page 343 "Technical data" Test can only be expected when following the reference conditions corresponding to DIN VDE 0435/Teil 303 or IEC 255 and using precision measuring instruments.

During all checks it is important that the corresponding annunciations are for remote signaling transmitted to the LEDs and are passed on via the alarm relays.

Before you start the checks with the secondary values:

- Read out the disconnecter replica with DIGSI Plant Visualization. The output corresponds to the plant status.
- Check whether the assignment of the switching devices in the plant visualization is correct.

## 7.4.2 Trip Characteristic of the Busbar Protection

Connect the test currents directly to the measuring inputs of the bay units. Depending on the model the rated current of the bay unit is 1 A or 5 A.

The test setup for the zone-selective protection is shown in Figure 7-11, page 310. By the TRIP commands of the feeders the test equipment is switched off.

The test setup for the check zone is shown in Figure 7-13, page 312. When the bus selectivity is checked switch one or more bays on a second bus (possibly by a feeder position simulation)

### 7.4.2.1 busbar-selective Protection

To check the busbar-selective protection the check zone must be set more sensitive than the bus -zone selective protection. By this, the release of the check zone is granted before the release of the busbar-selective protection.

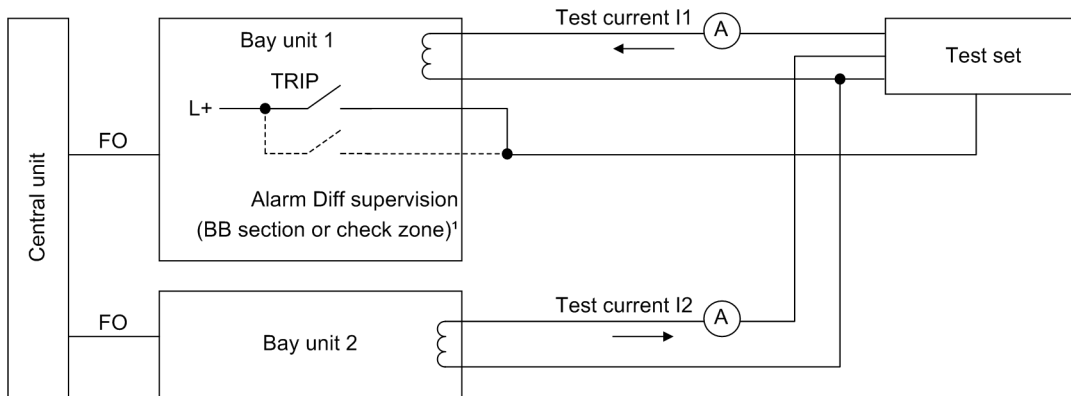
#### Example

You can set the Trip characteristic for the busbar-selective protection shall be set with the parameters **Id> BZ (6102/CU) = 2,0**  $I_{n0}$  and the stabilizing factor **STAB FAC:BZ (6101/CU) = 0,8**.

For the check zone the parameters for the differential current threshold is assumed to be set **Id> CZ (6104/CU) to 0,5**  $I_{n0}$  and the stabilizing factor **STAB FAC:CZ (6103/CU) to 0,5**.

#### Test setup

- For the test use 2 bays (no sectionalizers, no bus couplers) with the same normalization factor (CT-transformation ratio).
- Connect both bays to the same busbar.



1 For testing the diff-current limit for supervisory function (refer to Chapter 7.3.3, page 298)

Figure 7-11 Test setup for the trip characteristic of the busbar-selective measuring system

**Test steps**

- ❑ To prevent that the differential current supervision from blocking the protection during the test switch it off with the parameter **DIFF SUPERV (6306/CU)**.
- ❑ Set the differential current threshold and the stabilisation factor for the busbar-selective protection and the check zone as desired.
- ❑ Set the parameters **I>TRIP (XX13/CU)** for the overcurrent thresholds for the affected bays to **0**.
- ❑ The test currents  $I_1$  and  $I_2$  must have a phase displacement of  $180^\circ$ . To find out the phase angle, check the feeders 1 and 2 each with the same current ( $0.5 I_N$ ).



**NOTE**

The percentages of the differential and stabilisation currents refer to Normalized Current (Chapter 4.3.7, page 82). The percentages of the feeders refer to the transformer-rated value of the particular feeder. If the same percentages are displayed this does not mean necessarily that the same current is flowing in the concerned feeders.

- ❑ If the connection is correct the differential current must be nearly zero and the stabilisation current must be the double of the supply current.
- ❑ If the differential current is not zero, check the connection. If that is correct reverse the polarity in a feeder.
- ❑ If the current  $I_2$  is zero, then increase the current  $I_1$  for so long until a TRIP command is output. The current in the feeder must correspond to the differential current threshold set in the parameter **Id> BZ (6102/CU)**.
- ❑ Apply a constant current  $I_1$  which is smaller than the set differential current threshold to the feeder 1 from the test setup
- ❑ Increase the current  $I_2$  in feeder 2 slowly until the protection trips.
- ❑ The following formulas are valid:

$$\text{Differential current } I_d = | I_1 + I_2 |$$

$$\text{Stabilizing current } I_s = | I_1 | + | I_2 |$$

$$\text{Stabilizing factor } k = I_d / I_s = | I_1 + I_2 | / ( | I_1 | + | I_2 | )$$

On the trip characteristic is valid  $|I_2 - I_1| = k [|I_1| + |I_2|]$

Because the currents  $I_1$  and  $I_2$  have a phase displacement of  $180^\circ$ , you have

$$I_2 (1 - k) = I_1 (1 + k) \text{ or } I_2 = I_1 (1 + k) / (1 - k) \text{ and}$$

$$I_2 = 9 \times I_1, \text{ if } k = 0,8$$

- Repeat the checking with a different constant current  $I_1$ . The Trip characteristic graph is shown in Figure 7-12, page 311.
- After the checking, switch on the differential current supervision again with the parameter **DIFF SUPERV (6306/CU)**.

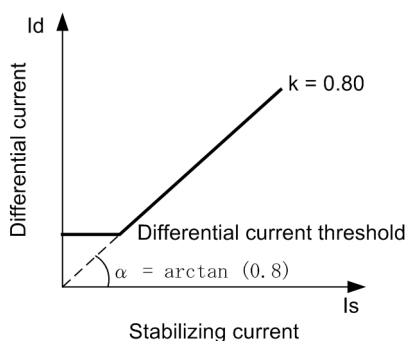


Figure 7-12 Trip characteristic of the busbar protection

#### 7.4.2.2 Check Zone

Alternatively, the decision to trigger by the checkzone can be requested via the message "Trip L1 CZ" (**FNo. 10457 to 10459 / CU**) as a phase selection. This enables a check which is independent of the selected bus protection.

#### Example

You want to set the trip characteristic for the check zone with the parameters for the differential current threshold **Id > CZ (6104/CU) = 2,0 I<sub>no</sub>** and the stabilizing factor **STAB FAC:CZ (6103/CU) = 0.8**.

You want to set the busbar-selective protection the parameters **Id > BZ (6102/CU) to 0,5 I<sub>no</sub>** and the stabilizing factor **STAB FAC:BZ (6101/CU) to 0.5**.

#### Test setup

- For the test setup use three bays with the same normalizing factor. Sectionalizers, or bus couplers must not be used for testing.
- Connect the bays 1 and 2 to the same bus zone.
- Connect the current inputs of these bay units back to back (see Figure 7-13, page 312). Connect bay 3 to a different bus.

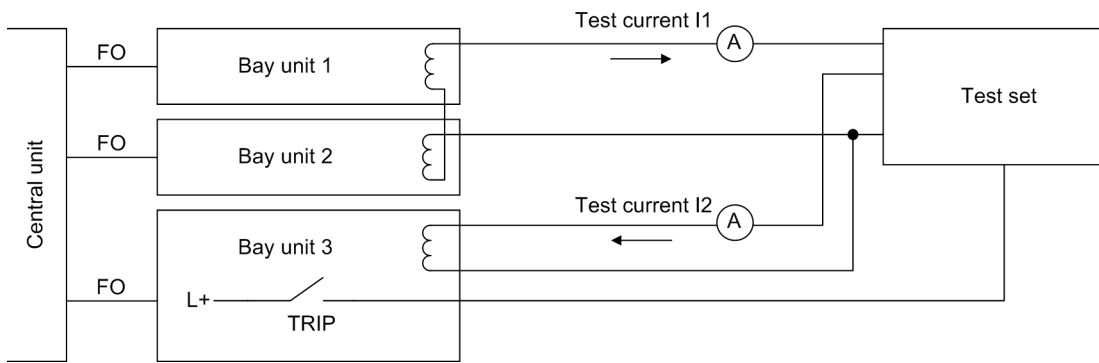


Figure 7-13 Test setup for the trip characteristic of the check zone.

**Test steps**

- ❑ Prevent the differential current supervision from blocking the protection during the tests switch it off with the parameter **DIFF SUPERV (6306/CU)**.
- ❑ Set the differential current threshold and the stabilisation factor for the busbar-selective protection and the check zone as desired.
- ❑ Set the parameters **I>TRIP (XX13/CU)** for the overcurrent limits for the affected bays to **0**.
- ❑ The test current  $I_1$  in bay unit 1 and 2 must have a phase shift of  $180^\circ$ . To find out the phase angle, check the feeders 1 and 2 each with the same current ( $0,5 I_N$ ).
- ❑ If the connection is correct the differential current of the bus zone must be nearly zero and the stabilisation current must be the double of the supply current.
- ❑ If the differential current is not zero, reverse the polarity in a feeder.
- ❑ If the current  $I_1$  is zero, increase the current  $I_2$  until the annunciation Trip L1 CZ to Trip L3 CZ (**FNo. 10457 to 10459/CU**) is output by the measuring system which is assigned to bay 3. The current  $I_2$  must correspond to the differential current threshold set in the parameter **Id> CZ (6104/CU)**.
- ❑ Apply to the bays 1 and 2 of the test setup with a constant current  $I_1$ .
- ❑ Increase the current  $I_2$  in bay 3 slowly until the protection trips. The differential current is then  $I_2$  and the stabilizing current  $I_1$  (Chapter 5.2, page 138). The stabilizing factor  $k$  is then equal to the ratio of  $I_2$  to  $I_1$ .
- ❑ Repeat the test with different constant currents  $I_1$ . The trip characteristic graph is shown in Figure 7-12, page 311.



## 7.4.3 Differential Current Monitoring

### 7.4.3.1 busbar-selective Protection

To check the busbar-selective protection, the busbar-selective protection must be set more sensitive than the check zone so that the supervision of the differential current of the check zone picks up later.

#### Example

You want to test the supervision for the busbar-selective protection with the parameters for the differential current threshold **Id> SUPERV BZ (6308/CU) = 0.2 I<sub>I<sub>no</sub></sub>** and the delay time **(6307/CU) = 2.0 s**.

For the check zone the parameter for the differential current threshold **Id> SUPERV CZ (6309/CU)** is assumed to be set to **0,8 I<sub>I<sub>no</sub></sub>**.

#### Test setup

- Arrange the test setup as in Chapter 7.4.2, page 309.

#### Test steps

- To make the differential current supervision block the protection, set it with the parameter **DIFF SUPERV (6306/CU)** to **On**.
- Set the parameters for the differential current threshold **Id> SUPERV BZ (6308/CU)** and the delay time **T-Idiff SUPERV (6307/CU)** as desired.
- Set the parameters for the overcurrent thresholds **I>TRIP (XX13/CU)** for the concerned bays to **0**.
- If the parameter **DIF SUP mode BZ (6310/CU)** is set to **block**, carry out the following 3 steps:
  - Connect the bays 1 and 2 to different bus zones.
  - Increase the current  $I_1$  in feeder 1 slowly until the annunciation of the differential current supervision signals that it has picked up. The current must correspond to the pickup threshold set in parameter **Id> SUPERV BZ (6308/CU)**. Now the bus is blocked. Even if  $I_1$  is further increased, there is no tripping.
  - Apply to feeder 2 a current 4 times as high as the rated current  $I_N$ . The protection system now switches off the current in feeder 2.

The last 2 test steps guarantee that the supervision of the differential current is busbar-selective.

- If the parameter **DIF SUP mode BZ (6310/CU)** is set to **alarm only** without protection blocking, carry out the following 3 steps:
  - Connect the bays 1 and 2 to the same bus zone.
  - Increase the current  $I_1$  in feeder 1 slowly until the differential current signals that it has picked up. The current must correspond to the set pickup threshold in parameter **Id> SUPERV BZ (6308/CU)**.
  - Apply to feeder 2 a current 4 times as high as the rated current  $I_N$ . By doing this the protection system now switches off the current in the feeders 1 and 2.

### 7.4.3.2 Check Zone

To test the check zone, the check zone must be set more selective than the busbar-selective protection so that the supervision of the check zone picks up earlier.

#### Example

You want to test the supervision of the check zone with the parameters for the differential current threshold  $I_{d> SUPERV CZ (6309/CU)} = 0,2 I_{no}$  and the delay time  $T-Idiff SUPERV (6307/CU) = 2,0$  s. For the busbar-selective protection the parameter  $I_{d> SUPERV BZ (6308/CU)}$  is assumed to be set to  $0,8 I_{no}$ .

#### Test setup

- Arrange the test setup as in Chapter 7.4.2, page 309.

#### Test steps

Check of the pickup threshold and the delay time:

- Increase the current in feeder 1 slowly until the check zone supervision picks up. The measured current must correspond to the set current  $I_{d> SUPERV CZ (6309/CU)}$ .

- Carry out a time measuring as in Chapter 7.4.3.3, page 314

Checking the blocking:

- The reaction of the protection when the differential current supervision of the check zone picks up can be set with the parameter **DIF SUP mode CZ (6311/CU)** to **blocking** or to only **indicate** (without protective blocking).
- Connect the bays 1 and 2 to the same bus zone.
- Increase the current in feeder 1 slowly until the supervision of the check zone picks up.
- Apply to feeder 2 a current 4 times as high as the rated current  $I_N$ . If the parameter is set **DIF SUP mode CZ (6311/CU)** to **blocking**, no TRIP commands follow.

### 7.4.3.3 Time Delay

Time measuring is possible with the standard test equipment for protection devices.

- To measure the delay time for the differential current supervision, apply to feeder 1 through the testing device twice the current set in the parameter differential current threshold  $I_{d> SUPERV BZ (6308/CU)}$ .
- As soon as the differential current supervision picks up, the test current source is switched off. The measured time corresponds to the set delay time in parameter **T-Idiff SUPERV (6307/CU)**.

## 7.4.4 Overcurrent Threshold Tripping

- Example** For two feeders the overcurrent limit shall be checked which is set in parameter **I>TRIP (XX13 / CU)**.
- Test setup** □ Arrange the test setup as in Chapter 7.4.2, page 309.
- Test steps**
- To prevent the differential current supervision from blocking the protection during the test switch it off with the parameter **DIFF SUPERV (6306 / CU)**.
  - Set the differential current thresholds for the busbar-selective measuring system and for the check zone with the parameters **Id> BZ (6102 / CU)** and **Id> CZ (6104 / CU)** to **1, 0 I<sub>no</sub>**.
  - Set the overcurrent threshold with the parameter **I>TRIP (XX13 / CU)** for feeder 1 to **2, 0 I<sub>n</sub>** and for the feeder 2 to **0, 0 I<sub>n</sub>**.
  - Set the disconnectors so that bay 1 and 2 are connected to the same bus zone
  - Increase the current in feeder 1 slowly with the test equipment. At  $1 I_{no}$  bay unit 2 must output a TRIP command, because the overcurrent threshold for this feeder is set to **0, 0 I<sub>n</sub>**. Bay unit 1 must output a TRIP command at  $2 I_N$ .

## 7.4.5 Breaker Failure Protection

### 7.4.5.1 Trip Characteristic for Operating Mode “Unbalancing”

- Example** The trip characteristic is assumed to be characterized by the parameters **I> BF (XX18 / CU) = 0, 5 I<sub>N</sub>** for the differential current threshold **STAB FAC:BF (6201 / CU) = 0, 5** for the stabilizing factor.

- Test setup** The test setup is shown in Figure 7-14, page 315.

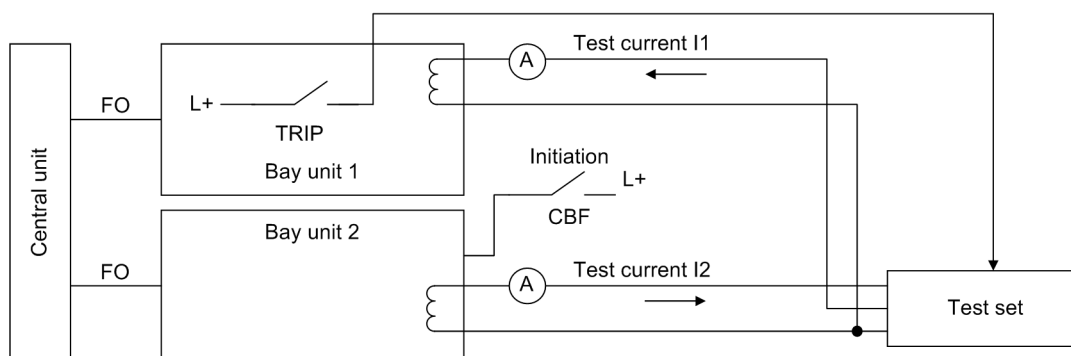


Figure 7-14 Test setup for the trip characteristic of the breaker failure protection

**Test steps**

- ❑ To prevent the differential current supervision from blocking the protection during checking switch it off with the parameter **DIFF SUPERV (6306/CU)**.
- ❑ Set the supervision of the breaker failure protection triggering inputs with the parameter **BF BI MODE (XX14/CU)** to **1-ch w/o sup** or **2-ch w/o sup**.
- ❑ Configure the feeder-selective parameter to **BF OP MODE (XX15/CU) BZ unbalance**.
- ❑ Set the parameters for the differential current threshold **I> BF (XX18/CU)** and the stabilizing factor **STAB FAC:BF (6201/CU)** to the desired value.
- ❑ Set the disconnectors so that bay 1 and 2 are connected to the same bus zone.
- ❑ The test currents  $I_1$  and  $I_2$  must have a phase displacement of 180°. To find out the phase angle, check the feeders 1 and 2 each with the same current ( $0,5 I_N$ ).
- ❑ If the differential current is not zero reverse the polarity in a feeder.
- ❑ Apply to the bays 1 and 2 though the test equipment a constant current  $I_1$ . After the start by the feeder protection (TRIP command) in feeder 2 the protection system permanently unbalances the measuring value of feeder 2.
- ❑ If the connection is correct there must be a differential current and the stabilizing current must be twice the supply current.
- ❑ Slowly increase the current in feeder 2 until the protection trips.
- ❑ The differential current must then be  $| I_1 + I_2 |$  and the stabilizing current must be  $| I_1 | + | I_2 |$ . The stabilizing factor must be the ratio of differential current to stabilizing current  $k = | I_1 + I_2 | / ( | I_1 | + | I_2 | )$ .

**7.4.5.2 Delay Time at Operating Mode “Unbalancing” and “I>Query”**

**Test setup**

The test setup for the measuring of the time delay is shown in Figure 7-14, page 315.

**Test steps**

- ❑ Set the two feeders to the same normalizing factor i.e.to the same CT transformation ratio.
- ❑ Set the CT polarity in such a way that the current flow (approx.  $2 I_N$ ) before the unbalancing corresponds to an external short-circuit (flowing through current). The differential current is approx. zero.
- ❑ Apply for the test to one bay unit twice the current set in parameter **I> BF (XX18/CU)**.
- ❑ Simulate the TRIP command from the feeder protection for feeder 2 and start the time measuring.
- ❑ Stop the time measuring device with the TRIP command of the busbar protection. The value displayed by the measuring device corresponds to the set delay time plus the tripping time of the protection.

**7.4.6 Finishing the Tests with Secondary Values.**

- ❑ Remove all devices for the tests with secondary values and re-establish the original status (switching off the test switch,...).

## 7.5 Checks With Primary Values

- The operational preparations according to Chapter 7.4, page 308 must be completed.



### WARNING

Primary tests may only be carried out by qualified persons who are familiar with the commissioning of protection systems, with the management of power systems and the relevant safety rules and guidelines (switching, earthing etc.)

- Switch on the primary values.

### 7.5.1 Transformer Polarity

To check the polarity of a current transformer you will need an operating current of at least 10% the rated current.

If the operation current is not sufficient, use test equipment for primary values.

#### Test steps

- Read out the disconnector replica with DIGSI plant visualization. The output corresponds to the plant status.
- Set all feeders with the parameter **Bay status (XX12/CU)**, (**4500/BU**), via the binary inputs of the bay units or easier locally at the operator panel with the function key **F1 out of service**.
- If the protection works correctly, the differential current for the module ZPS-BSZ2 must be nearly zero. Additionally the module ZPS-BSZ1 (check zone) shows the current differential, because putting the feeders out of operation does not influence the module ZPS-BSZ1.
- In the bay units the differential and stabilizing currents of the check zone are displayed as well. Bus couplers display the currents of the adjacent bus zone on the left. By this the transformer polarity can be checked locally at the bay units.
- Put one feeder into **service (F1)**. Read out the differential and stabilizing currents with DIGSI Plant Visualization or the measured value window with DIGSI. The result corresponds to the product of feeder current and normalizing factor (CT transformation ratio). Otherwise you have to check whether the CT transformation ratio is correct. Set the feeder out of service.
- Repeat the previous step for each feeder.
- After that put all feeders **out of service**.
- Put the feeder with the highest current at the busbar into **service** and note down the differential current of the module ZPS-BSZ2.
- Put the feeder with the next lower current at the busbar into **service**. If the polarity is correct, the load direction corresponds to the load direction of the next higher current. The differential current must increase. If the load direction is reversed, check the configuration and the connections of the transformer.
- Repeat the previous step until all feeders at the busbar have been put into operation.

- ❑ Repeat the last 3 steps for all configured busbars. At the end of the measurements the differential current must be nearly zero.
- ❑ Read out the differential and stabilizing currents of module ZPS-BSZ1 with DIGSI Plant Visualization or the measured value window with DIGSI. The differential current must be nearly zero and the stabilizing current must be the sum of all currents.
- ❑ If the plant conditions allow it, make a busbar coupling via the bus coupler bay. Then check the polarity of the transformers in the bus coupler bay again.

### Transformer polarity reversal

The polarity of a feeder's transformer can be reversed for test purposes via a configuration in DIGSI. The corresponding operating address "4601 CT-POLARITY" can be reached via the arrow keys in the test settings or simply by pressing the F4 function key. Entering the password F3F1F3F1F3F1 is required for this function.

After its confirmation, the three phase currents are transmitted to the central unit with inverted signs. The annunciations "TF RevPo1 \$00" (**FNo. 176.1195/CU**) for the corresponding bay unit and the group annunciation "TF RevPo1 G" (**FNo. 10451/CU**) are reported as ON in the central unit and in the bay unit. In the bay unit, "CT inversion" (**FNo. 7656/BU**) is reported as ON.

The inversion of the currents is done until the process is undone again. Then, the annunciations "TF RevPo1 \$00" (**FNo. 176.1195/CU**) and the group annunciation "TF RevPo1 \$00" in the central unit and the annunciation "CT inversion" (**FNo. 7656/BU**) in the bay unit is reported as OFF.

The transformer polarity reversal is reset when the bay unit is restarted.

## 7.6 Final Check of the Protection

To finally check the protection, carry out the following steps:

- ❑ In case the parameters had been changed during the testing check their settings again. The green LED (RUN) at the central unit must shine green. The red "Error" LED must not be lit.
- ❑ The TRIP commands must be switched conductive. If there is a switch available with test and operation position, switch it to the position "operation".

# Maintenance and Repair

# 8

This chapter is intended both for personnel in charge of operation and for protection engineers.

The chapter tells you how to analyze malfunctions of the device, and describes the maintenance and repair procedures that are required to ensure the functioning of the SIPROTEC 7SS52 V4 protection system.

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| 8.3 | Troubleshooting | 329 |
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## 8.1 Maintenance

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### WARNING

Before executing tests or maintenance works it has to be ensured that there arises no danger for personnel and that the tests do not influence station components which are in service.

---



### WARNING

Hazardous voltages are present in this electrical equipment during operation. Severe personal injury or property damage can result if the device is not handled properly.

Only qualified personnel shall work on and around this equipment. After becoming thoroughly familiar with all warnings and safety notices in this instruction manual as well as with the applicable safety steps, safety regulations, and precautionary measures.

The main points to observe are:

- The device is to be earthed to the substation earth before any other connections are made.
  - Hazardous voltages can exist in the power supply and at the connections to current transformers, voltage transformers, and test circuits.
  - Hazardous voltages can be present in the device even after the power supply voltage has been removed, i.e. capacitors can still be charged.
  - The limit values given in Chapter 9, page 343 "Technical Data", must not be exceeded, neither during testing nor during commissioning.
- 



### DANGER

The output terminals of the current transformers must be short-circuited before the power supply lines to the bay unit are disconnected.

Where a test switch is available that short-circuits automatically the output lines of the current transformer, it will be sufficient to set it to "Test" position, provided that the short-circuiters have been checked in the first place.

---

All measuring and signal processing circuits of the SIPROTEC 7SS52 V4 distributed busbar and breaker failure protection are provided with electronic components which do not require any maintenance.

As the protection is almost completely self-monitored, from the measuring inputs up to the coils of the trip relays, device faults are automatically annunciated. This provides for a high degree of availability of the protection system. Maintenance tests at short intervals therefore become superfluous.

The following tests are recommended in intervals of about 5 years:

- To check all measuring circuits with regard to the accuracy requirements, inject test currents into each bay unit, their magnitude lying in the nominal current range (selected between 0.8 and 1.2  $I_N$ ). Make sure not to feed in any currents that might lead to an inadvertent tripping. Feeding in higher currents is not necessary since the complete dynamic range is monitored via internal tests.
- To monitor the magnitude of the injected current value, you can read the bay current at the central unit or the bay unit. A tolerance of up to 5 % is permissible.



- If you want to take additional precautionary measures to prevent the protection from tripping due to an operator mistake, the 7SS52 V4 offers you the following options:
  - Set the operator menu **Control** → **Taggings** → **Set** → **Trip Blocking** on the central unit to **ON** for as long as test currents are applied. In this operating state of the protection system, you can check measured values and annunciations without risk of a spurious trip.
  - You can also set in the operator menu of the central unit **Parameter** → **BU** → **BUXX** the parameter **Bay status (XX12/CU)** of bay XX to **out of service** - on the bay unit you do the same with the function key **F1**. Check the measured values and annunciations of the bay unit.
- Check the trip circuits of each bay unit with the ancillary function „Circuit breaker test“ (Chapter 6.3.4, page 265).
- Check the function of the binary inputs in the bay units and the central unit. To do so, simulate both states of the binary inputs. The reaction of the protection to the selected input signal can be analysed via the LED indications or by means of the contents in the operations or fault event memories.
- Check the alarm outputs. The functional check of the alarm relays and of the LEDs of the central unit is supported by the DIGSI communication software.
  - Check the bay unit outputs. The functional check of the command and alarm outputs is supported by the local operation and the DIGSI operating program.

## 8.2 Fault Analysis

Disturbances of digital protection devices are in most cases caused by component failures. Practical experience also shows that environmental conditions may in few cases initiate failure alarm. Such environmental conditions can be e.g. short electromagnetic interference beyond the values guaranteed by the manufacturer.

If the protection system or its components are continuously disturbed, the green LED (RUN) goes out, the red LED (ERROR) lights up and the "Device operative / healthy" (FNo. 51/BU) alarm relay drops off. In the event of a continuous disturbance, the protection system or its components are blocked to avoid overfunction. In the event of a failure in one bay unit or in the transmission link between one bay unit and the central unit, the availability of the intact system can be ensured.

The disturbance can be caused by:

- Failures in the central unit  
(Failure or defect in the auxiliary voltage supply, module failure)
- Failures in one of the connected bay units  
(interruption of the power supply, defective measuring circuit, module failure)
- Interruption of the communication link to one of the bay units  
(defective transmission or reception modules, interrupted FO link, increased number of transmission errors)

The protection system provides the following diagnostic information to support the user in a systematic analysis of the causes for the disturbance:

- Central unit
  - operational event buffer
  - fault event buffer
  - operational events marshalled to LEDs
  - LED indications on the modules
- Bay unit
  - operational events marshalled to LEDs
  - operational event buffer

### 8.2.1 Evaluation of Operational Events

The central unit's operational events provide first hand information about the cause of a registered device failure.

- If operational events which have been marshalled to LEDs are missing, you should interrogate immediately the operational event buffer in the central unit. You will get there information about:
  - auxiliary voltage failure
  - pick-up of the differential current supervision
  - errors in the measured value supervision of the bay units and
  - failure detection by the cyclic test

If failures are detected in the bay unit, they are indicated with their bay number.

It is then possible to locate the failure more precisely within the bay. Operational events which support identification of a failure are e.g.:

- Disturbance of the power supply
- Failure detection by the measured value supervision

## 8.2.2 Checking the Auxiliary Voltage Supply

The alarm of auxiliary voltage failure in the protection device can be caused by a device failure as well as by disturbances in the external wiring.

- It should be checked whether:
  - the auxiliary voltage can be measured with adequate magnitude and correct polarity.
  - the ON/OFF switch for the integrated converter is in ON position (this switch can be found on the front panel of the bay unit 7SS523 or behind the front panel of the central unit).
  - the modules are correctly fitted and locked.
  - the fuses in the power supply section of the central unit (module SV) or the bay unit (module SAF or SVW ) have not blown.

You will find an explanation of the LED indication of the power supply module in the central unit in Chapter 8.2.3, page 323.

## 8.2.3 Checking the LEDs on the Modules

The processor modules ZPS-SBK, ZPS-BSZ, ZPS-SK in the central unit and the power supply (module SV) are equipped with LED indications which are only visible after opening the front panel of the central unit.



### WARNING

For testing and commissioning, the ruling safety regulations for working in high-voltage installations have to be obeyed.

The following inspection steps are performed in the presence of dangerous voltages. Only appropriately qualified personnel familiar with and adhering to safety requirements and precautionary measures may perform these steps.

---

5 LEDs are located vertically on the central processor modules (ZPS). Here is a description of what their indications mean.

**Module  
ZPS-SBK**

Table 8-1 LEDs of the ZPS-SBK module

| LEDs       |              |               |               |               | Status  |
|------------|--------------|---------------|---------------|---------------|---|
| RED<br>H1r | GREEN<br>H1g | YELLOW1<br>H2 | YELLOW2<br>H3 | YELLOW3<br>H4 |   |
| •          | o            | •             | ⊗             | ∇             | Operational status  |
| o          | •            | •             | •             | ⊗             | Failure status<br>(diagnosis by means of fault buffer required) |

o bright                      ∇ dim  
• dark                         ⊗ flashing

On detecting a system failure, the protection system is reset. After three unsuccessful restarts within a 3 second window of time, the device automatically removes itself from service and indicates the failure by the alarm relay "Device failure". This is indicated on the ZPS-SBK by flashing of the 3rd yellow LED (H4). The cause for the failure which blocked the protection can be read from the fault event buffer (Chapter 8.2.1, page 322).

**Module  
ZPS-SBK**

Table 8-2 LEDs of the ZPS-BSZ module

| LEDs       |              |               |               |               | Status   |
|------------|--------------|---------------|---------------|---------------|--|
| RED<br>H1r | GREEN<br>H1g | YELLOW1<br>H2 | YELLOW2<br>H3 | YELLOW3<br>H4 |  |
| •          | o            | •             | ⊗             | •             | Operational status   |
| o          | •            | •             | •             | ⊗             | Failure status   |
| o          | •            | o             | •             | •             | Start-up not completed successfully<br>(diagnosis by means of fault buffer required) |

o bright                      ∇ dim  
• dark                         ⊗ flashing

**Module  
ZPS-SK**

Table 8-3 LEDs of the ZPS-SK module

| LEDs       |              |               |               |               | Status                                  |
|------------|--------------|---------------|---------------|---------------|---|
| RED<br>H1r | GREEN<br>H1g | YELLOW1<br>H2 | YELLOW2<br>H3 | YELLOW3<br>H4 |   |
| •          | o            | •             | •             | •             | Fault-free cyclic process               |
| o          | o            | •             | •             | ⊗             | Failure of one bay unit or one channel  |
| o          | •            | •             | •             | ⊗             | Failure of the SK module                |
| o          | •            | o             | o             | o             | Module plugged in, no feeder configured |

o bright                      ∇ dim  
• dark                         ⊗ flashing

The green LED shines when the module is running without faults. The red LED is lit in the event of a module failure. In the event of failure of a configured bay, but normal function of the module, the green LED flashes in addition to the shining red LED.

**Reset of the ZPS modules**

To reset a central processor module (ZPS):

- Press the reset button on the module concerned. The button is located below the LEDs (Figure A-7, page 382). When you reset the ZPS-SBK module, the central unit is restarted, and the setting parameters related to the bay units are updated.

**SV module**

Table 8-4 LEDs of the SV module

| LED designation | Colour | Function   |
|-----------------|--------|--|
| + 5 V           | Green  | Auxiliary voltage for supply of the processor modules and for the alarm relay "device failure" |
| + 15 V          | Green  | Alarm relay voltage  |
| + 24 V          | Green  | Alarm relay voltage  |

LED ON means that the corresponding auxiliary voltage is available.

- If the LED indication fails completely, check the auxiliary voltage supply (Chapter 8.2.2, page 323), replace the fine-wire fuse (Chapter 8.4.2, page 336).

### 8.2.4 Analysis of Internal Communication Failures

The following components of the protection participate in the protection-internal fast data transmission (Figure 8-1, page 326):

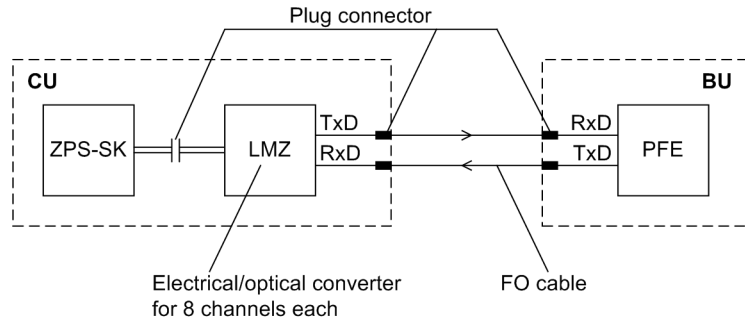


Figure 8-1 Components for data transmission

If the protection system is blocked, the cause may be a failure in the communication system, or in a bay unit. The faulty bay is shown in the alarm list which can be called up by pressing the function key **F1** on the central unit.

The following measures allow to locate the failure.

#### General measures

If the substation is operating and the control voltage for the trip circuits of the circuit breakers is on, the intact portion of the protection system can remain available until the failure is eliminated.

- ❑ The protection processing remains active for all zones which are not affected by the failure. Tripping is enabled by the check zone. As a result, the functioning of the faulty bay is suspended (Chapter 5.5.1, page 167).
- ❑ Set the parameter **Bay status (XX12/CU)** to **out of service** to take the faulty bay out of service. The protection function is now active again for all zones. The faulty bay unit no longer appears in the alarm list of the central unit.



#### NOTE

You can retrieve a quick and clear overview of the current communication status for the individual bay units via the Web Monitor under SIEMENS Internal Diagnostics → HDLC State (see Figure 7-4, page 296).

#### Test mode of the SK module

To further locate the failure, switch the ZPS-SK module to test mode. The protection processing is the same as in normal mode, but more tolerant to errors.

In test mode, the LEDs on the ZPS-SK module have more options for indicating information. The LEDs are visible after opening the front panel of the central unit. One red flashing LED per ZPS-SK module indicates that the ZPS-SK module is in test mode. One green and three yellow LED indicate the disturbed duplex channel with the highest channel number according to Table 8-5, page 327. A flashing green LED indicated that at least one duplex channel on the ZPS-SK module is faulty.

Table 8-5 LEDs of the ZPS-SK module in SK test mode

| LEDs       |              |               |               |               | Status                      |
|------------|--------------|---------------|---------------|---------------|-----------------------------|
| RED<br>H1r | GREEN<br>H1g | YELLOW1<br>H2 | YELLOW2<br>H3 | YELLOW3<br>H4 |                             |
| ⊗          | o            | •             | •             | •             | no failure                  |
| ⊗          | ⊗            | •             | •             | •             | Failure in channel 0, bay 1 |
| ⊗          | ⊗            | o             | •             | •             | Failure in channel 1, bay 2 |
| ⊗          | ⊗            | •             | o             | •             | Failure in channel 2, bay 3 |
| ⊗          | ⊗            | o             | o             | •             | Failure in channel 3, bay 4 |
| ⊗          | ⊗            | •             | •             | o             | Failure in channel 4, bay 5 |
| ⊗          | ⊗            | o             | •             | o             | Failure in channel 5, bay 6 |
| ⊗          | ⊗            | •             | o             | o             | Failure in channel 6, bay 7 |
| ⊗          | ⊗            | o             | o             | o             | Failure in channel 7, bay 8 |

o bright

• dark

▽ dim

⊗ flashing

There are two ways for activating the test mode on the ZPS-SK module. The first is to activate the test mode with the DIGSI communication software:

- Open the central unit in the DIGSI Manager.
- Double-click in the navigation window of the DIGSI Device Configuration the folder **Online**. This will open the directory containing the operating functions of the device (see Figure 6-1, page 243).
- Click **Parameters**. The function selection now shows the groups of parameters.
- Double-click **Parametergruppe**. You will now see the “Parameter Group” window.
- Double-click the function **Schutz allgemein**. You will now see the “Schutz allgemein – Parametergruppe A” window.
- Check the checkbox **Weitere Parameter anzeigen**.
- In parameter **Test mode for module SK (5108A/CU)**, click the column **Wert**. You will now see a list of setting options.
- Click **On** in the list and then **OK**.

The second way describes how the test mode is activated by the hardware:

- Set jumper X34 on the ZPS-SK module to “on”. For the location of the jumper on the board, and the jumper settings of the ZPS-SK module, please refer to Chapter A.4.1, page 382.
- Set jumper X34 on the ZPS-SBK module to “on”.
- Reset the device by switching the auxiliary voltage off and on again.

### Testing the fiber-optic cables

To further locate the failure, test the affected duplex channel by shorting it with a fiber-optic cable between the transmitter and the receiver. A short FO cable is included in the delivery of the central unit.

- ❑ If the substation is operating and the control voltage for the TRIP circuits is on, an additional safeguard against spurious tripping must be provided by setting the marking **TRIP commands blocking** to **on** (see Chapter 6.3.2.1, page 256).
- ❑ Short the affected duplex channel with a fiber-optic cable between the transmitter and the receiver. You can short as many duplex channels as you like. If the failure disappears after installing the fiber-optic cable, the signal path, including the LMZ converter module, is healthy.
- ❑ Remove the fiber-optic cable which connects the transmitter and the receiver of the channel you have just checked.
- ❑ Reconnect the fiber-optic cables running to the bay unit.
- ❑ Connect the fiber-optic cables on the bay unit using a fiber-optic coupler. This coupler is included in the delivery of the central unit. It allows you to check transmission paths with a length of up to 750 m.
- ❑ After completion of the test, remove the jumper from the ZPS-SK and ZPS-SBK module and reestablish the old settings.

If the test of the fiber-optic cables has been successful as well, the cause of the disturbed channel is very probably a defect on the bay unit.

- ❑ Try to replace the bay unit by a different one.

### Testing the FO interface of bay unit

The functionality of the FO interface of the bay unit can be tested. Before carrying out test, the FO connection to the central unit must be disconnected and at the bay unit, the receiver must be bridged with the transmitter via an optical fibre.

The test function of the bay unit can be started via the membrane keypad or with DIGSI. "4100 TEST OF COM MUNICAT.INTERFAC"

The test takes approx. 10 s. Afterwards, the fault rate is displayed (in %). After the test, the jumper must be replaced with the correct optical fibre again.



### 8.3 Troubleshooting

If the device indicates a defect, the following procedure is recommended:

- If none of the LEDs on the front panel of the device is on, then check:
  - Are the modules inserted in the correct slots and locked by the front cover?
  - Are the connectors of the ribbon cables on the modules plugged in and their locks latched?
  - Can the auxiliary voltage be measured with adequate magnitude and correct polarity at the terminals (see overview diagrams in the Chapter A.3, page 376)?
  - Is the mini-fuse in the power supply section intact (Figure 8-8, page 338)? Replace the fuse if necessary (Chapter 8.4.2, page 336).
- If the red fault indicator LED is on and the green ready LED remains dark, you can try to restart the device by switching the auxiliary voltage off and on again (Chapter 6.3.6, page 268).
- If the display shows the “Monitor“ mode (Figure 8-2, page 329), you can re-initialize the device with DIGSI:

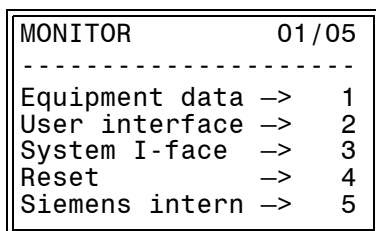


Figure 8-2 Monitor mode shown in the device display

- Connect the serial port of your PC with the PC port of the central unit, and start DIGSI.
- Select in the menu bar under **Device** the option **Initialize Device** (Figure 8-3, page 329).

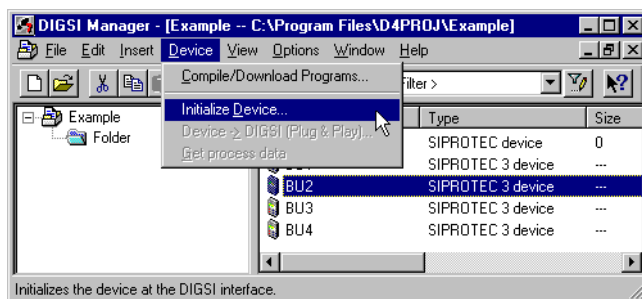


Figure 8-3 Initializing the device with DIGSI – Example

- Enter password No. 7 for the parameter set. The text in the device display disappears for a moment. After successful initialization, the LED indicate normal operation again, and the default image is shown in the display. The device-specific settings have been reloaded into the device, provided that they were saved on the PC during commissioning. The device is now ready for operation.

### Reading out the fault buffer of the CU

In order to read out the fault buffer file of the CU (ErrorBuf.txt) in the 7SS52, please proceed as follows: In the DIGSI manager, with the 7SS52 device symbol selected, select **Read out process data** via the pop-up menu (right mouse button). For this, the central device must be connected with the PC, e.g. via a DIGSI cable. Then, please select and confirm the interface used.



#### NOTE

Please use original cables only.

---

The data are stored in a folder called "Diagnosis". The exact name for the "Path" is stored in the tab "System management" of the device properties. You may select the content of "Path", copy it and insert it in the Explorer address line.



#### NOTE

For further information on this and on other topics, please visit us on the Internet under our homepage [WWW.SIPROTEC.COM](http://WWW.SIPROTEC.COM) - FAQs.

---

### Further support

If the above measures are not successful, please contact our hotline.

Please have the following data ready:

- the complete ordering information (MLFB) of the device,
- the serial number of the device,
- the version of the implemented protection firmware,
- the boot system version.

This information can be read out in the display when the device is operational. To access the appropriate submenu, select **MAIN MENU** → **Settings** → **Setup/Extras** → **MLFB/Version**. The ordering information (MLFB) and the serial number can also be found on the nameplate sticker on the device housing.

This data can also be read from the file created for the device in DIGSI, as shown in Figure 8-4, page 331.

- Select in offline mode in the menu bar from **File** the option **Properties**. The desired information is then shown on the **Device** tab.

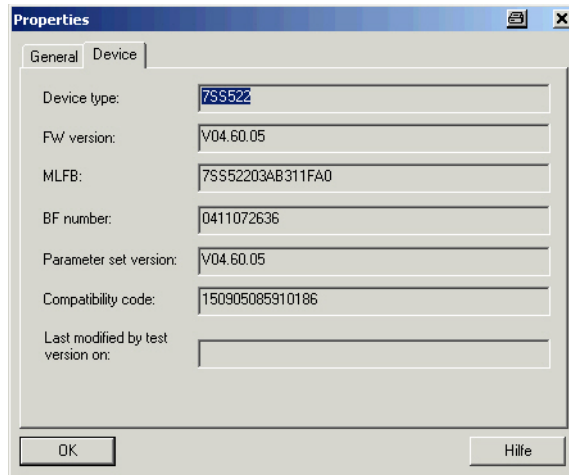


Figure 8-4 Reading out device information in DIGSI – Example

## 8.4 Repair

Siemens strongly recommends to refrain from repairing units or modules, because they contain especially selected components, which must be handled according to the regulations for EED (**E**lectrostatically **E**ndangered **D**evelopments). Most importantly, special techniques are required for working with the printed circuit boards, so that the flow-soldered boards and sensitive components are not damaged.

Therefore, if a defect cannot be eliminated by the operations described in this chapter, it is recommended to send the complete unit or defective module back to the manufacturer.

In case it is unavoidable to replace single modules, the EED-regulations have to be followed (handling of electrostatically endangered devices).



### WARNING

Hazardous voltages can be present in the device even after the power supply voltage has been removed, i.e. capacitors can still be charged.

---



### CAUTION

Electrostatic discharges via the components, printed conductors and connection pins must under all circumstances be avoided by previous contact with earthed metal parts. This applies in the same way for replacing components in sockets, such as EPROMs or EEPROMs. Suitable electrostatic protecting packing has to be used for mailing.

---

Modules fitted in the unit are not endangered.

The module or bay unit must be safely packed for shipping. Shock resistance as per IEC 60255-21-1 Class 2 and IEC 60255-21-2 Class 1 must be ensured.

If a module or bay unit needs to be replaced, please observe the following:

- Protective devices in housings or factory-assembled mounting racks are delivered as complete units and can be replaced as such by units with the same MLFB. Match the pick-up threshold of the binary inputs to the station conditions.
- Plug-in modules are normally interchangeable if their ordering numbers are identical as far as the oblique stroke.
- Note on ZPS modules the address setting and the order number and on the EAZ modules and the D-CPU module also the jumper setting of the control voltage.
- Individual modules of the bay unit cannot be replaced.

After replacement of devices or modules, complete parameterizing of the system may be required. Details are given in the Chapters 5, page 113 and 6, page 239.

## 8.4.1 Replacing the Buffer Battery

The annunciations and fault record data of the device are saved in the RAM. The RAM and the internal system clock with calendar are protected against voltage failures with a buffer battery. To maintain this information in case of a voltage failure, a buffer battery must be fitted.

The battery should be replaced when the annunciation "Batt. superv. CU" (on the central unit) or "Fail. Battery" (on the bay unit) appears, but at least after approx. 10 years of operation.

Recommended batteries are listed in the Appendix in the Table A-9, page 373.

- Have a replacement battery ready.



### CAUTION

Do not short-circuit the battery! Do not reload the battery!

- 
- Read out the device annunciations. If you read out the annunciations with the DIGSI communication software, the information will be saved on the PC.



### NOTE

The complete saved configuration and setting information is protected against power failure. The memory in which they are stored is independent of the buffer battery. They will thus not be lost, neither when the battery is replaced nor when the device operates without a battery.

- 
- Disconnect all auxiliary power circuit connections of the device at the miniature circuit breaker.



### WARNING

Hazardous voltages can be present in the device even after the power supply voltage has been removed, i.e. capacitors can still be charged.



### CAUTION

Electrostatic discharges via the components, printed conductors and connection pins must under all circumstances be avoided by previous contact with earthed metal parts. Do not plug or unplug interface connectors under live conditions.

#### Central unit

To replace the battery in the central unit:

- Loosen the screws and swing down the front panel.
- The battery is located on the top front of the D-CPU communication module (Figure 8-5, page 334).

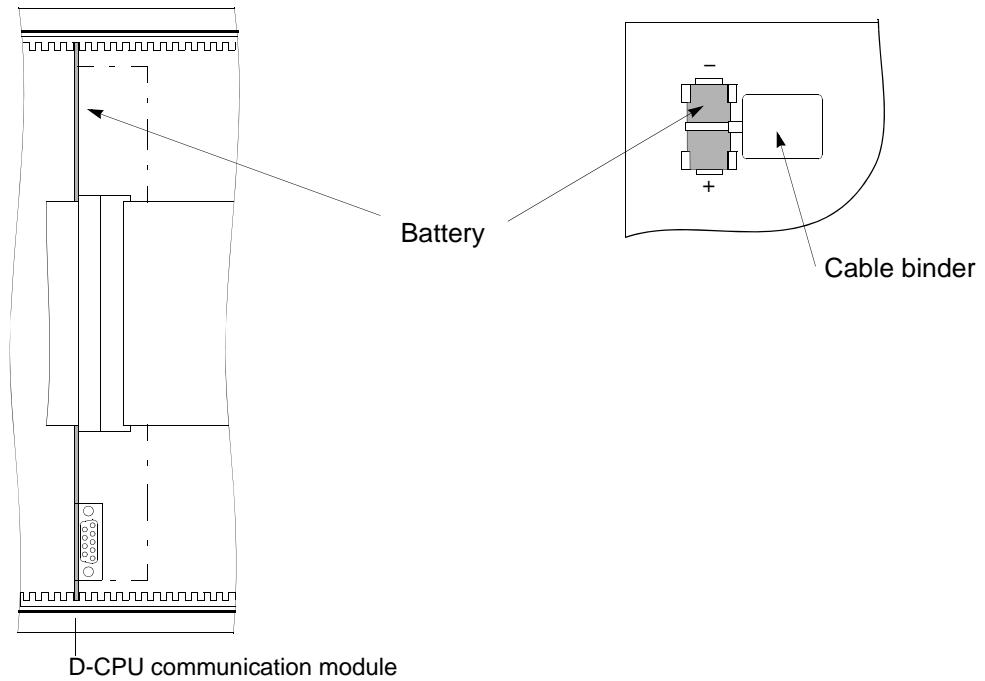


Figure 8-5 Front view after removing the front panel, and location of the buffer battery

- Use the cable binder to pull the spent battery out from its snap-in holder.
- Remove the cable binder from the old battery and fasten it to the new battery.
- Press the new battery firmly into its snap-in holder (see Figure 8-5, page 334).  
**Observe the correct battery polarity!**
- Close the front cover and fasten it again to the housing with the screws.
- Put the screw covers back on.
- Switch the auxiliary voltage on again.

Where the internal system clock is not automatically synchronized through one of the serial ports, you can now set it , as described in Chapter 6.3.7, page 269.



## WARNING

The spent battery contains lithium. The applicable regulations for its disposal must be strictly complied with!

**Do not reverse the polarity! Do not reload! Do not throw into the fire! Risk of explosion!**

---

**Bay unit**

To replace the battery in the bay unit:

- Loosen the screws and swing open the front panel to the left.
- The battery is located on the bottom front of the PFE module (Figure 8-6, page 335).

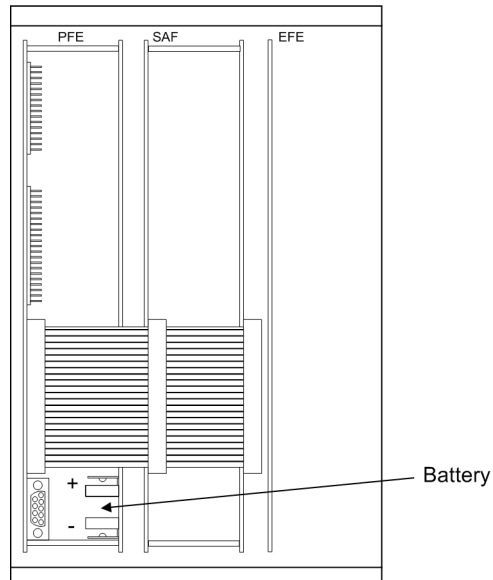


Figure 8-6 Front view after removing the front panel, and location of the buffer battery 7SS523

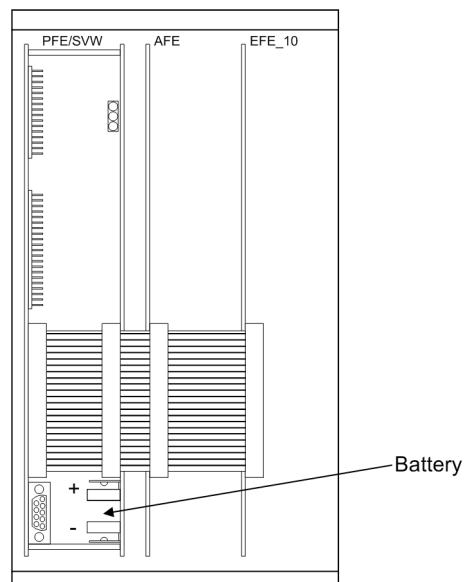


Figure 8-7 Front view after removing the front panel, and location of the buffer battery 7SS525

- Use the cable binder to pull the spent battery out from its snap-in holder.

- ❑ Remove the cable binder from the old battery and fasten it to the new battery.
- ❑ Press the new battery firmly into its snap-in holder (see Figure 8-6, page 335 or Figure 8-7, page 335). **Observe the correct battery polarity!**
- ❑ Close the front cover and fasten it again to the housing with the screws.
- ❑ Put the screw covers back on.
- ❑ Switch the auxiliary voltage on again.



### WARNING

The spent battery contains lithium. The applicable regulations for its disposal must be strictly complied with!

**Do not reverse the polarity! Do not reload! Do not throw into the fire! Risk of explosion!**

---

## 8.4.2 Replacing the Fine-Wire Fuse

The power supply modules SV in the central unit and SAF or SVW in the bay units are protected against short-circuit by fine-wire fuses.

The ratings of the required fuses can be found for the central unit in Figure 8-8, page 338, and for the bay units in Figure A-11, page 389.

- ❑ Disconnect all auxiliary power circuit connections of the device at the miniature circuit breaker.



### WARNING

Hazardous voltages can be present in the device even after the power supply voltage has been removed, i.e. capacitors can still be charged.

---



### CAUTION

Electrostatic discharges can occur if printed conductors, connectors and connecting pins are touched. To avoid such electrostatic discharges, touch a grounded piece of metal first.

---

#### Central unit

To replace the fine-wire fuse in the central unit:

- ❑ Loosen the screws and swing down the front panel.
- ❑ The fine-wire fuse is located on the power supply module (SV). This module is plugged in at the rightmost slot in the rack (Figure 2-2, page 36).
- ❑ Open the latch that holds the module in place.



- ❑ Pull the module out of the housing. Use the extraction handle (included in the delivery) to loosen the module.  
To avoid electrostatic discharge through components, the withdrawn modules should be placed vertically on a conductive surface. Such a conductive surface could be e.g. an EMC mat.
- ❑ Replace the fine-wire fuse. The location of the fine-wire fuses can be seen in Figure 8-8, page 338.
- ❑ Insert the module again into the housing. Make sure that the module is fixed correctly and firmly contacted with the rear-side plug connector.
- ❑ Fasten the front panel again.
- ❑ After fastening the front panel, switch the device on. If the auxiliary voltage failure continues to be indicated, there must be a failure or short-circuit in the internal power supply. The power supply module (SV) should be sent to the factory.

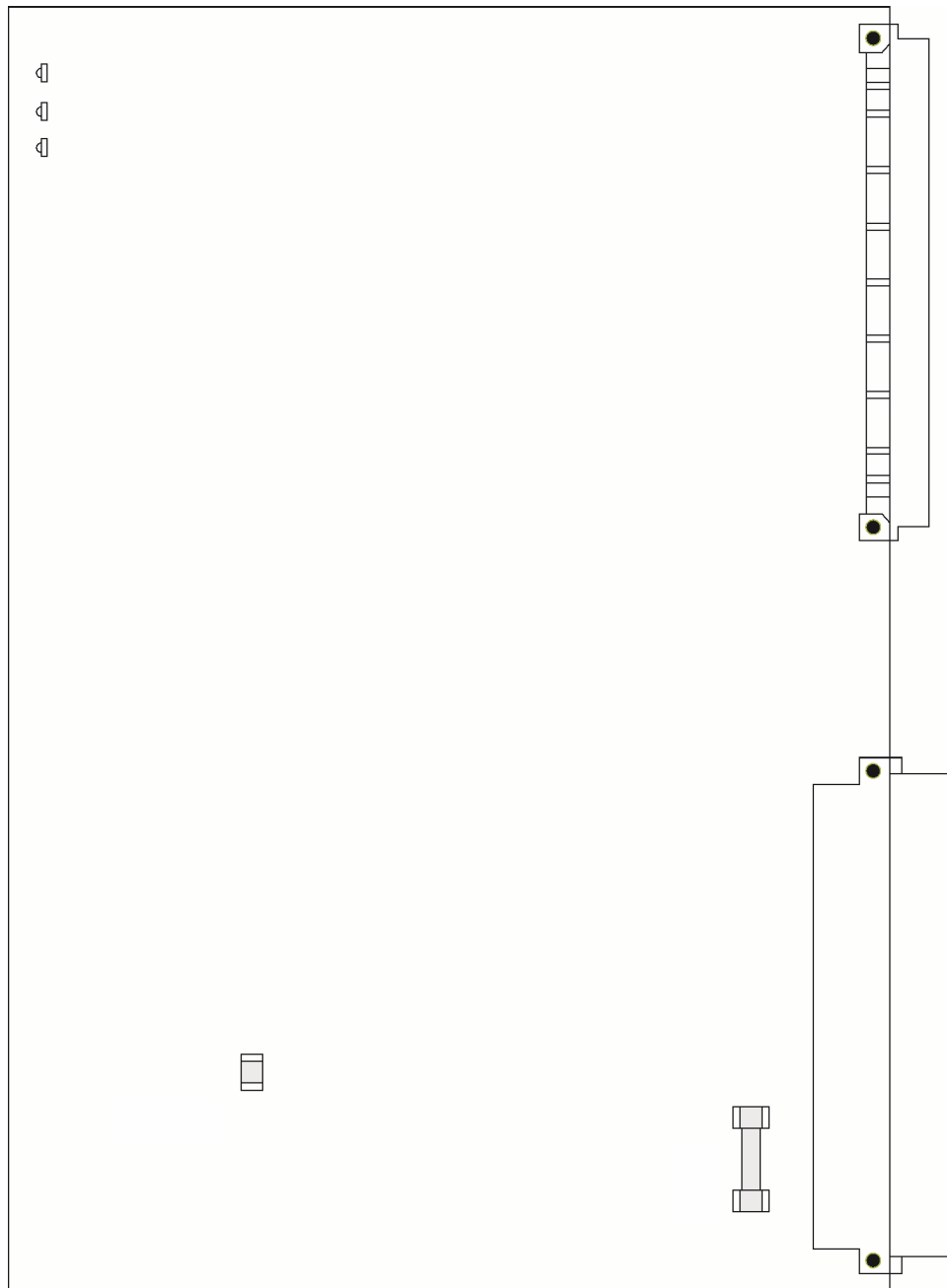


Figure 8-8 Location of the fine-wire fuses on the power supply module (SV) of the central unit release 7SS522../KK

The following fuse (or identical) is used as input fuse:

F1: Schurter SPT 3.15 AT ( $I^2t$  value  $\geq 33.7 \text{ A}^2\text{s}$ ), type of construction 5x20 mm, DC-Rating (see Chapter 9. Technical Data).

F2: TBU High Speed Protector Bourns (TBU-CA-065-500), Impulse Voltage Rating: 650 V, Trigger Current: 500 mA

**Bay unit**

To replace the fine-wire fuse in the bay unit:

- ❑ Loosen the screws and swing the front panel to the left (for 7SS523) or remove it (for 7SS525).
- ❑ The fine-wire fuse is located on the power supply module (SAF or PFE/SVW). The location of that module is shown in Figure 8-6, page 335 or Figure 8-7, page 335.
- ❑ Pull off the front connector of the ribbon cable from the module.
- ❑ Pull the module out of the housing. Use the extraction handle (included in the delivery) to loosen the module.  
To avoid electrostatic discharge through components, the withdrawn modules should be placed vertically on a conductive surface. Such a conductive surface could be e.g. an EMC mat.
- ❑ Replace the fine-wire fuse. The location of the fine-wire fuse can be seen in Figure 8-9, page 340 or Figure A-11, page 389.
- ❑ Insert the module again into the housing. Make sure that the module is fixed correctly and firmly contacted with the rear-side plug connector.
- ❑ Re-establish the electrical connections with the power supply, and fasten the front panel again.
- ❑ After fastening the front panel, switch the device on. If the auxiliary voltage failure continues to be indicated, there must be a failure or short-circuit in the internal power supply. The complete bay unit should be sent to the factory.

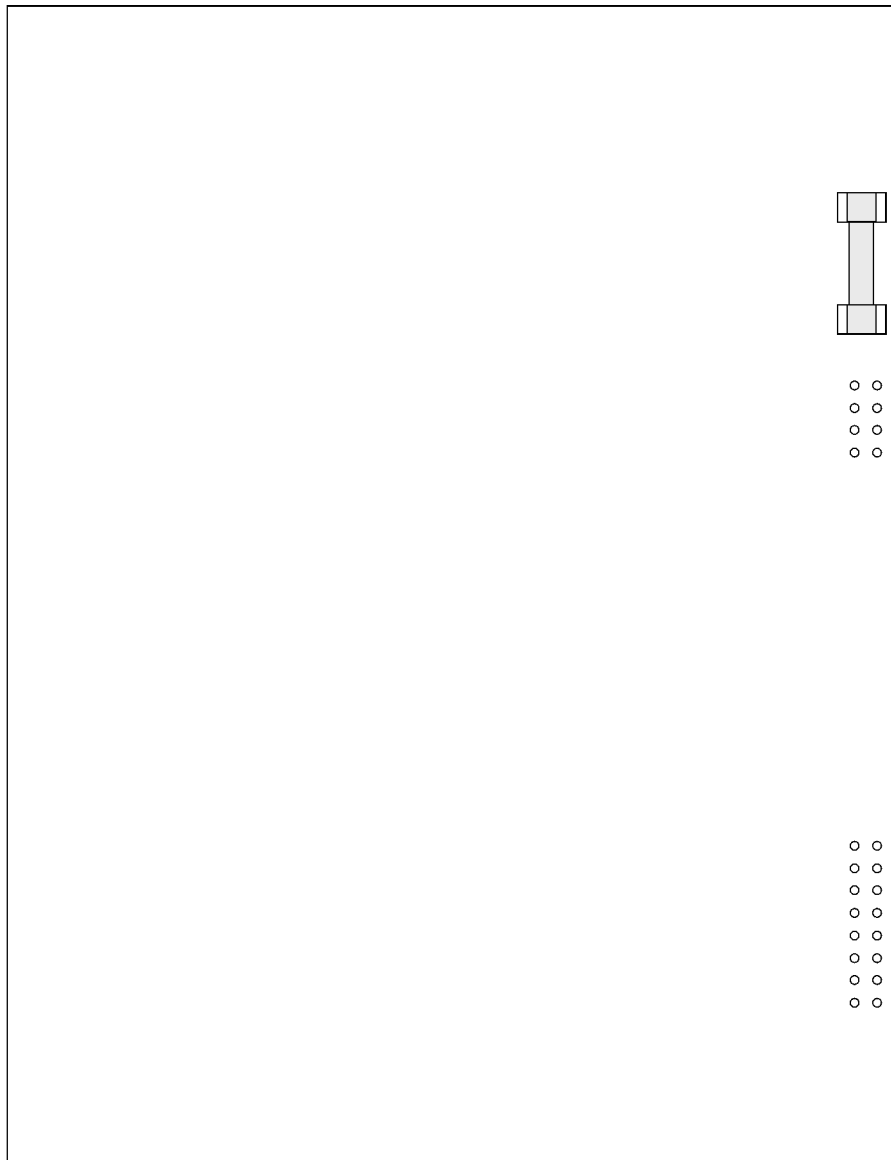


Figure 8-9 Location of the fine-wire fuse on the power supply module (SAF) of the bay unit 7SS523 release 7SS523../HH

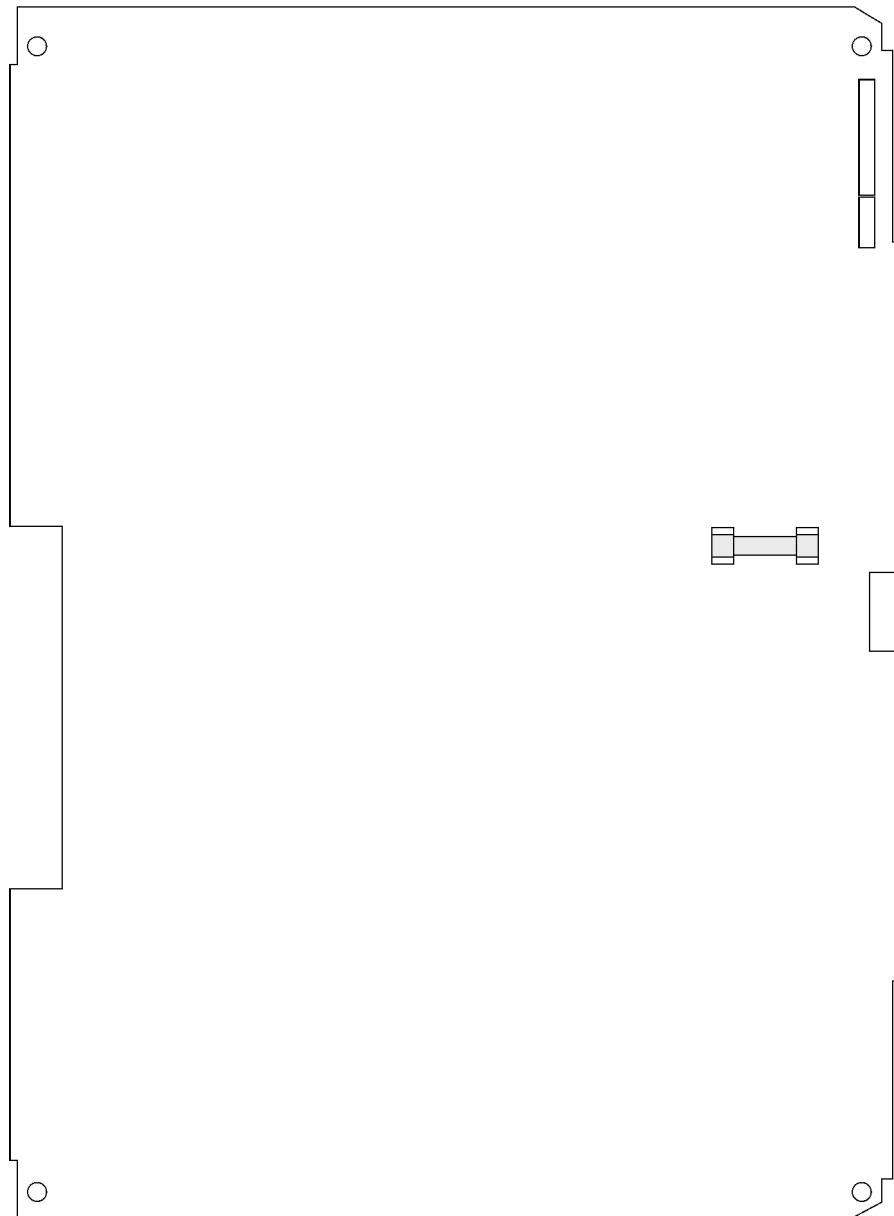


Figure 8-10 Location of the fine-wire fuse on the power supply module (SVW) of the bay unit  
7SS525 release 7SS525../GG

The following fuse (or identical) is used as input fuse:

F1: Schurter 0.8 AT ( $I^2t$  value  $\geq 2.3 \text{ A}^2\text{s}$ ), type of construction 5x20 mm,  
DC-Rating (see Chapter 9. Technical Data).

### 8.4.3 Startup with a Defective Bay Unit / Defective Fiber-Optic Cable

The protection system can be started up even if a bay has failed (defective bay unit or defective fiber-optic cable).

The faulty bay is shown in a separate alarm list which can be called up by pressing the function key **F1** on the central unit.

To be able to go on operating the substation until the defective bay unit or fiber-optic cable has been replaced, proceed as follows:

- Set the parameter **Status (XX12/CU)** to **out of service**.



#### **NOTE**

The faulty bay must first be excluded from the protection zone by isolating it in the primary system.

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## Technical Data

This chapter describes the technical specifications of the SIPROTEC 7SS52 V4 distributed busbar and breaker failure protection system, and of its functions, including limits that may on no account be exceeded. The electrical and functional data for the maximum scope of functions are followed by the mechanical data and the dimension drawings.

|     |                     |     |
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## 9.1 General Data

|  |   |             |   |
|--|---|-------------|---|
| <b>TRIP command</b>                        | Minimum duration of TRIP command          |             | 0.02 s to 1.00 s (in steps of 0.01)   |
|  | Minimum current limit for reset of signal | $I / I_N^1$ | 0.20 to 2.00 (in steps of 0.1)  |
| <b>Overcurrent release of TRIP signals</b> | Setting range                             | $I / I_N^1$ | 0.00 to 25.00 (in steps of 0.1)   |
| <b>Disconnecting running time</b>          | Setting range in s                        |             | 1.00 s to 180.00 s (in steps of 0.01)   |
| <b>Busbar (BB) configuration</b>           | Busbar arrangement (max.)                 |             | Quintuple busbar including transfer busbar; up to 16 couplers and 48 sectionalizers<br>12 bus sections,<br>12 coupler bus sections <sup>2</sup> |
|  | Number of bays                            |             | 48 (including bus couplers and sectionalizers)  |

1 Nominal current of the feeder current transformer (1 A or 5 A)

2 These are sections which serve exclusively for coupling of the bus zones; they have no feeder bays



## 9.2 General Device Data

### 9.2.1 Analog Inputs and Outputs

|                       |   |        |                  |            |
|-----------------------|---|--------|------------------|------------|
|                       | Rated frequency                             | $f_N$  | 50 Hz or 60 Hz   | (settable) |
| <b>Current inputs</b> | Rated current                               | $I_N$  | 1 A or 5 A       |            |
|                       | Thermal overload capability of current path |        |                  |            |
|                       | – continuous                                |        | $4 \times I_N$   |            |
|                       | – for 10 s                                  |        | $30 \times I_N$  |            |
|                       | – for 1 s                                   |        | $100 \times I_N$ |            |
|                       | Dynamic overload capability (1 half-cycle)  |        | $250 \times I_N$ |            |
|                       | Power consumption                           |        |                  |            |
| – at $I_N = 1$ A      |   | 0.1 VA |                  |            |
| – at $I_N = 5$ A      |   | 0.2 VA |                  |            |

### 9.2.2 Rated Auxiliary Voltage

|   |  |                                       |
|---|--|---------------------------------------|
| Rated auxiliary voltage $U_{aux}$                                 |  |                                       |
| – Central unit  |  | DC 48 V to 250 V                      |
| – Bay unit  |  | DC 48 V to 250 V                      |
| Permissible tolerance of rated auxiliary voltage $U_{aux}$        |  | $\pm 20$ %                            |
| Max. ripple   |  | $\leq 15$ %                           |
| Power consumption (dependent on station configuration)            |  |                                       |
| Quiescent   |  |                                       |
| – Central unit  |  | 35 W to 55 W                          |
| Basic requirement of device:                                      |  | approx. 15,0 W                        |
| per module ZPS2:  |  | approx. 3,5 W                         |
| – Bay unit  |  | 12 W [10 W] <sup>1)</sup>             |
| Energized   |  |                                       |
| – Central unit  |  | < 70 W                                |
| – Bay unit  |  | 16 W [14 W] <sup>1)</sup>             |
| Bridging time during failure / short circuit of auxiliary voltage |  | $\geq 50$ ms (at $U_{aux} \geq 60$ V) |

<sup>1)</sup> Values in brackets [ ] for Bay unit 7SS525

### 9.2.3 Binary Inputs

|                                |   |
|--------------------------------|---|
| Number                         |   |
| – Central unit                 | 12  |
| – Bay unit                     | 20 [10] <sup>1)</sup>                                       |
| Voltage range                  | DC 24 V to 250 V (thresholds selectable by plug-in jumpers) |
| Nominal control voltage        | DC 24 V; 60 V; 110 V; 220 V                                 |
| Pick-up threshold              | $0.8 \times U_N$  |
| Drop-off threshold             | $0.65 \times U_N$   |
| Current consumption            | approx. 1.6 mA / input                                      |
| Maximum input voltage          |   |
| - Central Unit                 |   |
| BI 1 to BI 5 (Module D-CPU)    | DC 300 V  |
| BI 6 to BI 12 (Module EAZ)     |   |
| nominal control voltages 24 V  | DC 200 V  |
| nominal control voltages 60 V  | DC 220 V  |
| nominal control voltages 110 V | DC 260 V  |
| nominal control voltages 220 V | DC 300 V  |
| - Bay unit                     |   |
| nominal control voltages 24 V  | DC 200 V  |
| nominal control voltages 60 V  | DC 220 V  |
| nominal control voltages 110 V | DC 260 V  |
| nominal control voltages 220 V | DC 300 V  |

When delivered, the binary inputs of the nominal control voltage are preset to 220 V.

### 9.2.4 Alarm Contacts

|                                  |   |
|----------------------------------|---|
| Number of relays                 |   |
| Marshallable                     |   |
| – Central unit                   | 16 (NO contacts)                                  |
| – Bay unit                       | 1 (1 NO contact)                                  |
| Not marshallable                 |   |
| – Central unit                   | 1 (2 NC contacts)                                 |
| – Bay unit                       | 1 (2 NC contacts) [1 NC contacts] <sup>1)</sup>   |
| Switching capacity MAKE/BREAK    | 50 W resistive<br>30 VA<br>25 W/VA at L/R ≤ 50 ms |
| Switching voltage                | AC / DC 250 V                                     |
| Permissible current continuously | 1 A   |

<sup>1)</sup> Values in brackets [ ] for Bay unit 7SS525

### 9.2.5 Trip Contacts

|                 |                      |  |
|-----------------|----------------------|--|
| <b>Bay unit</b> | Number of relays     | 4 [3] <sup>1)</sup> (each 2 NO contacts)<br>1 [2] <sup>1)</sup> (1 NO contact) |
|                 | Switching capacity   |  |
|                 | – CLOSE              | 1000 W / VA  |
|                 | – OPEN               | 30 VA  |
|                 |                      | 50 W resistive   |
|                 |                      | 25 W/VA at L/R ≤ 50 ms   |
|                 | Switching voltage    | AC / DC 250 V  |
|                 | Permissible current: |  |
|                 | – continuously       | 5 A  |
|                 | – 0.5 s              | 30 A   |

<sup>1)</sup> Values in brackets [ ] for Bay unit 7SS525

### 9.2.6 Light Emitting Diodes

|                     |                                |                      |
|---------------------|--------------------------------|----------------------|
| <b>Central unit</b> | Ready for service (green)      | 1                    |
|                     | Failure indication (red)       | 1                    |
|                     | Marshallable indications (red) | 32                   |
| <b>Bay unit</b>     | Ready for service (green)      | 1                    |
|                     | Failure indication (red)       | 1                    |
|                     | Indications (marshallable)     |                      |
|                     | – red                          | 11 [1] <sup>1)</sup> |
|                     | – green                        | 5 [0] <sup>1)</sup>  |

<sup>1)</sup> Values in brackets [ ] for Bay unit 7SS525

### 9.2.7 Operation, Displays

|  |                   |                         |
|--|-------------------|-------------------------|
|  | LC display        |                         |
|  | – Central unit    | 4 lines × 20 characters |
|  | – Bay unit 7SS523 | 4 lines × 16 characters |
|  | Sealed keypad     |                         |
|  | – Central unit    | 24 keys                 |
|  | – Bay unit 7SS523 | 12 keys                 |

No display or keypad for bay unit 7SS525.

### 9.2.8 Serial Ports

|  |   |   |
|--|---|---|
| <b>Central unit</b>                    | PC port (front)                                     |   |
|  | – Connection electrical                             | D-SUB 9-pole  |
|  | – Baud rate   | 4800 bauds to 115000 bauds                                  |
|  | System port (rear) IEC 60870-5-103                  |   |
|  | – Connection optical                                | ST connectors   |
|  | – Baud rate   | 4800 bauds to 115000 bauds                                  |
|  | System port (rear) IEC 61850, electrical with EN100 |   |
|  | – Connection electrical                             | RJ45 connectors   |
|  | – Baud rate   | up to 100 Mbaud   |
|  | System port IEC 61850, optical with EN100           |   |
|  | – Connection optical                                | Duplex-LC connectors  |
|  | – Baud rate   | up to 100 Mbaud   |
|  | – Laser Class 1 according to EN 60825-1/-2          | When using glass fiber 50/125 µm or glass fiber 62.5/125 µm |
| clock synchronization interface (rear) |   |   |
| – Connection electrical                | D-SUB 9-pole  |   |
| Service port (rear)                    |   |   |
| – Connection optical                   | ST connectors                                       |   |
| – Connection electrical                | D-SUB 9-pole  |   |
| – Baud rate                            | 4800 bauds to 115000 bauds                          |   |
| <hr/>                                  |   |   |
| <b>Bay unit</b>                        | PC port (front)                                     |   |
|  | – Connection electrical                             | D-SUB 9-pole (subminiature ISO 2110)                        |
|  | – Baud rate   | 1200 bauds to 38400 bauds                                   |
| <hr/>                                  |   |   |
| <b>Central/bay unit</b>                | Interface for high-speed data communication         |   |
|  | – Connection  | ST connectors   |
|  | – Fiber-optic cable                                 | glass fiber 62.5 µm/ 125 µm                                 |
|  | – Optical wavelength                                | 820 nm  |
|  | – Permissible cable attenuation                     | max. 8 dB   |
|  | – Transmission distance                             | max. 1.5 km <sup>1</sup>                                    |
|  | – Laser Class 1 according to EN 60825-1/-2          | When using glass fiber 50/125 µm or glass fiber 62.5/125 µm |

1 Note: Determination of the maximum distance

$$L_{\max} = \frac{8 \text{ dB} - \text{reserve} - \text{plug attenuation}}{\text{attenuation factor of FO cable}}$$

- typ. reserve for ageing and temperature drift: 2 to 3 dB
- plug attenuation (ST): approx. 0.3 dB per plug
- FO attenuation coefficient  $\alpha$  (glass fiber 62.5 µm / 125 µm): 3.5 dB / km

## 9.2.9 Fuse

| Values |                        | central unit:           |                   | bay unit:              |
|--------|------------------------|-------------------------|-------------------|------------------------|
|        | Voltage min.           |                         | 300 VDC           |                        |
|        | Current                | 3.15 AT                 |                   | 0.8 AT                 |
|        | Type of construction   |                         | 5x20 mm           |                        |
|        | I <sup>2</sup> t value | ≥ 33.7 A <sup>2</sup> s |                   | ≥ 2.3 A <sup>2</sup> s |
|        | Voltage drop max.      |                         | 500 mV            |                        |
|        | Breaking capacity      |                         | 1500 A at 300 VDC |                        |
|        | Certification          |                         | VDE/UL            |                        |

## 9.2.10 Busbar Protection

| Characteristic        |   |                   | Stabilized differential current measurement |
|-----------------------|---|-------------------|---|
| <b>Setting ranges</b> | Overcurrent   | $I / I_{no}^1$    | 0.20 to 4.00 (in steps of 0.01)             |
|                       | Stabilising factor for bus section-selective protection         | k                 | 0.10 to 0.80 (in steps of 0.01)             |
|                       | Stabilising factor for the check zone                           | k                 | 0.00 to 0.80 (in steps of 0.01)             |
|                       | Cross stabilisation factor for bus section-selective protection |                   | 0.00 to 1.00 (in steps of 0.01)             |
|                       | Cross stabilisation factor for the check zone                   |                   | 0.00 to 1.00 (in steps of 0.01)             |
|                       | <b>Diff-current supervision</b>                                 | Current threshold | $I / I_{no}^1$                              |
| <b>Setting ranges</b> | Time delay  |                   | 1 s to 10 s (in steps of 1) <sup>2</sup>    |
| <b>Tripping time</b>  | Typical tripping time   |                   | 15 ms                                       |
| <b>Tolerances</b>     | Current   |                   | 5 % of setting value or 50 mA               |
|                       | k factor  |                   | 5 % of setting value                        |
|                       | Time  |                   | 5 % of setting value or 50 ms               |

1  $I_{no}$  = normalizing current (Reference value)

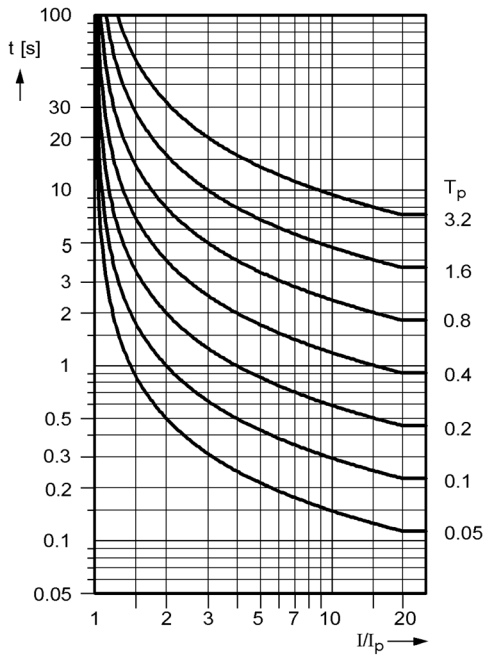
2 Identical setting ranges for the zone-selective protection and the check zone

### 9.2.11 Circuit Breaker Failure Protection

|                           |   |                    |  |
|---------------------------|---|--------------------|--|
| <b>Control modes</b>      | One or two-channel initiation   |                    |  |
| <b>Modes of operation</b> | Individually selectable per feeder: <ul style="list-style-type: none"> <li>- I&gt;query</li> <li>- TRIP repeat (1/3-phase) with I&gt;query</li> <li>- Unbalancing (1-stage CBF)</li> <li>- Unbalancing with TRIP repeat (1-/3-phase, 2-stage CBF)</li> <li>- TRIP by external CBF protection (tripping via disconnecter replica of busbar protection)</li> <li>- plus for each mode (except for TRIP by external CBF):</li> <li>  low-current mode</li> <li>- plus for modes with TRIP repeat:</li> <li>  pulse mode</li> </ul> |                    |  |
| <b>Setting ranges</b>     | Overcurrent   | I / I <sub>N</sub> | 0.10 to 2.00 (in steps of 0.01)<br>0.05 to 2.00 (Sensitive characteristic) |
|                           | Stabilizing factor  | k                  | 0.05 to 0.80 (in steps of 0.01)  |
|                           | Time delay for unbalancing / I>query  |                    | 0.05 s to 10.00 s (in steps of 0.01)                                       |
|                           | Time delay for TRIP repeat  |                    | 0.00 s to 10.00 s (in steps of 0.01)                                       |
| <b>Drop-off times</b>     | Mode "unbalancing"  |                    | Approx. 2 ms   |
|                           | Mode "I>query"  |                    | Approx.25 ms   |
|                           | Definite time (backup protection)   |                    | Approx.25 ms   |
| <b>Tolerances</b>         | Current   |                    | 5 % of setting value or 50 mA  |
|                           | k factor  |                    | 5 % of setting value   |
|                           | Time  |                    | 5 % of setting value or 50 ms  |

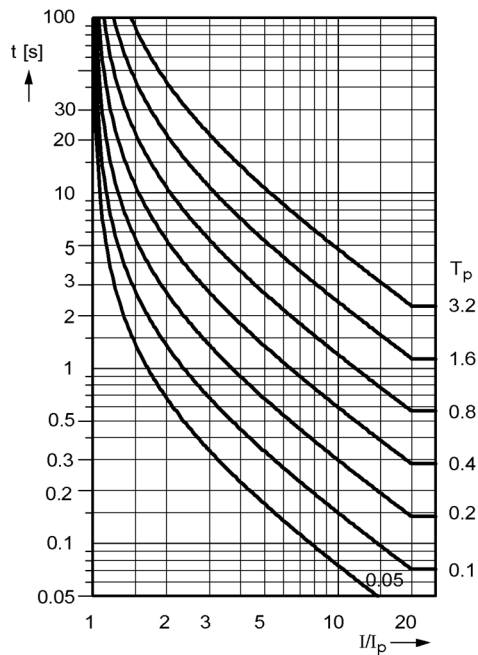
## 9.2.12 Overcurrent Protection in the Bay Unit

| Characteristic                              | Definite or inverse time overcurrent protection |                             |   |
|---|---|-----------------------------|---|
| <b>Setting ranges</b>                       | High-set stage                                  | $I_{>>}$ (phase) $I / I_N$  | 0.05 to 25.00 (in steps of 0.01)  |
|   | High-set stage                                  | $I_{E>>}$ (earth) $I / I_N$ | 0.05 to 25.00 (in steps of 0.01)  |
|   | Trip time delays                                | $T_{I>>}$ , $T_{I_{E>>}}$   | 0.00 s to 60.00 s or $\infty$   |
| <b>Definite time overcurrent protection</b> | Overcurrent stage                               | $I_{>}$ (phase) $I / I_N$   | 0.05 to 25.00 (in steps of 0.01)  |
|   | Overcurrent stage                               | $I_{E>}$ (earth) $I / I_N$  | 0.05 to 25.00 (in steps of 0.01)  |
|   | Trip time delays                                | $T_{I>}$ , $T_{I_{E>}}$     | 0.00 s to 60.00 s or $\infty$   |
| <b>Inverse-time overcurrent protection</b>  | Inverse time O/C stage                          | $I_P$ (phase) $I / I_N$     | 0.10 to 4.00 (in steps of 0.01)   |
|   | Inverse time O/C stage                          | $I_E$ (earth) $I / I_N$     | 0.10 to 4.00 (in steps of 0.01)   |
|   | Trip time delays                                | $T_{I_P}$ , $T_{I_E}$       | 0.00 to 10.00 or $\infty$   |
|   | Characteristics                                 |                             | inverse (IEC 255-3 type A)<br>very inverse (IEC 255-3 type B)<br>extremely inverse (IEC 255-3 type C) |
| <b>tripping times</b>                       | $I_{>-}$ , $I_{>>}$ stage                       |                             | Approx.25 ms  |
| <b>Drop-off times</b>                       | definite time                                   |                             | Approx.25 ms  |
| <b>Tolerances</b>                           | Current   |                             | 5 % of setting value or 50 mA   |
|   | Time  |                             | 5 % of setting value or 50 ms<br>+ 2 % current tolerance or 50 ms                                     |



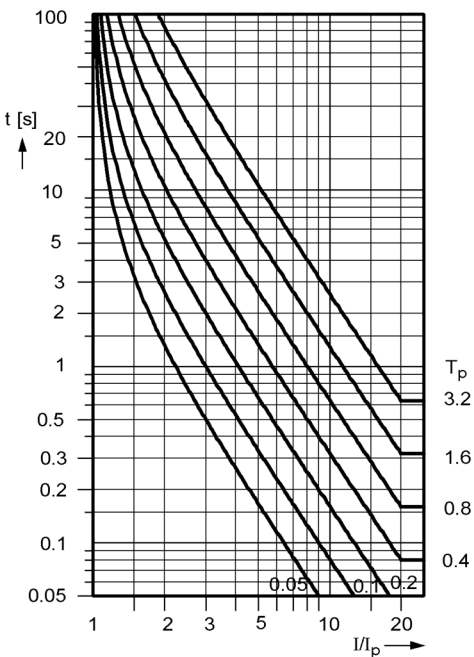
**Normal inverse:  
(Type A)**

$$t = \frac{0.14}{(I/I_p)^{0.02} - 1} \cdot T_p \text{ [s]}$$



**Very inverse:  
(Type B)**

$$t = \frac{13.5}{(I/I_p)^1 - 1} \cdot T_p \text{ [s]}$$



**Extremely inverse:  
(Type C)**

$$t = \frac{80}{(I/I_p)^2 - 1} \cdot T_p \text{ [s]}$$

- t Trip time
- $T_p$  Setting value time multiplier
- I Fault current
- $I_p$  Setting value current

Figure 9-1 Trip time characteristics of the inverse-time overcurrent protection, in acc. with IEC 255-3



### 9.2.13 Auxiliary Functions

|   |  |   |
|---|--|---|
| <b>Self-diagnosis</b>                           | <ul style="list-style-type: none"> <li>– Current monitoring per feeder</li> <li>– Auxiliary voltage monitoring</li> <li>– Cyclic test</li> <li>– Check of the data transmission between central unit and bay units</li> <li>– Memory tests</li> </ul>  |   |
| <b>Operational measured values Central unit</b> | <p>Feeder currents</p> <ul style="list-style-type: none"> <li>– Range</li> <li>– Tolerance</li> </ul> <p>Differential and restraint (stabilizing) currents of all bus sections and the Checkzone (separate for ZPS-BSZ1 and ZPS-BSZ2)</p> <ul style="list-style-type: none"> <li>– Range</li> </ul>                      | <p><math>I_{L1}; I_{L2}; I_{L3}</math><br/>in A primary,<br/>in % <math>I_N</math> (feeder transformer) and<br/>in % <math>I_{No}</math> (reference transformer)<br/>0 % to 1000 % <math>I_N</math><br/>typically 2% of measured value</p> <p><math>I_{dL1}; I_{dL2}; I_{dL3}</math> in % <math>I_{No}</math><br/><math>I_{sL1}; I_{sL2}; I_{sL3}</math> in % <math>I_{No}</math></p> <p>0 % to 1000 % <math>I_N</math></p>         |
| <b>Operational measured values Bay unit</b>     | <p>Feeder currents</p> <ul style="list-style-type: none"> <li>– Range</li> <li>– Tolerance</li> </ul> <p>Differential and restraint (stabilizing) currents</p> <ul style="list-style-type: none"> <li>– Range</li> </ul> <p>Frequency</p> <ul style="list-style-type: none"> <li>– Range</li> <li>– Tolerance</li> </ul> | <p><math>I_{L1}; I_{L2}; I_{L3}; I_E</math><br/>in A primary and in % <math>I_N</math> and in % <math>I_{No}</math><br/>0 % to 6000 % <math>I_N</math><br/>typically 2 % of measured value</p> <p><math>I_{dL1}; I_{dL2}; I_{dL3}</math><br/><math>I_{sL1}; I_{sL2}; I_{sL3}</math><br/>0 % to 6000 % <math>I_N</math></p> <p><math>f</math> in Hz (<math>I &gt; 0.1 I_N</math>)<br/><math>f_N \pm 5\text{Hz}</math><br/>0.1 Hz</p> |
| <b>Event recording</b>                          | <p><b>Central unit</b></p> <p>Storage of the last<br/>200 operational events and 80 fault events</p> <p><b>Bay unit</b></p> <p>Storage of the last<br/>50 operational events and 100 fault events</p>  |   |

| <b>Fault recording</b> | <b>Central unit</b>   |
|------------------------|---|
|                        | Resolution<br>1 ms at 50 Hz<br>0.83 ms at 60 Hz   |
|                        | Pre/post capture time (from busbar TRIP or initiation by binary input/operation)<br>- 500 ms to + 500 ms at 50 Hz<br>- 416 ms to + 416 ms at 60 Hz<br>(up to 8 fault records) |
|                        | Capture Time<br>max. 5 s (total)  |
|                        | Number of digital channels<br>40 (freely marshallable)  |
|                        | Number of analog channels<br>6 + 6 * number of bus zones<br>(ldiff and lstab for L1, L2, L3 for check zone and all bus zones)   |
|                        | <b>Bay unit</b>   |
|                        | Resolution<br>1 ms at 50 Hz<br>0.83 ms at 60 Hz   |
|                        | Pre/post capture time (from busbar TRIP or initiation by binary input/operation)<br>- 500 ms to + 500 ms at 50 Hz<br>- 416 ms to + 416 ms at 60 Hz<br>(up to 8 fault records) |
|                        | Capture Time<br>max. 5 s (total)  |
|                        | Number of digital channels<br>28 (fix)  |
|                        | Number of analog channels<br>4 ( I1, I2, I3, In)  |

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### 9.2.14 User-Configurable Functions (CFC)

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| <b>Function Module</b> | <b>Comment</b>  |
|------------------------|---|
| ABSVALUE               | Formation of absolute value                                   |
| ADD                    | Addition  |
| ALARM                  | Alarm   |
| AND                    | AND gate  |
| BLINK                  | Flash Block   |
| BOOL_TO_CO             | Boolean to command, conversion                                |
| BOOL_TO_DI             | Boolean to double-point indication, conversion                |
| BOOL_TO_IC             | Boolean to internal single-point indication, conversion       |
| BUILD_DI               | Generation of double-point indication                         |
| CMD_CHAIN              | Switching sequence  |
| CMD_CANCEL             | Cancel command  |
| CMD_INF                | Command information   |
| COMPARE                | measured value comparison                                     |
| CONNECT                | Connection  |
| D_FF                   | D-Flipflop  |
| D_FF_MEMO              | D-Flipflop with preservation of information following restart |
| DI_GET_STATUS          | Information status double point indication, decoder           |
| DI_SET_STATUS          | Double point indication with status, encoder                  |
| DI_TO_BOOL             | Double-point indication to Boolean, conversion                |
| DIV                    | Division  |
| DM_DECODE              | Decoding of double-point indication                           |
| DYN_OR                 | Dynamic OR gate   |
| LIVE_ZERO              | Live zero monitoring, non-linear characteristic               |
| LONG_TIMER             | Timer (max. 1193 h)   |
| LOOP                   | Signal feedback   |

|                |   |
|----------------|---|
| LOWER_SETPOINT | Value below lower limit                             |
| MEMORY         | data memory   |
| MUL            | Multiplication                                      |
| MV_GET_STATUS  | Information status measured value, decoder          |
| MV_SET_STATUS  | Measured value with status, encoder                 |
| NAND           | NAND gate   |
| NEG            | Negator   |
| NOR            | NOR gate  |
| OR             | OR gate   |
| REAL_TO_INT    | Adapter   |
| REAL_TO_UINT   | Real after U-Int, adapter                           |
| RISE_DETECT    | Flankendetektor                                     |
| RS_FF          | RS Flipflop   |
| RS_FF_MEMO     | Status memory for restart                           |
| SI_GET_STATUS  | Information status single point indication, decoder |
| SI_SET_STATUS  | Single point indication with status, encoder        |
| SQUARE_ROOT    | Square-root extraction                              |
| SR_FF          | SR Flipflop   |
| SR_FF_MEMO     | Status memory for restart                           |
| ST_AND         | AND gate with status                                |
| ST_NOT         | Negator with status                                 |
| ST_OR          | OR gate with status                                 |
| SUB            | Subtraction   |
| TIMER          | Universal timer                                     |
| TIMER_SHORT    | Simple timer  |
| UINT_TO_REAL   | U-Int to Real, Adapter                              |
| UPPER_SETPOINT | Value above upper limit                             |
| X_OR           | (XOR gate)  |
| ZERO_POINT     | Zero point suppression                              |

To find out which priority classes are associated with which function blocks, please consult the DIGSI CFC Manual/3/.

**Device specific limits**

| Maximum Number of TICKS <sup>1)</sup> in the Task Levels |                   |
|--|-------------------|
| Task level   | Limit in in TICKS |
| MW_BEARB (measured value processing)                     | 10000             |
| PLC1_BEARB (slow PLC-processing)                         | 1900              |
| PLC_BEARB (fast PLC-processing)                          | 200               |
| SFS_BEARB (interlocking)                                 | 10000             |

<sup>1)</sup>When the sum of TICKS of all blocks exceeds the limits mentioned before, an error message is output in the CFC.

### 9.2.15 Electrical Tests

|                                  |  |  |
|----------------------------------|--|--|
| <b>CE conformity regulations</b> | <p>This product complies with the directive of the Council of the European Communities on the approximation of the laws of the Member States relating to electromagnetic compatibility (EMC Council Directive 2004/108/EC) and concerning electrical equipment for use within specified voltage limits (Low-voltage directive 2006/95 EC).</p> <p>This conformity is proved by tests conducted by Siemens AG in accordance with the Council Directive in agreement with the generic standards EN 61000-6-2 and EN 61000-6-4 for EMC directive, and with the standards EN 60255-5 and EN 60255-27 for the low-voltage directive.</p> <p>The device has been designed and produced for industrial use.</p> <p>The product conforms with the international standards of IEC 60255 and the German standard VDE 0435.</p> |  |
| <b>Insulation tests</b>          | Standards:   | IEC 60255-27; IEC 60255-5 and IEC 60870-2-1  |
|                                  | – High voltage test (routine test) all circuits except auxiliary voltage input, binary inputs, data interfaces (service, system and clock synchronization interface)   | AC 2 kV (r.m.s. value); 50 Hz; 1 min   |
|                                  | – High voltage test (routine test) auxiliary voltage binary inputs   | DC 3.5 kV<br>DC 2.8 kV   |
|                                  | – High-voltage test (routine test) only data interfaces (service,system and clock synchronization interface)   | AC 500 V (r.m.s. value); 50 Hz; 1 min  |
|                                  | – Impulse voltage test (type test) all circuits without communication and clock synchronization interface, Class III   | 5 kV (peak value); 1.2 μs / 50 μs; 0.5 J; 3 positive and 3 negative pulses in intervals of 5 s |

|   |   |   |
|---|---|---|
| <b>EMC tests for immunity</b><br>(type tests)                                       | Standards:  | IEC 60255-1, -22 and -26, (product standards)<br>EN 61000-6-2 (generic standard)<br>VDE 0435  |
|   | – High-frequency test<br>IEC 60255-22-1 and   | 2.5 kV (peak); 1 MHz; $\tau = 15 \mu\text{s}$ ;<br>400 pulses per s; test duration 10 s;<br>$R_1 = 200 \Omega$  |
|   | – Attenuated oscillation<br>IEC 61000-4-18 <sup>1)</sup>  | 2.5 kV (Peak Value)<br>100 kHz, 1 MHz, $R_1 = 200 \Omega$   |
|   | – Discharge of static electricity<br>IEC 60255-22-2, Class IV<br>and IEC 61000-4-2, Class IV  | 8 kV contact discharge;<br>15 kV air discharge; both polarities;<br>150 pF; $R_1 = 330 \Omega$  |
|   | – Irradiation with HF field,<br>frequency sweep<br>IEC 60255-22-3,<br>IEC 61000-4-3, Class III  | 10 V/m; 80 MHz to 2.7 GHz;<br>80 % AM; 1 kHz  |
|   | – Irradiation with HF field,<br>single frequencies IEC 60255-22-3,<br>IEC 61000-4-3, amplitude-modulated<br>Class III:                                | 10 V/m 80 MHz/160 MHz/450 MHz/<br>900 MHz/1850 MHz/2150 MHz;<br>80 % AM 1 kHz; duty cycle > 10 s  |
|   | – Radiated Electromagnetic Interference<br>IEEE Std C37.90.2 <sup>2)</sup>  | 35 V/m; 80 MHz to 1 GHz<br>20 V/m; 80 MHz to 1 GHz; 80 % AM; 1 kHz  |
|   | – Fast transient disturbance/Burst<br>IEC 60255-22-4 Class A and<br>IEC 61000-4-4   | 4 kV; 5 ns/50 ns; 5 kHz;<br>burst duration 15 ms;<br>repetition rate 300 ms; both polarities;<br>$R_1 = 50 \Omega$ ; test duration 1 min                |
|   | – High-energy surge voltages (SURGE), Impulse: 1.2 $\mu\text{s}$ /50 $\mu\text{s}$<br>IEC 61000-4-5<br>Auxiliary voltage<br>7SS523;<br>7SS522; 7SS525 | common mode: 4 kV; 12 $\Omega$ ; 9 $\mu\text{F}$<br>common mode: 2 kV; 12 $\Omega$ ; 9 $\mu\text{F}$<br>diff. mode: 1 kV; 2 $\Omega$ ; 18 $\mu\text{F}$ |
|   | measuring inputs, binary inputs<br>and relay outputs  | common mode: 2 kV; 42 $\Omega$ ; 0.5 $\mu\text{F}$<br>diff. mode: 1 kV; 42 $\Omega$ ; 0.5 $\mu\text{F}$   |
| – HF on lines<br>IEC 60255-22-6<br>IEC 61000-4-6 Class III                          | 10 V (r.m.s. value);<br>150 kHz to 80 MHz; 80 %; 1 kHz; AM;<br>$R_1 = 150 \Omega$   |   |
| – Power system-frequency<br>magnetic field<br>IEC 61000-4-8 Class IV<br>IEC 60255-1 | 30 A/m continuously;<br>300 A/m for 3 s; 50 Hz;   |   |

1) 100 kHz only 7SS523 and 7SS525

2) only 7SS522

|                                     |  |  |
|-------------------------------------|--|--|
| <b>EMC tests for noise emission</b> | Standard:  | EN 61000-6-4, IEC 60255-26<br>(generic standard) |
|                                     | – Radio disturbance voltage on lines, only auxiliary voltage<br>IEC-CISPR 11 | 150 kHz to 30 MHz<br>limit value class A         |
|                                     | – Disturbance field intensity<br>IEC-CISPR 11                                | 30 MHz to 1000 MHz<br>limit value class A        |

---

### 9.2.16 Mechanical Tests

---

|                                  |  |  |
|----------------------------------|--|--|
| <b>Mechanical impact</b>         | Permissible mechanical impact  |  |
|                                  | – in service<br>Standards:   | Oscillation sinusoidal;<br>IEC 60255-21-1 Class II<br>IEC 60068-2-6 test Fc<br>10 Hz to 60 Hz; ± 0.075 mm amplitude;<br>60 Hz to 150 Hz; 1 g acceleration;<br>frequency sweep rate 1 octave/min;<br>20 cycles in 3 orthogonal axes |
|                                  | Standard:  | Shock semi-sinusoidal<br>IEC 60255-21-2<br>IEC/EN 60028-2-27 Class I<br>5 g acceleration, duration 11 ms,<br>each 3 shocks (in both directions of the 3 axes)  |
| – during transport<br>Standards: | Oscillation sinusoidal;<br>IEC 60255-21-1 Class I<br>IEC 60068-2-6 test Fc<br>5 Hz to 8 Hz; ± 3.5 mm amplitude;<br>8 Hz to 150 Hz; 1 g acceleration;<br>frequency sweep rate 1 octave/min;<br>20 cycles in 3 orthogonal axes |  |

---

## 9.2.17 Climatic Stress Tests



### WARNING

Commissioning at temperatures  $\leq 0\text{ °C}$  may only be performed if plant conditions ensure that no command/trip outputs can be activated until the modules have reached their minimum permissible service temperature.

### Temperatures

|  |   |
|--|---|
| Standards:   | IEC 60255-6   |
| Permissible temporary operating temperature (tested for 96 h)  | $-10\text{ °C}$ to $+55\text{ °C}$ (Above $+55\text{ °C}$ the legibility of the display can be impaired.) |
| recommended for permanent operation (in acc. with IEC 60255-1) | $-5\text{ °C}$ to $+55\text{ °C}$   |
| Limiting temperatures for storage                              | $-25\text{ °C}$ to $+55\text{ °C}$  |
| Limit temperatures for transport                               | $-25\text{ °C}$ to $+70\text{ °C}$  |

Storage and transport with factory packaging!

### Humidity

Permissible humidity  
in service

yearly mean  $\leq 75\%$  relative humidity;  
on 30 in the year up to  $95\%$  relative  
humidity; moisture condensation not  
permissible

We recommend to install the devices so that they are not subject to direct sunlight and strong fluctuations in temperature which could lead to moisture condensation. Commissioning at temperatures  $\leq 0\text{ °C}$  is permissible only if site conditions ensure that no command output can be activated before the device temperature has reached  $0\text{ °C}$ .

### 9.2.18 Service Conditions

The relay is designed for use in industrial environment, for installation in standard relay rooms and compartments so that with proper installation electro-magnetic compatibility (EMC) is ensured. The following should also be heeded:

- All contactors and relays which operate in the same cubicle or on the same relay panel as the digital protection equipment should, as a rule, be fitted with suitable spike quenching elements.
  - All external connection leads in substations from 100 kV upwards should be screened with a screen capable of carrying power currents and earthed at both sides. No special measures are normally necessary for substations of lower voltages.
  - Individual modules must not be withdrawn or inserted under voltage. In withdrawn condition, some components are electrostatically endangered; during handling the EEC standards (standards for electrostatically endangered components) must be observed. The modules are not endangered when plugged in.
- 

### 9.2.19 Design Versions

|                     |  |   |
|---------------------|--|---|
| <b>Central unit</b> | SIPAC subrack<br>Terminals   | IP 20<br>IP 2x  |
| <b>Bay unit</b>     | Housing (7XP20)<br>– with window pane front<br>– without window pane front<br>Terminals<br>Degree of protection acc. to EN 60529 | IP 51<br>IP 30 [IP 20] <sup>1)</sup><br>IP 2x                                     |
| <b>Weight</b>       | Weight at maximum configuration<br>Central unit<br>– SIPAC subrack<br>Bay unit<br>– flush-mounted<br>– surface-mounted           | 14,3 kg<br>8.1 kg [5,5 kg] <sup>1)</sup><br>11.8 kg [not available] <sup>1)</sup> |
| <b>Dimensions</b>   | See dimensional drawings, Chapter 9.3, page 362  |   |

<sup>1)</sup> Values in brackets [ ] for Bay unit 7SS525



### 9.2.20 MCBs for Device 7SS52x

---

The miniature circuit breaker have one tripping characteristic for thermal overload as well as one for short circuits ( for magnetic trip actuator).

For the dimensioning of overload, the continuous as well as momentary current has to be taken into consideration.

For magnetic trip actuator, please observe the transitory current ratio. The limitation of the transitory current ratio correspond to the following requirements

- approx. 18 A peak value for a period of time of < 0,25 ms
  - approx. 12 A peak value for a period of time of < 1 ms
-

## 9.3 Dimensions

### 9.3.1 Central Unit

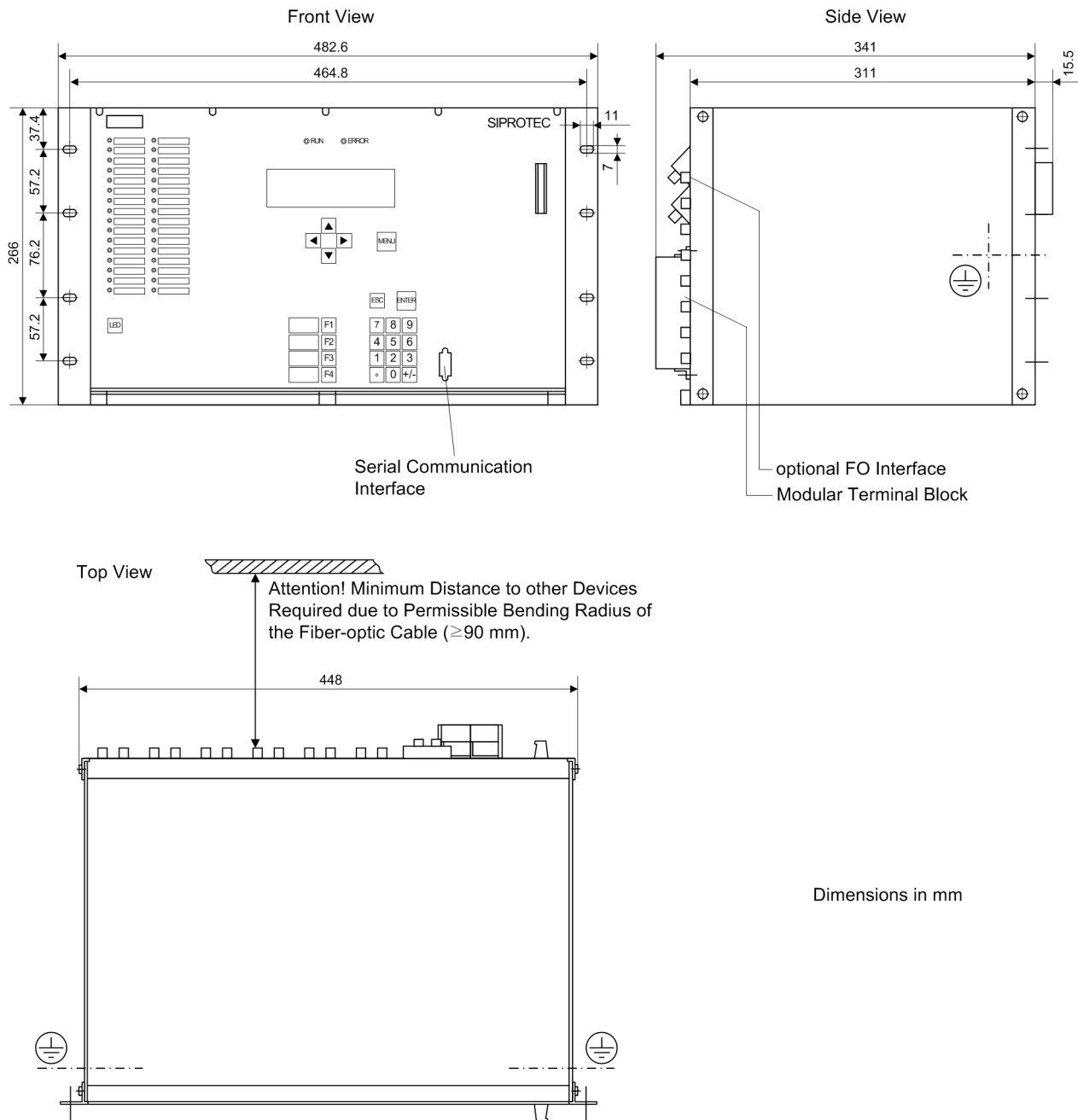


Figure 9-2 Mechanical dimensions of the subrack

If you use the optionally available spacer angles, the installation depth will be reduced by 40 mm.

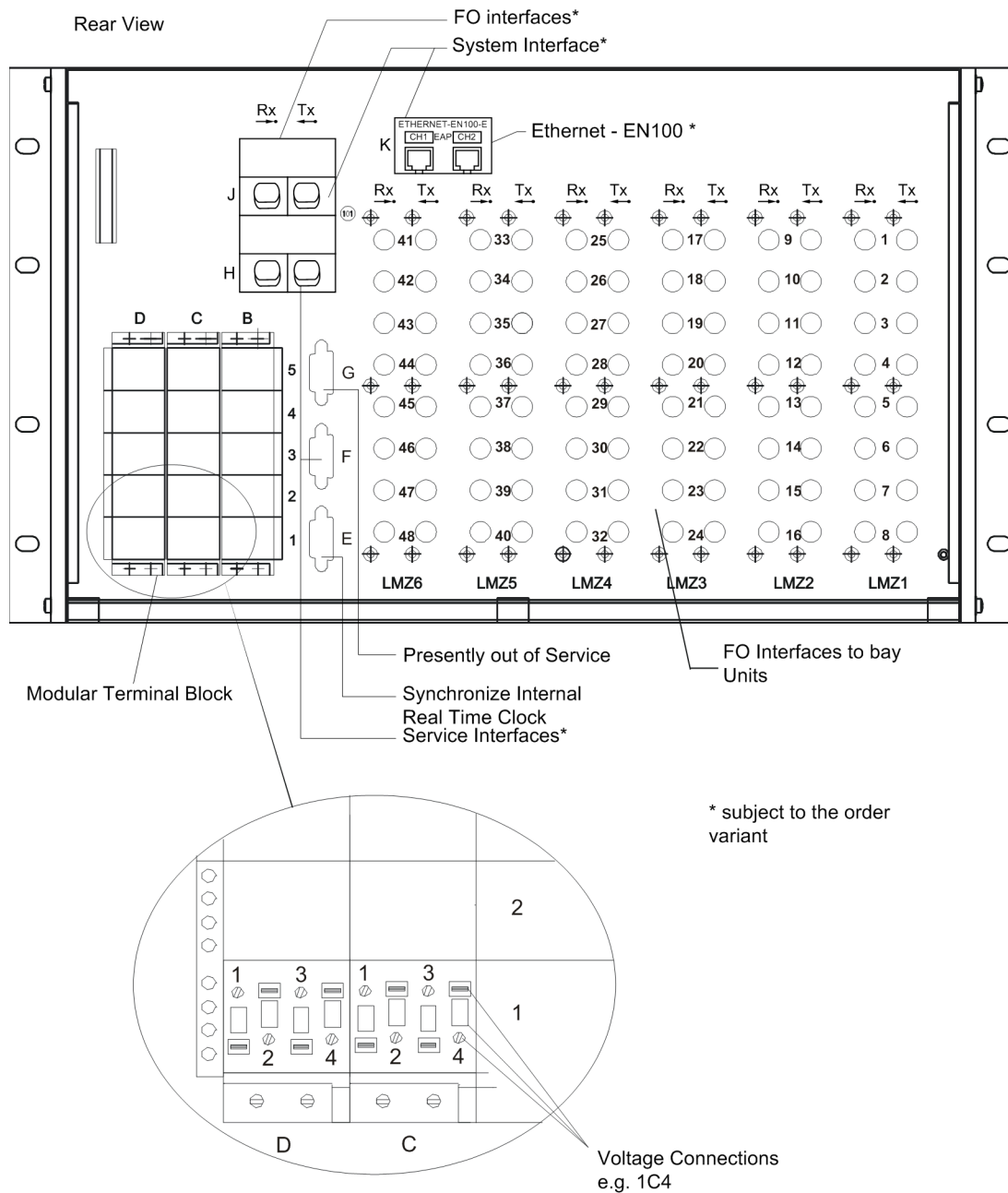


Figure 9-3 Connection plugs (rear view) of the subrack

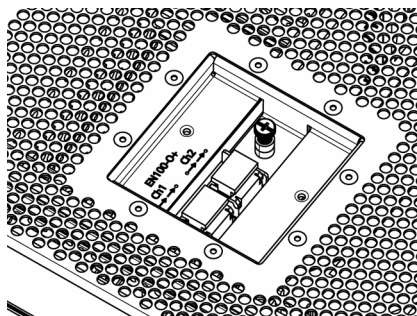


Figure 9-4 Optional EN100-O+ connection at the bottom side of the central unit

### 9.3.2 Bay Unit

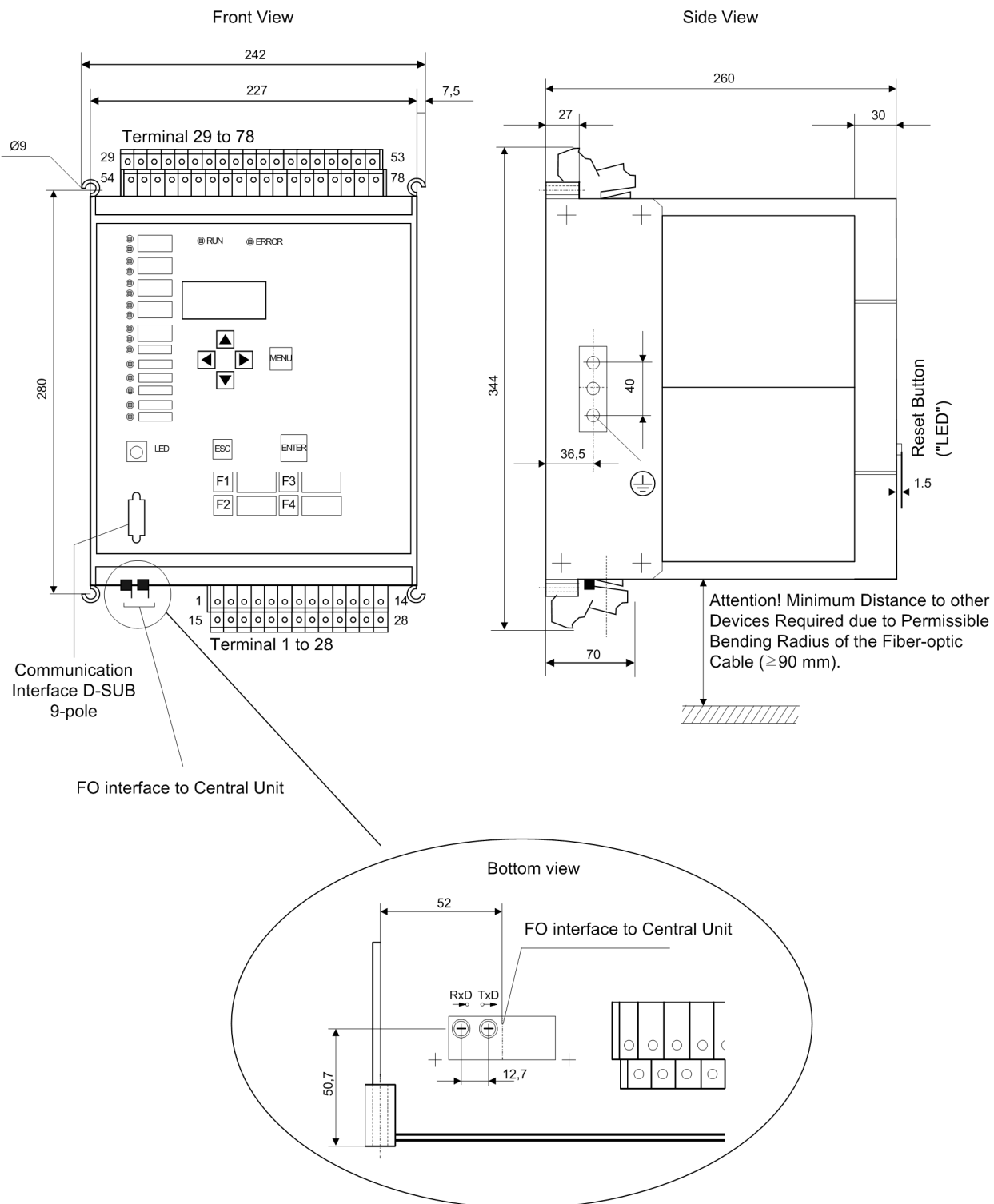


Figure 9-5 Dimensional drawing of 7XP20 for panel surface mounting 7SS523 (all dimensions in mm)

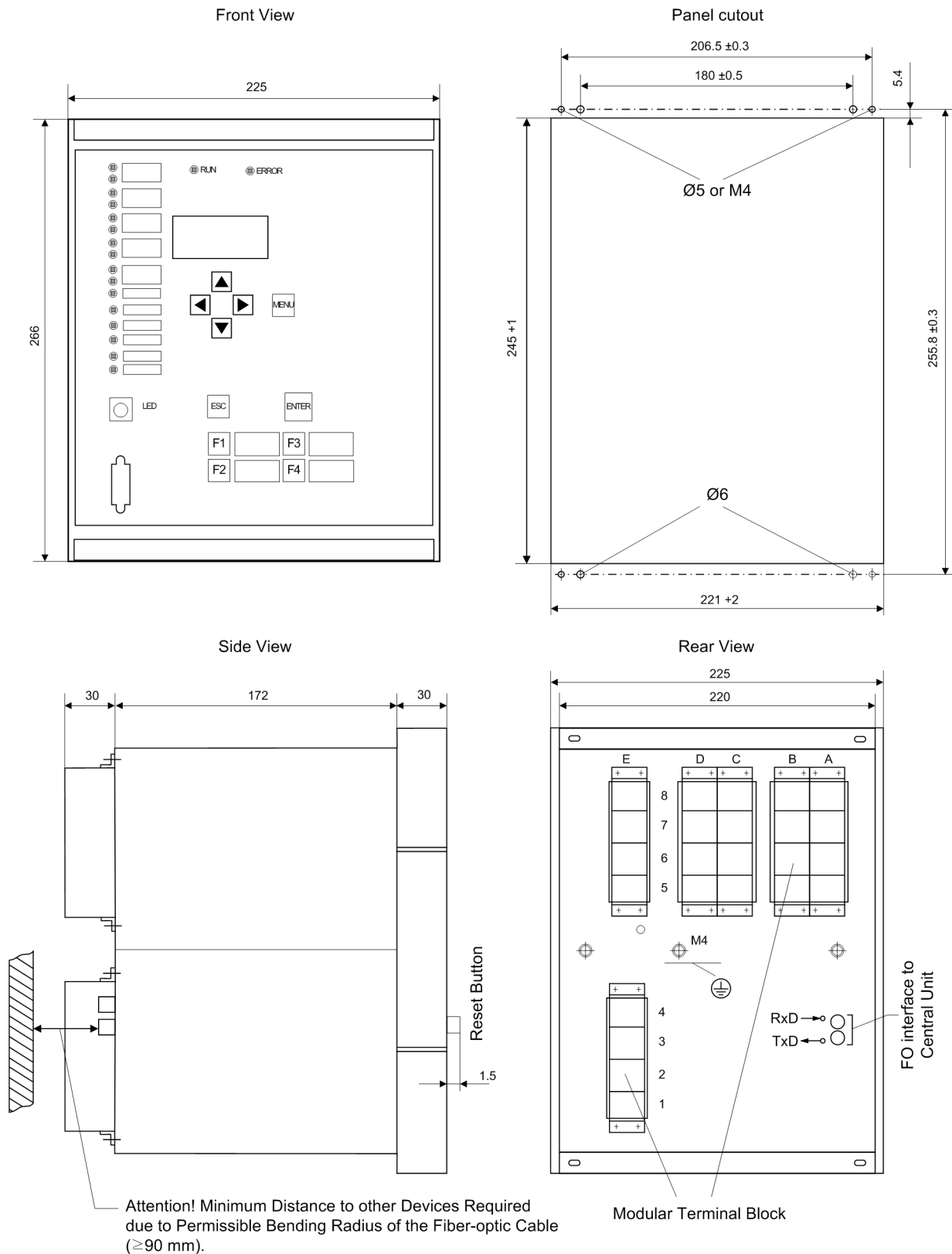


Figure 9-6 Dimensional drawing of 7XP20 for panel or cubicle flush mounting 7SS523 (all dimensions in mm)

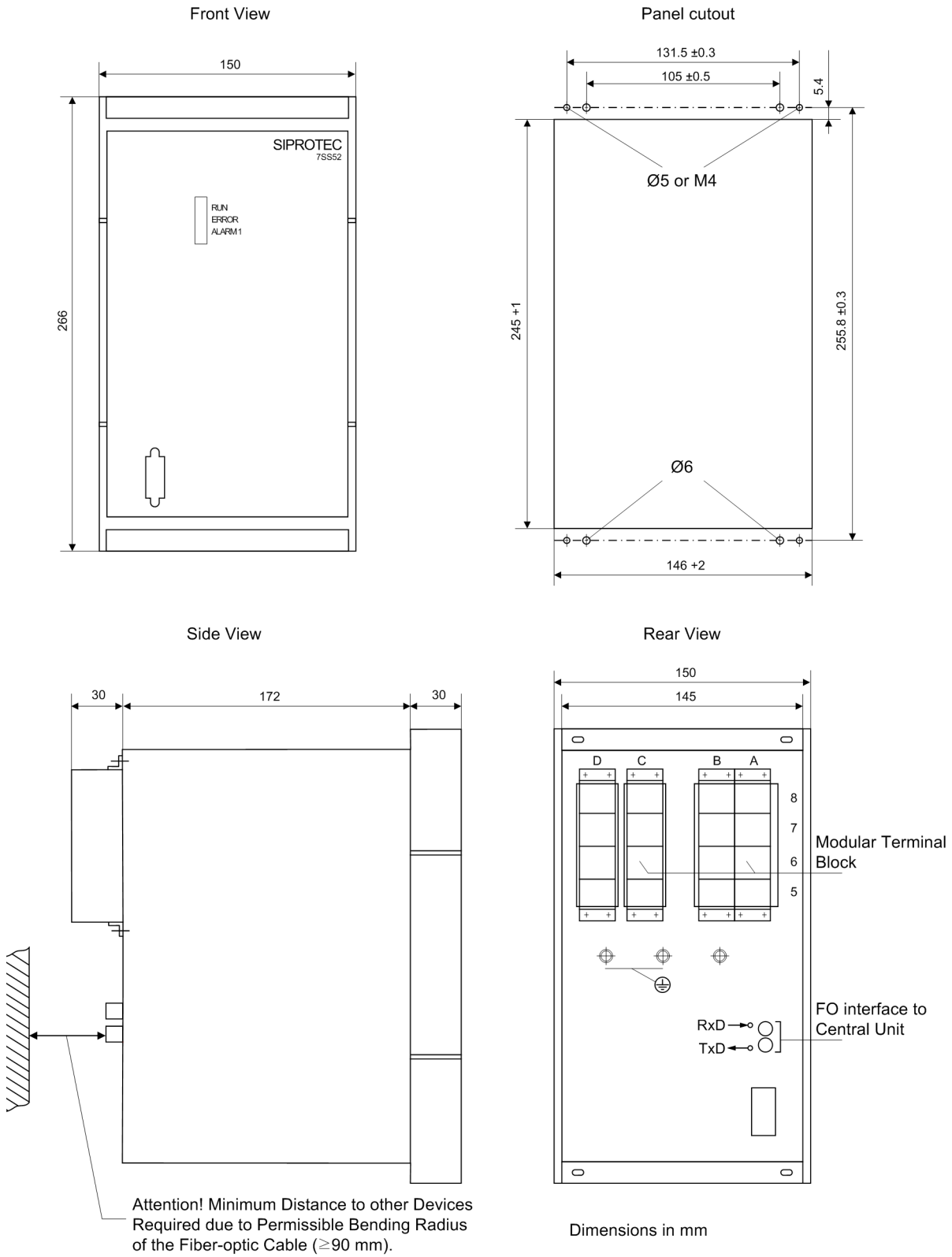


Figure 9-7 Dimensional drawing of 7XP20 for panel or cubicle flush mounting 7SS525 (all dimensions in mm)

# Appendix

# A

This appendix contains ordering information, general diagrams and connection diagrams, tabular listings of all settings and information of the distributed busbar and failure protection SIPROTEC 7SS52 V4 for the full scope of device functions.

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## A.1 Data for Selection and Ordering

Table A-1, page 368 to Table A-6, page 371 gives an overview of the available variants of the components (central unit, bay units) of the protection system SIPROTEC 7SS52 V4 and their ordering codes.

Necessary ancillary devices with corresponding ordering codes are added.

### A.1.1 Central Unit

Table A-1 Selection and ordering data for central unit

|  |  |
|--|--|
| <b>Distributed busbar and breaker failure protection</b><br><b>SIPROTEC 7SS52 V4</b><br><b>CENTRAL UNIT</b>  | Order No.<br>7 S S 5 2 <input type="checkbox"/> 0 - <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> - <input type="checkbox"/> <input type="checkbox"/> A 0 |
| <b>System version</b><br>50 Hz/60 Hz V4  | ↑<br>2   |
| <b>Rated auxiliary voltage of converters</b><br>DC 48 V to 250 V   | ↑<br>6   |
| <b>Mechanical design</b><br>in subrack ES902 C (SIPAC)   | ↑<br>A   |
| <b>Communication language</b><br>Region DE, Language German (Lang. changeable)<br>Region World, Language English (UK) (Lang. changeable)<br>Region US, Language English (US) (Lang. changeable)<br>Region World, Language French (Lang. changeable)<br>Region World, Language Spanish (Lang. changeable)<br>Region World, Language Italian (Lang. changeable)<br>Region World, Language Russian (Lang. changeable) | ↑<br>A<br>B<br>C<br>D<br>E<br>F<br>G   |
| <b>System interface</b><br>no interface<br>Protocol IEC 60870-5-103, optical 820 nm, ST plugs<br>Additional protocols, see additional information L  | ↑<br>0<br>3<br>9   |



Table A-1 Selection and ordering data for central unit

|  |   |  |  |                                 |
|--|---|--|--|---------------------------------|
| <b>Distributed busbar and breaker failure protection<br/>SIPROTEC 7SS52 V4<br/>CENTRAL UNIT</b>                                    | Order No.<br><b>7 S S 5 2</b> <input type="checkbox"/> <b>0</b> - <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> - <input type="checkbox"/> <input type="checkbox"/> <b>A 0</b> |  |  |                                 |
| <b>Service interface</b> (rear port)<br>DIGSI 4, electrical RS232<br>DIGSI 4, electrical RS485<br>DIGSI 4, optical 820 nm, ST plug |   |  |  | ↑<br>1<br>2<br>3                |
| <b>additional Functions</b><br>without<br>with cross stabilisation   |   |  |  | ↑<br>1<br>2                     |
| <b>Fitted for</b><br>8 bays<br>16 bays<br>24 bays<br>32 bays<br>40 bays<br>48 bays   |   |  |  | ↑<br>A<br>B<br>C<br>D<br>E<br>F |

| <b>Additional information L, further protocols (port K)</b>     | Position | 21 | 22 |  |
|---|----------|----|----|--|
| IEC 61850, electrical with EN100 (RJ45 connector) <sup>1)</sup> |          | 0  | R  |  |
| IEC 61850, optical with EN100-double                            |          | 0  | S  |  |

<sup>1)</sup> Only delivery ex works possible

Table A-2 Nominal voltages binary inputs for central unit <sup>2)</sup>

| <b>Jumper settings X-No.</b>                   | <b>Special Design</b> |
|--|-----------------------|
| Nominal control voltage binary inputs DC 24 V  | Y10                   |
| Nominal control voltage binary inputs DC 60 V  | Y11                   |
| Nominal control voltage binary inputs DC 110 V | Y12                   |

<sup>2)</sup> Delivery setting 220 V

### A.1.2 Bay Units

Table A-3 Selection and ordering data for bay unit 7SS523

|   |   |
|---|---|
| <b>Distributed busbar and breaker failure protection<br/>SIPROTEC 7SS52 V4<br/>BAY UNIT</b>   | Order No.<br>7 S S 5 2 <input type="checkbox"/> <input type="checkbox"/> - <input type="checkbox"/> <input type="checkbox"/> A 0 1 - <input type="checkbox"/> A A 1 |
| <b>System version</b><br>50 Hz/60 Hz V3.*   | ↑<br>3  |
| <b>Rated current at 50/60 Hz</b><br>1 A<br>5 A  | ↑<br>1<br>5   |
| <b>Rated auxiliary voltage of converters</b><br>DC 48 V to 250 V  | ↑<br>5  |
| <b>Mechanical design in casing</b><br>in casing 7XP20 flush mounting housing, with face-plate<br>in casing 7XP20 surface mounting housing<br>in casing 7XP20 flush mounting housing, without face-plate | ↑<br>C<br>D<br>E  |
| <b>Ancillary functions</b><br>without<br>with overcurrent time protection   | ↑<br>0<br>1   |

Table A-4 Nominal voltages binary inputs for bay unit 7SS523

| Jumper settings X-No.                          | Special Design |
|--|----------------|
| Nominal control voltage binary inputs DC 24 V  | Y10            |
| Nominal control voltage binary inputs DC 60 V  | Y11            |
| Nominal control voltage binary inputs DC 110 V | Y12            |

Table A-5 Selection and ordering data for bay unit 7SS525

|  |   |
|--|---|
| <b>Distributed busbar and breaker failure protection<br/>SIPROTEC 7SS52 V4<br/>BAY UNIT</b>      | Order No.<br><b>7 S S 5 2 5 □ - 5 F A 0 1 - □ A A 1</b> |
| <b>System version</b><br>50 Hz/60 Hz V3.*  | ↑<br>5  |
| <b>Rated current at 50/60 Hz</b><br>1 A<br>5 A   | ↑<br>1<br>5   |
| <b>Rated auxiliary voltage of converters</b><br>DC 48 V to 250 V                                 | ↑<br>5  |
| <b>Mechanical design in casing</b><br>in casing 7XP20 flush mounting housing, without face-plate | ↑<br>F  |
| <b>Ancillary functions</b><br>without<br>with overcurrent time protection                        | ↑<br>0<br>1   |

Table A-6 Nominal voltages binary inputs for bay unit 7SS525

| <b>Jumper settings X-No.</b>                   | <b>Special Design</b> |
|--|-----------------------|
| Nominal control voltage binary inputs DC 24 V  | Y10                   |
| Nominal control voltage binary inputs DC 60 V  | Y11                   |
| Nominal control voltage binary inputs DC 110 V | Y12                   |

### A.1.3 Accessories

Table A-7 Accessories for Central Unit

| <b>Accessories</b>  |   |
|---|---|
| The following accessories are contained in the delivery of the central unit:  | <ul style="list-style-type: none"> <li>• CD with firmware, manuals, labeling software</li> <li>• Extraction handle for printed circuit boards</li> <li>• FO Simplex indoor cable, length 0.2 m (2 pieces)</li> <li>• FO coupler</li> <li>• Self-adhesive labeling film</li> <li>• Torx-socket wrench insert T8, T10, T20</li> <li>• Buffer battery (see also Table A-9, page 373)</li> <li>• Plastic rings for FO cables</li> <br/> <li>• Plug-in jumpers for boards</li> </ul> |
| Spacer angles for central unit with mounting sketch   | <b>C53207-A361-D701-1</b>   |
| Extraction handle, coding plug (10 x 2,54 mm + 25 x 5,08 mm), FO damping rings, FO test lead, FO plug-in connector and CD with manual | <b>C53207-A361-D702-1</b>   |
| FO damping rings (120 pcs.) as well as coding and test plugs (plug 10 x 2,54 + 25 x 5,08 mm)  | <b>C53207-A361-D703-1</b>   |
| Coding plugs (100 pcs. 5,08 mm)   | <b>C53207-A361-D704-1</b>   |
| Upgrade kit for EN100-O+ module (release LL and higher)   | <b>C53207-A351-D695-1</b>   |

Table A-8 Ordering data for PC communication software DIGSI

| <b>ANCILLARY COMPONENTS</b>   | Order No..            |
|---|-----------------------|
| PC communication software DIGSI, Basic<br>German, English   | <b>7XS 5400-0AA00</b> |
| PC communication software DIGSI, Professional<br>(Basic and all optional packets, incl. SIGRA)<br>German, English | <b>7XS 5402-0AA00</b> |
| DIGSI REMOTE<br>Software for the remote control of protection devices via<br>modem with DIGSI<br>German, English  | <b>7XS 5440-0AA00</b> |
| SIGRA<br>Software for the graphical visualization, analysis and<br>evaluation of fault records<br>German, English | <b>7XS 5410-0AA00</b> |
| Connection cable protection device -PC (9-pole; D-SUB)  | <b>7XV 5100-4</b>     |

Table A-9 Selection and ordering data for spare parts

| Spare parts for the 7SS52 V4 distributed busbar and breaker failure protection                                | Order No.  |
|---|--|
| <b>Buffer battery for central and bay unit</b><br>Lithium battery 3 V / 1 Ah, Type CR 1/2 AA                  | <b>6127 101 301 (Varta)</b><br><b>BR-1/2AA (Panasonic)</b> |
| <b>Processor boards Central Unit</b><br>ZPS2-SBK <sup>1)</sup><br>D-CPU <sup>2)</sup>                         | <b>6MA 3523-0AA00</b><br><b>6MA 3542-0AA00</b>             |
| <b>Input/output board Central Unit</b><br>EAZ   | <b>6MA 3262-0BA01</b>                                      |
| <b>Electrical/optical converter module Central Unit</b><br>LMZ  | <b>6MA 3263-0AA10</b>                                      |
| <b>Power supply Central Unit 7SS522 (of release 7SS522 ../ HH and higher)</b><br>DC 48 to 250 V <sup>3)</sup> | <b>6MA 1891-0AA05</b>                                      |
| <b>EN100-E Modul for Central Unit 7SS522</b>  | <b>C53207-A351-D677-1</b>                                  |

1) The ZPS2-SK boards and ZPS2-BSZ boards differ from the board ZPS2-SBK only in terms of jumper settings and firmware. Jumpers and firmware are included in the accessories of the central unit.

2) Additional order specifications required

- full order number of central unit
- Serial number of central unit (BF-...)
- Firmware version of central unit

3) Usage only for 7SS522 devices, which contain the following processor modules exclusively:  
6MA3523-xx (ZPS2-SBK, ZPS2-BSZx) and 6MA3533-xx (ZPS2-SKx).

Table A-10 Selection and ordering data for FO connections

| <b>ANCILLARY COMPONENTS</b><br><b>Fiber-optic connections central unit - bay units</b>  | Order No.   |
|---|---|
| FO-Duplex outdoor cable 2G62,5/125, 2 fibers,<br>ST-plugs on both sides   | <b>6 X V 8 1 0 0 - 0 B D 4 1 - □ □ □ 0</b>                    |
| FO-Duplex indoor cable 2G62,5/125, 2 fibers,<br>ST-plugs on both sides  | <b>6 X V 8 1 0 0 - 0 B E 4 1 - □ □ □ 0</b>                    |
| 100 meter lengths<br><br>Length 0 m<br>Length 100 m<br>Length 200 m<br>Length 300 m<br>Length 400 m<br>Length 500 m<br>Length 600 m<br>Length 700 m<br>Length 800 m<br>Length 900 m | ↑<br>↑<br>↑<br>0<br>1<br>2<br>3<br>4<br>5<br>6<br>7<br>8<br>9 |
| 10 meter lengths:<br><br>Length 0 m<br>Length 10 m<br>Length 20 m<br>Length 30 m<br>Length 40 m<br>Length 50 m<br>Length 60 m<br>Length 70 m<br>Length 80 m<br>Length 90 m          | A<br>B<br>C<br>D<br>E<br>F<br>G<br>H<br>J<br>K                |
| 1 meter lengths:<br><br>Length 0 m<br>Length 1 m<br>Length 2 m<br>Length 3 m<br>Length 4 m<br>Length 5 m<br>Length 6 m<br>Length 7 m<br>Length 8 m<br>Length 9 m                    | A<br>B<br>C<br>D<br>E<br>F<br>G<br>H<br>J<br>K                |

1 Plain text order required for non-standardized lengths

2 Before delivery, the non-metallic rodent protection is stripped at both ends on a length of 1 m. Extended stripping lengths (max. 2.5 m) have to be ordered by plain text..



**NOTE**

- FO cable up to 1.500 m length
- Wavelength 820 nm

## A.2 Basis for Selection of the Stabilisation Factor $k$

In a first step, the relationship between the point (in time) at which saturation occurs and the stabilisation factor is established.

The following condition must be fulfilled in order to prevent bus zone tripping for an external fault (see Figure A-1, page 375):

$$2 I_{\text{SC max}} \sin \omega T_S \times k \geq I_{\text{SC max}} \quad (1) \text{ or}$$

$$2 \sin \omega T_S \times k \geq 1 \quad (2)$$

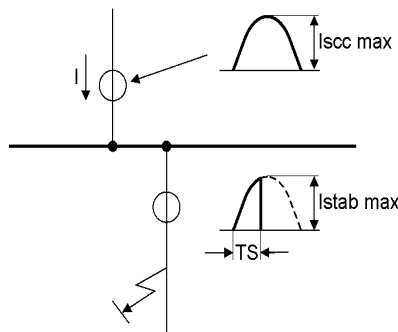
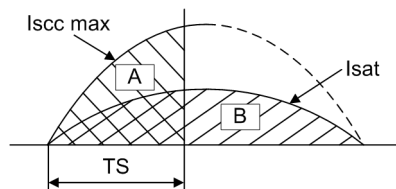


Figure A-1 Short-circuit on a feeder with CT saturation

To determine the point in time  $T_S$  at which saturation occurs, the burdening factor  $K_b$  must be considered.



$$I_{\text{sat}} = I_{\text{pn}} * K'_{\text{ssc}}$$

$$K_b = I_{\text{SC max}} / I_{\text{sat}}$$

Figure A-2 Current/time characteristic

If the CT is burdened with  $I_{\text{SC max}} = K_b I_{\text{sat}}$ , it will saturate after time  $T_S$ , with area A being equal to area B .

$$\text{i.e.} \quad \int_0^{\omega T_S} (I_{\text{SC max}} \cdot \sin \omega t) = \int_0^{\pi} (I_{\text{sat}} \cdot \sin \omega t) \quad (3)$$

$$K_b (1 - \cos \omega T_S) = 2 \quad (4)$$

If inequation (2) and equation (4) are combined, the result is the minimum selectable stabilisation factor  $k$ :

$$k > \frac{K_b}{4 \cdot \sqrt{K_b - 1}} \quad \text{for } K_b \geq 2 \quad (5)$$

### A.3 Connection Diagrams

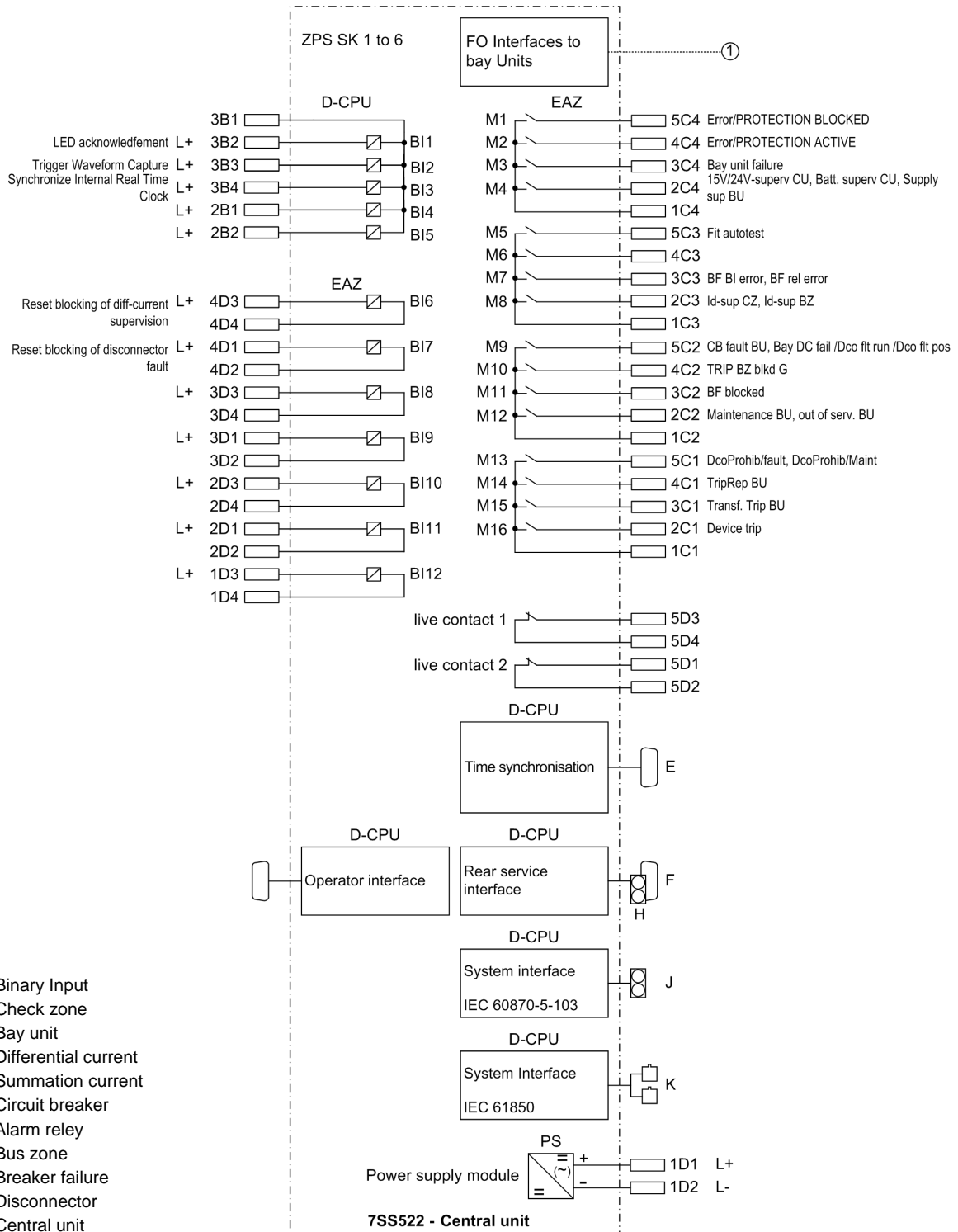


Figure A-3 Connection diagram central unit (continued in Figure A-4, page 377)



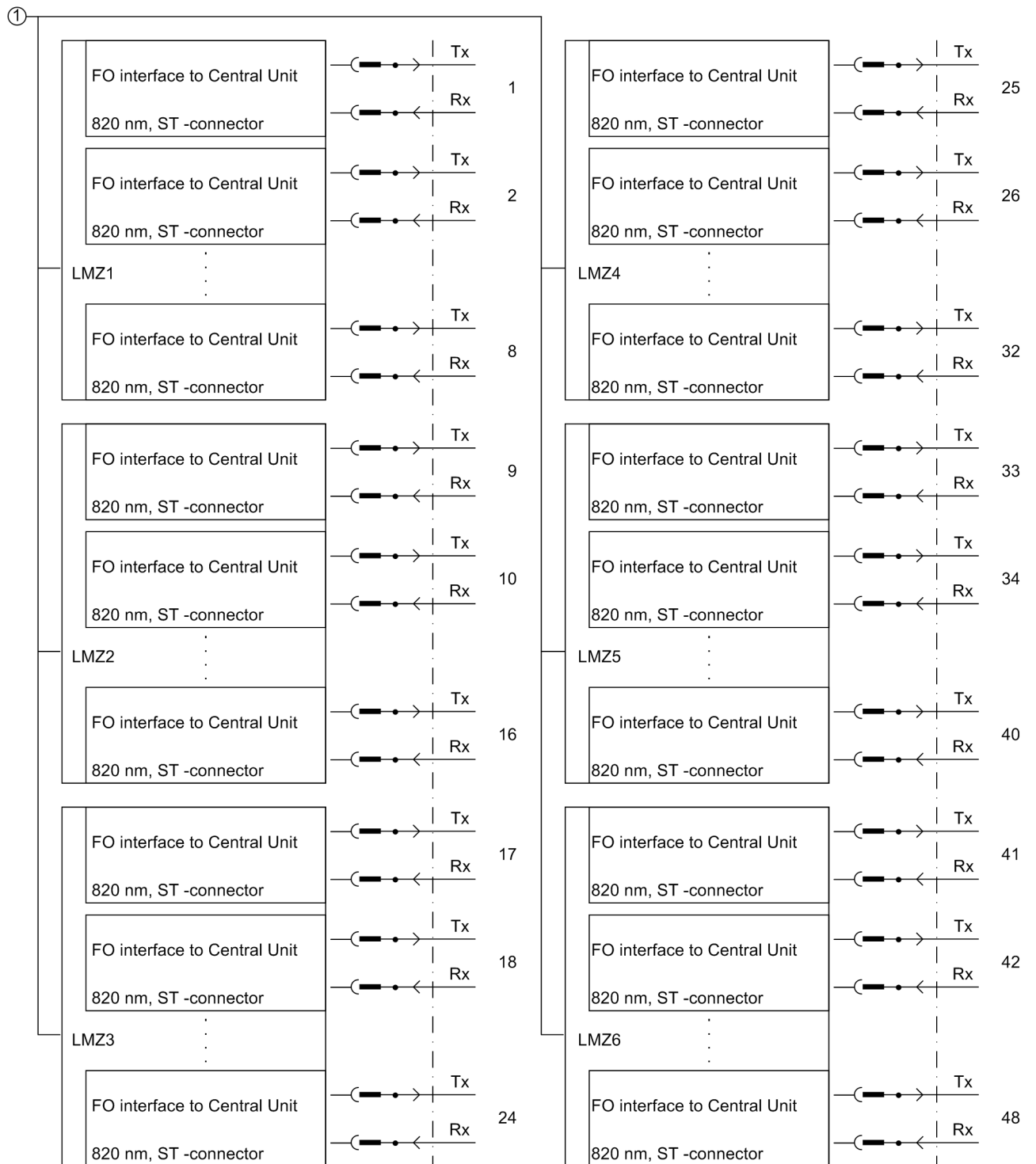


Figure A-4 Connection diagram central unit (continued from Figure A-3, page 376)

## D-SUB Connectors

| Pin No.                                   | PC port | Service port (F)        |                  | Time synchronizing port (E) |
|---|---------|-------------------------|------------------|-----------------------------|
|   |         | RS 232                  | RS 485           |                             |
| Shield electrically connected with collar |         |                         |                  |                             |
| 1   | -       | -                       | -                | P24_TSIG                    |
| 2   | RxD     | RxD                     | -                | P5_TSIG                     |
| 3   | TxD     | TxD                     | A/A' (RxD/TxD-N) | M_TSIG                      |
| 4   | -       | -                       | -                | _2                          |
| 5   | GND     | GND                     | C/C' (GND)       | -                           |
| 6   | -       | -                       | -                | -                           |
| 7   | -       | $\overline{\text{RTS}}$ | _1               | P12_TSIG                    |
| 8   | -       | $\overline{\text{CTS}}$ | B/B' (RxD/TxD-P) | -                           |
| 9   | -       | -                       | -                | -                           |

- 1 Pin 7 carries the  $\overline{\text{RTS}}$  signal with RS232 level even if operated as RS 485 interface.  
Therefore pin 7 must not be connected!
- 2 Pin 4 is assigned but cannot be used

## Connections for FOs

The transmit and receive connections of the FO cables are identified by the symbols  $\bullet \longrightarrow$  for transmit (output) and  $\longrightarrow \bullet$  for receive (input).

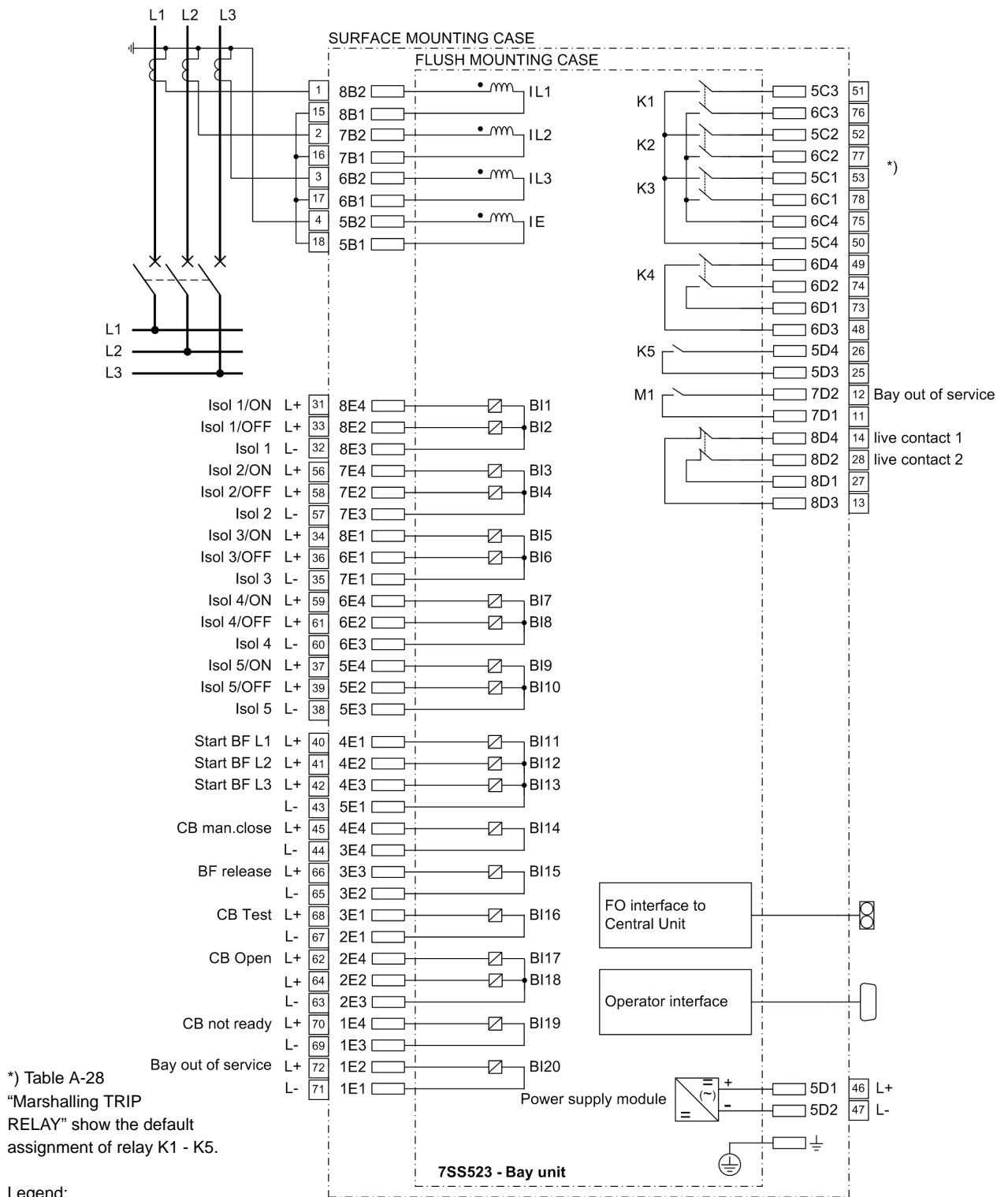


Figure A-5 Connection diagram bay unit 7SS523

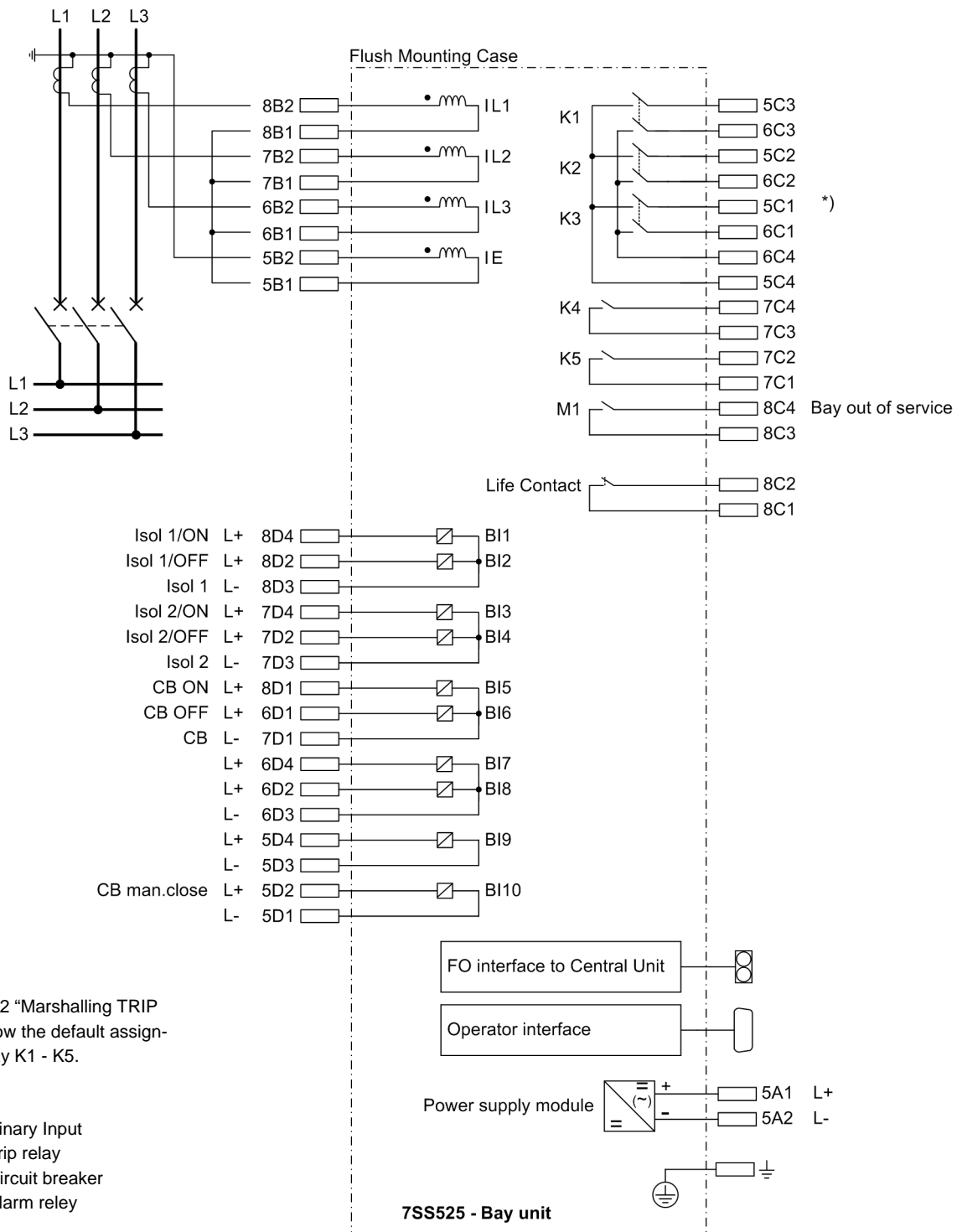


Figure A-6 Connection diagram bay unit 7SS525

**D-SUB connectors**

| Pin No.                                   | PC port |
|---|---------|
| Shield electrically connected with collar |         |
| 1   | -       |
| 2   | RxD     |
| 3   | TxD     |
| 4   | -       |
| 5   | GND     |
| 6   | -       |
| 7   | -       |
| 8   | -       |
| 9   | -       |

**Connections for FOs**

The transmit and receive connections of the FO cables are identified by the symbols  $\bullet \longrightarrow$  for transmit (output) and  $\longrightarrow \bullet$  for receive (input).

## A.4 Module View Central Unit

### A.4.1 View of the ZPS Module

**ZPS2 module of release 7SS522 ../HH and higher**

The ZPS2 module can be used as master (ZPS-SBK) or slave (ZPS-BSZ or ZPS-SK) in a multi-processor system. The C53207-A361-B28-1 module can be applied universally as ZPS-SK, ZPS-SBK and ZPS-BSZ. Each module is assigned its particular task unambiguously by means of jumpers.

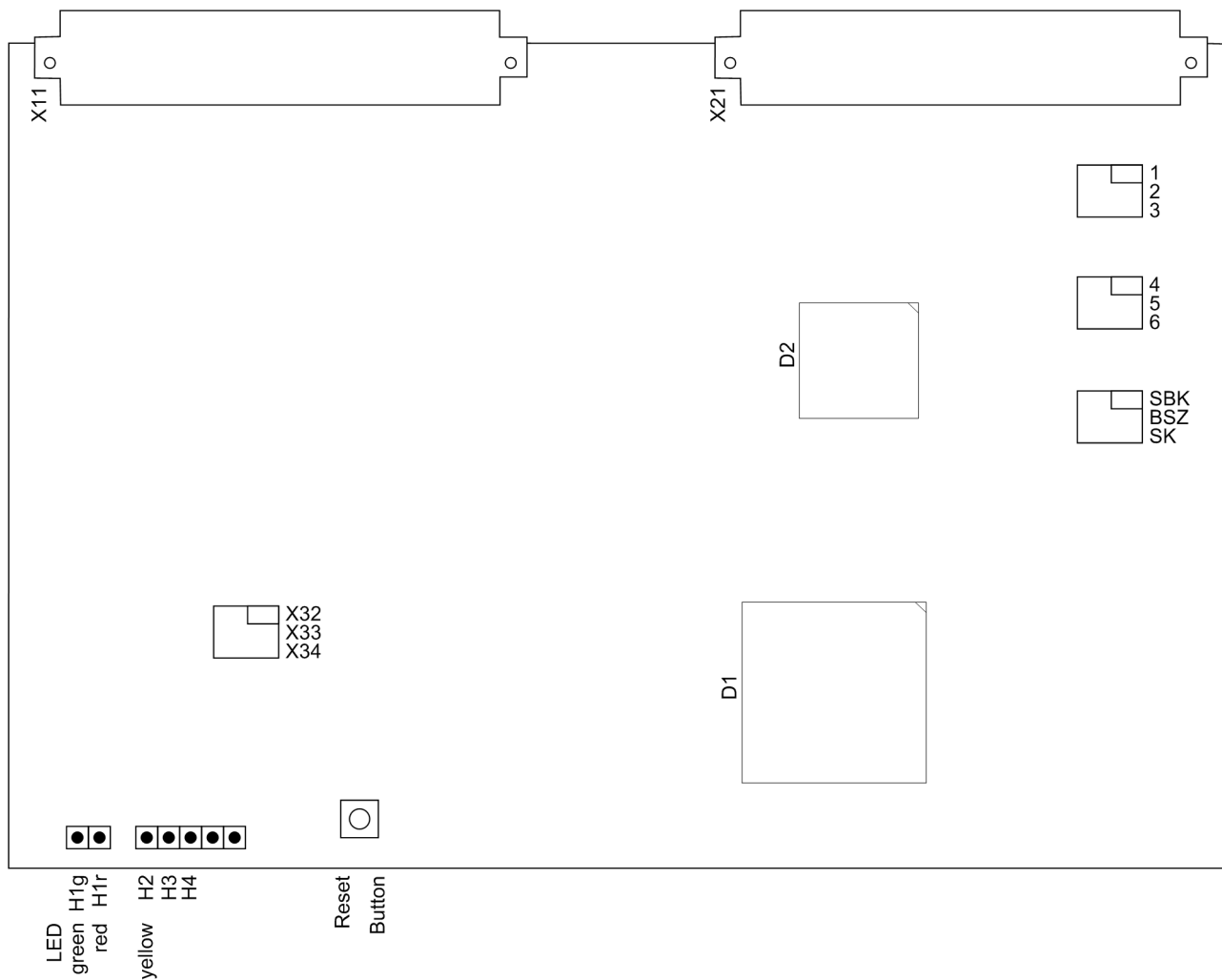


Figure A-7 Setting elements of the ZPS2 module

Prior to the installation of a module it is recommended that you check the jumper settings. You can find a list of these settings in Table A-11, page 383 of the Appendix.

Table A-11 Jumper settings for the ZPS2 module

| ZPS2-Functions |     |       |       |       |      |      |      |      |      |      |
|----------------|-----|-------|-------|-------|------|------|------|------|------|------|
| Jumper         | SBK | BSZ 1 | BSZ 2 | BSZ 3 | SK 1 | SK 2 | SK 3 | SK 4 | SK 5 | SK 6 |
| SBK            | on  | off   | off   | off   | off  | off  | off  | off  | off  | off  |
| BSZ            | off | on    | on    | on    | off  | off  | off  | off  | off  | off  |
| SK             | off | off   | off   | off   | on   | on   | on   | on   | on   | on   |
| 1              | on  | on    | off   | off   | on   | off  | off  | off  | off  | off  |
| 2              | off | off   | on    | off   | off  | on   | off  | off  | off  | off  |
| 3              | off | off   | off   | on    | off  | off  | on   | off  | off  | off  |
| 4              | off | off   | off   | off   | off  | off  | off  | on   | off  | off  |
| 5              | off | off   | off   | off   | off  | off  | off  | off  | on   | off  |
| 6              | off | off   | off   | off   | off  | off  | off  | off  | off  | on   |
| X32            | on  | on    | on    | on    | on   | on   | on   | on   | on   | on   |
| X33            | off | off   | off   | off   | off  | off  | off  | off  | off  | off  |
| X34            | off | off   | off   | off   | off  | off  | off  | off  | off  | off  |

In the case of an unsuccessful firmware update, the loading of the firmware can be forced by changing the jumper settings on the assembly SBK (X32 =off, X33 = on, X34 = on). After completion the jumper settings have to be returned to their original state.

**NOTE**

The second plug can be taken from the sequence field "1".

### A.4.2 View of the EAZ Module

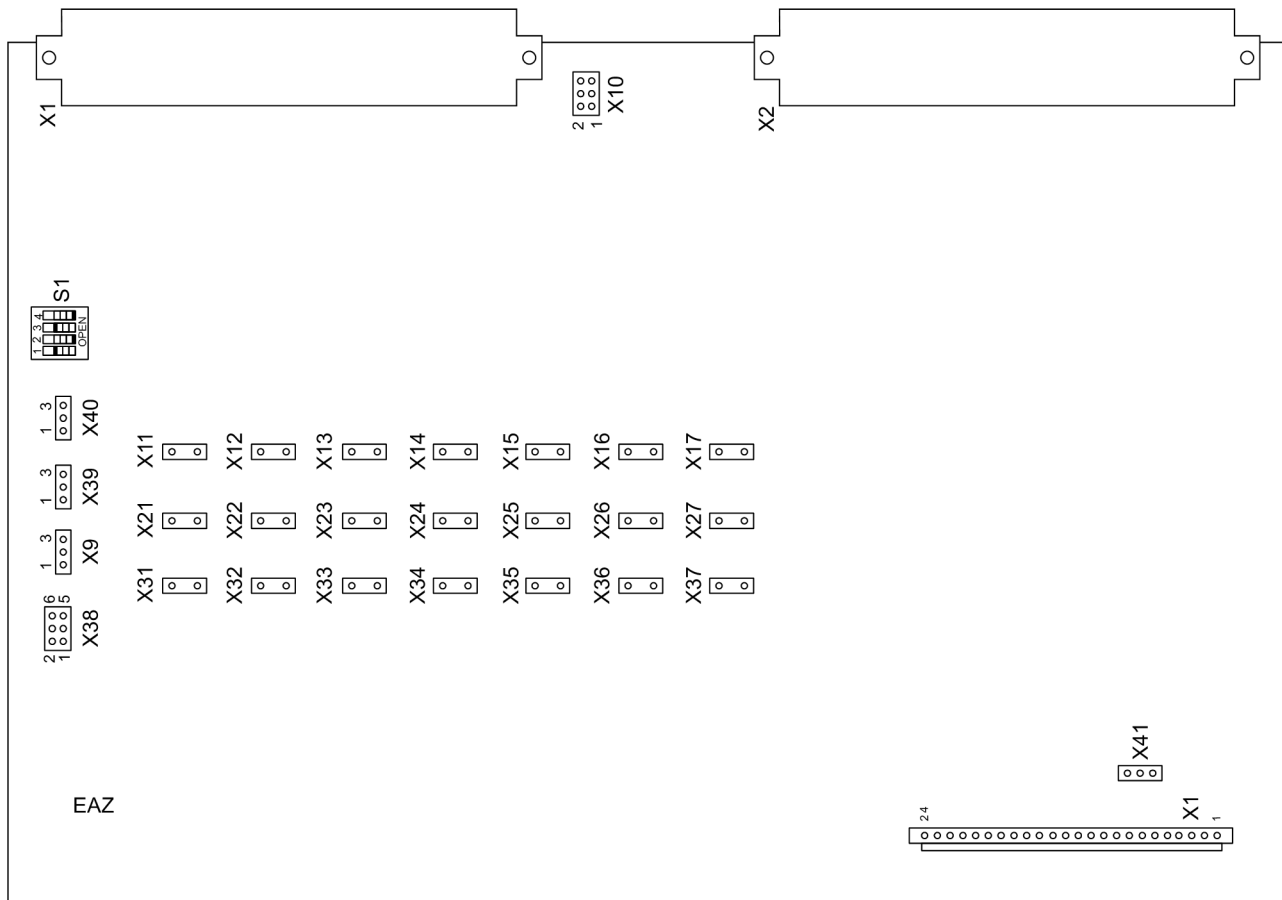


Figure A-8 Setting elements of the EAZ module

Table A-12 Jumper settings for the EAZmodule

| Connector  | Jumper  |
|------------|---|
| X9         | Not installed   |
| X10        | 1-2   |
| X11 to X17 | Jumpers for the setting of the control voltage (see Table A-13, page 385) |
| X21 to X27 |   |
| X31 to X37 |   |
| X38        | 5-6   |
| X39        | 1-2   |
| X40        | 2-3   |
| X41        | 1-2   |



Table A-13 Jumper settings for different control voltages of the binary inputs of the EAZ module

| Name   | Setting for nominal control voltage |      |       |                     |
|--|-------------------------------------|------|-------|---------------------|
|  | 24 V                                | 60 V | 110 V | 220 V <sup>1)</sup> |
| BI1 to BI5 (on module D-CPU, Table A-16, page 387) |                                     |      |       |                     |
| BI6  | X31                                 | X21  | X11   | -                   |
| BI7  | X32                                 | X22  | X12   | -                   |
| BI8  | X33                                 | X23  | X13   | -                   |
| BI9  | X34                                 | X24  | X14   | -                   |
| BI10   | X35                                 | X25  | X15   | -                   |
| BI11   | X36                                 | X26  | X16   | -                   |
| BI12   | X37                                 | X27  | X17   | -                   |

1) Delivery setting

Table A-14 Coding switch setting for the EAZ module

| Switch S1 | Position |
|-----------|----------|
| S1.1      | off      |
| S1.2      | on       |
| S1.3      | off      |
| S1.4      | off      |

### A.4.3 View of the D-CPU Module

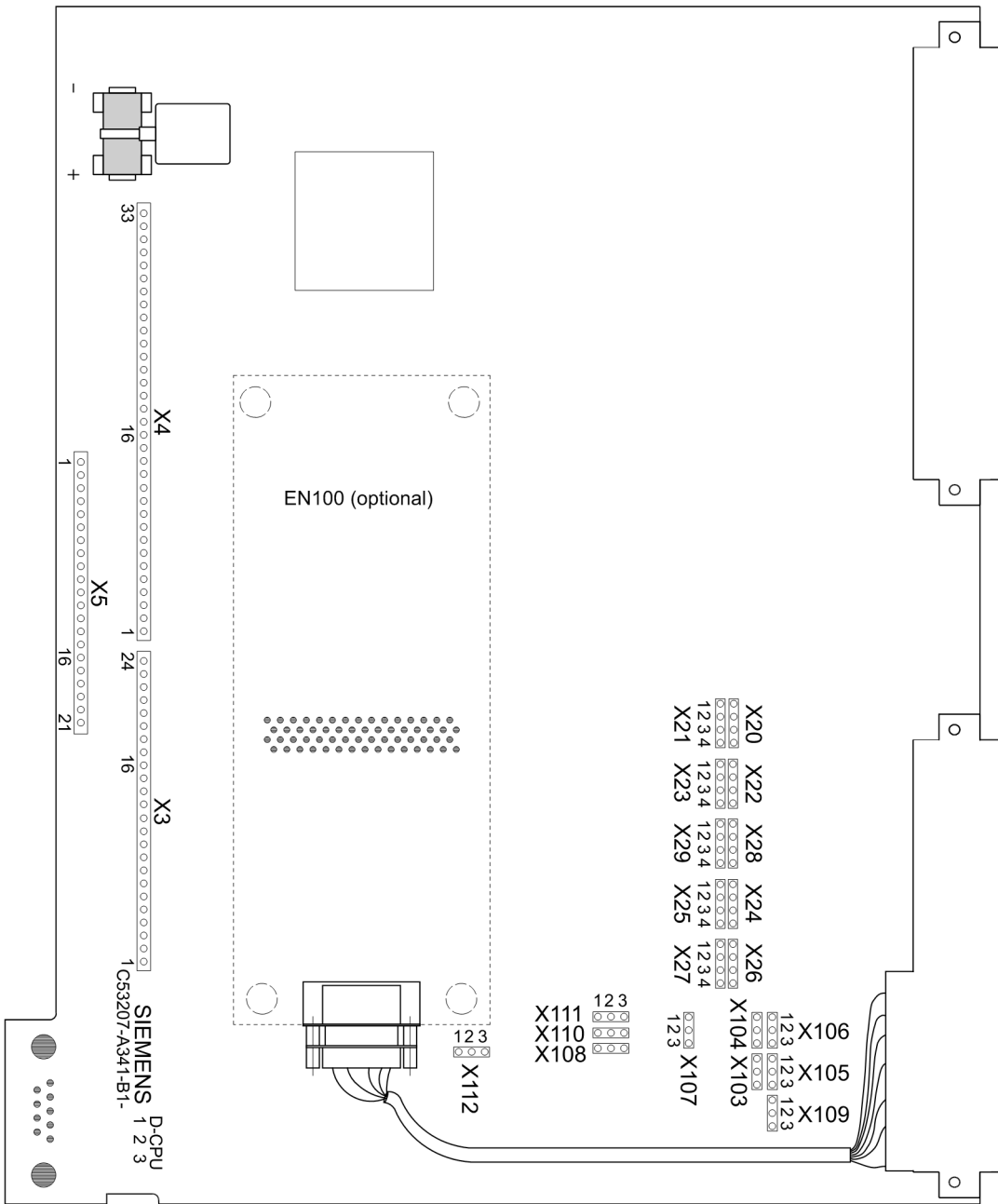


Figure A-9 Setting elements of the D-CPU module

The service port can be configured as RS232, RS485 or as optical interface. Insert the jumpers according to Table A-15, page 387.

The Ethernet interface module EN100 has no plug-in jumpers.

**NOTE**

The jumpers settings on the connectors X103 and X104 must always be the same, i.e. either both on 1-2 or both on 2-3.

Table A-15 Jumper settings (service port) for the D-CPU-module

| Connector | Jumper |       |         |
|-----------|--------|-------|---------|
|           | RS232  | RS485 | optical |
| X103      | 1-2    | 1)    | any     |
| X104      | 1-2    | 1)    | any     |
| X105      | 1-2    | 2-3   | any     |
| X106      | 1-2    | 2-3   | any     |
| X107      | 1-2    | 2-3   | any     |
| X108      | 1-2    | 2-3   | 1-2     |
| X109      | 1-2    | 2-3   | any     |
| X110      | 1-2    | 2-3   | any     |
| X111      | 2-3    | 2-3   | 2-3     |
| X112      | 2-3    | 2-3   | 1-2     |

- 1) 2-3, switches the terminating resistors on if the device is connected to the beginning or the end of a RS485 bus line.  
1-2, switches the terminating resistors off

Table A-16 Jumper settings (binary inputs) for the D-CPU module

| Connector | Binary-inputs                                     | Jumper |      |       |                     |
|-----------|---|--------|------|-------|---------------------|
|           |   | 24 V   | 60 V | 110 V | 220 V <sup>1)</sup> |
| X20, X21  | BI1   | 1-1    | 2-2  | 3-3   | 4-4                 |
| X22, X23  | BI2   | 1-1    | 2-2  | 3-3   | 4-4                 |
| X24, X25  | BI3   | 1-1    | 2-2  | 3-3   | 4-4                 |
| X26, X27  | BI4   | 1-1    | 2-2  | 3-3   | 4-4                 |
| X28, X29  | BI5   | 1-1    | 2-2  | 3-3   | 4-4                 |
|           | BI6 to BI12 (on module EAZ, Table A-13, page 385) |        |      |       |                     |

- 1) Delivery setting

## A.5 Module View Bay Unit

### A.5.1 View of the PFE Module (7SS523, 7SS525)

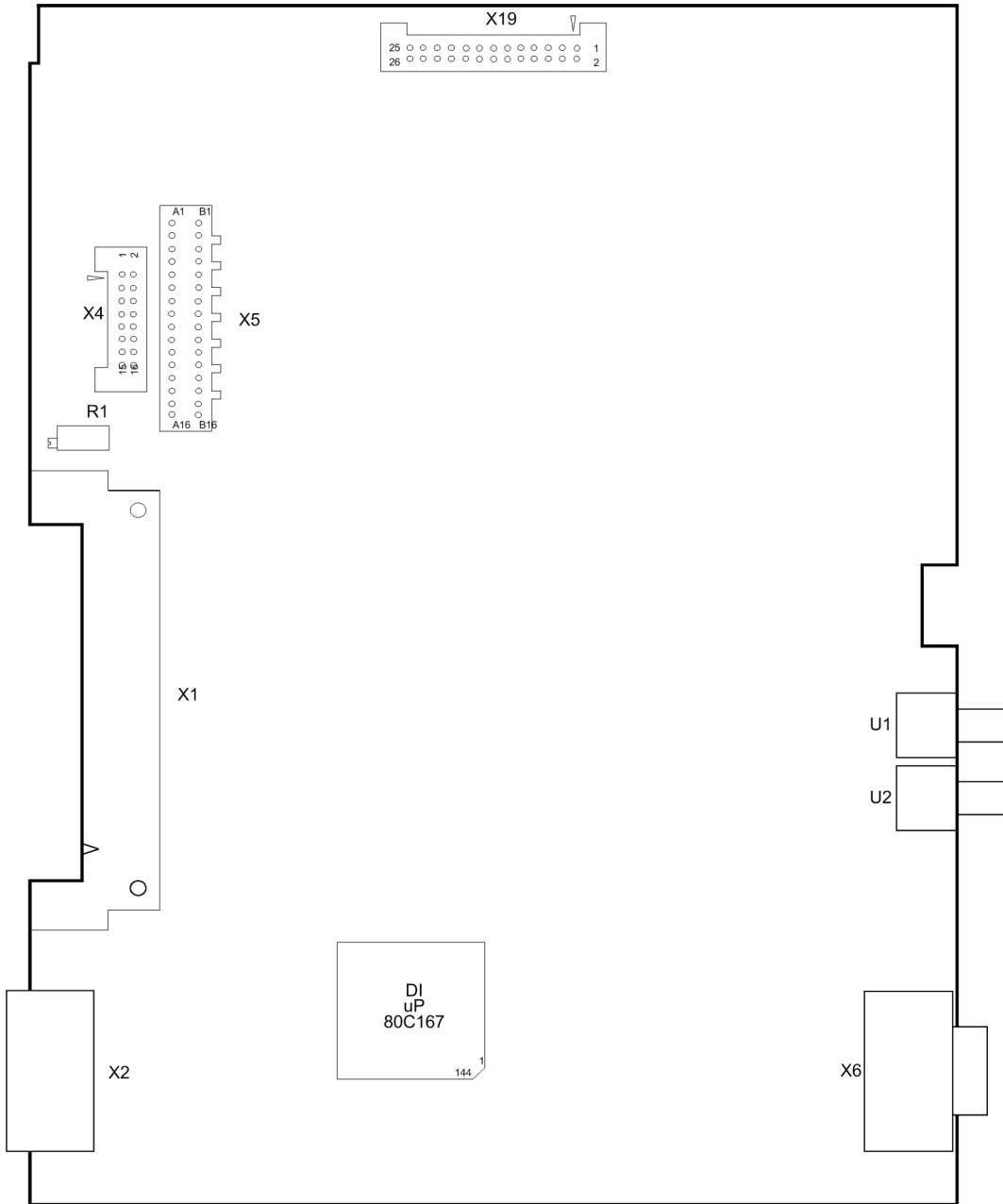


Figure A-10 View of the PFE module

### A.5.2 View of the SVW Module (7SS525)

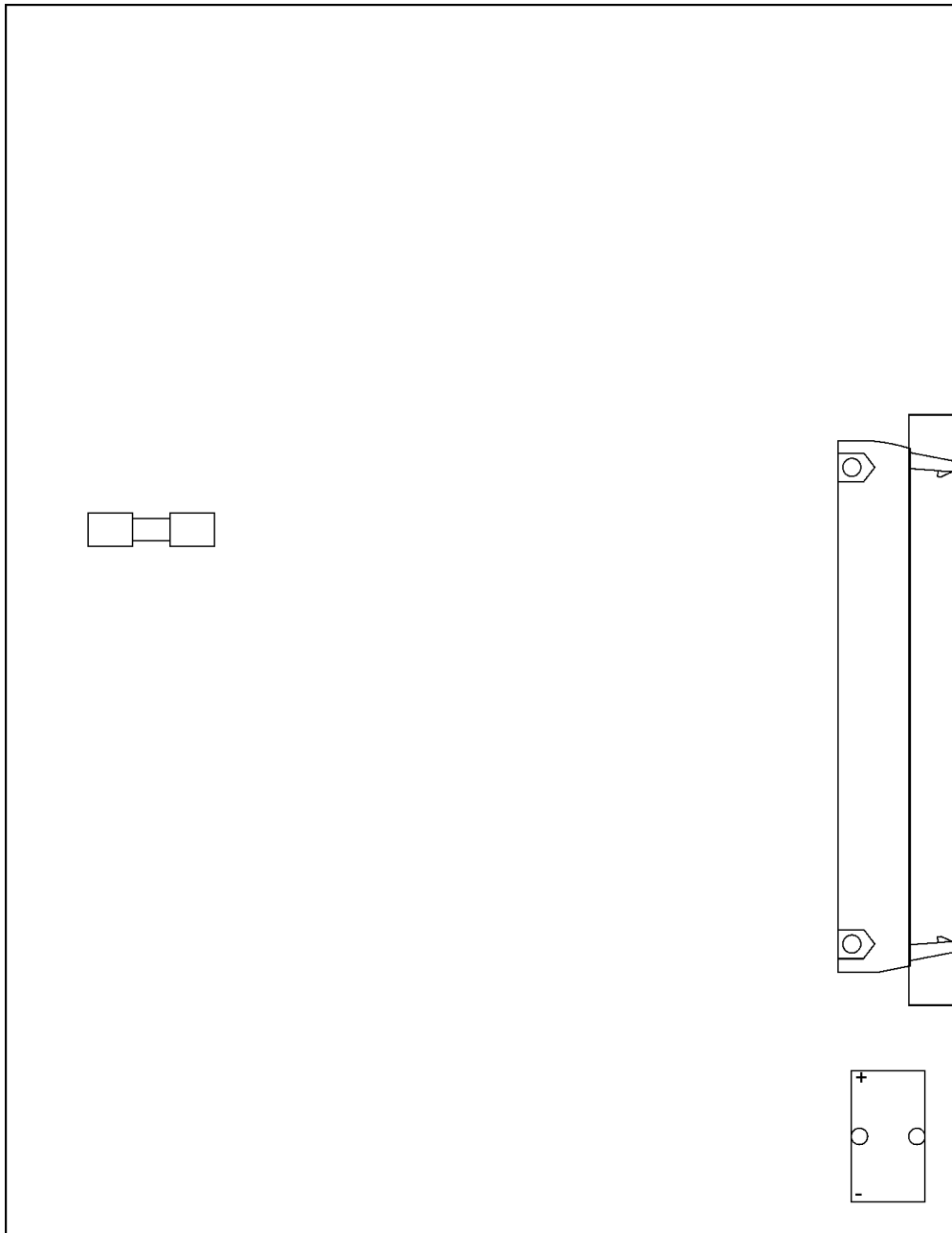


Figure A-11 View of the SVW module

### A.5.3 View of the SAF Module (7SS523)

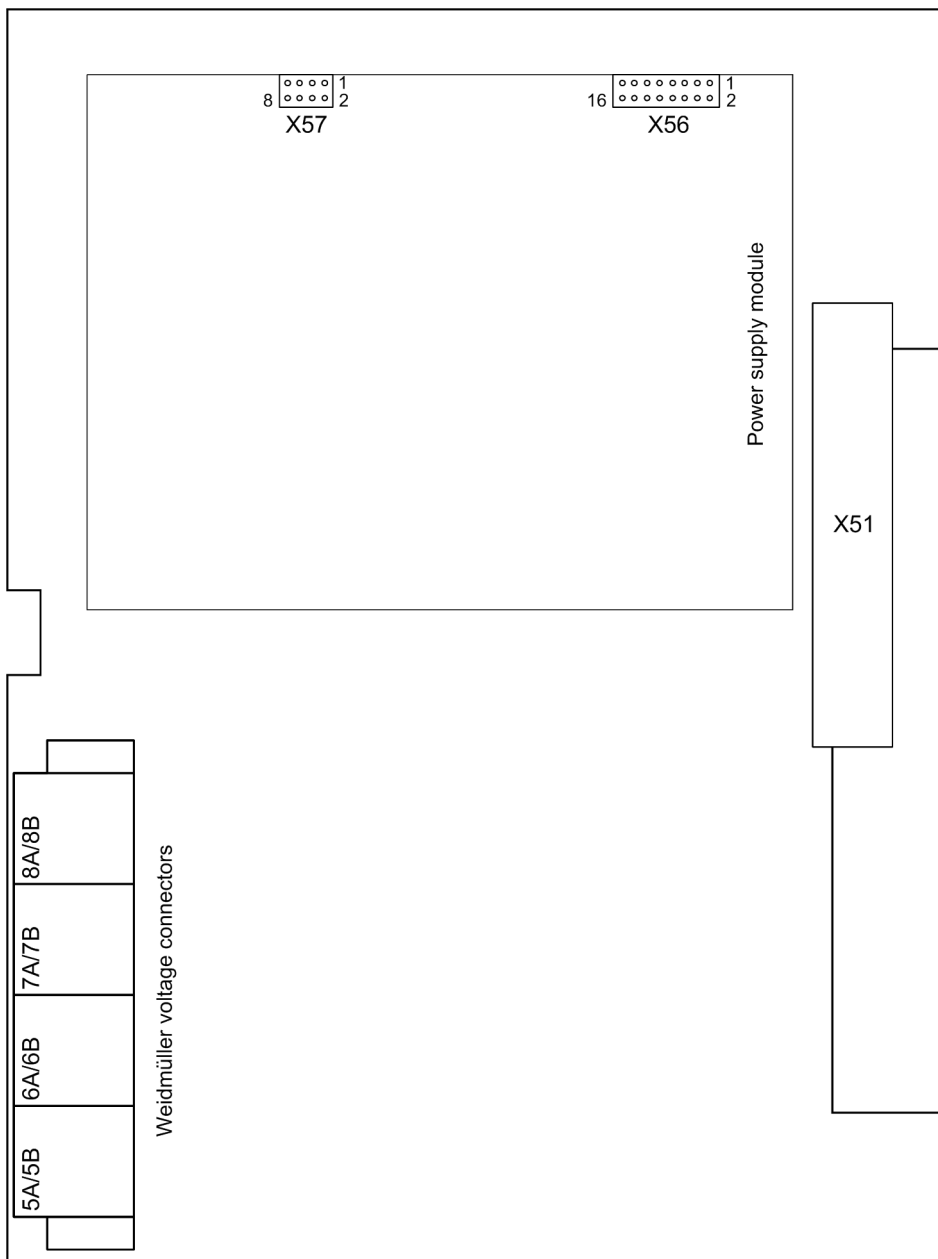


Figure A-12 View of the SAF module

### A.5.4 View of the AFE Module (7SS525)

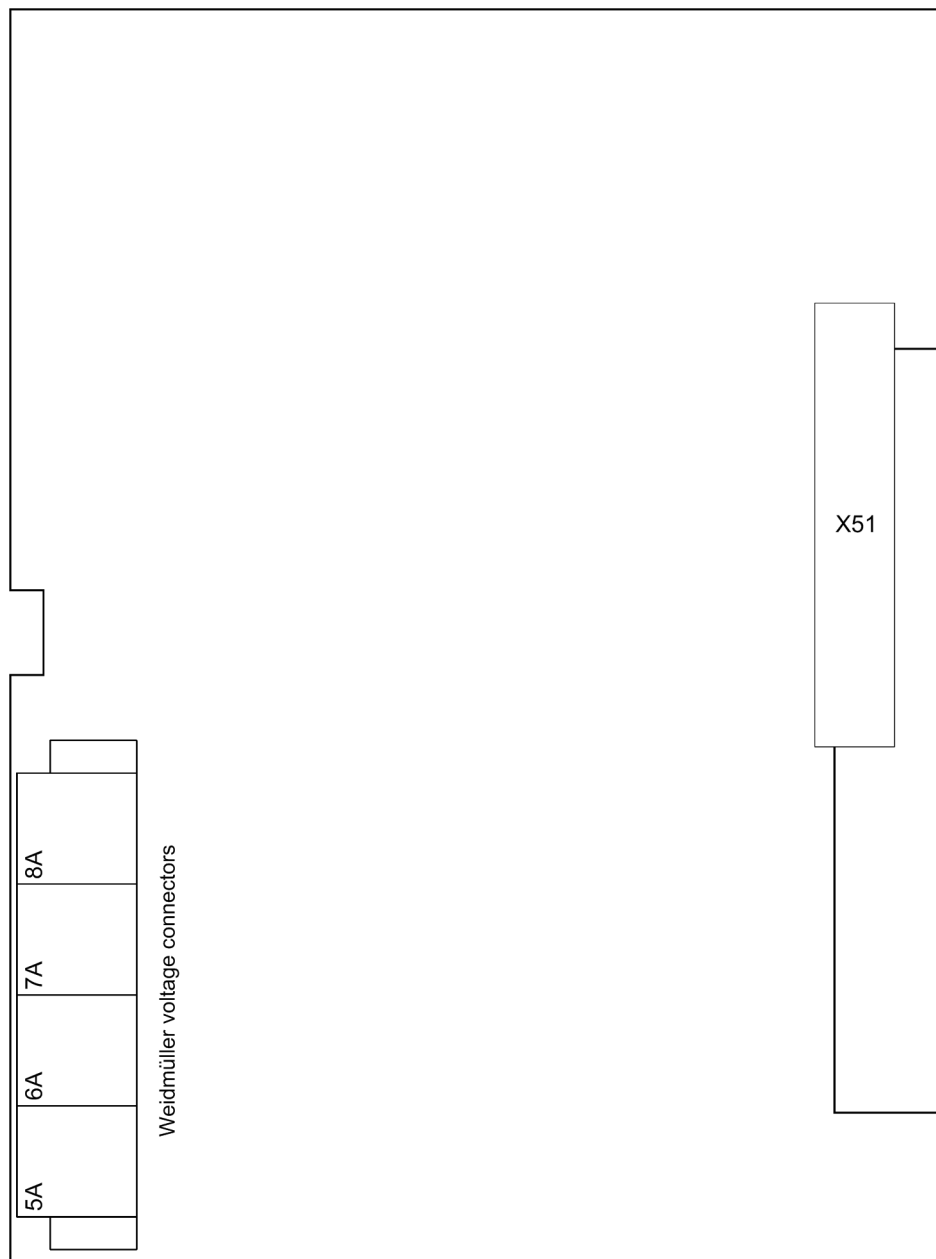


Figure A-13 View of the AFE module

### A.5.5 View of the EFE Module (7SS523)

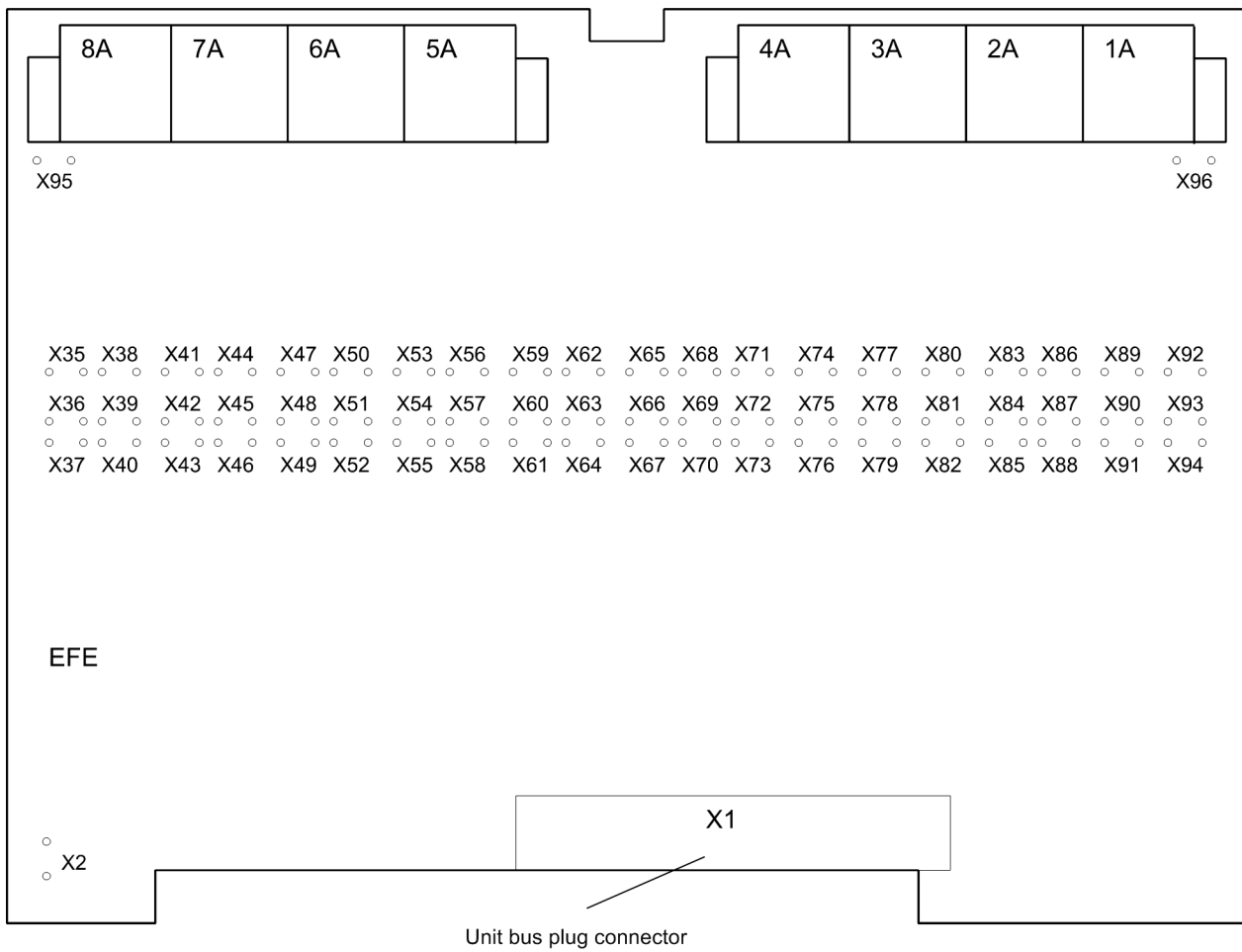


Figure A-14 Setting elements of the EFE module

Table A-17 Jumper settings for the EFE module

| Connector         | Jumper  |
|-------------------|---|
| X35 to X94        | Jumpers for the voltage setting, see Table A-18, page 393 |
| X2 (wire jumper)  | Not installed   |
| X95 (wire jumper) | Not installed   |
| X96 (wire jumper) | Not installed   |



Table A-18 Jumper settings for different control voltages of the binary inputs of the EFE module

| Name  | Setting for nominal control voltage |      |       |                     |
|-------|-------------------------------------|------|-------|---------------------|
|       | 24 V                                | 60 V | 110 V | 220 V <sup>1)</sup> |
| BI 1  | X37                                 | X36  | X35   | -                   |
| BI 2  | X40                                 | X39  | X38   | -                   |
| BI 3  | X43                                 | X42  | X41   | -                   |
| BI 4  | X46                                 | X45  | X44   | -                   |
| BI 5  | X49                                 | X48  | X47   | -                   |
| BI 6  | X52                                 | X51  | X50   | -                   |
| BI 7  | X55                                 | X54  | X53   | -                   |
| BI 8  | X58                                 | X57  | X56   | -                   |
| BI 9  | X61                                 | X60  | X59   | -                   |
| BI 10 | X64                                 | X63  | X62   | -                   |
| BI 11 | X67                                 | X66  | X65   | -                   |
| BI 12 | X70                                 | X69  | X68   | -                   |
| BI 13 | X73                                 | X72  | X71   | -                   |
| BI 14 | X76                                 | X75  | X74   | -                   |
| BI 15 | X79                                 | X78  | X77   | -                   |
| BI 16 | X82                                 | X81  | X80   | -                   |
| BI 17 | X85                                 | X84  | X83   | -                   |
| BI 18 | X88                                 | X87  | X86   | -                   |
| BI 19 | X91                                 | X90  | X89   | -                   |
| BI 20 | X94                                 | X93  | X92   | -                   |

1) Delivery setting

### A.5.6 View of the EFE\_10 Module (7SS525)

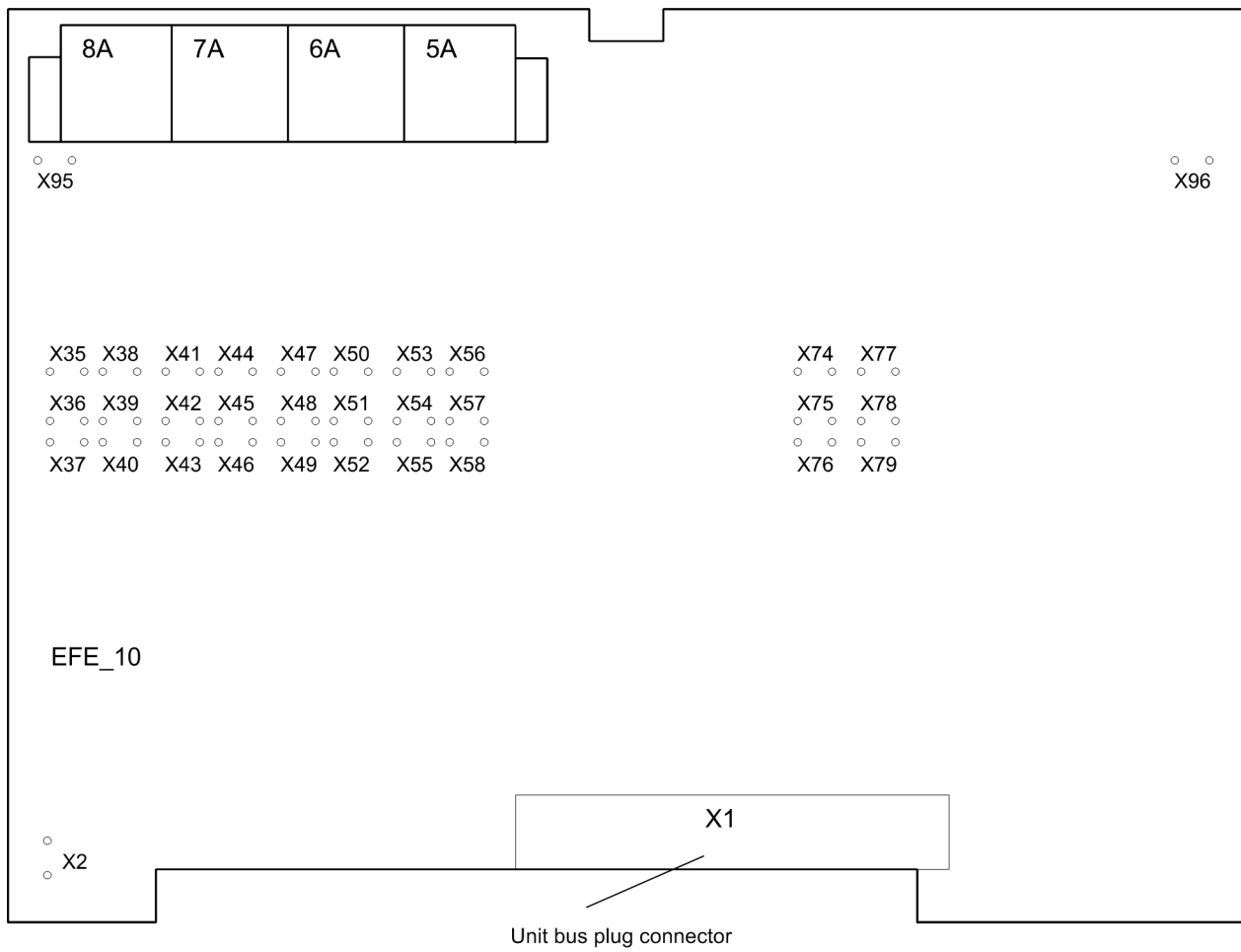


Figure A-15 Setting elements of the EFE\_10 module

Table A-19 Jumper settings for the EFE\_10 module

| Connector                 | Jumper  |
|---------------------------|---|
| X35 to X58 and X74 to X79 | Jumpers for the voltage setting, see Table A-20, page 395 |
| X2 (wire jumper)          | Not installed   |
| X95 (wire jumper)         | Not installed   |
| X96 (wire jumper)         | Not installed   |

Table A-20 Jumper settings for different control voltages of the binary inputs of the EFE\_10 module

| Name  | Setting for nominal control voltage |      |       |                     |
|-------|-------------------------------------|------|-------|---------------------|
|       | 24 V                                | 60 V | 110 V | 220 V <sup>1)</sup> |
| BI 1  | X37                                 | X36  | X35   | -                   |
| BI 2  | X40                                 | X39  | X38   | -                   |
| BI 3  | X43                                 | X42  | X41   | -                   |
| BI 4  | X46                                 | X45  | X44   | -                   |
| BI 5  | X49                                 | X48  | X47   | -                   |
| BI 6  | X52                                 | X51  | X50   | -                   |
| BI 7  | X55                                 | X54  | X53   | -                   |
| BI 8  | X58                                 | X57  | X56   | -                   |
| BI 9  | X76                                 | X75  | X74   | -                   |
| BI 10 | X79                                 | X78  | X77   | -                   |

1) Delivery setting

## A.6 Protocol-Dependent Functions

Table A-21 Protocol dependent functions

| Function  | IEC 60870-5-103 Protocol | IEC 61850 (EN100) Protocol |
|---|--------------------------|----------------------------|
| Operational measured values   | Yes                      | Yes                        |
| Fault recording   | Yes                      | Yes                        |
| Protection setting by remote control  | No                       | No                         |
| User-defined indications and switching objects  | Yes                      | Yes                        |
| Time synchronization  | Yes                      | Yes                        |
| Annunciation with time stamp  | Yes                      | Yes                        |
| Commissioning Aids <ul style="list-style-type: none"> <li>• Alarm and Measured Value Transmission Blocking</li> <li>• Creating test annunciations</li> <li>• Acknowledging LED</li> </ul> | Yes<br>Yes<br>Yes        | Yes<br>Yes<br>Yes          |
| Physical mode   | Asynchronous             | Synchronous                |
| Transmission mode   | Cyclic/Event             | Cyclic/Event               |
| Baud rate   | 4800 to 38400            | up to 100 MBaud            |
| Type  | FO                       | Ethernet TP                |

## A.7 Parameter Listing - Central Unit

In the running text of the manual, "XX" is usually used as variable for the first digit (number of the bay unit) of the parameters 106A to 156A (XX12 instead of 112).

| Addr. | Setting Title  | Function        | Setting Options  | Default Setting | Comments                                 |
|-------|----------------|-----------------|--|-----------------|--|
| 106A  | Combi-Coupler  | BU@             | YES<br>NO  | NO              | Combi-Coupler                            |
| 112   | Bay status     | BU@             | out of service<br>in service<br>maintenance  | in service      | Bay status                               |
| 113   | I>TRIP         | BU@             | 0.00 .. 25.00 I/In   | 0.00 I/In       | Current threshold for TRIP release       |
| 114   | BF BI MODE     | BU@             | 1-ch w/o sup<br>1-ch w sup<br>2-ch w/o sup<br>2-ch w sup                                 | 1-ch w sup      | Binary input mode / supervision BF       |
| 115   | BF OP MODE     | BU@             | non existent<br>external<br>BZ unbalance<br>trip rep/unbal<br>I>query<br>trip rep/I>quer | BZ unbalance    | Operation mode BF                        |
| 116   | BF I<          | BU@             | ON<br>OFF  | OFF             | Low-current mode BF                      |
| 117   | TRIP REP. MODE | BU@             | 1pole<br>3pole   | 1pole           | TRIP repeat mode                         |
| 118   | I> BF          | BU@             | 0.10 .. 2.00 I/In  | 0.50 I/In       | Current threshold for BF                 |
| 119A  | I> BF s. char. | BU@             | 0.05 .. 2.00 I/In  | 0.25 I/In       | Current threshold for BF - sens. char.   |
| 120   | T-BF-1P        | BU@             | 0.05 .. 10.00 sec  | 0.25 sec        | Time delay for BF with 1-pole faults     |
| 121   | T-BF-mP        | BU@             | 0.05 .. 10.00 sec  | 0.25 sec        | Time delay for BF with multi-pole faults |
| 122   | T-BF I<        | BU@             | 0.05 .. 10.00 sec  | 0.25 sec        | Time delay for BF low current mode       |
| 123A  | T-BF IMP       | BU@             | 0.05 .. 10.00 sec  | 0.50 sec        | Time delay for BF pulse mode             |
| 124   | T-BF CB fault  | BU@             | 0.00 .. 10.00 sec  | 0.10 sec        | Time delay BF after CB fault             |
| 125   | T-TRIP repeat  | BU@             | 0.00 .. 10.00 sec  | 0.12 sec        | Time delay for TRIP repeat               |
| 126   | T-CB open      | BU@             | 0.00 .. 10.00 sec  | 0.00 sec        | Time delay for CB open                   |
| 127   | T-BF rel sup   | BU@             | 0.02 .. 15.00 sec  | 15.00 sec       | Supervision bin. input BF-release        |
| 128   | T-BF 2chan     | BU@             | 0.06 .. 1.00 sec   | 0.06 sec        | Supervision time BF start / release      |
| 129   | End Fault Prot | BU@             | ON<br>OFF  | OFF             | End fault protection                     |
| 151A  | Maint. Dco1    | BU@             | YES<br>NO  | YES             | Maintenance for disconnecter 1           |
| 152A  | Maint. Dco2    | BU@             | YES<br>NO  | YES             | Maintenance for disconnecter 2           |
| 153A  | Maint. Dco3    | BU@             | YES<br>NO  | YES             | Maintenance for disconnecter 3           |
| 154A  | Maint. Dco4    | BU@             | YES<br>NO  | YES             | Maintenance for disconnecter 4           |
| 155A  | Maint. Dco5    | BU@             | YES<br>NO  | YES             | Maintenance for disconnecter 5           |
| 156A  | Maint. CB      | BU@             | YES<br>NO  | YES             | Maintenance for CB                       |
| 5104  | FREQUENCY      | P.System Data 1 | 50 Hz<br>60 Hz   | 50 Hz           | Nominal frequency                        |
| 5108A | Test mode SK   | Protec. general | OFF<br>ON  | OFF             | Test mode for module SK                  |
| 5111  | Language BU    | Protec. general | German<br>English<br>French<br>Spanish<br>Italian<br>Russian                             | English         | Language of bay units                    |
| 5112A | OutEn BU-TEST  | Protec. general | NO<br>YES  | NO              | Bay unit output enable during test mode  |

| Addr. | Setting Title   | Function        | Setting Options  | Default Setting | Comments                                       |
|-------|-----------------|-----------------|--|-----------------|--|
| 5299A | TO IV-Bit T103  | Device          | 0 .. 1500 min  | 1380 min        | Timeout IV-Bit T103                            |
| 5401  | PROT TR BUS     | Protec. general | YES<br>NO  | YES             | Selective protection for transfer busbar       |
| 6101  | STAB FAC:BZ     | BB Protection   | 0.10 .. 0.80   | 0.65            | Stabilising factor - BZ                        |
| 6102  | Id> BZ          | BB Protection   | 0.20 .. 4.00 I/Ino   | 1.00 I/Ino      | Diff-current threshold - BZ                    |
| 6103  | STAB FAC:CZ     | BB Protection   | 0.00 .. 0.80   | 0.50            | Stabilising factor - CZ                        |
| 6104  | Id> CZ          | BB Protection   | 0.20 .. 4.00 I/Ino   | 1.00 I/Ino      | Diff-current threshold - CZ                    |
| 6105A | CrossStabFac BZ | BB Protection   | 0.00 .. 1.00   | 0.40            | Cross stabilisation factor - BZ                |
| 6106  | Tmin TRIP       | Protec. general | 0.01 .. 32.00 sec  | 0.15 sec        | Minimum duration of TRIP command               |
| 6107A | CrossStabFac CZ | BB Protection   | 0.00 .. 1.00   | 0.40            | Cross stabilisation factor - CZ                |
| 6108A | Is< BZ s. char. | BB Protection   | 0.00 .. 25.00 I/Ino  | 5.00 I/Ino      | Stabilising current threshold - BZ sens. char. |
| 6109A | Id> BZ s. char. | BB Protection   | 0.05 .. 4.00 I/Ino   | 0.25 I/Ino      | Diff-current threshold - BZ sens. char.        |
| 6110A | Is< CZ s. char. | BB Protection   | 0.00 .. 25.00 I/Ino  | 4.50 I/Ino      | Stabilising current threshold - CZ sens. char. |
| 6111A | Id> CZ s. char. | BB Protection   | 0.05 .. 4.00 I/Ino   | 0.25 I/Ino      | Diff-current threshold - CZ sens. char.        |
| 6120A | Add. crit.      | Protec. general | existent<br>nonexistent                                    | nonexistent     | Additional criterion for tripping              |
| 6201  | STAB FAC:BF     | BF-Protection   | 0.00 .. 0.80   | 0.50            | Stabilising factor BF protection               |
| 6202A | Is< BF s. char. | BF-Protection   | 0.00 .. 25.00 I/In   | 5.00 I/Ino      | Stabilising current threshold - BF sens. char. |
| 6301  | DCO TIME        | Monitoring      | 1.00 .. 180.00 sec   | 7.00 sec        | Limit value disconnector time                  |
| 6302  | DCO Malfunct    | Monitoring      | alarm only<br>blocking<br>block./release<br>block./acknow. | alarm only      | Reaction on disconnector malfunction           |
| 6303  | DCO DC FAIL     | Monitoring      | OLD<br>ON  | OLD             | Treatment disconnector status on DC fail       |
| 6304  | DCO ST 1/1      | Monitoring      | OLD<br>ON  | OLD             | Treatment disconn. status not plausible        |
| 6306  | DIFF SUPERV     | Monitoring      | ON<br>OFF  | ON              | Differential current supervision               |
| 6307  | T-Idiff SUPERV  | Monitoring      | 1.00 .. 10.00 sec  | 2.00 sec        | Time delay for diff-current supervision        |
| 6308  | Id> SUPERV BZ   | Monitoring      | 0.05 .. 0.80 I/Ino   | 0.10 I/Ino      | Limit value diff-current supervision -BZ       |
| 6309  | Id> SUPERV CZ   | Monitoring      | 0.05 .. 0.80 I/Ino   | 0.10 I/Ino      | Limit value diff-current supervision -CZ       |
| 6310  | DIF SUP mode BZ | Monitoring      | alarm only<br>blocking<br>block./release                   | blocking        | Diff-current supervision mode -BZ              |
| 6311  | DIF SUP mode CZ | Monitoring      | alarm only<br>blocking<br>block./release                   | alarm only      | Diff-current supervision mode -CZ              |
| 6312A | ZERO CR SUPERV  | Monitoring      | ON<br>OFF  | ON              | Zero crossing supervision                      |
| 6313A | I> ZERO CR      | Monitoring      | 0.15 .. 4.00 I/Ino   | 0.50 I/Ino      | Threshold for zero crossing supervision        |
| 6315  | CB SUP TIME     | Monitoring      | 1.00 .. 180.00 sec   | 7.00 sec        | CB supervision time                            |
| 6316  | I> MAN TRIP     | Monitoring      | 0.00 .. 2.50 I/In; ∞                                       | 0.05 I/In       | Limit value for circuit breaker test           |
| 6317  | T-TRIP-Rel sup  | Monitoring      | 0.06 .. 1.00 sec   | 0.06 sec        | Supervision bin. input TRIP-Release            |
| 6318  | CTRL REL BU     | Protec. general | released<br>blocked  | released        | Control release for bay units                  |
| 6319A | Superv. A.crit. | Monitoring      | OFF<br>alarm only<br>blocking                              | OFF             | Supervision BI add. criterion                  |
| 6320A | Sens. charact.  | Protec. general | released<br>blocked  | blocked         | Sensitive characteristic switchover            |
| 6321A | Superv. S. char | Monitoring      | NO<br>YES  | YES             | Supervision BI sensitive characteristic        |
| 6401A | fault rec mode  | Osc. Fault Rec. | global<br>central<br>decentralized                         | central         | Mode of fault recording                        |
| 6404  | MAX. LENGTH     | Osc. Fault Rec. | 0.30 .. 5.00 sec   | 2.00 sec        | Max. length of a Waveform Capture Record       |
| 6405  | PRE. TRIG. TIME | Osc. Fault Rec. | 0.05 .. 0.50 sec   | 0.20 sec        | Captured Waveform Prior to Trigger             |

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| Addr. | Setting Title   | Function        | Setting Options     | Default Setting | Comments                      |
|-------|-----------------|-----------------|---------------------|-----------------|-------------------------------|
| 6406  | POST REC. TIME  | Osc. Fault Rec. | 0.05 .. 0.50 sec    | 0.20 sec        | Captured Waveform after Event |
| 6407  | BinIn CAPT.TIME | Osc. Fault Rec. | 0.10 .. 5.00 sec; ∞ | 0.40 sec        | Capture Time via Binary Input |

## A.8 Parameter Listing - Bay Unit

| Addr. | Setting Title | Function              | Setting Options                                     | Default Setting       | Comments   |
|-------|---------------|-----------------------|---|-----------------------|--|
| 1101  | CT STARPNT    | Power System Data     | TOWARDS LINE<br>TOWARDS BUSBAR                      | TOWARDS LINE          | Current transformer polarity   |
| 1105  | In PRIMARY    | Power System Data     | 10..20000 A   | 400 A                 | Primary Rated current  |
| 1141  | T TRIP        | Power System Data     | 0.01..32.00 s                                       | 0.15 s                | Minimum trip command duration  |
| 1201  | O/C PHASES    | O/C Protection Phases | ON<br>OFF   | ON                    | O/C protection for phase faults  |
| 1202  | I>>           | O/C Protection Phases | 0.05..25.00 I/I <sub>N</sub>                        | 2.00 I/I <sub>N</sub> | Pick-up value of the high-set stage I>>  |
| 1203  | T-I>>         | O/C Protection Phases | 0.00..60.00 s                                       | 0.10 s                | Trip time delay of the high-set stage  |
| 1206  | MEAS.REPET    | O/C Protection Phases | NO<br>YES   | NO                    | Measurement repetition   |
| 1211  | CHARACTER.    | O/C Protection Phases | NORMAL INVERSE<br>VERY INVERSE<br>EXTREMELY INVERS. | NORMAL INVERSE        | Characteristic of the O/C stage Ip   |
| 1212  | I>            | O/C Protection Phases | 0.05.. 25.00 I/I <sub>N</sub>                       | 1.00 I/I <sub>N</sub> | Pick-up value of the overcurrent stage I>  |
| 1213  | T-I>          | O/C Protection Phases | 0.00..60.00 s<br>infinite                           | 0.50 s                | Trip time delay of the overcurrent stage I>  |
| 1214  | Ip            | O/C Protection Phases | 0.10..4.00 I/I <sub>N</sub>                         | 1.00 I/I <sub>N</sub> | Pick-up value inverse time O/C stage Ip  |
| 1215  | T-Ip          | O/C Protection Phases | 0.05..10.00 s<br>0<br>infinite                      | 0.50 s                | Trip time delay inverse time O/C stage Ip  |
| 1216  | RMS FORMAT    | O/C Protection Phases | FUNDAMENTAL<br>TRUE RMS                             | FUNDAMENTAL           | RMS format for inverse time O/C protection   |
| 1221  | MAN.CLOSE     | O/C Protection Phases | I>> UNDELAYED<br>I>/Ip UNDELAYED<br>INEFFECTIVE     | I>> UNDELAYED         | Overcurrent stage valid for phase currents when the circuit breaker is manually closed |
| 1501  | O/C EARTH     | O/C Protection Earth  | ON<br>OFF   | ON                    | O/C protection for earth faults  |
| 1502  | IE>>          | O/C Protection Earth  | 0.05..25.00 I/I <sub>N</sub>                        | 0.50 I/I <sub>N</sub> | Pick-up value of the high-set stage IE>>   |
| 1503  | T-IE>>        | O/C Protection Earth  | 0.00..60.00 s                                       | 0.50 s                | Trip time delay of the high-set stage IE>>   |
| 1506  | MEAS.REPET    | O/C Protection Earth  | YES<br>NO   | NO                    | Measurement repetition   |
| 1511  | CHARACTER.    | O/C Protection Earth  | NORMAL INVERSE<br>VERY INVERSE<br>EXTREMELY INVERS  | NORMAL INVERS         | Characteristic of the O/C stage IEp  |
| 1512  | IE>           | O/C Protection Earth  | 0.05..25.00 I/I <sub>N</sub>                        | 0.20 I/I <sub>N</sub> | Pick-up value of the overcurrent stage IE>   |
| 1513  | T-IE>         | O/C Protection Earth  | 0.00..60.00 s<br>infinite                           | 0.50 s                | Trip time delay of the overcurrent stage IE>   |
| 1514  | IEp           | O/C Protection Earth  | 0.10..4.00 I/I <sub>N</sub>                         | 0.10 I/I <sub>N</sub> | Pick-up value inverse time O/C stage IEp   |
| 1515  | T-IEp         | O/C Protection Earth  | 0.05..10.00 s<br>0<br>infinite                      | 0.50 s                | Trip time delay inverse time O/C stage IEp   |



| Addr. | Setting Title | Function                        | Setting Options                                   | Default Setting       | Comments   |
|-------|---------------|---------------------------------|---|-----------------------|--|
| 1516  | RMS FORMAT    | O/C Protection Earth            | FUNDAMENTAL<br>TRUE RMS                           | FUNDAMENTAL           | RMS format for inverse time O/C protection   |
| 1521  | MAN.CLOSE     | O/C Protection Earth            | IE>> UNDELAYED<br>IE>/IEp UNDELAY.<br>INEFFECTIVE | IE>> UNDELAYED        | Overcurrent stage valid for phase currents when the circuit breaker is manually closed |
| 2801  | T-Annunc.1    | User Logic Functions            | 0.00..10.00 s                                     | 0.00 s                | Delay time for 1st user defined annunciation   |
| 2802  | T-Annunc.2    | User Logic Functions            | 0.00..10.00 s                                     | 0.00 s                | Delay time for 2nd user defined annunciation   |
| 2803  | T-Annunc.3    | User Logic Functions            | 0.00..10.00 s                                     | 0.00 s                | Delay time for 3rd user defined annunciation   |
| 2804  | T-Annunc.4    | User Logic Functions            | 0.00..10.00 s                                     | 0.00 s                | Delay time for 4th user defined annunciation   |
| 2811  | ANNUN1byCU    | User Logic Functions            | NO<br>YES   | 0.00 s                | Processing of annunciation 1 by central unit   |
| 2812  | ANNUN2byCU    | User Logic Functions            | NO<br>YES   | 0.00 s                | Processing of annunciation 2 by central unit   |
| 2813  | ANNUN3byCU    | User Logic Functions            | NO<br>YES   | 0.00 s                | Processing of annunciation 3 by central unit   |
| 2814  | ANNUN4byCU    | User Logic Functions            | NO<br>YES   | 0.00 s                | Processing of annunciation 4 by central unit   |
| 2821  | ANN1Fct.No    | User Logic Functions            | 0..9999   | 0                     | Binary input annunciation (Fct.no) by annunc.1   |
| 2822  | ANN2Fct.No    | User Logic Functions            | 0..9999   | 0                     | Binary input annunciation (Fct.no) by annunc.2   |
| 2823  | ANN3Fct.No    | User Logic Functions            | 0..9999   | 0                     | Binary input annunciation (Fct.no) by annunc.3   |
| 2824  | ANN4Fct.No    | User Logic Functions            | 0..9999   | 0                     | Binary input annunciation (Fct.no) by annunc.4   |
| 2831  | ANN1Inp.No    | User Logic Functions            | 0..9999   | 0                     | Input-annunciation (Fct.no) for userdef. logic1  |
| 2832  | ANN2Inp.No    | User Logic Functions            | 0..9999   | 0                     | Input-annunciation (Fct.no) for userdef. logic2  |
| 2833  | ANN3Inp.No    | User Logic Functions            | 0..9999   | 0                     | Input-annunciation (Fct.no) for userdef. logic3  |
| 2834  | ANN4Inp.No    | User Logic Functions            | 0..9999   | 0                     | Input-annunciation (Fct.no) for userdef. logic4  |
| 3901  | BackUp CBF    | Back-Up Breaker Fail.Protection | OFF<br>ON   | OFF                   | State of back-up circuit breaker failure prot.   |
| 3911  | B.U.CBF-I     | Back-Up Breaker Fail.Protection | 0.10..4.00 I/I <sub>N</sub>                       | 0.50 I/I <sub>N</sub> | Current threshold of back-up breaker fail.prot   |
| 3912  | B.U.CBF-T     | Back-Up Break.Fail.Prot.        | 0.06..60.00 s; +*                                 | 0.12 s                | Time delay of back-up breaker failure prot.  |
| 4101  | CU-INTERF.    | Tests                           |   |                       | Interface to central unit  |
| 4201  | BLOCKAGE      | Tests                           |   |                       | Switch on the blockage of busbar trip  |
| 4202  | BLOCKAGE      | Tests                           |   |                       | Switch off the blockage of busbar trip   |
| 4301  | BLOCKAGE      | Tests                           |   |                       | Switch on the blockage of BF-prot.ec.ext.start   |
| 4302  | BLOCKAGE      | Tests                           |   |                       | Switch off the blockage of BF-prot.ec.ext.start  |
| 4401  | CB TRIP       | Tests                           |   |                       | Circuit breaker trip test 1pole L1   |

| Addr. | Setting Title    | Function                    | Setting Options | Default Setting | Comments                                    |
|-------|------------------|-----------------------------|-----------------|-----------------|---|
| 4402  | CB TRIP          | Tests                       |                 |                 | Circuit breaker trip test 1pole L2          |
| 4403  | CB TRIP          | Tests                       |                 |                 | Circuit breaker trip test 1pole L3          |
| 4404  | CB TRIP          | Tests                       |                 |                 | Circuit breaker trip test 3pole             |
| 4501  | Com. CU          | Tests                       |                 |                 | Switching bay out of service                |
| 4502  | Com. CU          | Tests                       |                 |                 | Switching bay in service                    |
| 4503  | Com. CU          | Tests                       |                 |                 | Switching bay in maintenance                |
| 4601  | CT-POLARITY      | Tests                       |                 |                 | Turn around polarity of current transformer |
| 4701  | BI1-STATE        | Tests                       |                 |                 | Show state of binary input 1                |
| ...   | ...              | ...                         |                 |                 | ...   |
| 4720  | BI20-STATE       | Tests                       |                 |                 | Show state of binary input 20               |
| 4801  | TRIP RELAY1      | Tests                       |                 |                 | Switch on trip relay 1                      |
| 4802  | TRIP RELAY1      | Tests                       |                 |                 | Switch off trip relay 1                     |
| 4803  | TRIP RELAY2      | Tests                       |                 |                 | Switch on trip relay 2                      |
| 4804  | TRIP RELAY2      | Tests                       |                 |                 | Switch off trip relay 2                     |
| 4805  | TRIP RELAY3      | Tests                       |                 |                 | Switch on trip relay 3                      |
| 4806  | TRIP RELAY3      | Tests                       |                 |                 | Switch off trip relay 3                     |
| 4807  | TRIP RELAY4      | Tests                       |                 |                 | Switch on trip relay 4                      |
| 4808  | TRIP RELAY4      | Tests                       |                 |                 | Switch off trip relay 4                     |
| 4809  | TRIP RELAY5      | Tests                       |                 |                 | Switch on trip relay 5                      |
| 4810  | TRIP RELAY5      | Tests                       |                 |                 | Switch off trip relay 5                     |
| 4811  | SIGN.RELAY1      | Tests                       |                 |                 | Switch on signal relay 1                    |
| 4812  | SIGN.RELAY1      | Tests                       |                 |                 | Switch off signal relay 1                   |
| 4901  | FAULT REC.       | Tests                       |                 |                 | Initiation of fault recording               |
| 5604  | Trip No =        | CB operat. statistics       |                 |                 | Number of trip commands issued              |
| 5607  | $\Sigma$ IL1/In= | CB operat. statistics       |                 |                 | Summated current tripped IL1/In             |
| 5608  | $\Sigma$ IL2/In= | CB operat. statistics       |                 |                 | Summated current tripped IL3/In             |
| 5609  | $\Sigma$ IL3/In= | CB operat. statistics       |                 |                 | Summated current tripped IL2/In             |
| 5610  | IL1/In=          | CB operat. statistics       |                 |                 | Last trip current IL1/In                    |
| 5611  | IL2/In=          | CB operat. statistics       |                 |                 | Last trip current IL2/In                    |
| 5612  | IL3/In=          | CB operat. statistics       |                 |                 | Last trip current IL3/In                    |
| 5701  | IL1 =            | Operational measured values |                 |                 | Current in phase L1 = %In                   |
| 5702  | IL2 =            | Operational measured values |                 |                 | Current in phase L2 = %In                   |
| 5703  | IL3 =            | Operational measured values |                 |                 | Current in phase L3 = %In                   |
| 5704  | IE =             | Operational measured values |                 |                 | Earth current = %In                         |

| Addr. | Setting Title   | Function                    | Setting Options  | Default Setting | Comments  |
|-------|-----------------|-----------------------------|--|-----------------|---|
| 5705  | IL1 =           | Operational measured values |  |                 | Current in phase L1 = A   |
| 5706  | IL2 =           | Operational measured values |  |                 | Current in phase L2 = A   |
| 5707  | IL3 =           | Operational measured values |  |                 | Current in phase L3 = A   |
| 5708  | IE =            | Operational measured values |  |                 | Earth current = A   |
| 5709  | IL1 =           | Operational measured values |  |                 | Current in phase L1 = %Ino  |
| 5710  | IL2 =           | Operational measured values |  |                 | Current in phase L2 = %Ino  |
| 5711  | IL3 =           | Operational measured values |  |                 | Current in phase L3 = %Ino  |
| 5712  | IE =            | Operational measured values |  |                 | Earth current = %Ino  |
| 5713  | IDL1 =          | Operational measured values |  |                 | Bus Zone: Idiff L1 = %Ino   |
| 5714  | IDL2 =          | Operational measured values |  |                 | Bus Zone: Idiff L2 = %Ino   |
| 5715  | IDL3 =          | Operational measured values |  |                 | Bus Zone: Idiff L3 = %Ino   |
| 5716  | ISL1 =          | Operational measured values |  |                 | Bus Zone: Istab L1= %Ino  |
| 5717  | ISL2 =          | Operational measured values |  |                 | Bus Zone: Istab L2= %Ino  |
| 5718  | ISL3 =          | Operational measured values |  |                 | Bus Zone: Istab L3= %Ino  |
| 5719  | f [Hz] =        | Operational measured values |  |                 | Frequency f [Hz] =  |
| 6101  | BINARY INPUT 1  | Marshalling                 |  |                 | Binary input 1  |
| ...   | ...             | ...                         |  |                 | ...   |
| 6120  | BINARY INPUT 20 | Marshalling                 |  |                 | Binary input 20   |
| 6201  | SIGNAL RELAY 1  | Marshalling                 |  |                 | Signal relay 1  |
| 6301  | LED 1           | Marshalling                 |  |                 | LED 1   |
| ...   | ...             | ...                         |  |                 | ...   |
| 6316  | LED 16          | Marshalling                 |  |                 | LED 16  |
| 6401  | TRIP RELAY 1    | Marshalling                 |  |                 | Trip relay 1  |
| ...   | ...             | ...                         |  |                 | ...   |
| 6405  | TRIP RELAY 5    | Marshalling                 |  |                 | Trip relay 5  |
| 7101  | Language        | Integrated Operation        | DEUTSCH<br>ENGLISH<br>FRANCAIS<br>ESPANOL<br>ITALIANO<br>PYCCK.  | ENGLISH         | Language  |
| 7120  | OPER.1st L.     | Integrated Operation        | IL1, IL2, IL3, IE<br>I-DIFF. L1, I-DIFF. L2,<br>I-DIFF. L3<br>I-RESTR. L1, I-RESTR.<br>L2, I-RESTR. L3 | IL1             | Display of measured values in the 1st line of the quiescent-state indication in 4-line mode |
| 7121  | OPER.1st L.     | Integrated Operation        | SECONDARY<br>PRIMARY<br>NORMALIZED   | SECONDARY       | Display of measured values in the 1st line as primary or secondary (percent) values         |

| Addr. | Setting Title | Function             | Setting Options  | Default Setting | Comments  |
|-------|---------------|----------------------|--|-----------------|---|
| 7122  | OPER.2nd L.   | Integrated Operation | IL1, IL2, IL3, IE<br>I-DIFF. L1, I-DIFF. L2,<br>I-DIFF. L3<br>I-RESTR. L1, I-RESTR.<br>L2, I-RESTR. L3 | IL2             | Display of measured values in the 2nd line of the quiescent-state indication in 4-line mode |
| 7123  | OPER.2nd L.   | Integrated Operation | PRIMARY<br>SECONDARY<br>NORMALIZED   | SECONDARY       | Display of measured values in the 2nd line as primary or secondary (percent) values         |
| 7124  | OPER.3rd L.   | Integrated Operation | IL1, IL2, IL3, IE<br>I-DIFF. L1, I-DIFF. L2,<br>I-DIFF. L3<br>I-RESTR. L1, I-RESTR.<br>L2, I-RESTR. L3 | IL3             | Display of measured values in the 3rd line of the quiescent-state indication in 4-line mode |
| 7125  | OPER.3rd L.   | Integrated Operation | PRIMARY<br>SECONDARY<br>NORMALIZED   | SECONDARY       | Display of measured values in the 3rd line as primary or secondary (percent) values         |
| 7126  | OPER.4th L.   | Integrated Operation | IL1, IL2, IL3, IE<br>I-DIFF. L1, I-DIFF. L2,<br>I-DIFF. L3<br>I-RESTR. L1, I-RESTR.<br>L2, I-RESTR. L3 | IE              | Display of measured values in the 4th line of the quiescent-state indication in 4-line mode |
| 7127  | OPER.4th L.   | Integrated Operation | PRIMARY<br>SECONDARY<br>NORMALISED   | SECONDARY       | Display of measured values in the 4th line as primary or secondary (percent) values         |
| 7201  | DEVICE ADD.   | PC/System Interfaces | 1..254   |                 | Device address  |
| 7202  | FEEDER ADD.   | PC/System Interfaces | 1..254   |                 | Feeder address  |
| 7203  | SUBST. ADD.   | PC/System Interfaces | 1..254   |                 | Substation address  |
| 7208  | FUNCT. TYPE   | PC/System Interfaces | 1..254   | 160             | Function type in accordance with VDEW/ZVEI  |
| 7209  | DEVICE TYPE   | PC/System Interfaces | 0..255   | 194             | Device type   |
| 7211  | PC INTERF.    | PC/System Interfaces | DIGSI V3<br>ASCII  | DIGSI V3        | Data format for PC-interface  |
| 7215  | PC BAUDRATE   | PC/System Interfaces | 1200 BAUD<br>2400 BAUD<br>4800 BAUD<br>9600 BAUD<br>19200 BAUD   | 9600 BAUD       | Transmission baud rate for PC-interface   |
| 7216  | PC PARITY     | PC/System Interfaces | DIGSI V3<br>NO 2 STOP<br>NO 1 STOP   | DIGSI V3        | Parity and stop-bits for PC-interface   |
| 7221  | SYS INTERF.   | PC/System Interfaces | VDEW COMPATIBLE<br>VDEW EXTENDED<br>DIGSI V3   | DIGSI V3        | Data format for system-interface  |
| 7222  | SYS MEASUR.   | PC/System Interfaces | VDEW COMPATIBLE<br>VDEW EXTENDED   | VDEW COMPATIBLE | Measurement format for system-interface   |
| 7227  | SYS-SWITCH    | PC/System Interfaces | NO<br>YES  | NO              | Online-switch VDEW-DIGSI enabled  |
| 7233  | SYS SUBV.T    | PC/System Interfaces | 1.. 600 s<br>infinite  | 120 s           | Supervision time for system-interface   |
| 7235  | SYS-PARAMET   | PC/System Interfaces | NO<br>YES  | NO              | Parameterizing via system-interface   |
| 7402  | INITIATION    | Fault Recordings     | STORAGE BY FD.<br>STORAGE BY TRIP<br>START WITH TRIP   | STORAGE BY FD.  | Initiation of data storage  |
| 7410  | T-MAX         | Fault Recordings     | 0.30..5.00 s   | 2.00 s          | Maximum time period of a fault recording!   |

| Addr. | Setting Title | Function           | Setting Options               | Default Setting | Comments                                    |
|-------|---------------|--------------------|-------------------------------|-----------------|---|
| 7411  | T-PRE         | Fault Recordings   | 0.05..0.50 s                  | 0.20 s          | Pre-trigger time for fault recording        |
| 7412  | T-POST        | Fault Recordings   | 0.05..0.50 s                  | 0.20 s          | Post-fault time for fault recording         |
| 7431  | T-BINARY IN   | Fault Recordings   | 0.10..5.00 s<br>infinite      | 0.40 s          | Storage time by initiation via binary input |
| 7432  | T-KEYBOARD    | Fault Recordingsg  | 0.10..5.00 s                  | 0.40 s          | Storage time by initiation via keyboard     |
| 7812  | CHARAC. PH    | SCOPE OF FUNCTIONS | DEFINITE TIME<br>INVERSE TIME | DEFINITE TIME   | Characteristic O/C protection phases        |
| 7815  | CHARAC. E     | SCOPE OF FUNCTIONS | DEFINITE TIME<br>INVERSE TIME | DEFINITE TIME   | Characteristic O/C protection earth         |
| 7899  | FREQUENCY     | SCOPE OF FUNCTIONS | 50 Hz<br>60 Hz                | 50 Hz           | Rated system frequency                      |
| 8201  | RESET         | RESET              |                               |                 | Reset of LED memories                       |
| 8202  | RESET         | RESET              |                               |                 | Reset of operational annunciation buffer    |
| 8203  | RESET         | RESET              |                               |                 | Reset of fault annunciation buffer          |
| 8204  | RESET         | RESET              |                               |                 | Reset of CB operation counters              |
| 8205  | RESET         | RESET              |                               |                 | Reset of the total of interrupted currents  |

## A.9 List of information - Central Unit

Indications for IEC 60870-5-103 are always reported as ON / OFF if they are subject to general interrogation for IEC 60870-5-103. If not, they are only reported as ON.

New user-defined indications or such newly allocated to IEC 60 870-5-103 are set to ON / OFF and subjected to general interrogation if the information type is not a spontaneous event ("..\_W"). For further information on the indications, please refer to the SIPROTEC® 4 System Description, Order No. E50417-H1100-C151.

For information on mapping and logical nodes for IEC 61 850, please refer to the manual SIPROTEC Distributed Busbar/Breaker Failure Protection IEC 61850 PIXIT Order No. C53000-G1176-C180-1.

In columns "Event Log", "Trip Log" and "Ground Fault Log" the following applies:

UPPER CASE NOTATION ON/OFF: definitely set, not allocatable

lower case notation ON/OFF: preset, allocatable

\*: not preset, allocatable

<blank>: neither preset nor allocatable

In column "Marked in Oscill.Record" the following applies:

UPPER CASE NOTATION M: definitely set, not allocatable

lower case notation M: preset, allocatable

\*: not preset, allocatable

<blank>: neither preset nor allocatable

### 1. column "Meaning":

\$00, ..., \$03 are variables which can be replaced automatically with

\$00 Number of the bay unit

\$01 Bay name

\$02 Name of the switching element (e.g. Disconnecter or circuit breaker)

\$03 Name of the bus zone

### 2. column "Event buffer":

"Operational events and fault events": The abbreviations for the marshalling and pre-setting of the annunciations can be depicted in the following table.

| Abbreviation | Matrix changeable | Pre-setting |           |
|--------------|-------------------|-------------|-----------|
|              |                   | ON          | OFF       |
| -            | -                 | -           | -         |
| off          | -                 | -           | allocated |
| on           | -                 | allocated   | -         |
| on/off       | -                 | allocated   | allocated |
| *            | yes               | -           | -         |
| off          | yes               | -           | allocated |
| on           | yes               | allocated   | -         |
| on/off       | yes               | allocated   | allocated |

"Earth fault alarm" not in 7SS52 V4.

**3. column "IEC 60870-5-103":**

**Column "Type" (Function Bus Zone):** Information that belong to the bus zones are of type 207. In this type up to 256 information numbers can be addressed. The type is divided into 12 blocks with 21 information numbers each. The blocks are assigned to the bus zones. The basic type number is given in brackets. Example:

| Bus Zone<br>n | Information<br>Number m | Type | Effective Information<br>Number x |
|---------------|-------------------------|------|-----------------------------------|
| 1             | 1                       | 207  | 1                                 |
|               | ...                     |      | ...                               |
|               | 21                      |      | 21                                |
| ...           | ...                     | ...  | ...                               |
| 12            | 1                       | 207  | 232                               |
|               | ...                     |      | ...                               |
|               | 21                      |      | 252                               |

The effective information number can be calculated with the following formula:

$$x = 21 * (n - 1) + m$$

**Column "Type" (Function Bay Unit):** Informationen that belong to the bay units are of types 195 to 206. In these types up to 256 information numbers can be addressed. These types are divided into 4 blocks each with 63 information numbers each. The blocks are assigned to the bay units. The basic type number is given in brackets. Example:

| Bay Unit No. | n   | Information Number m | Type | Effective Information Number x |
|--------------|-----|----------------------|------|--------------------------------|
| 1            | 1   | 1                    | 195  | 1                              |
|              |     | ...                  |      | ...                            |
|              |     | 63                   |      | 63                             |
| 2            | 2   | 1                    | 195  | 64                             |
|              |     | ...                  |      | ...                            |
|              |     | 63                   |      | 126                            |
| 3            | 3   | 1                    | 195  | 127                            |
|              |     | ...                  |      | ...                            |
|              |     | 63                   |      | 189                            |
| 4            | 4   | 1                    | 195  | 190                            |
|              |     | ...                  |      | ...                            |
|              |     | 63                   |      | 252                            |
| 5            | 1   | 1                    | 196  | 1                              |
|              |     | ...                  |      | ...                            |
|              |     | 63                   |      | 63                             |
| ...          | ... | ...                  | ...  | ...                            |
| 8            | 4   | 1                    | 196  | 190                            |
|              |     | ...                  |      | ...                            |
|              |     | 63                   |      | 252                            |
| ...          | ... | ...                  | ...  | ...                            |
| 48           | 4   | 1                    | 206  | 190                            |
|              |     | ...                  |      | ...                            |
|              |     | 63                   |      | 252                            |

The following table shows the type and information numbers for the "instantiated" alarms as examples for the first instance (bay unit or busbarsection). The effective information number of each type number can be calculated with the following formula:

$$x = 63 * (n - 1) + m$$

**Column "Information number":** The basic information number is given in brackets.



**NOTE**

Only the annunciations subject to general interrogation are reported as ON/OFF to the IEC 60870-5-103 interface. Indications that are not subject to general interrogation are only reported as ON.



| FNo.  | Description  | Function        | Type of information | Log-Buffer       |                         |                         |                          | Configurable in Matrix |              |              |               |                  | IEC 60870-5-103 |                 |           |                       |
|-------|--|-----------------|---------------------|------------------|-------------------------|-------------------------|--------------------------|------------------------|--------------|--------------|---------------|------------------|-----------------|-----------------|-----------|-----------------------|
|       |  |                 |                     | Event Log On/Off | Trip (Fault) Log On/Off | Ground Fault Log On/Off | Marked in Oscill. Record | LED                    | Binary Input | Function Key | Binary Output | Chatter Blocking | Type            | Information No. | Data Unit | General Interrogation |
| 3     | >Synchronize Internal Real Time Clock (>Time Synch)        | Device          | SP_Ev               | *                | *                       |                         |                          | LED                    | BI           |              | BO            |                  | 135             | 48              | 1         | No                    |
| 4     | >Trigger Waveform Capture (>Trig.Wave.Cap.)                | Osc. Fault Rec. | SP                  | on               | *                       |                         | m                        | LED                    | BI           |              | BO            |                  | 135             | 49              | 1         | Yes                   |
| 5     | >Reset LED (>Reset LED)                                    | Device          | SP                  | on               | *                       |                         | *                        | LED                    | BI           |              | BO            |                  | 135             | 50              | 1         | Yes                   |
| 15    | >Test mode (>Test mode)                                    | Device          | SP                  | on off           | *                       |                         | *                        | LED                    | BI           |              | BO            |                  | 135             | 53              | 1         | Yes                   |
| 16    | >Stop data transmission (>DataS-top)                       | Device          | SP                  | on off           | *                       |                         | *                        | LED                    | BI           |              | BO            |                  | 135             | 54              | 1         | Yes                   |
| 51    | Device is Operational and Protecting (Device OK)           | Device          | OUT                 | on off           | *                       |                         | *                        | LED                    |              |              | BO            |                  | 135             | 81              | 1         | Yes                   |
| 55    | Reset Device (Reset Device)                                | Device          | OUT                 | on               | *                       |                         | *                        | LED                    |              |              | BO            |                  |                 |                 |           |                       |
| 56    | Initial Start of Device (Initial Start)                    | Device          | OUT                 | on               | *                       |                         | *                        | LED                    |              |              | BO            |                  | 194             | 5               | 1         | No                    |
| 67    | Resume (Resume)  | Device          | OUT                 | on               | *                       |                         | *                        | LED                    |              |              | BO            |                  | 135             | 97              | 1         | Yes                   |
| 68    | Clock Synchronization Error (Clock SyncError)              | Device          | OUT                 | on off           | *                       |                         | *                        | LED                    |              |              | BO            |                  | 135             | 202             | 1         | Yes                   |
| 69    | Daylight Saving Time (DayLight-SavTime)                    | Device          | OUT                 | on off           | *                       |                         | *                        | LED                    |              |              | BO            |                  |                 |                 |           |                       |
| 70    | Setting calculation is running (Settings Calc.)            | Device          | OUT                 | on off           | *                       |                         | *                        | LED                    |              |              | BO            |                  | 194             | 22              | 1         | Yes                   |
| 71    | Settings Check (Settings Check)                            | Device          | OUT                 | *                | *                       |                         | *                        | LED                    |              |              | BO            |                  |                 |                 |           |                       |
| 72    | Level-2 change (Level-2 change)                            | Device          | OUT                 | on off           | *                       |                         | *                        | LED                    |              |              | BO            |                  |                 |                 |           |                       |
| 73    | Local setting change (Local change)                        | Device          | OUT                 |                  |                         |                         |                          |                        |              |              |               |                  |                 |                 |           |                       |
| 95    | Setting change in progress (Change in Prog.)               | Device          | OUT                 | *                | *                       |                         | *                        | LED                    |              |              | BO            |                  |                 |                 |           |                       |
| 110   | Event lost (Event Lost)                                    | Device          | OUT_Ev              | on               | *                       |                         | *                        | LED                    |              |              | BO            |                  | 135             | 130             | 1         | No                    |
| 113   | Flag Lost (Flag Lost)                                      | Device          | OUT                 | on               | *                       |                         | m                        | LED                    |              |              | BO            |                  | 135             | 136             | 1         | Yes                   |
| 125   | Chatter ON (Chatter ON)                                    | Device          | OUT                 | on off           | *                       |                         | *                        | LED                    |              |              | BO            |                  |                 |                 |           |                       |
| 203   | Waveform data deleted (Wave. deleted)                      | Osc. Fault Rec. | OUT_Ev              | on               | *                       |                         |                          | LED                    |              |              | BO            |                  | 135             | 203             | 1         | No                    |
| 301   | Power System fault (Pow.Sys.Flt.)                          | Device          | OUT                 | ON OFF           | ON                      |                         |                          |                        |              |              |               |                  | 135             | 231             | 2         | Yes                   |
| 302   | Fault Event (Fault Event)                                  | Device          | OUT                 | *                | ON                      |                         |                          |                        |              |              |               |                  | 135             | 232             | 2         | Yes                   |
| 320   | Warn: Limit of Memory Data exceeded (Warn Mem. Data)       | Device          | OUT                 | on off           | *                       |                         | *                        | LED                    |              |              | BO            |                  |                 |                 |           |                       |
| 321   | Warn: Limit of Memory Parameter exceeded (Warn Mem. Para.) | Device          | OUT                 | on off           | *                       |                         | *                        | LED                    |              |              | BO            |                  |                 |                 |           |                       |
| 322   | Warn: Limit of Memory Operation exceeded (Warn Mem. Oper.) | Device          | OUT                 | on off           | *                       |                         | *                        | LED                    |              |              | BO            |                  |                 |                 |           |                       |
| 323   | Warn: Limit of Memory New exceeded (Warn Mem. New)         | Device          | OUT                 | on off           | *                       |                         | *                        | LED                    |              |              | BO            |                  |                 |                 |           |                       |
| 10410 | Diff-current superv. CZ (group alarm) (Id-sup CZ G)        | Monitoring      | OUT                 | *                | *                       |                         | *                        | LED                    |              |              | BO            |                  | 194             | 205             | 1         | Yes                   |
| 10411 | Diff-current supervision Check Zone L1 (Id-sup CZ L1)      | Monitoring      | OUT                 | on off           | *                       |                         | *                        | LED                    |              |              | BO            |                  | 194             | 206             | 1         | Yes                   |
| 10412 | Diff-current supervision Check Zone L2 (Id-sup CZ L2)      | Monitoring      | OUT                 | on off           | *                       |                         | *                        | LED                    |              |              | BO            |                  | 194             | 207             | 1         | Yes                   |
| 10413 | Diff-current supervision Check Zone L3 (Id-sup CZ L3)      | Monitoring      | OUT                 | on off           | *                       |                         | *                        | LED                    |              |              | BO            |                  | 194             | 208             | 1         | Yes                   |

| FNo.  | Description   | Function      | Type of information | Log-Buffer       |                         |                         |                          | Configurable in Matrix |              |              |               |                  | IEC 60870-5-103 |                 |           |                       |
|-------|---|---------------|---------------------|------------------|-------------------------|-------------------------|--------------------------|------------------------|--------------|--------------|---------------|------------------|-----------------|-----------------|-----------|-----------------------|
|       |   |               |                     | Event Log On/Off | Trip (Fault) Log On/Off | Ground Fault Log On/Off | Marked in Oscill. Record | LED                    | Binary Input | Function Key | Binary Output | Chatter Blocking | Type            | Information No. | Data Unit | General Interrogation |
| 10415 | Diff-current superv. BZ (group alarm) (Id-sup BZ G)       | Monitoring    | OUT                 | *                | *                       |                         | *                        | LED                    |              |              | BO            |                  | 194             | 200             | 1         | Yes                   |
| 10416 | Diff-current superv. BZ L1 (group alarm) (Id-sup BZ L1 G) | Monitoring    | OUT                 | *                | *                       |                         | *                        | LED                    |              |              | BO            |                  | 194             | 201             | 1         | Yes                   |
| 10417 | Diff-current superv. BZ L2 (group alarm) (Id-sup BZ L2 G) | Monitoring    | OUT                 | *                | *                       |                         | *                        | LED                    |              |              | BO            |                  | 194             | 202             | 1         | Yes                   |
| 10418 | Diff-current superv. BZ L3 (group alarm) (Id-sup BZ L3 G) | Monitoring    | OUT                 | *                | *                       |                         | *                        | LED                    |              |              | BO            |                  | 194             | 203             | 1         | Yes                   |
| 10420 | 15V supply supervision central unit (15V-superv CU)       | Monitoring    | OUT                 | on off           | *                       |                         | *                        | LED                    |              |              | BO            |                  | 194             | 212             | 1         | Yes                   |
| 10421 | 24V supply supervision central unit (24V-superv CU)       | Monitoring    | OUT                 | on off           | *                       |                         | *                        | LED                    |              |              | BO            |                  | 194             | 213             | 1         | Yes                   |
| 10422 | Battery supervision central unit (Batt. superv CU)        | Monitoring    | OUT                 | on off           | *                       |                         | *                        | LED                    |              |              | BO            |                  | 194             | 214             | 1         | Yes                   |
| 10423 | Measured value superv. BU (group alarm) (Meas sup BU G)   | Monitoring    | OUT                 | on off           | *                       |                         | *                        | LED                    |              |              | BO            |                  | 194             | 216             | 1         | Yes                   |
| 10424 | Supply voltage superv. BU (group alarm) (Supply sup BU G) | Monitoring    | OUT                 | *                | *                       |                         | *                        | LED                    |              |              | BO            |                  | 194             | 215             | 1         | Yes                   |
| 10425 | Disconnecter fault alarm (Dco flt alarm)                  | Monitoring    | OUT                 | *                | *                       |                         | *                        | LED                    |              |              | BO            |                  | 194             | 186             | 1         | Yes                   |
| 10426 | Failure of disconn. aux. voltage (g.a.) (Bay DC fail G)   | Monitoring    | OUT                 | *                | *                       |                         | *                        | LED                    |              |              | BO            |                  | 194             | 185             | 1         | Yes                   |
| 10427 | Disconn. fault: run time (group alarm) (Dco flt run G)    | Monitoring    | OUT                 | *                | *                       |                         | *                        | LED                    |              |              | BO            |                  | 194             | 184             | 1         | Yes                   |
| 10428 | Disconn. position faulty (group alarm) (Dco flt pos G)    | Monitoring    | OUT                 | *                | *                       |                         | *                        | LED                    |              |              | BO            |                  | 194             | 183             | 1         | Yes                   |
| 10429 | Failure in auto testing (group alarm) (Flt autotest G)    | Monitoring    | OUT                 | *                | *                       |                         | *                        | LED                    |              |              | BO            |                  | 194             | 210             | 1         | Yes                   |
| 10430 | >Blocking of Breaker Failure Protection (>Blocking BF)    | BF-Protection | SP                  | on off           | *                       |                         | *                        | LED                    | BI           |              | BO            |                  | 194             | 164             | 1         | Yes                   |
| 10431 | Blocking of Breaker Failure Protection (Blocking BF)      | BF-Protection | IntSP               | on off           | *                       |                         | *                        | LED                    |              |              | BO            |                  |                 |                 |           |                       |
| 10432 | Breaker Failure Protection blocked (BF blocked)           | BF-Protection | OUT                 | on off           | *                       |                         | *                        | LED                    |              |              | BO            |                  | 194             | 165             | 1         | Yes                   |
| 10433 | Breaker Failure/Transfer Trip (g.a.) (Transf. Trip G)     | BF-Protection | OUT                 | *                | *                       |                         | m                        | LED                    |              |              | BO            |                  | 194             | 180             | 2         | Yes                   |
| 10434 | Disturbance BF input (group alarm) (BF Inp. Dist. G)      | BF-Protection | OUT                 | *                | *                       |                         | *                        | LED                    |              |              | BO            |                  | 194             | 181             | 1         | Yes                   |
| 10435 | Disturbance BF release (group alarm) (BF Rel. Dist. G)    | BF-Protection | OUT                 | *                | *                       |                         | *                        | LED                    |              |              | BO            |                  | 194             | 182             | 1         | Yes                   |
| 10436 | Trip command BF (group alarm) (Trip BF G)                 | BF-Protection | OUT                 | *                | *                       |                         | *                        | LED                    |              |              | BO            |                  | 194             | 176             | 2         | Yes                   |
| 10437 | Disturbance BF impulse input (g.a.) (BF Imp Dist. G)      | BF-Protection | OUT                 | *                | *                       |                         | *                        | LED                    |              |              | BO            |                  | 194             | 189             | 1         | Yes                   |
| 10440 | >TRIP commands blocking (>TRIP blocking)                  | Device        | SP                  | on off           | *                       |                         | *                        | LED                    | BI           |              | BO            |                  | 194             | 162             | 1         | Yes                   |
| 10441 | TRIP commands blocking (TRIP blocking)                    | Device        | IntSP               | on off           | *                       |                         | *                        | LED                    |              |              | BO            |                  | 194             | 154             | 1         | Yes                   |
| 10442 | TRIP commands blocked (TRIP blocked)                      | Device        | OUT                 | on off           | *                       |                         | *                        | LED                    |              |              | BO            |                  | 194             | 163             | 1         | Yes                   |
| 10443 | BZ blocked selective (group alarm) (Block BZ sel G)       | BB Protection | OUT                 | *                | *                       |                         | *                        | LED                    |              |              | BO            |                  | 194             | 192             | 1         | Yes                   |
| 10444 | Blocking by supervision zero crossing (Block ZeroCross)   | Monitoring    | OUT                 | on off           | *                       |                         | *                        | LED                    |              |              | BO            |                  |                 |                 |           |                       |
| 10445 | Device Trip (group alarm) (Device trip G)                 | BB Protection | OUT                 | *                | *                       |                         | m                        | LED                    |              |              | BO            |                  | 194             | 170             | 2         | Yes                   |

| FNo.  | Description   | Function        | Type of information | Log-Buffer       |                         |                         |                          | Configurable in Matrix |              |              |               |                  | IEC 60870-5-103 |                 |           |                       |
|-------|---|-----------------|---------------------|------------------|-------------------------|-------------------------|--------------------------|------------------------|--------------|--------------|---------------|------------------|-----------------|-----------------|-----------|-----------------------|
|       |   |                 |                     | Event Log On/Off | Trip (Fault) Log On/Off | Ground Fault Log On/Off | Marked in Oscill. Record | LED                    | Binary Input | Function Key | Binary Output | Chatter Blocking | Type            | Information No. | Data Unit | General Interrogation |
| 10446 | Trip command L1 (group alarm) (Trip L1 G)                 | BB Protection   | OUT                 | *                | *                       |                         | *                        | LED                    |              |              | BO            |                  | 194             | 171             | 2         | Yes                   |
| 10447 | Trip command L2 (group alarm) (Trip L2 G)                 | BB Protection   | OUT                 | *                | *                       |                         | *                        | LED                    |              |              | BO            |                  | 194             | 172             | 2         | Yes                   |
| 10448 | Trip command L3 (group alarm) (Trip L3 G)                 | BB Protection   | OUT                 | *                | *                       |                         | *                        | LED                    |              |              | BO            |                  | 194             | 173             | 2         | Yes                   |
| 10449 | Trip command BBP (group alarm) (Trip BBP G)               | BB Protection   | OUT                 | *                | *                       |                         | *                        | LED                    |              |              | BO            |                  | 194             | 174             | 2         | Yes                   |
| 10450 | Trip repeat BU (group alarm) (TripRep BU G)               | BB Protection   | OUT                 | *                | *                       |                         | *                        | LED                    |              |              | BO            |                  | 194             | 175             | 2         | Yes                   |
| 10451 | Transformer reversed in polarity (g.a.) (TF RevPol G)     | Protec. general | OUT                 | on off           | *                       |                         | *                        | LED                    |              |              | BO            |                  | 194             | 211             | 1         | Yes                   |
| 10453 | Bay out of service (group alarm) (out of serv. G)         | BB Protection   | OUT                 | *                | *                       |                         | *                        | LED                    |              |              | BO            |                  | 194             | 157             | 1         | Yes                   |
| 10454 | Maintenance of bay (group alarm) (Maintenance G)          | BB Protection   | OUT                 | *                | *                       |                         | *                        | LED                    |              |              | BO            |                  | 194             | 156             | 1         | Yes                   |
| 10455 | Bay unit failure (group alarm) (BU fail G)                | BB Protection   | OUT                 | *                | *                       |                         | *                        | LED                    |              |              | BO            |                  | 194             | 158             | 1         | Yes                   |
| 10456 | Circuit breaker fault (group alarm) (CB fault G)          | BB Protection   | OUT                 | *                | *                       |                         | *                        | LED                    |              |              | BO            |                  | 194             | 190             | 1         | Yes                   |
| 10457 | Trip command L1 check zone (Trip L1 CZ)                   | BB Protection   | OUT                 | on off           | *                       |                         | *                        | LED                    |              |              | BO            |                  |                 |                 |           |                       |
| 10458 | Trip command L2 check zone (Trip L2 CZ)                   | BB Protection   | OUT                 | on off           | *                       |                         | *                        | LED                    |              |              | BO            |                  |                 |                 |           |                       |
| 10459 | Trip command L3 check zone (Trip L3 CZ)                   | BB Protection   | OUT                 | on off           | *                       |                         | *                        | LED                    |              |              | BO            |                  |                 |                 |           |                       |
| 10460 | >Reset blocking of diff-current superv. (>Reset Id-Block) | Monitoring      | SP                  | on               | *                       |                         | *                        | LED                    | BI           |              | BO            |                  | 194             | 220             | 1         | Yes                   |
| 10461 | Reset blocking of diff-current superv. (Reset Id-Block)   | Monitoring      | OUT                 | on               | *                       |                         | *                        | LED                    |              |              | BO            |                  |                 |                 |           |                       |
| 10462 | Blocking of diff-current superv. reset (Id-Block Reset)   | Monitoring      | OUT_Ev              | on               | *                       |                         | *                        | LED                    |              |              | BO            |                  |                 |                 |           |                       |
| 10465 | >Reset blocking of disconnecter fault (>Reset DcoMalBI)   | Monitoring      | SP                  | on               | *                       |                         | *                        | LED                    | BI           |              | BO            |                  | 194             | 222             | 1         | Yes                   |
| 10466 | Reset blocking of disconnecter fault (Reset DcoMalBI)     | Monitoring      | OUT                 | on               | *                       |                         | *                        | LED                    |              |              | BO            |                  |                 |                 |           |                       |
| 10467 | Blocking of disconnecter fault reset (DcoMalBI Reset)     | Monitoring      | OUT_Ev              | on               | *                       |                         | *                        | LED                    |              |              | BO            |                  |                 |                 |           |                       |
| 10470 | Disconn. oper. prohibited (dco.fault) (DcoProhib/fault)   | Monitoring      | OUT                 | on off           | *                       |                         | *                        | LED                    |              |              | BO            |                  | 194             | 187             | 1         | Yes                   |
| 10471 | Disconn. oper. prohibited (group alarm) (DcoProhib G)     | Monitoring      | OUT                 | on off           | *                       |                         | *                        | LED                    |              |              | BO            |                  | 194             | 188             | 1         | Yes                   |
| 10475 | Error without protection blocking (Err PROT ACTIVE)       | BB Protection   | OUT                 | on off           | *                       |                         | *                        | LED                    |              |              | BO            |                  | 194             | 152             | 1         | Yes                   |
| 10476 | Error with protection blocking (Err PROT BLOCK)           | BB Protection   | OUT                 | on off           | *                       |                         | *                        | LED                    |              |              | BO            |                  | 194             | 151             | 1         | Yes                   |
| 10477 | Check zone released (CZ release)                          | BB Protection   | OUT                 | on off           | *                       |                         | *                        | LED                    |              |              | BO            |                  | 194             | 178             | 1         | Yes                   |
| 10478 | >Sensitive characteristic active (>Sens. charact.)        | BB Protection   | SP                  | on off           | *                       |                         | *                        | LED                    | BI           |              | BO            |                  | 194             | 160             | 1         | Yes                   |
| 10479 | Sensitive characteristic active (Sens. charact.)          | BB Protection   | OUT                 | on off           | *                       |                         | *                        | LED                    |              |              | BO            |                  | 194             | 161             | 1         | Yes                   |
| 10486 | Disturbance ext. trip release (ext.TripRelDist)           | Monitoring      | OUT                 | *                | *                       |                         | *                        | LED                    |              |              | BO            |                  | 194             | 179             | 1         | Yes                   |
| 10487 | >Release for external trip command (>TRIP-Release)        | BB Protection   | SP                  | on off           | *                       |                         | *                        | LED                    | BI           |              | BO            |                  | 194             | 159             | 1         | Yes                   |

| FNo.     | Description   | Function        | Type of information | Log-Buffer       |                         |                         |                          | Configurable in Matrix |              |              |               |                  | IEC 60870-5-103 |                 |           |                       |
|----------|---|-----------------|---------------------|------------------|-------------------------|-------------------------|--------------------------|------------------------|--------------|--------------|---------------|------------------|-----------------|-----------------|-----------|-----------------------|
|          |   |                 |                     | Event Log On/Off | Trip (Fault) Log On/Off | Ground Fault Log On/Off | Marked in Oscill. Record | LED                    | Binary Input | Function Key | Binary Output | Chatter Blocking | Type            | Information No. | Data Unit | General Interrogation |
| 10490    | >Blocking back-up breaker fail.prot. BU (>Block BF of BU) | BF-Protection   | SP                  | on off           | *                       |                         | *                        | LED                    | BI           |              | BO            |                  | 194             | 167             | 1         | Yes                   |
| 10491    | Blocking back-up breaker fail.prot. BU (Block BF of BU)   | BF-Protection   | IntSP               | on off           | *                       |                         | *                        | LED                    |              |              | BO            |                  | 194             | 168             | 1         | Yes                   |
| 10492    | Back-up breaker fail.prot. of BU blocked (Blkd BF of BU)  | BF-Protection   | OUT                 | on off           | *                       |                         | *                        | LED                    |              |              | BO            |                  | 194             | 169             | 1         | Yes                   |
| 10493    | >Blocking O/C protection of BU (>Block O/C BU)            | Protec. general | SP                  | on off           | *                       |                         | *                        | LED                    | BI           |              | BO            |                  | 194             | 195             | 1         | Yes                   |
| 10494    | Blocking O/C protection of BU (Block O/C BU)              | Protec. general | IntSP               | on off           | *                       |                         | *                        | LED                    |              |              | BO            |                  | 194             | 196             | 1         | Yes                   |
| 10495    | O/C protection of BU blocked (Blkd O/C BU)                | Protec. general | OUT                 | on off           | *                       |                         | *                        | LED                    |              |              | BO            |                  | 194             | 197             | 1         | Yes                   |
| 10496    | BF protection BZ blocked (group alarm) (BF BZ blkd G)     | BF-Protection   | OUT                 | on off           | *                       |                         | *                        | LED                    |              |              | BO            |                  |                 |                 |           |                       |
| 10497    | Trip command BZ blocked (group alarm) (TRIP BZ blkd G)    | BB Protection   | OUT                 | on off           | *                       |                         | *                        | LED                    |              |              | BO            |                  |                 |                 |           |                       |
| 10498    | >Additional criterion BBP-trip L1 (>AddCr BBtripL1)       | BB Protection   | SP                  | on off           | *                       |                         | *                        | LED                    | BI           |              | BO            |                  |                 |                 |           |                       |
| 10499    | >Additional criterion BBP-trip L2 (>AddCr BBtripL2)       | BB Protection   | SP                  | on off           | *                       |                         | *                        | LED                    | BI           |              | BO            |                  |                 |                 |           |                       |
| 10500    | >Additional criterion BBP-trip L3 (>AddCr BBtripL3)       | BB Protection   | SP                  | on off           | *                       |                         | *                        | LED                    | BI           |              | BO            |                  |                 |                 |           |                       |
| 10503    | No additional criterion BBP-trip L1 (No AddCrit. L1)      | BB Protection   | OUT_Ev              | on               | *                       |                         | *                        | LED                    |              |              | BO            |                  |                 |                 |           |                       |
| 10504    | No additional criterion BBP-trip L2 (No AddCrit. L2)      | BB Protection   | OUT_Ev              | on               | *                       |                         | *                        | LED                    |              |              | BO            |                  |                 |                 |           |                       |
| 10505    | No additional criterion BBP-trip L3 (No AddCrit. L3)      | BB Protection   | OUT_Ev              | on               | *                       |                         | *                        | LED                    |              |              | BO            |                  |                 |                 |           |                       |
| 10506    | Disturbance BI add. criterion L1 (Dist.AddCrit.L1)        | BB Protection   | OUT                 | on off           | *                       |                         | *                        | LED                    |              |              | BO            |                  |                 |                 |           |                       |
| 10507    | Disturbance BI add. criterion L2 (Dist.AddCrit.L2)        | BB Protection   | OUT                 | on off           | *                       |                         | *                        | LED                    |              |              | BO            |                  |                 |                 |           |                       |
| 10508    | Disturbance BI add. criterion L3 (Dist.AddCrit.L3)        | BB Protection   | OUT                 | on off           | *                       |                         | *                        | LED                    |              |              | BO            |                  |                 |                 |           |                       |
| 10509    | Disturbance BI sensitive characteristic (Dist. BI s.char) | BB Protection   | OUT                 | on off           | *                       |                         | *                        | LED                    |              |              | BO            |                  |                 |                 |           |                       |
| 10510    | Diff-current superv. off (Superv.Idif off)                | Monitoring      | OUT                 | on off           | *                       |                         | *                        | LED                    |              |              | BO            |                  |                 |                 |           |                       |
| 10511    | Cross stabilisation - BZ L1 (CrossStab BZ L1)             | BB Protection   | OUT_Ev              | on               | *                       |                         | *                        | LED                    |              |              | BO            |                  |                 |                 |           |                       |
| 10512    | Cross stabilisation - BZ L2 (CrossStab BZ L2)             | BB Protection   | OUT_Ev              | on               | *                       |                         | *                        | LED                    |              |              | BO            |                  |                 |                 |           |                       |
| 10513    | Cross stabilisation - BZ L3 (CrossStab BZ L3)             | BB Protection   | OUT_Ev              | on               | *                       |                         | *                        | LED                    |              |              | BO            |                  |                 |                 |           |                       |
| 10514    | Cross stabilisation - CZ L1 (CrossStab CZ L1)             | BB Protection   | OUT_Ev              | on               | *                       |                         | *                        | LED                    |              |              | BO            |                  |                 |                 |           |                       |
| 10515    | Cross stabilisation - CZ L2 (CrossStab CZ L2)             | BB Protection   | OUT_Ev              | on               | *                       |                         | *                        | LED                    |              |              | BO            |                  |                 |                 |           |                       |
| 10516    | Cross stabilisation - CZ L3 (CrossStab CZ L3)             | BB Protection   | OUT_Ev              | on               | *                       |                         | *                        | LED                    |              |              | BO            |                  |                 |                 |           |                       |
| 30053    | Fault recording is running (Fault rec. run.)              | Osc. Fault Rec. | OUT                 | *                | *                       |                         | *                        | LED                    |              |              | BO            |                  |                 |                 |           |                       |
| 009.0100 | Failure EN100 Modul (Failure Modul)                       | EN100-Modul 1   | IntSP               | on off           | *                       |                         | *                        | LED                    |              |              | BO            |                  |                 |                 |           |                       |
| 009.0101 | Failure EN100 Link Channel 1 (Ch1) (Fail Ch1)             | EN100-Modul 1   | IntSP               | on off           | *                       |                         | *                        | LED                    |              |              | BO            |                  |                 |                 |           |                       |

| FNo.     | Description   | Function      | Type of information | Log-Buffer       |                         |                         |                          | Configurable in Matrix |              |              |               |                  | IEC 60870-5-103 |                 |           |                       |  |
|----------|---|---------------|---------------------|------------------|-------------------------|-------------------------|--------------------------|------------------------|--------------|--------------|---------------|------------------|-----------------|-----------------|-----------|-----------------------|--|
|          |   |               |                     | Event Log On/Off | Trip (Fault) Log On/Off | Ground Fault Log On/Off | Marked in Oscill. Record | LED                    | Binary Input | Function Key | Binary Output | Chatter Blocking | Type            | Information No. | Data Unit | General Interrogation |  |
| 009.0102 | Failure EN100 Link Channel 2 (Ch2) (Fail Ch2)         | EN100-Modul 1 | IntSP               | on off           | *                       |                         | *                        | LED                    |              |              | BO            |                  |                 |                 |           |                       |  |
| 176.1061 | \$00 out of service (OutOfSer \$00)                   | BU@           | OUT                 | on off           | *                       |                         | *                        | LED                    |              |              | BO            |                  | 195             | 6               | 1         | Yes                   |  |
| 176.1062 | \$00 disconnector maintenance (Mainten. \$00)         | BU@           | OUT                 | on off           | *                       |                         | *                        | LED                    |              |              | BO            |                  | 195             | 3               | 1         | Yes                   |  |
| 176.1063 | \$00 failure (Failure \$00)                           | BU@           | OUT                 | on off           | *                       |                         | *                        | LED                    |              |              | BO            |                  | 195             | 8               | 1         | Yes                   |  |
| 176.1071 | Trip repeat \$00 phase L1 (TripRep\$00 L1)            | BU@           | OUT                 | *                | on                      |                         | *                        | LED                    |              |              | BO            |                  | 195             | 10              | 2         | Yes                   |  |
| 176.1072 | Trip repeat \$00 phase L2 (TripRep\$00 L2)            | BU@           | OUT                 | *                | on                      |                         | *                        | LED                    |              |              | BO            |                  | 195             | 11              | 2         | Yes                   |  |
| 176.1073 | Trip repeat \$00 phase L3 (TripRep\$00 L3)            | BU@           | OUT                 | *                | on                      |                         | *                        | LED                    |              |              | BO            |                  | 195             | 12              | 2         | Yes                   |  |
| 176.1081 | No release of TRIP command \$00 (noTripRel \$00)      | BU@           | OUT                 | *                | on                      |                         | *                        | LED                    |              |              | BO            |                  | 195             | 15              | 2         | Yes                   |  |
| 176.1082 | Breaker fail/Transfer trip \$00 (TrnsfTrip \$00)      | BU@           | OUT                 | *                | on                      |                         | *                        | LED                    |              |              | BO            |                  | 195             | 16              | 2         | Yes                   |  |
| 176.1091 | Disturbance BF input \$00 L1 (BF Dist\$00 L1)         | BU@           | OUT                 | on off           | *                       |                         | *                        | LED                    |              |              | BO            |                  | 195             | 18              | 1         | Yes                   |  |
| 176.1092 | Disturbance BF input \$00 L2 (BF Dist\$00 L2)         | BU@           | OUT                 | on off           | *                       |                         | *                        | LED                    |              |              | BO            |                  | 195             | 19              | 1         | Yes                   |  |
| 176.1093 | Disturbance BF input \$00 L3 (BF Dist\$00 L3)         | BU@           | OUT                 | on off           | *                       |                         | *                        | LED                    |              |              | BO            |                  | 195             | 20              | 1         | Yes                   |  |
| 176.1094 | Disturbance BF input \$00 3pole (BF Dist\$00 3P)      | BU@           | OUT                 | on off           | *                       |                         | *                        | LED                    |              |              | BO            |                  | 195             | 21              | 1         | Yes                   |  |
| 176.1101 | Disturbance BF release input \$00 1P (BFRelDi\$00 1P) | BU@           | OUT                 | on off           | *                       |                         | *                        | LED                    |              |              | BO            |                  | 195             | 23              | 1         | Yes                   |  |
| 176.1102 | Disturbance BF release input \$00 3P (BFRelDi\$00 3P) | BU@           | OUT                 | on off           | *                       |                         | *                        | LED                    |              |              | BO            |                  | 195             | 24              | 1         | Yes                   |  |
| 176.1104 | Disturbance BF pulse input \$00 (BF ImpDis \$00)      | BU@           | OUT                 | on off           | *                       |                         | *                        | LED                    |              |              | BO            |                  | 195             | 17              | 1         | Yes                   |  |
| 176.1110 | \$01 disconnector \$02 (\$01 \$02) <sup>1)</sup>      | BU@           | DP                  | *                | *                       |                         | *                        | LED                    |              |              | BO            |                  | 195             | 25              | 1         | Yes                   |  |
| 176.1112 | Fault: run time \$01 disconn. \$02 (FitR \$01 \$02)   | BU@           | OUT                 | on               | *                       |                         | *                        | LED                    |              |              | BO            |                  | 195             | 35              | 1         | Yes                   |  |
| 176.1113 | Fault: dist.pos. \$01 disconn. \$02 (FitP \$01 \$02)  | BU@           | OUT                 | on               | *                       |                         | *                        | LED                    |              |              | BO            |                  | 195             | 30              | 1         | Yes                   |  |
| 176.1115 | \$01 disconnector \$02 (\$01 \$02) <sup>1)</sup>      | BU@           | DP                  | *                | *                       |                         | *                        | LED                    |              |              | BO            |                  | 195             | 26              | 1         | Yes                   |  |
| 176.1117 | Fault: run time \$01 disconn. \$02 (FitR \$01 \$02)   | BU@           | OUT                 | on               | *                       |                         | *                        | LED                    |              |              | BO            |                  | 195             | 36              | 1         | Yes                   |  |
| 176.1118 | Fault: dist.pos. \$01 disconn. \$02 (FitP \$01 \$02)  | BU@           | OUT                 | on               | *                       |                         | *                        | LED                    |              |              | BO            |                  | 195             | 31              | 1         | Yes                   |  |
| 176.1120 | \$01 disconnector \$02 (\$01 \$02) <sup>1)</sup>      | BU@           | DP                  | *                | *                       |                         | *                        | LED                    |              |              | BO            |                  | 195             | 27              | 1         | Yes                   |  |
| 176.1122 | Fault: run time \$01 disconn. \$02 (FitR \$01 \$02)   | BU@           | OUT                 | on               | *                       |                         | *                        | LED                    |              |              | BO            |                  | 195             | 37              | 1         | Yes                   |  |
| 176.1123 | Fault: dist.pos. \$01 disconn. \$02 (FitP \$01 \$02)  | BU@           | OUT                 | on               | *                       |                         | *                        | LED                    |              |              | BO            |                  | 195             | 32              | 1         | Yes                   |  |
| 176.1125 | \$01 disconnector \$02 (\$01 \$02) <sup>1)</sup>      | BU@           | DP                  | *                | *                       |                         | *                        | LED                    |              |              | BO            |                  | 195             | 28              | 1         | Yes                   |  |
| 176.1127 | Fault: run time \$01 disconn. \$02 (FitR \$01 \$02)   | BU@           | OUT                 | on               | *                       |                         | *                        | LED                    |              |              | BO            |                  | 195             | 38              | 1         | Yes                   |  |
| 176.1128 | Fault: dist.pos. \$01 disconn. \$02 (FitP \$01 \$02)  | BU@           | OUT                 | on               | *                       |                         | *                        | LED                    |              |              | BO            |                  | 195             | 33              | 1         | Yes                   |  |
| 176.1130 | \$01 disconnector \$02 (\$01 \$02) <sup>1)</sup>      | BU@           | DP                  | *                | *                       |                         | *                        | LED                    |              |              | BO            |                  | 195             | 29              | 1         | Yes                   |  |
| 176.1132 | Fault: run time \$01 disconn. \$02 (FitR \$01 \$02)   | BU@           | OUT                 | on               | *                       |                         | *                        | LED                    |              |              | BO            |                  | 195             | 39              | 1         | Yes                   |  |

| FNo.     | Description  | Function        | Type of information | Log-Buffer       |                         |                         |                          | Configurable in Matrix |              |              |               |                  | IEC 60870-5-103 |                 |           |                       |
|----------|--|-----------------|---------------------|------------------|-------------------------|-------------------------|--------------------------|------------------------|--------------|--------------|---------------|------------------|-----------------|-----------------|-----------|-----------------------|
|          |  |                 |                     | Event Log On/Off | Trip (Fault) Log On/Off | Ground Fault Log On/Off | Marked in Oscill. Record | LED                    | Binary Input | Function Key | Binary Output | Chatter Blocking | Type            | Information No. | Data Unit | General Interrogation |
| 176.1133 | Fault: dist.pos. \$01 disconn. \$02 (FltP \$01 \$02)   | BU@             | OUT                 | on               | *                       |                         | *                        | LED                    |              |              | BO            |                  | 195             | 34              | 1         | Yes                   |
| 176.1134 | Failure disconnecter AuxVoltage \$00 (BayDCfail \$00)  | BU@             | OUT                 | on off           | *                       |                         | *                        | LED                    |              |              | BO            |                  | 195             | 40              | 1         | Yes                   |
| 176.1135 | \$01 circuit breaker \$02 (\$01 \$02)                  | BU@             | DP                  | *                | *                       |                         | *                        | LED                    |              |              | BO            |                  | 195             | 43              | 1         | Yes                   |
| 176.1136 | Circuit breaker fault \$01 (CB fault \$01)             | BU@             | OUT                 | on off           | *                       |                         | *                        | LED                    |              |              | BO            |                  | 195             | 44              | 1         | Yes                   |
| 176.1141 | Input 1 from \$00 (IN1 \$00)                           | BU@             | OUT                 | *                | *                       |                         | *                        | LED                    |              |              | BO            |                  | 195             | 45              | 1         | Yes                   |
| 176.1142 | Output 1 to \$00 (OUT1 \$00)                           | BU@             | OUT                 | *                | *                       |                         | *                        | LED                    |              |              | BO            |                  | 195             | 46              | 1         | Yes                   |
| 176.1143 | Input 2 from \$00 (IN2 \$00)                           | BU@             | OUT                 | *                | *                       |                         | *                        | LED                    |              |              | BO            |                  | 195             | 47              | 1         | Yes                   |
| 176.1144 | Output 2 to \$00 (OUT2 \$00)                           | BU@             | OUT                 | *                | *                       |                         | *                        | LED                    |              |              | BO            |                  | 195             | 48              | 1         | Yes                   |
| 176.1145 | Input 3 from \$00 (IN3 \$00)                           | BU@             | OUT                 | *                | *                       |                         | *                        | LED                    |              |              | BO            |                  | 195             | 49              | 1         | Yes                   |
| 176.1146 | Output 3 to \$00 (OUT3 \$00)                           | BU@             | OUT                 | *                | *                       |                         | *                        | LED                    |              |              | BO            |                  | 195             | 50              | 1         | Yes                   |
| 176.1147 | Input 4 from \$00 (IN4 \$00)                           | BU@             | OUT                 | *                | *                       |                         | *                        | LED                    |              |              | BO            |                  | 195             | 51              | 1         | Yes                   |
| 176.1148 | Output 4 to \$00 (OUT4 \$00)                           | BU@             | OUT                 | *                | *                       |                         | *                        | LED                    |              |              | BO            |                  | 195             | 52              | 1         | Yes                   |
| 176.1171 | 15V supply supervision \$00 (15Vsuperv \$00)           | BU@             | OUT                 | on off           | *                       |                         | *                        | LED                    |              |              | BO            |                  | 195             | 56              | 1         | Yes                   |
| 176.1172 | 5V supply supervision \$00 (5V-superv \$00)            | BU@             | OUT                 | on off           | *                       |                         | *                        | LED                    |              |              | BO            |                  | 195             | 57              | 1         | Yes                   |
| 176.1173 | 0V supply supervision \$00 (0V-superv \$00)            | BU@             | OUT                 | on off           | *                       |                         | *                        | LED                    |              |              | BO            |                  | 195             | 58              | 1         | Yes                   |
| 176.1174 | Battery supervision \$00 (BatSuperv \$00)              | BU@             | OUT                 | on off           | *                       |                         | *                        | LED                    |              |              | BO            |                  | 195             | 59              | 1         | Yes                   |
| 176.1175 | Measured value superv I-SUM \$00 (MeasInSup \$00)      | BU@             | OUT                 | on off           | *                       |                         | *                        | LED                    |              |              | BO            |                  | 195             | 60              | 1         | Yes                   |
| 176.1190 | Failure automatic testing \$00 (Flt aut \$00)          | BU@             | OUT                 | on               | *                       |                         | *                        | LED                    |              |              | BO            |                  | 195             | 55              | 1         | Yes                   |
| 176.1195 | CT reversed polarity \$00 (TF RevPol \$00)             | BU@             | OUT                 | on off           | *                       |                         | *                        | LED                    |              |              | BO            |                  | 195             | 53              | 1         | Yes                   |
| 176.1339 | Block Trip command BB by \$00 (BlkTripBB \$00)         | BU@             | OUT                 | on off           | *                       |                         | *                        | LED                    |              |              | BO            |                  | 195             | 13              | 1         | Yes                   |
| 176.1349 | Block BF protection BB by \$00 (BlkBF BB \$00)         | BU@             | OUT                 | on off           | *                       |                         | *                        | LED                    |              |              | BO            |                  | 195             | 14              | 1         | Yes                   |
| 176.1365 | Disturbance back-up BF input \$00 (BFBUinpDis\$00)     | BU@             | OUT                 | on off           | *                       |                         | *                        | LED                    |              |              | BO            |                  | 195             | 61              | 1         | Yes                   |
| 176.1370 | Operate end fault protection \$00 (Op EFP \$00)        | BU@             | OUT                 | on off           | on                      |                         | *                        | LED                    |              |              | BO            |                  |                 |                 |           |                       |
| 177.1321 | Id-sup \$03 L1-2 (Id-supL1-2 \$03)                     | Protection Zone | OUT                 | on off           | *                       |                         | *                        | LED                    |              |              | BO            |                  | 207             | 8               | 1         | Yes                   |
| 177.1322 | Id-sup \$03 L2-2 (Id-supL2-2 \$03)                     | Protection Zone | OUT                 | on off           | *                       |                         | *                        | LED                    |              |              | BO            |                  | 207             | 9               | 1         | Yes                   |
| 177.1323 | Id-sup \$03 L3-2 (Id-supL3-2 \$03)                     | Protection Zone | OUT                 | on off           | *                       |                         | *                        | LED                    |              |              | BO            |                  | 207             | 10              | 1         | Yes                   |
| 177.1326 | Id-sup \$03 L1-3 (Id-supL1-3 \$03)                     | Protection Zone | OUT                 | on off           | *                       |                         | *                        | LED                    |              |              | BO            |                  | 207             | 11              | 1         | Yes                   |
| 177.1327 | Id-sup \$03 L2-3 (Id-supL2-3 \$03)                     | Protection Zone | OUT                 | on off           | *                       |                         | *                        | LED                    |              |              | BO            |                  | 207             | 12              | 1         | Yes                   |
| 177.1328 | Id-sup \$03 L3-3 (Id-supL3-3 \$03)                     | Protection Zone | OUT                 | on off           | *                       |                         | *                        | LED                    |              |              | BO            |                  | 207             | 13              | 1         | Yes                   |
| 177.1331 | Id-sup \$03 (g.a.) (Id-sup \$03 G)                     | Protection Zone | OUT                 | *                | *                       |                         | *                        | LED                    |              |              | BO            |                  | 207             | 7               | 1         | Yes                   |
| 177.1332 | Transfer Trip \$03 (TrfTrip \$03)                      | Protection Zone | OUT                 | *                | on                      |                         | *                        | LED                    |              |              | BO            |                  | 207             | 5               | 2         | Yes                   |
| 177.1333 | Measuring system blocked by fault \$03 (\$03 blkd Flt) | Protection Zone | OUT                 | on off           | *                       |                         | *                        | LED                    |              |              | BO            |                  | 207             | 6               | 2         | Yes                   |

| FNo.     | Description   | Function        | Type of information | Log-Buffer       |                         |                         |                          | Configurable in Matrix |              |              |               |                  | IEC 60870-5-103 |                 |           |                       |     |
|----------|---|-----------------|---------------------|------------------|-------------------------|-------------------------|--------------------------|------------------------|--------------|--------------|---------------|------------------|-----------------|-----------------|-----------|-----------------------|-----|
|          |   |                 |                     | Event Log On/Off | Trip (Fault) Log On/Off | Ground Fault Log On/Off | Marked in Oscill. Record | LED                    | Binary Input | Function Key | Binary Output | Chatter Blocking | Type            | Information No. | Data Unit | General Interrogation |     |
| 177.1334 | >Block measuring system \$03 (>Blk \$03)                | Protection Zone | SP                  | on off           | *                       |                         | *                        | LED                    | BI           |              | BO            | CB               |                 |                 |           |                       |     |
| 177.1335 | Measuring system blocked by BI \$03 (\$03 blocked BI)   | Protection Zone | OUT                 | on off           | *                       |                         | *                        | LED                    |              |              | BO            |                  | 207             | 14              | 1         | Yes                   |     |
| 177.1336 | >Block Trip command for \$03 (>Blk Trip \$03)           | Protection Zone | SP                  | on off           | *                       |                         | *                        | LED                    | BI           |              | BO            | CB               |                 |                 |           |                       | Yes |
| 177.1337 | Block Trip command \$03 (\$03 Blk-Trip)                 | Protection Zone | IntSP               | on off           | *                       |                         | *                        | LED                    |              |              | BO            |                  |                 |                 |           |                       | Yes |
| 177.1338 | Blocked Trip command \$03 (\$03 BlkdTrip)               | Protection Zone | OUT                 | on off           | *                       |                         | *                        | LED                    |              |              | BO            |                  | 207             | 15              | 1         | Yes                   |     |
| 177.1341 | Trip command for \$03 (group alarm) (Trip \$03 G)       | Protection Zone | OUT                 | *                | *                       |                         | *                        | LED                    |              |              | BO            |                  | 207             | 1               | 2         | Yes                   |     |
| 177.1342 | Trip command for \$03 L1 (Trip \$03 L1)                 | Protection Zone | OUT                 | *                | on                      |                         | *                        | LED                    |              |              | BO            |                  | 207             | 2               | 2         | Yes                   |     |
| 177.1343 | Trip command for \$03 L2 (Trip \$03 L2)                 | Protection Zone | OUT                 | *                | on                      |                         | *                        | LED                    |              |              | BO            |                  | 207             | 3               | 2         | Yes                   |     |
| 177.1344 | Trip command for \$03 L3 (Trip \$03 L3)                 | Protection Zone | OUT                 | *                | on                      |                         | *                        | LED                    |              |              | BO            |                  | 207             | 4               | 2         | Yes                   |     |
| 177.1346 | >Block BF protection for \$03 (>Blk BF \$03)            | Protection Zone | SP                  | on off           | *                       |                         | *                        | LED                    | BI           |              | BO            | CB               |                 |                 |           |                       |     |
| 177.1347 | Block BF protection for \$03 (\$03 BlkBF)               | Protection Zone | IntSP               | on off           | *                       |                         | *                        | LED                    |              |              | BO            |                  |                 |                 |           |                       |     |
| 177.1348 | Blocked BF protection for \$03 (\$03 BlkdBF)            | Protection Zone | OUT                 | on off           | *                       |                         | *                        | LED                    |              |              | BO            |                  | 207             | 16              | 1         | Yes                   |     |
| 177.1352 | Trip command BF for \$03 phase L1 (Trip BF \$03 L1)     | Protection Zone | OUT                 | *                | on                      |                         | *                        | LED                    |              |              | BO            |                  | 207             | 17              | 2         | Yes                   |     |
| 177.1353 | Trip command BF for \$03 phase L2 (Trip BF \$03 L2)     | Protection Zone | OUT                 | *                | on                      |                         | *                        | LED                    |              |              | BO            |                  | 207             | 18              | 2         | Yes                   |     |
| 177.1354 | Trip command BF for \$03 phase L3 (Trip BF \$03 L3)     | Protection Zone | OUT                 | *                | on                      |                         | *                        | LED                    |              |              | BO            |                  | 207             | 19              | 2         | Yes                   |     |
| 177.1360 | >external trip \$03 (>ext. Trip \$03)                   | Protection Zone | SP                  | on off           | *                       |                         | *                        | LED                    | BI           |              | BO            | CB               |                 |                 |           |                       |     |
| 177.1361 | Disturbance ext. trip input \$03 (ext-TripDist\$03)     | Protection Zone | OUT                 | *                | on                      |                         | *                        | LED                    |              |              | BO            |                  |                 |                 |           |                       |     |
| 177.1362 | Disturbance trip command release \$03 (TripRelDist\$03) | Protection Zone | OUT                 | *                | on                      |                         | *                        | LED                    |              |              | BO            |                  |                 |                 |           |                       |     |
| 177.1363 | Trip command by BI for \$03 (Trip BI \$03)              | Protection Zone | OUT                 | *                | *                       |                         | *                        | LED                    |              |              | BO            |                  |                 |                 |           |                       |     |
| -        | Clock Synchronization (Synch-Clock)                     | Device          | IntSP_Ev            | *                |                         |                         | *                        | LED                    |              |              | BO            |                  |                 |                 |           |                       |     |
| -        | Disturbance CFC (Distur.CFC)                            | Device          | OUT                 | on off           | *                       |                         | *                        | LED                    |              |              | BO            |                  |                 |                 |           |                       |     |
| -        | Fault Recording Start (FitRecSta)                       | Osc. Fault Rec. | IntSP               | on off           | *                       |                         | m                        | LED                    |              |              | BO            |                  | 135             | 208             | 1         | No                    |     |
| -        | Hardware Test Mode (HWTestMod)                          | Device          | IntSP               | on off           | *                       |                         | *                        | LED                    |              |              | BO            |                  |                 |                 |           |                       |     |
| -        | Reset LED (Reset LED)                                   | Device          | IntSP               | on               | *                       |                         | *                        | LED                    |              |              | BO            |                  | 194             | 19              | 1         | No                    |     |
| -        | Stop data transmission (DataStop)                       | Device          | IntSP               | on off           |                         |                         | *                        | LED                    |              |              | BO            |                  | 194             | 20              | 1         | Yes                   |     |
| -        | Test mode (Test mode)                                   | Device          | IntSP               | on off           |                         |                         | *                        | LED                    |              |              | BO            |                  | 194             | 21              | 1         | Yes                   |     |
| -        | Unlock data transmission via BI (UnlockDT)              | Device          | IntSP               | *                | *                       |                         | *                        | LED                    |              |              | BO            |                  |                 |                 |           |                       |     |

1) Depending on the configuration, wildcards such as \$01... will be substituted by the configured values.

## A.10 List of Information - Bay Unit

| FNo. | Short Text    | Logical Function                        | Log Buffers                     |                         | Configurable in Matrix | IEC 60870-5-103 |                         |                       |  |  |                    |
|------|---------------|---|---------------------------------|-------------------------|------------------------|-----------------|-------------------------|-----------------------|--|--|--------------------|
|      |               |   | Event Log On/Off Measured Value | Trip (Fault) Log On/Off |                        | Data Unit       | Compatible Annunciation | General Interrogation | Annunc. for Fault Rec. Buffer (Tagged) | Type (p: Corresponds to parameter "Function type") | Information Number |
| 3    | >Time Synchro | >Time synchronization                   |                                 |                         | IO                     |                 |                         |                       |  |  |                    |
| 4    | >Start FltRec | >Start fault recording                  | on                              |                         | IO                     |                 |                         |                       |  |  |                    |
| 5    | >LED reset    | >Reset LED indicators                   |                                 |                         | IO                     |                 |                         |                       |  |  |                    |
| 11   | >Annunc. 1    | >User defined annunciation 1            | on/off                          |                         | IOT                    | 1               | CA                      | GI                    | TA                                     | p  | 27                 |
| 12   | >Annunc. 2    | >User defined annunciation 2            | on/off                          |                         | IOT                    | 1               | CA                      | GI                    | TA                                     | p  | 28                 |
| 13   | >Annunc. 3    | >User defined annunciation 3            | on/off                          |                         | IOT                    | 1               | CA                      | GI                    | TA                                     | p  | 29                 |
| 14   | >Annunc. 4    | >User defined annunciation 4            | on/off                          |                         | IOT                    | 1               | CA                      | GI                    | TA                                     | p  | 30                 |
| 51   | Dev.operative | Device operative / healthy              | on/off                          |                         |                        | 1               |                         | GI                    |  | 135  | 81                 |
| 52   | Prot. operat. | Any protection operative                | on/off                          |                         | O                      | 1               | CA                      | GI                    |  | p  | 18                 |
| 55   | Re-start      | Re-start of processor system            | on                              |                         |                        | 1               | CA                      |                       |  | p  | 4                  |
| 56   | Initial start | Initial start of processor system       | on                              |                         |                        | 1               | CA                      |                       |  | p  | 5                  |
| 59   | Rel.TimeResp. | Real time response to LSA               | on                              |                         |                        | 1               |                         |                       |  |  |                    |
| 60   | LED reset     | LED Reset                               | on                              |                         | O                      | 1               | CA                      |                       |  | p  | 19                 |
| 61   | LogMeasBlock  | Logging and measuring functions blocked | on/off                          |                         |                        | 1               | CA                      | GI                    |  | p  | 20                 |
| 62   | Test mode     | Test mode                               | on/off                          |                         |                        | 1               | CA                      | GI                    |  | p  | 21                 |
| 95   | Param.running | Parameters are being set                | on/off                          |                         |                        | 1               | CA                      | GI                    |  | p  | 22                 |
| 110  | Annunc. lost  | Annunciations lost (buffer overflow)    | on                              |                         |                        | 1               |                         |                       |  | 135  | 130                |
| 111  | Annu. PC lost | Annunciations for PC lost               | on                              |                         |                        |                 |                         |                       |  |  |                    |
| 112  | Annu.LSA lost | Annunciations for LSA lost              | on                              |                         |                        | 1               |                         |                       |  | 135  | 131                |
| 113  | Tag lost      | Fault tag lost                          |                                 |                         |                        | 1               |                         |                       | TA                                     | 135  | 136                |
| 115  | Flt.Buff.Over | Fault annunciation buffer overflow      |                                 | on                      |                        |                 |                         |                       |  |  |                    |
| 120  | Oper.Ann.Inva | Operational annunciations invalid       | on/off                          |                         |                        |                 |                         |                       |  |  |                    |
| 121  | Flt.Ann.Inval | Fault annunciations invalid             | on/off                          |                         |                        |                 |                         |                       |  |  |                    |
| 122  | E/F.Prot Inva | Earth fault annunciations invalid       | on/off                          |                         |                        |                 |                         |                       |  |  |                    |
| 123  | Stat.Buff.Inv | Statistic annunciation buffer invalid   | on/off                          |                         |                        |                 |                         |                       |  |  |                    |
| 124  | LED Buff.Inva | LED annunciation buffer invalid         | on/off                          |                         |                        |                 |                         |                       |  |  |                    |
| 129  | VDEW-StateInv | VDEW state invalid                      | on/off                          |                         |                        |                 |                         |                       |  |  |                    |
| 135  | Chs Error     | Error in check sum                      | on/off                          |                         |                        |                 |                         |                       |  |  |                    |
| 140  | Device Fail.  | General internal failure of device      | on/off                          |                         |                        | 1               | CA                      | GI                    |  | p  | 47                 |
| 143  | Failure 15V   | Failure of internal 15 VDC power supply | on/off                          |                         |                        | 1               |                         | GI                    |  | 135  | 163                |
| 144  | Failure 5V    | Failure of internal 5 VDC power supply  | on/off                          |                         |                        | 1               |                         | GI                    |  | 135  | 164                |
| 145  | Failure 0V    | Failure of internal 0 VDC power supply  | on/off                          |                         |                        | 1               |                         | GI                    |  | 135  | 165                |
| 150  | Failure I/O   | Failure in I/O module                   | on/off                          |                         |                        | 1               |                         | GI                    |  | 135  | 170                |
| 154  | Fail. TripRel | Supervision trip circuit                | on/off                          |                         |                        | 1               | CA                      | GI                    |  | p  | 36                 |
| 160  | Common alarm  | Common alarm                            | on/off                          |                         |                        | 1               | CA                      | GI                    |  | p  | 46                 |
| 161  | I supervision | Measured value supervision of currents  |                                 |                         | O                      | 1               | CA                      | GI                    |  | p  | 32                 |
| 177  | Fail.Battery  | Failure: Battery                        | on/off                          |                         | O                      |                 |                         |                       |  |  |                    |



| FNo. | Short Text     | Logical Function                        | Log Buffers                     |                         | Configurable in Matrix | IEC 60870-5-103 |                         |                       |  |  |                    |  |
|------|----------------|---|---------------------------------|-------------------------|------------------------|-----------------|-------------------------|-----------------------|--|--|--------------------|--|
|      |                |   | Event Log On/Off Measured Value | Trip (Fault) Log On/Off |                        | Data Unit       | Compatible Annunciation | General Interrogation | Annunc. for Fault Rec. Buffer (Tagged) | Type (p: Corresponds to parameter "Function type") | Information Number |  |
| 203  | Flt.RecDatDel  | Fault recording data deleted            | on                              |                         |                        |                 |                         |                       |  |  |                    |  |
| 204  | Flt.Rec.viaBI  | Fault recording initiated via bin.input | on                              |                         |                        | 1               |                         |                       | TA                                     | 135  | 204                |  |
| 205  | Flt.Rec.viaKB  | Fault recording initiated via keyboard  | on                              |                         |                        | 1               |                         |                       | TA                                     | 135  | 205                |  |
| 206  | Flt.Rec.viaPC  | Fault recording initiated via PC interf | on                              |                         |                        | 1               |                         |                       | TA                                     | 135  | 206                |  |
| 244  | D Time=        | Diff. time of clock synchronism         | M                               |                         |                        |                 |                         |                       |  |  |                    |  |
| 301  | Syst.Flt       | Fault in the power system               | on/off                          | on                      |                        | 2               |                         |                       |  | 135  | 231                |  |
| 302  | Fault          | Flt. event w. consecutive no.           |                                 | on                      |                        | 2               |                         |                       |  | 135  | 232                |  |
| 303  | E/F Det.       | E/Flt.det. in isol/comp.netw.           | on/off                          |                         |                        | 1               |                         | GI                    |  | 135  | 233                |  |
| 501  | Device FltDet  | General fault detection of device       |                                 | on/off                  |                        | 2               |                         | GI                    | TA                                     | 150  | 151                |  |
| 502  | Dev. Drop-off  | General drop-off of device              |                                 | on                      |                        |                 |                         |                       |  |  |                    |  |
| 511  | Device Trip    | General trip of device                  |                                 | on                      |                        | 2               |                         |                       | TA                                     | 150  | 161                |  |
| 521  | IL1/In=        | Interrupted current: Phase L1(I/In)     |                                 | on                      |                        | 4               |                         |                       |  | 150  | 171                |  |
| 522  | IL2/In=        | Interrupted current: Phase L2(I/In)     |                                 | on                      |                        | 4               |                         |                       |  | 150  | 172                |  |
| 523  | IL3/In=        | Interrupted current: Phase L3(I/In)     |                                 | on                      |                        | 4               |                         |                       |  | 150  | 173                |  |
| 561  | Manual Close   | Circuit breaker manually closed (pulse) | on                              |                         |                        | 1               |                         |                       |  | 150  | 211                |  |
| 601  | IL1 =          | Current in phase L1 =                   | M                               |                         |                        |                 |                         |                       |  |  |                    |  |
| 602  | IL2 =          | Current in phase L2 =                   | M                               |                         |                        |                 |                         |                       |  |  |                    |  |
| 603  | IL3 =          | Current in phase L3 =                   | M                               |                         |                        |                 |                         |                       |  |  |                    |  |
| 604  | IE =           | Earth current =                         | M                               |                         |                        |                 |                         |                       |  |  |                    |  |
| 651  | IL1 =          | Current in phase L1 =                   | M                               |                         |                        |                 |                         |                       |  |  |                    |  |
| 652  | IL2 =          | Current in phase L2 =                   | M                               |                         |                        |                 |                         |                       |  |  |                    |  |
| 653  | IL3 =          | Current in phase L3 =                   | M                               |                         |                        |                 |                         |                       |  |  |                    |  |
| 654  | IE =           | Earth current =                         | M                               |                         |                        |                 |                         |                       |  |  |                    |  |
| 694  | f [Hz]=        | Frequency f [Hz] =                      | M                               |                         |                        |                 |                         |                       |  |  |                    |  |
| 1000 | Trip No =      | Number of trip commands issued          | M                               |                         |                        |                 |                         |                       |  |  |                    |  |
| 1004 | Σ IL1/In=      | Summated current tripped IL1/In         | M                               |                         |                        |                 |                         |                       |  |  |                    |  |
| 1005 | Σ IL2/In=      | Summated current tripped IL2/In         | M                               |                         |                        |                 |                         |                       |  |  |                    |  |
| 1006 | Σ IL3/In=      | Summated current tripped IL3/In         | M                               |                         |                        |                 |                         |                       |  |  |                    |  |
| 1015 | IL1/In=        | Last trip current L1 IL1/In=            | M                               |                         |                        |                 |                         |                       |  |  |                    |  |
| 1016 | IL2/In=        | Last trip current L2 IL2/In=            | M                               |                         |                        |                 |                         |                       |  |  |                    |  |
| 1017 | IL3/In=        | Last trip current L3 IL3/In=            | M                               |                         |                        |                 |                         |                       |  |  |                    |  |
| 1156 | >CB Test       | >CB test start                          |                                 |                         | IOT                    |                 |                         |                       |  |  |                    |  |
| 1174 | CB in Test     | Circuit breaker test in progress        | on/off                          |                         |                        | 1               |                         | GI                    |  | 151  | 74                 |  |
| 1181 | CB Test Trip   | Circuit breaker test: General trip      | on                              |                         |                        | 1               |                         |                       |  | 151  | 81                 |  |
| 1401 | >b.u. CBF on   | >Switch on back-up breaker fail. prot.  |                                 |                         | IOT                    |                 |                         |                       |  |  |                    |  |
| 1402 | >b.u. CBF off  | >Switch off back-up breaker fail. prot. |                                 |                         | IOT                    |                 |                         |                       |  |  |                    |  |
| 1403 | >b.u. CBF blk. | >Block back-up breaker failure protect. | on/off                          |                         | IOT                    |                 |                         |                       |  |  |                    |  |
| 1451 | b.u. CBF off   | Back-up breaker fail.prot. switched off | on/off                          |                         | OT                     | 1               |                         | GI                    |  | 166  | 151                |  |
| 1452 | b.u. CBF blk.  | Back-up breaker fail.prot. is blocked   | on/off                          |                         | OT                     |                 |                         |                       |  |  |                    |  |
| 1453 | b.u. CBF act.  | Back-up breaker failure prot. is active |                                 |                         | OT                     | 1               |                         | GI                    |  | 166  | 153                |  |
| 1455 | b.u. CBF flt.  | Back-up breaker fail. prot.: fault det. |                                 | on                      | OT                     | 2               |                         |                       |  | 166  | 155                |  |
| 1471 | b.u. CBF Trip  | Trip by back-up breaker failure prot.   |                                 | on                      | OT                     | 2               |                         |                       | TA                                     | 166  | 171                |  |

| FNo. | Short Text    | Logical Function                        | Log Buffers                     |                         | Configurable in Matrix | IEC 60870-5-103 |                         |                       |  |  |
|------|---------------|---|---------------------------------|-------------------------|------------------------|-----------------|-------------------------|-----------------------|--|--|
|      |               |   | Event Log On/Off Measured Value | Trip (Fault) Log On/Off |                        | Data Unit       | Compatible Annunciation | General Interrogation | Annunc. for Fault Rec. Buffer (Tagged) | Type (p: Corresponds to parameter "Function type") |
| 1701 | >O/C Ph on    | >Switch on O/C protection phase         |                                 |                         | IOT                    |                 |                         |                       |  |  |
| 1702 | >O/C Ph off   | >Switch off O/C protection phase        |                                 |                         | IOT                    |                 |                         |                       |  |  |
| 1704 | >O/C Ph block | >Block overcurrent protection phases    | on/off                          |                         | IOT                    |                 |                         |                       |  |  |
| 1711 | >O/C E on     | >Switch on overcurrent protection earth |                                 |                         | IOT                    |                 |                         |                       |  |  |
| 1712 | >O/C E off    | >Switch off overcurrent protec. earth   |                                 |                         | IOT                    |                 |                         |                       |  |  |
| 1714 | >O/C E block  | >Block overcurrent protection earth     | on/off                          |                         | IOT                    |                 |                         |                       |  |  |
| 1721 | >I>> block    | >Overcurrent protection:block stage I>> | on/off                          |                         | IOT                    | 1               |                         | GI                    | 60                                     | 1  |
| 1722 | >I> block     | >Overcurrent protection:block stage I>  | on/off                          |                         | IOT                    | 1               |                         | GI                    | 60                                     | 2  |
| 1723 | >Ip block     | >Overcurrent protection:block stage Ip  | on/off                          |                         | IOT                    | 1               |                         | GI                    | 60                                     | 3  |
| 1724 | >IE>> block   | >Overcurrent protec.: block stage IE>>  | on/off                          |                         | IOT                    | 1               |                         | GI                    | 60                                     | 4  |
| 1725 | >IE> block    | >Overcurrent protection:block stage IE> | on/off                          |                         | IOT                    | 1               |                         | GI                    | 60                                     | 5  |
| 1726 | >IEp block    | >Overcurrent protection:block stage IEp | on/off                          |                         | IOT                    | 1               |                         | GI                    | 60                                     | 6  |
| 1751 | O/C Ph off    | Overcurrent prot. phase is switched off | on/off                          |                         | OT                     | 1               |                         | GI                    | 60                                     | 21   |
| 1752 | O/C Ph block  | Overcurrent prot. phase is blocked      | on/off                          |                         | OT                     |                 |                         |                       |  |  |
| 1753 | O/C Ph active | Overcurrent prot. phase is active       |                                 |                         | OT                     | 1               |                         | GI                    | 60                                     | 23   |
| 1754 | O/C I> off    | O/C protection phase is switched off I> | on/off                          |                         |                        | 1               |                         | GI                    | 60                                     | 24   |
| 1755 | O/C Ip off    | O/C protection phase is switched off Ip | on/off                          |                         |                        | 1               |                         | GI                    | 60                                     | 25   |
| 1756 | O/C E off     | O/C protection earth is switched off    | on/off                          |                         | IOT                    | 1               |                         | GI                    | 60                                     | 26   |
| 1757 | O/C E block   | O/C protection earth is blocked         |                                 |                         | OT                     |                 |                         |                       |  |  |
| 1758 | O/C E active  | O/C protection earth is active          |                                 |                         | OT                     | 1               |                         | GI                    | 60                                     | 28   |
| 1759 | O/C IE> off   | O/C prot. earth is switched off IE>     | on/off                          |                         |                        | 1               |                         | GI                    | 60                                     | 29   |
| 1760 | O/C IEp off   | O/C prot. earth is switched off IEp     | on/off                          |                         |                        | 1               |                         | GI                    | 60                                     | 30   |
| 1761 | O/C Gen.Fault | General fault detection O/C             |                                 |                         | OT                     | 2               | CA                      | GI                    | p                                      | 84   |
| 1762 | Fault L1      | O/C fault detection phase L1            |                                 |                         | OT                     | 2               | CA                      | GI                    | p                                      | 64   |
| 1763 | Fault L2      | O/C fault detection phase L2            |                                 |                         | OT                     | 2               | CA                      | GI                    | p                                      | 65   |
| 1764 | Fault L3      | O/C fault detection phase L3            |                                 |                         | OT                     | 2               | CA                      | GI                    | p                                      | 66   |
| 1765 | Fault E       | O/C fault detection earth               |                                 |                         | OT                     | 2               | CA                      | GI                    | p                                      | 67   |
| 1771 | Fault L1      | O/C fault detection L1 only             |                                 | on                      |                        | 2               |                         |                       | 60                                     | 31   |
| 1772 | Fault L1E     | O/C fault detection L1-E                |                                 | on                      |                        | 2               |                         |                       | 60                                     | 32   |
| 1773 | Fault L2      | O/C fault detection L2 only             |                                 | on                      |                        | 2               |                         |                       | 60                                     | 33   |
| 1774 | Fault L2E     | O/C fault detection L2-E                |                                 | on                      |                        | 2               |                         |                       | 60                                     | 34   |
| 1775 | Fault L12     | O/C fault detection L1-L2               |                                 | on                      |                        | 2               |                         |                       | 60                                     | 35   |
| 1776 | Fault L12E    | O/C fault detection L1-L2-E             |                                 | on                      |                        | 2               |                         |                       | 60                                     | 36   |
| 1777 | Fault L3      | O/C fault detection L3 only             |                                 | on                      |                        | 2               |                         |                       | 60                                     | 37   |
| 1778 | Fault L3E     | O/C fault detection L3-E                |                                 | on                      |                        | 2               |                         |                       | 60                                     | 38   |
| 1779 | Fault L13     | O/C fault detection L1-L3               |                                 | on                      |                        | 2               |                         |                       | 60                                     | 39   |
| 1780 | Fault L13E    | O/C fault detection L1-L3-E             |                                 | on                      |                        | 2               |                         |                       | 60                                     | 40   |
| 1781 | Fault L23     | O/C fault detection L2-L3               |                                 | on                      |                        | 2               |                         |                       | 60                                     | 41   |
| 1782 | Fault L23E    | O/C fault detection L2-L3-E             |                                 | on                      |                        | 2               |                         |                       | 60                                     | 42   |
| 1783 | Fault L123    | O/C fault detection L1-L2-L3            |                                 | on                      |                        | 2               |                         |                       | 60                                     | 43   |
| 1784 | Fault L123E   | O/C fault detection L1-L2-L3-E          |                                 | on                      |                        | 2               |                         |                       | 60                                     | 44   |
| 1785 | Fault E       | O/C fault detection E only              |                                 | on                      |                        | 2               |                         |                       | 60                                     | 45   |

| FNo. | Short Text     | Logical Function                        | Log Buffers                     |                         | Configurable in Matrix | IEC 60870-5-103 |                         |                       |  |  |                    |
|------|----------------|---|---------------------------------|-------------------------|------------------------|-----------------|-------------------------|-----------------------|--|--|--------------------|
|      |                |   | Event Log On/Off Measured Value | Trip (Fault) Log On/Off |                        | Data Unit       | Compatible Annunciation | General Interrogation | Annunc. for Fault Rec. Buffer (Tagged) | Type (p: Corresponds to parameter "Function type") | Information Number |
| 1791 | O/C Gen.Trip   | O/C general trip command                |                                 | on                      | OT                     | 2               | CA                      |                       | TA                                     | p  | 68                 |
| 1800 | I>> Fault      | O/C fault detection stage I>>           |                                 | on                      | OT                     |                 |                         |                       |  |  |                    |
| 1801 | I>> Fault L1   | O/C fault detection stage I>> phase L1  |                                 |                         | OT                     | 2               |                         | GI                    |  | 60   | 46                 |
| 1802 | I>> Fault L2   | O/C fault detection stage I>> phase L2  |                                 |                         | OT                     | 2               |                         | GI                    |  | 60   | 47                 |
| 1803 | I>> Fault L3   | O/C fault detection stage I>> phase L3  |                                 |                         | OT                     | 2               |                         | GI                    |  | 60   | 48                 |
| 1804 | T-I>> expired  | O/C time TI>> expired                   |                                 | on                      | OT                     | 2               |                         |                       |  | 60   | 49                 |
| 1805 | I>> Trip       | O/C protection I>> phase trip           |                                 |                         | OT                     | 2               | CA                      |                       |  | p  | 91                 |
| 1810 | I> Fault       | O/C fault detection stage I>            |                                 | on                      | OT                     |                 |                         |                       |  |  |                    |
| 1811 | I> Fault L1    | O/C fault detection stage I> phase L1   |                                 |                         | OT                     | 2               |                         | GI                    |  | 60   | 50                 |
| 1812 | I> Fault L2    | O/C fault detection stage I> phase L2   |                                 |                         | OT                     | 2               |                         | GI                    |  | 60   | 51                 |
| 1813 | I> Fault L3    | O/C fault detection stage I> phase L3   |                                 |                         | OT                     | 2               |                         | GI                    |  | 60   | 52                 |
| 1814 | T-I> expired   | O/C time TI> expired                    |                                 | v                       | OT                     | 2               |                         |                       |  | 60   | 53                 |
| 1815 | I> Trip        | O/C protection I> phase trip            |                                 |                         | OT                     | 2               | CA                      |                       |  | p  | 90                 |
| 1820 | Ip Fault       | O/C fault detection Ip                  |                                 | on                      | OT                     |                 |                         |                       |  |  |                    |
| 1821 | Ip Fault L1    | O/C fault detection Ip phase L1         |                                 |                         | OT                     | 2               |                         | GI                    |  | 60   | 54                 |
| 1822 | Ip Fault L2    | O/C fault detection Ip phase L2         |                                 |                         | OT                     | 2               |                         | GI                    |  | 60   | 55                 |
| 1823 | Ip Fault L3    | O/C fault detection Ip phase L3         |                                 |                         | OT                     | 2               |                         | GI                    |  | 60   | 56                 |
| 1824 | T-Ip expired   | O/C time TIp expired                    |                                 | on                      | OT                     | 2               |                         |                       |  | 60   | 57                 |
| 1825 | Ip Trip        | O/C protection Ip phase trip            |                                 |                         | OT                     | 2               |                         |                       |  | 60   | 58                 |
| 1831 | IE>> Fault     | O/C fault detection IE>> earth          |                                 | on                      | OT                     | 2               |                         | GI                    |  | 60   | 59                 |
| 1832 | T-IE>> expired | O/C time TIE>> expired                  |                                 | on                      | OT                     | 2               |                         |                       |  | 60   | 60                 |
| 1833 | IE>> Trip      | O/C protection IE>> earth trip          |                                 |                         | OT                     | 2               |                         |                       |  | 60   | 61                 |
| 1834 | IE> Fault      | O/C fault detection IE> earth           |                                 | on                      | OT                     | 2               |                         | GI                    |  | 60   | 62                 |
| 1835 | T-IE> expired  | O/C time TIE> expired                   |                                 | on                      | OT                     | 2               |                         |                       |  | 60   | 63                 |
| 1836 | IE> Trip       | O/C protection IE> earth trip           |                                 |                         | OT                     | 2               | CA                      |                       |  | p  | 92                 |
| 1837 | IEp Fault      | O/C fault detection IEp earth           |                                 | on                      | OT                     | 2               |                         | GI                    |  | 60   | 64                 |
| 1838 | T-IEp expired  | O/C time TIEp expired                   |                                 | on                      | OT                     | 2               |                         |                       |  | 60   | 65                 |
| 1839 | IEp Trip       | O/C protection IEp earth trip           |                                 |                         | OT                     | 2               |                         |                       |  | 60   | 66                 |
| 7601 | >Isolator1on   | >Isolator 1 - position closed           | on/off                          |                         | IOT                    |                 |                         |                       |  |  |                    |
| 7602 | >Isolator1off  | >Isolator 1 - position open             | on/off                          |                         | IOT                    |                 |                         |                       |  |  |                    |
| 7603 | >Isolator2on   | >Isolator 2 - position closed           | on/off                          |                         | IOT                    |                 |                         |                       |  |  |                    |
| 7604 | >Isolator2off  | >Isolator 2 - position open             | on/off                          |                         | IOT                    |                 |                         |                       |  |  |                    |
| 7605 | >Isolator3on   | >Isolator 3 - position closed           | on/off                          |                         | IOT                    |                 |                         |                       |  |  |                    |
| 7606 | >Isolator3off  | >Isolator 3 - position open             | on/off                          |                         | IOT                    |                 |                         |                       |  |  |                    |
| 7607 | >Isolator4on   | >Isolator 4 - position closed           | on/off                          |                         | IOT                    |                 |                         |                       |  |  |                    |
| 7608 | >Isolator4off  | >Isolator 4 - position open             | on/off                          |                         | IOT                    |                 |                         |                       |  |  |                    |
| 7609 | >Isolator5on   | >Isolator 5 - position closed           | on/off                          |                         | IOT                    |                 |                         |                       |  |  |                    |
| 7610 | >Isolator5off  | >Isolator 5 - position open             | on/off                          |                         | IOT                    |                 |                         |                       |  |  |                    |
| 7611 | >CBF L1        | >Circuit breaker failure start phase L1 | on                              |                         | IOT                    | 1               |                         |                       | TA                                     | 194  | 70                 |
| 7612 | >CBF L2        | >Circuit breaker failure start phase L2 | on                              |                         | IOT                    | 1               |                         |                       | TA                                     | 194  | 71                 |
| 7613 | >CBF L3        | >Circuit breaker failure start phase L3 | on                              |                         | IOT                    | 1               |                         |                       | TA                                     | 194  | 72                 |
| 7614 | >CBF puls      | >Circuit breaker failure pulse          | on                              |                         | IOT                    | 1               |                         |                       | TA                                     | 194  | 73                 |

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|------|----------------|---|---------------------------------|-------------------------|------------------------|-----------------|-------------------------|-----------------------|--|--|--------------------|
|      |                |   | Event Log On/Off Measured Value | Trip (Fault) Log On/Off |                        | Data Unit       | Compatible Annunciation | General Interrogation | Annunc. for Fault Rec. Buffer (Tagged) | Type (p: Corresponds to parameter "Function type") | Information Number |
| 7615 | >CBF release   | >Circuit breaker failure release        | on/off                          |                         | IOT                    | 1               |                         |                       | TA                                     | 194  | 74                 |
| 7616 | >TRIP release  | >Trip release                           | on/off                          |                         | IOT                    | 1               |                         |                       | TA                                     | 194  | 75                 |
| 7617 | >CB OFF        | >Circuit breaker open                   | on/off                          |                         | IOT                    |                 |                         |                       |  |  |                    |
| 7618 | >CB man.close  | >Circuit breaker manual close           | on                              |                         | IOT                    | 1               |                         |                       | TA                                     | 194  | 77                 |
| 7619 | >CB not ready  | >Circuit breaker not ready              | on/off                          |                         | IOT                    | 1               |                         | GI                    |  | 194  | 78                 |
| 7620 | >Bay o.of ser. | >Bay out of service                     | on/off                          |                         | IOT                    | 1               |                         | GI                    |  | 194  | 79                 |
| 7621 | >CBF 3-pole    | >Circuit breaker failure start 3-pole   | on/off                          |                         | IOT                    | 1               |                         |                       | TA                                     | 194  | 80                 |
| 7622 | >CBF rel.3p.   | >Circuit breaker failure release 3-pole | on/off                          |                         | IOT                    | 1               |                         |                       | TA                                     | 194  | 81                 |
| 7623 | >CB ON         | >Circuit breaker closed                 | on/off                          |                         | IOT                    |                 |                         |                       |  |  |                    |
| 7624 | >Isol.maint.   | >Isolator maintenance                   | on/off                          |                         | IOT                    | 1               |                         | GI                    |  | 194  | 83                 |
| 7625 | >b.u.CBF L1    | >Back-up breaker failure start phase L1 | on                              |                         | IOT                    | 1               |                         |                       | TA                                     | 194  | 84                 |
| 7626 | >b.u.CBF L2    | >Back-up breaker failure start phase L2 | on                              |                         | IOT                    | 1               |                         |                       | TA                                     | 194  | 85                 |
| 7627 | >b.u.CBF L3    | >Back-up breaker failure start phase L3 | on                              |                         | IOT                    | 1               |                         |                       | TA                                     | 194  | 86                 |
| 7628 | >b.u.CBF 3pol  | >Back-up breaker failure start 3-pole   | on                              |                         | IOT                    | 1               |                         |                       | TA                                     | 194  | 87                 |
| 7629 | >Blk.BB TRIP   | >Block TRIP commands of whole busbar    | on                              |                         | IOT                    |                 |                         |                       |  |  |                    |
| 7630 | BB flt.detect  | Busbar protection: Fault detected       |                                 | on                      |                        | 2               |                         | GI                    |  | 194  | 90                 |
| 7631 | BB Trip L123   | Busbar protection: Trip in phase L123   |                                 | on                      | OT                     | 2               |                         |                       | TA                                     | 194  | 100                |
| 7632 | CBF Trp.rp.3p  | CBF protection: Trip repeat phase L123  |                                 | on                      | OT                     | 2               |                         |                       | TA                                     | 194  | 101                |
| 7633 | CBF Trp.rp.L1  | CBF protection: Trip repeat phase L1    |                                 | on                      | OT                     | 2               |                         |                       | TA                                     | 194  | 102                |
| 7634 | CBF Trp.rp.L2  | CBF protection: Trip repeat phase L2    |                                 | on                      | OT                     | 2               |                         |                       | TA                                     | 194  | 103                |
| 7635 | CBF Trp.rp.L3  | CBF protection: Trip repeat phase L3    |                                 | on                      | OT                     | 2               |                         |                       | TA                                     | 194  | 104                |
| 7636 | CB Test L1     | Circuit breaker test: Trip phase L1     |                                 | on                      | OT                     | 2               |                         |                       |  | 194  | 105                |
| 7637 | CB Test L2     | Circuit breaker test: Trip phase L2     |                                 | on                      | OT                     | 2               |                         |                       |  | 194  | 106                |
| 7638 | CB Test L3     | Circuit breaker test: Trip phase L3     |                                 | on                      | OT                     | 2               |                         |                       |  | 194  | 107                |
| 7639 | Intertrip      | Intertrip                               |                                 | on                      | OT                     | 2               |                         |                       |  | 194  | 108                |
| 7640 | Bay o.of serv. | Bay is out of service                   | on/off                          |                         | OT                     |                 |                         |                       |  |  |                    |
| 7641 | Isol.mainten.  | Isolator maintenance                    | on/off                          |                         | OT                     |                 |                         |                       |  |  |                    |
| 7642 | CB not plaus.  | State of circuit breaker not plausible  | on/off                          |                         | OT                     | 1               |                         |                       |  | 194  | 124                |
| 7643 | CBF Trip L123  | CBF protection: Trip L123               |                                 | on                      | OT                     | 2               |                         |                       | TA                                     | 194  | 125                |
| 7644 | End-Flt. Trip  | End fault protection: Trip phase L123   |                                 | on                      | OT                     | 2               |                         |                       | TA                                     | 194  | 126                |
| 7645 | Trip blocked   | Trip is blocked by Central Unit         | on/off                          |                         | OT                     |                 |                         |                       |  |  |                    |
| 7646 | CBF-Prot.bloc  | CBF protection blocked by Central Unit  | on/off                          |                         | OT                     |                 |                         |                       |  |  |                    |
| 7650 | Fail Com.CU    | Failure in communication w.Central Unit | on/off                          |                         | O                      | 1               |                         | GI                    |  | 194  | 121                |
| 7651 | Param.f.CU     | Receiving parameters from Central Unit  | on                              |                         |                        | 1               |                         |                       |  | 194  | 122                |
| 7652 | Fail MV.Offs.  | Failure in offset of measured values    | on/off                          |                         | O                      | 1               |                         | GI                    |  | 194  | 129                |
| 7656 | CT inversion   | Inversion polarity of curr. transformer | on/off                          |                         | OT                     |                 |                         |                       |  |  |                    |
| 7657 | BB TRIP block  | TRIP commands of whole busbar blocked   | on/off                          |                         | OT                     |                 |                         |                       |  |  |                    |
| 7658 | BF BZ blkd.    | BF (ext.start) of whole busbar blocked  | on/off                          |                         | OT                     |                 |                         |                       |  |  |                    |
| 7659 | Test mode      | Test mode of protective functions       | on/off                          |                         | OT                     |                 |                         |                       |  |  |                    |
| 7672 | IDL1 =         | Bus Zone: Idiff L1 =                    | M                               |                         |                        |                 |                         |                       |  |  |                    |
| 7673 | IDL2 =         | Bus Zone: Idiff L2 =                    | M                               |                         |                        |                 |                         |                       |  |  |                    |
| 7674 | IDL3 =         | Bus Zone: Idiff L3 =                    | M                               |                         |                        |                 |                         |                       |  |  |                    |

| FNo. | Short Text    | Logical Function                        | Log Buffers                     |                         | Configurable in Matrix | IEC 60870-5-103 |                         |                       |  |  |                    |  |
|------|---------------|---|---------------------------------|-------------------------|------------------------|-----------------|-------------------------|-----------------------|--|--|--------------------|--|
|      |               |   | Event Log On/Off Measured Value | Trip (Fault) Log On/Off |                        | Data Unit       | Compatible Annunciation | General Interrogation | Annunc. for Fault Rec. Buffer (Tagged) | Type (p: Corresponds to parameter "Function type") | Information Number |  |
| 7675 | ISL1 =        | Bus Zone: Istab L1 =                    | M                               |                         |                        |                 |                         |                       |  |  |                    |  |
| 7676 | ISL2 =        | Bus Zone: Istab L2 =                    | M                               |                         |                        |                 |                         |                       |  |  |                    |  |
| 7677 | ISL3 =        | Bus Zone: Istab L3 =                    | M                               |                         |                        |                 |                         |                       |  |  |                    |  |
| 7684 | IL1=          | Current in phase L1 =                   | M                               |                         |                        |                 |                         |                       |  |  |                    |  |
| 7685 | IL2=          | Current in phase L2 =                   | M                               |                         |                        |                 |                         |                       |  |  |                    |  |
| 7686 | IL3=          | Current in phase L3 =                   | M                               |                         |                        |                 |                         |                       |  |  |                    |  |
| 7687 | IE=           | Earth current IE =                      | M                               |                         |                        |                 |                         |                       |  |  |                    |  |
| 7689 | TR fIt,Trp.po | Relay control circuit fIt.,trip possib. | on/off                          |                         | OT                     | 1               |                         | GI                    |  | 194  | 144                |  |
| 7690 | >Blk.BF of BB | >Block.BF (ex.start) of whole busbar    | on/off                          | on                      | IOT                    |                 |                         |                       |  |  |                    |  |
| 7691 | TR1fIt,Trp.np | Relay1 control circuit fIt.,no trip pos | on/off                          |                         | OT                     | 1               |                         | GI                    |  | 194  | 145                |  |
| 7692 | TR2fIt,Trp.np | Relay2 control circuit fIt.,no trip pos | on/off                          |                         | OT                     | 1               |                         | GI                    |  | 194  | 146                |  |
| 7693 | TR3fIt,Trp.np | Relay3 control circuit fIt.,no trip pos | on/off                          |                         | OT                     | 1               |                         | GI                    |  | 194  | 147                |  |
| 7694 | TR4fIt,Trp.np | Relay4 control circuit fIt.,no trip pos | on/off                          |                         | OT                     | 1               |                         | GI                    |  | 194  | 148                |  |
| 7695 | TR5fIt,Trp.np | Relay5 control circuit fIt.,no trip pos | on/off                          |                         | OT                     | 1               |                         | GI                    |  | 194  | 149                |  |
| 7696 | Annunc. 1     | User defined annunciation 1             | on/off                          |                         | OT                     |                 |                         |                       |  |  |                    |  |
| 7697 | Annunc. 2     | User defined annunciation 2             | on/off                          |                         | OT                     |                 |                         |                       |  |  |                    |  |
| 7698 | Annunc. 3     | User defined annunciation 3             | on/off                          |                         | OT                     |                 |                         |                       |  |  |                    |  |
| 7699 | Annunc. 4     | User defined annunciation 4             | on/off                          |                         | OT                     |                 |                         |                       |  |  |                    |  |

## A.11 Group Alarms - Central Unit

|                      |   |
|----------------------|---|
| <b>Abbreviations</b> | \$00, ..., \$03 are variables which are replaced automatically with       |
|                      | \$00 Number of the bay unit   |
|                      | \$01 Bay name   |
|                      | \$02 Name of the switching element (e.g. Disconnecter or circuit breaker) |
|                      | \$03 Name of the bus zone   |
|                      | BU <sub>nn</sub> Bay number 01 to 48                                      |
|                      | BSZ <sub>z</sub> Modules for protection processing BSZ1, BSZ2, BSZ3       |
|                      | Ln Phase L1, L2, L3   |
|                      | BZ <sub>nn</sub> Bus zone 01 to12   |
|                      | Dcon Disconnecter 1 to 5  |

| Group Alarm |                                   | Alarm    |   |                               |
|-------------|-----------------------------------|----------|---|-------------------------------|
| FNo.        | Description                       | FNo.     | Logical function  | Relates to                    |
| 10476       | Error with protection blocking    | 10455    | Bay unit failure  | BU <sub>nn</sub>              |
|             |                                   | 10425    | Disconnecter fault alarm <sup>1</sup>                   | BU <sub>nn</sub> , Dcon       |
|             |                                   | 10443    | BZ blocked selective (g. a.)                            | BZ <sub>nn</sub>              |
|             |                                   | 10410    | Diff-current superv. CZ (group alarm) <sup>2</sup>      | Ln                            |
|             |                                   | 10415    | Diff-current superv. BZ (group alarm) <sup>3</sup>      | BZ <sub>nn</sub> , Ln, BSZ2/3 |
|             |                                   | 176.1171 | 15V supply supervision \$00                             | BU <sub>nn</sub>              |
|             |                                   | 176.1172 | 5V supply supervision \$00                              | BU <sub>nn</sub>              |
|             |                                   | 176.1173 | 0V supply supervision \$00                              | BU <sub>nn</sub>              |
|             |                                   | 10423    | Measured value superv. BU (group alarm) <sup>7</sup>    | BU <sub>nn</sub>              |
|             |                                   | 10444    | Blocking by supervision zero crossing (Block ZeroCross) | BZ <sub>nn</sub>              |
| 10475       | Error without protection blocking | 10425    | Disconnecter fault alarm <sup>4</sup>                   | BU <sub>nn</sub> , Dcon       |
|             |                                   | 10410    | Diff-current superv. CZ (group alarm) <sup>5</sup>      | Ln                            |
|             |                                   | 10415    | Diff-current superv. BZ (group alarm) <sup>6</sup>      | BZ <sub>nn</sub> , Ln, BSZ2/3 |
|             |                                   | 10420    | 15V supply supervision central uni                      |                               |
|             |                                   | 10421    | 24V supply supervision central uni                      |                               |
|             |                                   | 10422    | Battery supervision central unit                        |                               |
|             |                                   | 176.1174 | Battery supervision \$00                                | BU <sub>nn</sub>              |
|             |                                   | 10423    | Measured value superv. BU (group alarm) <sup>8</sup>    | BU <sub>nn</sub>              |
| 10445       | Device Trip                       | 177.1342 | Trip command for \$03 L1                                | BZ <sub>nn</sub>              |
|             |                                   | 177.1352 | Trip command BF for \$03 phase L1                       | BZ <sub>nn</sub>              |
|             |                                   | 177.1343 | Trip command for \$03 L2                                | BZ <sub>nn</sub>              |
|             |                                   | 177.1353 | Trip command BF for \$03 phase L2                       | BZ <sub>nn</sub>              |
|             |                                   | 177.1344 | Trip command for \$03 L3                                | BZ <sub>nn</sub>              |
|             |                                   | 177.1354 | Trip command BF for \$03 phase L3                       | BZ <sub>nn</sub>              |

| Group Alarm |                                      | Alarm    |                                       |            |
|-------------|--------------------------------------|----------|---------------------------------------|------------|
| FNo.        | Description                          | FNo.     | Logical function                      | Relates to |
| 10449       | Trip command BBP                     | 177.1342 | Trip command for \$03 L1              | BZnn       |
|             |                                      | 177.1343 | Trip command for \$03 L2              | BZnn       |
|             |                                      | 177.1344 | Trip command for \$03 L3              | BZnn       |
| 10436       | Trip command BF                      | 177.1352 | Trip command BF for \$03 phase L1     | BZnn       |
|             |                                      | 177.1353 | Trip command BF for \$03 phase L2     | BZnn       |
|             |                                      | 177.1354 | Trip command BF for \$03 phase L3     | BZnn       |
| 177.1341    | Trip command for \$03                | 177.1342 | Trip command for \$03 L1              | BZnn       |
|             |                                      | 177.1352 | Trip command BF for \$03 phase L1     | BZnn       |
|             |                                      | 177.1343 | Trip command for \$03 L2              | BZnn       |
|             |                                      | 177.1353 | Trip command BF for \$03 phase L2     | BZnn       |
|             |                                      | 177.1344 | Trip command for \$03 L3              | BZnn       |
|             |                                      | 177.1354 | Trip command BF for \$03 phase L3     | BZnn       |
| 10446       | Trip command L1                      | 177.1342 | Trip command for \$03 L1              | BZnn       |
|             |                                      | 177.1352 | Trip command BF for \$03 phase L1     | BZnn       |
| 10447       | Trip command L2                      | 177.1343 | Trip command for \$03 L2              | BZnn       |
|             |                                      | 177.1353 | Trip command BF for \$03 phase L2     | BZnn       |
| 10448       | Trip command L3                      | 177.1344 | Trip command for \$03 L3              | BZnn       |
|             |                                      | 177.1354 | Trip command BF for \$03 phase L3     | BZnn       |
| 10450       | Trip repeat BU                       | 176.1071 | Trip repeat \$00 phase L1             | BUnn       |
|             |                                      | 176.1072 | Trip repeat \$00 phase L2             | BUnn       |
|             |                                      | 176.1073 | Trip repeat \$00 phase L3             | BUnn       |
| 10433       | Breaker Failure/Transfer Trip        | 176.1082 | Breaker failure/Transfer trip \$00    | BUnn       |
| 10434       | Disturbance BF input (group alarm)   | 176.1091 | Disturbance BF input \$00 L1          | BUnn       |
|             |                                      | 176.1092 | Disturbance BF input \$00 L2          | BUnn       |
|             |                                      | 176.1093 | Disturbance BF input \$00 L3          | BUnn       |
|             |                                      | 176.1094 | Disturbance BF input \$00 3pole       | BUnn       |
| 10435       | Disturbance BF release (group alarm) | 176.1101 | Disturbance BF release input \$00 1P  | BUnn       |
|             |                                      | 176.1102 | Disturbance BF release input \$00 3P  | BUnn       |
| 10437       | Disturbance BF impulse input (g.a.)  | 176.1104 | Disturbance BF pulse input \$00       | BUnn       |
| 10453       | Bay out of service                   | 176.1061 | Bay \$00 out of service               | BUnn       |
| 10454       | Maintenance of bay (group alarm)     | 176.1062 | \$00 disconnecter maintenance         | BUnn       |
| 10471       | Disconnecter oper. prohibited        | 176.1062 | \$00 disconnecter maintenance         | BUnn       |
|             |                                      | 177.1338 | Blocked Trip command \$03             | BZnn       |
|             |                                      | 177.1348 | Blocked BF protection for \$03        | BZnn       |
| 10455       | Bay unit failure                     | 176.1063 | Bay unit \$00 failure                 | BUnn       |
| 10451       | Transformer reversed in polarity     | 176.1195 | Transformer reversed in polarity \$00 | BUnn       |
| 10456       | Circuit breaker fault                | 176.1136 | Circuit breaker fault \$01            | BUnn       |

| Group Alarm |  | Alarm    |  |            |
|-------------|--|----------|--|------------|
| FNo.        | Description                                | FNo.     | Logical function   | Relates to |
| 10424       | Supply voltage superv. BU                  | 176.1171 | 15V supply supervision \$00                              | BUnn       |
|             |  | 176.1172 | 5V supply supervision \$00                               | BUnn       |
|             |  | 176.1173 | 0V supply supervision \$00                               | BUnn       |
| 10443       | BZ blocked selective (g. a.)               | 177.1333 | Measuring system blocked by fault \$03                   | BZnn       |
| 10425       | Disconnecter fault alarm                   | 10426    | Failure of disconnector aux. voltage (g.a.) <sup>1</sup> | BUnn       |
|             |  | 10427    | Disconnecter fault: run time (group alarm) <sup>1</sup>  | BUnn, Dcon |
|             |  | 10428    | Disconnecter position faulty (group alarm) <sup>1</sup>  | BUnn, Dcon |
| 10427       | Disconnecter fault: run time               | 176.1112 | Fault: run time \$01 disconnector \$02                   | BUnn       |
|             |  | 176.1117 | Fault: run time \$01 disconnector \$02                   | BUnn       |
|             |  | 176.1122 | Fault: run time \$01 disconnector \$02                   | BUnn       |
|             |  | 176.1127 | Fault: run time \$01 disconnector \$02                   | BUnn       |
|             |  | 176.1132 | Fault: run time \$01 disconnector \$02                   | BUnn       |
| 10428       | Disconnecter position faulty (group alarm) | 176.1113 | Fault: dist. position \$01 disconnector \$02             | BUnn       |
|             |  | 176.1118 | Fault: dist. position \$01 disconnector \$02             | BUnn       |
|             |  | 176.1123 | Fault: dist. position \$01 disconnector \$02             | BUnn       |
|             |  | 176.1128 | Fault: dist. position \$01 disconnector \$02             | BUnn       |
|             |  | 176.1133 | Fault: dist. position \$01 disconnector \$02             | BUnn       |
| 10410       | Diff-current superv. CZ                    | 10411    | Diff-current supervision Check Zone L1                   |            |
|             |  | 10412    | Diff-current supervision Check Zone L2                   |            |
|             |  | 10413    | Diff-current supervision Check Zone L3                   |            |
| 10415       | Diff-current superv. BZ                    | 177.1321 | Id-sup \$03 L1-2   | BZnn       |
|             |  | 177.1322 | Id-sup \$03 L2-2   | BZnn       |
|             |  | 177.1323 | Id-sup \$03 L3-2   | BZnn       |
|             |  | 177.1326 | Id-sup \$03 L1-3   | BZnn       |
|             |  | 177.1327 | Id-sup \$03 L2-3   | BZnn       |
|             |  | 177.1328 | Id-sup \$03 L3-3   | BZnn       |
| 10416       | Diff-current superv. BZ L1                 | 177.1321 | Id-sup \$03 L1-2   | BZnn       |
|             |  | 177.1326 | Id-sup \$03 L1-3   | BZnn       |
| 10417       | Diff-current superv. BZ L2                 | 177.1322 | Id-sup \$03 L2-2   | BZnn       |
|             |  | 177.1327 | Id-sup \$03 L2-3   | BZnn       |
| 10418       | Diff-current superv. BZ L3                 | 177.1323 | Id-sup \$03 L3-2   | BZnn       |
|             |  | 177.1328 | Id-sup \$03 L3-3   | BZnn       |



| Group Alarm |                           | Alarm    |                                   |                  |
|-------------|---------------------------|----------|-----------------------------------|------------------|
| FNo.        | Description               | FNo.     | Logical function                  | Relates to       |
| 10423       | Measured value superv. BU | 176.1175 | Measured value superv. \$00       | BU <sub>nn</sub> |
| 10429       | Failure in auto testing   | 176.1190 | Failure in automatic testing \$00 | BU <sub>nn</sub> |

- 1 If Parameter **DCO Malfunc**(6302/CU) is set to **Blocking**.
- 2 If Parameter **DIF SUP mode CZ** (6311/CU) is set to **Blocking**.
- 3 If Parameter **DIF SUP mode BZ**(6310/CU) is set to **Blocking**.
- 4 If Parameter **DCO Malfunc** (6302/CU) s set to **alarm only**.
- 5 If Parameter **DIF SUP mode CZ** (6311/CU) is set to **alarm only**.
- 6 If Parameter **DIF SUP mode BZ** (6310/CU) is set t **oalarm only**.
- 7 If the bay unit is connected to any busbar.
- 8 If the bay unit is not connected to any busbar.

## A.12 Group Alarms - Bay Unit

| Group Alarm |  | Alarm |   |
|-------------|--|-------|---|
| FNo.        | Description                            | FNo.  | Logical function  |
| 140         | General internal failure of device     | 161   | Only existing alarm is 161.   |
| 161         | Measured value supervision of currents | 161   | Standard-Group Alarms for all Measured Value Supervisions. On BU the summation current will be monitored. |
| 501         | General fault detection of device      | 1455  | Back-up breaker fail. prot.: fault det.   |
|             |  | 1761  | General fault detection O/C   |
|             |  | 7630  | Busbar protection: Fault detected   |
| 511         | General trip of device                 | 1471  | Trip by back-up breaker failure prot.   |
|             |  | 1791  | O/C general trip command  |
|             |  | 7631  | Busbar protection: Trip in phase L123   |
|             |  | 7632  | CBF protection: Trip repeat phase L123  |
|             |  | 7633  | CBF protection: Trip repeat phase L1  |
|             |  | 7634  | CBF protection: Trip repeat phase L2  |
|             |  | 7635  | CBF protection: Trip repeat phase L3  |
|             |  | 7643  | CBF protection: Trip L123   |
|             |  | 7644  | End fault protection: Trip phase L123   |

## A.13 Measured Value List - Central Unit

### Abbreviations

\$00, ..., \$03 are variables which are replaced automatically by

### Comments

\$00 Number of the bay unit

\$01 Bay name

\$02 Name of the switching element (e.g. disconnector or circuit breaker)

\$03 Name of the bus zone

**Column Function:** Checkzone  $I_d$ ,  $I_s$  is not allocatable to the control center.

**Column Information No. (Function Bus Zone):** The bus zones1 to12 are assigned to the Information numbers 100 to111. The basic-information number is given in brackets.

**Column Information No. (Function Bay Unit):** The Information number corresponds to the number of the bay unit assigned by you. The basic Information number is given in brackets.

**Column Position:** The positions of the information in a block correspond to the position given in the table. The basic-position number is given in brackets.

**Column Configurable in Matrix:** Control display and Default display not in 7SS52 V4.

| FNo.     | Description                           | Function        | IEC 60870-5-103 |                 |               |           |          | Configurable in Matrix |                 |                 |
|----------|---------------------------------------|-----------------|-----------------|-----------------|---------------|-----------|----------|------------------------|-----------------|-----------------|
|          |                                       |                 | Function type   | Information No. | Compatibility | Data Unit | Position | CFC                    | Control Display | Default Display |
| 10401    | CZ Idiff L1= (CZ Id1=)                | CZ Id, Is       |                 |                 |               |           |          | CFC                    |                 |                 |
| 10402    | CZ Idiff L2= (CZ Id2=)                | CZ Id, Is       |                 |                 |               |           |          | CFC                    |                 |                 |
| 10403    | CZ Idiff L3= (CZ Id3=)                | CZ Id, Is       |                 |                 |               |           |          | CFC                    |                 |                 |
| 10404    | CZ Istab L1= (CZ Is1=)                | CZ Id, Is       |                 |                 |               |           |          | CFC                    |                 |                 |
| 10405    | CZ Istab L2= (CZ Is2=)                | CZ Id, Is       |                 |                 |               |           |          | CFC                    |                 |                 |
| 10406    | CZ Istab L3= (CZ Is3=)                | CZ Id, Is       |                 |                 |               |           |          | CFC                    |                 |                 |
| 176.1011 | Current \$01 in phase L1= (\$01 IL1=) | BU@             | 132             | (1)             | priv          | 9         | (1)      | CFC                    |                 |                 |
| 176.1012 | Current \$01 in phase L2= (\$01 IL2=) | BU@             | 132             | (1)             | priv          | 9         | (2)      | CFC                    |                 |                 |
| 176.1013 | Current \$01 in phase L3= (\$01 IL3=) | BU@             | 132             | (1)             | priv          | 9         | (3)      | CFC                    |                 |                 |
| 177.1301 | \$03 Idiff L1= (\$03 Id1=)            | Protection Zone | 132             | (100)           | priv          | 9         | (1)      | CFC                    |                 |                 |
| 177.1302 | \$03 Idiff L2= (\$03 Id2=)            | Protection Zone | 132             | (100)           | priv          | 9         | (2)      | CFC                    |                 |                 |
| 177.1303 | \$03 Idiff L3= (\$03 Id3=)            | Protection Zone | 132             | (100)           | priv          | 9         | (3)      | CFC                    |                 |                 |
| 177.1306 | \$03 Istab L1= (\$03 Is1=)            | Protection Zone | 132             | (100)           | priv          | 9         | (4)      | CFC                    |                 |                 |
| 177.1307 | \$03 Istab L2= (\$03 Is2=)            | Protection Zone | 132             | (100)           | priv          | 9         | (5)      | CFC                    |                 |                 |
| 177.1308 | \$03 Istab L3= (\$03 Is3=)            | Protection Zone | 132             | (100)           | priv          | 9         | (6)      | CFC                    |                 |                 |

## A.14 Measured Value List - Bay Unit

| FNo. | Description                       | Function | IEC 60870-5-103 |                 |               |           |          | Configurable in Matrix |                 |                 |
|------|-----------------------------------|----------|-----------------|-----------------|---------------|-----------|----------|------------------------|-----------------|-----------------|
|      |                                   |          | Function type   | Information No. | Compatibility | Data Unit | Position | CFC                    | Control Display | Default Display |
| 5701 | IL1 = Current in phase L1 = %In   |          |                 |                 |               |           |          |                        |                 |                 |
| 5702 | IL2 = Current in phase L2 = %In   |          |                 |                 |               |           |          |                        |                 |                 |
| 5703 | IL3 = Current in phase L3 = %In   |          |                 |                 |               |           |          |                        |                 |                 |
| 5704 | IE = Earth Current = %In          |          |                 |                 |               |           |          |                        |                 |                 |
| 5705 | IL1 = Current in phase L1 = A     |          |                 |                 |               |           |          |                        |                 |                 |
| 5706 | IL2 = Current in phase L2 = A     |          |                 |                 |               |           |          |                        |                 |                 |
| 5707 | IL3 = Current in phase L3 = A     |          |                 |                 |               |           |          |                        |                 |                 |
| 5708 | IE = Earth Current = A            |          |                 |                 |               |           |          |                        |                 |                 |
| 5709 | IL1 = Current in phase IL1 = %Ino |          |                 |                 |               |           |          |                        |                 |                 |
| 5710 | IL2 = Current in phase IL2 = %Ino |          |                 |                 |               |           |          |                        |                 |                 |
| 5711 | IL3 = Current in phase IL3 = %Ino |          |                 |                 |               |           |          |                        |                 |                 |
| 5712 | IE = Earth Current = %Ino         |          |                 |                 |               |           |          |                        |                 |                 |
| 5713 | IDL1 = Bus Zone: Idiff L1 = %Ino  |          |                 |                 |               |           |          |                        |                 |                 |
| 5714 | IDL2 = Bus Zone: Idiff L2 = %Ino  |          |                 |                 |               |           |          |                        |                 |                 |
| 5715 | IDL3 = Bus Zone: Idiff L3 = %Ino  |          |                 |                 |               |           |          |                        |                 |                 |
| 5716 | ISL1 = Bus Zone: Istab L1 = %Ino  |          |                 |                 |               |           |          |                        |                 |                 |
| 5717 | ISL2 = Bus Zone: Istab L2 = %Ino  |          |                 |                 |               |           |          |                        |                 |                 |
| 5718 | ISL3 = Bus Zone: Istab L3 = %Ino  |          |                 |                 |               |           |          |                        |                 |                 |
| 5719 | f [Hz] = Frequency f [Hz] = Hz    |          |                 |                 |               |           |          |                        |                 |                 |

## A.15 Marshalling - Central Unit

When the device leaves the factory, the annunciations for the binary inputs, relays, LEDs and function keys are preallocated for the maximum scope. For the preallocation, please refer to Table A-22, page 429.

Table A-22 Marshalling of the Binary Inputs

| Binary Input | Annunciation    | FNo.  | Comments                               |
|--------------|-----------------|-------|--|
| 1            | >Reset LED      | 5     | Reset LED diplays                      |
| 2            | >Start FltRec   | 4     | Start fault recording                  |
| 3            | >Time synchron  | 3     | Time synchronization                   |
| 4            | empty           | –     | empty                                  |
| 5            | empty           | –     | empty                                  |
| 6            | >Reset Id-Block | 10461 | Reset blocking of diff-current superv. |
| 7            | >Reset DcoMalBl | 10465 | >Reset blocking of disconnecter fault  |
| 8            | empty           | –     | empty                                  |
| ...          | ...             | ...   | ...                                    |
| 12           | empty           | –     | empty                                  |

Table A-23 Marshalling of the Relay

| Relay | Annunciation    | FNo.  | Comments                             |
|-------|-----------------|-------|--------------------------------------|
| 1     | Err PROT BLOCK  | 10476 | Error with protection blocking       |
| 2     | Err PROT ACTIVE | 10475 | Error without protection blocking    |
| 3     | BU fail G       | 10455 | Bay unit failure                     |
| 3     | Meas sup BU G   | 10423 | Measured value superv. BU            |
| 4     | 15V-superv CU   | 10420 | 15V supply supervision central unit  |
|       | 24V-superv CU   | 10421 | 24V supply supervision central unit  |
|       | Batt. superv CU | 10422 | Battery supervision central unit     |
|       | Supply sup BU G | 10424 | Supply voltage superv. BU            |
| 5     | Flt autotest G  | 10429 | Failure in auto testing              |
| 6     | not assigned    | –     | not assigned                         |
| 7     | BF Imp Dist. G  | 10437 | Disturbance BF impulse input (g.a.)  |
|       | BF Rel. Dist. G | 10435 | Disturbance BF release (group alarm) |
|       | BF Inp. Dist. G | 10434 | Disturbance BF input (group alarm)   |

| Relay | Annunciation    | FNo.  | Comments                             |
|-------|-----------------|-------|--------------------------------------|
| 8     | Id-sup CZ G     | 10410 | Diff-current superv. CZ              |
|       | Id-sup BZ G     | 10415 | Diff-current superv. BZ              |
| 9     | CB fault G      | 10456 | Circuit breaker fault                |
|       | Bay DC fail G   | 10426 | Failure of disconnecter aux. voltage |
|       | Dco flt run G   | 10427 | Disconnecter fault: run time         |
|       | Dco flt pos G   | 10428 | Disconnecter position faulty         |
|       | Dco flt alarm   | 10425 | Disconnecter fault alarm             |
| 10    | TRIP blocked    | 10442 | TRIP commands blocked                |
| 11    | BF blocked      | 10432 | Breaker Failure Protection blocked   |
| 12    | Maintenance G   | 10454 | Maintenance of bay                   |
|       | out of serv. G  | 10453 | Bay out of service                   |
| 13    | DcoProhib/fault | 10470 | Disconnecter oper. prohibited        |
|       | DcoProhib G     | 10471 | Disconnecter oper. prohibited        |
| 14    | TripRep BU G    | 10450 | Trip repeat BU                       |
| 15    | Transf. Trip G  | 10433 | Breaker Failure/Transfer Trip        |
| 16    | Device Trip     | 10445 | Device Trip                          |

Table A-24 Marshalling of the LEDs

| LED | Annunciation    | FNo   | Comments                             |
|-----|-----------------|-------|--------------------------------------|
| 1   | Err PROT BLOCK  | 10476 | Error with protection blocking       |
| 2   | Err PROT ACTIVE | 10475 | Error without protection blocking    |
| 3   | BU fail G       | 10455 | Bay unit failure                     |
|     | Meas sup BU G   | 10423 | Measured value superv. BU            |
| 4   | 15V-superv CU   | 10420 | 15V supply supervision central unit  |
|     | 24V-superv CU)  | 10421 | 24V supply supervision central unit  |
|     | Batt. superv CU | 10422 | Battery supervision central unit     |
|     | Supply sup BU G | 10424 | Supply voltage superv. BU            |
| 5   | Flt autotest G  | 10429 | Failure in auto testing              |
| 6   | not assigned    | –     | not assigned                         |
| 7   | BF Imp Dist. G  | 10437 | Disturbance BF impulse input (g.a.)  |
|     | BF Rel. Dist. G | 10435 | Disturbance BF release (group alarm) |
|     | BF Inp. Dist. G | 10434 | Disturbance BF input (group alarm)   |
| 8   | Id-sup CZ G     | 10410 | Diff-current superv. CZ              |
|     | Id-sup BZ G     | 10415 | Diff-current superv. BZ              |

| LED | Annunciation    | FNo   | Comments                             |
|-----|-----------------|-------|--------------------------------------|
| 9   | CB fault G      | 10456 | Circuit breaker fault                |
|     | Bay DC fail G   | 10426 | Failure of disconnecter aux. voltage |
|     | Dco flt run G   | 10427 | Disconnector fault: run time         |
|     | Dco flt pos G   | 10428 | Disconnector position faulty         |
|     | Dco flt alarm   | 10425 | Disconnector fault alarm             |
| 10  | TRIP blocked    | 10442 | TRIP commands blocked                |
| 11  | BF blocked      | 10432 | Breaker Failure Protection blocked   |
| 12  | Maintenance G   | 10454 | Maintenance of bay                   |
|     | out of serv. G  | 10453 | Bay out of service                   |
| 13  | DcoProhib/fault | 10470 | Disconnector oper. prohibited        |
|     | DcoProhib G     | 10471 | Disconnector oper. prohibited        |
| 14  | TripRep BU G    | 10450 | Trip repeat BU                       |
| 15  | Transf. Trip G  | 10433 | Breaker Failure/Transfer Trip        |
| 16  | Device trip G   | 10445 | Device Trip                          |
| 17  | Trip L1 G       | 10446 | Trip command L1                      |
| 18  | Trip L2 G       | 10447 | Trip command L2                      |
| 19  | Trip L3 G       | 10448 | Trip command L3                      |

Table A-25 Marshalling of the function keys

| Function key | Annunciation       |
|--------------|--------------------|
| F1           | Alarm list         |
| F2           | Operational events |
| F3           | Measured values    |
| F4           | Last fault         |

## A.16 Marshalling - Bay Unit 7SS523

When the device is delivered, annunciators are marshalled to the binary inputs, relays, and LEDs for the maximum scope. The functional keys are pre-assigned. The marshalling can be found in Table A-26, page 432 to Table A-30, page 434.

Table A-26 Marshalling of the binary inputs of the bay unit 7SS523

| Address | 1st display line | 2nd display line |    | FNo. | Comment                                 |
|---------|------------------|------------------|----|------|---|
| 6101    | BINARY INPUT 1   | >Isolator1on     | NO | 7601 | >Isolator 1 - position closed           |
| 6102    | BINARY INPUT 2   | >Isolator1off    | NO | 7602 | >Isolator 1 - position open             |
| 6103    | BINARY INPUT 3   | >Isolator2on     | NO | 7603 | >Isolator 2 - position closed           |
| 6104    | BINARY INPUT 4   | >Isolator2off    | NO | 7604 | >Isolator 2 - position open             |
| 6105    | BINARY INPUT 5   | >Isolator3on     | NO | 7605 | >Isolator 3 - position closed           |
| 6106    | BINARY INPUT 6   | >Isolator3off    | NO | 7606 | >Isolator 3 - position open             |
| 6107    | BINARY INPUT 7   | >Isolator4on     | NO | 7607 | >Isolator 4 - position closed           |
| 6108    | BINARY INPUT 8   | >Isolator4off    | NO | 7608 | >Isolator 4 - position open             |
| 6109    | BINARY INPUT 9   | >Isolator5on     | NO | 7609 | >Isolator 5 - position closed           |
| 6110    | BINARY INPUT 10  | >Isolator5off    | NO | 7610 | >Isolator 5 - position open             |
| 6111    | BINARY INPUT 11  | >CBF L1          | NO | 7611 | >Circuit breaker failure start phase L1 |
| 6112    | BINARY INPUT 12  | >CBF L2          | NO | 7612 | >Circuit breaker failure start phase L2 |
| 6113    | BINARY INPUT 13  | >CBF L3          | NO | 7613 | >Circuit breaker failure start phase L3 |
| 6114    | BINARY INPUT 14  | >CB man.close    | NO | 7618 | >Circuit breaker manual close           |
| 6115    | BINARY INPUT 15  | >CBF release     | NO | 7615 | >Circuit breaker failure release        |
| 6116    | BINARY INPUT 16  | >CB Test         | NO | 1156 | >CB test start                          |
| 6117    | BINARY INPUT 17  | >CB OFF          | NO | 7617 | >Circuit breaker open                   |
| 6118    | BINARY INPUT 18  | not marshalled   | NO | 1    | No function assigned to this input      |
| 6119    | BINARY INPUT 19  | >CB not ready    | NO | 7619 | >Circuit breaker not ready              |
| 6120    | BINARY INPUT 20  | >Bay o.of ser    | NO | 7620 | >Bay out of service                     |

NO: NO contact (active when energized)

NC: NC contact (active when not energized)

Table A-27 Default setting function keys

| Function key | Function                      |
|--------------|-------------------------------|
| F1           | Bay out of service            |
| F2           | CB test trip                  |
| F3           | Maintenance of bay            |
| F4           | Transformer polarity reversal |



Table A-28 Marshalling Signal Relays of the bay unit 7SS523

| Address | 1st display line | 2nd display line | FNo. | Comment               |
|---------|------------------|------------------|------|-----------------------|
| 6201    | SIGNAL RELAY 1   | Bay o.of serv    | 7640 | Bay is out of service |

Table A-29 Marshalling TRIP RELAYS of the bay unit 7SS523

| Address | 1st display line | 2nd display line  | FNo.   | Comment   |
|---------|------------------|---|--|---|
| 6401    | TRIP RELAY 1     | BB Trip L123<br>CBF Trip L123<br>CBF Trp.rp.3p<br>CBF Trp.rp.L1<br>CB Test L1<br>O/C Gen.Trip   | 7631<br>7643<br>7632<br>7633<br>7636<br>1791                                 | Busbar protection: Trip in phase L123<br>CBF protection: Trip L123<br>CBF protection: Trip repeat phase L123<br>CBF protection: Trip repeat phase L1<br>Circuit breaker test: Trip phase L1<br>O/C general trip command   |
| 6402    | TRIP RELAY 2     | BB Trip L123<br>CBF Trip L123<br>CBF Trp.rp.3p<br>CBF Trp.rp.L2<br>CB Test L2<br>O/C Gen.Trip   | 7631<br>7643<br>7632<br>7634<br>7637<br>1791                                 | Busbar protection: Trip in phase L123<br>CBF protection: Trip L123<br>CBF protection: Trip repeat phase L123<br>CBF protection: Trip repeat phase L2<br>Circuit breaker test: Trip phase L2<br>O/C general trip command   |
| 6403    | TRIP RELAY 3     | BB Trip L123<br>CBF Trip L123<br>CBF Trp.rp.3p<br>CBF Trp.rp.L3<br>CB Test L3<br>O/C Gen.Trip   | 7631<br>7643<br>7632<br>7635<br>7638<br>1791                                 | Busbar protection: Trip in phase L123<br>CBF protection: Trip L123<br>CBF protection: Trip repeat phase L123<br>CBF protection: Trip repeat phase L3<br>Circuit breaker test: Trip phase L3<br>O/C general trip command   |
| 6404    | TRIP RELAY 4     | BB Trip L123<br>CBF Trip L123<br>CBF Trp.rp.3p<br>CBF Trp.rp.L1<br>CBF Trp.rp.L2<br>CBF Trp.rp.L3<br>CB Test L1<br>CB Test L2<br>CB Test L3<br>O/C Gen.Trip | 7631<br>7643<br>7632<br>7633<br>7634<br>7635<br>7636<br>7637<br>7638<br>1791 | Busbar protection: Trip in phase L123<br>CBF protection: Trip L123<br>CBF protection: Trip repeat phase L123<br>CBF protection: Trip repeat phase L1<br>CBF protection: Trip repeat phase L2<br>CBF protection: Trip repeat phase L3<br>Circuit breaker test: Trip phase L1<br>Circuit breaker test: Trip phase L2<br>Circuit breaker test: Trip phase L3<br>O/C general trip command |
| 6405    | TRIP RELAY 5     | Intertrip<br>End-Flt. Trip  | 7639<br>7644   | Intertrip<br>End fault protection: Trip phase L123  |

Table A-30 Marshalling LED indicators of the bay unit 7SS523

| Address | 1st display line | 2nd display line |    | FNo. | Comment  |
|---------|------------------|------------------|----|------|--|
| 6301    | LED 1            | >Isolator1on     | nm | 7601 | >Isolator 1 - position closed                        |
| 6302    | LED 2            | >Isolator1off    | nm | 7602 | >Isolator 1 - position open                          |
| 6303    | LED 3            | >Isolator2on     | nm | 7603 | >Isolator 2 - position closed                        |
| 6304    | LED 4            | >Isolator2off    | nm | 7604 | >Isolator 2 - position open                          |
| 6305    | LED 5            | >Isolator3on     | nm | 7605 | >Isolator 3 - position closed                        |
| 6306    | LED 6            | >Isolator3off    | nm | 7606 | >Isolator 3 - position open                          |
| 6307    | LED 7            | >Isolator4on     | nm | 7607 | >Isolator 4 - position closed                        |
| 6308    | LED 8            | >Isolator4off    | nm | 7608 | >Isolator 4 - position open                          |
| 6309    | LED 9            | >Isolator5on     | nm | 7609 | >Isolator 5 - position closed                        |
| 6310    | LED 10           | >Isolator5off    | nm | 7610 | >Isolator 5 - position open                          |
| 6311    | LED 11           | I supervision    | nm | 0161 | Measured value supervision of currents (group alarm) |
| 6312    | LED 12           | not marshalled   |    | 1    | No function assigned to this output                  |
| 6313    | LED 13           | Fail Com.CU      | nm | 7650 | Failure in communication w.Central Unit              |
| 6314    | LED 14           | BB Trip L123     | m  | 7631 | Busbar protection: Trip in phase L123                |
|         |                  | CBF Trip L123    | m  | 7643 | CBF protection: Trip L123                            |
|         |                  | CBF Trp.rp.3p    | m  | 7632 | CBF protection: Trip repeat phase L123               |
|         |                  | CBF Trp.rp.L1    | m  | 7633 | CBF protection: Trip repeat phase L1                 |
|         |                  | CBF Trp.rp.L2    | m  | 7634 | CBF protection: Trip repeat phase L2                 |
|         |                  | CBF Trp.rp.L3    | m  | 7635 | CBF protection: Trip repeat phase L3                 |
|         |                  | CB Test L1       | m  | 7636 | Circuit breaker test: Trip phase L1                  |
|         |                  | CB Test L2       | m  | 7637 | Circuit breaker test: Trip phase L2                  |
|         |                  | CB Test L3       | m  | 7638 | Circuit breaker test: Trip phase L3                  |
|         |                  | relay Trip       | m  | 0511 | General trip of device                               |
| 6315    | LED 15           | Intertrip        | m  | 7639 | Intertrip  |
|         |                  | End-Flt. Trip    | m  | 7644 | End fault protection: Trip phase L123                |
| 6316    | LED 16           | Bay o.of serv    | nm | 7640 | Bay is out of service                                |

nm: not memorized

m: memorized

## A.17 Marshalling - Bay Unit 7SS525

When the device is delivered, annunciators are marshalled to the binary inputs, relays, and LEDs for the maximum scope. The functional keys are pre-assigned. The marshalling can be found in Table A-31, page 435 to Table A-33, page 436.

Table A-31 Marshalling of the binary inputs of the bay unit 7SS525

| Address | 1st display line | 2nd display line |    | FNo. | Comment                            |
|---------|------------------|------------------|----|------|------------------------------------|
| 6101    | BINARY INPUT1    | >Isolator1on     | NO | 7601 | >Isolator 1 - position closed      |
| 6102    | BINARY INPUT 2   | >Isolator1off    | NO | 7602 | >Isolator 1 - position open        |
| 6103    | BINARY INPUT 3   | >Isolator2on     | NO | 7603 | >Isolator 2 - position closed      |
| 6104    | BINARY INPUT 4   | >Isolator2off    | NO | 7604 | >Isolator 2 - position open        |
| 6105    | BINARY INPUT 5   | >CB ON           | NO | 7623 | >Circuit breaker closed            |
| 6106    | BINARY INPUT 6   | >CB OFF          | NO | 7617 | >Circuit breaker open              |
| 6107    | BINARY INPUT 7   | not marshalled   | NO | 1    | No function assigned to this input |
| 6108    | BINARY INPUT 8   | not marshalled   | NO | 1    | No function assigned to this input |
| 6109    | BINARY INPUT 9   | not marshalled   | NO | 1    | No function assigned to this input |
| 6110    | BINARY INPUT 10  | >CB man.close    | NO | 7618 | >Circuit breaker manual close      |

NO: NO contact (active when energized)

NC: NC contact (active when not energized)

Table A-32 Marshalling Signal Relays of the bay unit 7SS525

| Address | 1st display line | 2nd display line | FNo. | Comment               |
|---------|------------------|------------------|------|-----------------------|
| 6201    | SIGNAL RELAY 1   | Bay o.of serv    | 7640 | Bay is out of service |

Table A-33 Marshalling TRIP RELAYS of the bay unit 7SS525

| Address | 1st display line | 2nd display line  | FNo.   | Comment   |
|---------|------------------|---|--|---|
| 6401    | TRIP RELAY 1     | BB Trip L123<br>CBF Trip L123<br>CBF Trp.rp.3p<br>CBF Trp.rp.L1<br>CB Test L1<br>O/C Gen.Trip   | 7631<br>7643<br>7632<br>7633<br>7636<br>1791                                 | Busbar protection: Trip in phase L123<br>CBF protection: Trip L123<br>CBF protection: Trip repeat phase L123<br>CBF protection: Trip repeat phase L1<br>Circuit breaker test: Trip phase L1<br>O/C general trip command   |
| 6402    | TRIP RELAY 2     | BB Trip L123<br>CBF Trip L123<br>CBF Trp.rp.3p<br>CBF Trp.rp.L2<br>CB Test L2<br>O/C Gen.Trip   | 7631<br>7643<br>7632<br>7634<br>7637<br>1791                                 | Busbar protection: Trip in phase L123<br>CBF protection: Trip L123<br>CBF protection: Trip repeat phase L123<br>CBF protection: Trip repeat phase L2<br>Circuit breaker test: Trip phase L2<br>O/C general trip command   |
| 6403    | TRIP RELAY 3     | BB Trip L123<br>CBF Trip L123<br>CBF Trp.rp.3p<br>CBF Trp.rp.L3<br>CB Test L3<br>O/C Gen.Trip   | 7631<br>7643<br>7632<br>7635<br>7638<br>1791                                 | Busbar protection: Trip in phase L123<br>CBF protection: Trip L123<br>CBF protection: Trip repeat phase L123<br>CBF protection: Trip repeat phase L3<br>Circuit breaker test: Trip phase L3<br>O/C general trip command   |
| 6404    | TRIP RELAY 4     | BB Trip L123<br>CBF Trip L123<br>CBF Trp.rp.3p<br>CBF Trp.rp.L1<br>CBF Trp.rp.L2<br>CBF Trp.rp.L3<br>CB Test L1<br>CB Test L2<br>CB Test L3<br>O/C Gen.Trip | 7631<br>7643<br>7632<br>7633<br>7634<br>7635<br>7636<br>7637<br>7638<br>1791 | Busbar protection: Trip in phase L123<br>CBF protection: Trip L123<br>CBF protection: Trip repeat phase L123<br>CBF protection: Trip repeat phase L1<br>CBF protection: Trip repeat phase L2<br>CBF protection: Trip repeat phase L3<br>Circuit breaker test: Trip phase L1<br>Circuit breaker test: Trip phase L2<br>Circuit breaker test: Trip phase L3<br>O/C general trip command |
| 6405    | TRIP RELAY 5     | Intertrip<br>End-Flt. Trip  | 7639<br>7644   | Intertrip<br>End fault protection: Trip phase L123  |

Table A-34 Marshalling LED indicators of the bay unit 7SS525

| Address | 1st display line | 2nd display line |    | FNo. | Comment                                 |
|---------|------------------|------------------|----|------|---|
| 6301    | LED 1            | Fail Com.CU      | nm | 7650 | Failure in communication w.Central Unit |

nm: not memorized  
m: memorized

## A.18 Navigation Tree - Central Unit

The following navigation tree gives an overview of the parameter blocks and the individual parameters that can be selected in the central unit of the SIPROTEC 7SS52 V4 distributed busbar and breaker failure protection. It shows the operations which are necessary to achieve certain setting options.

Table A-35 Navigation tree of the central unit

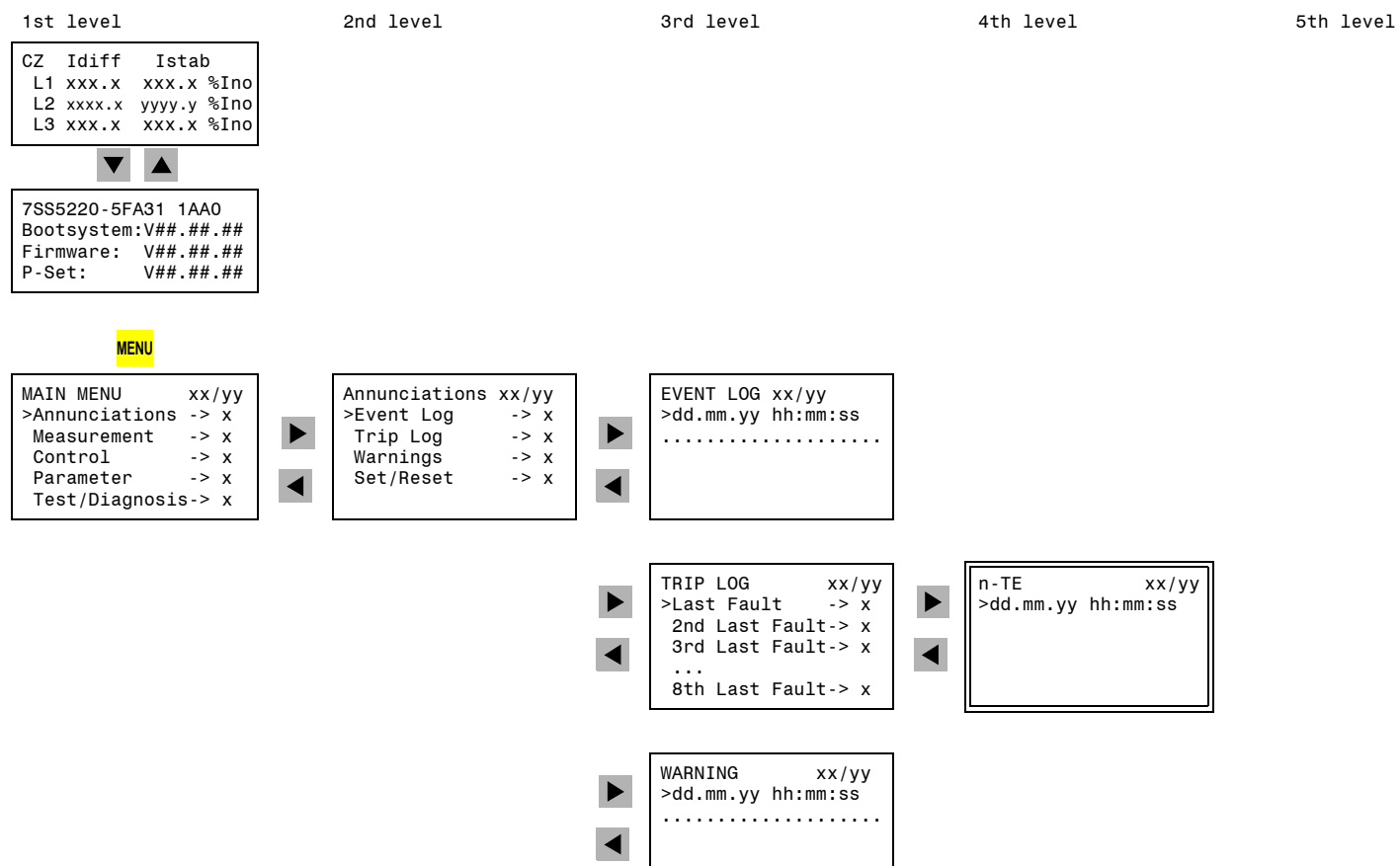


Table A-35 Navigation tree of the central unit

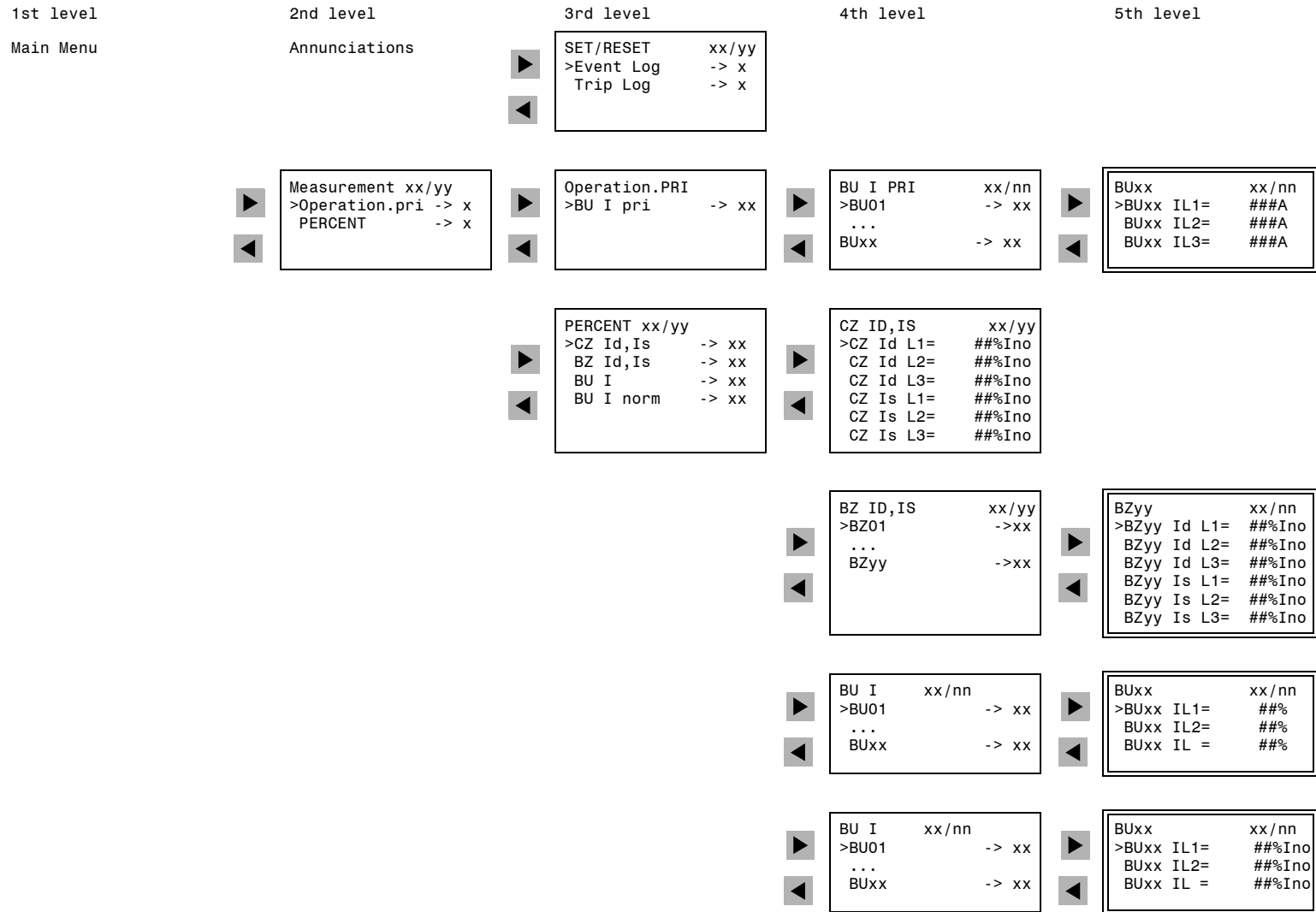


Table A-35 Navigation tree of the central unit

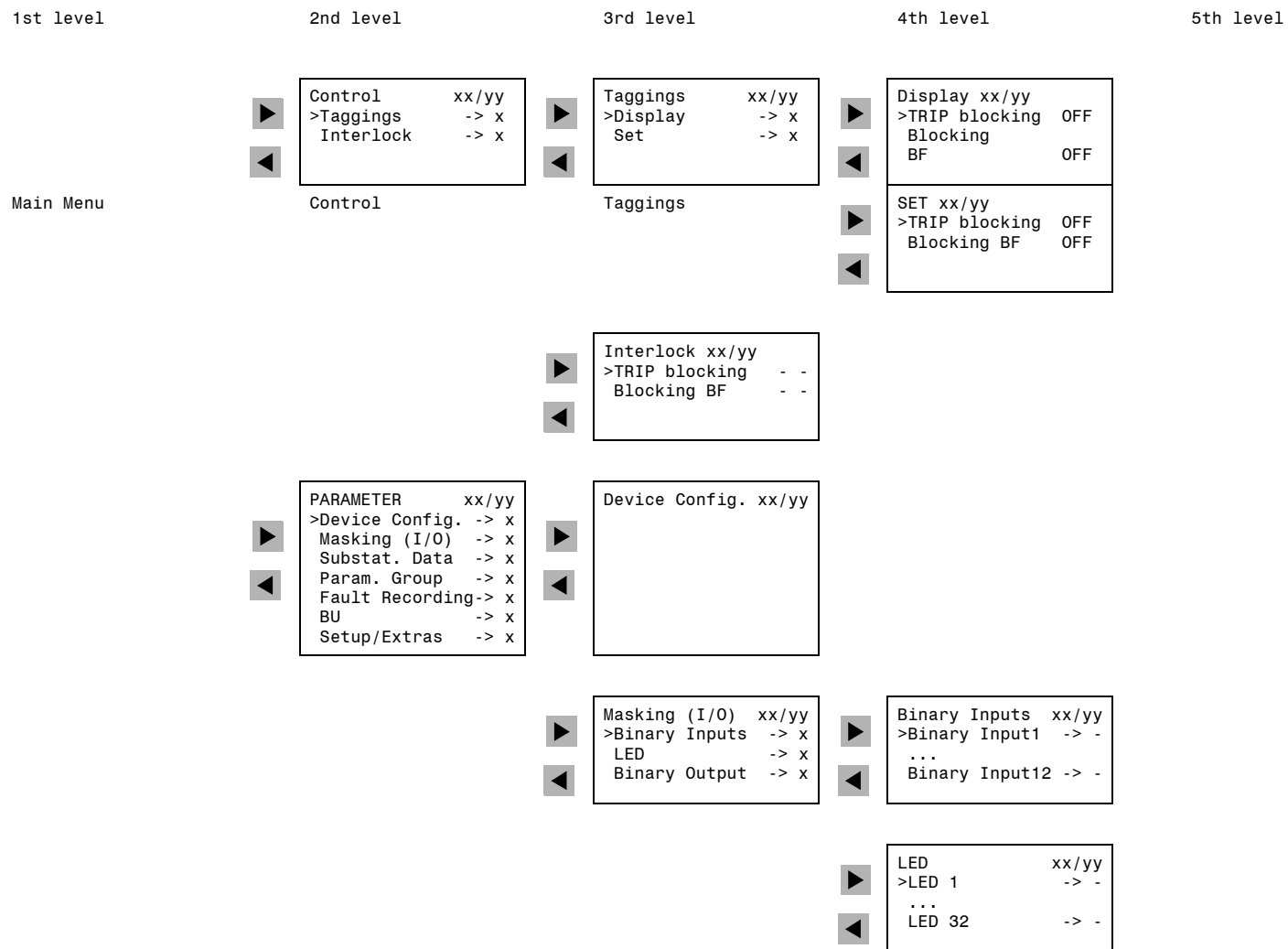






Table A-35 Navigation tree of the central unit

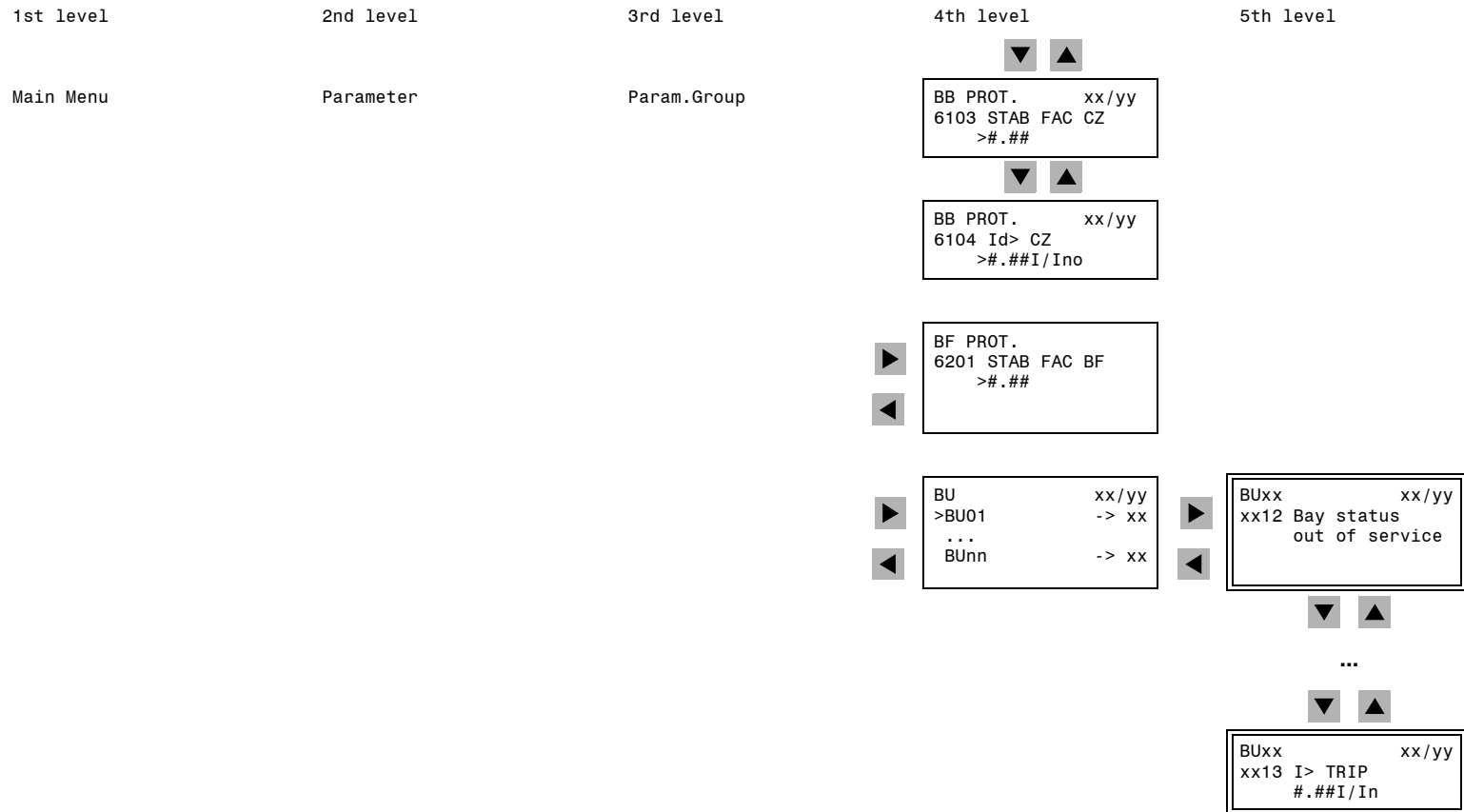


Table A-35 Navigation tree of the central unit

















| 1st level | 2nd level | 3rd level    | 4th level   | 5th level |
|-----------|-----------|--------------|---|-----------|
| Main Menu | Parameter | Param. Group | Supervision xx/yy<br>6306 DIFF.SUPERV<br>>ON  |           |
|           |           |              |       |           |
|           |           |              | Supervision xx/yy<br>6308 Id> SUPERV BZ<br>>#.##I/Ino   |           |
|           |           |              |       |           |
|           |           |              | Supervision xx/yy<br>6309 Id> SUPERV CZ<br>>#.##I/Ino   |           |
|           |           |              |       |           |
|           |           |              | Supervision xx/yy<br>6310 DIF SUP mode BZ<br>blocking   |           |
|           |           |              |       |           |
|           |           |              | Supervision xx/yy<br>6311 DIF SUP mode CZ<br>alarm only   |           |
|           |           |              |       |           |
|           |           |              | Supervision xx/yy<br>6307 TIdiff SUPERV<br>>#.##s   |           |
|           |           |              |       |           |
|           |           |              | Supervision xx/yy<br>6301 DCO TIME<br>>#.##s  |           |
|           |           |              |   |           |
|           |           |              | Supervision xx/yy<br>6303 DCO DC FAIL<br>>old disconnecter<br>status  |           |
|           |           |              |   |           |

Table A-35 Navigation tree of the central unit

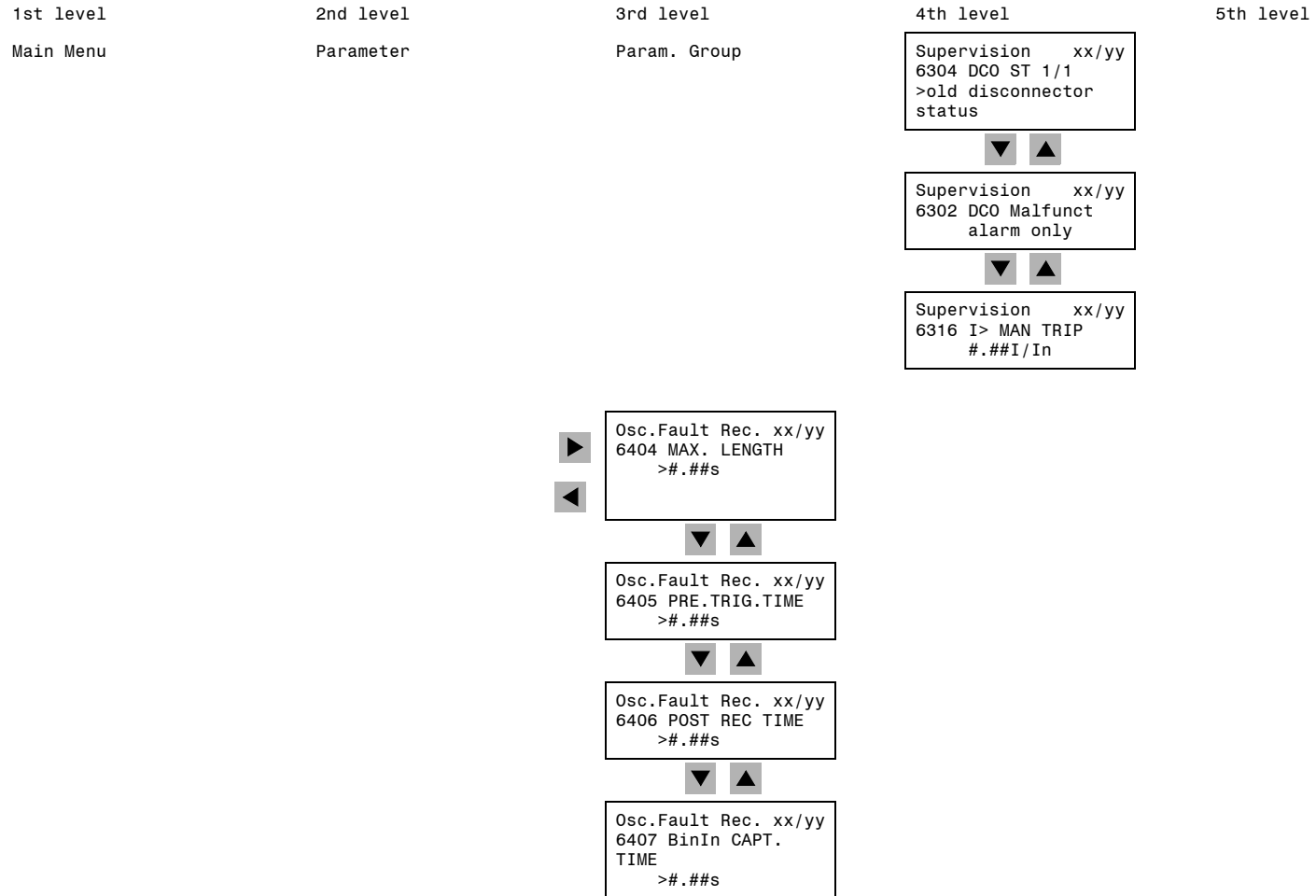


Table A-35 Navigation tree of the central unit

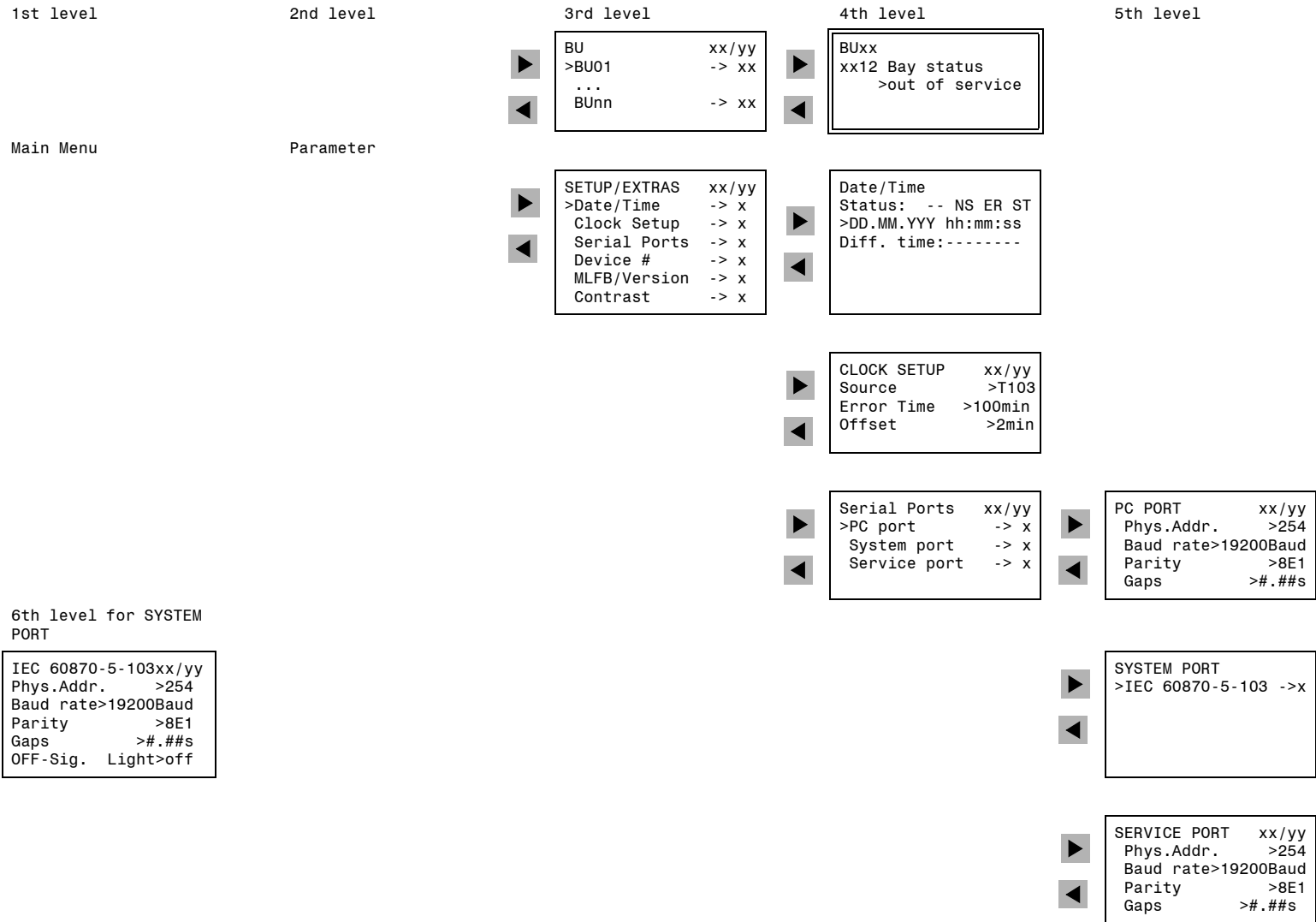


Table A-35 Navigation tree of the central unit

|           |           |           |           |           |
|-----------|-----------|-----------|-----------|-----------|
| 1st level | 2nd level | 3rd level | 4th level | 5th level |
|-----------|-----------|-----------|-----------|-----------|

Main Menu

Parameter

Setup/Extras

▶ DEVICE #  
Device #           xxxx  
◀

▶ MLFB/VERSION   xx/yy  
MLFB:7SS5220-5FA31  
1AA0  
◀ LB-No.:       #####  
Firmware: V##.##.##  
Bootsystem:V##.##.##  
P-Set:       V##.##.##

▶ CONTRAST  
◀

▶ TEST/DIAGNOSIS xx/yy  
◀ >Device reset    x  
Test Enable   -> x  
Blk Data Trans-> x  
Hardware Test -> x  
Osc.Fault Rec.-> x  
Set/Reset    -> x  
SIEMENS Intern x

▶ Device reset ...  
◀

▶ TEST Enable  
◀ TEST Enable    >OFF

Table A-35 Navigation tree of the central unit

| 1st level | 2nd level      | 3rd level   | 4th level | 5th level |
|-----------|----------------|---|-----------|-----------|
| Main Menu | Test/Diagnosis | <div style="border: 1px solid black; padding: 2px;">                     BLK DATA TRANS<br/>                     Blk Data Trans &gt;OFF                 </div>  |           |           |
|           |                | <div style="border: 1px solid black; padding: 2px;">                     Hardware Test<br/>                     HWTestMod &gt;OFF                 </div>  |           |           |
|           |                | <div style="border: 1px solid black; padding: 2px;">                     Osc.Fault Rec.<br/>                     FltRecSta &gt;ON                 </div>  |           |           |
|           |                | <div style="border: 1px solid black; padding: 2px;">                     Set/Reset      xx/yy<br/>                     &gt;Event Log      x<br/>                     TRIP log        x<br/>                     Reset Id-Block x<br/>                     Reset DcoMalBl x                 </div> |           |           |

4 Fault

Device TRIP  
 Transf. TRIP G

5 Startup

SIPROTEC  
 7SS5220-5FA31 1AA0  
 Firmware: V##.##.##  
 Bootsystem:V##.##.##

## A.19 Navigation Tree of the Bay Unit

The following navigation tree gives an overview of the parameter blocks and the individual parameters that can be set in the bay units of the SIPROTEC 7SS52 V4 distributed busbar and failure protection.

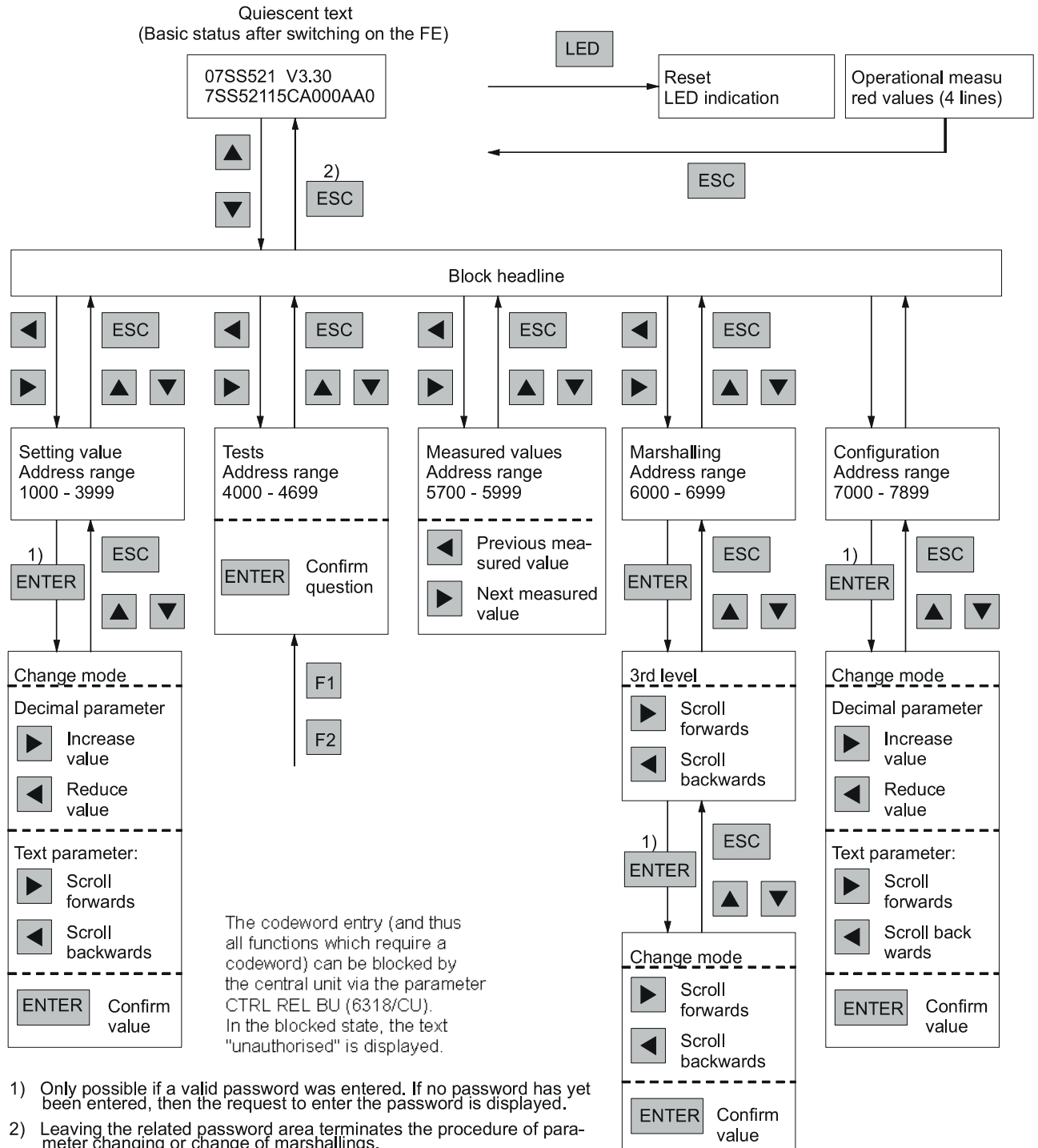


Figure A-16 Navigation tree of the bay unit

## A.20 Abbreviations

|        |   |
|--------|---|
| AB     | Auxiliary bus (bus coupler) sections (sections which serve exclusively for longitudinal connection of bus zones and to which no outgoing feeders are connected) |
| BB     | Busbar protection   |
| BF     | Breaker Failure   |
| BI     | Binary input  |
| BO     | Binary output   |
| BSZ1   | Processing board for protection in the check zone   |
| BSZ2/3 | Processing boards for protection in the selective zones   |
| BU     | Bay unit  |
| BZ     | Bus zone  |
| CB     | Circuit Breaker   |
| CBF    | Breaker failure protection  |
| CFC    | Continuous Function Chart   |
| CU     | Central unit  |
| CZ     | Check zone  |
| DA     | Direct address  |
| DCO    | Disconnecter  |
| EAZ    | Input/output module   |
| g.a.   | group alarm   |
| HW     | Hardware  |
| ISOL   | Isolator  |
| KOM    | Communication board used for operation  |
| LED    | Light emitting diode  |
| M      | Measurement   |
| MLFB   | Coded ordering numbers  |
| PC     | Personal computer   |
| REL    | Relay   |
| RTC    | Real Time Clock   |
| SBK    | Control-operation-interface board   |
| SK     | Serial link board   |
| ZPS    | Central processor board of protection   |



## A.21 References

- /1/ SIPROTEC 4, System Description  
E50417-H1176-C151-B6
- /2/ SIPROTEC DIGSI 4, Start-Up  
E50417-G1176-C152-A5
- /3/ DIGSI CFC, Manual  
E50417-H1176-C098-B2
- /4/ SIPROTEC SIGRA 4, Manual  
E50417-H1176-C070-A7
- /5/ Ethernet & IEC 61850 Start UP  
E50417-F1100-C324-A3
- /6/ SIPROTEC Distributed Busbar/Breaker Failure Protection  
IEC 61850 PIXIT  
C53000-G1176-C180-3
- /7/ SIPROTEC 4 Ethernet Module EN100 for IEC 61850 with electrical/optical  
100 MBit Interface  
C53000-G1140-C167



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