SIPROTEC

Distributed Busbar/ Breaker Failure Protection
7SS522 V4.6
7SS523 V3.3
7SS525 V3.3

Manual

C53000-G1176-C182-3

Exclusion of Liability

We have checked the contents of this publication and every effort has been made to ensure that the descriptions of both hardware and software are as accurate as possible. However, deviations from the description cannot be completely ruled out, so that no liability can be accepted for any errors or omissions contained in the information given.

The data in this manual are checked regularly and the necessary corrections are included in subsequent editions. We are grateful for any improvements that you care to suggest.

Subject to technical modifications.
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Preface

Aim 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 45
- Description of the system functions and their setting options → Chapter 5, page 91
- Information on control during operation → Chapter 6, page 209
- Information on installation and commissioning → Chapter 7, page 255
- Overview of technical data → Chapter 9, page 311
- and a compilation of the most important information for the experienced user → Chapter A.1, page 336

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 of validity of this manual

This manual is valid for the complete SIPROTEC 7SS52 V4 distributed busbar and breaker failure protection system, firmware version 4.6. The system comprises the central unit 7SS522 V4.6 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 89/336/EEC) and concerning electrical equipment for use within specified voltage limits (Low-voltage directive 73/23 EEC).

This conformity has been proved by tests performed according to Article 10 of 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 60255-6 (for Low Voltage Directive) by Siemens AG.

The device is designed and manufactured for application in industrial environment.

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

Additional support

For any questions concerning your SIPROTEC system, please contact your Siemens representative.

Training courses

Individual course offers may be found in our Training Catalog, or questions can be directed to our training center in Nuremberg.

Instructions and Warnings

The warnings and notes contained in this manual serve for your own safety and for an appropriate lifetime of the device. Please observe them!

The following terms and definitions are used:

DANGER

indicates that death, severe personal injury or substantial property damage will result if proper precautions are not taken.

Warning

indicates that death, severe personal injury or substantial property damage can result if proper precautions are not taken.

Caution

indicates that minor personal injury or property damage can result if proper precautions are not taken. This is especially valid for damage on or in the device itself and consequential damage thereof.

Note

indicates information about the device or respective part of the instruction manual which is essential to highlight.

Warning!

Hazardous voltages are present in this electrical equipment during operation. Non–observance of the safety rules can result in severe personal injury or property damage.

Only qualified personnel shall work on and around this equipment after becoming thoroughly familiar with all warnings and safety notices of this manual as well as with the applicable safety regulations.

The successful and safe operation of this device is dependent on proper handling, installation, operation, and maintenance by qualified personnel under observance of all warnings and hints contained in this manual.

In particular the general erection and safety regulations (e.g. IEC, DIN, VDE, EN or other national and international standards) regarding the correct use of hoisting gear must be observed. Non–observance can result in death, personal injury or substantial property damage.

QUALIFIED PERSONNEL

For the purpose of this instruction manual and product labels, a qualified person is one who is familiar with the installation, construction and operation of the equipment and the hazards involved. In addition, he or she has the following qualifications:

- Is trained and authorized to energize, de-energize, clear, ground and tag circuits and equipment in accordance with established safety practices.
- Is trained in the proper care and use of protective equipment in accordance with established safety practices.
- Is trained in rendering first aid.

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:

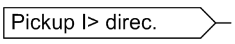
`Parameter names`, i.e. designators of configuration or function parameters, which may appear word-for-word in the display of the device or on the screen of a personal computer (with DIGSI), are marked in bold letters of a monospace type style.

`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.

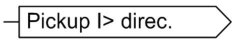
“`Annunciations`”, i.e. designators for information, which may be output by the relay or required from other devices or from the switch gear, are marked in a monospace type style in quotes.

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

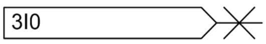
The following symbols are used in drawings:



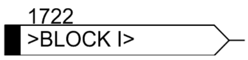
Device-internal logical input signal



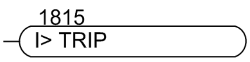
Device-internal logical output signal



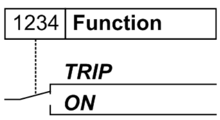
Internal input signal of an analog quantity



External binary input signal with number (binary input, input indication)

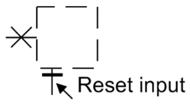


External binary output signal with number (device indication)

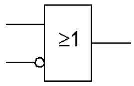


Example of a parameter switch designated with the address and the possible settings

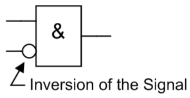
Besides these, graphical symbols are used according to IEC 60 617–12 and IEC 60 617–13 or symbols derived from these standards. The most frequent symbols are the following:



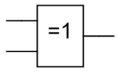
Input signal of an analogue quantity



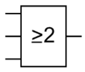
OR-combination of input values



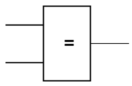
AND-combination of input values



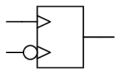
Exclusive–OR gate: output is active, if only **one** of the inputs is active



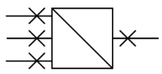
2-of-3-combination of input values



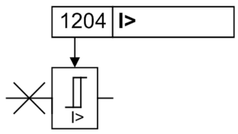
Coincidence: output is active if **both** inputs are active or inactive at the same time



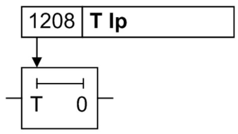
Dynamic input signals (edge–triggered) above with positive, below with negative edge



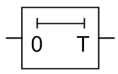
Formation of one analogue output signal from a number of analogue input signals



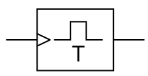
Limit value stage with parameter address and parameter name



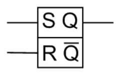
Timer (pickup delay T adjustable) with parameter address and parameter name



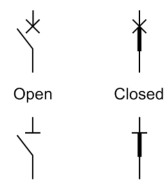
Timer (dropout delay T, non-adjustable)



Edge-controlled time stage with effective time T



Static memory (RS-flipflop) with setting input (S), resetting input (R), output (Q) and inverted output (Q)



Circuit breaker (open and closed)

Isolator (open and closed)

Table of Contents

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.

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 3 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 210 summarizes the operator options during operation.

The bay units capture the isolator 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 isolator 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.

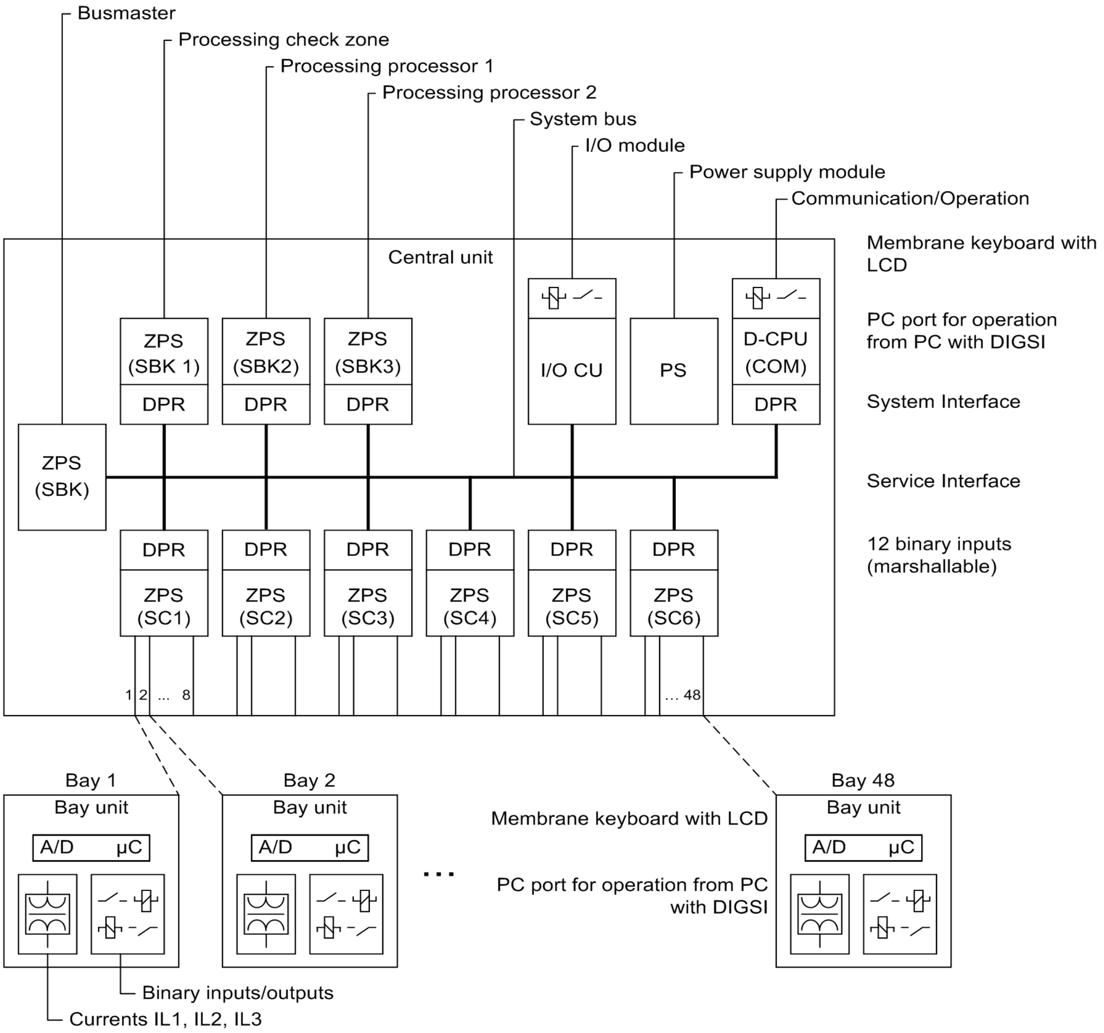
Central unit

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.



SBK:	Protection processing	SC:	Serial coupling
DPR:	Dual port RAM	PS:	Power supply
I/O CU:	Input/output central unit	ZPS:	Central processor protection
SBK:	Bus master		

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 24 sectionalizing isolators and 16 bus couplers with one bay unit or 8 bus couplers with two bay units.

By virtue of the universal isolator 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 ≥ 2 ms for stability in the case of external faults and ≥ 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 119):

- 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 CBF and tripping via the isolator 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 119):

- 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 188):

- 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> / Ip)
- Overcurrent stage for the earth current with definite time or inverse time characteristic (IE> / IEp)

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 isolator 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 isolator 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
- IEC 61850
- 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 stabilization (Figure 1-2, page 7)
- 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 isolator 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)
- Stabilization 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
  - Isolator 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 7)
  - Earth fault characteristic (Figure 1-3, page 7)
- 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 isolator replica
- Direct operation of the circuit breaker by the bay unit
- Direct tripping of busbar sections via binary inputs of the central unit

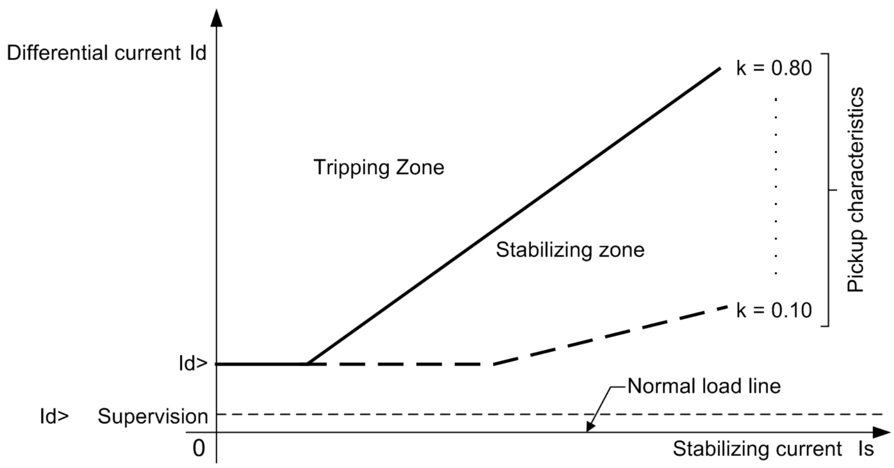


Figure 1-2 Pick-up characteristics of the busbar and breaker failure protection (unbalancing)

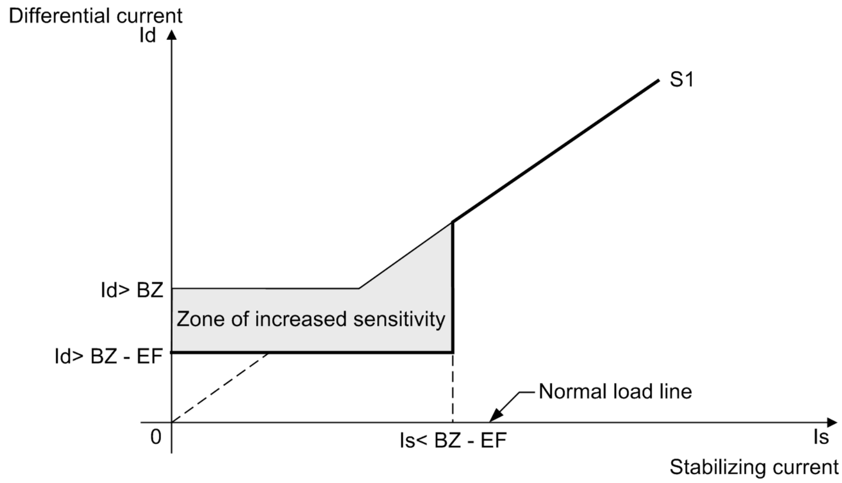


Figure 1-3 Earth fault characteristic

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 isolator 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 isolator 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 188):

- 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.

Isolator replica

The isolator replica is common for the busbar protection and the circuit-breaker failure protection function. The isolator 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. Combi-bus 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 isolators.
- Isolator running time supervision
- Integrated storage of isolator status on loss of DC supply:
  The isolator replica allows to allocate to the isolators their positions prior to the DC supply failure. It is also possible to allocate to all isolators of this feeder the position CLOSED. The allocation of NOT OPEN = CLOSED eliminates the necessity of calibrated isolator 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 isolator 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

Fault recording

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.

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.

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.

**Relays,
LEds and
binary inputs**

All inputs and outputs are freely marshallable.

Each LED or relay can be allocated to more than one event; likewise, events can be marshalled more than one LED or relay.

of the central unit

12 binary inputs are available to control the functions of the central unit (e.g. clock synchronization, LED reset).

16 alarm relays and 32 LED in the central unit can be allocated to various functions for user-specific output and indication.

of the bay unit

The bay units are the interface link to the station.

Each bay unit 7SS523 has

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

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

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

16 binary inputs can be marshalled to various functions, such as recognition of the isolator states.

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 isolator 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.

Event buffer in central unit

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.

Up to 200 operational events and 80 fault events with real-time information are stored in a circulating buffer in the central unit.

Operational events include switching operations, protection status indications, isolator status irregularities and monitoring functions.

Fault events include trip signals in the event of busbar short-circuits, circuit-breaker failure and transfer trip.

Event buffer in bay unit

Up to 50 operational events and 100 fault events per fault.

Self monitoring

Hardware and software are continuously monitored; irregularities are recognized instantly and annunciated.

A high degree of security and availability is achieved by the continuous monitoring of:

- Isolator statuses
- Trip circuits
- Measured current circuits
- Measured value transformations
- Supply voltages
- Program memories
- Program processing
- Discharge degree of battery (central unit and bay unit)

For diagnosis purposes in the event of device failures, a battery-buffered dedicated data memory is available in the central unit.

Clock control

- Central unit
  - Battery-buffered time with 1 ms resolution
  - Time set by entry of current data
  - Synchronization of the central unit via binary input or system port (synchronization signal DCF77, IRIG B by satellite receiver)
  - IEC 60870-5-103 and IEC 61850
- Bay unit
  - Battery-buffered time with 1 ms resolution
  - Clock synchronization by central unit in intervals of 1 minute
  - Local clock setting possible as well

Battery-buffered functions

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.

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.

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 336.

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 ≥ 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

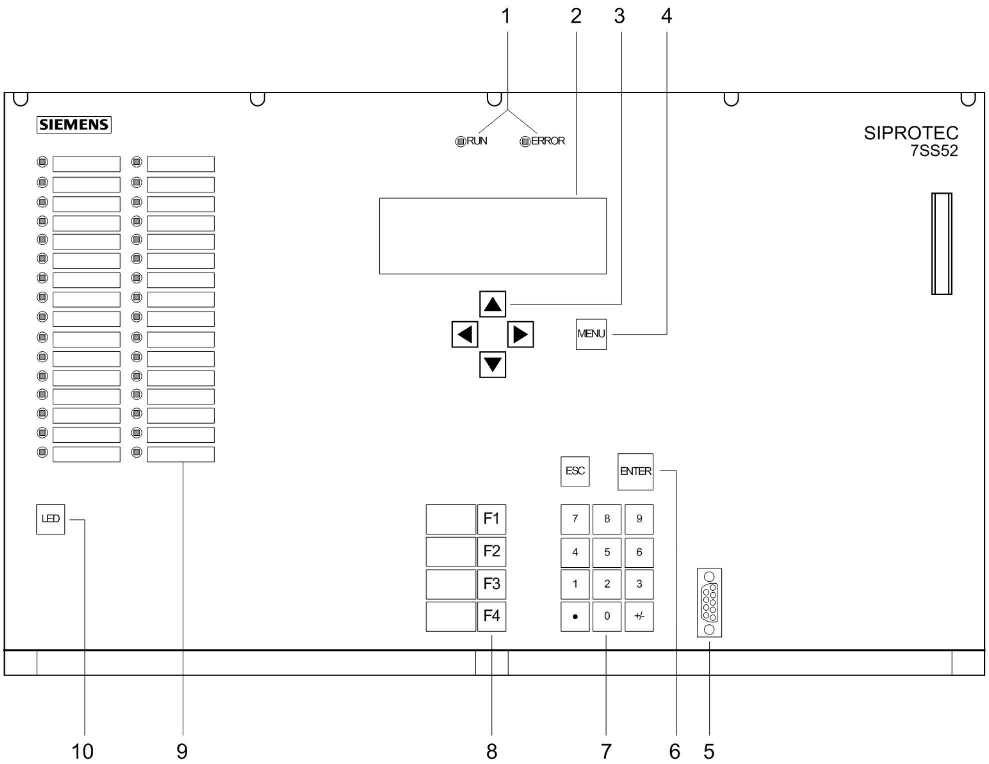


Figure 2-1 Front view of the central unit

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

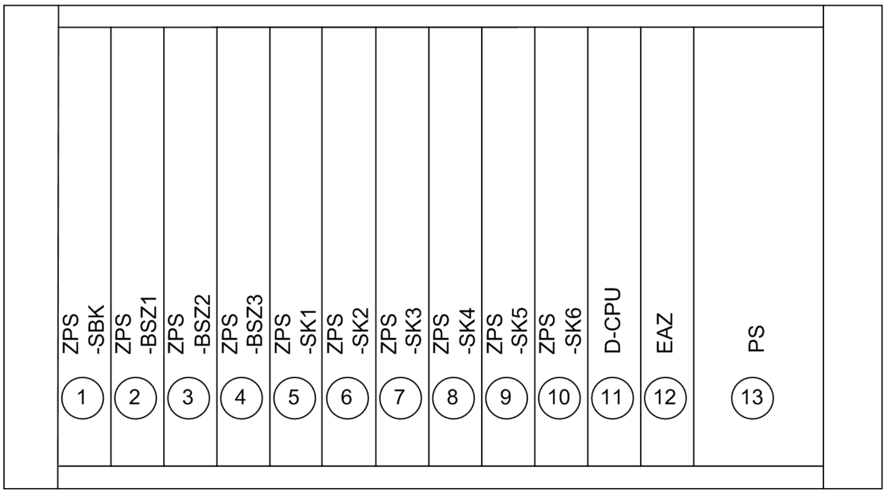


Figure 2-2 Module arrangement in the central unit

Power supply module (SV)

The power supply (SV) has a width of 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 integrated electrical EN100 module for the communication via IEC 61850 is optionally available.

Input/output module (EAZ)

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

Processor modules (ZPS)

The 4 processor modules (ZPS-SBK; ZPS-BSZ1 to ZPS-BSZ3) provide the protection functions.

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.

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.

Fiber-optic module (LMZ)

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.

Terminal blocks

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 22.

2.1.3 Design

Subrack ES902 C (SIPAC)

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.

The dimensions of the housing can be in Figure 9-2, page 329.

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

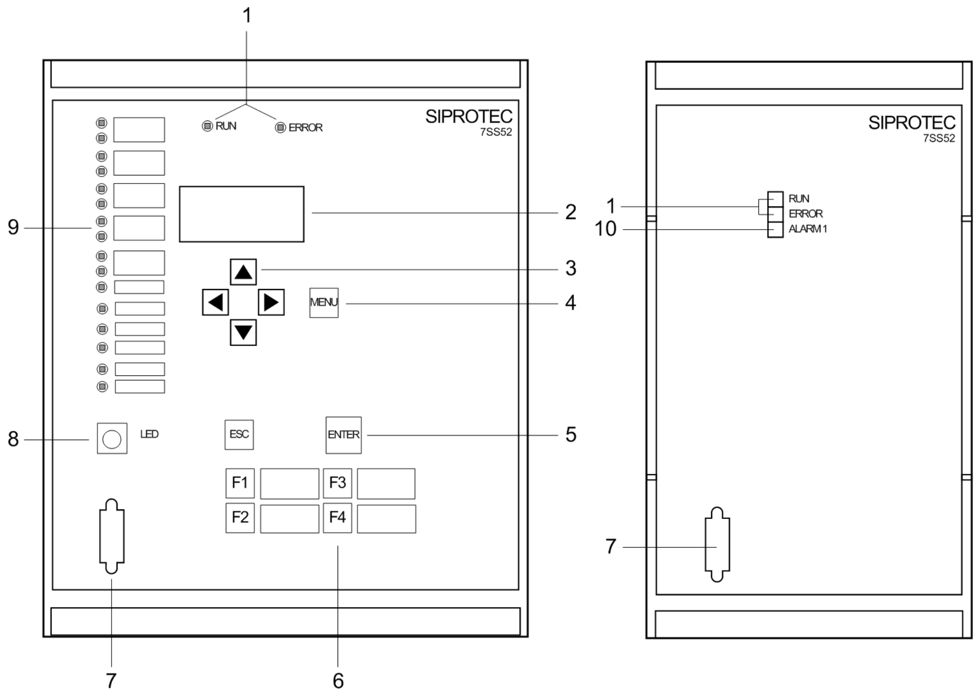


Figure 2-3 Front view of the bay unit 7SS523 and 7SS525

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

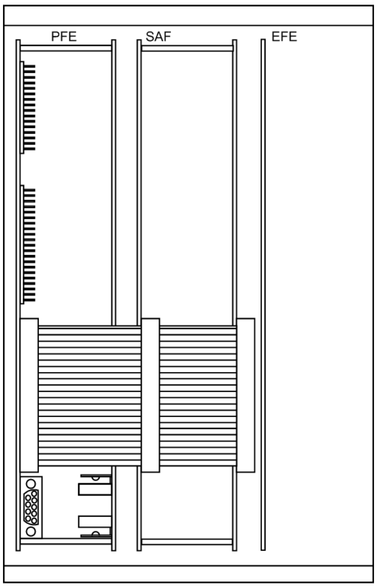


Figure 2-4 Module arrangement in the bay unit 7SS523

PFE module

In the PFE module the firmware is located and processed; it also contains the current transformers and the measured value acquisition function.

SAF module

The SAF module contains the power supply and the alarm and trip relays.

EFE module

The EFE contains the binary inputs and receives indications (e.g. from isolators 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 2-8, page 24.

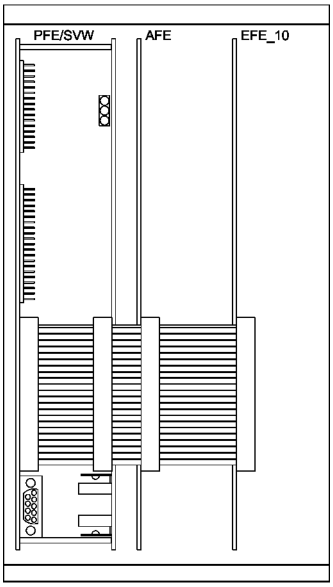


Figure 2-5 Module arrangement in the bay unit 7SS525

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 isolators 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 2-8, page 24.

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 2-7, page 23).

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 9-4, page 331.

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 9-5, page 332.

2.3 Connection Method

2.3.1 Location of Device Connections

Central unit

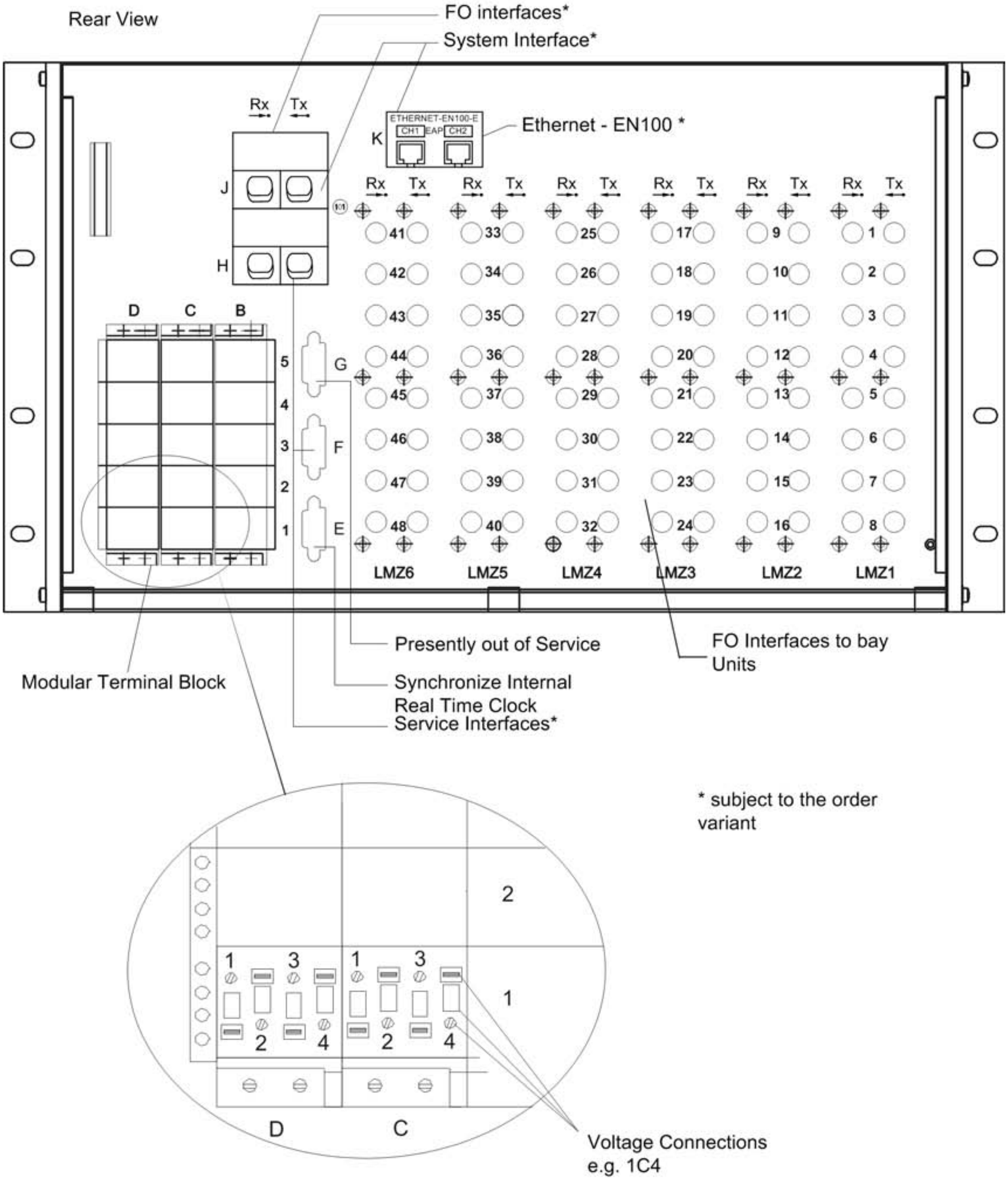


Figure 2-6 Device connections on central unit

Bay unit Panel surface mounting

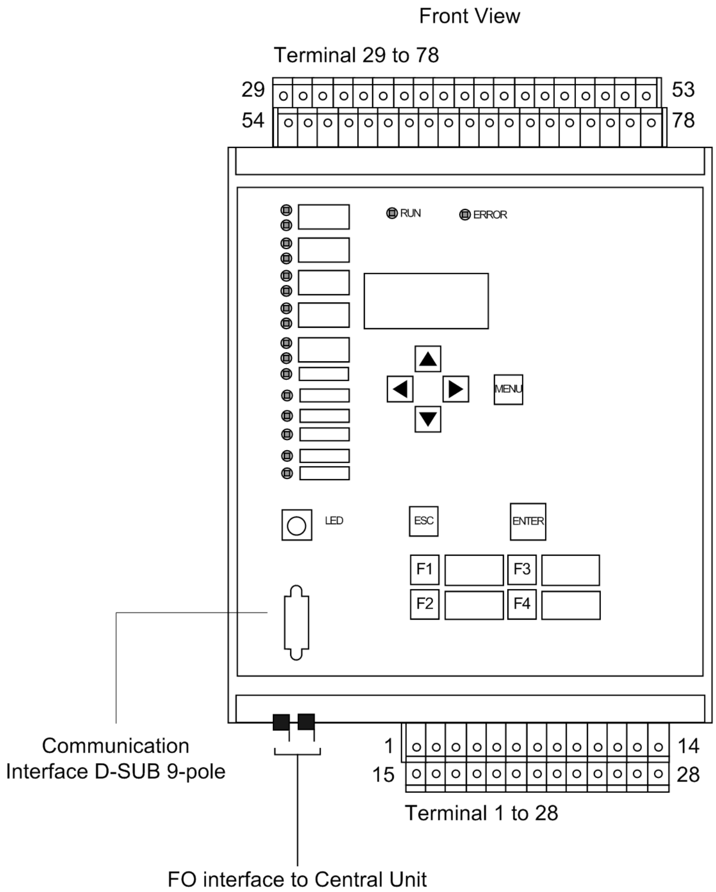


Figure 2-7 Device connections on bay unit 7SS523 for panel surface mounting

7SS523 bay unit
Panel flush mounting or cubicle mounting

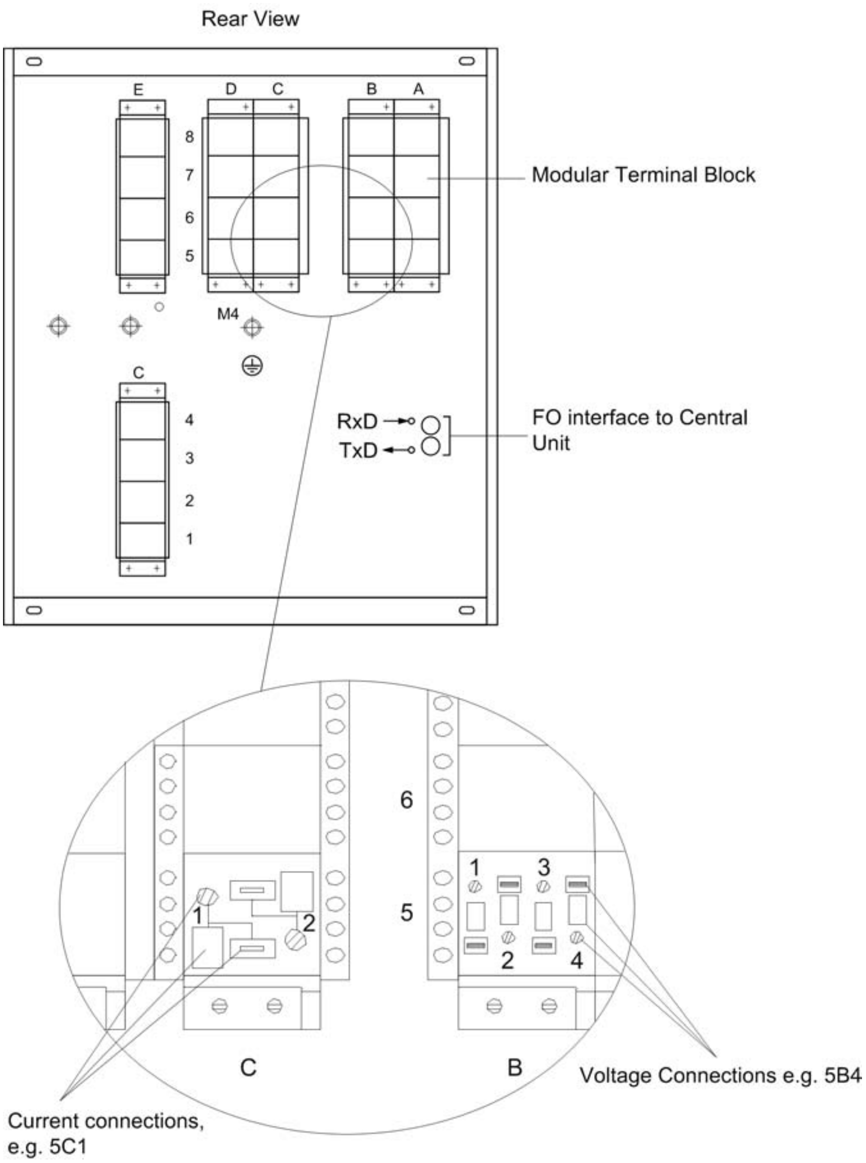


Figure 2-8 Device connections on bay unit for panel flush mounting or cubicle mounting

7SS525 bay unit Panel flush mounting or cubicle mounting

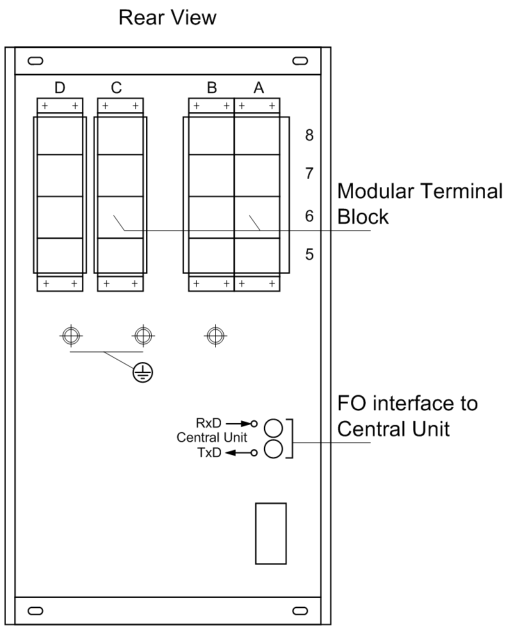


Figure 2-9 Device connections on bay unit 7SS525

2.3.2 Device Connections

Table 2-1 Overview of device connections

Variant	Current connections	Voltage connections	FO connections
Central unit		Screw connection for max. 1.5 mm² and Double leaf-spring-crimp contact for max. 1.5 mm²	Integrated ST connector for FO connection, glass fiber 62.5/125 µm FO duplex outdoor cable or FO duplex indoor cable
Bay unit Panel surface mounting	Screw-type terminals for stranded wires with max. 4 mm² or for solid wires with max. 7 mm²		Integrated ST connector for FO connection, glass fiber 62.5/125 µm
Bay unit Panel flush mounting or cubicle mounting	Screw connection for max. 4 mm² and Double leaf-spring-crimp contact for max. 2.5 mm²	Screw connection for max. 1.5 mm² and Double leaf-spring-crimp contact for max. 1.5 mm²	Integrated ST connector for FO connection, glass fiber 62.5/125 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 342 and A-5, page 345 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^2 and 4 mm^2 (equivalent to AWG 20 to 12) and a length up to:

Conductor cross-section	Length (without collar)
0.5 mm^2	10 mm
0.75 and 1 mm^2	12 mm
1.5; 2.5 and 4 mm^2	18 mm

Tools

Use a screwdriver for slot-head screws size 6 × 1.

Use a crimping tool for end sleeves between 0.5 mm^2 and 6 mm^2 (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 342 and A-5, page 345 in the Appendix.

Connection method (current terminals)

Use copper conductors only!

Use stranded conductors with a cross-section between 1.5 mm^2 and 2.5 mm^2.

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^2 and 1 mm^2.

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

Connectors

The serial ports of the central unit and of the bay units have 9-pole D-SUB female connectors. The serial ports include:

- the PC port at the front of the central unit and the bay unit
- the service port at the back of the central unit
- the system port at the back of the central unit
- the clock synchronization interface at the back of the central unit

For assignment of the connectors, please refer to the Figures A-3, page 342 and A-5, page 345 in the Appendix.

Connection method

You can use any standard 9-pole D-SUB plug connectors per MIL-C-24308 and DIN 41652.

Depending on the device version, the pin assignment is the same as for an RS232 or RS485 port.

You can use for connection e.g. a 5-strand, shielded interface cable.

Tools

No tools are required for connection the interface cables.

2.3.2.4 Fiber-Optic Cable Connections

Central unit

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 22).

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 22).

Bay units

Depending on the mounting variant, the fiber-optic interface to the central unit is located on the bottom (Figure 2-7, page 23) or the rear (Figure 2-8, page 24) of the bay unit. For assignment of the connectors, please refer to Figure A-4, page 343 in the Appendix.

Connection method

FO connector type:	ST connector
Use fiber type:	Multimode FO, G50/125 µm, G62.5/125 µm, G100/140 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.

By using the fiber types G50/125 µm and G62,5/125 µm, compliance with class 1 acc. to EN 60825-1 is ensured.

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 inferface. 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.

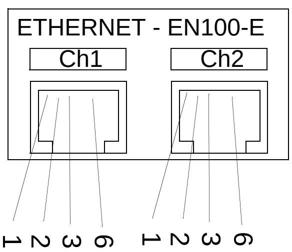


Figure 2-10 Ethernet connection

Connector type:RJ45 connector in acc. with IEEE 802

Lines: 150 W STP (shielded twisted-pair)

Note

For the implementation of an optical IEC 61850 interface, an external converter is additionally required.

Getting Started 3

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.

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-4, page 338).

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 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 336. 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.

3.3 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 16.
- ❑ Remove the front plug connectors X3, X4, X5 on the D-CPU module (Figure 3-2, page 33).
- ❑ 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 32 and Table 3-1, page 32).
- ❑ Change the rated control voltages for the binary inputs of the D-CPU module by relocating the jumpers (shown in Figure 3-2, page 33 and Table 3-2, page 33).

To insert the buffer battery into the central unit:

- ❑ Press the battery firmly into its snap-in holder (see Figure 3-2, page 33) on the D-CPU module. **Observe the correct battery polarity!**

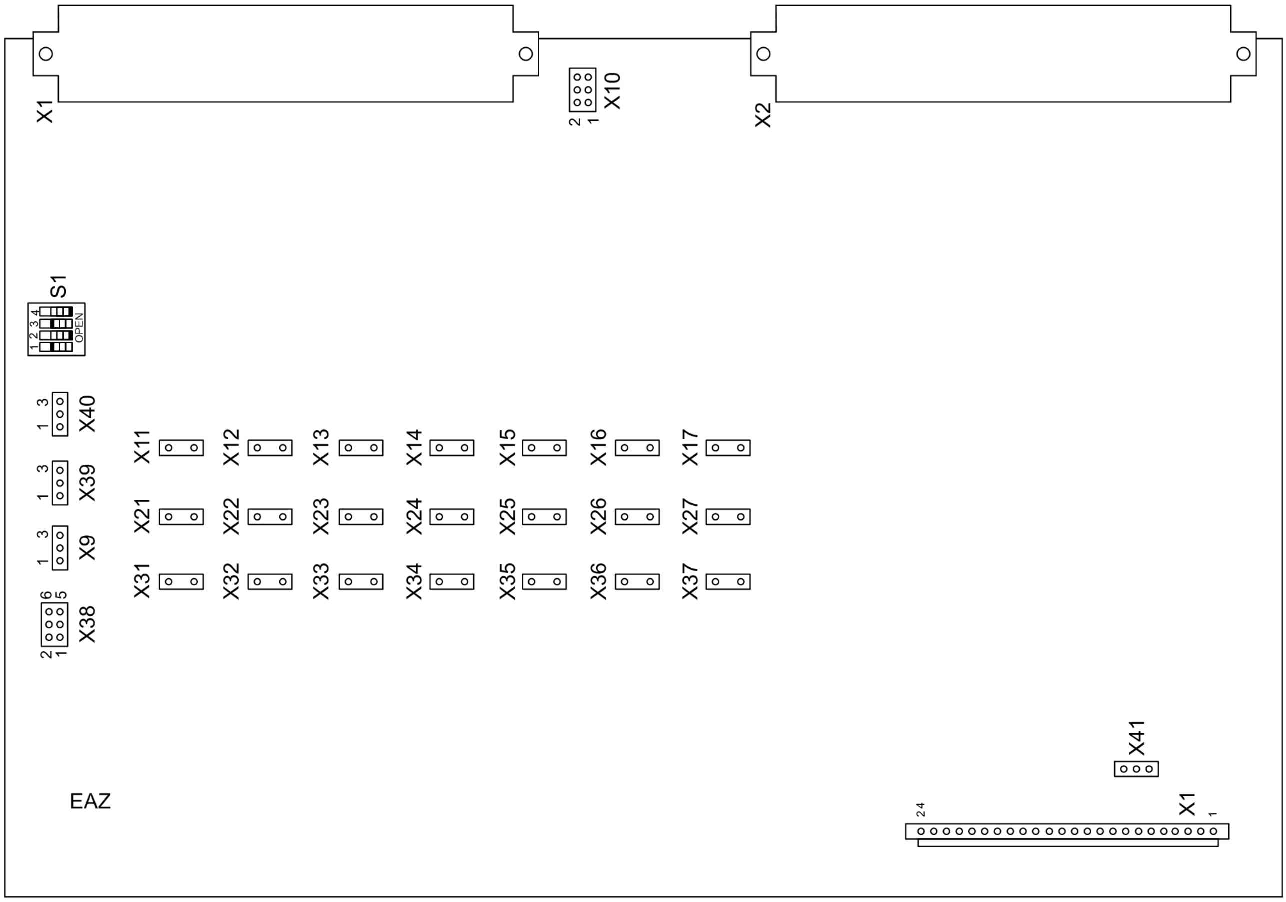


Figure 3-1 Location of the jumpers on the EAZ module (central unit)

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 33)				
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	-

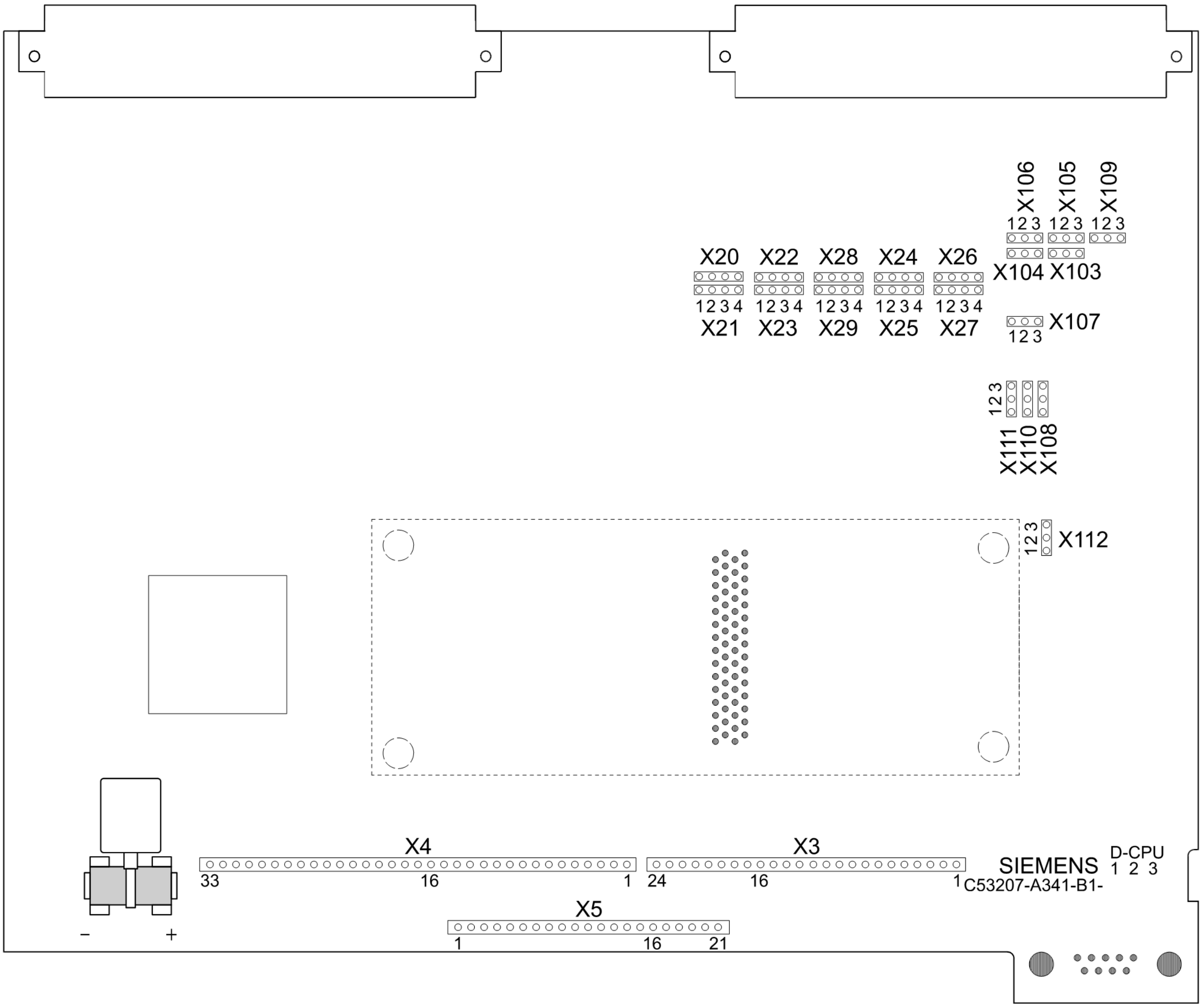


Figure 3-2 Location of the jumpers and the buffer battery on the D-CPU module (central unit)

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 32)				

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 19.
- Remove the plug connector X1 to the front plate on the EFE module (Figure 3-3, page 34) and pull out the module.
- Change the rated control voltages of the binary inputs to the desired settings, see Figure 3-3, page 34 and Table 3-3, page 35.

To insert the buffer battery into the bay unit:

- Press the battery firmly into its snap-in holder (see Figure 2-4, page 19) on the PFE module. **Observe the correct battery polarity!** The polarity is marked on the back of the board.

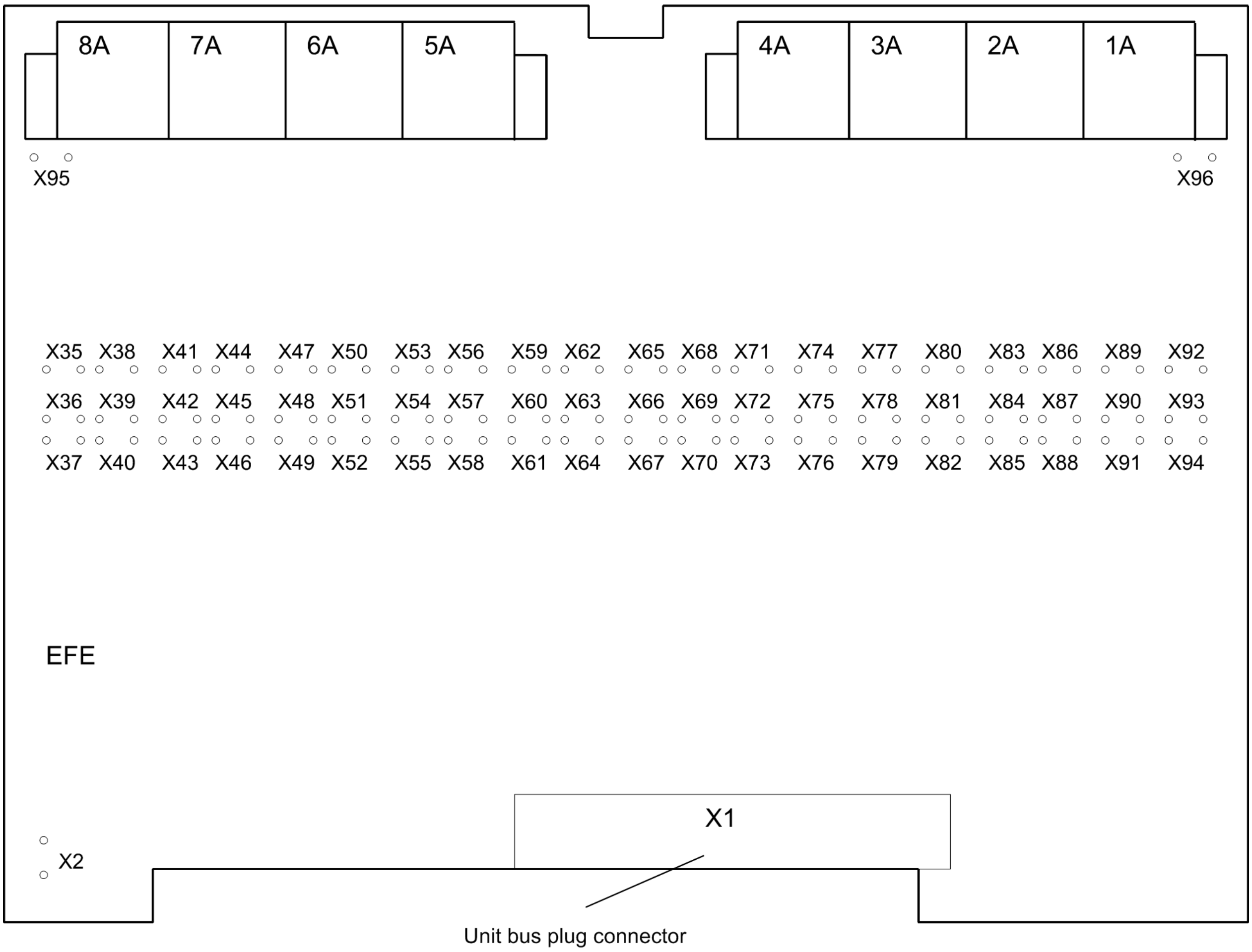


Figure 3-3 Location of the jumpers on the EFE module (bay unit 7SS523)

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 20.
- Remove the plug connector X1 to the front plate on the EFE_10 module (Figure 3-4, page 36) and pull out the module.
- Change the rated control voltages of the binary inputs to the desired settings, see Figure 3-4, page 36 and Table 3-4, page 37.

To insert the buffer battery into the bay unit:

- Press the battery firmly into its snap-in holder (see Figure 2-5, page 20) on the PFE/SVW module. **Observe the correct battery polarity!** The polarity is marked on the back of the board.

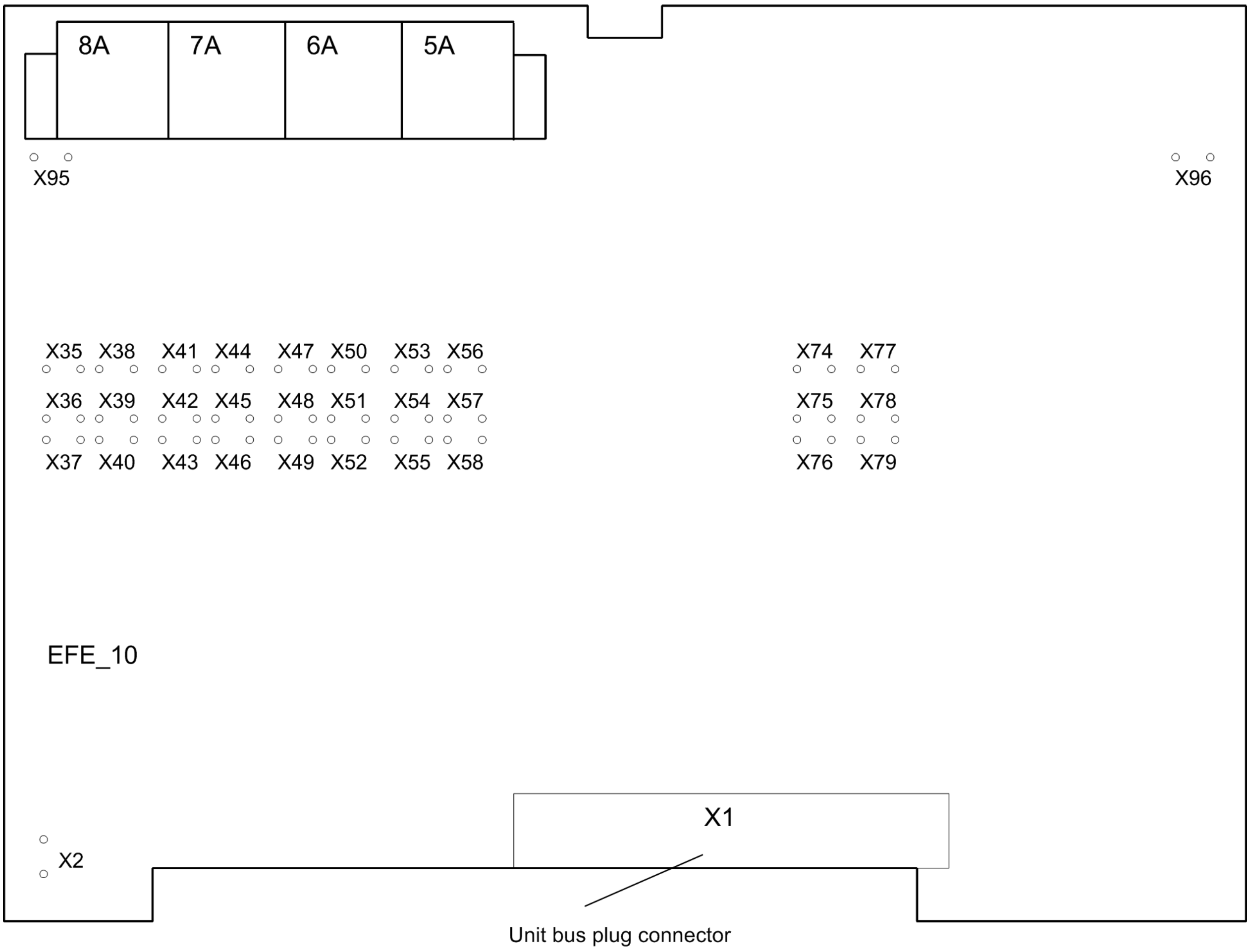


Figure 3-4 Location of the jumpers on the EFE_10 module (bay unit 7SS525)

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	X79	X78	X77	-
BI 10	X76	X75	X74	-

3.4 Electrical Checks

Make sure that the operating conditions are compliant with VDE 0100 and VDE 0105 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 342.
- ❑ 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.

3.5 Setting up the Communication between the Central Unit and the Bay Unit

The 7SS52 V4makes 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 25.
- ❑ Match the setting of the substation address, the feeder address and the 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 3.6.3, page 41), 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/.

3.6 Operation of SIPROTEC Devices from the Operator Panel

In addition to operating your station with the DIGSI software (see Chapter 6, page 209), the 7SS52 V4 allows you to operate the central unit and the bay units 7SS523 locally from the user interface on the device.

3.6.1 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.

3.6.2 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 ▲.
- Be 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 ▲.
- Be pressing the key ESC you return to the next higher level.

3.6.3 Setting Addresses in the Bay Unit

The central unit can only communicate with the bay units if the setting of the substation address, the feeder address and the device address in each bay unit matches 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 42).
- 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 itemt **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.

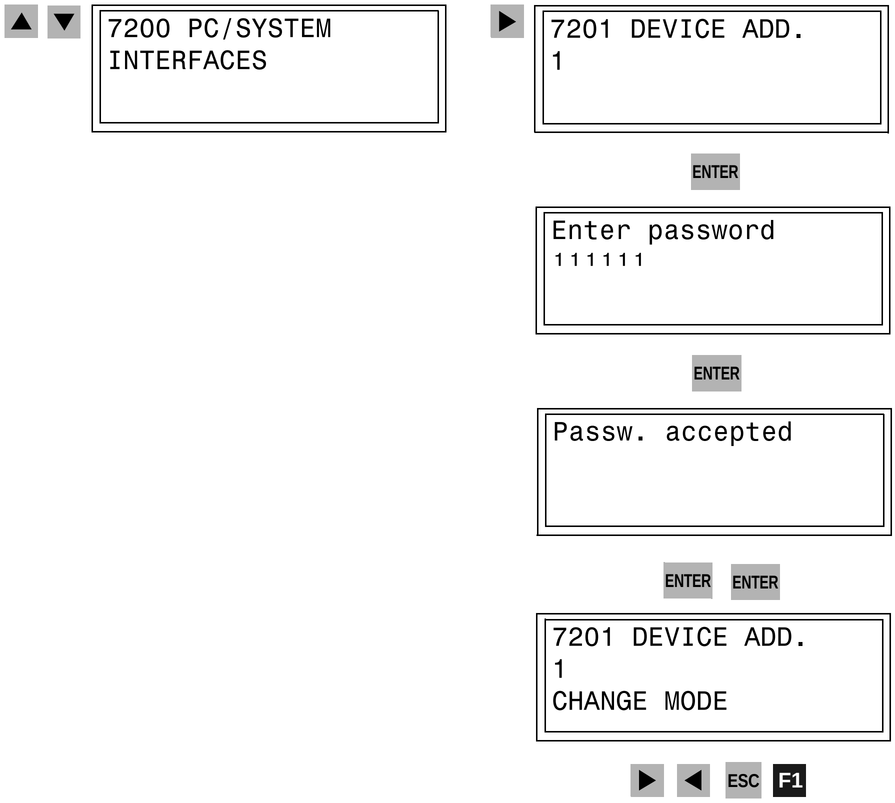


Figure 3-5 Operator menu for setting the device address in the bay units

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.

3.6.4 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.

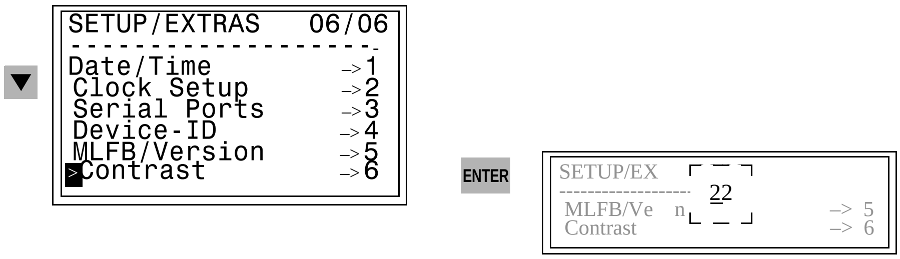


Figure 3-6 Operator menu for setting the display contrast

3.7 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 °C and +70 °C (-13 °F to +158 °F) (Chapter 9.2.16, page 326).
- To avoid premature aging of the electrolyte capacitors in the power supply, a temperature range of +10 °C to +35 °C (+50 °F to +95 °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 249 will tell you how to handle the Plant Visualization.

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.

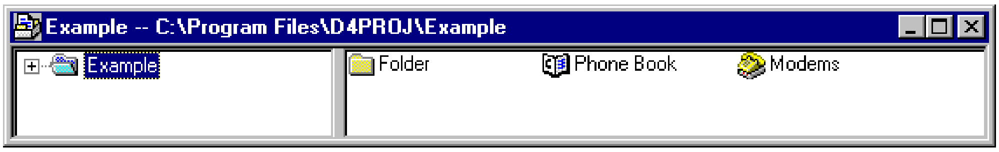


Figure 4-1 Project window after the creation of a new project

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.

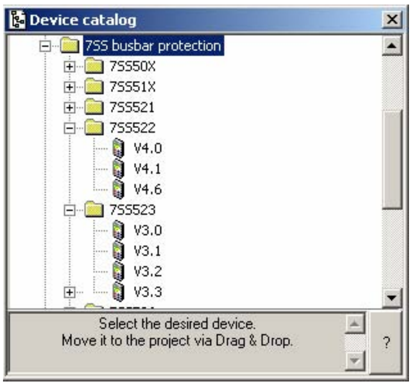


Figure 4-2 Device Catalog

- ❑ Switch to the directory **7SS522** in the Device Catalog and drag the object **V4.6** 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).

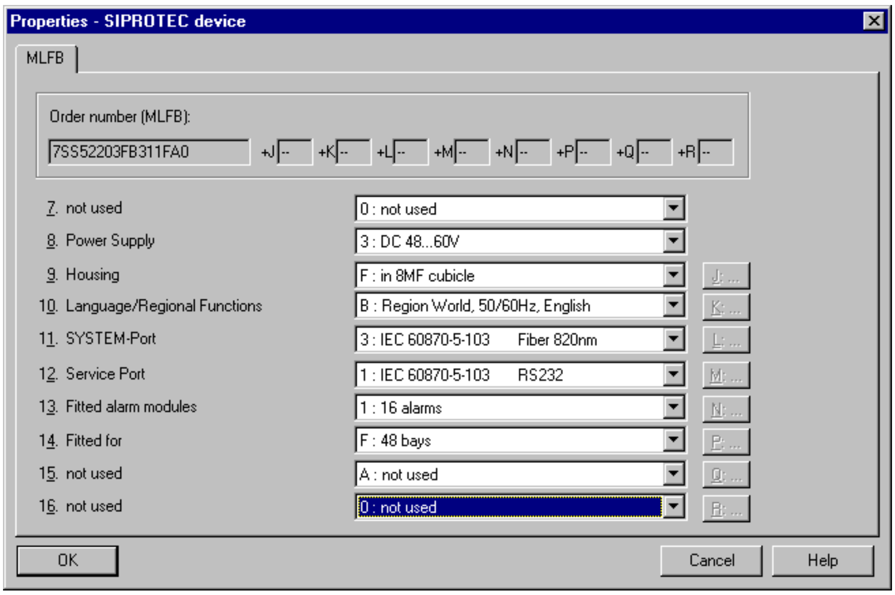


Figure 4-3 Dialog box **Properties - SIPROTEC 4 device**, Tab **MLFB**

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 isolator 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 89).

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 71).

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 50).

Note

Standard bays such as bus couplers and feeder bays are already available as **Typicals**. You can find Typicals 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 62).
- Draw the required **busbars** and name them (Chapter 4.3.3, page 52).
- Insert **bay names** to define the required bays (Chapter 4.3.4, page 54).
- Insert **dynamic elements** of the libraries into the substation chart (Chapter 4.3.5, page 56).
- **Link** the dynamic elements with the busbars. Use lines and connections for this purpose (Chapter 4.3.6, page 58).
- Insert **static text** e.g., for comments (Chapter 4.3.8, page 61).
- Create **Typicals** for frequently used substation components and insert them into the chart where needed (Chapter 4.3.9, page 62).
- **Save** the substation chart and **exit** the DIGSI Plant Configuration (Chapter 4.3.10, page 62).

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.

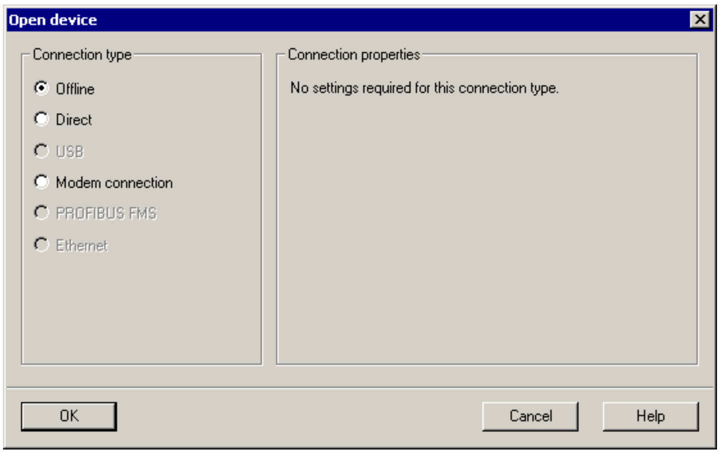


Figure 4-4 **Open Device** dialog box

- 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**.

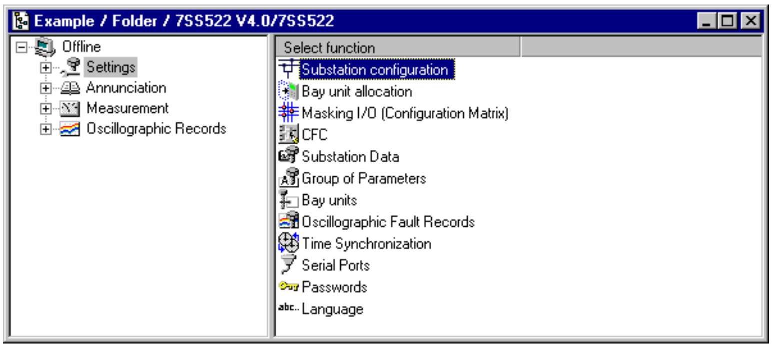


Figure 4-5 Start screen of the DIGSI Device Configuration

- 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.

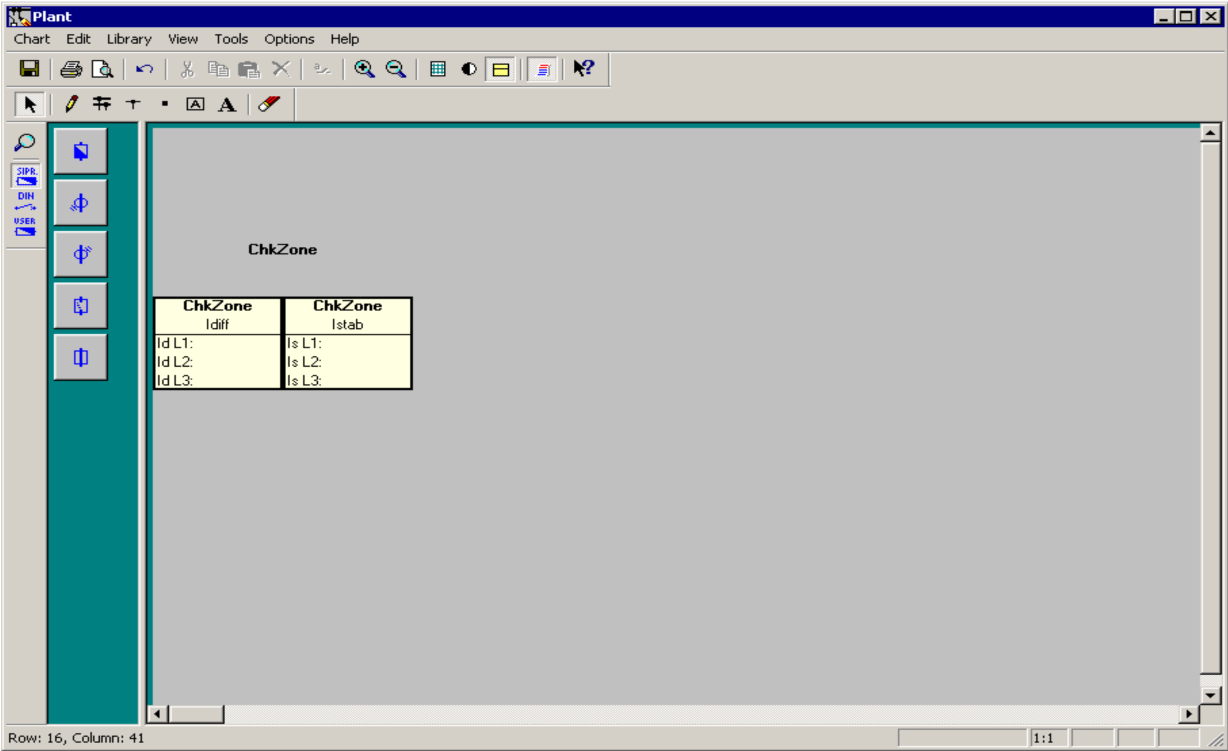


Figure 4-6 Start screen of the DIGSI Plant Configuration

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.

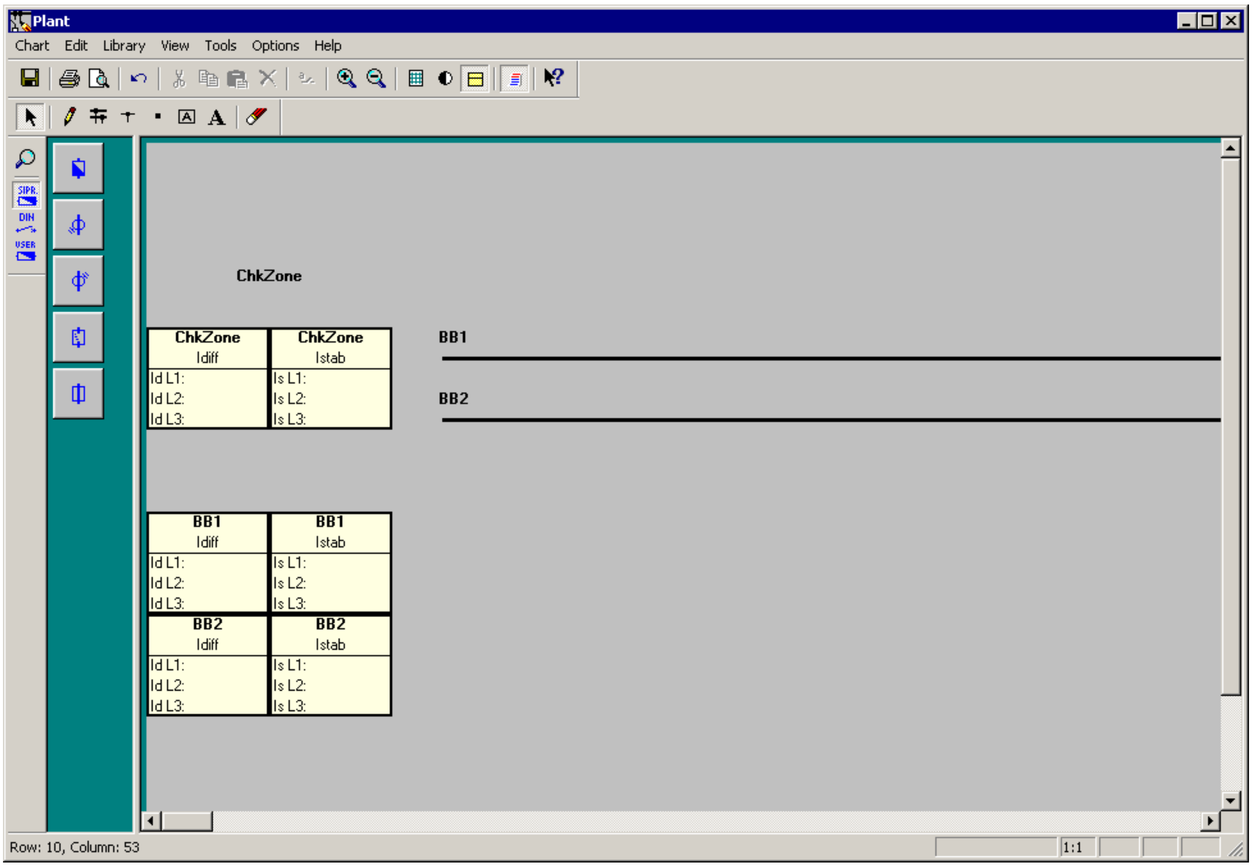


Figure 4-7 DIGSI Plant Configuration, Drawing busbars - Example

To name the busbar you must:

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

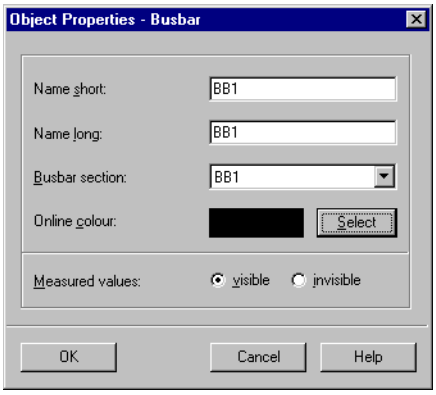


Figure 4-8 Dialog box **Object Properties - Busbar**

❑ 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 66 (BS1, BS2).

4.3.4 Defining Bays

Isolators, 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**.

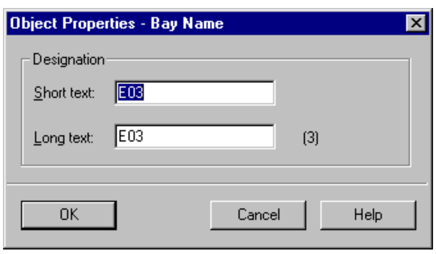


Figure 4-9 Dialog box **Object Properties - Bay Name**

- ❑ 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.

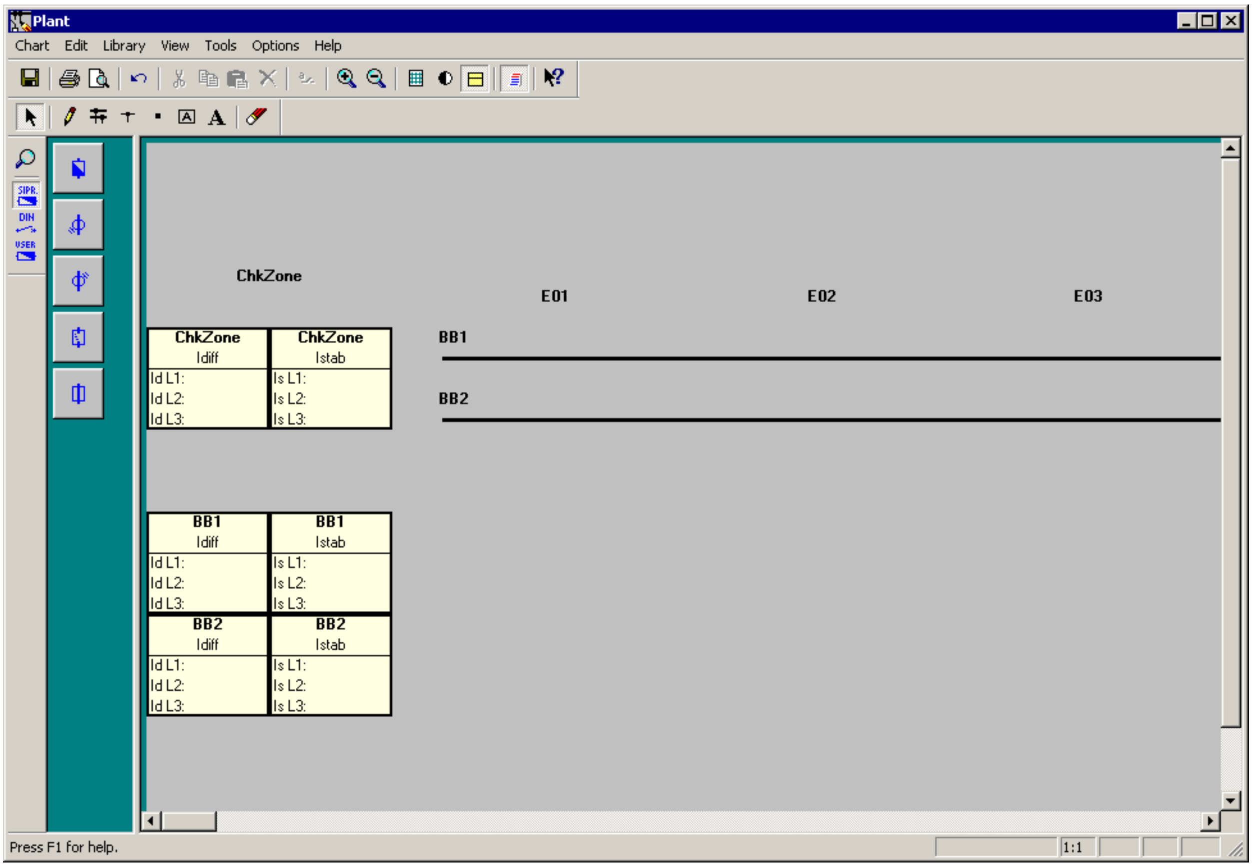


Figure 4-10 DIGSI Plant Configuration, Defining bays - Example

4.3.5 Inserting Dynamic Elements

Static and dynamic elements are inserted into the chart from libraries. Dynamic elements such as isolators, 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.

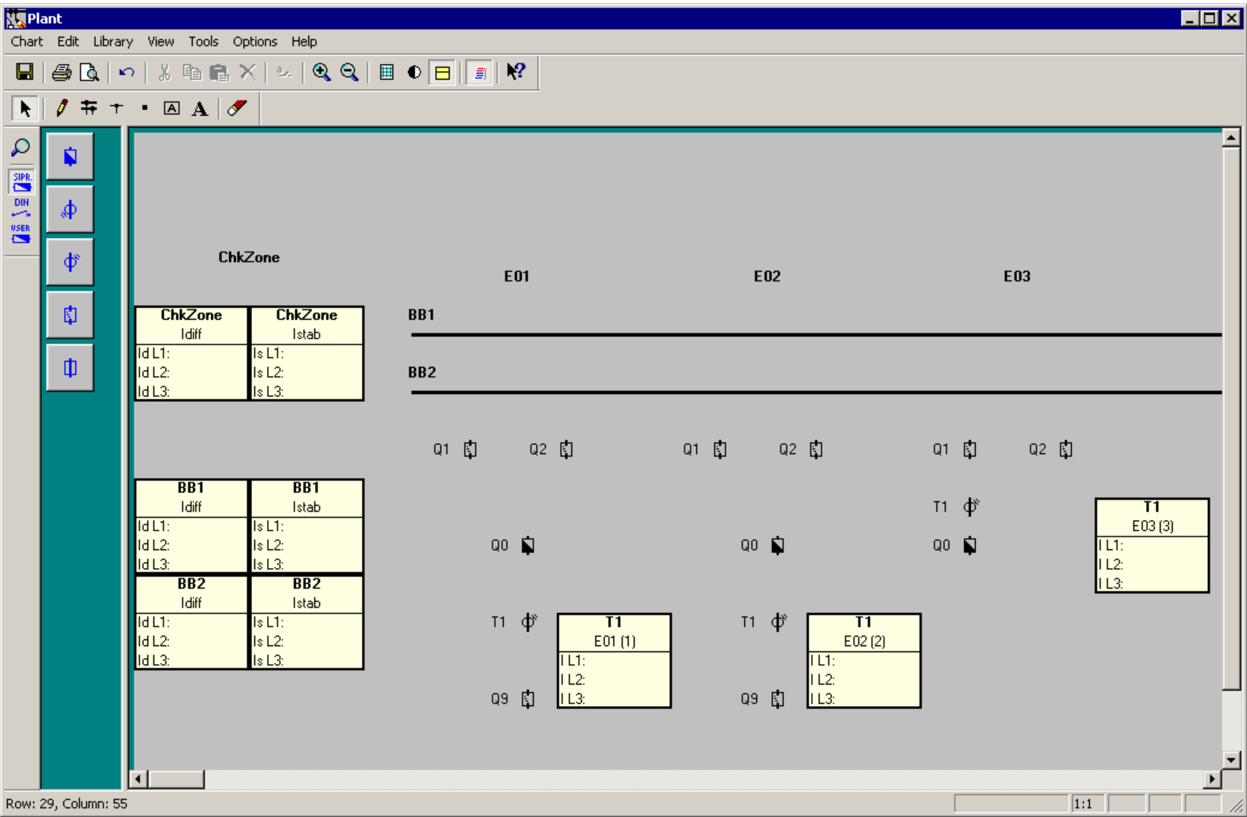


Figure 4-11 DIGSI Plant Configuration - Inserting dynamic elements - Example

Isolators, 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 isolators, 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.

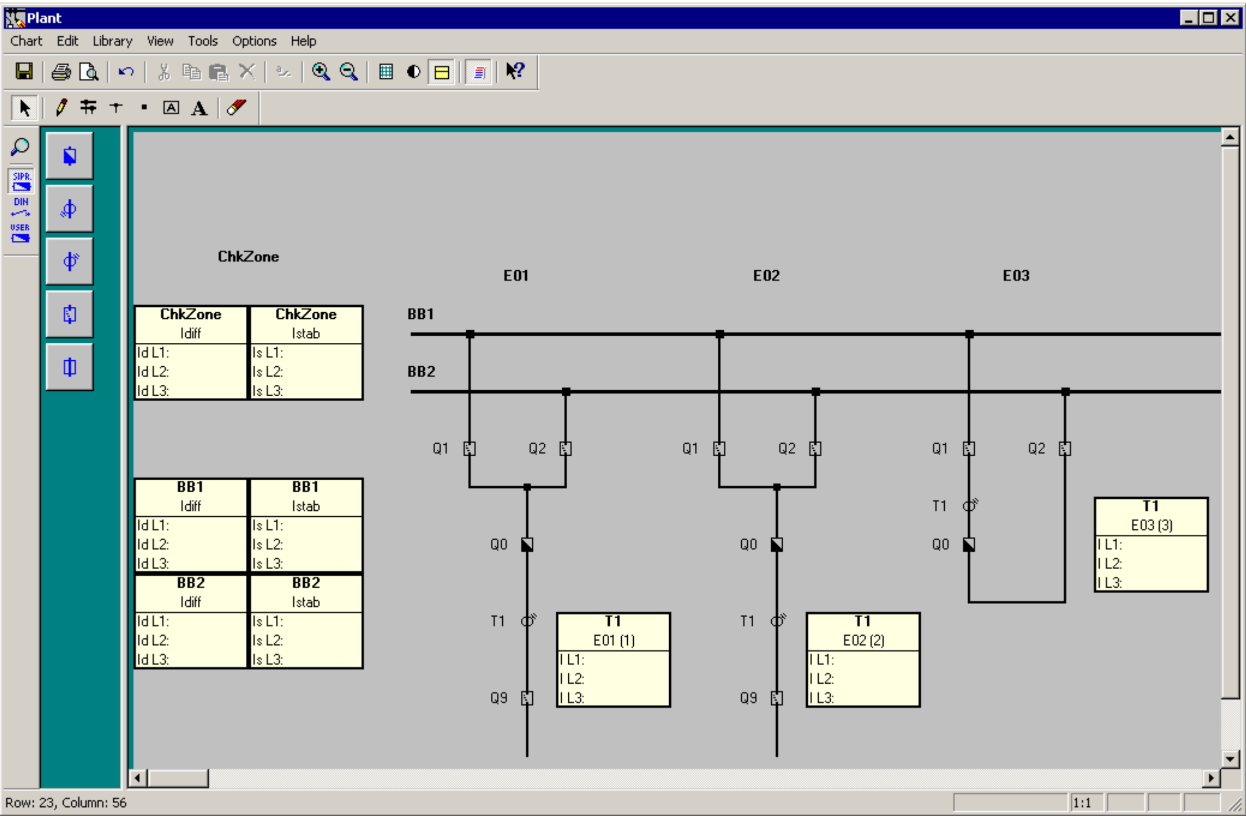


Figure 4-12 DIGSI Plant Configuration - Inserting lines and connections - Example

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/Ino 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 60). 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/Ino.

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

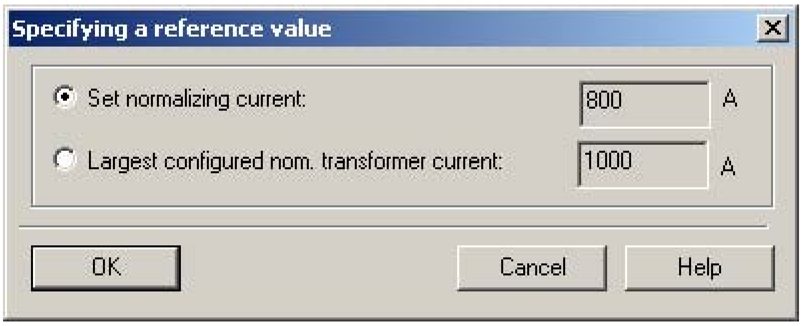


Figure 4-13 Select Reference Value

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.

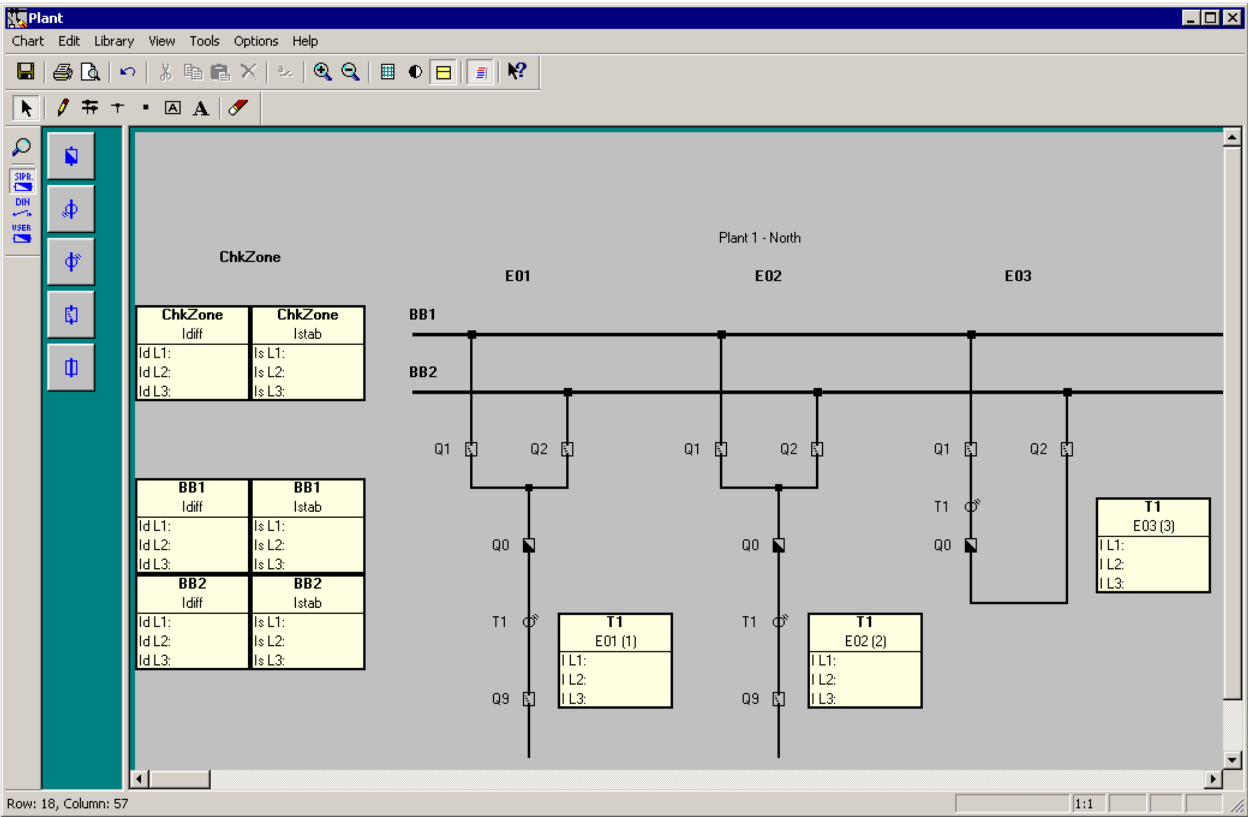


Figure 4-14 DIGSI Plant Configuration - Inserting static text - Example

4.3.9 Creating and Inserting Typicals.

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 89).

Note

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

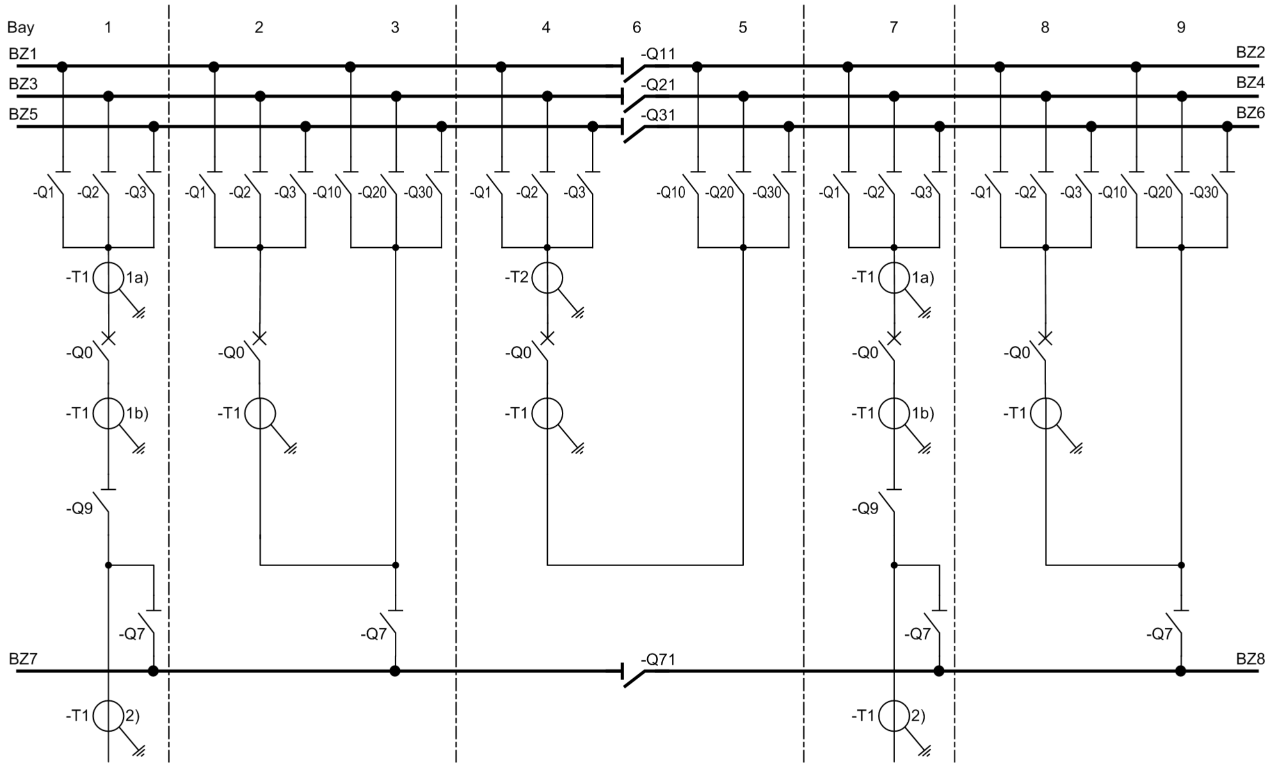
- 2-bay bus couplers must be parameterized to bay units with successive numbers (Figure 7-1, page 260).
- In 2-bay-couplers you can configure one or two current transformers (Chapter 7.1.3.2, page 259 and Chapter 7.1.3.3, page 259).
- For each bay unit you may configure not more than one transfer bus isolator. Transfer bus operation is only possible with transfer bus isolators of different bay units.
- Only switchgear or current transformers of the same bay may be assigned to a bay unit. Except sectionalising isolators.

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 64. The corresponding configuration data are collected in Table 4-1, page 65.

An example of a double busbar with a combination busbar is shown in Figure 4-16, page 66. The corresponding configuration data are collected in Table 4-2, page 66.



1a) inside current transformer (referred to Q7), in the direction of the busbar (referred to Q0)

1b) inside 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 1b) Bus side t. line 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 isolator	non existent
07	Feeder bay	1a) Bus side t. bus 1b) Bus side t. line 2) line side
08	2-bay coupler	Bus side t. line
09	2-bay coupler	non existent

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

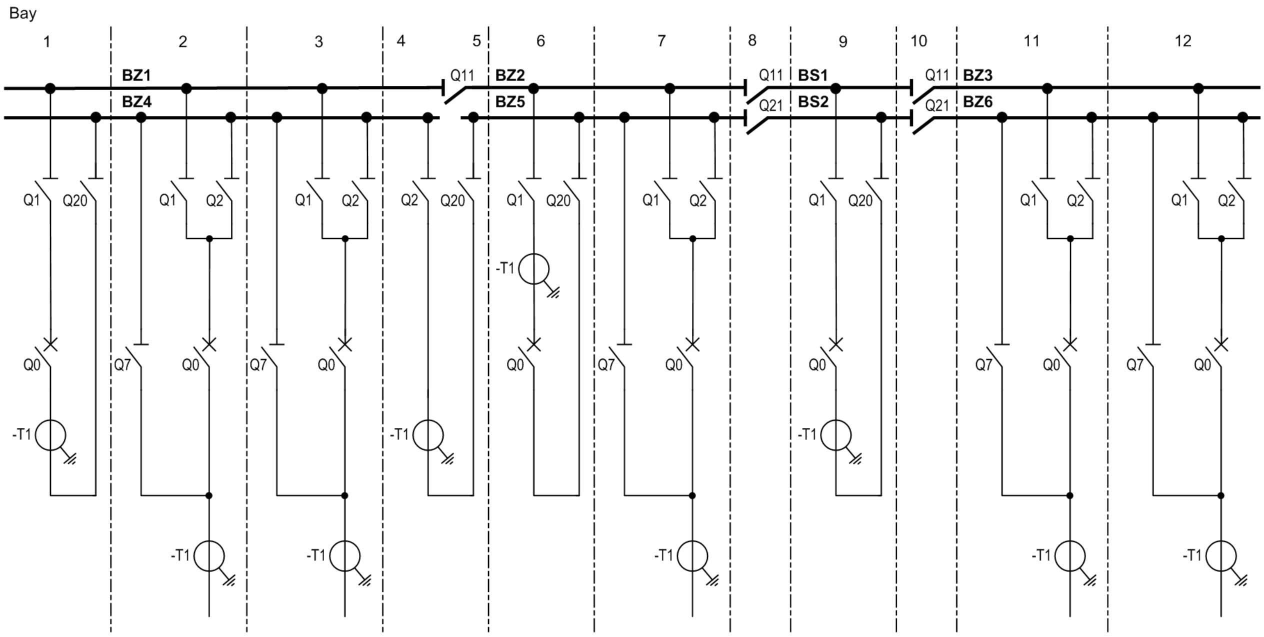


Figure 4-16 Double busbar with combi-bus

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 isolator	non existent
06	1-bay coupler	Bus side t. bus
07	Feeder bay	line side
08	Section isolator	non existent
09	1-bay coupler	Bus side t. line
10	Section isolator	non existent
11	Feeder bay	line side
12	Feeder bay	line side

Bay types

In the DIGSI Plant Configuration you may configure the feeders as 1-bay-coupler, 2-bay-coupler, feeder bay or sectionalizer.

Reserve bays

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 *not existent*, if it has been drawn in the Plant Configuration but is not assigned in the "Bay unit allocation".

Hardware design

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.

Station configuration

One bay unit is allocated to each feeder bay and each sectionalizer. The station configuration can include up to 16 bus couplers and 24 sectionalizers.

Accordingly, bus couplers may be assigned one or two bay units depending on the number of primary components.

Bus couplers

For further explanations about connection and setting of the bus coupler bays please refer to Chapter 7.1.3, page 258.

Isolator

Up to 5 isolators can be connected to each bay unit. Transferbus isolators must be marked correspondingly in the Object Properties.

For each isolator 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.

The binary inputs BI1 to BI10 of bay unit 7SS523 have default allocations (refer to Chapter A.15, page 395) which can however be changed. Bay unit 7SS525 with BI1 to BI4.

The isolators in the individual bus zones are assigned via the bus zone number.

Sectionalizing isolator

Isolators 1 to 5 can be used as sectionalizing isolator too. If the bay unit has exclusively sectionalizing isolators the type "sectionalizing isolator " is assigned to the bay unit. A maximum of 24 sectionalizers can be configured per substation.

CTs

To include the transfer or combi-bus in the protection system, the CTs in the feeder bays (Figure 4-16, page 66) must be located on the line side, and the protection function must be released in **PROT TR BUS** (**5401/CU**).

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 isolator (Figure 4-15, page 64, 1a)
- *busside towards line* means that the transformer is located upstream of the feeder isolator, i.e. between the circuit breaker and the feeder isolator (refer to Figure 4-15, page 64, 1b)
- *line side* means that the transformer is located downstream of the feeder isolator (Figure 4-15, page 64, 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 isolator 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 68 and Figure 4-18, page 69).

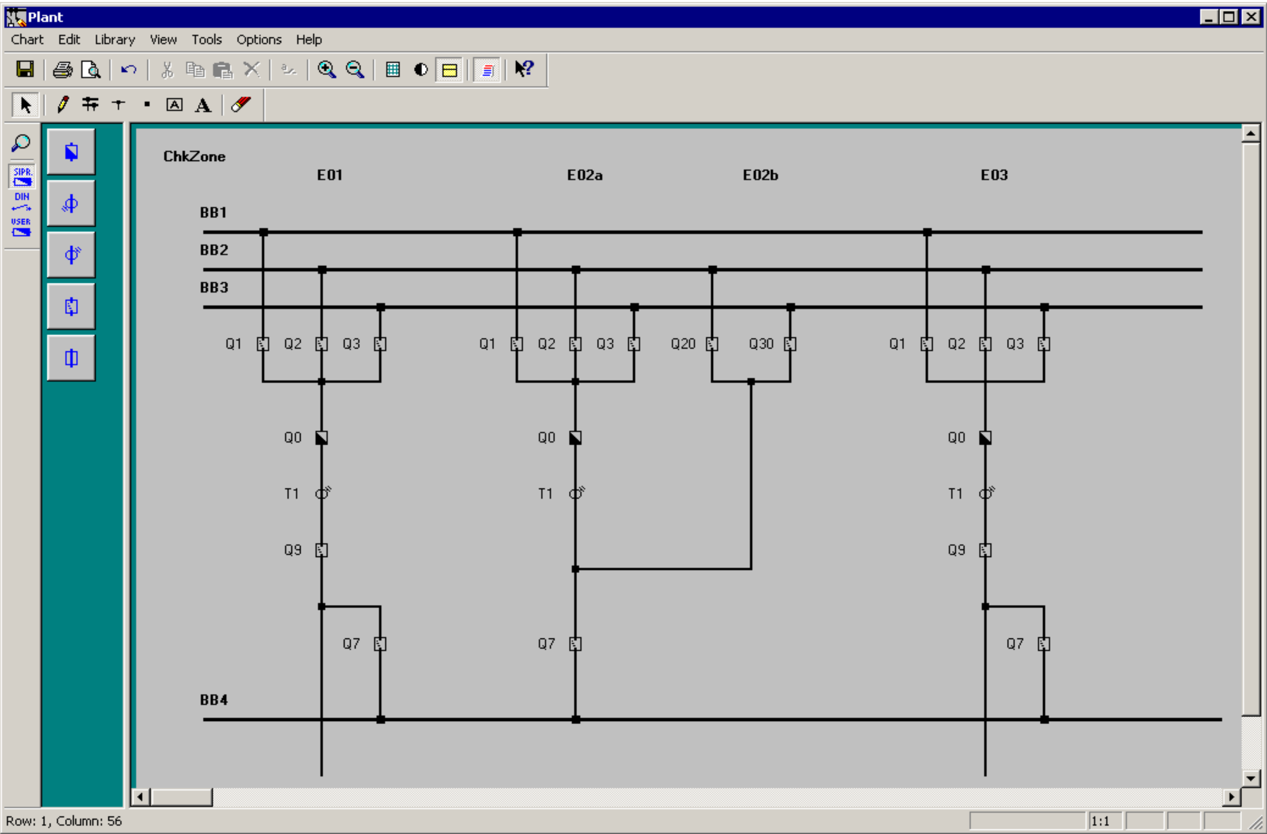


Figure 4-17 Example for the configuration of a 2-bay coupler with one CT

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

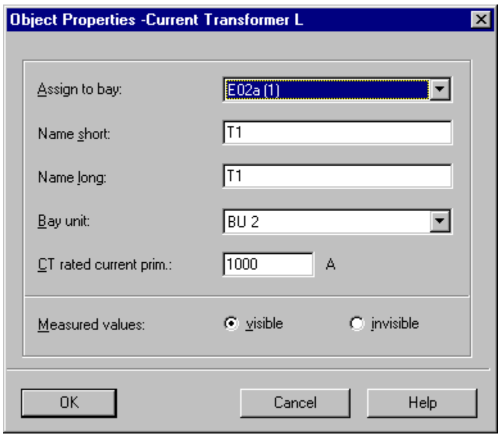


Figure 4-18 Object properties of the transformer T1 from the example given in Figure 4-17, page 68

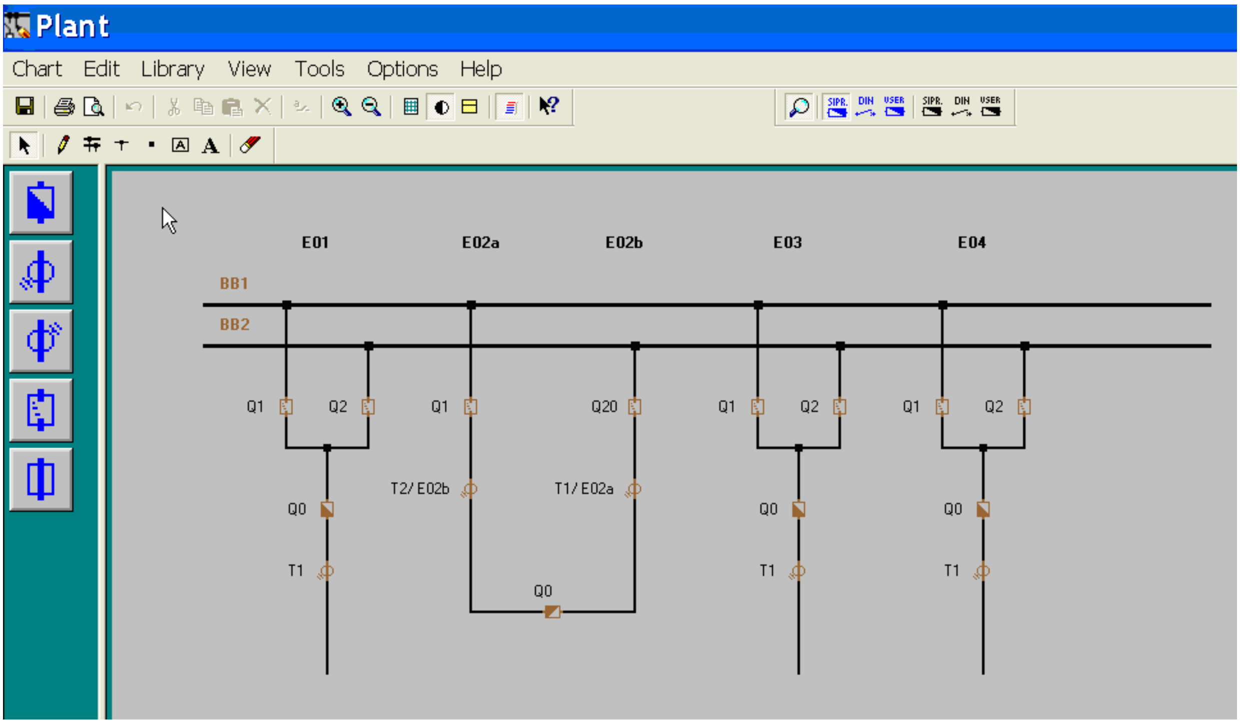


Figure 4-19 Example for the configuration of a 2-bay coupler with two CTs

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.

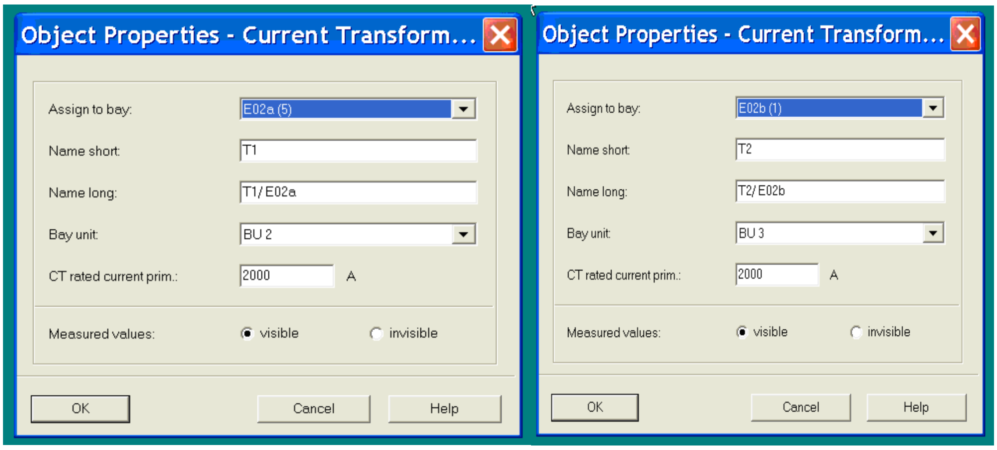


Figure 4-20 Object properties of the transformer from the example given in Figure 4-19, page 69

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 47). 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**.

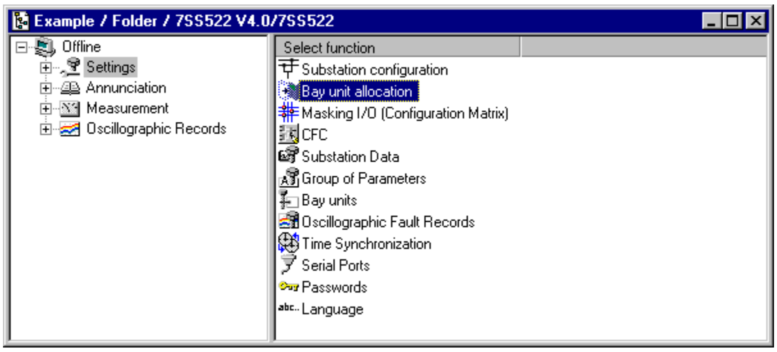


Figure 4-21 DIGSI Device Configuration - The folder Settings

❑ 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.

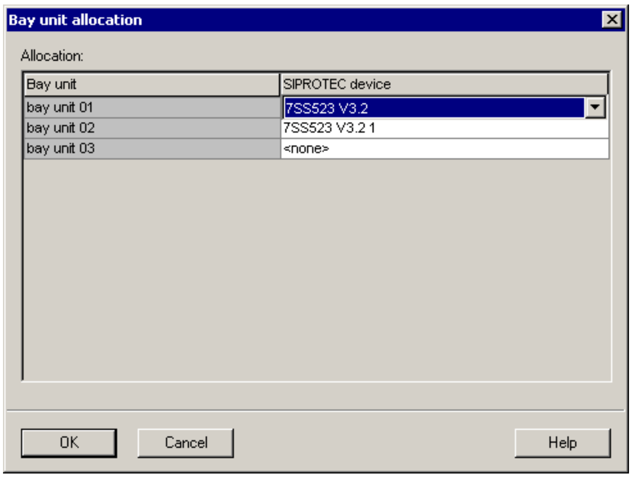


Figure 4-22 DIGSI Device Configuration - Dialog box for **Bay unit assignment**

- 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 47).

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. The can be activated with or without voltage.

Note

Allocate the indication “>EF charact.“(**FNo. 10478/CU**) for the earth fault characteristic to the binary input 1 to 5 since these binary inputs process by 1 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 395).

The Chapter A.9, page 373 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 389).

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 395 and A-24, page 396.

The Chapter A.9, page 373 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 56) and by saving the substation chart Chapter 4.3.10, page 62.

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.

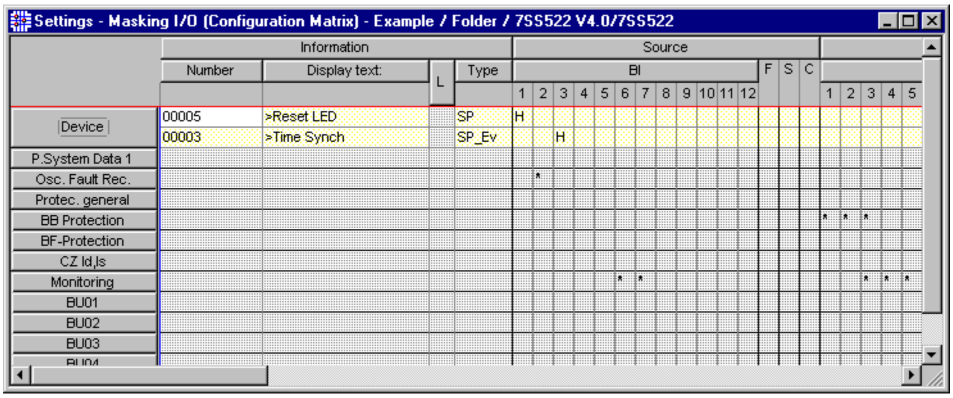


Figure 4-23 Partial view of the Configuration Matrix

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.

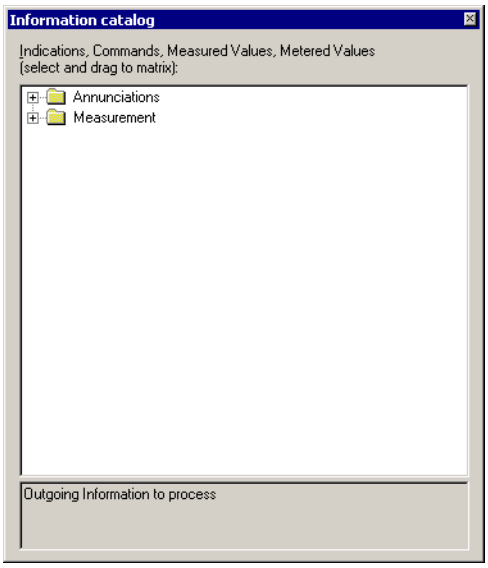


Figure 4-24 Information Catalog

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 398 and Table A-31, page 401 shows the default assignment of the binary inputs upon delivery.

Chapter A.10, page 383 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 383 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 unlatchted mode “nm”.

The ex-factory setting of the LEDs can be looked up in Table A-30, page 400.

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 383 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 399 and Table A-33, page 402.

The functions stated in Chapter A.10, page 383 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**.

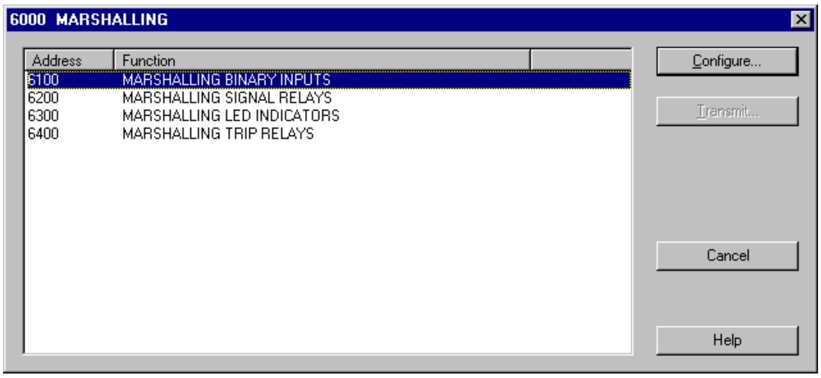


Figure 4-25 Marshalling the bay units - the dialog box Marshalling

- ❑ 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.

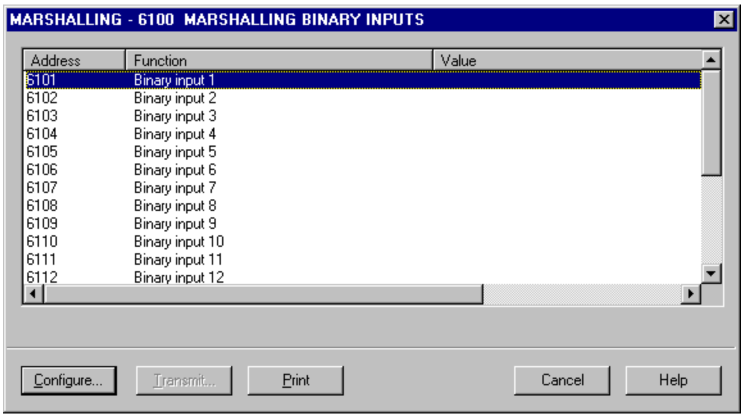


Figure 4-26 Marshalling the bay units - the dialog box Marshalling -

- 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.

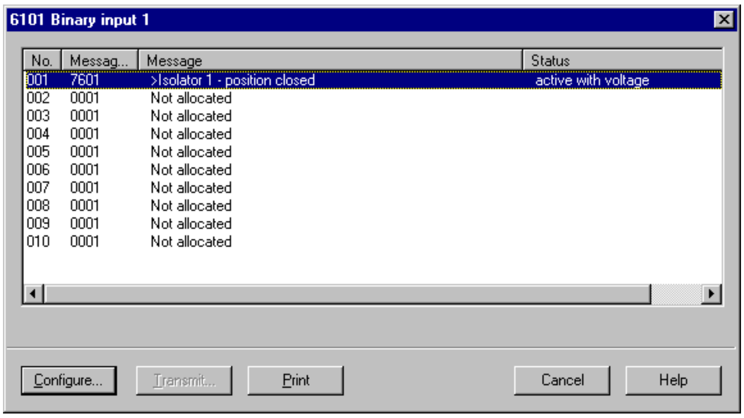


Figure 4-27 Marshalling the bay units - the dialog box Binary input 1

- 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.

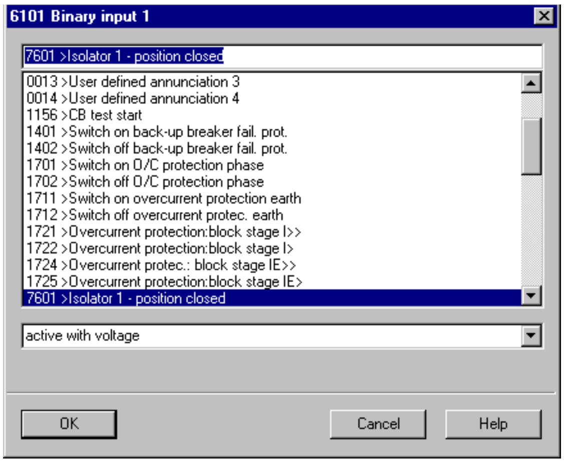


Figure 4-28 Marshalling the bay units - dialog box 6101 Binary input 1

- ❑ 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 177 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 DIGSIDevice 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 112.

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 112.

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 81). 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.

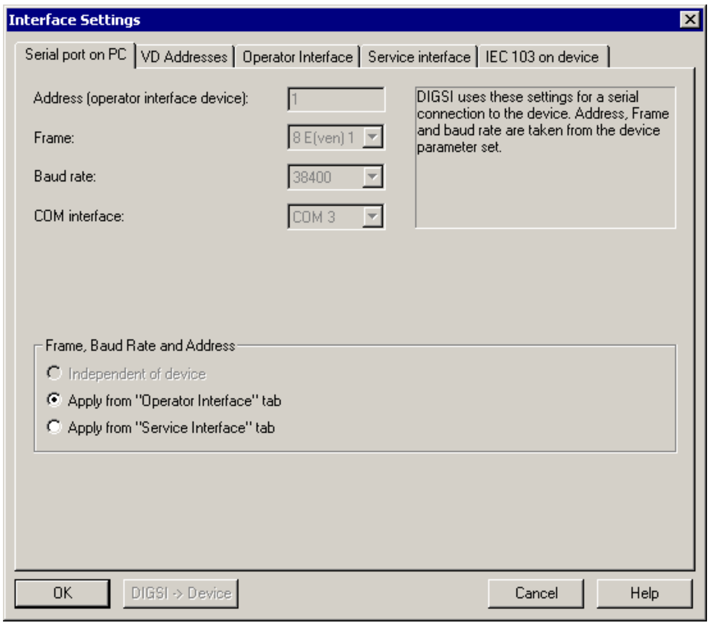


Figure 4-29 DIGSI, settings of the PC port

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 81). 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 82).

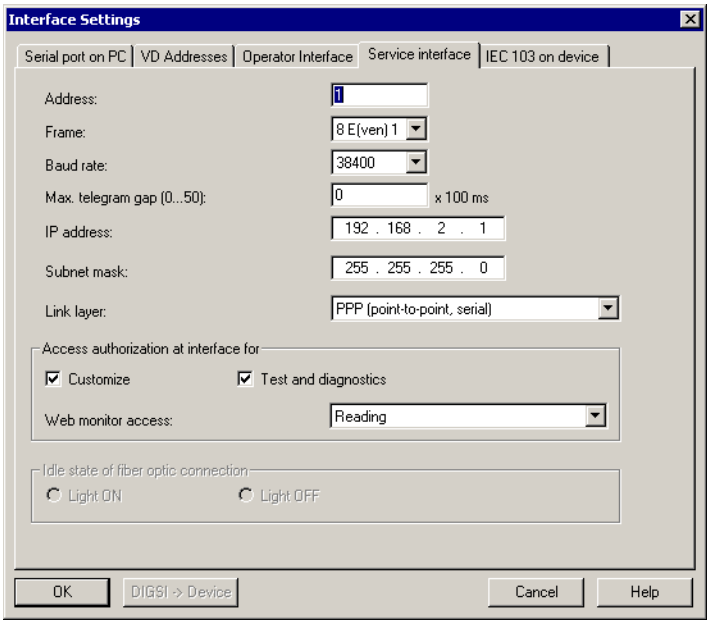


Figure 4-30 DIGSI, setting options of the service port – Example

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.

Note

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 83).

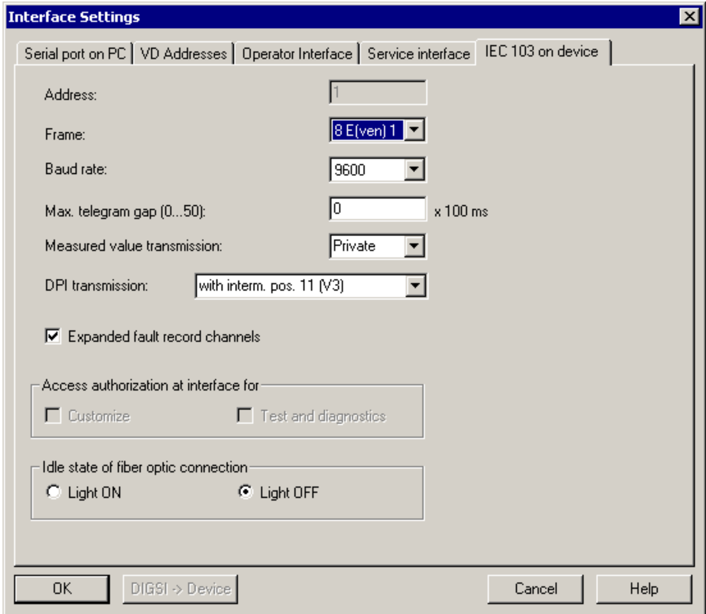


Figure 4-31 Settings for a fibre optic interface

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 83).

```
PC Port          01/04
---------------------
 Phys.Addres   █  >254
 Baudrate 19200 bauds
 Parity           8E1
 Gaps            0.0s
```

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 84). In case of a wired interface you will read “not existent” here.

```
PC Port      01/02
--------------------
>IEC60870–5–103 –> 1
```

```
IEC 60870–5–103
 -------------------
>Phys.Address     254
>Baudrate  9600 bauds
 Parity           8E1
 Gaps            0.0s
 OFF-Sig.   Light OFF
```

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 71) 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 85).

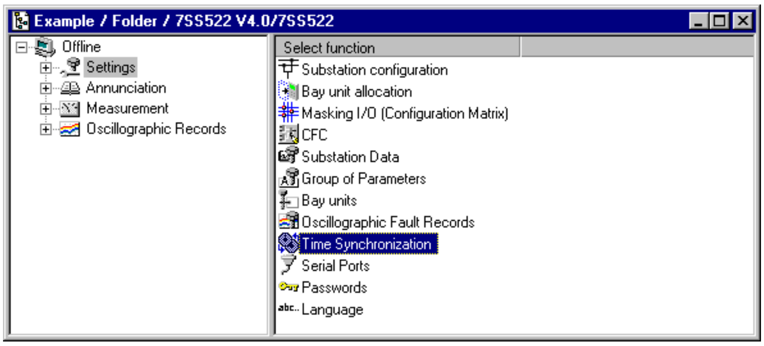


Figure 4-34 The window Settings in DIGSI – Example

Double-click **Time Synchronization**. The **Time Synchronization & Time Format** dialog box opens (Figure 4-35, page 86).

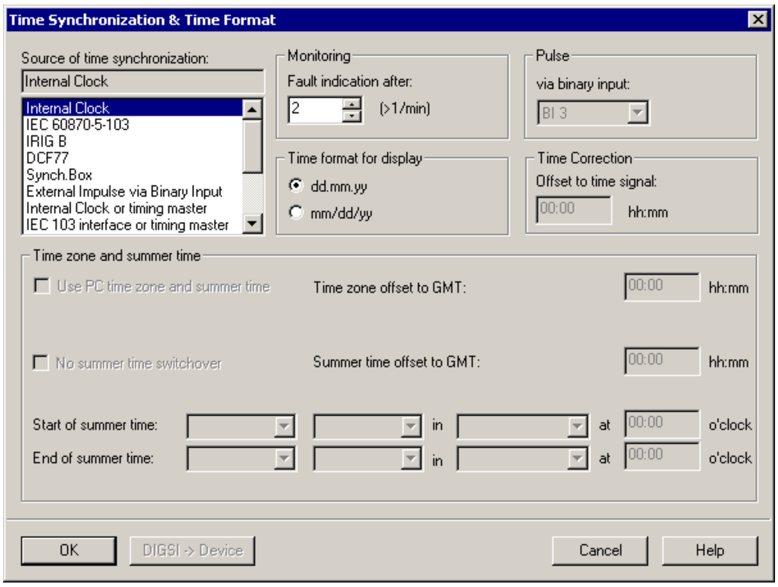


Figure 4-35 Time Synchronization & Time Format dialog box in DIGSI – Example

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	**`Internal Clock`**	Internal synchronization via RTC (default)
2	**`IEC 60870-5-103`**	External synchronization via IEC 60870-5-103–system interface
3	**`Time signal IRIG B`**	External synchronization via IRIG B
4	**`Time signal DCF77`**	External synchronization via the time signal DCF77
5	**`Time signal Sync. Box`**	External synchronization via the time signal SIMEAS-Synch.Box
6	**`External Impulse via Binary Input`**	External synchronization with impulse via binary input
7	**`NTP (IEC 61850)`**	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 239.

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 86).

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: ±23 h 59 min = ±1439 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.

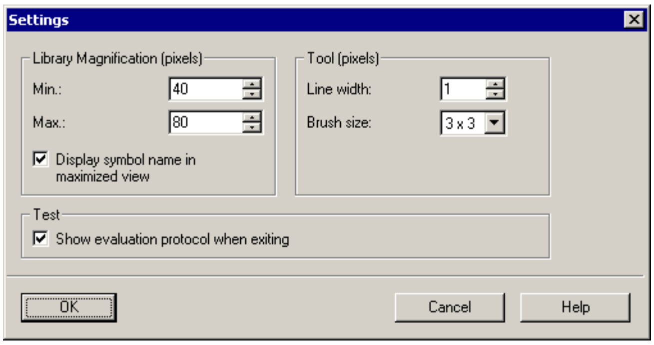


Figure 4-36 Customize window – Example

- ❑ Mark the checkbox **Show evaluation protocol when exiting**.
- ❑ Subsequently click **OK**. The evaluation protocol (report) (Figure 4-37, page 89) opens when you exit the Plant Configuration.

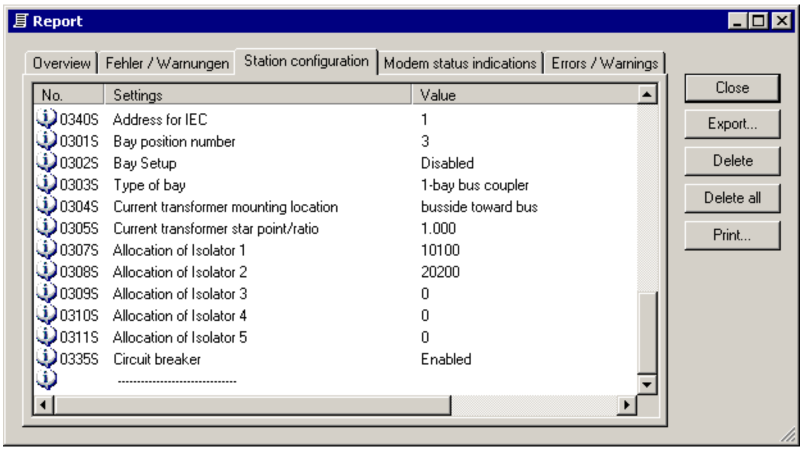


Figure 4-37 Evaluation protocol (report) when exiting the configuration – Example

Allocation of isolator

The evaluation protocol (report) shows the allocation of isolators as a coded value. The explanation is given in Table 4-4, page 90

Table 4-4 Allocation of isolator

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

Contents

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.

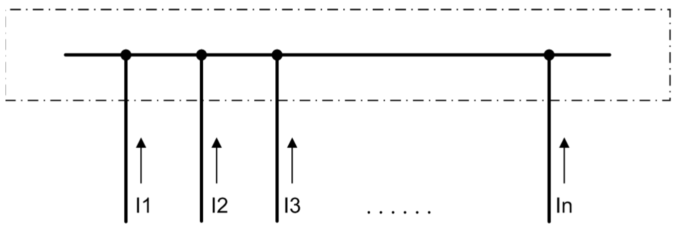


Figure 5-1 Busbar with n feeders

Assuming that the currents I_1, I_2, I_3 to I_n flow in the feeders (Figure 5-1, page 92) 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.

$$I_1 + I_2 + I_3 \ldots + I_n = 0 \qquad (1)$$

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 ($I_{prim.}$) proportionally into secondary currents ($I_{sek.}$). As a result, the following equation applies for the busbar protection in the fault-free condition:

$$I_{1\ sec.}\ n_1 + I_{2\ sec.}\ n_2 + I_{3\ sec.}\ n_3 \ldots + I_{n\ sec.}\ n_n = 0 \qquad (2)$$

n_1, n_2, n_3 ... n_n are the CT transformation ratios and

$I_{1\ sec.}$, $I_{2\ sec.}$.. $I_{n\ sec.}$ 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 stabilization (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 with a time constant $\tau = L / R$ of the impedance from source to fault. With the growing output ratings of the generator units, these time constants in the supply system tend to grow longer. A superimposed DC component speeds up the magnetic saturation in the transformer cores, thus considerably affecting the transformation task.

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:
  - Stabilization (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

Stabilization

The stabilization 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 94) to ensure stability even in cases of extreme saturation.

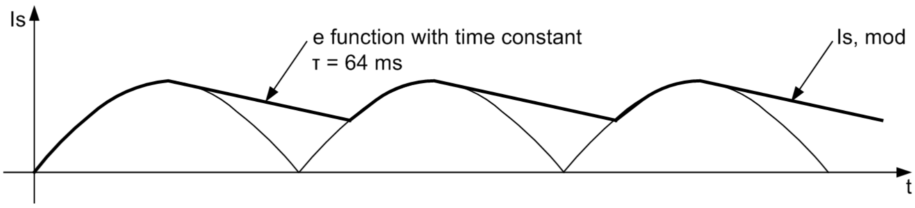


Figure 5-2 Formation of the stabilizing (restraint) current

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 ”Stabilization factor k” and ”Differential current limit Id>".

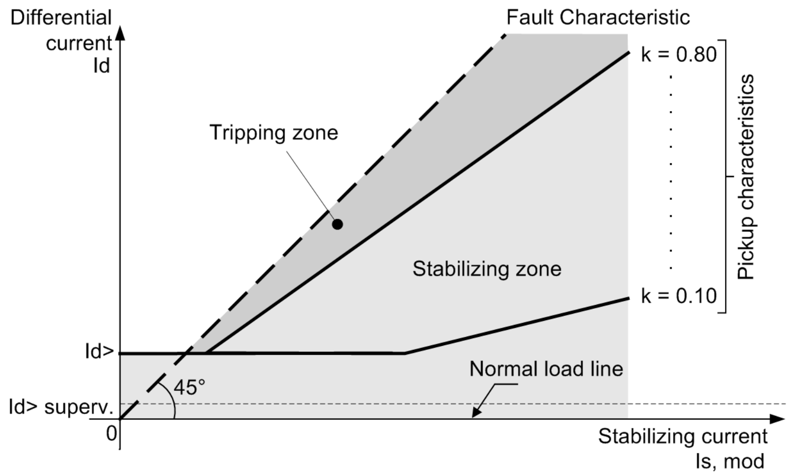


Figure 5-3 Standard characteristic

The vectorial sum I_d as the tripping quantity

$I_d = | I_1 + I_2 ... + I_n |$

is counterbalanced by the restraining quantity I_s

$I_s = | I_1 | + | I_2 | ... + | I_n |$

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

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

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

The modified stabilizing quantity $I_{s,\,mod}$ is derived from I_s and is illustrated in Figure 5-2, page 94.

Standard characteristic

Figure 5-3, page 95 illustrates the characteristic of a stabilized (restrained) differential protection system. In the diagram, the abscissa represents the sum $I_{s,\,mod}$ 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°.

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.

Earth fault characteristic

For the detection of high-resistance earth faults, tripping characteristics with increased sensitivity are provided for the selective protection zones, the check zone and circuit breaker failure. These more sensitive characteristics have their own parameters. The stabilizing factor is identical with the normal load line.

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

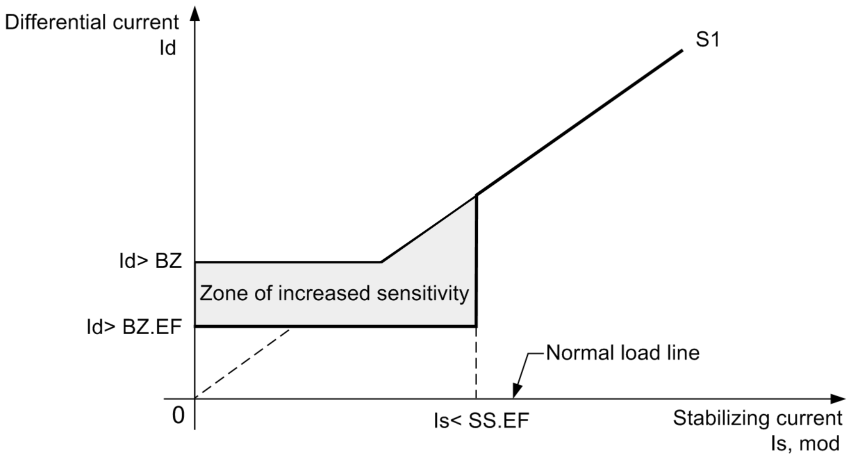


Figure 5-4 Earth fault characteristic

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 which decays according to the function $e^{-t/\tau}$. Time constants τ of approximately 64 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 5-5, page 98 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 5-5, page 98 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 5-5, page 98 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 5-5, page 98 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 5-5, page 98 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 5-5, page 98 a). The stabilization 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.

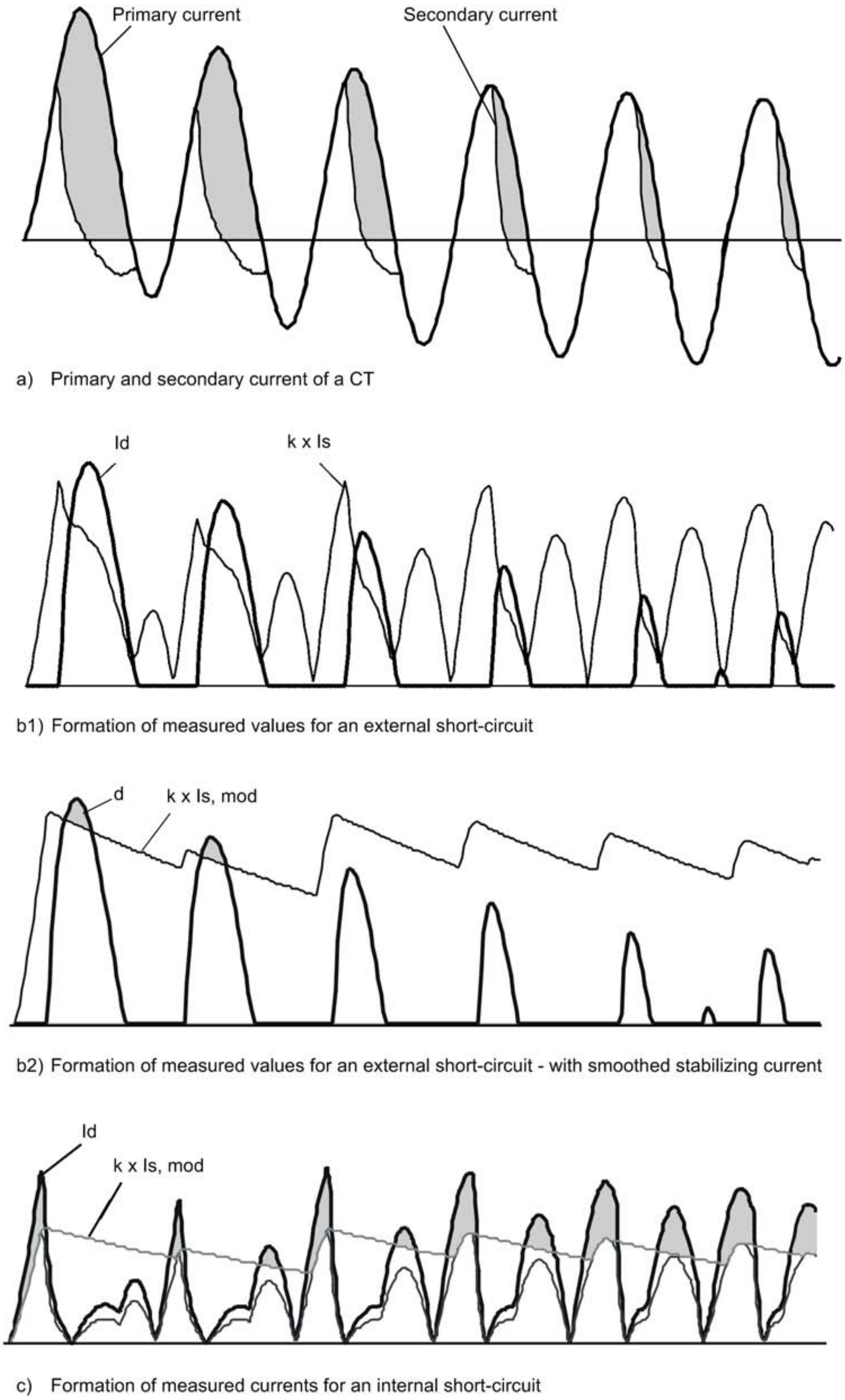


Figure 5-5 CT currents and measured values in the event of an initially fully offset fault current; DC component decaying with τ = 64 ms

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 5-5, page 98 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 dI_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 95) 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 94. 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 5-8, page 101).

5.1.1.6 Summary of the Measuring Method

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

Tripping occurs when

- $I_d >$ 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 5-6, page 100, 5-7, page 101 and 5-8, page 101.

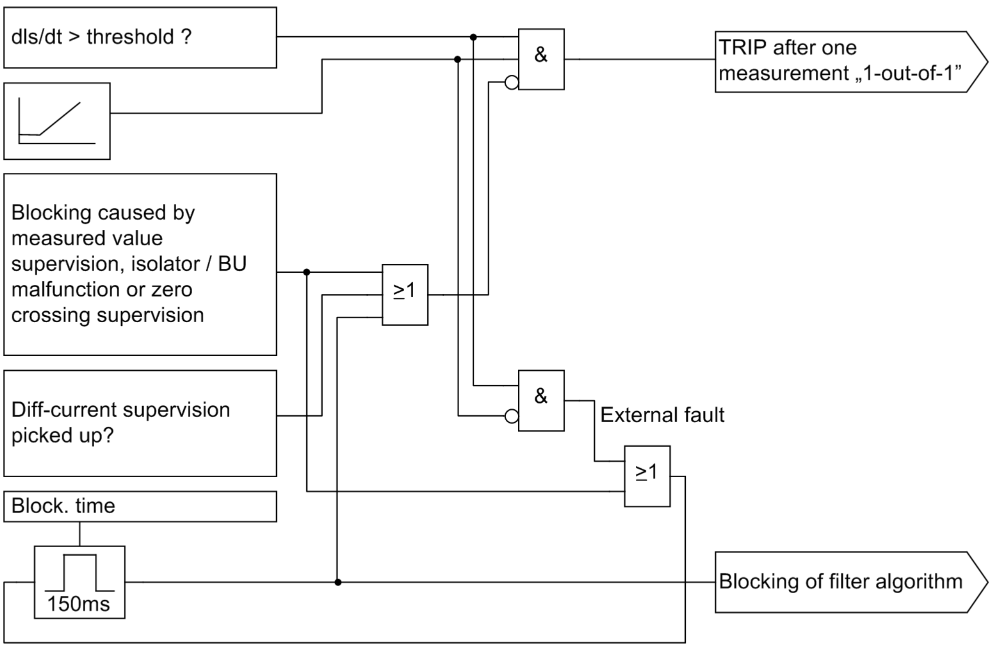


Figure 5-6 TRIP following 1-out-of-1 evaluation

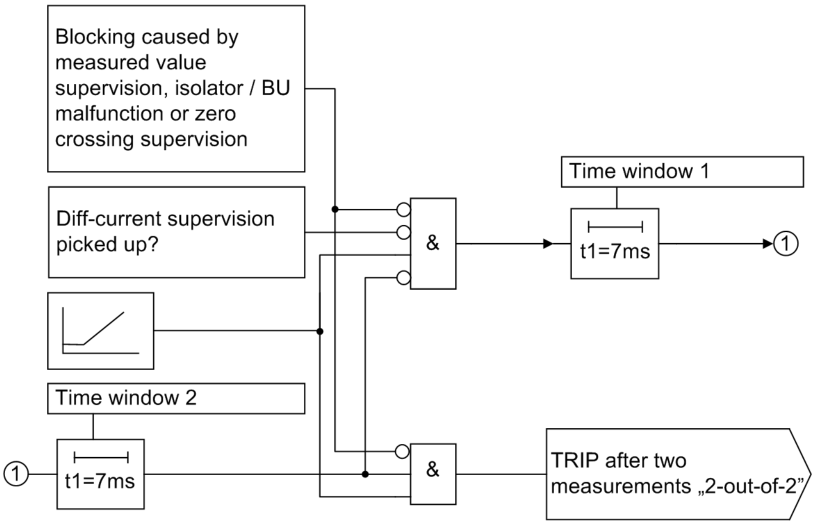


Figure 5-7 TRIP following 2-out-of-2 evaluation

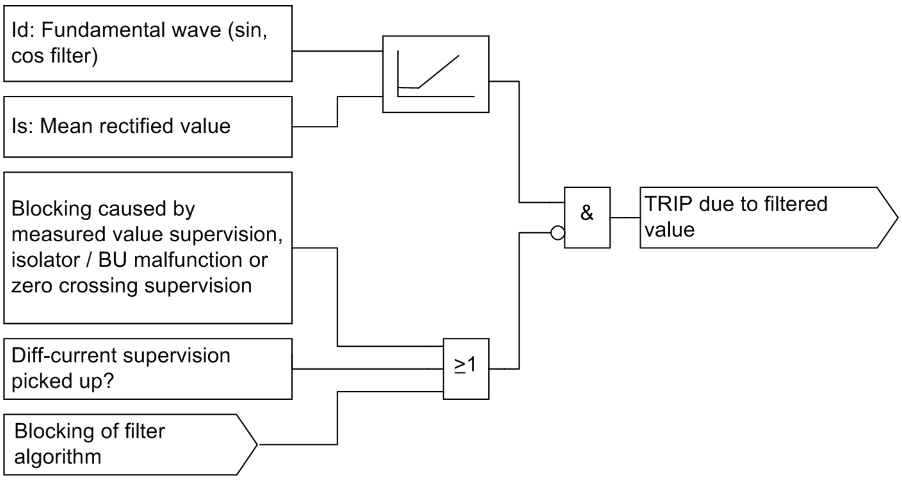


Figure 5-8 TRIP due to filtered value

5.1.2 Isolator Replica

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

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 isolator auxiliary contacts. The CLOSED position is only used for the isolator status supervision (isolator malfunction, isolator intermediate position).
For the determination of the isolator runtime the status changes of the two indications "Isolator OPEN" and "Isolator CLOSED" are used. Therefore, a true replica of the isolator 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 isolator 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 isolator 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 (CBaux).

Figure 5-9, page 102 shows the basic connection scheme.

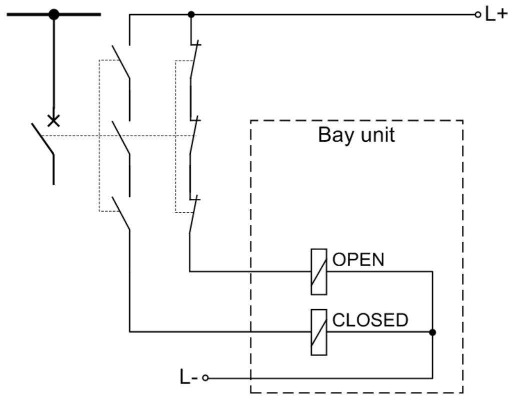


Figure 5-9 Isolator status indication

It is advantageous to connect the three auxiliary contacts of the position feedback "Closed" or "Open" in series. This ensures that an isolator will only be considered open if all the three poles are open. In any other case the isolator will be processed as closed.
The isolator 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 400.

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

Recognition of the feeder isolator 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 5-10, page 102). The protection sees a current in the zero sequence system of the earthed feeder.

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

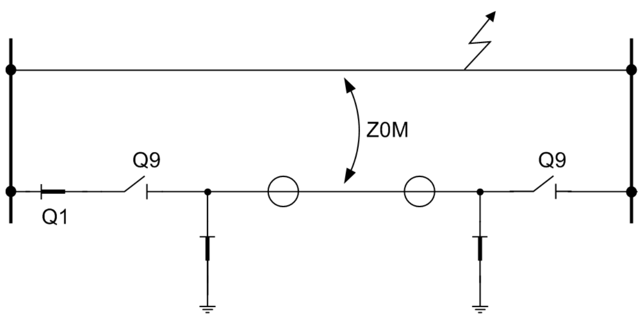


Figure 5-10 Parallel feeders

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

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

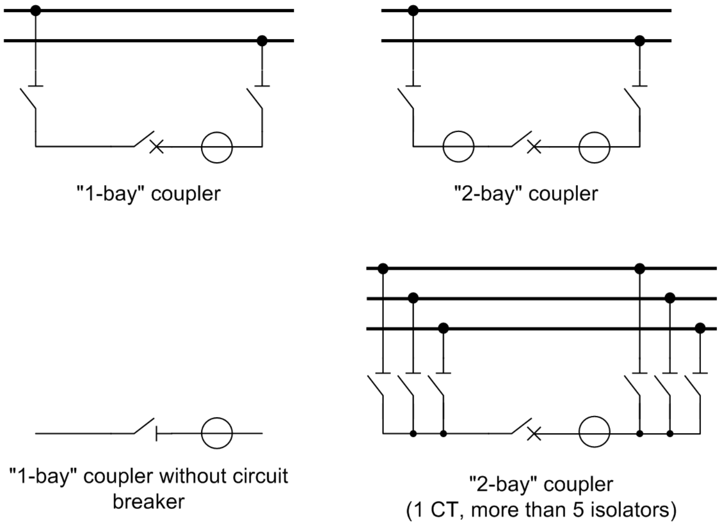


Figure 5-11 Examples of bus coupler variants

5.1.3.1 Bus Couplers with One Current Transformer

Bus couplers with circuit breaker and one current transformer (Figure 5-11, page 103) 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 5-11, page 103). The advantage of this design is that in case of a fault between the two current transformers both subsystems are tripped promptly, if 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 258.

5.1.3.3 Bus Couplers without Circuit Breaker

For cost reasons, bus zones are sometimes not connected by circuit breakers but by switch-isolators (Figure 5-11, page 103), in case of auxiliary busbars for bypass operation. In order to determine nevertheless the affected zone in case of fault, the current is measured at the coupling point. However, tripping always affects both coupled busbar sections.

5.1.3.4 Bus Couplers with more than 5 Isolators

Each bay unit can handle up to 5 isolators. If a coupler comprises more than 5 isolators, 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 259.

5.1.3.5 Combi-Coupler

The arrangement of the different switchgear elements is usally free and subject mainly to the operational requirements. Sporadically, the switching elements such as curcuit breaker, current transformer and isolator 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 (isolator closed on both sides), there are also no differences.

If isolators 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 5-12, page 105). 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.

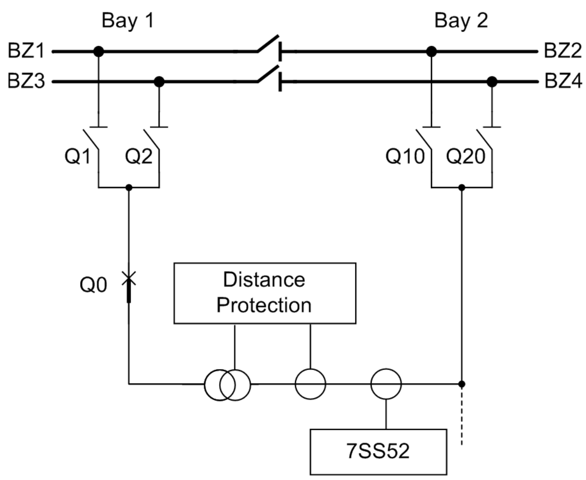


Figure 5-12 Operation of a bus coupler as switchgear bay

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

Configuration note: The dotted part must not be displayed with Digsi!

5.1.3.6 Transfer Busbars

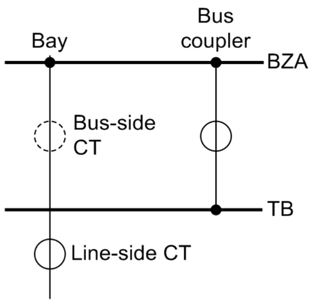
In the case of external transformers, the transfer busbar can be protected selectively. For this, configure **PROT TR BUS** (**5401/CU**) with ***Yes***. Any case of a fault will cause the tripping of the bypass breaker (coupler) and a transfer trip signal to trip the circuit breaker at the remote end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

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

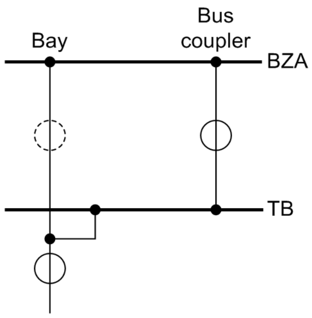
Figure 4-15, page 64 shows a plant configuration with transfer bus. Figure 5-13, page 106 summarizes the busbar allocation of the feeders.

Normally the check zone measurement does not require any isolator status information. For checkzone measurement, the current of the coupler must be considered if a feeder with internal current transformer is connected to the transfer busbar (see Chapter 5.1.3.7, page 107) or if with external current transformers no transfer busbar protection is required (configure parameter **PROT TR BUS** (**5401/CU**) with ***No***).



Phase A: Transfer (bypass) bus under voltage

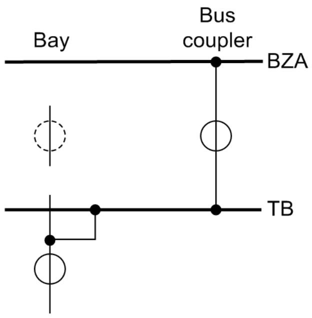
PROT TR BUS (5401/CU)	Meas. system / Bay/ CT	BZA	TB	Check zone
Yes	Line side	Feeder, bus coup.	Bus coupler	Feeder
	Bus side	Feeder, bus coup.	Bus coupler	Feeder
No	Line side	Feeder, bus coup.	unpro-tected	Feeder, Coup
	Bus side	Feeder, bus coup.	unpro-tected	Feeder, Coup



Phase B: Feeder simultaneously on transfer (bypass) and main bus

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

1) The current being fed by the feeder or into the feeder cannot be measured.



Phase C: Final condition, transfer (bypass) operation

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

1) The current being fed by the feeder or into the feeder cannot be measured.

Figure 5-13 Switching states in bypass operation (Feeder and bus coupler on the same bus zone)

5.1.3.7 Transfer Busbar With Inside Transformers

If the protection of the transfer busbar is impossible because of internal transformers or not required for outside 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.

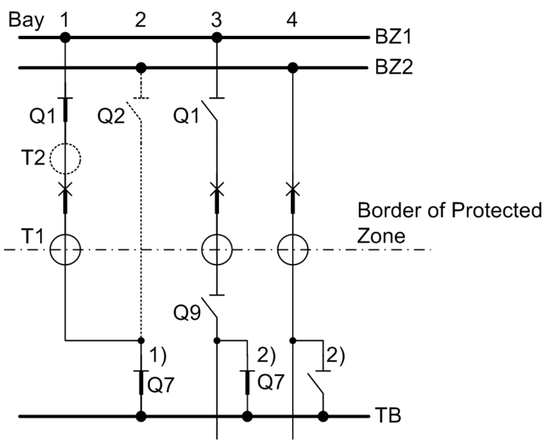


Figure 5-14 Transfer operation without transfer busbar protection

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 external 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 $I_{scc\ max}$ and the current I_{sat} at which CT saturation begins:

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

  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:

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

  The setting value k thus obtained comprises 20 % safety.
  The basis for this fomula is summarized in the Chapter A.2, page 341.

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

EF charact.

The parameter **EF charact.** (**6320A/CU**) is used to match the busbar and breaker failure protection to the system conditions and to the treatment of the starpoint. An explanation of the standard characteristic and of the earth fault characteristic is given on page 95.

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 - EF** (**6109A/CU**) or **Id> CZ - EF** (**6111A/CU**), and a stabilizing current threshold which is set with the parameters **Is< BZ - EF** (**6108A/CU**) or **Is< CZ - EF** (**6110A/CU**). The setting ***released*** enables also the marshalling of the binary input annunciation for characteristic switchover ">EF charact.“ (**FNo. 10478/CU**).

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 $I_{max\ feeder}$ + 30%.

$1.3\ I_{max\ feeder} < \mathbf{Id\!>\ BZ} < 0.8\ I_{scc\ min}$

Id> BZ - EF

The parameter **Id> BZ - EF** (**6109A/CU**) is used to set the diff-current threshold I_s/I_{no} for the bus zone-selective protection in the presence of a 1-pole earth fault.

This parameter is only displayed if the parameter **EF 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 - EF

The parameter **Is< BZ - EF** (**6108A/CU**) is used to set the stabilizing current threshold I_s/I_{no} for the bus zone-selective protection in the presence of a 1-pole earth fault

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

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

Is< BZ - EF = 1.2 * ($I_{max\ load}$ + I_{EF})

$I_{max\ load}$ = 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 overstabilization 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 $I_{max\ feeder}$ + 30%.

1.3 $I_{max\ feeder}$ < **Id**> **CZ** < 0.8 $I_{scc\ min}$

Id> CZ - EF

The parameter **Id> CZ - EF** (**6111A/CU**) is used to set the diff-current threshold I_d/I_{no} for the check zone measuring system in the presence of a 1-pole earth fault.

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

Siemens recommends to set the parameter **Id> CZ - EF** (**6111A/CU**) to 70% of the smallest 1-pole earth fault current to be expected.

Is< CZ - EF

The parameter **Is< CZ - EF** (**6110A/CU**) is used to set the stabilizing current threshold I_s/I_{no} for the check zone measuring system in the presence of a 1-pole earth fault.

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

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

Is< **BZ - EF** = 1.2 * 0.5 * $I_{max\ load}$.

5.1.5 Settings for the Central Unit

Addr.	Setting Title	Setting Options	Default Setting	Comments
106A	Combi-Coupler	YES NO	NO	Combi-Coupler
6101	STAB FAC:BZ	0.10 .. 0.80	0.65	Stabilizing 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	Stabilizing factor - check zone
6104	Id> CZ	0.20 .. 4.00 I/Ino	1.00 I/Ino	Diff-current threshold - check zone
6108A	Is< BZ - EF	0.00 .. 25.00 I/Ino	5.00 I/Ino	Stabilizing current threshold - BZ - EF
6109A	Id> BZ - EF	0.05 .. 4.00 I/Ino	0.25 I/Ino	Diff-current threshold - selective - EF
6110A	Is< CZ - EF	0.00 .. 25.00 I/Ino	4.50 I/Ino	Stabilizing current threshold - CZ - EF
6111A	Id> CZ - EF	0.05 .. 4.00 I/Ino	0.25 I/Ino	Diff-current threshold - check zone - EF
6320A	EF charact.	released blocked	blocked	Earth fault characteristic switchover

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 isolator status.

In some special cases, isolator 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, overstabilization results in multiple busbar systems. This overstabilization is caused by those bays which are not connected to the faulty busbar.

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

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

$\Sigma \mid I_n \mid$ =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 5-15, page 112 and in the equations below.

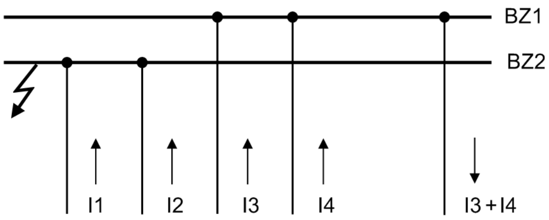


Figure 5-15 Treatment of the stabilizing current for the check zone

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

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 overstabilization.

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

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

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

$I_s = \Sigma | I_n | = | I_3 + I_4 |$ (= 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 94.

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 - EF** (**6111A/CU**) and **Is< CZ - EF** (**6110A/CU**) (Chapter 5.1.4, page 108).

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	Stabilizing factor check zone
6104	Id> CZ	0.20 .. 4.00 I/Ino	1.00 I/Ino	Diff-current threshold - check zone
6110A	Is< CZ - EF	0.00 .. 25.00 I/Ino	4.50 I/Ino	Stabilizing current threshold - CZ - EF
6111A	Id> CZ - EF	0.05 .. 4.00 I/Ino	0.25 I/Ino	Diff-current threshold - check zone - EF

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 119. 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 unbalanced mode has two separate parameter sets, one for 1-pole high-resistance earth faults and the other for multi-pole faults. Figure 5-16, page 114, shows the characteristics and the setting parameters.

Earth fault characteristic

For the detection of high-resistance earth faults, tripping characteristics with increased sensitivity for breaker failure are provided. For these more sensitive characteristics the parameters
I> BF-EF (**XX19/CU**) and **Is< BF - EF** (**6202A/CU**) apply. The stabilizing factor is identical with the standard characteristic. The marshallable binary input ">EF charact." (**FNo. 10478/CU**) in the central unit allows to switch over between characteristics, provided that the parameter **EF charact.** (**6320A/CU**) is set to ***released***. Figure 5-16, page 114, shows the characteristics and the setting parameters.

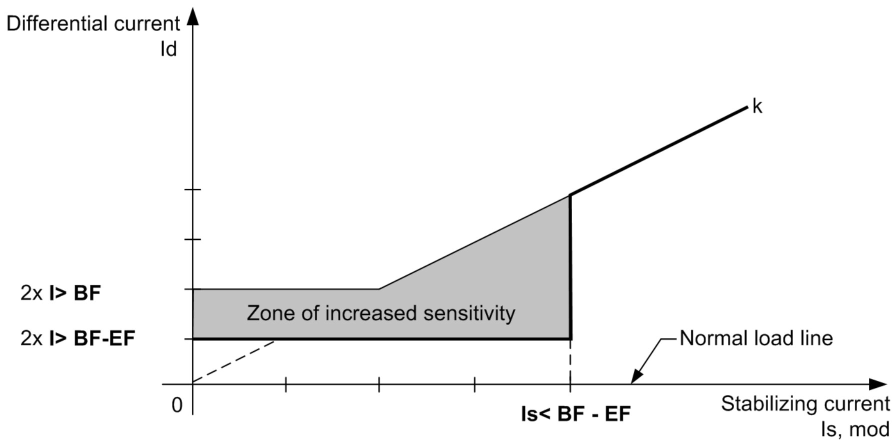


Figure 5-16 Characteristics of the breaker failure protection

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 135) and “**Current-Controlled TRIP Reset**“ (Chapter 5.9.1, page 167).

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 stabilization 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 128).

I> BF-EF

The parameter **I> BF-EF (XX19/CU)** is used to set for an earth fault the threshold I_d/I_n at which the protection detects a breaker failure and/or resets a TRIP.

Note

This parameter is also used for the functions “**End Fault Protection**“ (Chapter 5.4, page 135), “**Current-Controlled TRIP Reset**“ (Chapter 5.9.1, page 167).

Is< BF - EF

The parameter **Is< BF.EF (6202A/CU)** is used to set the stabilizing current threshold I_s/I_{no} for the breaker failure protection in the presence of an earth fault.

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 **EF 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
119	I> BF-EF	0.05 .. 2.00 I / In	0.25 I / In	Current threshold for BF - EF
6201	STAB FAC:BF	0.00 .. 0.80	0.50	Stabilizing factor BF protection
6202A	Is< BF.EF	0.00 .. 25.00 I/In	5.00 I/In	Stabilizing current threshold - BF - EF

5.3.4 List of Information from the Central Unit

FNo.	Alarm	Comments
10478	>EF charact.	>Earth fault 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 123 and Figure 5-22, page 121.

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-BIErr $00 Lx" (**FNo. 176.1091, 176.1092, 176.1093/CU**) or "BFBIErr $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 "BFRlErr $00 1P" (**FNo. 176.1101/CU**) or "BFRlErr $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-BIErr $00 Lx" (**FNo. 176.1091, 176.1092, 176.1093/CU**) or "BFBIErr $00 3P" (**FNo. 176.1094/CU**) is output.

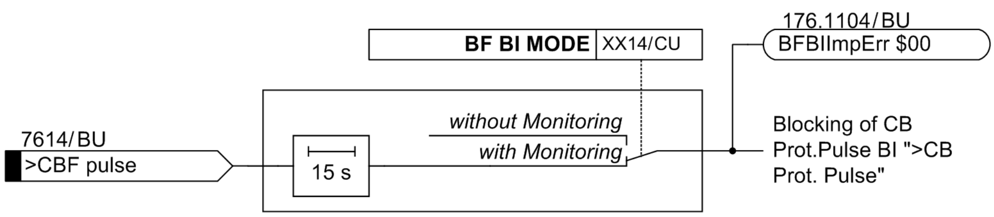


Figure 5-17 Characteristics of the breaker failure protection

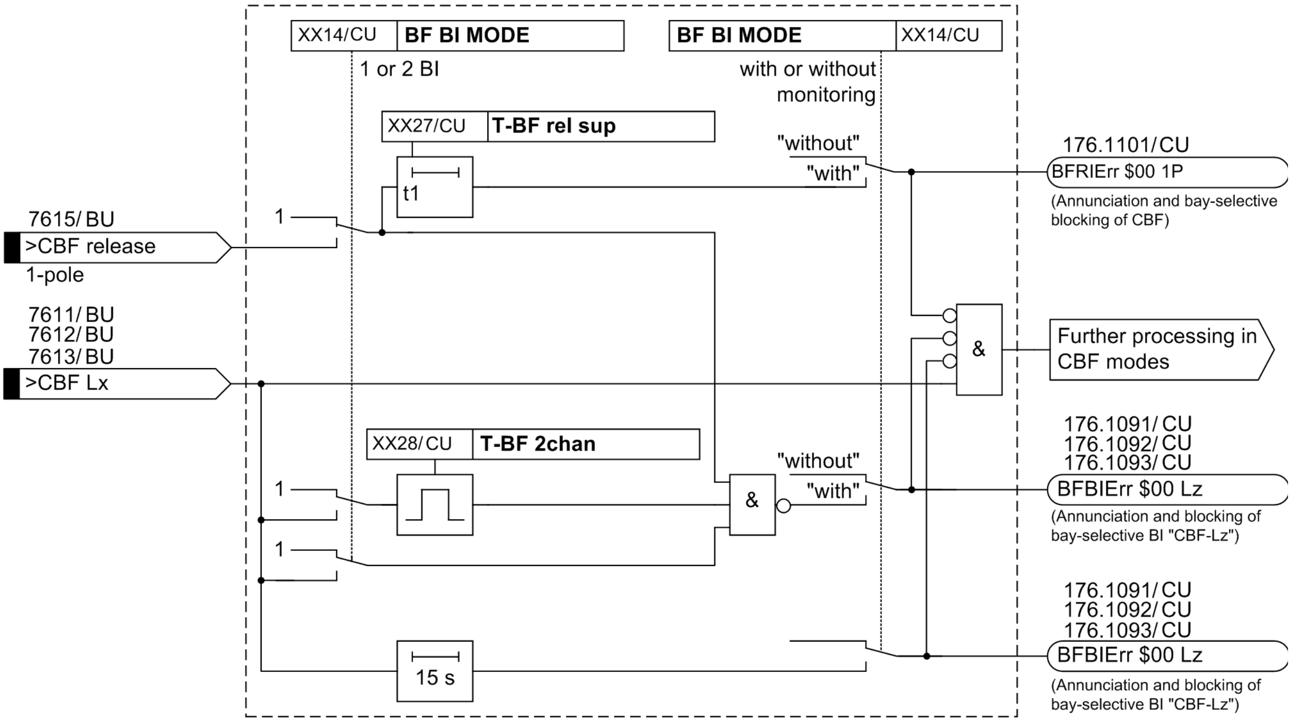


Figure 5-18 Triggering and releasing the breaker failure protection - 1-pole

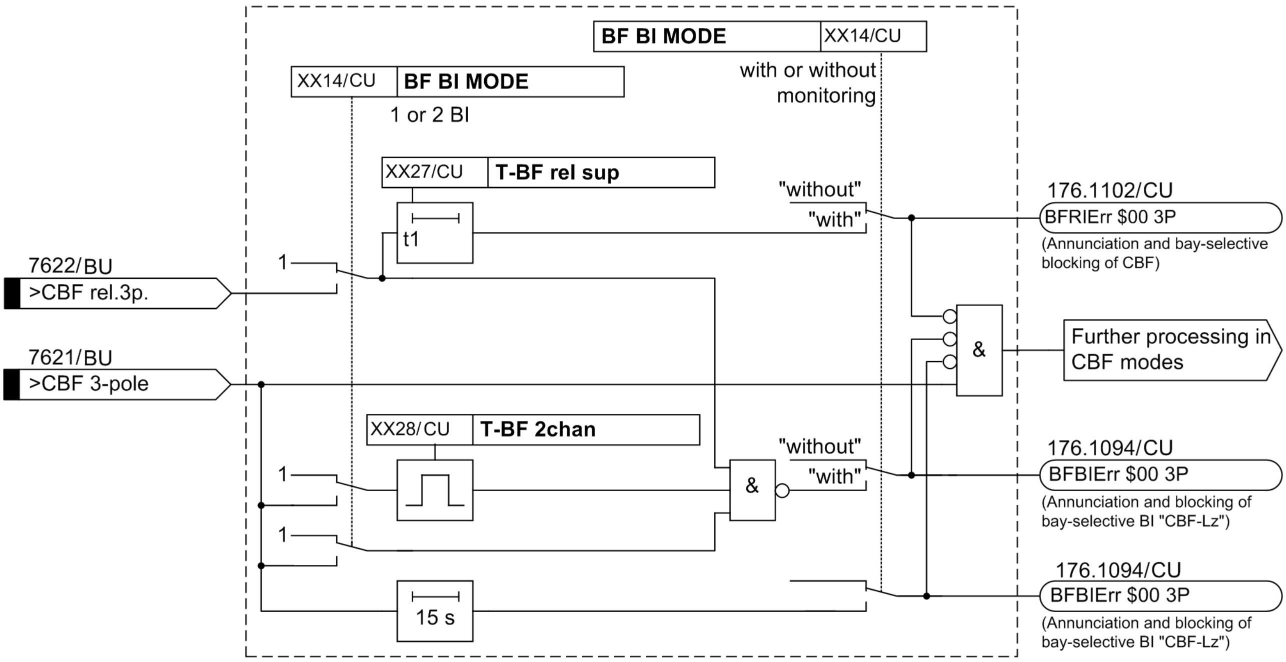


Figure 5-19 Monitoring the breaker failure protection triggering and release - 3-pole

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 curcuit 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**).

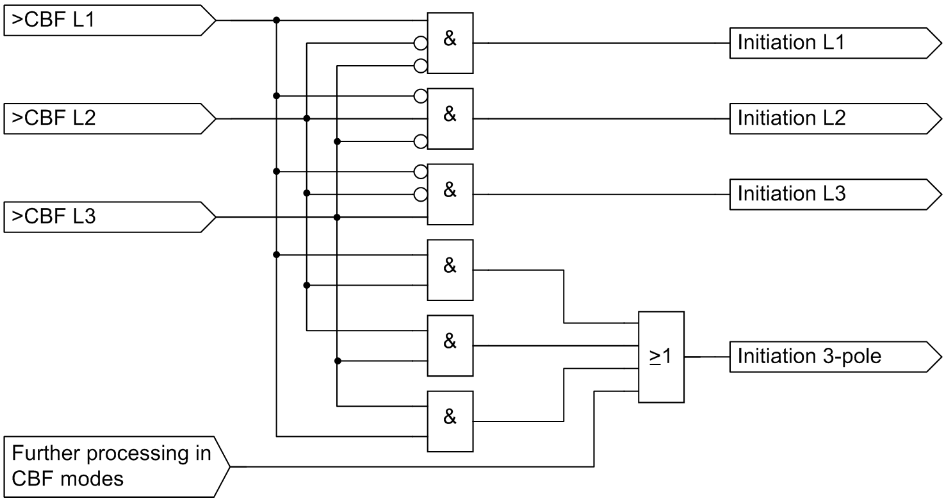


Figure 5-20 Triggering by binary inputs

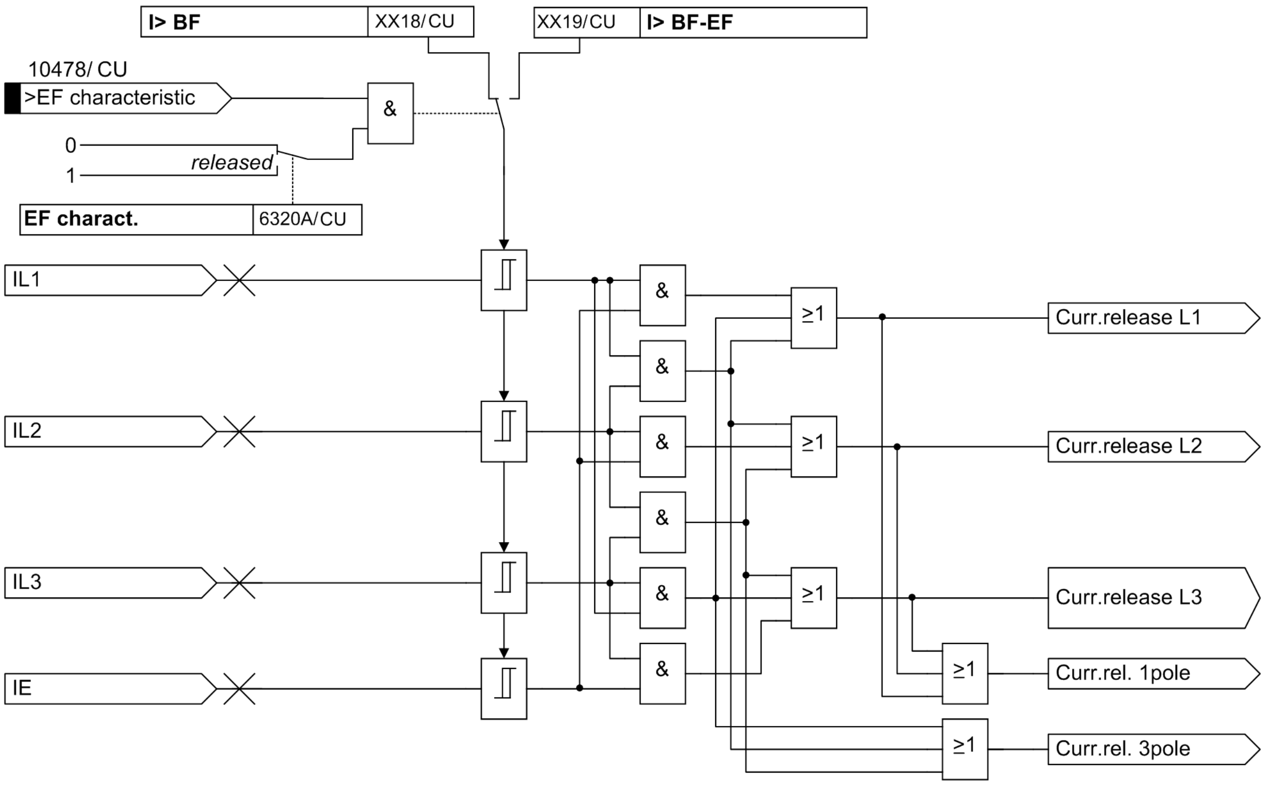
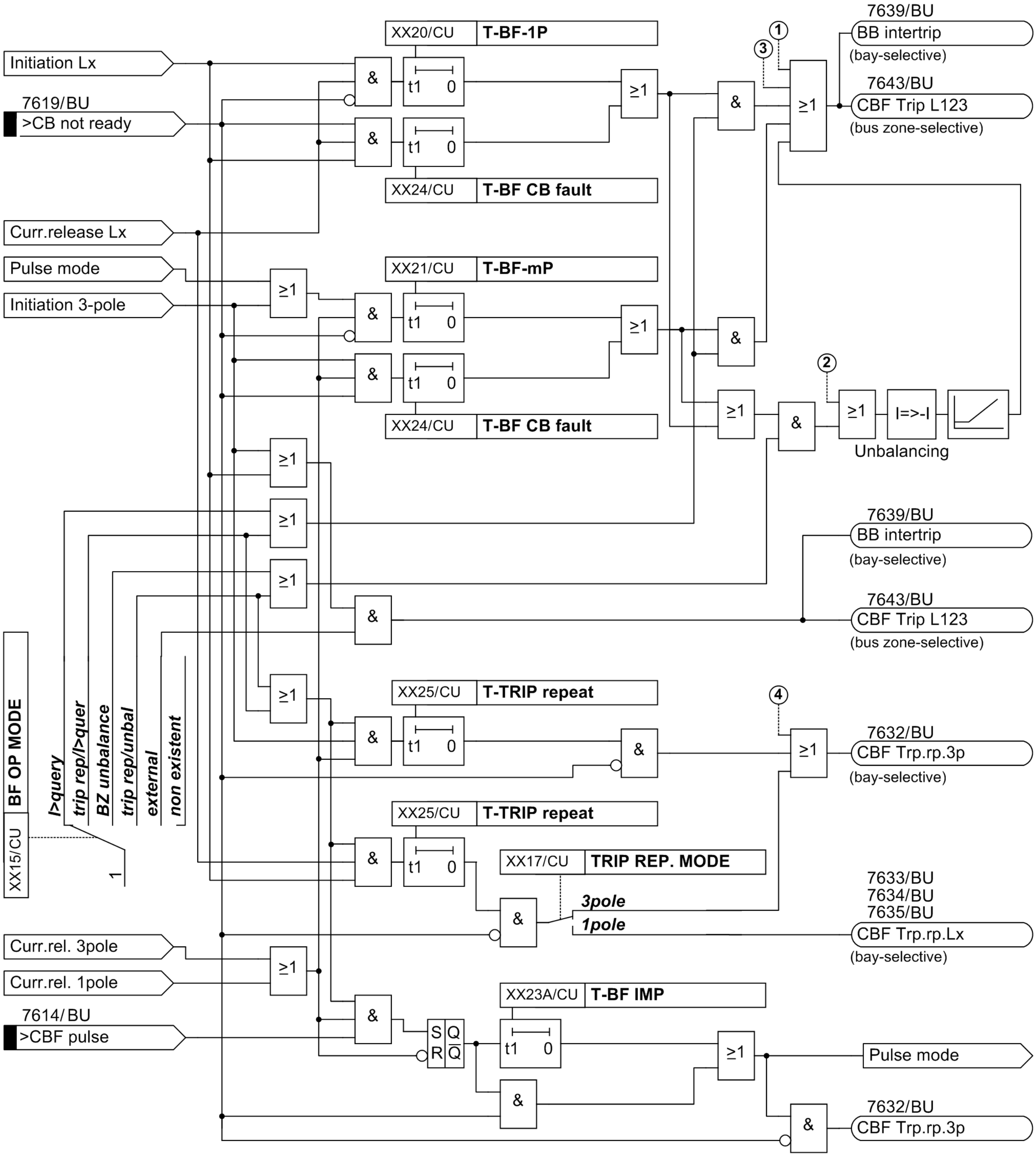


Figure 5-21 Logic of the current check of the breaker failure protection



Continuation for (1) and (2) see Figure 5-46, page 205
Continuation for (3) and (4) see Figure 5-24, page 125

Figure 5-22 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-EF** (**XX19/CU**) (Figure 5-21, page 120).
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 (internal BF), 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-EF** (**XX19/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-EF** (**XX19/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-EF** (**XX19/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 isolator 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" (FNr. 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 5-23, page 123. Unbalancing causes a differential current of twice the magnitude of the current in the CBF initiating feeder.

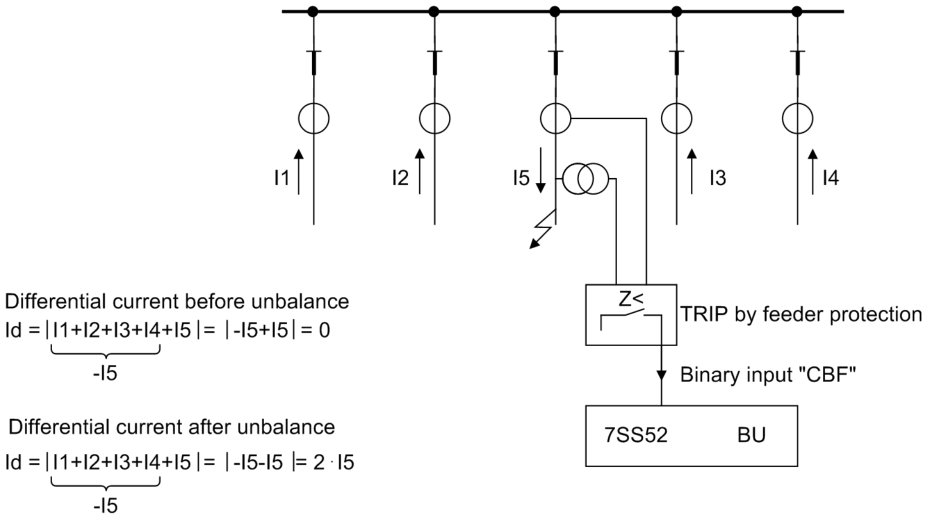


Figure 5-23 Principle of unbalancing for the circuit breaker failure protection

The **BZ unbalance** mode has two separate parameter sets, one for 1-pole earth faults and the other for multi-pole faults. The sensitive earth fault characteristic is released by a binary input in the central unit. Figure 5-16, page 114 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 isolator 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 117).

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.

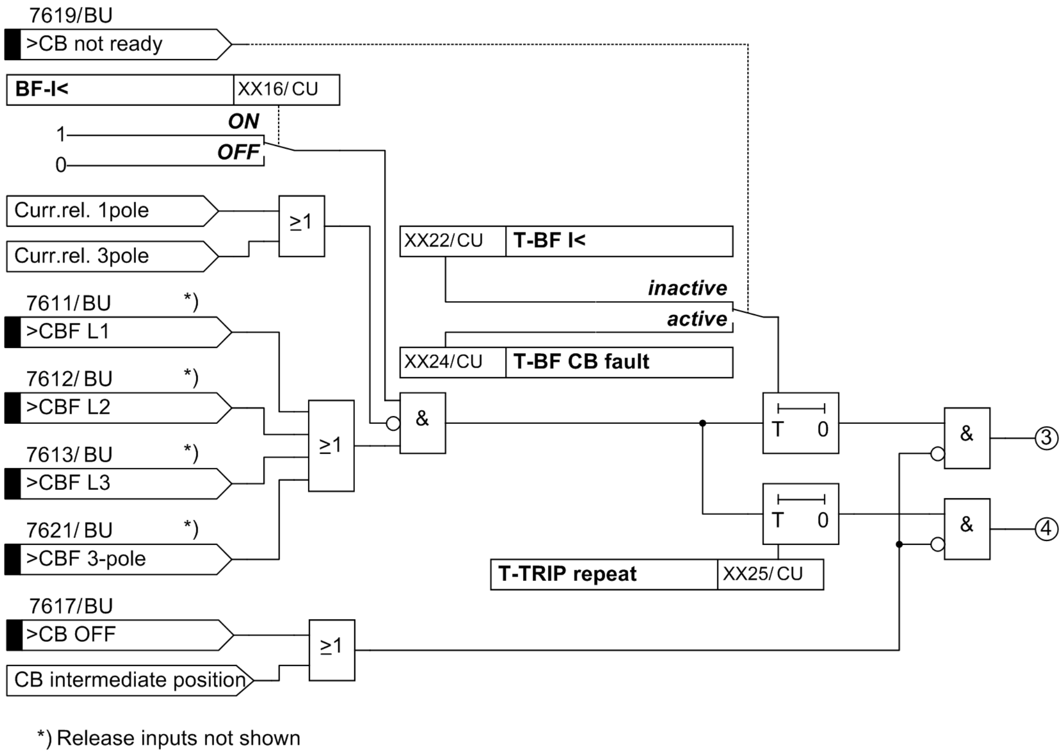
The low-current mode **BF I<** (**XX16/CU**) ensures that circuit breaker failure protection is provided nevertheless. After a set time **T-BF I<** (**XX22/CU**) has elapsed, and if the circuit breaker is closed, a busbar TRIP command for the affected bus zone is issued.

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 5-21, page 120.

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 128.

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:



Continuation for (3) and (4) see Figure 5-22, page 121

Figure 5-24 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 puls" (**FNo. 7614/BU**) is allocated accordingly. The ”pulse mode” only operates with the following modes:

- TRIP repetition/Unbalancing
- TRIP repetition/I> 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 puls" (**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 “BFBIImpErr $00” (**FNo. 176.1104.xx**) and the general fault alarm “BF ImpBI errorM” (**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 5-25, page 126).

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 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 5-26, page 126).

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**), "Trip BF $03 Lx" (**177.1352.$03/CU, 177.1353.$03/CU, 177.1354.$03/CU**), "Trip $03 G" (**177.1341.$03/CU**), "TrnsfTrip $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 BU" (**10433/CU**) will be issued.

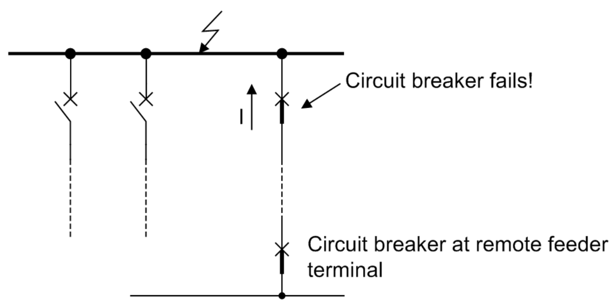


Figure 5-25 Circuit breaker failure during a busbar fault

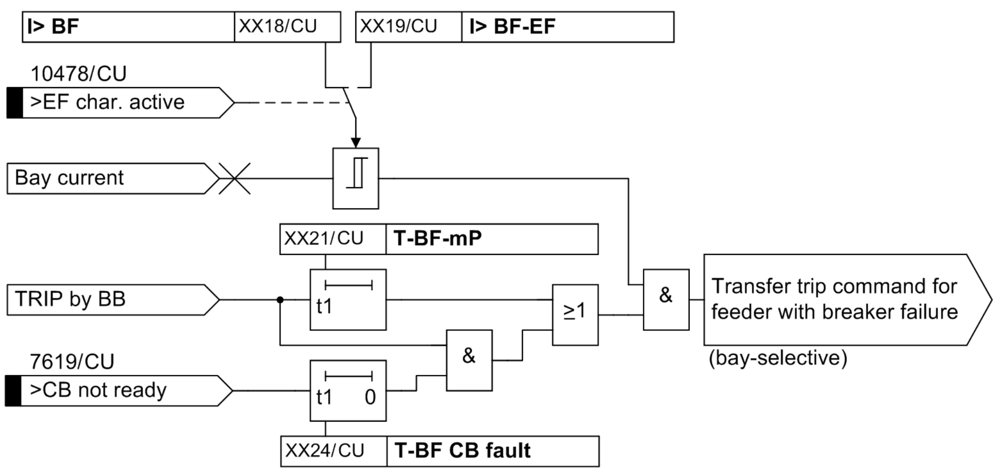


Figure 5-26 Circuit breaker failure protection for busbar faults

5.3.5.4 Failure of the Bus Coupler Circuit Breaker

If a busbar short-circuit occurs with the bus coupler closed (Figure 5-27, page 127), 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 (single unbalancing to BZ B).

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.

The trip criterion is thus fulfilled and bus zone BZ B is isolated, too. (2)

In the case of a breaker failure of the circuit breaker in the bus coupler bay (internal breaker failure), 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.

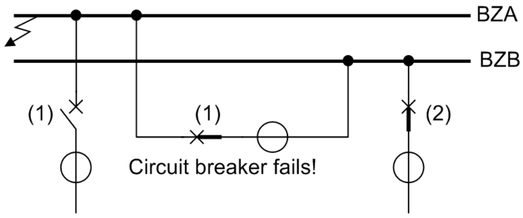


Figure 5-27 Fault on bus zone BZ A and failure of the bus coupler circuit breaker

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 5-22, page 121).

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.

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**).

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-EF** (**XX19/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-EF** (**XX19/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.

T-BF-mP

The parameter **T-BF-mP** (**XX21/CU**) is used to delay for multipole 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-mP** (**XX21/CU**).
The tripping of the affected bus zone takes place after the second stage has been processed. The parameter **T-BF-mP** (**XX21/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.

T-BF I<

The parameter **T-BF I<** (**XX22/CU**) is used to delay for the "low-current" mode the TRIP command and the transfer trip signal issued by the breaker failure protection.

T-BF IMP

The parameter **T-BF IMP** (**XX23A/CU**) is used to delay for pulse mode the feeder-selective TRIP repetition issued by the breaker failure protection.

T-BF CB fault

The parameter **T-BF CB fault** (**XX24/CU**) 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.

T-TRIP repeat

The parameter **T-TRIP repeat** (**XX25/CU**) is used to delay the feeder-selective repetition of the TRIP command issued by the breaker failure protection.

The time for the TRIP repetition must be set to less than the delay times for the breaker failure protection **T-BF-1P** (**XX20/CU**), **T-BF-mP** (**XX21/CU**) and for the pulse mode **T-BF IMP** (**XX23A/CU**).

T-BF rel sup

If the parameter **BF BI MODE** (**XX14/CU**) is set to ***with supervision***, the the parameter **T-BF rel sup** (**XX27/CU**)is used to set the time for supervising the duration of the CBF release signal.

T-BF 2chan

The parameter **T-BF 2chan** (**XX28/CU**) 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.

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 177).

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 1-ch w sup 2-ch w/o sup 2-ch w sup	1-ch w sup	Binary input mode / supervision BF
115	BF OP MODE	non existent external BZ unbalance trip rep/unbal I>query trip rep/I>quer	BZ unbalance	Operation mode BF
116	BF I<	ON OFF	OFF	Low-current mode BF
117	TRIP REP. MODE	1pole 3pole	1pole	TRIP repeat mode
118	I> BF	0.10 .. 2.00 I / In	0.50 I / In	Current threshold for BF
119	I> BF-EF	0.05 .. 2.00 I / In	0.25 I / In	Current threshold for BF - EF
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	EF charact.	released blocked	blocked	Earth fault characteristic switch-over

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
$01 Bay name
$02 Name of the switching element (e.g. isolator 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 ImpBI errorG	Timing error 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	>EF charact.	>Earth fault characteristic active
176.1082	TransfTrip $00	Breaker failure/Transfer trip $00
176.1091	BFBIErr $00 L1	Timing error BF input $00 L1
176.1092	BFBIErr $00 L2	Timing error BF input $00 L2
176.1093	BFBIErr $00 L3	Timing error BF input $00 L3
176.1094	BFBIErr $00 3P	Timing error BF input $00 3pole
176.1101	BFRlErr $00 1P	Timing error BF release $00 1pole
176.1102	BFRlErr $00 3P	Timing error BF release $00 3pole
176.1104	BFBIImpErr $00	Timing error BF impulse 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	BB intertrip	Busbar protection: Intertrip
7643	CBF TRIP L123	CBF protection blocked by Central Unit

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 5-28, page 136, 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.

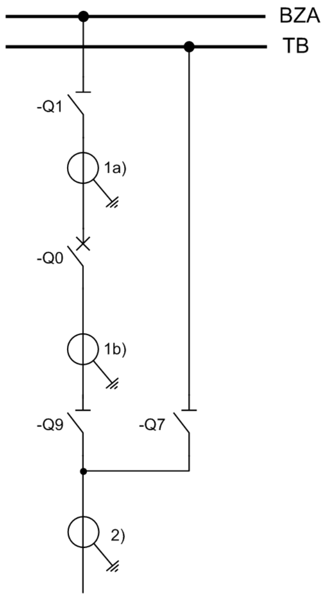
Line-side current transformers

With line-side current transformers (Figure 5-28, page 136, 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 5-29, page 136. 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 151) 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**).



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

Figure 5-28 Possible CT locations

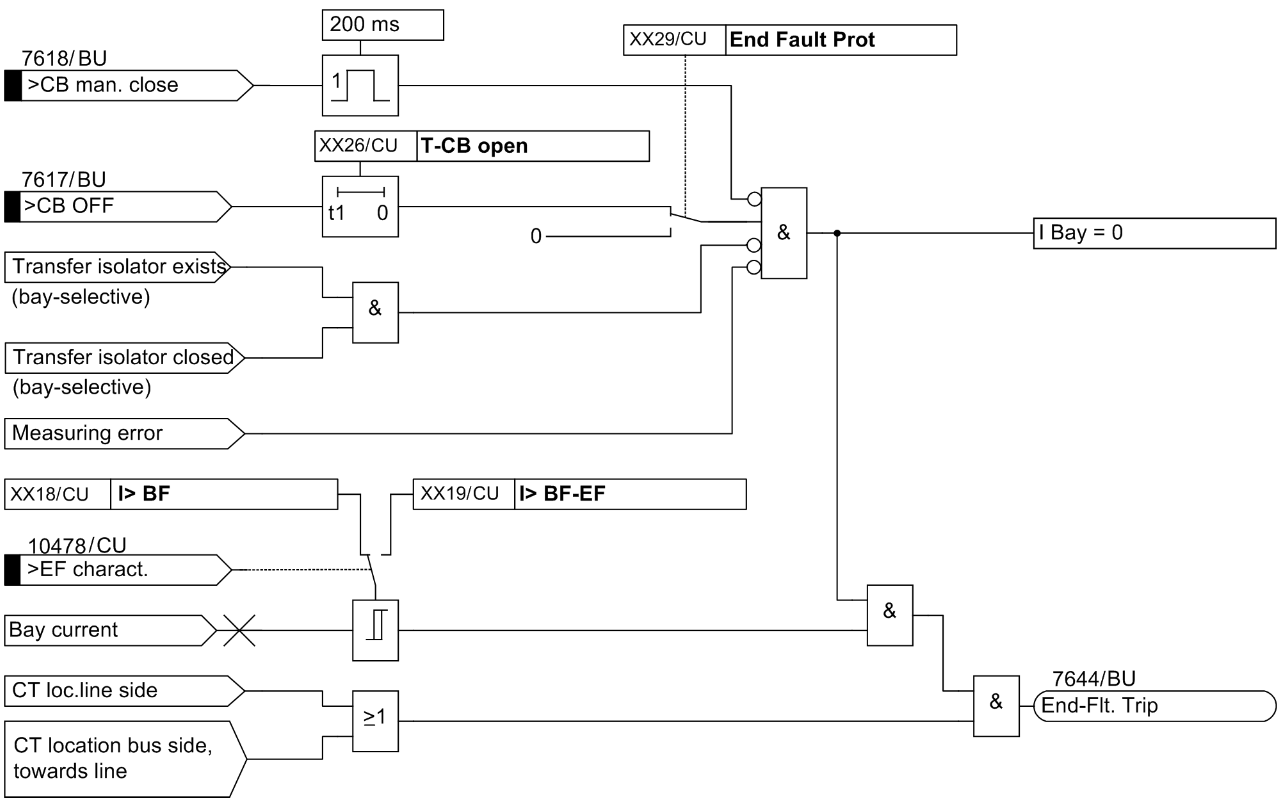


Figure 5-29 End fault protection

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.

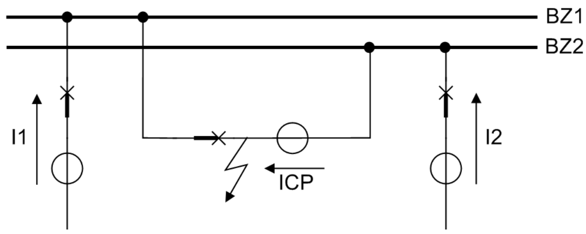


Figure 5-30 Fault in the dead zone of the bus coupler

5.4.2.1 Without detection of the circuit-breaker position

Bus coupler with one current transformer

First of all, the busbar BZ1 (Figure 5-30, page 137) 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 closed

Bus coupler with one current transformer

First of all, busbar BZ1 (Figure 5-30, page 137) 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 (unbalanced) 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 137.

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 137.

5.4.2.3 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

When after a bus fault the circuit breaker reaches its final position and the secondary CT currents decay, the breaker failure protection may be undercut. To avoid this, the coupler currents are only processed after the delay time set with the parameter **T-CB open** (**XX26/CU**) has elapsed.

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 5-31, page 138).

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

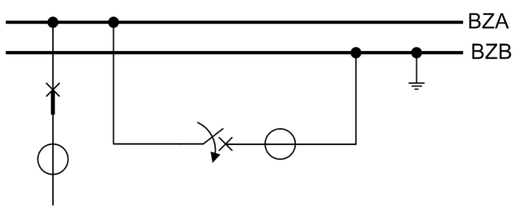


Figure 5-31 Switching onto an earthed busbar

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
119	I> BF-EF	0.05 .. 2.00 I / In	0.25 I / In	Current threshold for BF - EF
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 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	>EF charact.	>Earth fault characteristic active

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 most cases it will be desirable, in the case of external or internal faults and malfunctions of the 7SS52 protection system, to block only those measuring systems (protection zones) that are affected so that the healthy portion of the system can continue to operate. The setting of the parameter **BLOCKING MODE** (**6305/CU**) specifies whether the blocking acts selectively for a zone and perhaps a phase, or for the entire protection system.

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 is blocked in accordance with the settings of the parameter **BLOCKING MODE** (**6305/CU**), either selectively for the zone for which the respective bay unit is switched and, if required, for the phase, or completely.

Measured value errors

The analog inputs of the bay unit are cyclically monitored (Chapter 5.5.1.3, page 142). The measured value error 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 blocked - selectively or entirely - 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.

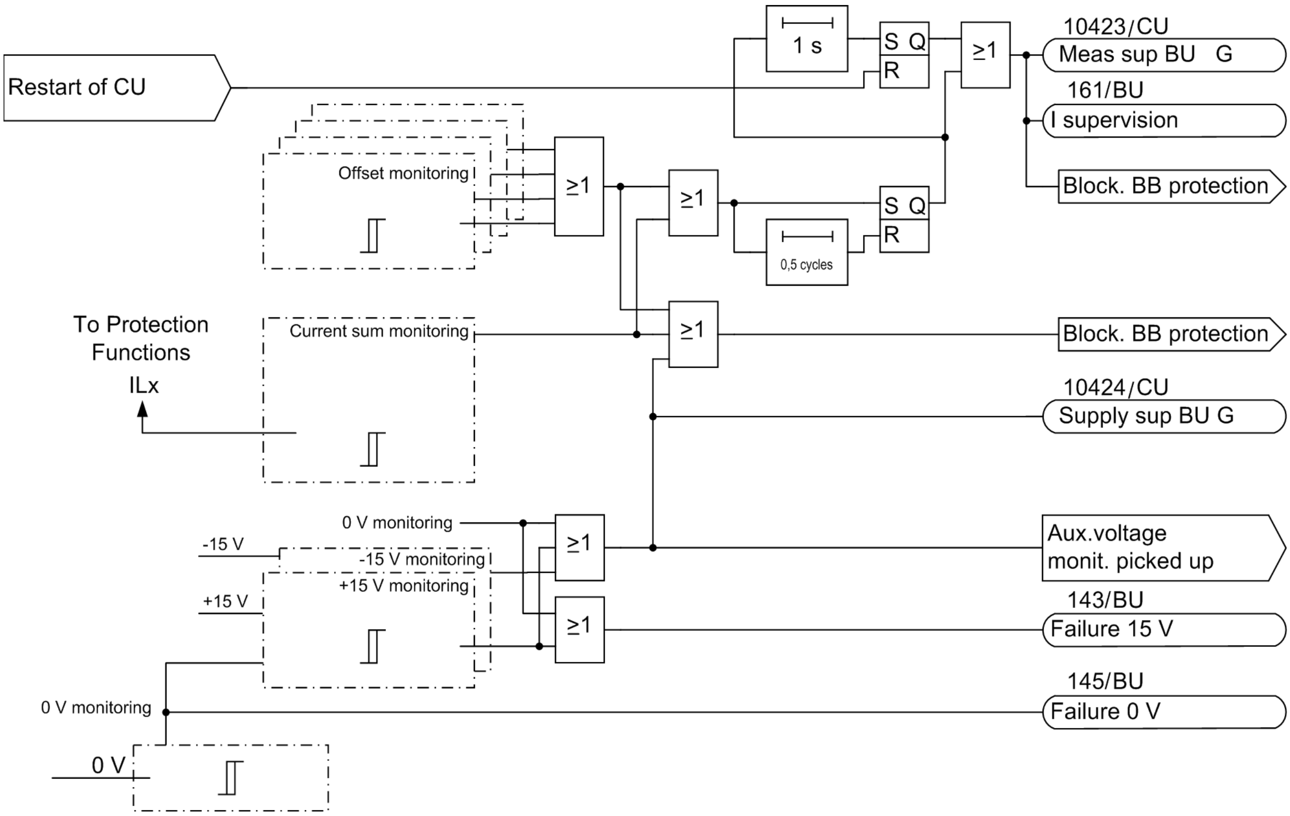


Figure 5-32 Simplified logic of the monitoring function

Isolator malfunction

Isolators are monitored with regard to runtime, isolator status plausibility and auxiliary voltage. An isolator malfunction with the parameter **ISOL Malfunct** (**6302/CU**) set to ***blocking*** and the parameter **BLOCKING MODE** (**6305/CU**) set to ***zone/phase*** causes a blocking of only the protection zone to which the feeder with the faulty isolator 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; depending on the setting of the parameter **BLOCKING MODE** (**6305/CU**), the blocking is selective or complete; 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 5-32, page 141).

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
Depending on the setting of the parameter **BLOCKING MODE** (**6305/CU**), a failure of the auxiliary voltage in a bay unit results in a selective or complete 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

$|\Delta I| > 0.2\ I/I_N$ and

$|\Delta I| > k \cdot \Sigma |I|$

with $k = 0.125$ (stabilizing factor)

The pick-up characteristic is shown in Figure 5-33, page 143.
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 or completely blocked and an annunciation "MeasInSup $00" (**FNo. 176.1175/CU**)

The blocking can only be reset with a warm restart (Figure 5-32, page 141).

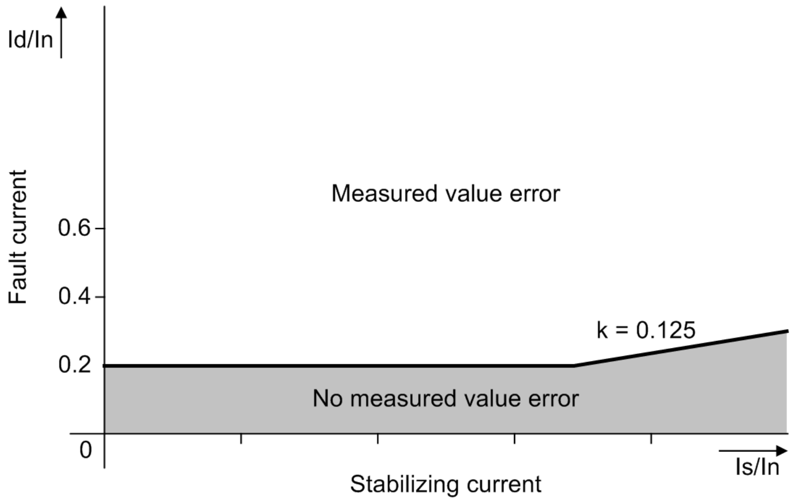


Figure 5-33 Characteristic for measured value monitoring

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 144).

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

Isolator supervision

While a bay is in maintenance, settable with the parameter **Bay status** (**XX12/CU**), there is no monitoring of the isolator 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 isolator 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 will switch into monitoring mode.

Read out the fault buffer of the central unit and contact the manufacturer.

Bay unit

In the bay units, the trip command circuits are monitored additionally.

The following alarms may come up:

- Group alarm: "`Flt autotest M`" (**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 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 M“ (**FNo. 10415/CU**),
  “Id-sup BZ L1 M“ (**FNo. 10416/CU**),
  “Id-sup BZ L2 M“ (**FNo. 10417/CU**),
  “Id-sup BZ L3 M“ (**FNo. 10418/CU**),
  “Id-sup $03 M” (**FNo. 177.1331/CU**)
- Group alarms (check zone):
  ”Id-sup CZ M” (**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**),

Linearized current transformers

Linearized current transformers may have angle errors. 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.

Zero current supervision

When the primary current is interrupted, a current continues to flow in the CT circuit on the secondary side. 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 Isolator Status Supervision

Preferential treatment for busbar coupling

If two busbars are solidly linked via the isolators of one feeder, 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. At the same time, the coupler bay is taken out of the allocation list with respect to the currents.

Isolator statuses

The isolator 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 intermediate position and 0-0 running position are combined.

Isolator running status

If an isolator changes position, for instance from the OPEN position, it needs a certain time (isolator running time) to reach the other position. During this running time, the isolator is considered to be in the CLOSED position. This intermediate status is monitored. If after a set isolator running time **ISOL TIME** (**6301/CU**) no checkback signal is given, the isolator assumes faulty status and an alarm is created by the central unit per isolator ("FltR $01 $02" (**FNo. 176.1122/CU**); e.g. for isolator 3 in bay Fxx). In addition, the indication "Isol flt alarm" (**FNo. 10425/CU**) is issued after the isolator running time has elapsed.

Behavior in the case of an isolator intermediate status

The parameter **ISOL ST 1/1** (**6304/CU**) is used to specify whether the isolator status is assumed to be “CLOSED” or the “old isolator status” if the isolator position is not plausible (“OPEN” and “CLOSED” at the same time). If the isolator is in intermediate position, the isolator will be reported as faulty after the time set in parameter **ISOL 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 "Isol flt alarm" (**FNo. 10425/CU**) is issued after the isolator running time has elapsed.

Auxiliary voltage supply failure

Usually, the isolator auxiliary voltage is sub-fused in each bay. If this auxiliary voltage is missing, then all the isolators in this bay display the bit pattern 0/0 (neither OPEN nor CLOSED). The indication "Bay DC fail G" (**FNo. 10426/CU**) and "Isol 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 isolator faults, at least two isolators are to be monitored. By cross-checking with the other isolator positions, this fault condition can be detected. The bay with the faulted isolator is either assigned the old positions according to the busbar protection (flip-flop relay characteristic) or all isolators of this bay are considered to be CLOSED. The type of treatment can be set with the parameter **ISOL 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 isolator status. In that case the isolator 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 isolator status
- Isolator is in OPEN position
- Fault on one busbar
- Second isolator 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 isolator malfunction status individually for each feeder ("FltR $01 $02" (**FNo. 176.1122/CU**); e.g. $02 for isolator 3).

The meaning of the isolator status indications is shown in the following table.

Table 5-1 Isolator status indications

Isolator status indication		Meaning	Reaction	Alarm
CLOSED	OPEN			
1	0	Isolator CLOSED	Isolator CLOSED	Alarm "CLOSED" (**FNo. 176.1110/CU**) *)
0	1	Isolator OPEN	Isolator OPEN	Alarm "OPEN" (**FNo 176.1110/CU**) *)
1	1	Isolator status not plausible	new isolator status according to setting **6304/CU**	"$01 $02" (**FNo. 176.1110/CU**), "FltP$01 $02" (**FNo. 176.1113/CU**) and "Isol fit pos M" (**FNo. 10428/CU**), “Isol flt alarm” (**FNo. 10425/BU**)

Isolator status indication		Meaning	Reaction	Alarm
CLOSED	OPEN			
0	0	Isolator malfunction: – runtime – wire break	new isolator status CLOSED	Alarm "$01 $02" (**FNo.176.1110/CU**), "FltR $01$02" (**FNo.176.1112/CU**), "Isol flt run G" (**FNo.10427/CU**), "Isol flt alarm" (**FNo. 176.10425/CU**),
		– no auxiliary voltage	new isolator status according to setting **6303/CU** (see “Auxiliary voltage supply failure” , page 147)	"BayDCfail $00" (**FNo.176.1134/CU**), "Bay DC fail G" (**FNo.10426/CU**), "Isol flt alarm" (**FNo.10425/CU**)

*) The values such as “CLOSED“ and “OPEN“ of the alarm (**FNo. 176.1110/CU**) are variable.
Depending on the isolator, the alarm is generated via **FNo. 176.1110/CU, 176.1115/CU, 176.1120/CU, 176.1125/CU** or **176.1130/CU.**

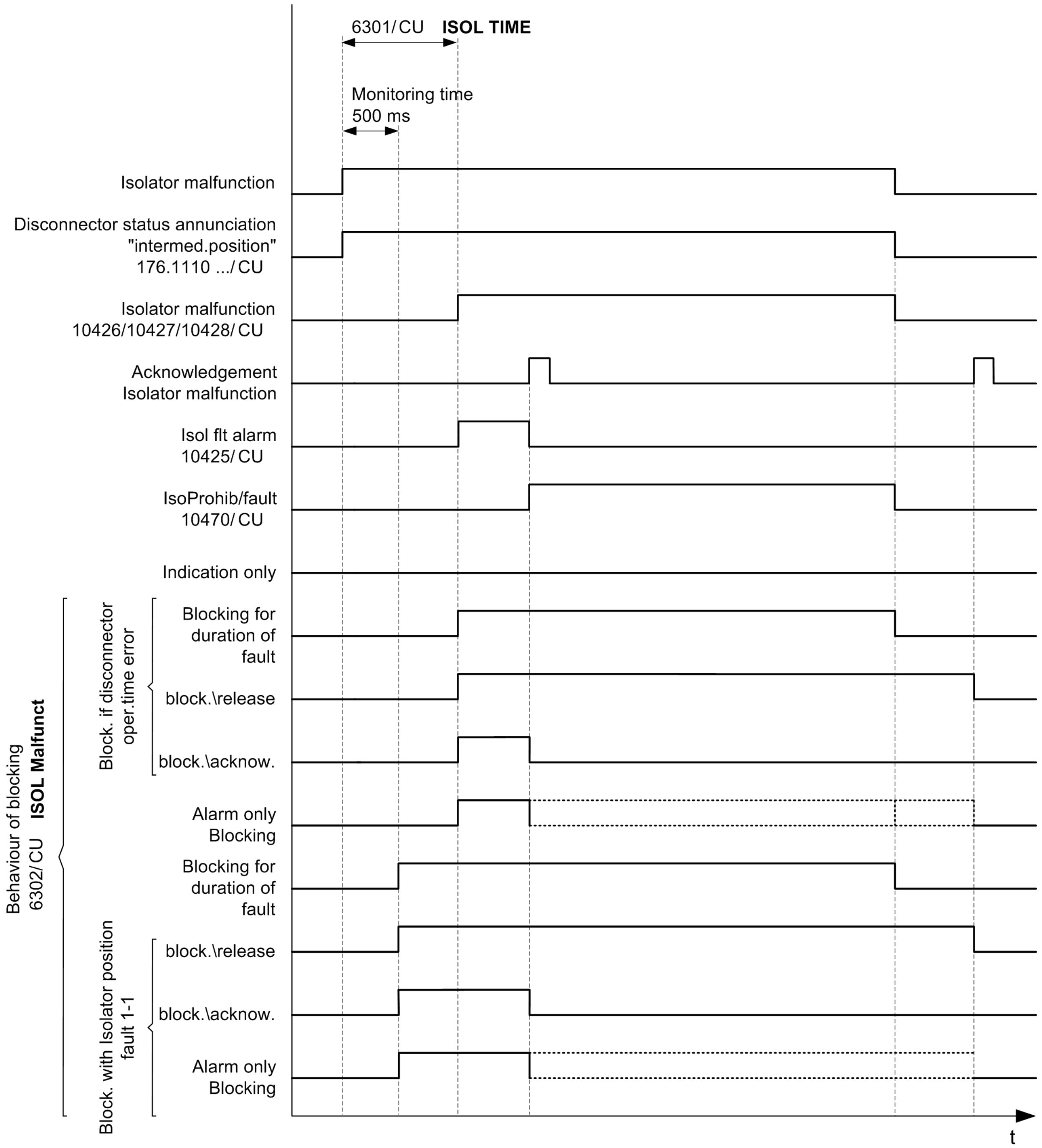
Isolators malfunctions (plausibility or runtime errors) and failure of the auxiliary voltage supply for the isolator checkback signals are not annunciated until the set isolator running time **ISOL TIME** (**6301/CU**) has elapsed.

Due to an isolator fault indicated with "Bay DC fail G" (**FNo. 10426/CU**), "Isol flt run G" (**FNo. 10427/CU**) or "Isol flt pos G" (**FNo. 10428/CU**) the indication "Isol flt alarm" (**FNo. 10425/CU**) is issued. This one is replaced by the indication "IsoProhib/fault" (**FNo. 10470/CU**) when the isolator fault is acknowledged.

While a bay is in maintenance, there is no monitoring of the isolator status checkback signals, nor a plausibility check.

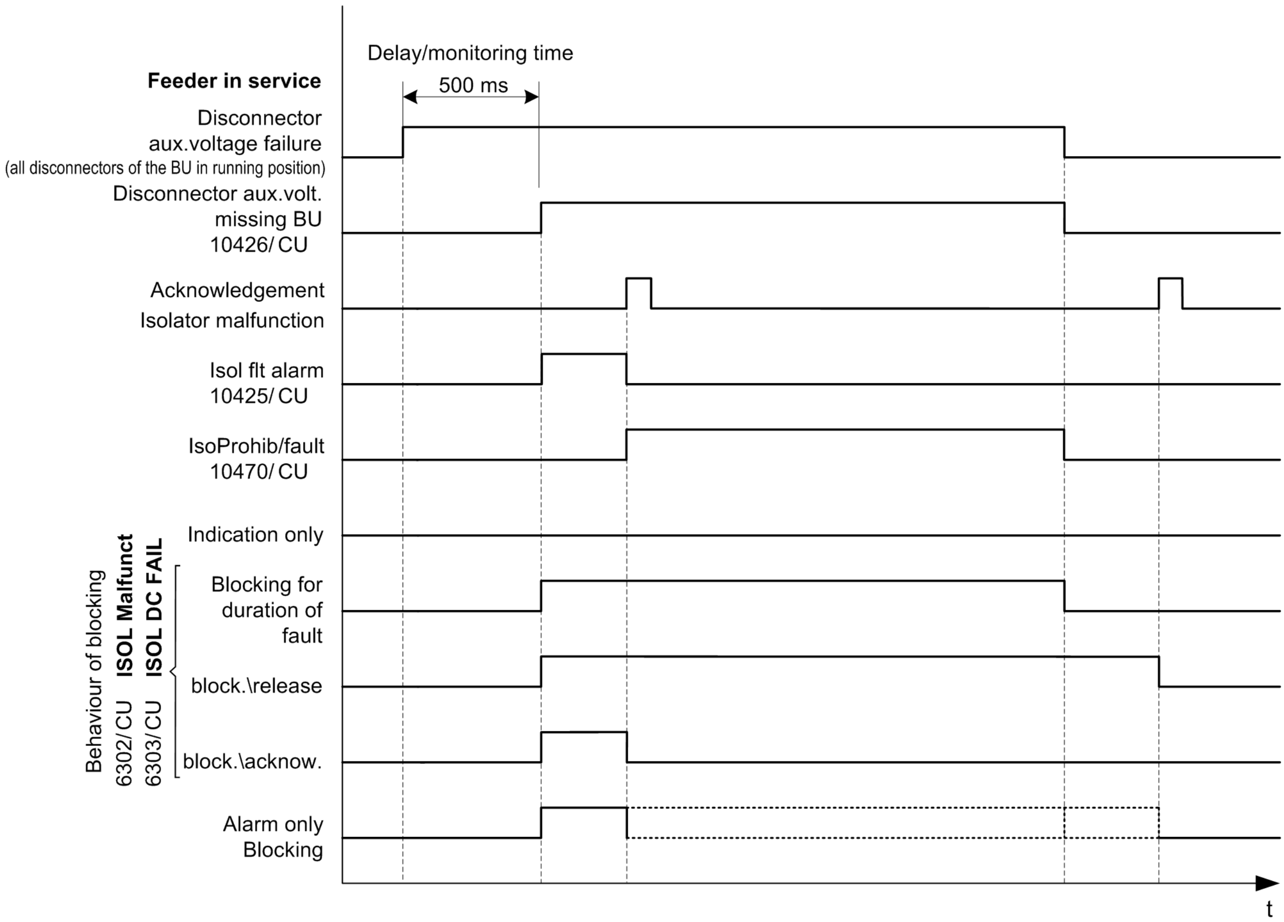
Reset of isolator alarms

Depending on the setting of the parameter **ISOL Malfunct** (**6302/CU**), several types of behaviour of the blocking are possible, see Figure 5-34, page 149.
The function is reset with the control "Reset IsoMalBl" or by the binary input ">Reset IsoMalBl" (**BI FNo. 7/CU**) in the central unit.



The following applies for the isolator position:
Blocking occurs only when the bay with the Isolator position fault is assigned to a busbar.
An alarm is generated, e.g. "$01 $02" (**FNo. 176.1110/CU, 176.1115/CU,176.1120/CU,176.1125/CU,176.1130/CU**).
a) 1-1 Position t_v = 500 ms 6304/CU is effective
During the delay time t_v the old isolator position is kept.
b) 0-0 Exceeding of the runtime t_v = 6301/CU (isolator in “CLOSED“ position)
The isolator position “CLOSED” is kept.
c) 0-0 Auxiliary voltage failure t_v = 500 ms 6303/CU is effective
During the delay time t_v the old isolator position is kept.

Figure 5-34 Annunciations and behaviour of the blocking in the case of isolator malfunction and acknowledgement



Note: Blocking will only be performed if the bay suffering an isolator auxiliary voltage failure is assigned to a busbar.

Figure 5-35 Alarms and Blockings upon Auxiliary Voltage Failure

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 135) and for low-current circuit breaker failure protection mode (Chapter 5.3.5.2, page 119).

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 5-36, page 151) 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 152).
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 135) and/or of the function ”Protection in the dead zone of the bus coupler” (Chapter 5.4.2, page 137).

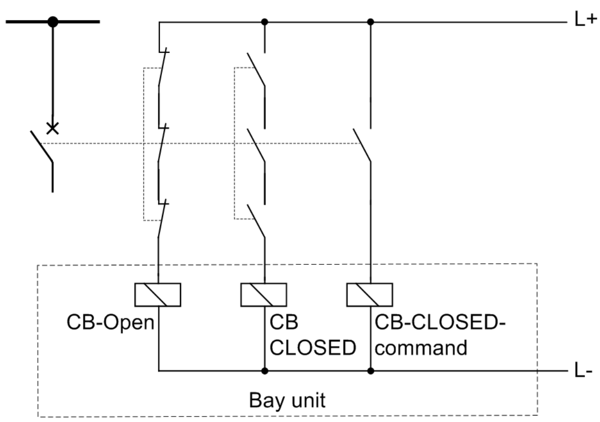


Figure 5-36 Interrogation of circuit breaker

Table 5-2 Alarms related to the circuit breaker status

Binary input			Status of the circuit breaker	Alarm
CB OPEN	**CB CLOSED**	**CB CLOSE command**		
0	0	0/1	Failure	“CB fault $01” (**FNo. 176.1136/CU**)
0	1	0	Closed	Closed
0	1	1	Closed by CLOSE command	“CB fault $01” (**FNo. 176.1136/CU**)
1	0	0/1	Open	Open
1	1	0/1	Failure	“CB fault $01” (**FNo. 176.1136/CU**)

For the treatment of the dead zone in the bus coupler and for the end fault protection, a circuit breaker in the intermediate position causes the blocking of the end fault protection after the expiry of the monitoring delay time **CB SUP TIME** (**6315/CU**).

For low-current mode of breaker failure protection, a circuit breaker which is in the intermediate position is assumed to be open after the expiry of the monitoring delay time **CB SUP TIME** (**6315/CU**). The low-current mode is not effective in this case.

For the busbar intertripping in the bus coupler bay, only the “CB OPEN“ is taken into account in the intermediate position.

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 Blocking of protection and alarm
BU: $(0\ V)_{Digit}$ $(15\ V)_{Digit}$ CU: 15 V 24 V	"0V-superv $00" (**FNo. 176.1173/CU**) "5V-superv $00" (**FNo. 176.1172/CU**) "15V-superv $00" (**FNo. 176.1171/CU**) Failure of the 5 V voltage causes reset of the device failure annunciation and thus blocks the device completely. "15V-superv CU" (**FNo. 10420/CU**) "24V-superv CU" (**FNo. 10421/CU**) Failure of the 15 V or 24 V voltage of the central unit does not block the protection.
Measured value monitoring BU $\mid \Delta I \mid > 0.2 \cdot I/I_N$ $\mid \Delta I \mid > 0.125 \cdot \Sigma \mid I \mid$	Internal device error in measured value acquisition Blocking of protection and alarm "MeasInSup $00" (**FNo. 176.1175/CU**) "Meas sup BU M" (**FNo. 10423/CU**)
Cyclic monitoring of the memories (BU, CU)	After three unsuccessful restart attempts the protection is blocked.

Monitoring	Possible cause and response
Permanent monitoring of the program flow by means of watchdog (BU, CU)	After three unsuccessful restart attempts the protection is blocked.
Differential current supervision • Bus zone-selective protection $\lvert\Sigma I\rvert$ >**Id> SUPERV BZ** (**6308/CU**) for T >**T-Idiff SUPERV** (**6307/CU**) • Check zone, all except bus coupler $\lvert\Sigma I\rvert$ >**Id> SUPERV CZ** (**6309/CU**) for T >**T-Idiff SUPERV** (**6307/CU**)	Current transformer circuit faulty Bus zone-selective blocking if the parameter **DIF SUP mode BZ** (**6310/ CU**) is set to blocking, otherwise only alarm "IdSup Lz-y $03" (**FNo. 177.1321, 177.1322, 177.1323, 177.1326, 177.1327, 177.1328/CU**) Blocking if the parameter **DIF SUP mode CZ** (**6311/CU**) is set to blocking, otherwise only alarm "Id-Sup CZ Lz" (**FNo. 10411, 10412, 10413/CU**)
Monitoring of isolator status • Running position Isolator OPEN/CLOSED = 0/0 for T >**ISOL TIME** (**6301/CU**) • Auxiliary voltage supply failure All isolator positions of one bay = 0/0 • Implausible isolator status Isolator OPEN/CLOSED = 1/1	Wire break or intermediate status Alarm "FltR $01 $02" (**FNo. 176.1112, 176.1117, 176.1122, 176.1127, 176.1132/CU**) Feeder aux. voltage MCB tripped Alarm "BayDC fail $00" (**FNo. 176.1134/CU**) Alarm "FltP $01 $02" (**FNo. 176.1113, 176.1118, 176.1123, 176.1128, 176.1133/CU**)
Cyclic check of the data transmission links (FO) between central unit and bay unit	Blocking of the protection system and alarm after two recognitions of a transmission error "Fail Com.CU" (**FNo. 7650/BU**)
Monitoring of ">CBF Lx", ">CBF 3-pole" for T > 15 s ">CBF Lx", ">CBF 3-pole" and ">CBF release", ">release 3-pole" for T > **T-BF 2chan** (**XX28/CU**) ">CBF release", ">release 3-pole" for T >**T-BF rel sup** (**XX27/CU**) ">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-BIErr $00 Lz" (**FNo. 176.1091, 176.1092, 176.1093/CU**) or "BF-BIErr $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; Alarm and blocking of CBF "BFRlErr $01 1P" (**FNo. 176.1101/CU**) or "BFRlErr $00 3P" (**FNo. 176.1102/CU**)
Cyclic test with simulation of a fault current and monitoring of the entire signal processing from the digitized measured values to the control currents of the trip relay coils	After three recognitions of an error blocking of the protection and alarm. "Flt aut $00" (**FNr. 176.1190/CU**) and "Flt autotest M" (**FNr. 10429/CU**)
Zero current monitoring	Monitoring is done phase-selectively and the alarm "Block ZeroCross" (**FNo. 10444/ CU**) is generated.

Monitoring	Possible cause and response
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 attmpts: fault
Monitoring of CB-feedback no plausible State CB OPEN/CLOSED = 0/0 or 1/1	Alarm: "**CB fault $01**" (**FNo. 176.1135/CU**) and (**FNo. 176.1136/CU**) Blocking of end fault protection and low-current mode of breaker failure protection.

5.5.2 Setting Notes

BLOCKING MODE

The parameter **BLOCKING MODE** (**6305/CU**) is used to select the blocking mode of the busbar and breaker failure protection in the event of

- Measured value errors
- Failure of a bay unit
- Isolator malfunctions (**6302/CU**)

With setting ***zone/phase*** 3-pole or 1-pole blocking is only performed on the protection zone allocated to the bay unit. If zone-selective blocking is performed on a 1-bay coupler, both affected protection zones will be blocked.

With setting ***protection*** the protection will be blocked completely.

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 blocked for the duration of the malfunction. Phase- and bus zone-selective blocking is performed if the parameter **BLOCKING MODE** (**6305/CU**) is set accordingly.

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 - EF** (**6109A/CU**) or **Id> CZ - EF** (**6111A/CU**), using the earth fault characteristic.

The DC component monitoring is performed for each measuring system. The differential current of the selective protection zones and of the check zone is compared with the set threshold.

f 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.

ISOL TIME

The parameter **ISOL TIME** (**6301/CU**) is used to set the threshold for the isolator runtime monitoring. If no final position checkback signal is received for an isolator after this time, the protection assumes the isolator to be faulty and issues an alarm.

This threshold is determined by the longest isolator runtime to be expected.

ISOL DC FAIL

The parameter **ISOL DC FAIL** (**6303/CU**) is used to choose the isolator status which will be assumed by the isolator replica if the auxiliary voltage for the isolator status checkback signal has failed.

With setting ***OLD*** the old status will be assumed.

With setting ***ON*** the isolator will be assumed to be CLOSED.

ISOL ST 1/1

The parameter **ISOL ST 1/1** (**6304/CU**) is used to choose the isolator 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 isolator will be assumed to be CLOSED.

ISOL Malfunct

The parameter **ISOL Malfunct** (**6302/CU**) is used to select the response of the protection to isolator malfunctions (runtime or plausibility error, auxiliary voltage failure).

With setting ***alarm only*** isolator malfunctions will only lead to the output of an alarm. The protection will not be blocked.

With setting ***blocking*** isolator malfunctions will lead to the output of an alarm and to a blocking of the protection system as set in the parameter **BLOCKING MODE** (**6305/CU**). The blocking is automatically cleared as soon as the isolator malfunction has been eliminated.

With setting ***block./release*** isolator malfunctions will lead to the output of an alarm and to a blocking of the protection system as set in the parameter **BLOCKING MODE** (**6305/CU**). The blocking will be maintained until the malfunction has been eliminated and the blocking has been selectively reset by the operator input "Reset IsoMalBl" or via the binary input ">Reset IsoMalBl" (**BI FNo. 7/CU**).

With setting ***block./acknow.*** isolator malfunctions will lead to the output of an alarm and to a blocking of the protection system as set in the parameter **BLOCKING MODE** (**6305/CU**). The blocking will be cancelled even if the malfunction persists if it has been selectively reset by the operator input "Reset IsoMalBl" or via the binary input ">Reset IsoMalBl" (**BI FNo. 7/CU**). In this case a warning "IsoProhib/fault" (**FNo. 10470/CU**) will be output.

The entry in the operational event buffer will reflect the actual presence of the isolator malfunction.

5.5.3 Settings for the Central Unit

Addr.	Setting Title	Setting Options	Default Setting	Comments
112	Bay status	out of service in service maintenance	in service	Bay status
127	T-BF rel sup	0.02 .. 15.00 sec	15.00 sec	Supervision bin. input BF-release
128	T-BF 2chan	0.06 .. 1.00 sec	0.06 sec	Supervision time BF start / 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 - check zone
6109A	Id> BZ - EF	0.05 .. 4.00 I/Ino	0.25 I/Ino	Diff-current threshold - selective - EF
6111A	Id> CZ - EF	0.05 .. 4.00 I/Ino	0.25 I/Ino	Diff-current threshold - check zone - EF
6312A	ZERO CR SUPERV	ON OFF	Ein	Zero crossing supervision
6301	ISOL TIME	1.00 .. 180.00 sec	7.00 sec	Limit value isolator time
6302	ISOL Malfunct	alarm only blocking block./release block./acknow.	alarm only	Reaction on isolator malfunction
6303	ISOL DC FAIL	OLD ON	OLD	Treatment isolator status on DC fail
6304	ISOL ST 1/1	OLD ON	OLD	Treatment isolator status not plausible
6305	BLOCKING MODE	zone/phase protection	zone/phase	Blocking mode on failure
6306	DIFF SUPERV	ON OFF	ON	Differential current supervision
6307	T-Idiff SUPERV	1.00 .. 10.00 sec	2.00 sec	Time delay for diff-current supervision
6308	Id> SUPERV BZ	0.05 .. 0.80 I/Ino	0.10 I/Ino	Limit value diff-current supervision -BZ
6309	Id> SUPERV CZ	0.05 .. 0.80 I/Ino	0.10 I/Ino	Limit value diff-current supervision -CZ
6310	DIF SUP mode BZ	alarm only blocking block./release	blocking	Diff-current supervision mode -BZ
6311	DIF SUP mode CZ	alarm only blocking block./release	alarm only	Diff-current supervision 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 M	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 M	Diff-current superv. BZ (group alarm)
10416	Id-sup BZ L1 M	Diff-current superv. BZ L1 (group alarm)
10417	Id-sup BZ L2 M	Diff-current superv. BZ L2 (group alarm)
10418	Id-sup BZ L3 M	Diff-current superv. BZ L3 (group alarm)
10420	15V-superv CU	15V supply supervision central unit
10421	24V-superv CU	24V supply supervision central unit
10422	Batt. superv CU	Battery supervision central unit
10423	Meas sup BU M	Measured value superv. BU (group alarm)
10424	Supply sup BU M	Supply voltage superv. BU (group alarm)
10425	Isol flt alarm	Isolator fault alarm
10426	Bay DC fail M	Failure of isolator aux. voltage (g. a.)
10427	Isol flt run M	Isolator fault: run time (group alarm)
10428	Isol flt pos M	Isolator position faulty (group alarm)
10429	Flt autotest M	Failure in auto testing (group alarm)
10444	Block ZeroCross	Blocking by supervision zero crossing
10470	IsoProhib/fault	Isolator oper. prohibitted (isol.fault)
176.1091	BFBIErr $00 L1	Timing error BF input $00 L1
176.1092	BFBIErr $00 L2	Timing error BF input $00 L2
176.1093	BFBIErr $00 L3	Timing error BF input $00 L3
176.1094	BFBIErr $00 3P	Timing error BF input $00 3pole
176.1101	BFRlErr $00 1P	Timing error BF release $00 1pole
176.1102	BFRlErr $00 3P	Timing error BF release $00 3pole
176.1110	$01 $02	$01 Isolator $02
176.1112	FltR $01 $02	Fault: run time $01 isolator $02
176.1113	FltP $01 $02	Fault: dist. pos. $01 isol. $02
176.1117	FltR $01 $02	Fault: run time $01 isol. $02
176.1118	FltP $01 $02	Fault: dist. pos. $01 isol. $02
176.1122	FltR $01 $02	Fault: run time $01 isol. $02
176.1123	FltP $01 $02	Fault: dist. pos. $01 isol. $02

FNo.	Alarm	Comments
176.1127	FltR $01 $02	Fault: run time $01 isol. $02
176.1128	FltP $01 $02	Fault: dist. pos. $01 isol. $02
176.1133	FltP $01 $02	Fault: dist. pos. $01 isol. $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 M	Id-sup $03 M

5.5.5 List of Information from the Bay Unit

FNo.	Alarm	Comments
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

Note

A description of the bay unit's fault recording function is provided in Chapter 5.13, page 182.
Reading out of oscillographic fault recording data is described in Chapter 6.2.3, page 221.

During a fault event, the instantaneous measured values are stored at intervals of 1 ms (f_N = 50 Hz) and 833 µs (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 ínput 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

fault rec mode

The parameter **fault rec mode** (**6401A/CU**) is used to specify the conditions under which oscillographic fault records will be stored.

With setting ***global storage, initiation by CU***, 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.

With setting ***global storage, local initiation***, 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 **INITIATION** *(***7402/BU***)* in the bay unit (Chapter 5.13.2, page 182).

With setting ***local storage, local initiation***, 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 **INITIATION** (**7402/BU**) in the bay unit (Chapter 5.13.2, page 182).

MAX. LENGTH

The parameter **MAX. LENGTH** (**6404/CU**) is used to set the maximum time available for one fault record.

PRE. TRIG. TIME

The parameter **PRE. TRIG. TIME** (**6405/CU**) 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.

POST REC. TIME

The parameter **POST REC. TIME** (**6406/CU**) 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.

BinIn CAPT.TIME

The parameter **BinIn CAPT.TIME** (**6407/CU**) 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 ”.”. Even so the capture time cannot exceed the time set with the parameter **MAX. LENGTH** (**6404/CU**), which specifies the maximum available length of a fault recording.

5.6.3 Settings for the Central Unit

Addr.	Setting Title	Setting Options	Default Setting	Comments
6401A	fault rec mode	global storage, local initiation global storage, initiation by CU 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. STORAGE BY TRIP 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

TO IV-Bit

Use parameter **TO 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

Reset Device

Annunciation: The device has performed a start-up.
Relevant information: On

Initial start

Annunciation: The device has performed an initial restart. All buffers have been reset. The parameter settings are unaffected.
(Information supplied with the Reset Device annunciation)
Relevant information: On

Resume

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.
(Information supplied with the Reset Device annunciation)
Relevant information: On

Device OK

Annunciation: Device is operational and protecting.
With this annunciation, the readiness relay picks up, and the Error LED goes out.
Relevant information: On

Setting Calc.

Annunciation: Setting calculation is running.
Relevant information: On, the function is occupied by the parameter setting process.
Relevant information: Off, the function has been released again.

Settings Check

Annunciation: the device is checking the new parameters (on-line parameter setting).
Relevant information: On, check has begun.
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.

Level-2 change

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.
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.
The event log information of this annunciation (On/Off) is maintained in case of an initial or restart.
Relevant information: On, parameter changes on-line from the device or through a parameter setting command.
Relevant information: Off, parameter set completely reloaded.

Reset LED

Acknowledgement that LEDs were reset.
Relevant information: On

Test mode

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.
Relevant information: On/Off

DataStop

Data transmission stop for annunciations, metered and measured values.
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.
Relevant information: On/Off

HWTestMod

Hardware test mode
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.
After the Off command, the annunciation “Hardware test Off” is output, and an initial restart of the device is initiated after 5 seconds.
Relevant information: On/Off

Time Synch

Input for the external minute pulse.
Relevant information (fleeting): On

Synch-Clock

Reset following a clock synchronization.
Relevant information (fleeting): On

DayLight SavTime

Annunciation: Device switched over to daylight saving time.
Relevant information: On, the date/time management has received a request for time synchronization with daylight saving time.
Relevant information: Off, the date/time management has received a time synchronization command without daylight saving time.

Clock SyncError

Annunciation: Clock synchronization error.
Relevant information: On, no synchronization received within parameterized tolerance time.
Relevant information: Off, synchronization received again.

Event Lost Annunciation: Not all annunciations generated by the device could be stored in the buffer. The cause is probably a buffer overflow.
Relevant information (fleeting): On

Flag lost 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.
Relevant information: On

UnlockDT The interlocking of this flag with binary input ">Data Stop" (**FNo. 16/CU**) 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.
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 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 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 **Tmin TRIP** (**6106/CU**) the feeder current drops below the threshold **I> BF** (**XX18/CU**) or **I> BF-EF** (**XX19/CU**).

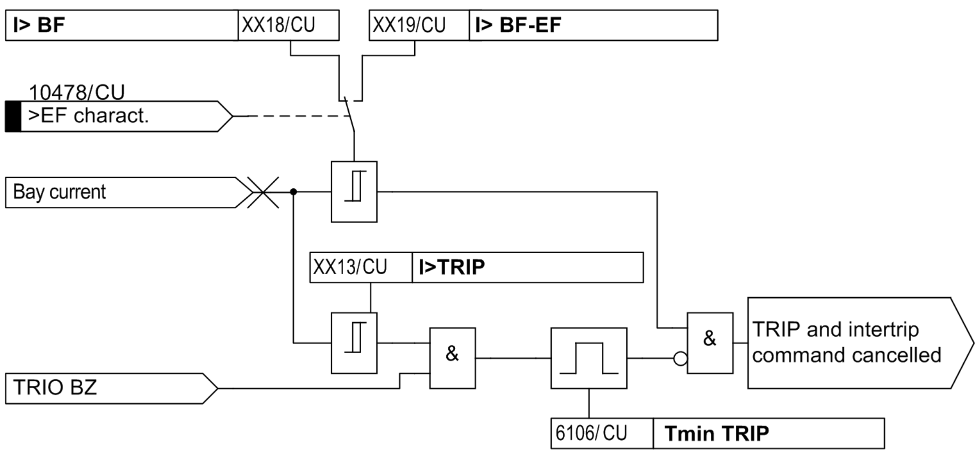


Figure 5-37 Minimum duration of TRIP command

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 **F3** 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**).

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 disconnector image ("isolator replica"). The service function "bay out of service" causes that this allocation is generally cancelled. In 2-bay couplers, this status is automatically assumed for both coupler bay units. Therefore the disconnectors of the affected bay unit in the internal disconnector image are processed as open. Further the disconnector 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 (=disconnector-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 isolator remains closed and only the circuit breaker and the line side isolator (without beeing 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 isolator 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 isolator 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. Iso** 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 isolator status must not be changed during maintenance mode; this is because the individual protection zones are managed on the basis of the frozen isolator replica.
- The circuit breaker monitoring and the isolator status monitoring are closed.
- A warning annunciation “IsoProhib/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 5-37, page 167).

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 5-38, page 170 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.

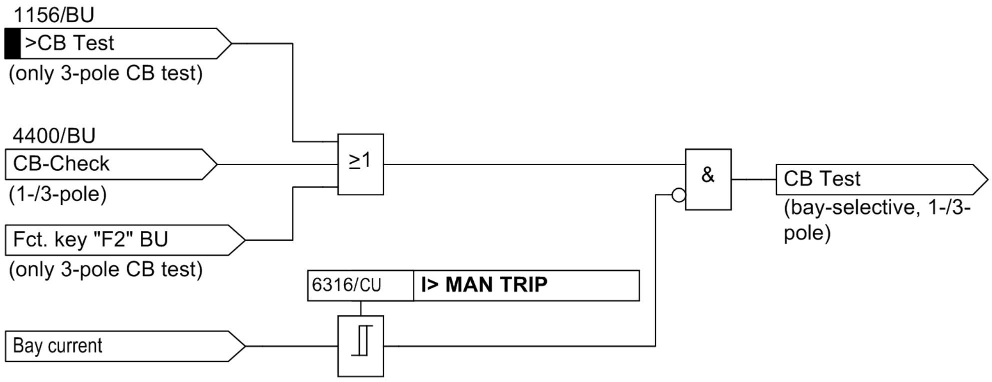


Figure 5-38 CB test live trip function

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 coupling is carried out via one binary input per bus zone with an additional common release via another binary input.

The alarm "`>TRIP-Release`" (**`FNo. 10487/CU`**) is generated for the release and "`>Trip $03`" (**`FNo. 177.1360.xx/CU`**) is generated for each triggering.
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: "`TripBIErr $03`" (**`FNo. 177.1361.xx/CU`**), the group alarm "`TripRelErr`" (**`FNo. 10486/CU`**) and the further processing of the binary input is blocked.
If there is no TRIP release, the following alarm is generated:
(**`FNo. 177.1362.xx/CU`**) "`noTripRel $03`".

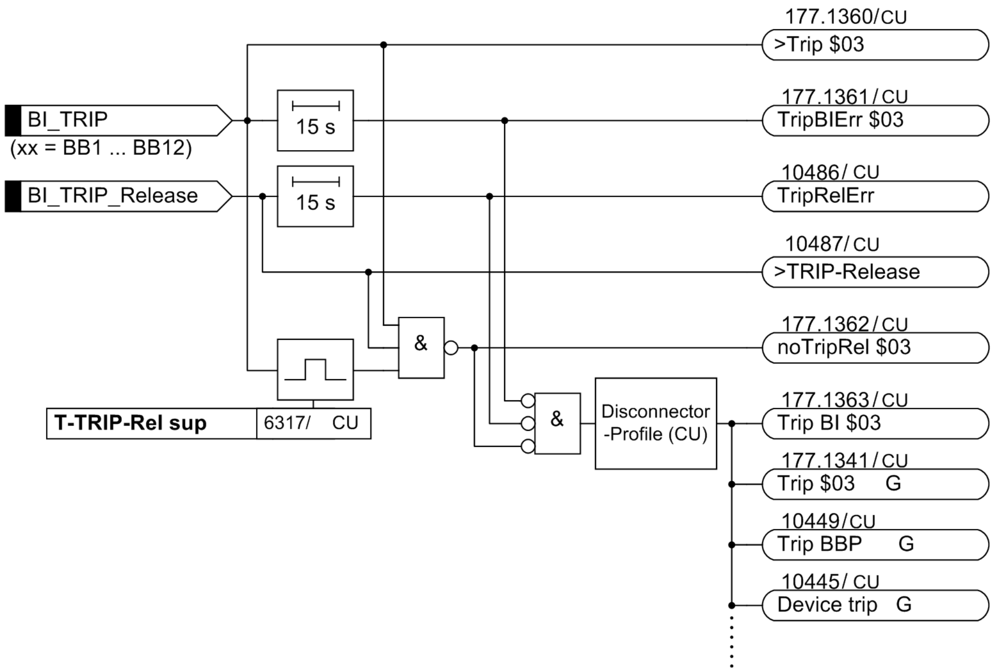


Figure 5-39 Logic of Busbar Tripping by External Signal

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 167). 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 only to the feeder settings ***out of service*** and ***maintenance***. It affects also the possibility to change the operating status by means of the function keys ***F1*** and ***F3*** 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”.

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 **NO**.

With setting ***released*** the protection of the transfer busbar will be on. This setting only makes sense in configurations with external current transformers.

With setting ***blocked*** 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 295). Siemens recommends to block all TRIP commands.
With test mode ***ON***, the protection is blocked.

Language BU

The parameter **Language BU** (**5111A/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 ***Deutsch***, 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 isolator 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 in service maintenance	in service	Bay status
113	I> TRIP	0.00..25.00 I / In	0.00 I / In	Current threshold for TRIP re- lease
115	BF OP MODE	non existent external BZ unbalance trip rep/unbal I>query 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
119	I> BF-EF	0.05..2.00 I / In	0.25 I / In	Current threshold for BF - EF
151A	Maint. Iso1	YES NO	YES	Maintenance for Isolator 1
156A	Maint. CB	YES NO	YES	Maintenance for CB
5401	PROT TR BUS	YES NO	YES	Selective protection for transfer busbar
5108A	Test mode SK	OFF ON	OFF	Test mode for module SK
5111A	Language BU	German English French Spanish Italian Russian	English	Language of bay units
6106	Tmin TRIP	0.01.. 32.00 s	0.15 s	Minimum duration of TRIP com- mand
6316	I> MAN TRIP	0.00 .. 2.50 I/In; ∞	0.05 I/In	Limit value for circuit breaker test
6317	T-TRIP-Rel sup	0.06 .. 1.00 s	0.06 s	Supervision bin. input TRIP-Re- lease
6318	CTRL REL BU	released 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. isolator 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	IsoProhib G	Isolator oper. prohibited (group alarm)
10478	>EF charact.	>Earth fault characteristic active
10486	TripRelErr	Timing error trip release
10487	>TRIP-Release	>TRIP-Release for external command
176.1135	$01 $02	$01 circuit breaker $02
177.1341	Trip $03 G	Trip command for $03 (group alarm)
177.1360	>Trip $01	>Trip command for $03
177.1361	TripBIErr $03	Timing error ext. Trip command $03
177.1362	noTripRel $03	No release of Trip command $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 / re-lease
1141	T TRIP	0.01..32.00 s	0.15 s	Minimum trip command duration
7101	LANGUAGE	integrated operator control	DEUTSCH ENGLISH FRANCAIS ESPANOL ITALIANO PYCCK.	ENGLISH

5.9.12 List of Information from the Bay Unit

FNo.	Alarm	Comments
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 114)
  - **Characteristics for the Circuit Breaker Failure Protection** (Chapter 5.3.1, page 114)
  - **Operating States "Bay Out of Service", "Maintenance Mode"** (Chapter 5.9.3, page 168)
  - **Triggering and Releasing the Breaker Failure Protection** (Chapter 5.3.5.1, page 117)
  - **Circuit Breaker Failure Protection during a Feeder Short-Circuit** (Chapter 5.3.5.2, page 119)
  - **Circuit Breaker Failure Protection for Busbar Faults** (Chapter 5.3.5.3, page 126)
  - **Failure of the Bus Coupler Circuit Breaker** (Chapter 5.3.5.4, page 127)
  - **Circuit Breaker Not Ready** (Chapter 5.3.5.5, page 127)
- **End Fault Protection** (Chapter 5.4, page 135)
  - **End Fault Protection in the Feeder** (Chapter 5.4.1, page 135)
  - **Protection with fault in the ”Dead Zone” of the Bus Coupler** (Chapter 5.4.2, page 137)
- **Protection General** (Chapter 5.9, page 167)
  - **Current-Controlled TRIP Reset** (Chapter 5.9.1, page 167)
  - **Local Control of the Bay Unit** (Chapter 5.9.2, page 167)
  - **Overcurrent-Controlled TRIP command** (Chapter 5.9.4, page 169)

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 114).

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** (**5111A/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 ***DEUTSCH*** the menus in the display of the bay unit appear in German.

With the setting ***ENGLISH, FRANCAIS, ESPANOL, ITALIANO, PYCCK.*** the menus in the display of the bay unit appear in the respective target language.

OPER.1st L.
OPER.2nd L.
OPER.3rd L.
OPER.4th L.

The parameters **OPER.1st L.** (**7120/BU**), **OPER.2nd L.** (**7122/BU**), **OPER.3rd L.** (**7124/BU**) and **OPER.4th L.** (**7126/BU**) are used to select the measured value which will be displayed in the 1st, 2nd, 3rd and 4th line of the “stand-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.
OPER.2nd L.
OPER.3rd L.
OPER.4th L.

The parameters **OPER. 1st L.** (**7121/BU**), **OPER.2nd L.** (**7123/BU**), **OPER.3rd L.** (**7125/BU**) and **OPER.4th L.** (**7127/BU**) are used to select the mode of display for the measured value in the 1st, 2nd, 3rd and 4th line of the “stand-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 ENGLISH FRANCAIS ESPANOL ITALIANO PYCCK.	ENGLISH	Operating language
7120	OPER.1st L.	IL1, IL2, IL3, IE I-DIFF. L1, I-DIFF. L2, I-DIFF. L3 I-RESTR. L1, I-RESTR. 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.	PRIMARY SECONDARY NORMALIZED	SECONDARY	Display of measured values in the 1st line as primary or secondary (percent) values
7122	OPER.2nd L.	IL1, IL2, IL3, IE I-DIFF. L1, I-DIFF. L2, I-DIFF. L3 I-RESTR. L1, I-RESTR. 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.	PRIMARY SECONDARY NORMALIZED	SECONDARY	Display of measured values in the 2nd line as primary or secondary (percent) values
7124	OPER.3rd L.	IL1, IL2, IL3, IE I-DIFF. L1, I-DIFF. L2, I-DIFF. L3 I-RESTR. L1, I-RESTR. 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.	PRIMARY SECONDARY NORMALIZED	SECONDARY	Display of measured values in the 3rd line as primary or secondary (percent) values
7126	OPER.4th L.	IL1, IL2, IL3, IE I-DIFF. L1, I-DIFF. L2, I-DIFF. L3 I-RESTR. L1, I-RESTR. 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.	PRIMARY SECONDARY 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 ASCII	DIGSI V3	Data format
7215	PC BAUDRATE	1200 Baud 2400 Baud 4800 Baud 9600 Baud 19200 Baud	9600 Baud	Transmission rate for PC poirt
7216	PC PARITY	DIGSI V3 No parity,2 stopbits No parity,1 stopbit	DIGSI V3	Parity of transmission telegrams
7233	SYS SUBV.T	1.. 600 s ; +*	120 s	Supervision time for system in-terface

5.13 Fault Recording in the Bay Unit (”Local Fault Recording”)

5.13.1 Functional Description

Note

A description of the central unit's fault recording function is provided in Chapter 5.6, page 160.
Reading out of oscillographic fault recording data is described in Chapter 6.2.3, page 221.

The instantaneous measured values are stored at intervals of 1 ms (f_N = 50 Hz) and 833 µs (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. STORAGE BY TRIP 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 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 188.

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 188).

With setting ***INVERSE TIME***, an inverse time characteristic will be used for the phase current overcurrent protection (Chapter 5.16.1, page 188).

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 188).

With setting ***INVERSE TIME***, an inverse time characteristic will be used for the earth current overcurrent protection (Chapter 5.16.1, page 188).

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 in service maintenance	in service	Bay status
5104	FREQUENCY	50 Hz 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 INVERSE TIME	Definite time	O/C protection characteristic for phase currents
7815	CHARAC. E	DEFINITE TIME INVERSE TIME	DEFINITE TIME	O/C protection characteristic for the earth current
7899	FREQUENCY	50 Hz 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.

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.

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 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 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/CU**) 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 5-43, page 203). Additionally, individual function elements can be blocked selectively via the binary inputs of the bay unit (Figure 5-40, page 189 and Figure 5-41, page 189).

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 320):

- 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 5-40, page 189 and 5-41, page 189.

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.close” (**FNo. 7618/BU**). In that case an undelayed trip command is issued if a fault is detected on the respective stage.

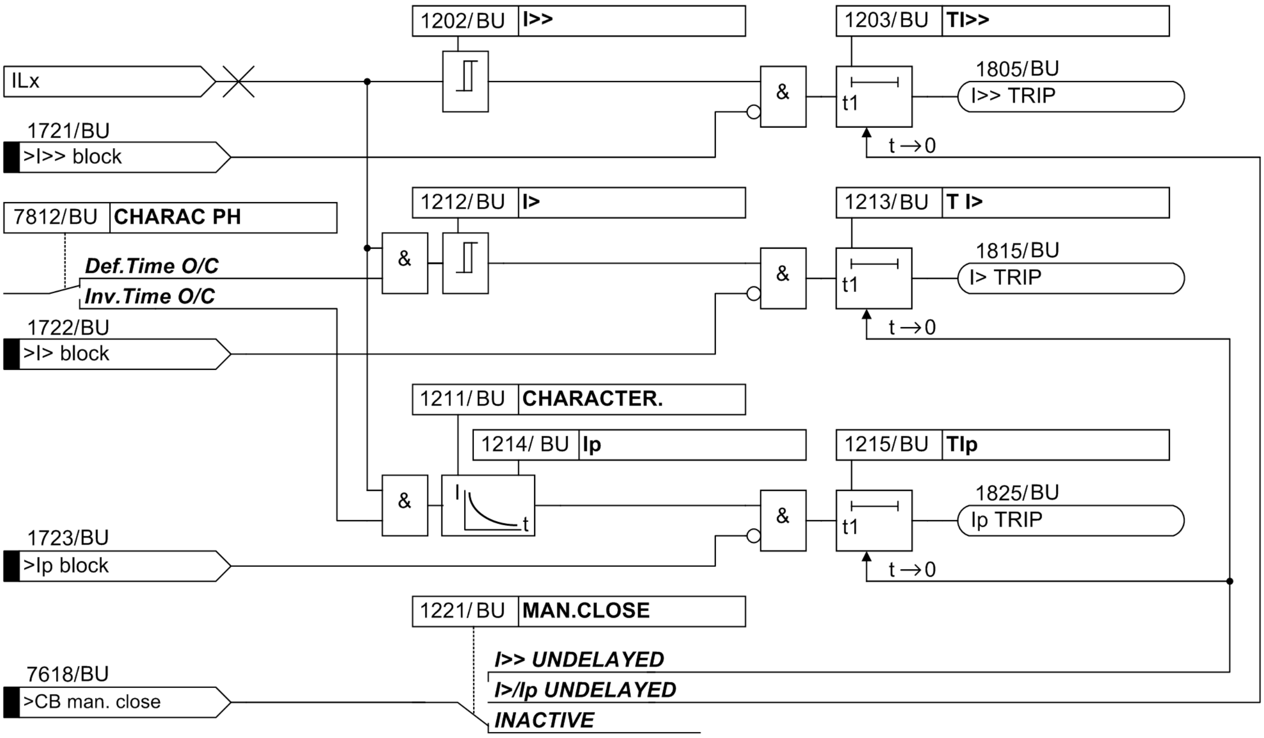


Figure 5-40 O/C protection for phase currents

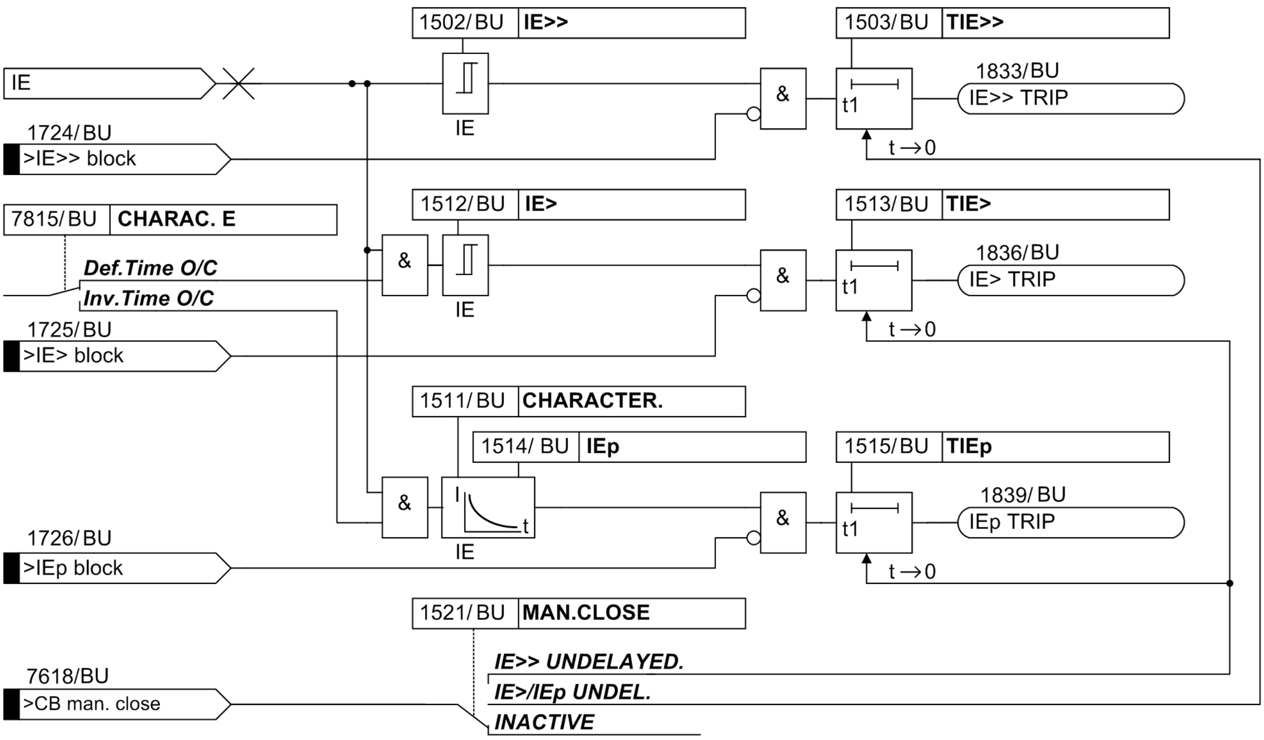


Figure 5-41 O/C protection for the earth current

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 184). 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 184). 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 184). 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 184). 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 ***INVERSE 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 ***INVERSE 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 ***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** (**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 OFF	ON	O/C protection for phase currents
1202	I>>	0.05 .. 25.00 I_N	2.00 I_N	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 NO	NO	Option to set a measurement repetition
1211	CHARACTER.	NORMAL INVERSE VERY INVERSE EXTREMELY INVERS	NORMAL INVERSE	Tripping characteristic for the phase current
1212	I>	0.05 .. 25.00 I_N	1.00 I_N	Pick-up value of the overcurrent stage I>
1213	TI>	0.00 .. 60.00 s; +* infinite	0.50 s	Trip time delay of the overcurrent stage I>
1214	Ip	0.10 .. 4.00 I_N	1.00 I_N	Pick-up value of the overcurrent stage Ip> for the phase currents
1215	TIp	0.05 .. 10.00 s 0; +*	0.50 s	Time multiplier for phase currents
1216	RMS FORMAT	FUNDAMENTAL TRUE RMS	FUNDAMENTAL	RMS format for inverse time O/C protection
1221	MAN.CLOSE	I>> UNDELAYED I> /Ip UNDELAYED INEFFECTIVE	I>> UNDELAYED	Overcurrent stage valid for phase currents when the circuit breaker is manually closed
1501	O/C EARTH	ON OFF	ON	O/C protection for the earth current
1502	IE>>	0.05 .. 25.00 I_N	0.50 I_N	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 NO	NO	Option to set a measurement repetition
1511	CHARACTER.	NORMAL INVERSE VERY INVERSE EXTREMELY INVERS	NORMAL INVERSE	Tripping characteristic for the earth current
1512	IE>	0.05 .. 25.00 I_N	0.20 I_N	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	IEp	0.10 .. 4.00 I_N	0.10 I_N	Pick-up value of the overcurrent stage IEp for the earth current

Addr.	Setting Title	Setting Options	Default Settings	Comments
1515	TIEp	0.05 .. 10.00 s 0; +*	0.50 s	Time multiplier for earth current
1516	RMS FORMAT	FUNDAMENTAL TRUE RMS	FUNDAMENTAL	RMS format of the earth current for inverse time O/C protection
1521	MAN.CLOSE	IE>> UNDELAYED IE> /IEp UNDELAYED 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 annunications "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 **>**Annunciation1 .. 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 “Annunciation1” .. 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.

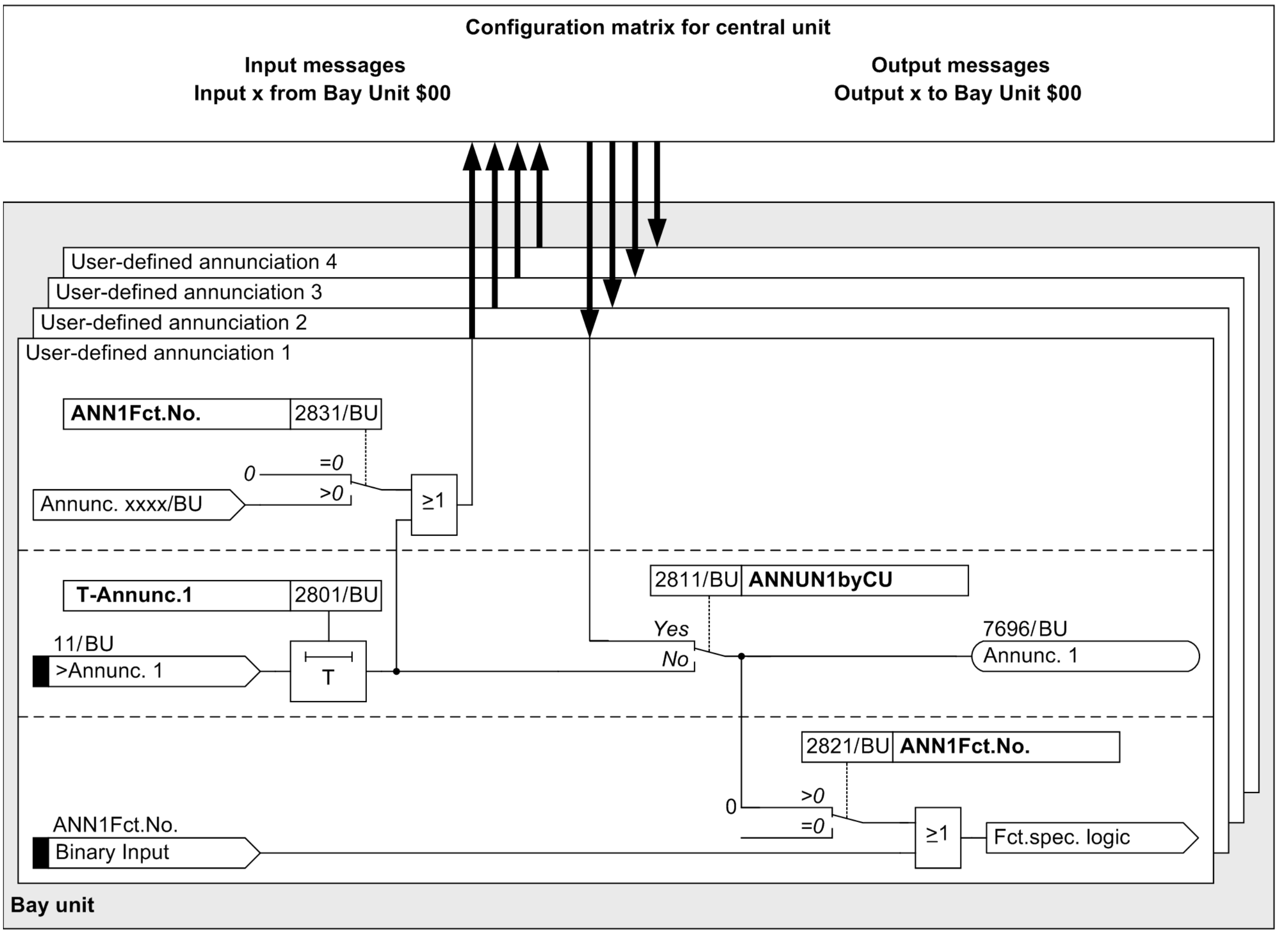


Figure 5-42 User-define annunciations

Note:

Do not interconnect the user-defined logic in such a way that the output annuciation 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

T-Annunc.1
T-Annunc.2
T-Annunc.3
T-Annunc.4

The parameters **T-Annunc.1** (**2801/BU**), **T-Annunc.2** (**2802/BU**), **T-Annunc.3** (**2803/BU**) and **T-Annunc.4** (**2804/BU**) are used to set the delay times for the user-defined annunciations 1, 2, 3 and 4.

ANN1Inp.No
ANN2Inp.No
ANN3Inp.No
ANN4Inp.No

Use parameters **ANN1Inp.No** to **ANN4Inp.No** (**2831/BU, 2832/BU, 2833/BU, 2834/BU**) to set any annunciation numbers (see Appendix A.10, page 383) that can be transferred to the central unit.

ANN1Fct.No
ANN2Fct.No
ANN3Fct.No
ANN4Fct.No

Use parameters **ANN1Fct.No** (**2821/BU**), **ANN2Fct.No** (**2822/BU**), **ANN3Fct.No** (**2823/BU**) and **ANN4Fct.No** (**2824/BU**) 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 YES	NO	Processing of annunciation 1 by central unit
2812	ANNUN2byCU	NO YES	NO	Processing of annunciation 2 by central unit
2813	ANNUN3byCU	NO YES	NO	Processing of annunciation 3by central unit
2814	ANNUN4byCU	NO 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 5-43, page 203 and Figure 5-46, page 205. 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 "CBF Trp.rp.3p" (**FNo. 7632/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.

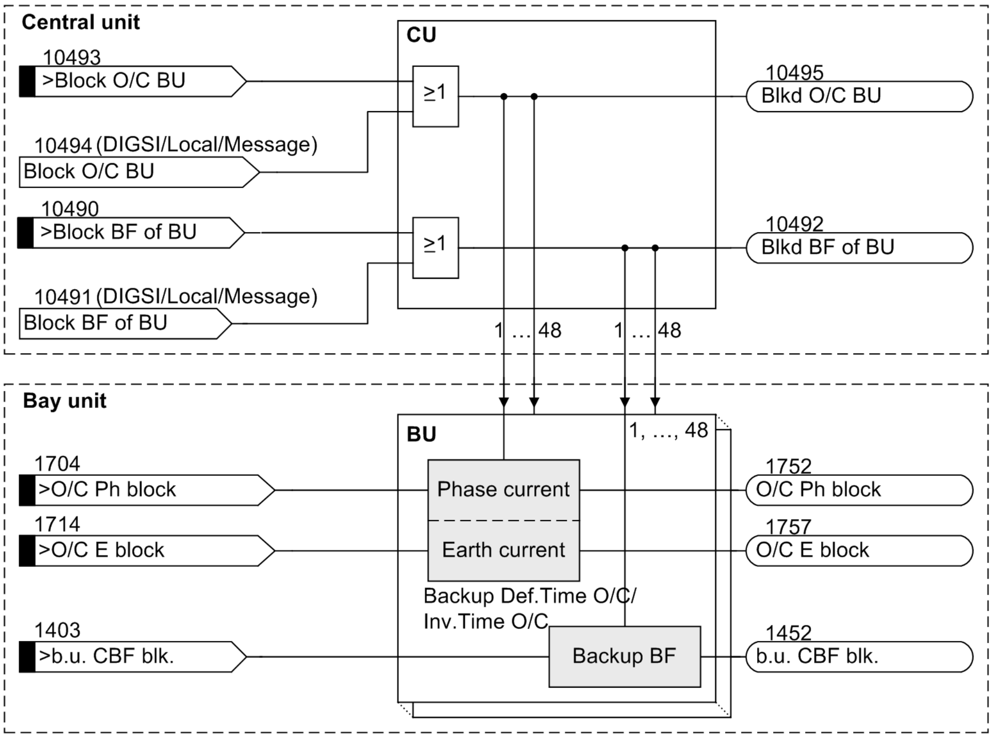


Figure 5-43 Blocking mechanism for the backup breaker failure protection and backup time overcurrent protection

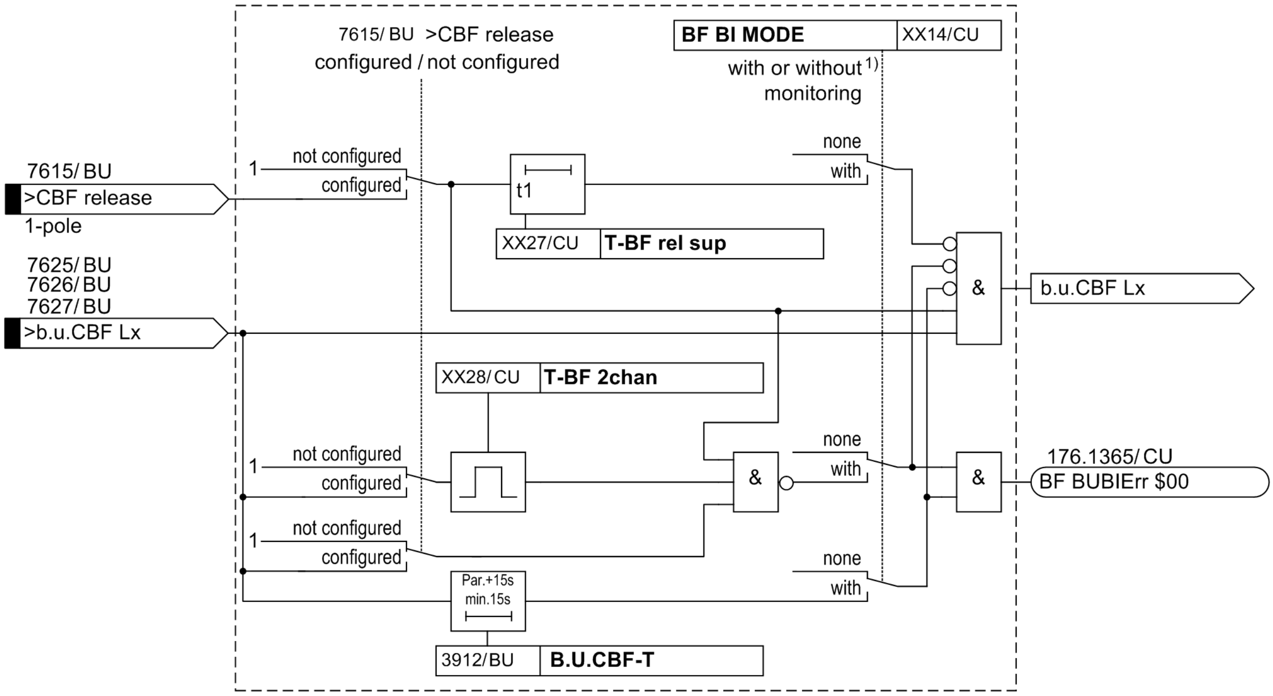


Figure 5-44 Monitoring of the Starting Binary Inputs of the Backup Protection-BFP 1-pole

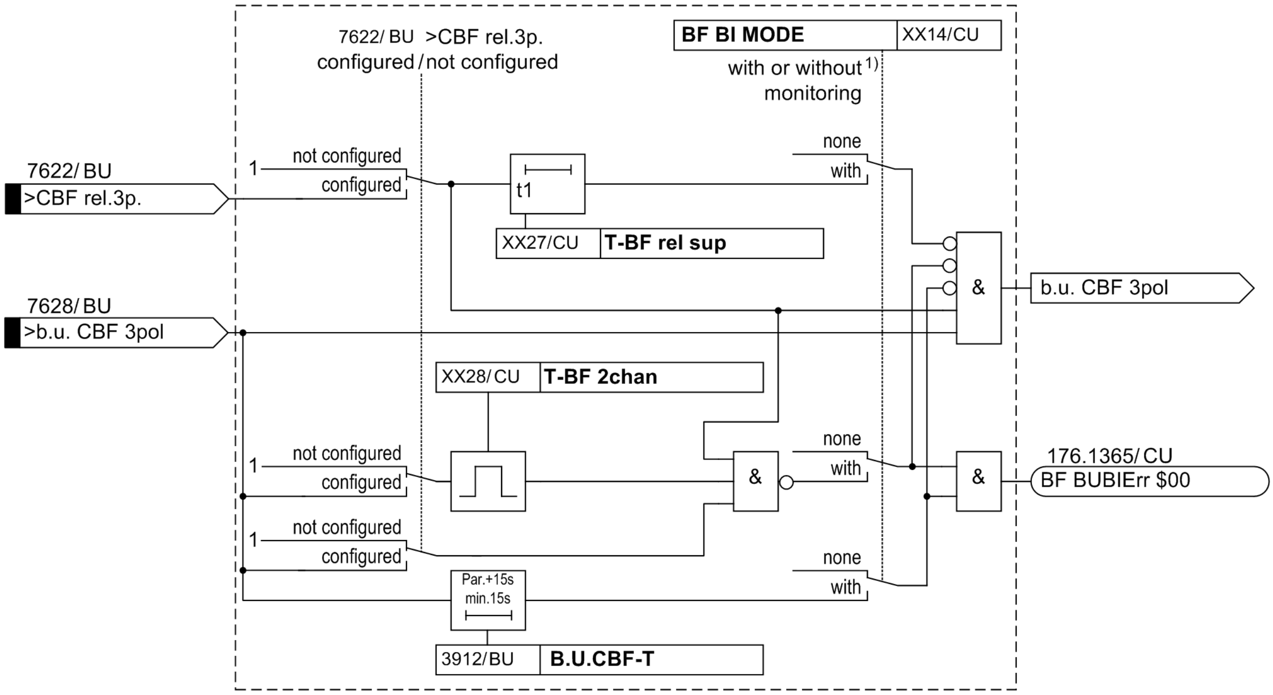
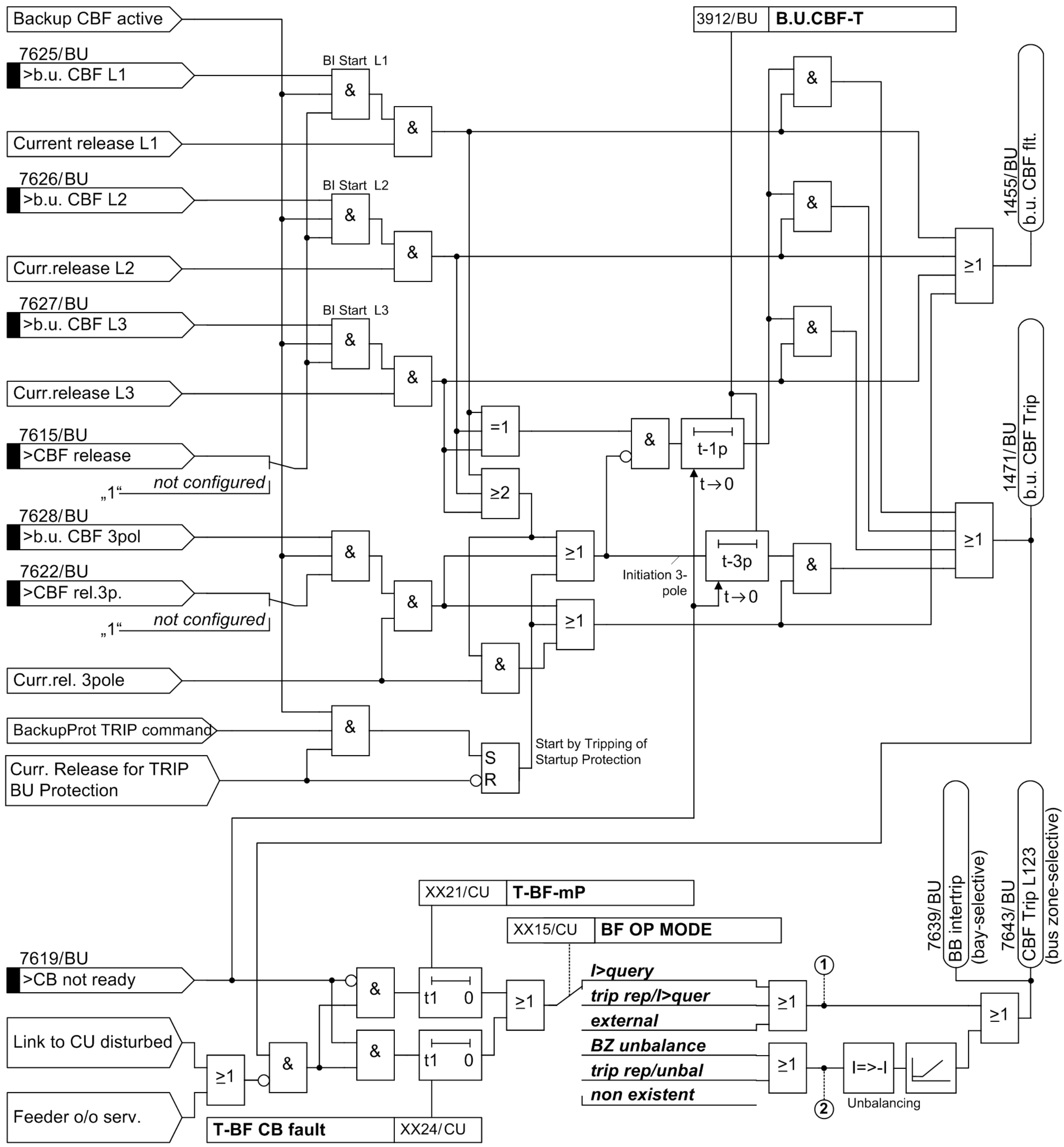


Figure 5-45 Monitoring of the Starting Binary Inputs of the Backup Protection-BFP 3-pole



Continuation for (1) and (2) see Figure 5-22, page 121

Figure 5-46 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 1-ch w sup 2-ch w/o sup 2-ch w sup	1-ch w sup	Binary input mode / supervision BF
115	BF OP MODE	non existent external BZ unbalance trip rep/unbal I>query trip rep/I>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 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

FNo.	Alarm	Comments
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 6

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 45 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

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 210.

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 214
• Fault events	CU, BU	X	X	6.2.1.2, page 216
• General interrogation	CU, BU	–	–	6.2.1.4, page 218
• Spontaneous annunciation	CU, BU	–	–	6.2.1.5, page 218
• Statistical counters	BU	–	X	6.2.1.6, page 219
Reading out measured values:	CU, BU	X	X	6.2.2, page 219
Reading out fault data:	CU, BU	–	–	6.2.3, page 221
Controlling device functions:				
• Generate oscillographic record	CU, BU	X	X	6.3.1, page 225
• Block TRIP command (also selectively)	CU, BU	X	X	6.3.2.1, page 226
• Block breaker failure protection (also selectively)	CU, BU	X	X	6.3.2.2, page 230
• Save annunciations	CU, BU	–	–	6.3.3.1, page 233
• Delete annunciations	CU, BU	X	X	6.3.3.2, page 234
• Circuit breaker test	BU	–	X	6.3.4, page 235
• Reset blocking of differential current supervision	CU	X	–	6.3.5.1, page 237
• Reset blocking of isolator status supervision	CU	X	–	6.3.5.2, page 238
• Busbar blocking - selective	–	only BI	–	6.3.2.3, page 232
• Trigger initial start and restart	CU	–	–	6.3.6, page 238
• Read and set date and time	CU	X	X	6.3.7, page 239
Feeder in/out of service	CU, BU	X	X	6.4, page 244

Table 6-1 Overview of the operating options and control options

Operating option	DIGSI logically to	CU operator panel	BU operator panel	Chapter
Maintenance mode	CU, BU	X	X	6.5, page 247
Plant visualization	CU	–	–	6.6, page 249
Current transformer polarity reversal	BU	–	X	7.5.1, page 287

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 213).

❑ 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.

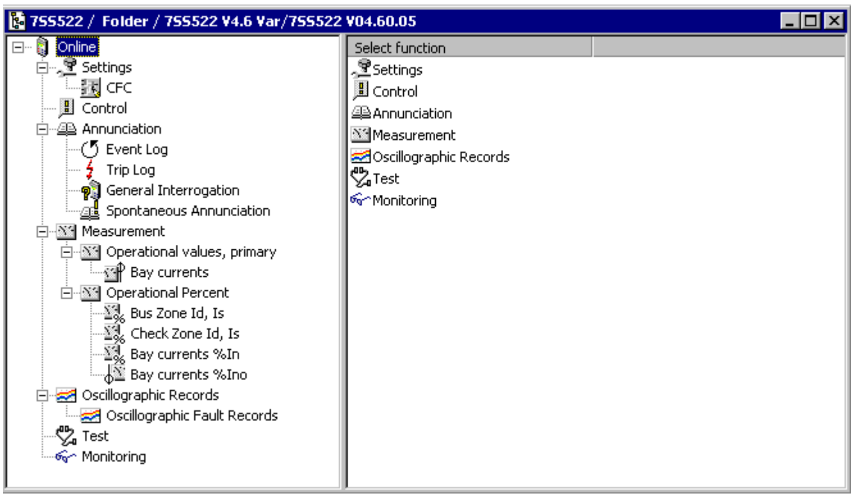


Figure 6-1 Annunciation groups in the DIGSI Device Configuration

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 289 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 45. 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 45 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 214).

Double-click an entry in the list view. The corresponding contents of the annunciation group is displayed in another window (Figure 6-3, page 215).

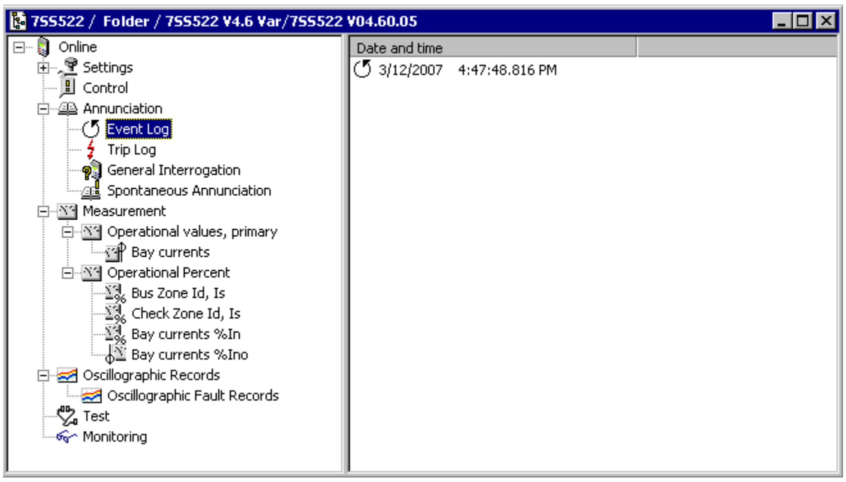
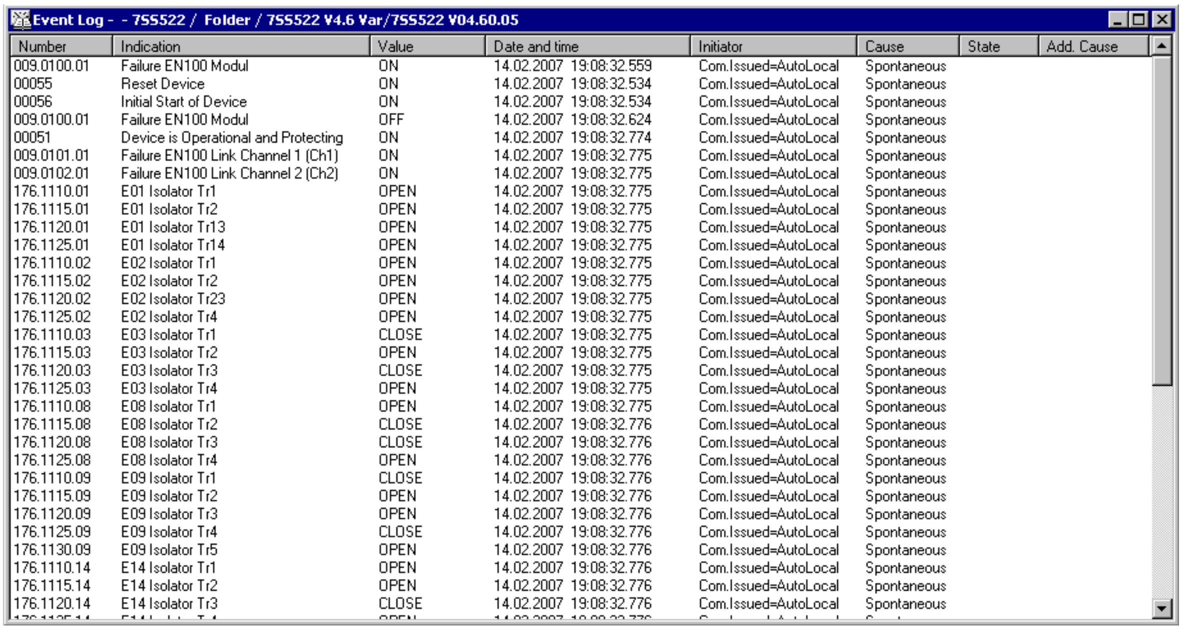


Figure 6-2 Overview of operational events in DIGSI – Example



Number	Indication	Value	Date and time	Initiator	Cause	State	Add. Cause
009.0100.01	Failure EN100 Modul	ON	14.02.2007 19:08:32.559	Com.Issued=AutoLocal	Spontaneous		
00055	Reset Device	ON	14.02.2007 19:08:32.534	Com.Issued=AutoLocal	Spontaneous		
00056	Initial Start of Device	ON	14.02.2007 19:08:32.534	Com.Issued=AutoLocal	Spontaneous		
009.0100.01	Failure EN100 Modul	OFF	14.02.2007 19:08:32.624	Com.Issued=AutoLocal	Spontaneous		
00051	Device is Operational and Protecting	ON	14.02.2007 19:08:32.774	Com.Issued=AutoLocal	Spontaneous		
009.0101.01	Failure EN100 Link Channel 1 (Ch1)	ON	14.02.2007 19:08:32.775	Com.Issued=AutoLocal	Spontaneous		
009.0102.01	Failure EN100 Link Channel 2 (Ch2)	ON	14.02.2007 19:08:32.775	Com.Issued=AutoLocal	Spontaneous		
176.1110.01	E01 Isolator Tr1	OPEN	14.02.2007 19:08:32.775	Com.Issued=AutoLocal	Spontaneous		
176.1115.01	E01 Isolator Tr2	OPEN	14.02.2007 19:08:32.775	Com.Issued=AutoLocal	Spontaneous		
176.1120.01	E01 Isolator Tr13	OPEN	14.02.2007 19:08:32.775	Com.Issued=AutoLocal	Spontaneous		
176.1125.01	E01 Isolator Tr14	OPEN	14.02.2007 19:08:32.775	Com.Issued=AutoLocal	Spontaneous		
176.1110.02	E02 Isolator Tr1	OPEN	14.02.2007 19:08:32.775	Com.Issued=AutoLocal	Spontaneous		
176.1115.02	E02 Isolator Tr2	OPEN	14.02.2007 19:08:32.775	Com.Issued=AutoLocal	Spontaneous		
176.1120.02	E02 Isolator Tr23	OPEN	14.02.2007 19:08:32.775	Com.Issued=AutoLocal	Spontaneous		
176.1125.02	E02 Isolator Tr4	OPEN	14.02.2007 19:08:32.775	Com.Issued=AutoLocal	Spontaneous		
176.1110.03	E03 Isolator Tr1	CLOSE	14.02.2007 19:08:32.775	Com.Issued=AutoLocal	Spontaneous		
176.1115.03	E03 Isolator Tr2	OPEN	14.02.2007 19:08:32.775	Com.Issued=AutoLocal	Spontaneous		
176.1120.03	E03 Isolator Tr3	CLOSE	14.02.2007 19:08:32.775	Com.Issued=AutoLocal	Spontaneous		
176.1125.03	E03 Isolator Tr4	OPEN	14.02.2007 19:08:32.775	Com.Issued=AutoLocal	Spontaneous		
176.1110.08	E08 Isolator Tr1	OPEN	14.02.2007 19:08:32.775	Com.Issued=AutoLocal	Spontaneous		
176.1115.08	E08 Isolator Tr2	CLOSE	14.02.2007 19:08:32.776	Com.Issued=AutoLocal	Spontaneous		
176.1120.08	E08 Isolator Tr3	CLOSE	14.02.2007 19:08:32.776	Com.Issued=AutoLocal	Spontaneous		
176.1125.08	E08 Isolator Tr4	OPEN	14.02.2007 19:08:32.776	Com.Issued=AutoLocal	Spontaneous		
176.1110.09	E09 Isolator Tr1	CLOSE	14.02.2007 19:08:32.776	Com.Issued=AutoLocal	Spontaneous		
176.1115.09	E09 Isolator Tr2	OPEN	14.02.2007 19:08:32.776	Com.Issued=AutoLocal	Spontaneous		
176.1120.09	E09 Isolator Tr3	OPEN	14.02.2007 19:08:32.776	Com.Issued=AutoLocal	Spontaneous		
176.1125.09	E09 Isolator Tr4	CLOSE	14.02.2007 19:08:32.776	Com.Issued=AutoLocal	Spontaneous		
176.1130.09	E09 Isolator Tr5	OPEN	14.02.2007 19:08:32.776	Com.Issued=AutoLocal	Spontaneous		
176.1110.14	E14 Isolator Tr1	OPEN	14.02.2007 19:08:32.776	Com.Issued=AutoLocal	Spontaneous		
176.1115.14	E14 Isolator Tr2	OPEN	14.02.2007 19:08:32.776	Com.Issued=AutoLocal	Spontaneous		
176.1120.14	E14 Isolator Tr3	CLOSE	14.02.2007 19:08:32.776	Com.Issued=AutoLocal	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 215).
- ❑ 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/.

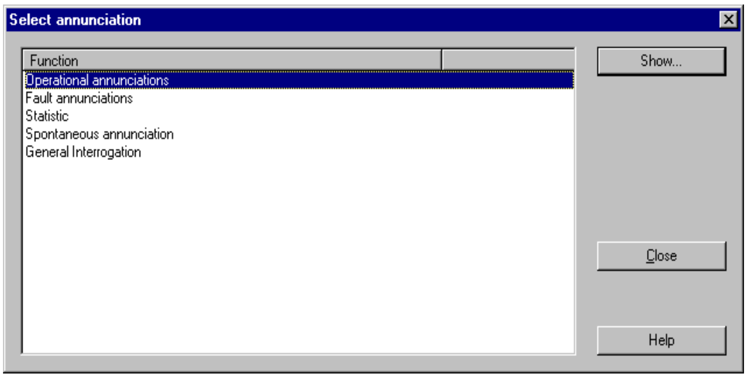
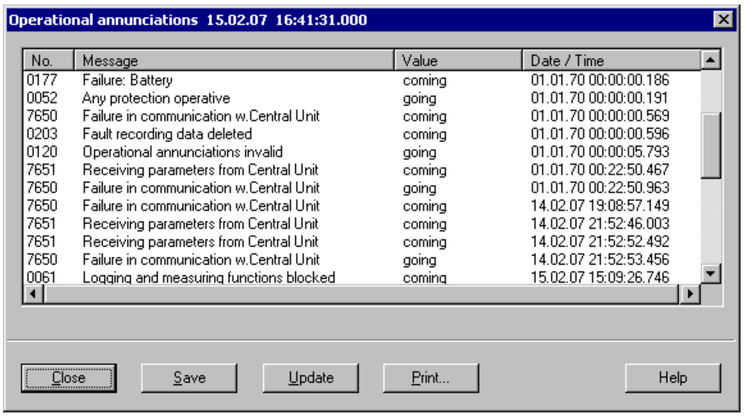


Figure 6-4 Select annunciation window in DIGSI of the bay unit



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 M`" (**`FNo.10445/CU`**) and the second line to the annunciation "`Transf. Trip M`" (**`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 216.

```
Device Trip M
Transf. Trip M
```

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 221) 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.

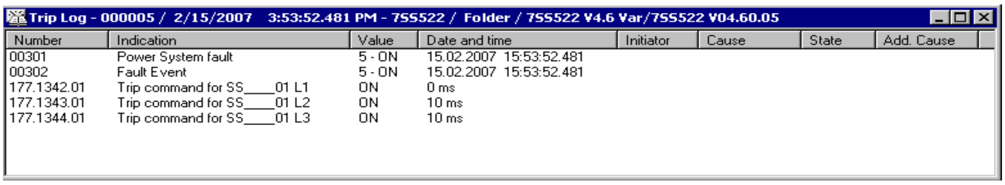
The central unit can store up to 8 faults with a maximum of 80 fault events each, and each bay unit can store 8 faults with a maximum of 100 fault events each. If more events are generated, the oldest are overwritten in the order of their generation.

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.


Trip Log - 000005 / 2/15/2007 3:53:52.481 PM - 7SS522 / Folder / 7SS522 V4.6 Var/7SS522 V04.60.05

Number	Indication	Value	Date and time	Initiator	Cause	State	Add. Cause
00301	Power System fault	5 - ON	15.02.2007 15:53:52.481				
00302	Fault Event	5 - ON	15.02.2007 15:53:52.481				
177.1342.01	Trip command for SS____01 L1	ON	0 ms				
177.1343.01	Trip command for SS____01 L2	ON	10 ms				
177.1344.01	Trip command for SS____01 L3	ON	10 ms				

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 295.

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 no 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 219.

Table 6-2 Operational Measured Values

Measured values		primary	I	I_N
Id_{L1}, Id_{L2}, Id_{L3}	Differential currents	–	% I_{no}	–
Is_{L1}, Is_{L2}, Is_{L3}	Restraint currents	–	% I_{no}	–
I_{L1}, I_{L2}, I_{L3}	Feeder currents	A	% I_{no}	% I_n
f_N	System frequency (display only in the bay units)	Hz	–	–

Note

The percentages I_{no} refer to the normalized currents of the station, the percentages I_N 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 213).

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 213).

❑ 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 220).

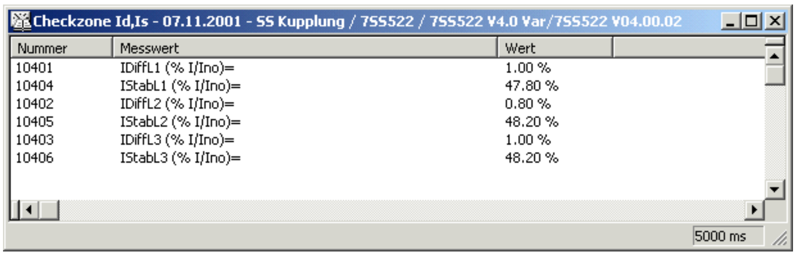


Figure 6-8 Metering window DIGSI – Example

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 221).

❑ 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 221).

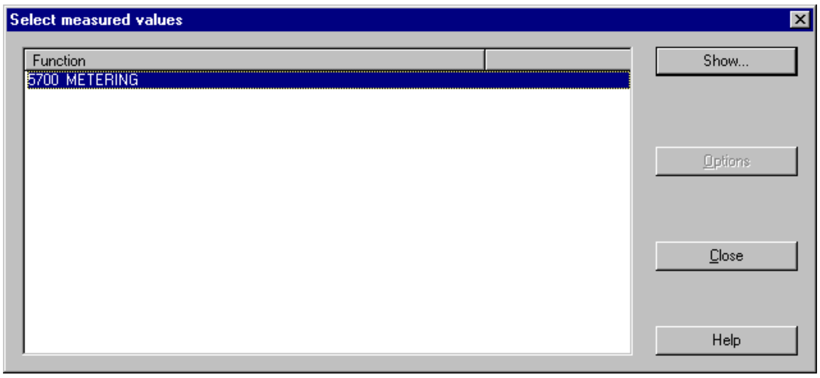


Figure 6-9 Select measured values window in DIGSI

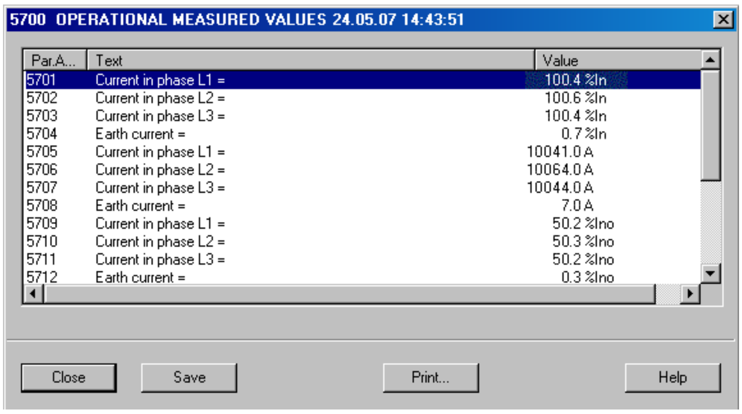


Figure 6-10 Window of the operational measured values DIGSI – Example

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 160 and 5.13, page 182.

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 222). 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 for each fault in the power system they are numbered starting from 1 upwards.

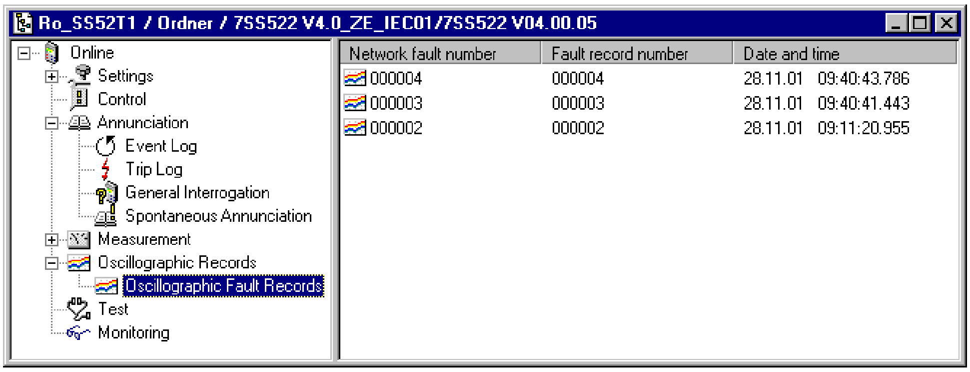


Figure 6-11 Reading out fault data in DIGSI – Example

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 161). 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.

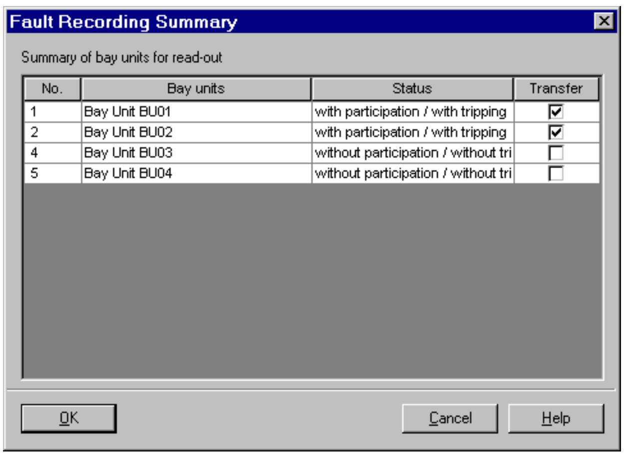


Figure 6-12 Selection of oscillographic records in DIGSI – Example

- 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 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 223). 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.

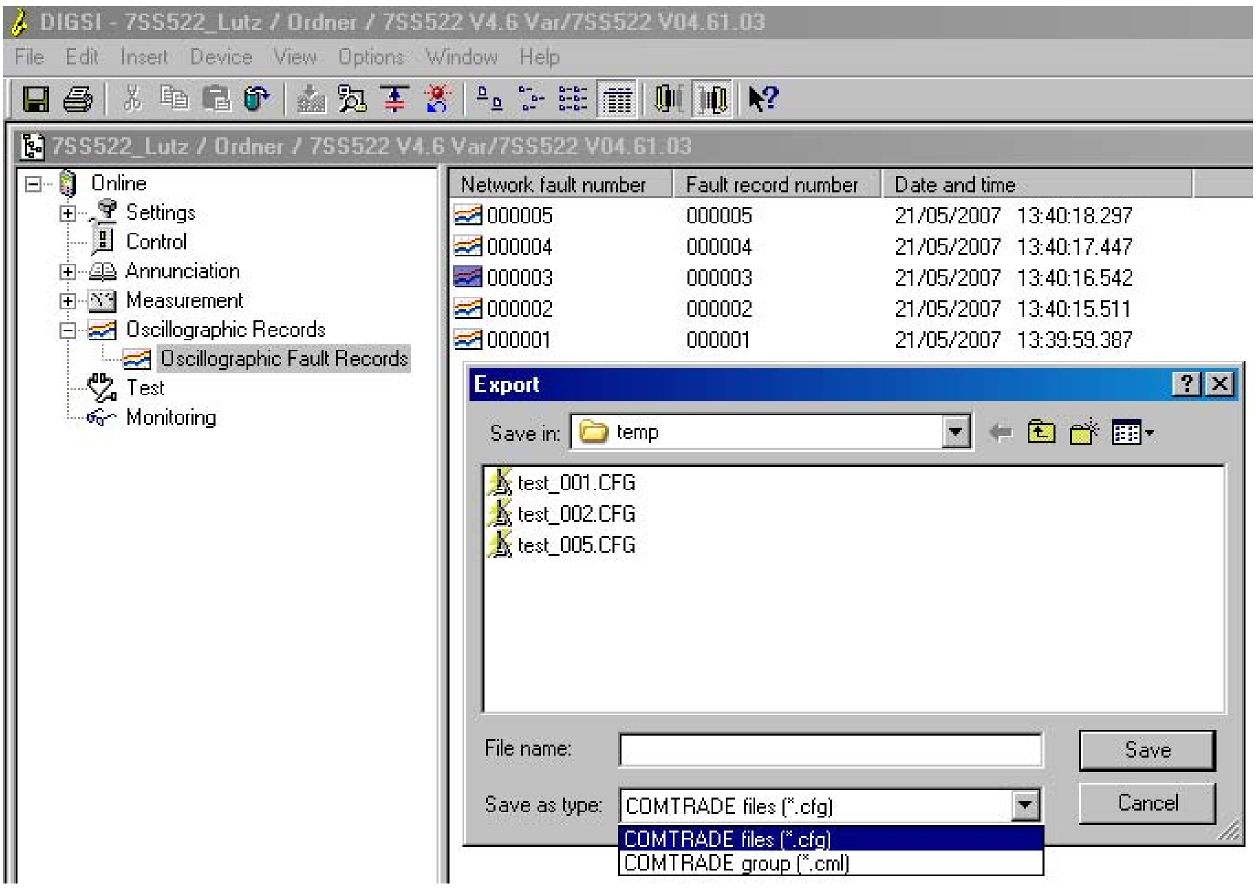


Figure 6-13 Saving the Fault Record

Please read the SIGRA Manual /4/ i f 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 224).
- ❑ 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).

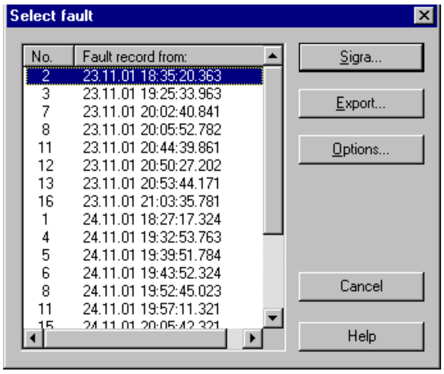


Figure 6-14 Select fault window in DIGSI

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 225)
- blocking the TRIP command (see Chapter 6.3.2.1, page 226)
- blocking the breaker failure protection (see Chapter 6.3.2.2, page 230)
- blocking of individual busbar sections (see Chapter 6.3.2.3, page 232)
- saving and erasing annunciations (see Chapter 6.3.3, page 233)
- circuit breaker test (see Chapter 6.3.4, page 235)
- resetting the blocking of the differential current supervision (see Chapter 6.3.5.1, page 237)
- resetting the blocking of the isolator status supervision (see Chapter 6.3.5.2, page 238)
- triggering an initial start and a restart (see Chapter 6.3.6, page 238)
- reading and setting date/time (see Chapter 6.3.7, page 239)

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 182).

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 160 and Chapter 5.13, page 182.

The data can be read out to a PC and evaluated by the DIGSI communication software (see Chapter 6.2.3, page 221).

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 226).
- ❑ Enter the desired fault record length and click **OK**. The fault recording starts. The fault record length must be within the specified limits.

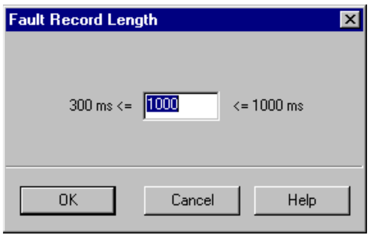


Figure 6-15 Fault Record Length dialog box in DIGSI

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

The TRIP commands can be blocked for the entire protection or busbar-selectively.

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 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**).

Caution!

If the busbar is to be blocked, make sure that it is an isolated bar, i.e. there are no closed sectionalizing isolators or sectionalizer forks provided. While being blocked, no switching operations are permitted on the blocked bar. The non-blocked busbar sections are not affected by any restrictions to the operational management.

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

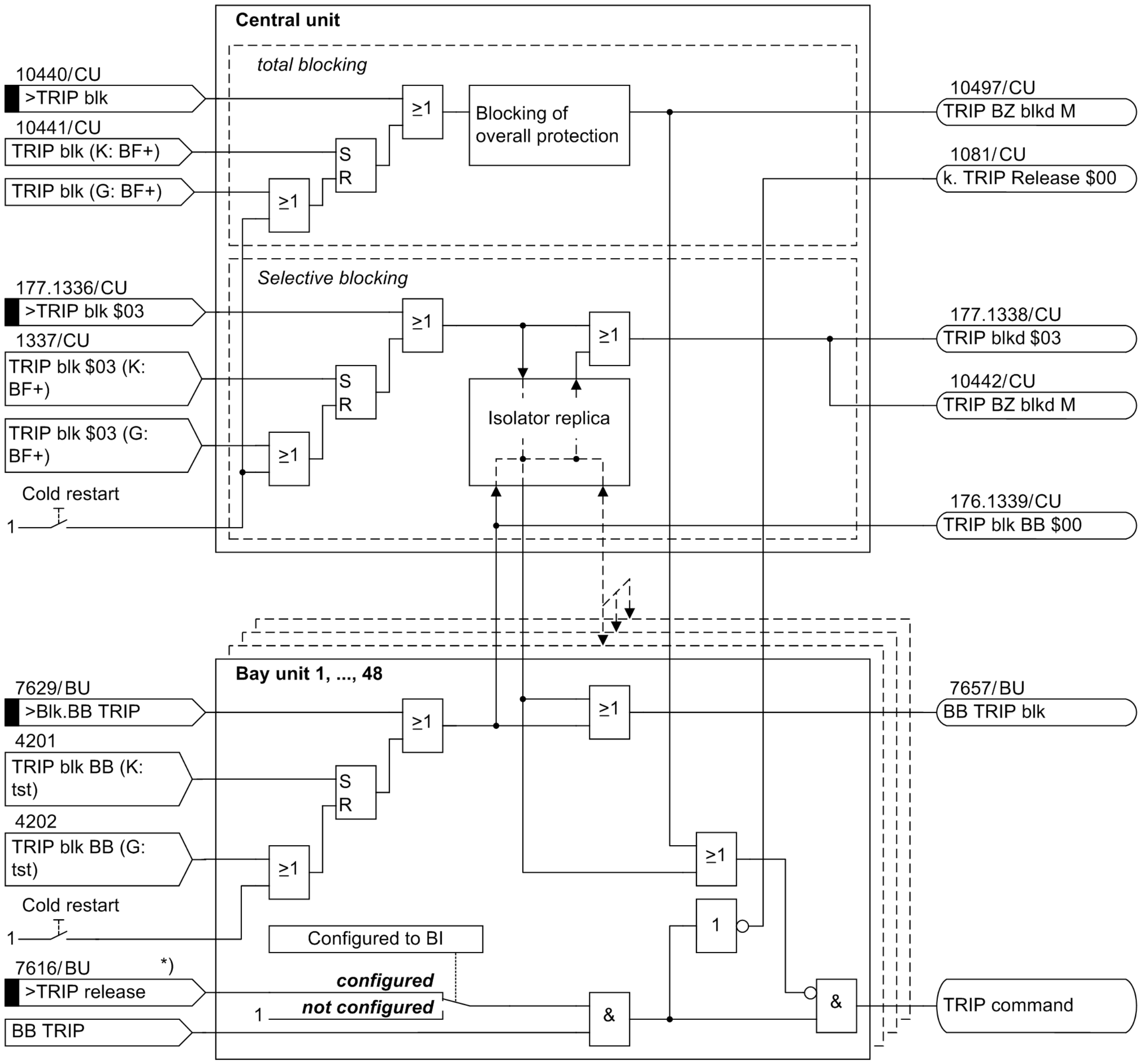
Blocking via the central unit is done with “$03 BlkTrip” (**FNo. 177.1337/CU**) or a binary input “>Blk Trip $03” (**FNo. 177.1336/CU**) and is indicated by the annunciation "$03 BlkdTrip" (**FNo. 177.1338/CU**) or "TRIP BZ blkd G" (**FNo. 10497/CU**). The annunciation "IsoProhib/Maint" (**FNo. 10471/CU**) 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 “Blocking BF” is retained. The tagging is erased in the case of an initial start.
The annunciation "IsoProhib G" (**FNo. 10471/CU**) is output.

The following figure gives an overview of these function:



BF+: CU command (system port, DIGSI, locally)
Pr.: BU test function (DIGSI, locally)
K: ON
G: OFF

*) the BI ">TRIP release" of the BU is only observed if it has been configured.

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 229).
- ❑ 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.

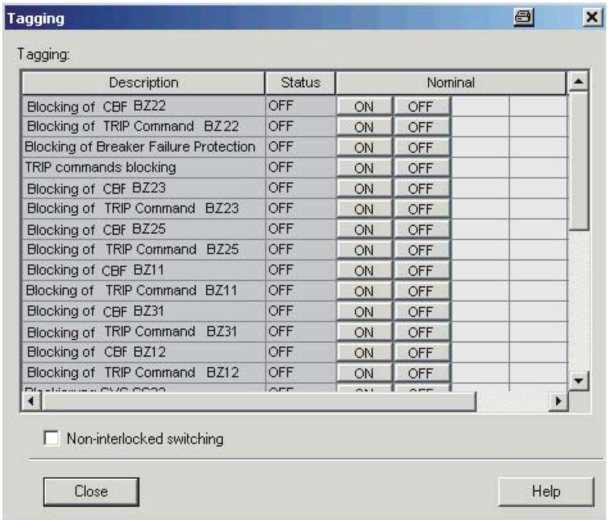


Figure 6-17 Tagging window in DIGSI

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 trip of the breaker failure protection can be blocked for the entire protection or busbar-selectively

With the external trip of the breaker failure protection blocked, all device-internal protection functions (central unit, bay unit) remain active. However, there is no trip of the breaker failure protection inititated, i.e. the breaker failure protection relays configured in the bay units are not activated. This is useful e.g. during the commissioning phase.

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.

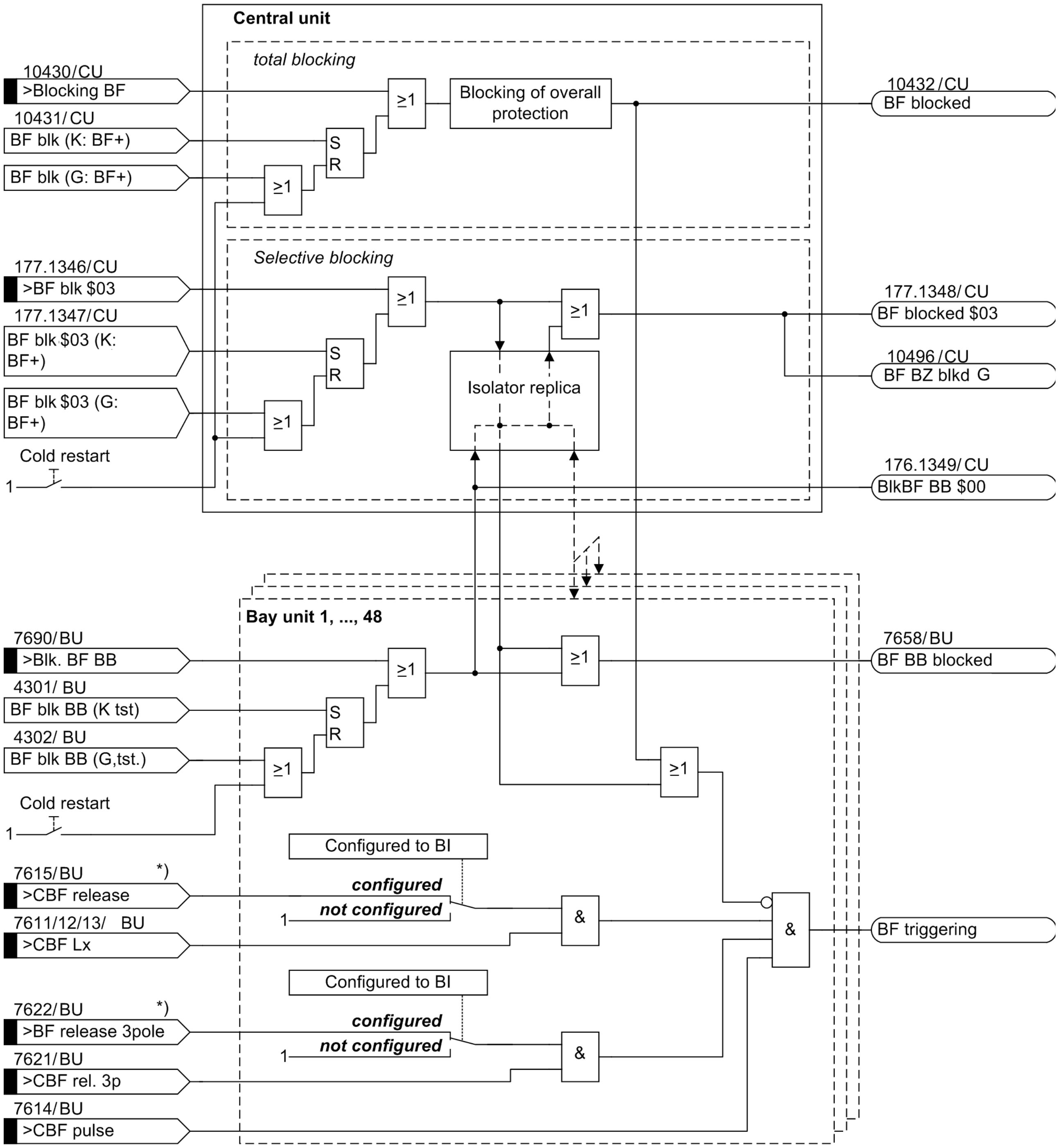
The blocking via the central unit is done via “BlkBF BB $00” (**FNo. 176.1349/CU**) or via a binary input “>Blk BF $03” (**FNo. 177.1346/CU**) and is indicated by the annunciation "$03 BlkdBF" (**FNo. 177.1348/CU**) or "BF blocked" (**FNo. 10432/CU**).

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 isolator of the blocked bus section are not permitted. The message "IsoProhib G (**FNo. 10471/CU**)" is outputted.

The following figure gives an overview of these functions:



BF+: CU command (system port, DIGSI, locally)
Pr.: BU test function (DIGSI, locally)
K: ON
G: OFF

*) The enable input is only observed if the operating mode "BF 2-channel" has been configured (param. XX14 BF BI mode).

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 229).
- ❑ 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 module 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 the preference of a measuring system by inserting a sectionalizer fork (connection of two busbars via an isolator).

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 214). 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.

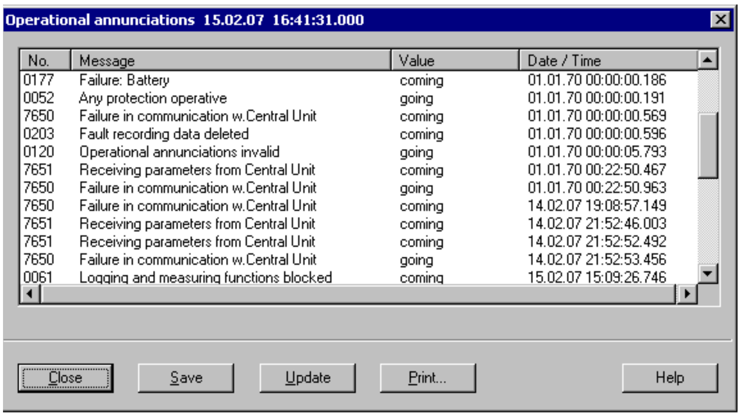


Figure 6-19 Saving annunciations – Example

- 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 214). 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.

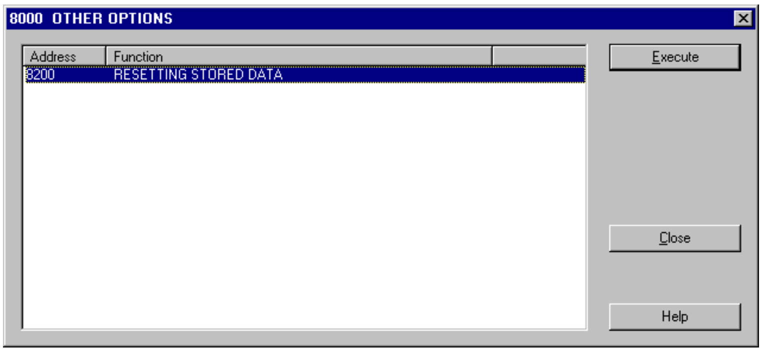


Figure 6-20 Deleting annunciations of a bay unit in DIGSI.

- ❑ 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 236, 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.

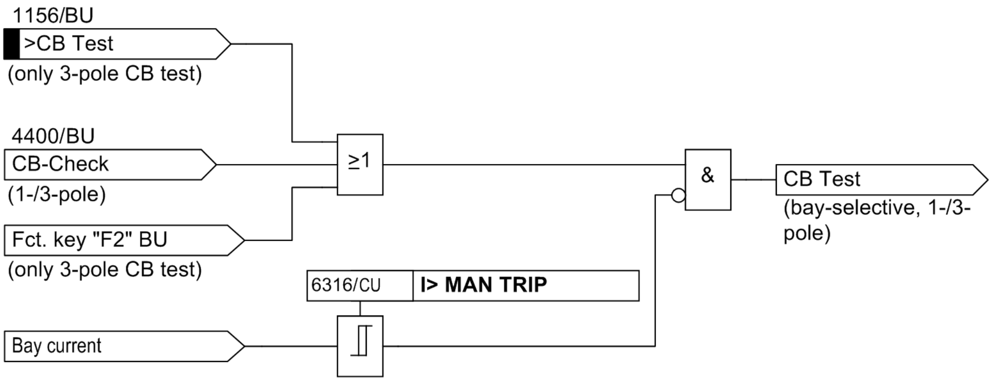


Figure 6-21 Trip test including circuit breaker

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.

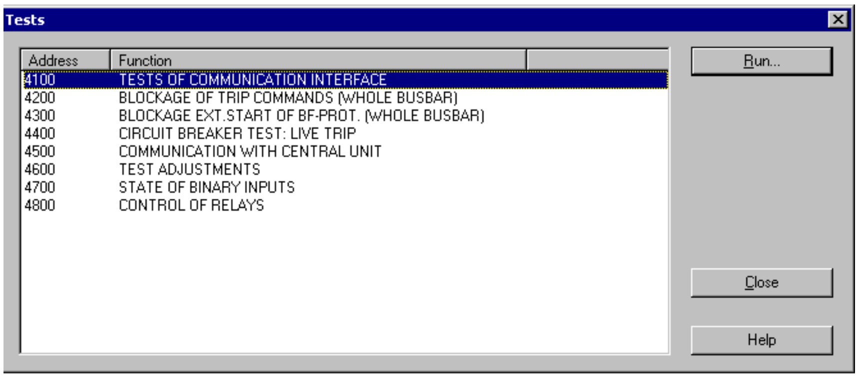


Figure 6-22 Tests window in DIGSI

- ❑ Click the entry **CIRCUIT BREAKER TEST : TRIP COMMAND** and click **Run...** The window 4400 CIRCUIT BREAKER TEST : TRIP COMMAND opens.

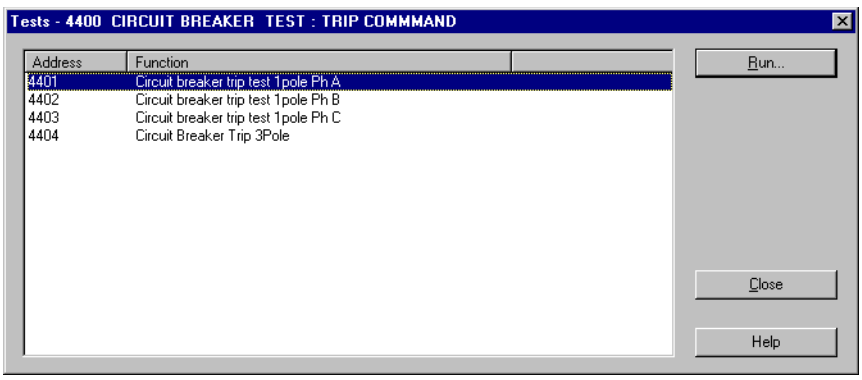


Figure 6-23 Window 4400 CIRCUIT BREAKER TEST : TRIP COMMAND in DIGSI

- ❑ 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 144).

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 237).
- ❑ Double-click **Rest 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.

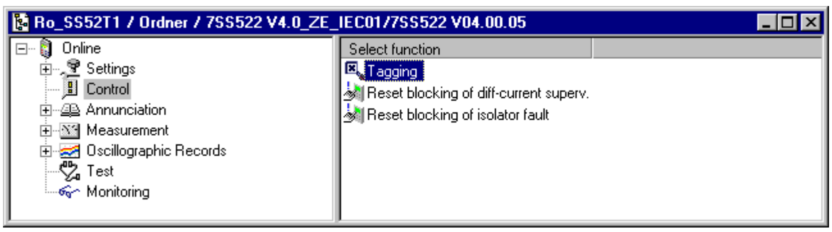


Figure 6-24 Reset blocking of differential current supervision using DIGSI

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 Isolator Fault

Depending on the setting of the parameter **`ISOL Malfunct`** (**`6302`**/**`CU`**), there are different options of how the blocking will behave (Chapter 5.5.1.9, page 146).

The function is acknowledged by applying "Reset IsoMalBl" or via binary input "`>Reset IsoMalBl`" (**`BI-FNo. 7`**/**`CU`**) in the central unit.

from the PC with DIGSI

To reset the blocking of the isolator fault at the **central unit** (PC linked to central unit) proceed as follows:

- ❑ Click **Control** in the navigation window.(see Figure 6-24, page 237).
- ❑ Double-click **Reset blocking of isolator 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 **`ISOL Malfunct`** (**`6302`**/**`CU`**) is set to ***`alarm only`***, the function **Reset blocking of isolator fault** is not available.

6.3.6 Trigger Initial Start and Restart

In case of an ***`initial start`*** 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 an initial start.

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 **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.

from the PC with DIGSI

To initiate an initial start or a restart of the **central unit** (PC linked to central unit) proceed as follows:

- ❑ Click **Device** → **Reset** or click **Device** → **Resume** on the menu bar.
- ❑ Activating an initial start 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 85 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 239 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 (± 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 241). 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.

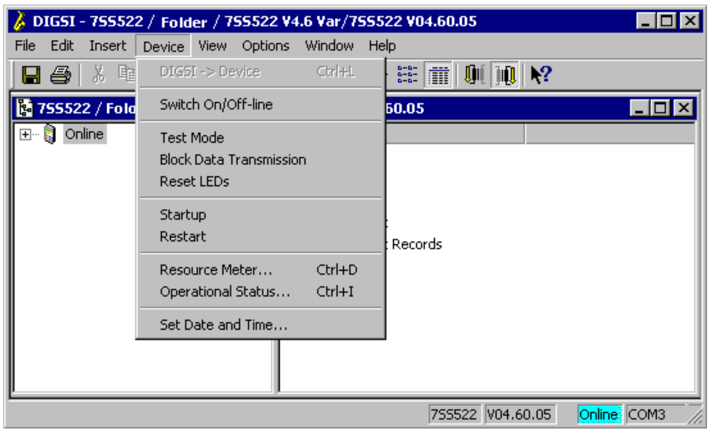


Figure 6-25 Selecting the Set date & time command

- Enter date and time in the corresponding boxes. Observe the correct notation (see Figure 6-26, page 242).
- Click **OK** to transfer the specified values into the device. The existing values are modified and the current dialog box closes.

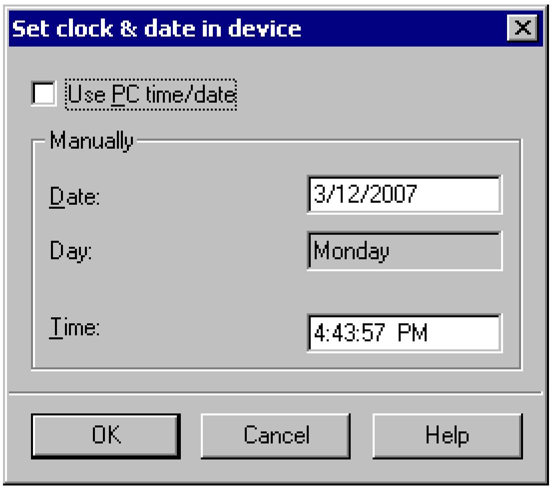


Figure 6-26 Set clock & date in device dialog box

- 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 242). The setting groups are shown in the function selection.

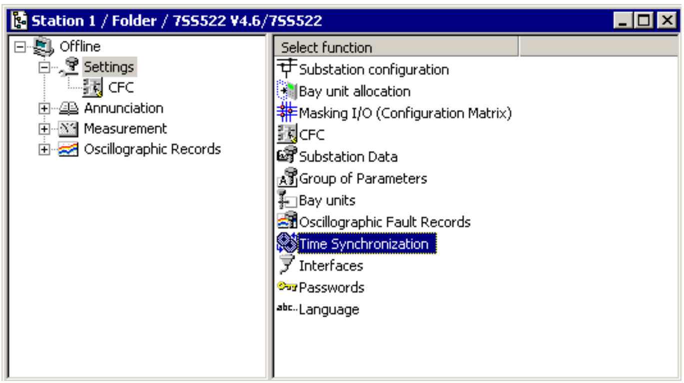


Figure 6-27 Selecting the time synchronization function

Double-click **Time Synchronization**. The Time Synchronization & Time Format dialog box opens (Figure 6-28, page 243).

- 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**.

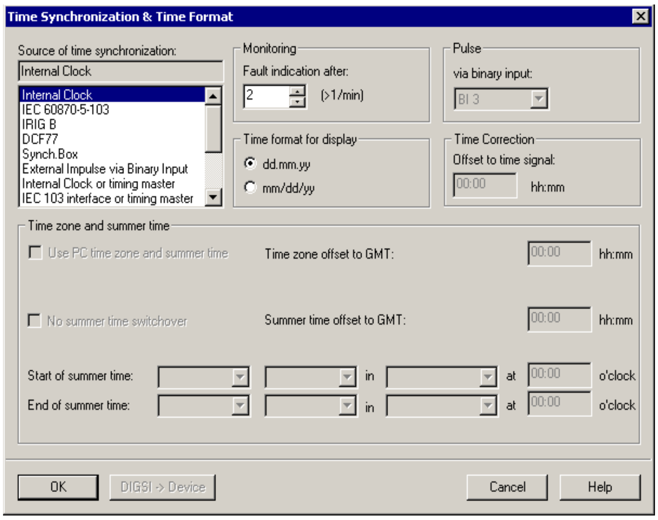


Figure 6-28 Example for Time Synchronization & Time Format dialog box in DIGSI

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 168.

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 **COMMUNICATI ON 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 245).
- ❑ Double-click the desired bay unit. The window Bay Unit BU 01 opens (Figure 6-30, page 245). 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.

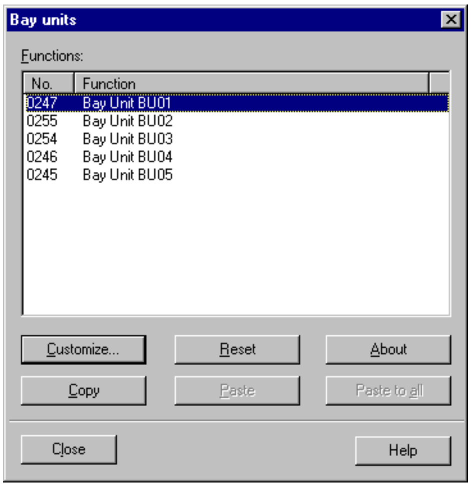


Figure 6-29 Bay units window – Example

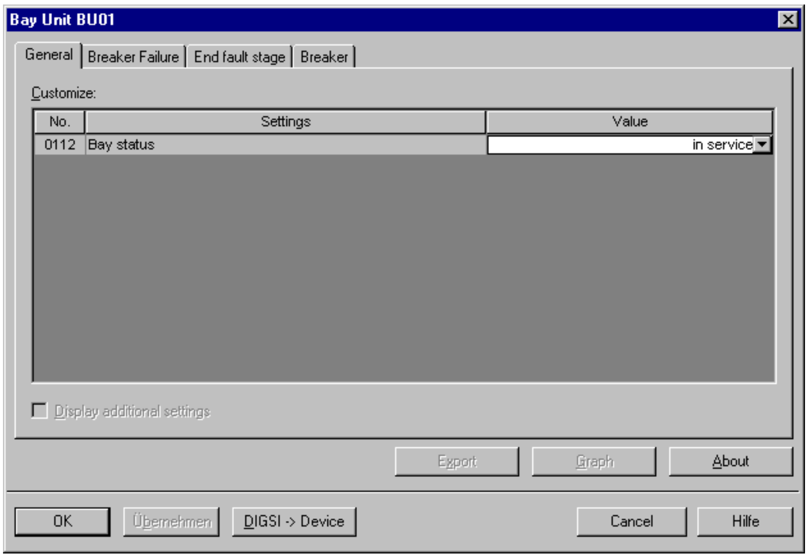


Figure 6-30 Bay status window – Example

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 236).
- ❑ Click the entry **COMMUNICATION WITH CENTRAL UNIT** and then click **Run...**. The window “Test - 4500 COMMUNICATION WITH CENTRAL UNIT” opens (Figure 6-31, page 246).

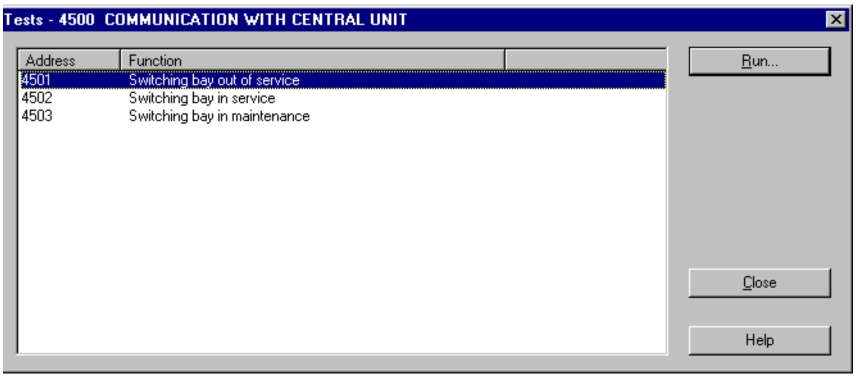


Figure 6-31 Window **Test - 4500 COMMUNICATION WITH CENTRAL UNIT**

- 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 168.

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 245).
- ❑ Double-click the desired bay unit. The window Bay Unit BU01 opens (Figure 6-30, page 245). 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 236).
- ❑ Click the entry **COMMUNICATION WITH CENTRAL UNIT** and then click **Run...**. The window Test - 4500 COMMUNICATION WITH CENTRAL UNIT opens (Figure 6-31, page 246).
- ❑ 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 49) 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.

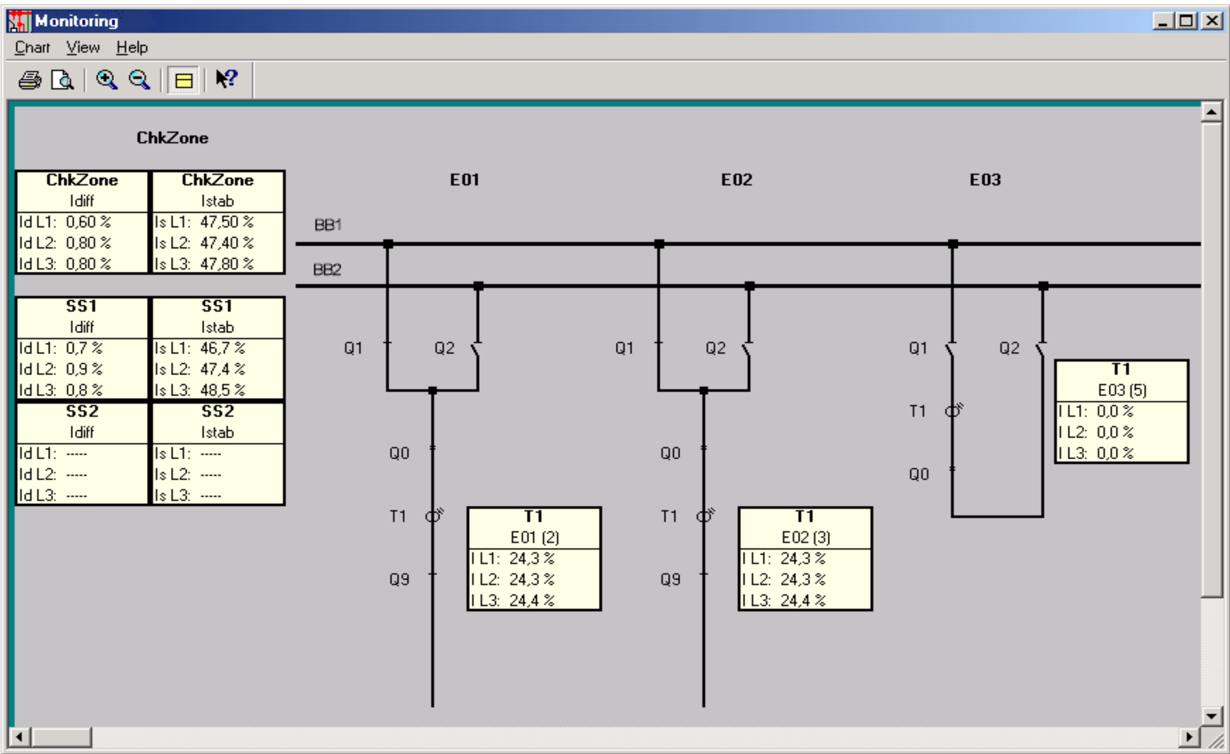


Figure 6-32 Start screen of the module Plant Visualization

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 isolator switches and circuit breakers
- colours of busbars, lines and isolator 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 isolator switches and circuit breakers is represented by the corresponding circuit symbols as shown in Figure 6-33, page 250.

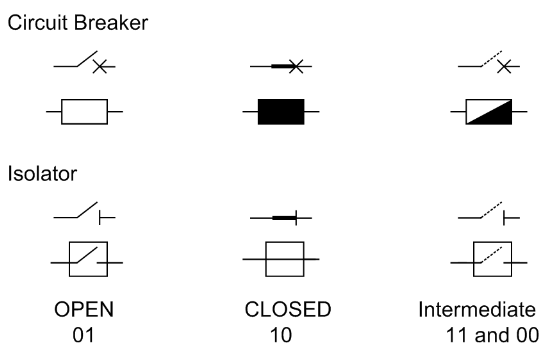


Figure 6-33 Circuit symbols of a circuit breaker

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 60) 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 stabilization 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 with each other via a sectionalizer fork, 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 an Isolator" 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.

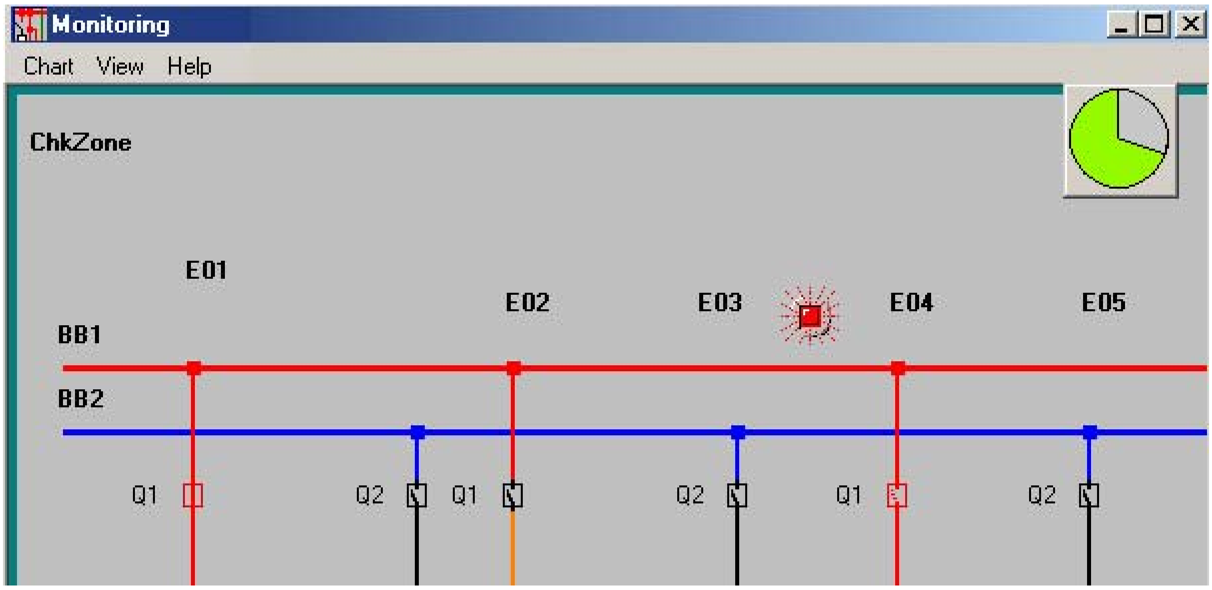


Figure 6-34 Display after Occurrence of Disturbance with Highlighted LED

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.

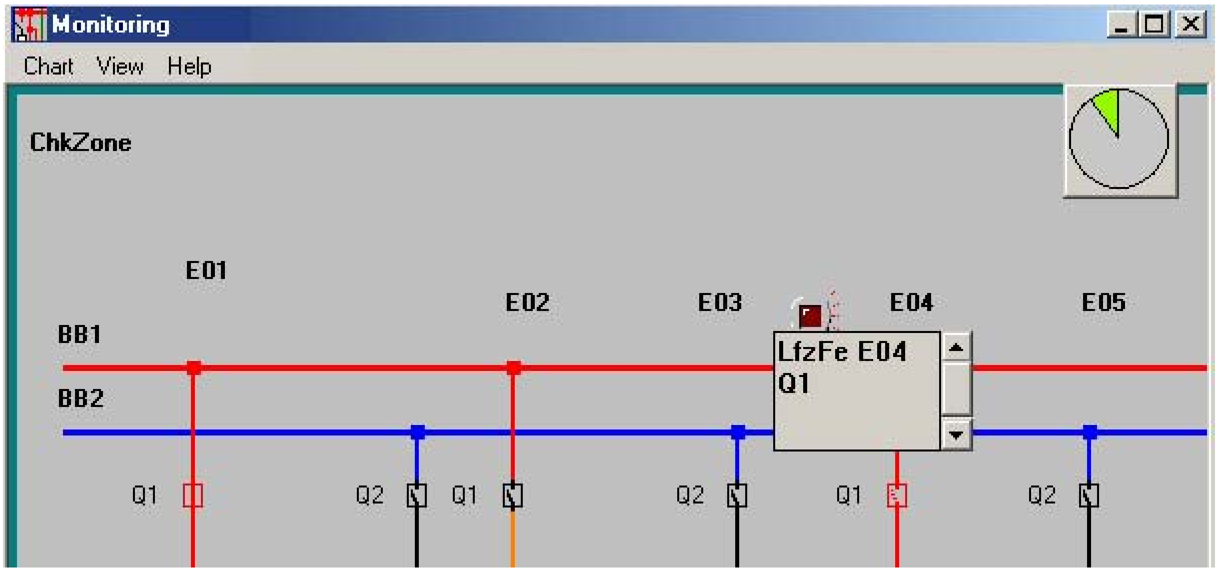


Figure 6-35 LED with Information Window

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 253.

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 isolator 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 isolator or sectionalizer fork is closed, 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.

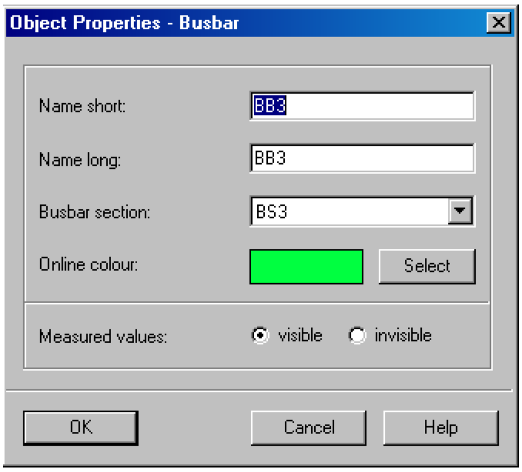


Figure 6-36 Object properties

Isolator Status

In a case of fault it is helpful for you to be able to analyze the current isolator 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.

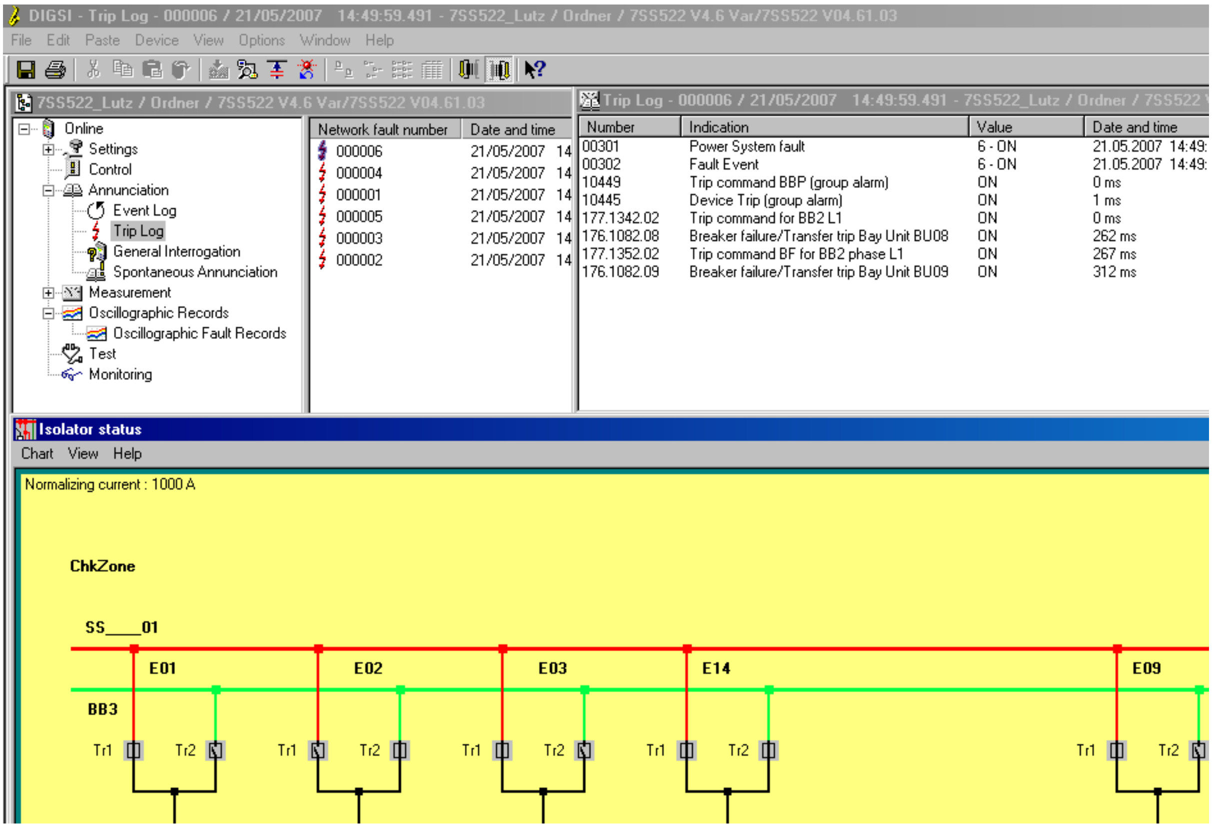


Figure 6-37 Switch Positions for a Case of Fault Displayed Graphically

Installation and Commissioning 7

The installation and commissioning may only be made by experienced commissioners. They have to be familiar with the commissioning of protection and control systems, 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.

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 **e**lectrostatically **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 329).
- 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 22).
- 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 fibre-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 22).

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 331 to 333).
- ❑ 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 2-8, page 24).
- ❑ 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 331).
- ❑ 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 isolators) 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 "grey zone" (fault between CB and CT) is protected by using the CB aux. When the CB is open, the current in the coupler is inverted 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.
Note: The operating mode "bus zone unbalance" only makes sense in conjunction with the mode "transfer bus operation", as the check zone would otherwise prevent tripping. If the breaker failure protection function is required, then the operating mode "current query" can be applied. In this case the check zone is not part of the tripping decision logic.

Maintenance of bay

This function is applied during isolator maintenance when the isolator feed-back signals do not correspond with the isolator switching state (e.g. when testing the auxiliary contacts or when the auxiliary supply for isolator 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 isolator switching state in this bay. The further isolator monitoring in this bay and resulting signals are blocked. A signal "Isolator 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 isolator on or off.
Individual switchgear (isolators, 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 isolators 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 isolators of the bay to 2 bay units (see also Configuration notes in Chapter 4.4, page 63).

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 260).
- ❑ Record the isolator 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.

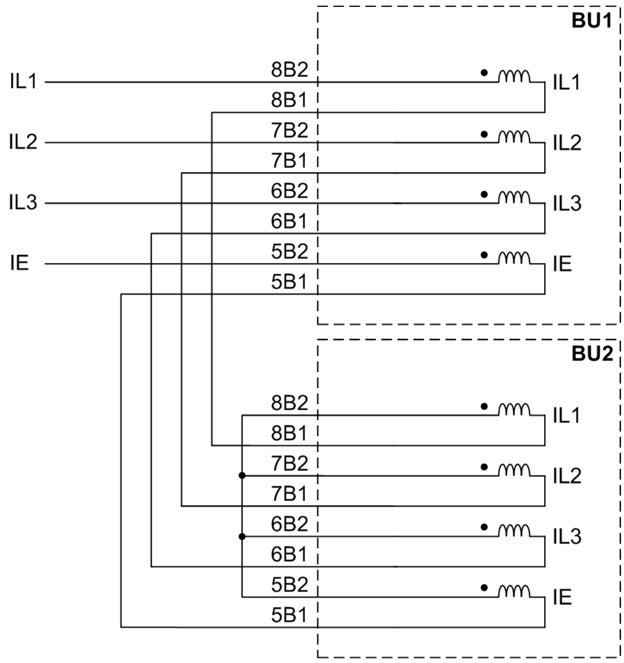


Figure 7-1 Connection of the current inputs of the bay units in bus couplers with only one current transformer.

7.2 Checking the Connections

The operational preparations according to Chapter 7.1, page 256 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 342. The allocating possibilities of the binary inputs and outputs are described in Chapter A.10, page 383.

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.
- ❑ 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 3.5, page 39) 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 295. 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

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.)

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 49.

First, put all feeders out of operation (see Chapter 6.4, page 244). Then commission the bay units one by one.

In DIGSIthe 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 isolator replica. The check includes the correct acquisition of the isolator 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 268). 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 235). 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 273).

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 "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 an other COM port of the operating PC (see Figure 7-2, page 264).

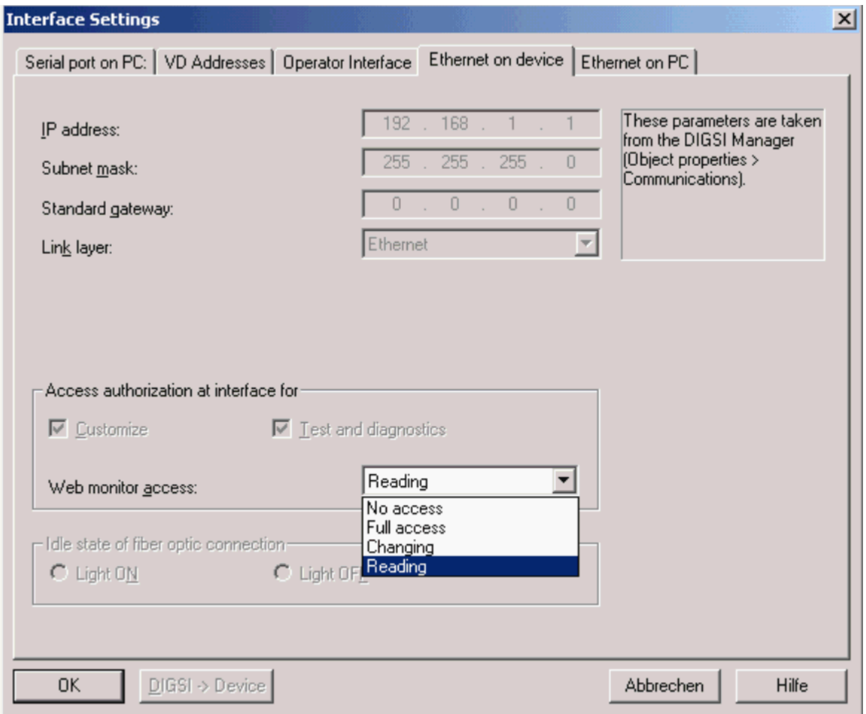


Figure 7-2 Setting the authorization for the Web Monitor for an access via Ethernet interface

7.3.2.2 Functions

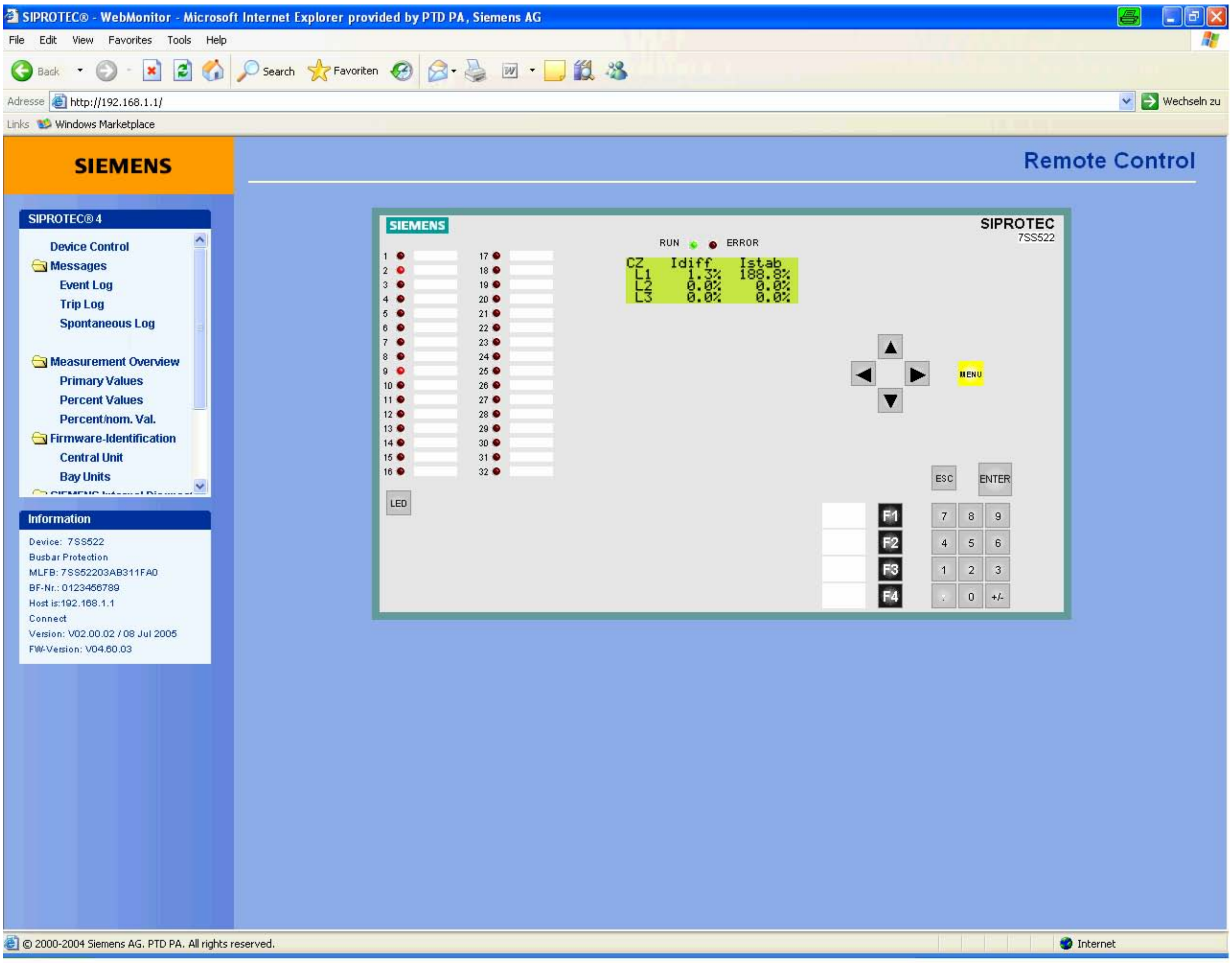


Figure 7-3 Web-monitor - Basic display

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.

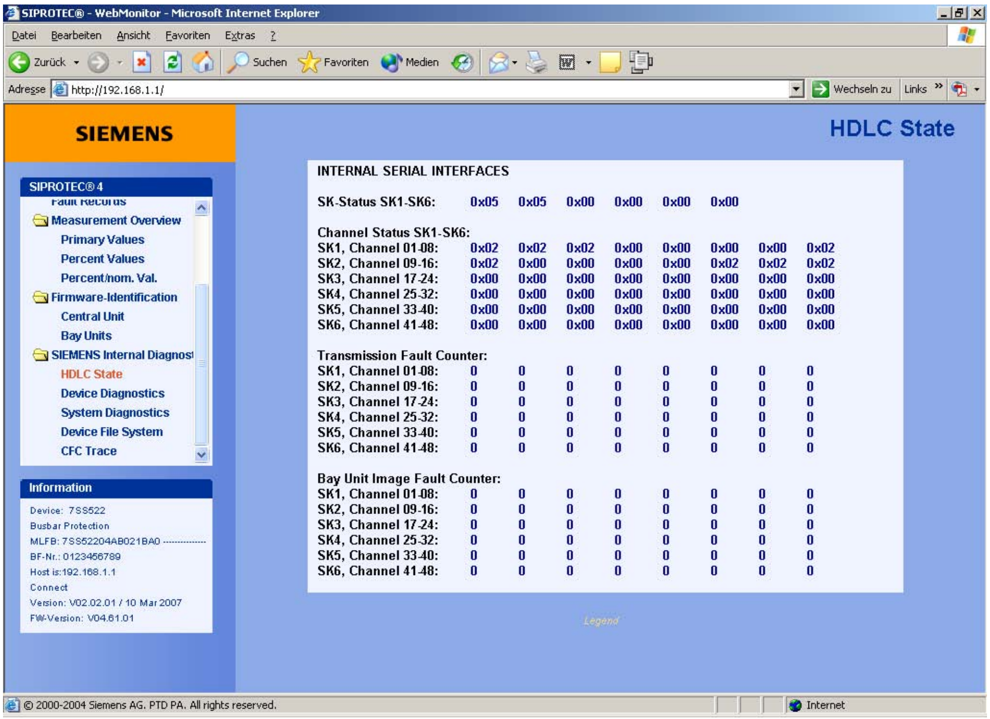


Figure 7-4 Example for the display of the HDLC status of the internal serial interfaces

A description of the values (0x00h ...) shown above can be displayed by clicking on "Legend".

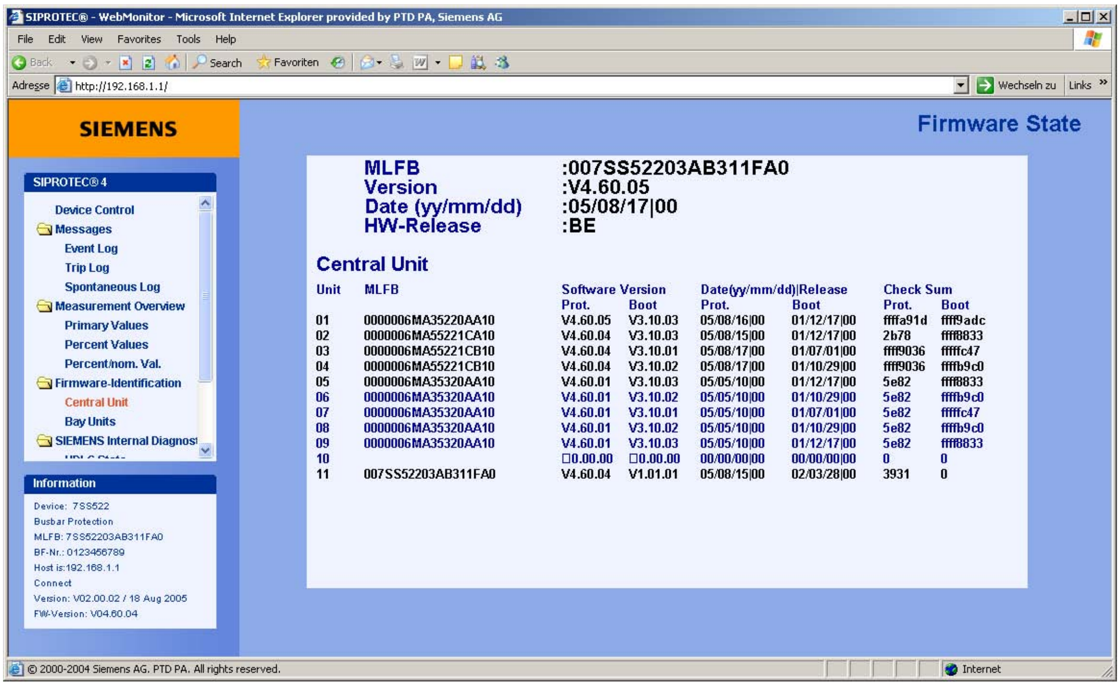


Figure 7-5 Example for the display of the firmware version for the modules of the central unit

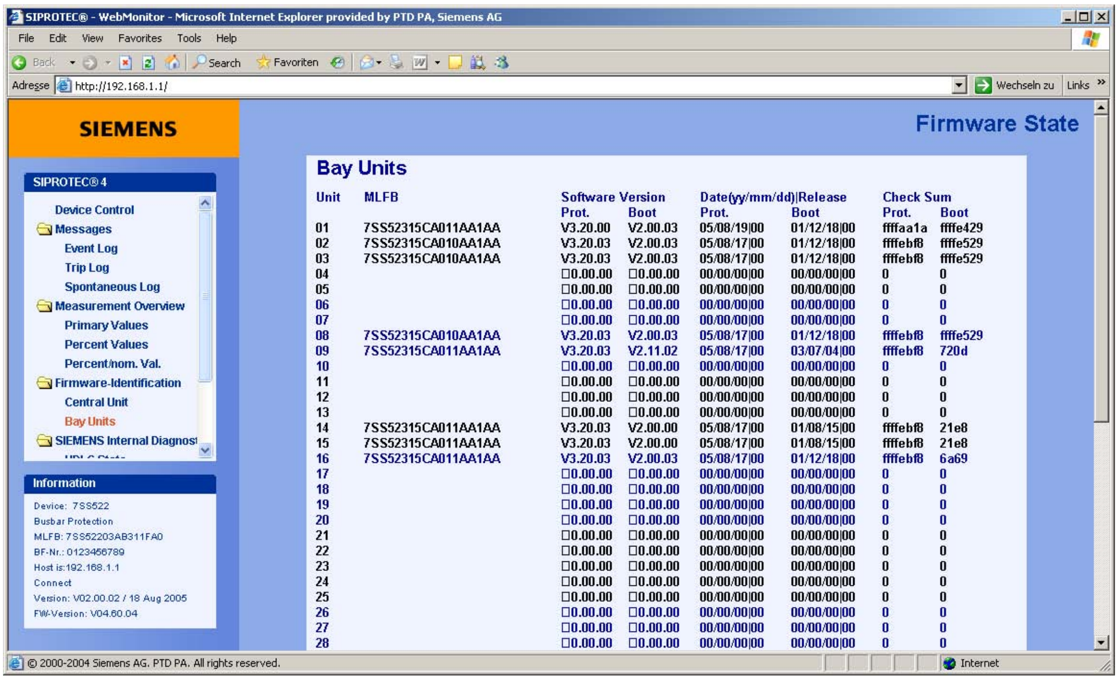


Figure 7-6 Example for the display of the firmware version for the modules of the bay units

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

vom PC mit 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 269).

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.

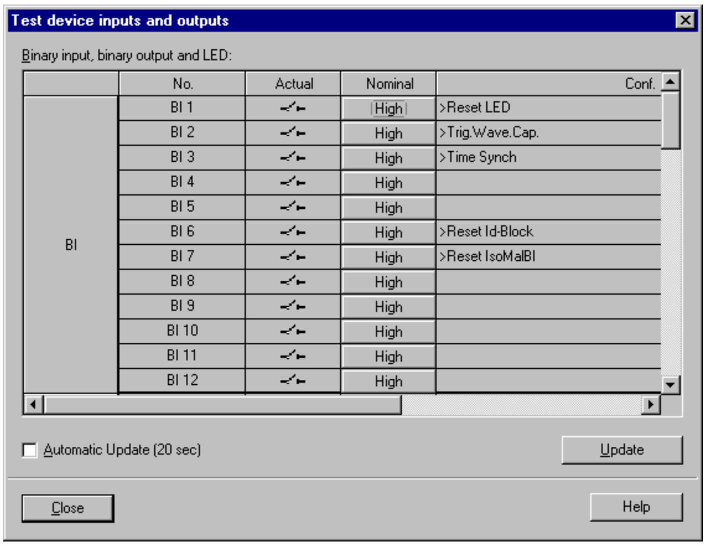


Figure 7-7 Dialog box devices in/outputs – Example

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 212).

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
- SHOW?
```

Physical state:
0: not activated
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
0
```

Physical state:
0: not activated
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 273).

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.

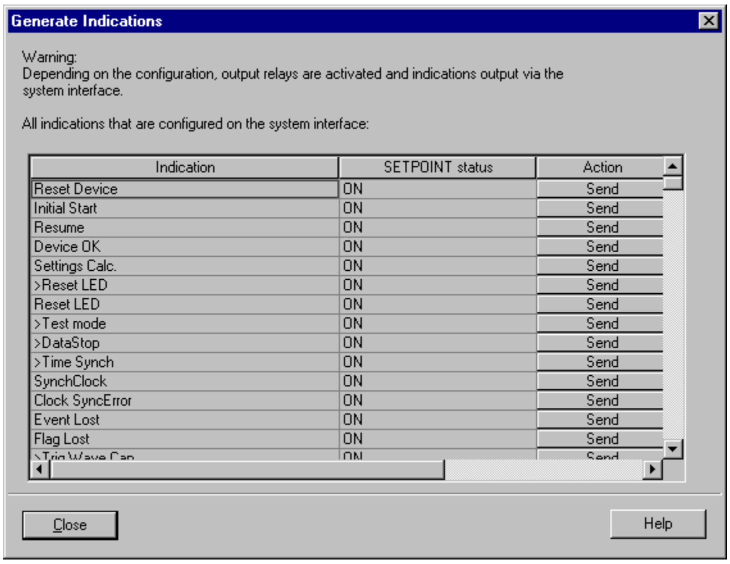


Figure 7-8 Dialog box Testing the system port – Example

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 212).

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 Isolator Replica

For test purposes, the isolator 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 isolator apply. The setting of the isolator 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 isolator status indications can be generated and transmitted to the protection device:
- OPEN position
- CLOSED position
- Not current (0-0)
- Intermediate position (1-1)

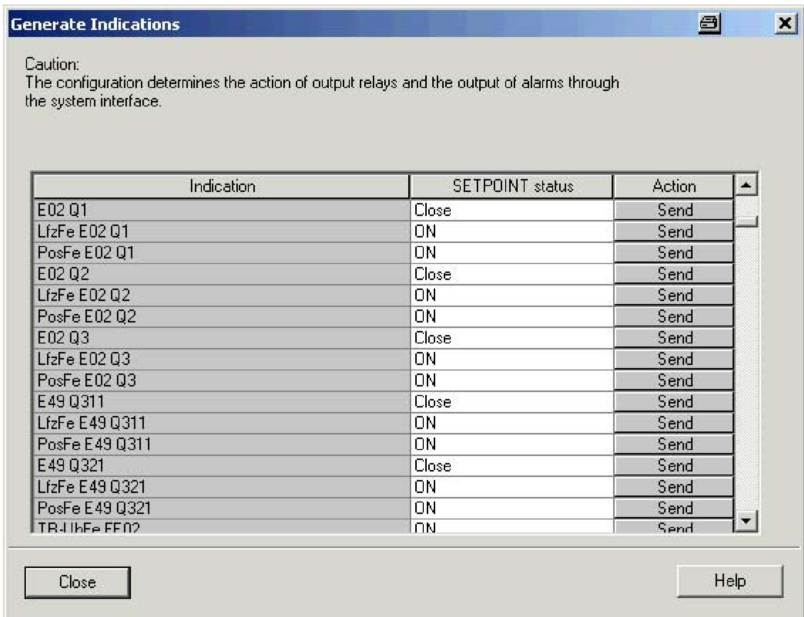
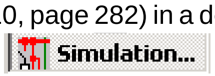


Figure 7-9 Isolator status indications

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 

in the taskbar.

When you "Close" the above window (Figure 7-9, page 281) the window "Simulation Mode" will be closed, too.

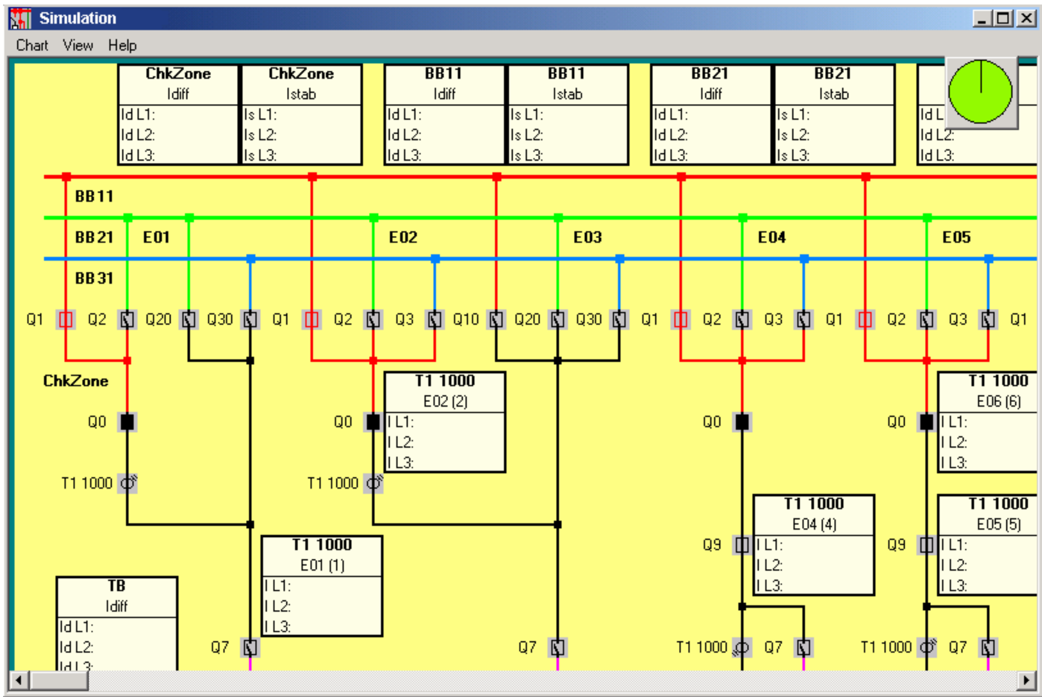


Figure 7-10 Simulation

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 261 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 311 “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 91). 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 311 “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 isolator 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 280. 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 282. 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.

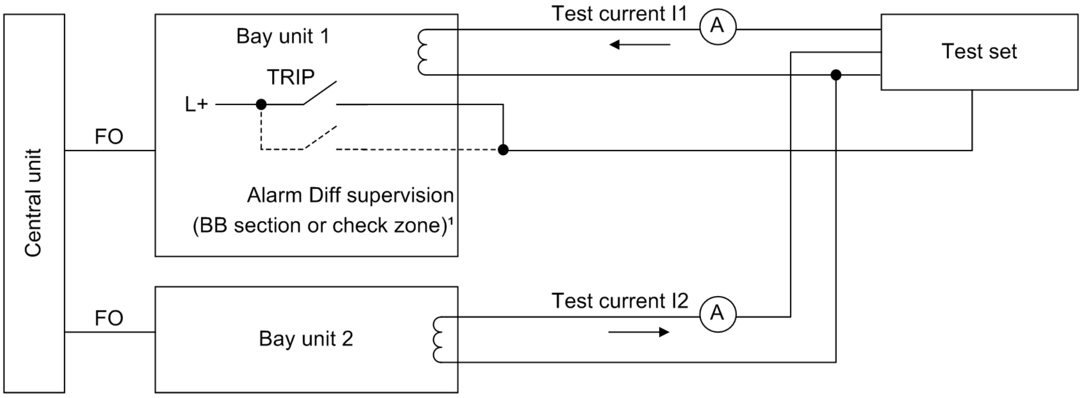
Example

You can set the Trip characteristic for the busbar-selective protection shall be set with the parameters **Id> BZ** (**6102**/**CU**) = *2,0* I_{no} 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_{no} 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 268)

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 stabilization 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°. 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 stabilization currents refer to Normalized Current (Chapter 4.3.7, page 60). 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 stabilization current must be the double of the supply current.
- ❑ If the differential current in 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 fomulas are valid:

  Differential current $I_d = | I_1 + I_2 |$

  Stabilizing current $I_s = | I_1 | + | I_2 |$

  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°, you have

$I_2 (1 - k) = I_1 (1 + k)$ or. $I_2 = I_1 (1 + k) / (1 - k)$ and

$I_2 = 9 \times I_1$, 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 281.
- ❑ After the checking, switch on the differential current supervision again with the parameter **DIFF SUPERV** (**6306**/**CU**).

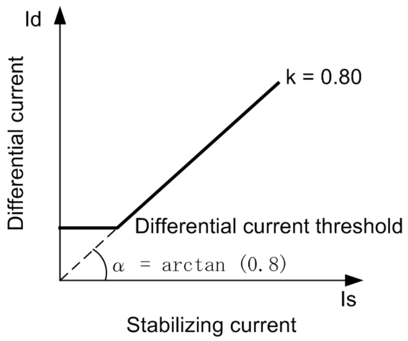


Figure 7-12 Trip characteristic of the busbar protection

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_{no} 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_{no} 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 282). Connect bay 3 to a different bus.

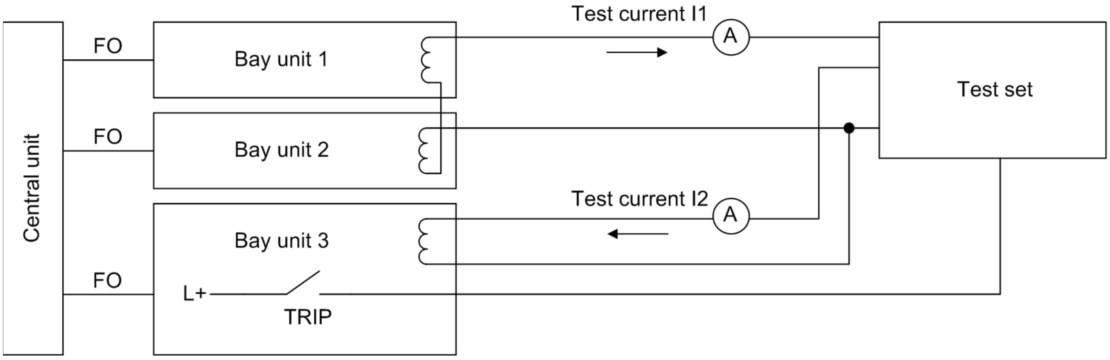


Figure 7-13 Test setup for the trip characteristic of the check zone.

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 stabilization 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°. 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 stabilization 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 112). 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 281.

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/I_{no} 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/I_{no}.

Test setup

- Arrange the test setup as in Chapter 7.4.2, page 279.

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 protectionblocking, 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 corespond 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 **Id> SUPERV CZ** (**6309/CU**) = ***0,2*** I/I_{no} and the delay time **T-Idiff SUPERV** (**6307/CU**) = ***2,0*** s. For the busbar-selective protection the parameter **Id> SUPERV BZ** (**6308/CU**) is assumed to be set to ***0,8*** I/I_{no}.

Test setup

- ❑ Arrange the test setup as in Chapter 7.4.2, page 279.

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 **Id> SUPERV CZ (6309/CU)**.
- ❑ Carry out a time measuring as in Chapter 7.4.3.3, page 284

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 **Id> 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 279.

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/I_{no}.
- ❑ Set the overcurrent threshold with the parameter **I>TRIP** (**XX13/CU**) for feeder 1 to ***2,0*** I/I_n and for the feeder 2 to ***0,0*** I/I_n.
- ❑ Set the isolators 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/I_n. 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/I_N 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 285.

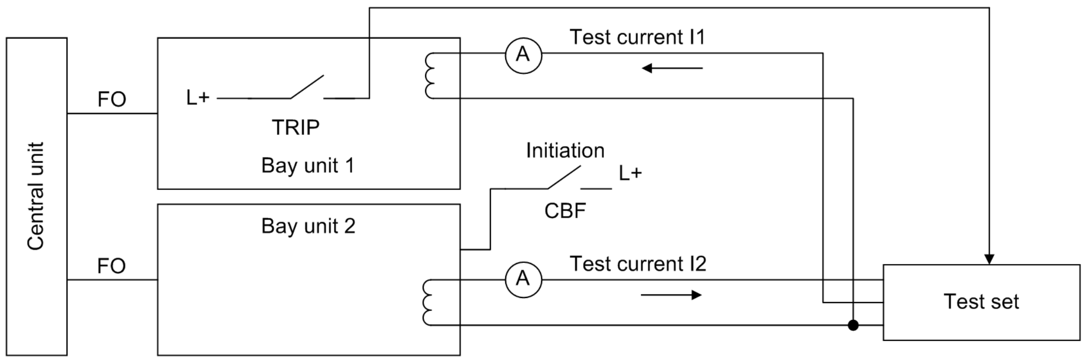


Figure 7-14 Test setup for the trip characteristic of the breaker failure protection

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 isolators 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 285.

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 278 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 isolator 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 and the earth current are transmitted to the central unit with inverted signs. The annunciations "`TF RevPol $00`" (**`FNo. 176.1195/CU`**) for the corresponding bay unit and the group annunciation "`TF RevPol M`" (**`FNo. 10451/CU`**) are reported as ON in the central unit and in the bay unit. In the bay unit, "`Fail MV.Offs.`" (**`FNo. 7652/BU`**) is reported as ON.

The inversion of the currents is done until the process is undone again. Then, the annunciations “`TF RevPol $00`” (**`FNo. 176.1195/CU`**) and the group annunciation “`TF RevPol $00`” in the central unit and the annunciations "`Fail MV.Offs`" (**`FNo. 7652/BU`**), "`CT inversion`" (**`FNo. 7656/BU`**) and "`BB TRIP block`" (**`FNo. 7657/BU`**) in the bay unit are 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.

8.1 Maintenance

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 311 “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 235).
- 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 by setting the parameter **BLOCKING MODE** (6305/CU) to ***zone/phase***.

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 293.

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 H1r	GREEN H1g	YELLOW1 H2	YELLOW2 H3	YELLOW3 H4	
•	o	•	⊗	∇	Operational status
o	•	•	•	⊗	Failure status (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 292).

Module ZPS-SBK

Table 8-2 LEDs of the ZPS-BSZ module

LEDs					Status
RED H1r	GREEN H1g	YELLOW1 H2	YELLOW2 H3	YELLOW3 H4	
•	o	•	⊗	•	Operational status
o	•	•	•	⊗	Failure status
o	•	o	•	•	Start-up not completed successfully (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 H1r	GREEN H1g	YELLOW1 H2	YELLOW2 H3	YELLOW3 H4	
•	o	•	•	•	Fault-free cyclic process
o	o	•	•	⊗	Failure of one bay unit or one channel
o	•	•	•	⊗	Failure of the SK module

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 348). 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 293), replace the fine-wire fuse (Chapter 8.4.2, page 306).

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 295):

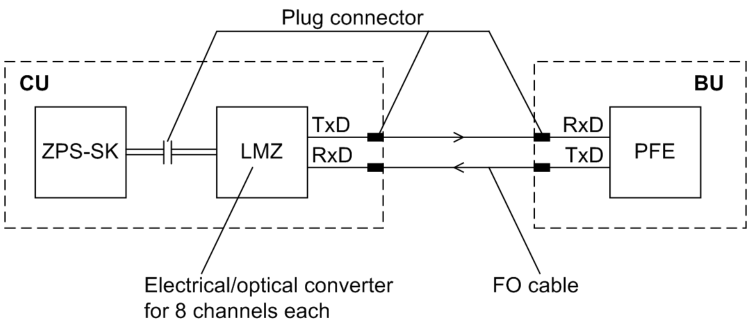


Figure 8-1 Components for data transmission

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.

- ❑ For this purpose, set the parameter **BLOCKING MODE** (6305/CU) to ***zone/phase***. 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 140).
- ❑ 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 266).

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 296. A flashing greed 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 H1r	**GREEN H1g**	**YELLOW1 H2**	**YELLOW2 H3**	**YELLOW3 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 ∇ dim
• dark ⊗ 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 213).
- 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 348.
- 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 226).
- 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

The functionality of the FO interface 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 342)?
  - – Is the mini-fuse in the power supply section intact (Figure 8-8, page 307 and Figure 8-9, page 308)? Replace the fuse if necessary (Chapter 8.4.2, page 306).
- ❑ 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 238).
- ❑ If the display shows the "Monitor" mode (Figure 8-2, page 299), you can re-initalize the device with DIGSI:

```
MONITOR            01/05
--------------------
Equipment data ->    1
User interface ->    2
System I-face  ->    3
Reset          ->    4
Siemens intern ->    5
```

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 299).

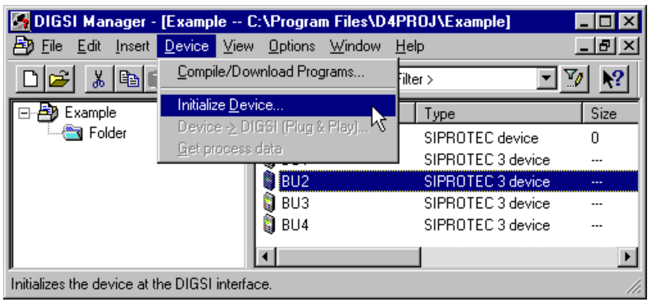


Figure 8-3 Initializing the device with DIGSI – Example

– 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 hompage 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 301.

❑ Select in offline mode in the menu bar from **File** the option **Properties**. The desired information is then shown on the **Device** tab.

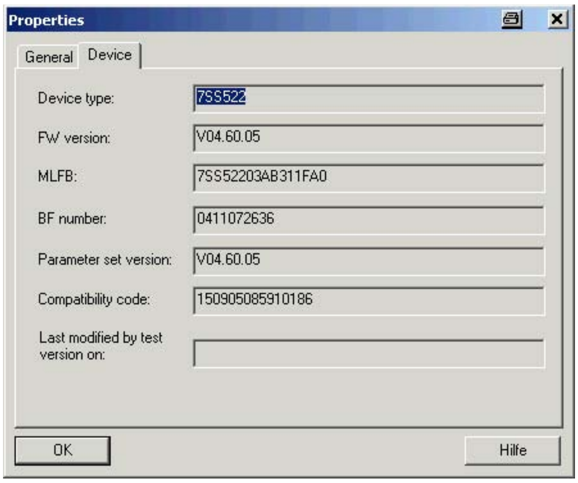


Figure 8-4 Reading out device information in DIGSI – Example

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**evices). 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 **e**lectrostatically **e**ndangered **d**evices).

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 91 and 6, page 209.

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-6, page 339.

- 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 in located on the top front of the D-CPU communication module (Figure 8-5, page 304).

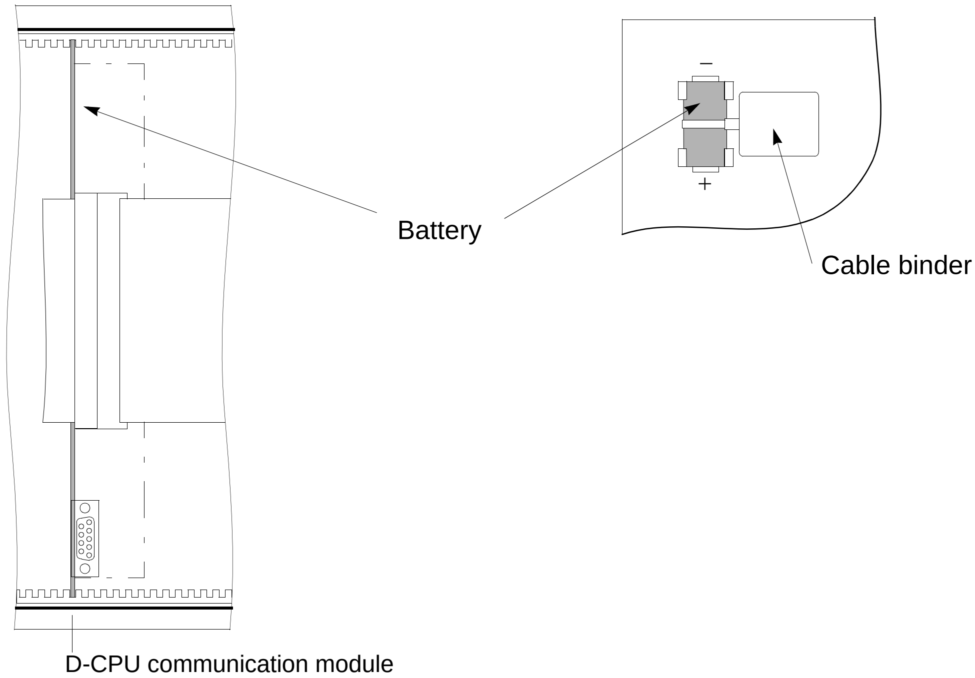


Figure 8-5 Front view after removing the front panel, and location of the buffer battery

- 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 304). **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 239.

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 305).

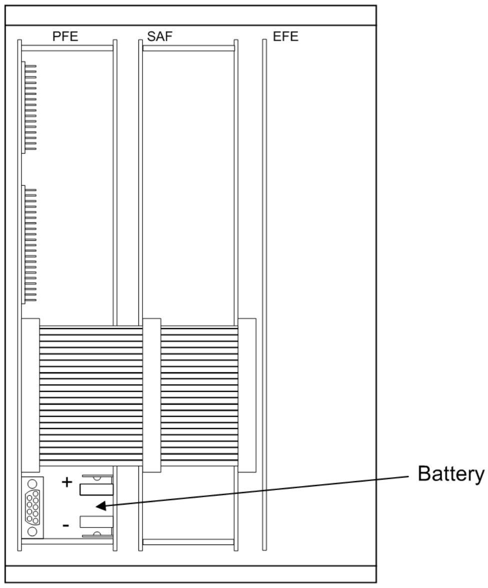


Figure 8-6 Front view after removing the front panel, and location of the buffer battery 7SS523

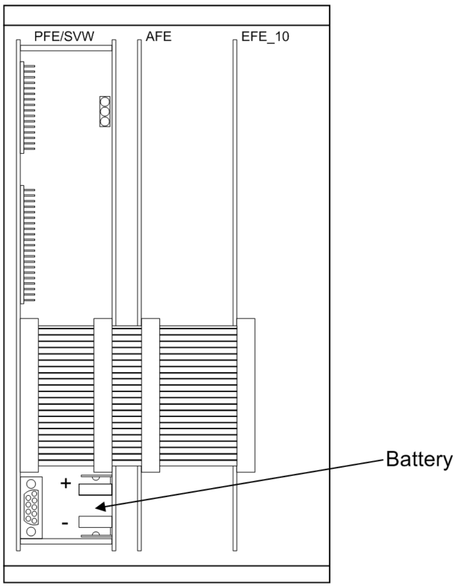


Figure 8-7 Front view after removing the front panel, and location of the buffer battery 7SS525

- ❑ 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 305 or Figure 8-7, page 305). **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 307, and for the bay units in Figure 8-9, page 308 or Figure A-12, page 357.

- ❑ 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 16).
- ❑ 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 fuse can be seen in Figure 8-8, page 307.
- ❑ 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. Please note that the switch for the power supply SV is not accessible with the front panel closed.
- ❑ 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.

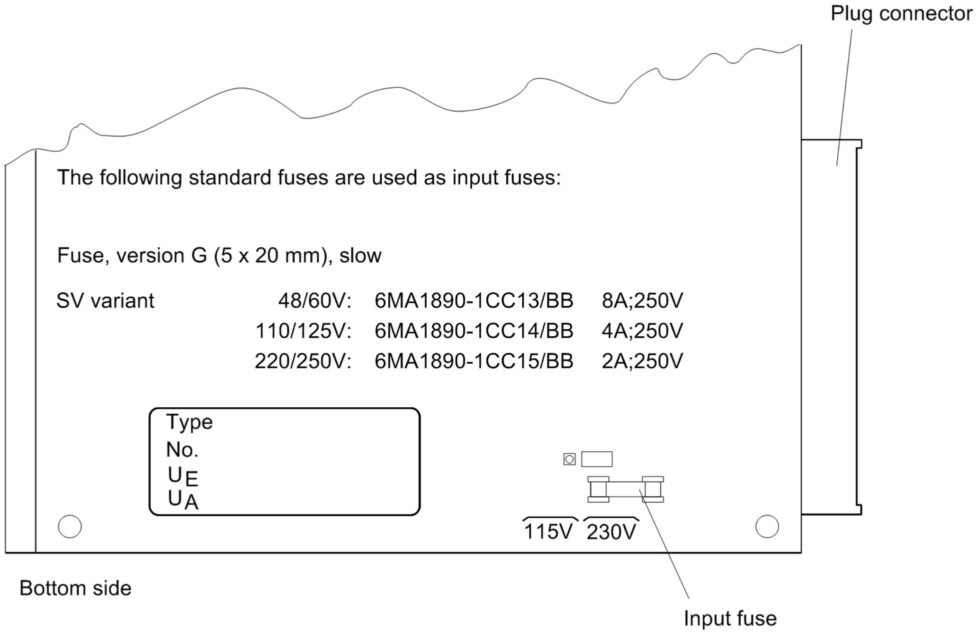


Figure 8-8 Location of the fine-wire fuse on the power supply module (SV) of the central unit

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 305 or Figure 8-7, page 305.
- ❑ 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 308 or Figure A-12, page 357.

- 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.

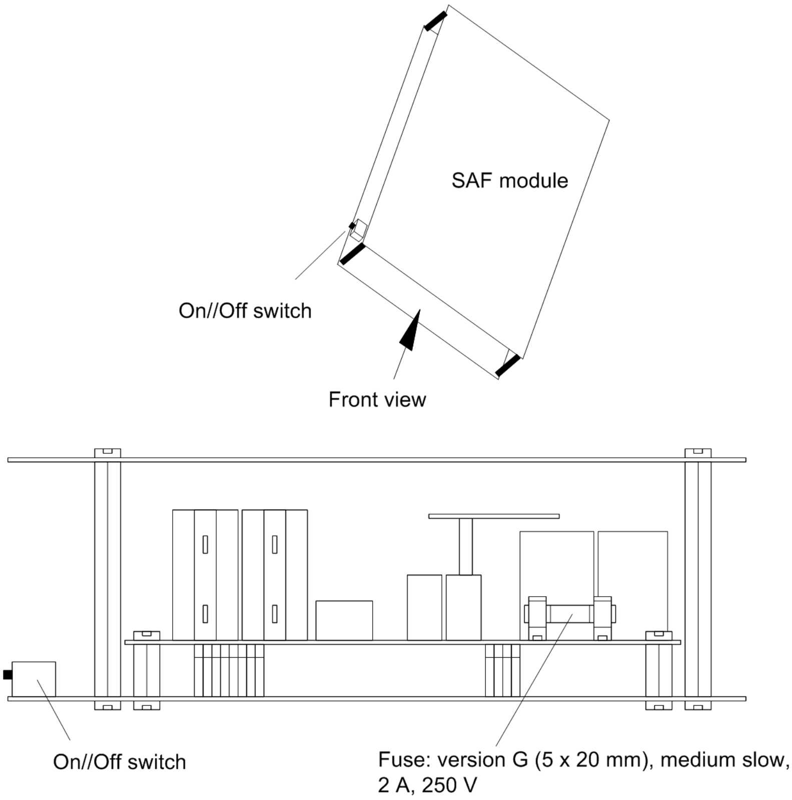


Figure 8-9 Location of the fine-wire fuse on the power supply module (SAF) of the bay unit 7SS523

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 system first starts up, and the whole protection is blocked. This happens regardless of the setting of parameter **BLOCKING MODE** (**6305**/**CU**).

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.

Technical Data

9

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.

9.1 General Data

TRIP command	Minimum duration of TRIP command		0.02 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)
Overcurrent release of TRIP signals	Setting range	I / I_N [1]	0.00 to 25.00 (in steps of 0.1)
Isolator running time	Setting range in s		1.00 to 180.00 s (in steps of 0.01)
Busbar (BB) configuration	Busbar arrangement (max.)		Quadruple or triple busbar with transfer busbar; up to 16 couplers and 24 sectionalizers 12 bus sections, 12 coupler bus sections [2]
	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)
Current inputs	Rated current	I_N	1 A or 5 A	
	Thermal overload capability of current path – continuous – for 10 s – for 1 s		 $4 \times I_N$ $30 \times I_N$ $100 \times I_N$	
	Dynamic overload capability (1 half-cycle)		$250 \times I_N$	
	Power consumption – at $I_N = 1$ A – at $I_N = 5$ A		 0.1 VA 0.2 VA	

9.2.2 Rated Auxiliary Voltage

	Rated auxiliary voltage U_{aux} – Central unit – Bay unit	 DC 48/60, 110/125, 220/250 V DC 48 to 250 V
	Permissible tolerance of rated auxiliary voltage U_{aux}	 ± 20%
	Max. ripple	≤ 15%
	Power consumption (dependent on station configuration)	
	Quiescent – Central unit Basic requirement of device: per module ZPS: per module ZPS2:	 30 to 120 W approx. 15,0 W approx. 9,0 W approx. 3,5 W
	– Bay unit	12 W [10] [1)]
	Energized – Central unit – Bay unit	 35 to 135 W 16 W [14] [1)]
	Bridging time during failure / short circuit of auxiliary voltage	 ≥ 50 ms (at $U_{aux} \geq 60$ V)

[1)] Values in brackets [ ] for Bay unit 7SS525

9.2.3 Binary Inputs

Number – Central unit – Bay unit	 12 20 [10] [1)]
Voltage range	DC 24 to 250 V (thresholds selectable by plug-in jumpers)
Nominal control voltage	DC 24; 60; 110; 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 6to 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 – Bay unit	 16 (NO contacts) 1 (1 NO contact)
Not marshallable – Central unit – Bay unit	 1 (2 NC contacts) 1 (2 NC contacts) [1 NC contacts] [1)]
Switching capacity MAKE/BREAK	20 W / VA
Switching voltage	AC / DC 250 V
Permissible current continuously	1 A

[1)] Values in brackets [ ] for Bay unit 7SS525

9.2.5 Trip Contacts

Bay unit	Number of relays	4 [3] [1)] (each 2 NO contacts) 1 [2] [1)] (1 NO contact)
	Switching capacity – CLOSE – OPEN	 1000 W / VA 30 W/ VA
	Switching voltage	AC / DC 250 V
	Permissible current: – continuously – 0.5 s	 5 A 30 A

[1)] Values in brackets [ ] for Bay unit 7SS525

9.2.6 Light Emitting Diodes

Central unit	Ready for service (green)	1
	Failure indication (red)	1
	Marshallable indications (red)	32
Bay unit	Ready for service (green)	1
	Failure indication (red)	1
	Indications (marshallable) – red	 11 [1] [1)]
	– green	5 [0] [1)]

[1)] Values in brackets [ ] for Bay unit 7SS525

9.2.7 Operation, Displays

	LC display – Central unit – Bay unit 7SS523	 4 lines × 20 characters 4 lines × 16 characters
	Sealed keypad – Central unit – Bay unit 7SS523	 24 keys 12 keys

No display or keypad for bay unit 7SS525.

9.2.8 Serial Ports

Central unit	PC port (front)	
	– Connection	
	electrical	D-SUB 9-pole
	– Baud rate	4800 to 115000 bauds
	System port (rear) IEC 60870-5-103	
	– Connection	
	optical	ST connectors
	– Baud rate	4800 to 115000 bauds
	System port (rear) IEC 61850, electrical with EN100	
	– Connection	
	electrical	RJ45 connectors
	– Baud rate	up to 100 Mbaud
	clock synchronization interface (rear)	
	– Connection	
	electrical	D-SUB 9-pole
	Service port (rear)	
	– Connection	
	optical	ST connectors
	electrical	D-SUB 9-pole
	– Baud rate	4800 to 115000 bauds
Bay unit	PC port (front)	
	– Connection	
	electrical	D-SUB 9-pole (subminiature ISO 2110)
	– Baud rate	1200 to 38400 bauds
Central/bay unit	Interface for high-speed data communication	
	– Connection	ST connectors
	– Fiber-optic cable	glass fiber 62.5 / 125 µm
	– Optical wavelength	820 nm
	– Permissible cable attenuation	max. 8 dB
	– Transmission distance	max. 1.5 km [1]

1 Note: Determination of the maximum distance

$$L_{max} = \frac{8\text{ dB - reserve - cable attenuation}}{\text{attenuation factor of FO cable}}$$

– typ. reserve for ageing and temperature drift: 2 to 3 dB
– plug attenuation (ST): approx. 0.3 dB per plug
– FO attenuation coefficient α (glass fiber 62.5 / 125 µm): 3.5 dB / km

9.2.9 Busbar Protection

Characteristic			Stabilized differential current measurement
Setting ranges	Overcurrent	I / I_{no} [1]	0.20 to 4.00 (in steps of 0.01)
	Stabilizing factor for bus section-selective protection	k	0.10 to 0.80 (in steps of 0.01)
	Stabilizing factor for the check zone	k	0.00 to 0.80 (in steps of 0.01)
Diff-current supervision Setting ranges	Current threshold	I / I_{no} [1]	0.05 to 0.80 (in steps of 0.01)
	Time delay		1 to 10 s (in steps of 1) [2]
Tripping time	Typical tripping time		15 ms
Drop-off times	TRIP Reset in Bay unit	Approx.	45 ms
Tolerances	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} = normalized nominal current referred to the current transformer with the highest ratio (base CT)

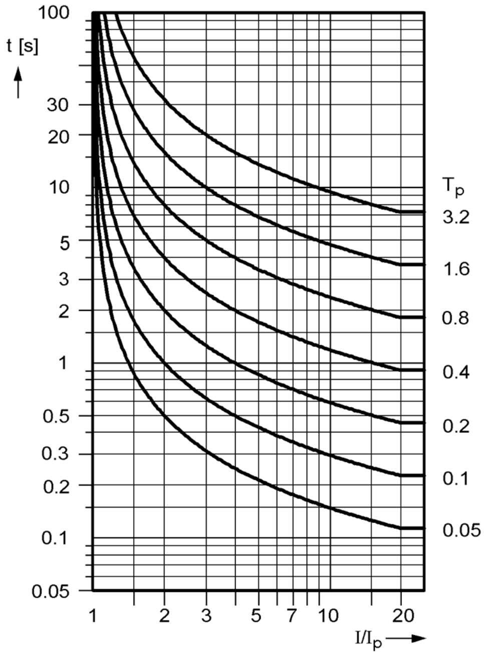
2 Identical setting ranges for the zone-selective protection and the check zone

9.2.10 Circuit Breaker Failure Protection

Control modes			One or two-channel initiation
Modes of operation			Individually selectable per feeder: – I>query – TRIP repeat (1/3-phase) with I>query – Unbalancing (1-stage CBF) – Unbalancing with TRIP repeat (1-/3-phase, 2-stage CBF) – TRIP by external CBF protection (tripping via isolator replica of busbar protection) – plus for each mode (except for TRIP by external CBF): low-current mode – plus for modes with TRIP repeat: pulse mode
Setting ranges	Overcurrent	I / I_N	0.10 to 2.00 (in steps of 0.01) 0.05 to 2.00 (Earthfault characteristic)
	Stabilizing factor	k	0.05 to 0.80 (in steps of 0.01)
	Time delay for unbalancing / I>query		0.05 to 10.00 s (in steps of 0.01)
	Time delay for TRIP repeat		0.00 to 10.00 s (in steps of 0.01)
Drop-off times	Mode “unbalancing”		Approx. 2 ms
	Mode “I>query”		Approx.25 ms
	Definite time (backup protection)		Approx.25 ms
Tolerances	Current k factor Time		5 % of setting value or 50 mA 5 % of setting value 5 % of setting value or 50 ms

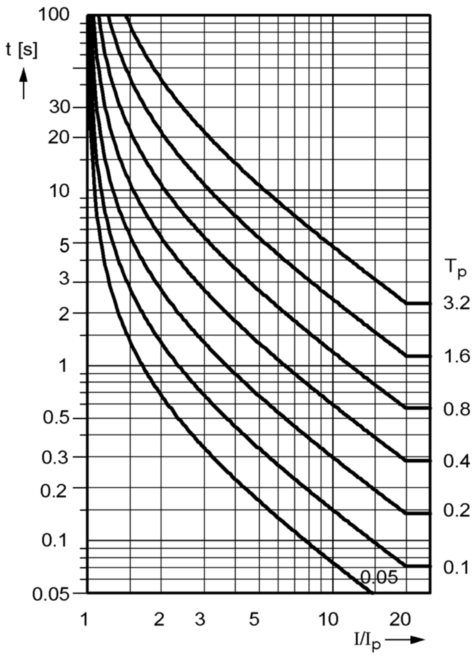
9.2.11 Overcurrent Protection in the Bay Unit

Characteristic			Definite or inverse time overcurrent protection
Setting ranges	High-set stage	I>> (phase) I / I_N	0.05 to 25.00 (in steps of 0.01)
	High-set stage	IE>> (earth) I / I_N	0.05 to 25.00 (in steps of 0.01)
	Trip time delays	TI>>, TIE>>	0.00 to 60.00 s or ∞
Definite time overcurrent protection	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	TI>, TIE>	0.00 to 60.00 s or ∞
Inverse-time overcurrent protection	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	TI_P, TI_E	0.00 to 10.00 or ∞
	Characteristics		inverse (IEC 255-3 type A) very inverse (IEC 255-3 type B) extremely inverse (IEC 255-3 type C)
tripping times	I>-, I>> stage		Approx.25 ms
Drop-off times	definite time		Approx.25 ms
Tolerances	Current Time		5 % of setting value or 50 mA 5 % of setting value or 50 ms + 2% current tolerance or 50 ms



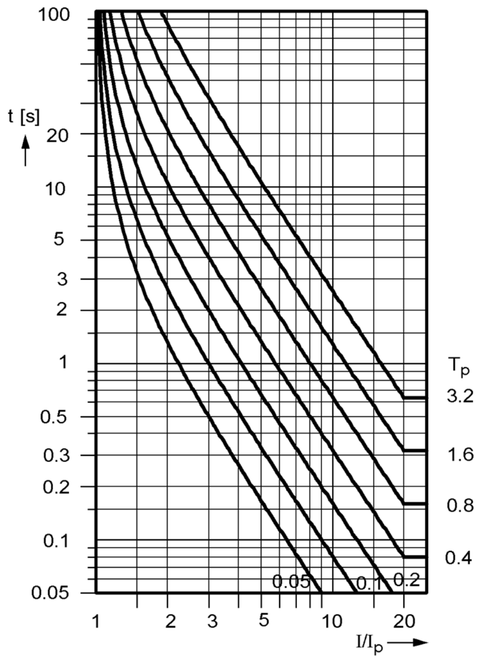
Normal inverse:
(Type A)

$$t = \frac{0.14}{(I/I_p)^{0.02} - 1} \cdot T_p \quad \text{[s]}$$



Very inverse:
(Type B)

$$t = \frac{13.5}{(I/I_p)^{1} - 1} \cdot T_p \quad \text{[s]}$$



Extremely inverse:
(Type C)

$$t = \frac{80}{(I/I_p)^{2} - 1} \cdot T_p \quad \text{[s]}$$

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

9.2.12 Auxiliary Functions

Self-diagnosis	– Current monitoring per feeder – Auxiliary voltage monitoring – Cyclic test – Check of the data transmission between central unit and bay units – Memory tests	
Operational measured values Central unit	Feeder currents	I_{L1}; I_{L2}, I_{L3} in A primary, in % I_N (feeder transformer) and in % I_{No} (reference transformer)
	– Range	0 to 1000% I_N
	– Tolerance	typically 2% of measured value
	Differential and restraint (stabilizing) currents of all bus sections and the Checkzone (separate for ZPS-BSZ1 and ZPS-BSZ2)	I_{dL1}; I_{dL2}; I_{dL3} in % I_{No} I_{sL1}; I_{sL2}; I_{sL3} in % I_{No}
	– Range	0 to 1000% I_N
Operational measured values Bay unit	Feeder currents	I_{L1}; I_{L2}, I_{L3}; I_E in A primary and in % I_N and in % I_{No}
	– Range	0 to 6000% I_N
	– Tolerance	typically 2% of measured value
	Differential and restraint (stabilizing) currents	I_{dL1}; I_{dL2}; I_{dL3} I_{sL1}; I_{sL2}; I_{sL3}
	– Range	0 to 6000% I_N
	Frequency	f in Hz ($I > 0.1\ I_N$)
	– Range	$f_N \pm 5$Hz
	– Tolerance	0.1 Hz
Event recording	**Central unit**	
	Storage of the last 200 operational events and 80 fault events	
	Bay unit	
	Storage of the last 50 operational events and 100 fault events	
Fault recording	**Central unit**	
	Resolution	1 ms at 50 Hz 0.83 ms at 60 Hz
	Pre/post capture time (from busbar TRIP or initiation by binary input/operation)	– 500 to + 500 ms at 50 Hz – 416 to + 416 ms at 60 Hz (up to 8 fault records)
	Capture Time	max. 5s (total)
	Bay unit	
	Resolution	1 ms at 50 Hz 0.83 ms at 60 Hz
	Pre/post capture time (from busbar TRIP or initiation by binary input/operation)	– 500 to + 500 ms at 50 Hz – 416 to + 416 ms at 60 Hz

	(up to 8 fault records)
Capture Time	max. 5s (total)

9.2.13 User-Configurable Functions (CFC)

Function Module	Comment
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/.

9.2.14 Electrical Tests

CE conformity regulations

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 89/336/EEC) and concerning electrical equipment for use within specified voltage limits (Low Voltage Directive 73/23 EEC).

This conformity has been proved by tests performed according to Article 10 of 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 60255-6 (for Low Voltage Directive) by Siemens AG.

The device is designed and manufactured for application in industrial environment.

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

Insulation tests

Standards:	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)	2 kV AC (r.m.s. value); 50 Hz; 1 min
– High voltage test (routine test) only auxiliary voltage input and binary inputs	2.8 kV DC; 30 sec; both polarities
– High-voltage test (routine test) only data interfaces (service,system and clock synchronization interface)	500 V AC (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 / 50 µs; 0.5 J; 3 positive and 3 negative pulses in intervals of 5 s

EMC tests for immunity (type tests)	Standards:	IEC 60255-6 and -22, (product standards) EN 61000-6-2 (generic standard) VDE 0435 Section 301, DIN VDE 0435-110
	– High-frequency test IEC 60255-22-1, Class III and VDE 0435 Section 303, Class III	2.5 kV (peak); 1 MHz; τ = 15 μs; 400 pulses per s; test duration 2 s; R_I= 200 Ω
	– Attenuated oscillation IEC 60694, IEC 61000-4-12	2.5 kV (Peak Value), polarity alternating 100 kHz, 1 MHz, 10 MHz and 50 MHz, R_I = 200 Ω
	– Discharge of static electricity IEC 60 55-22-2, Class IV and IEC 61000-4-2, Class IV	8 kV contact discharge; 15 kV air discharge; both polarities; 150 pF; R_I= 330 Ω
	– Irradiation with HF field, frequency sweep IEC 60255-22-3, Class III IEC 61000-4-3, Class III	10 V/m; 80 MHz to 1000 MHz; 10 V/m; 800 MHz to 960 MHz; 80% AM; 1kHz
	– Irradiation with HF field, single frequencies IEC 60255-22-3, IEC 61000-4-3, amplitude-modulated Class III:	10 V/m 80/160/450/900 MHz; r80 % AM 1 kHz; duty cycle > 10 s
	– Radiated Electromagnetic Interference IEEE Std C37.90.2	35 V/m; 25 MHz to 1000 MHz
	– Fast transient disturbance/Burst IEC 60255-22-4 and IEC 61000-4-4 Class IV	PE conductor: 1 kV / 5 kHz; all circuits: 4 kV / 2.5 kHz; 5 / 50 ns; 5 kHz; burst duration = 15 ms; repetition rate 300 ms; both polarities; R_I = 50 Ω; test duration 1 min
	– High-energy surge voltages (SURGE), IEC 61000-4-5 installation Class 3	Impulse: 1.2/50 μs
	Auxiliary voltage	common mode: 2 kV; 12 Ω; 9 μF diff. mode: 1 kV; 2 Ω; 18 μF
	measuring inputs, binary inputs and relay outputs	common mode: 2 kV; 42 Ω; 0.5 μF diff. mode: 1 kV; 42 Ω; 0.5 μF
	– HF on lines IEC 60255-22-6 IEC 61000-4-6 Class III	10 V (r.m.s. value); 150 kHz to 80 MHz; 80 %; 1 kHz; AM; R_I = 150 Ω
	– Power system-frequency magnetic field IEC 61000-4-8 IEC 255-6 Class IV	30 A/m continuously; 300 A/m for 3 s; 50 Hz;

EMC tests for noise emission	Standard:	EN 61000-6-4 (generic standard)
	– Radio disturbance voltage on lines, only auxiliary voltage IEC-CISPR 22	150 kHz to 30 MHz limit value class B
	– Disturbance field intensity IEC-CISPR 11	30 MHz to 1000 MHz limit value class A

9.2.15 Mechanical Tests

Mechanical impact	Standards:	IEC 60255-21-1 Class II IEC 60068-2-6 test Fc
	Permissible mechanical impact	
	– in service	sinusoidal; 10 Hz to 60 Hz; ± 0,075 mm amplitude; 60 Hz to 150 Hz; 1 g acceleration; frequency sweep rate 1 octave/min; 20 cycles in 3 orthogonal axes
	– during transport	sinusoidal; 5 Hz to 8 Hz; ± 7.5 mm amplitude; 8 Hz to 150 Hz; 2 g acceleration; frequency sweep rate 1 octave/min; 20 cycles in 3 orthogonal axes

9.2.16 Climatic Stress Tests

.

Warning!

Commissioning at temperatures ≤ 0 °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

Standard: IEC 60255–6

Permissible ambient temperature

– in service	– 10 °C	to + 55 °C (14 °F to 131 °F) (bay unit)
	– 5 °C	to + 55 °C (23 °F to 131 °F) (central unit)
– for storage	– 25 °C	to + 70 °C (-13 °F to 158 °F)
– during transport	– 25 °C	to + 70 °C (-13 °F to 158 °F)
– during start-up	– 10 °C	to + 55 °C (14 °F to 131 °F) (bay unit)*
	0 °C	to + 55 °C (32 °F to 131 °F) (central unit)

Storage and transport with factory packaging!

* Commissioning at temperatures ≤ 0 °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!

Humidity

Permissible humidity in service	yearly mean ≤ 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 ≤ 0 °C is permissible only if site conditions ensure that no command output can be activated before the device temperature has reached 0 °C.

9.2.17 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 **e**lectrostatically **e**ndangered **c**omponents) must be observed. The modules are not endangered when plugged in.

9.2.18 Design Versions

Central unit	SIPAC subrack Terminals	IP 20 IP 21
Bay unit	Housing (7XP20) – with window pane front – without window pane front	 IP 51 IP 30 [IP 20] 1)
	Terminals	IP 21
	Degree of protection acc. to EN 60529	
Weight	Weight at maximum configuration	
	Central unit – SIPAC subrack	 14,3 kg
	Bay unit – flush-mounted – surface-mounted	 8.1 kg [5,5 kg] 1) 11.8 kg [not available] 1)
Dimensions	See dimensional drawings, Chapter 9.3, page 329	

1) Values in brackets [ ] for Bay unit 7SS525

9.2.19 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

- max. 18A peak value for a period of time of < 0,25 ms
- max. 12A peak value for a period of time of < 1 ms

9.3 Dimensions

9.3.1 Central Unit

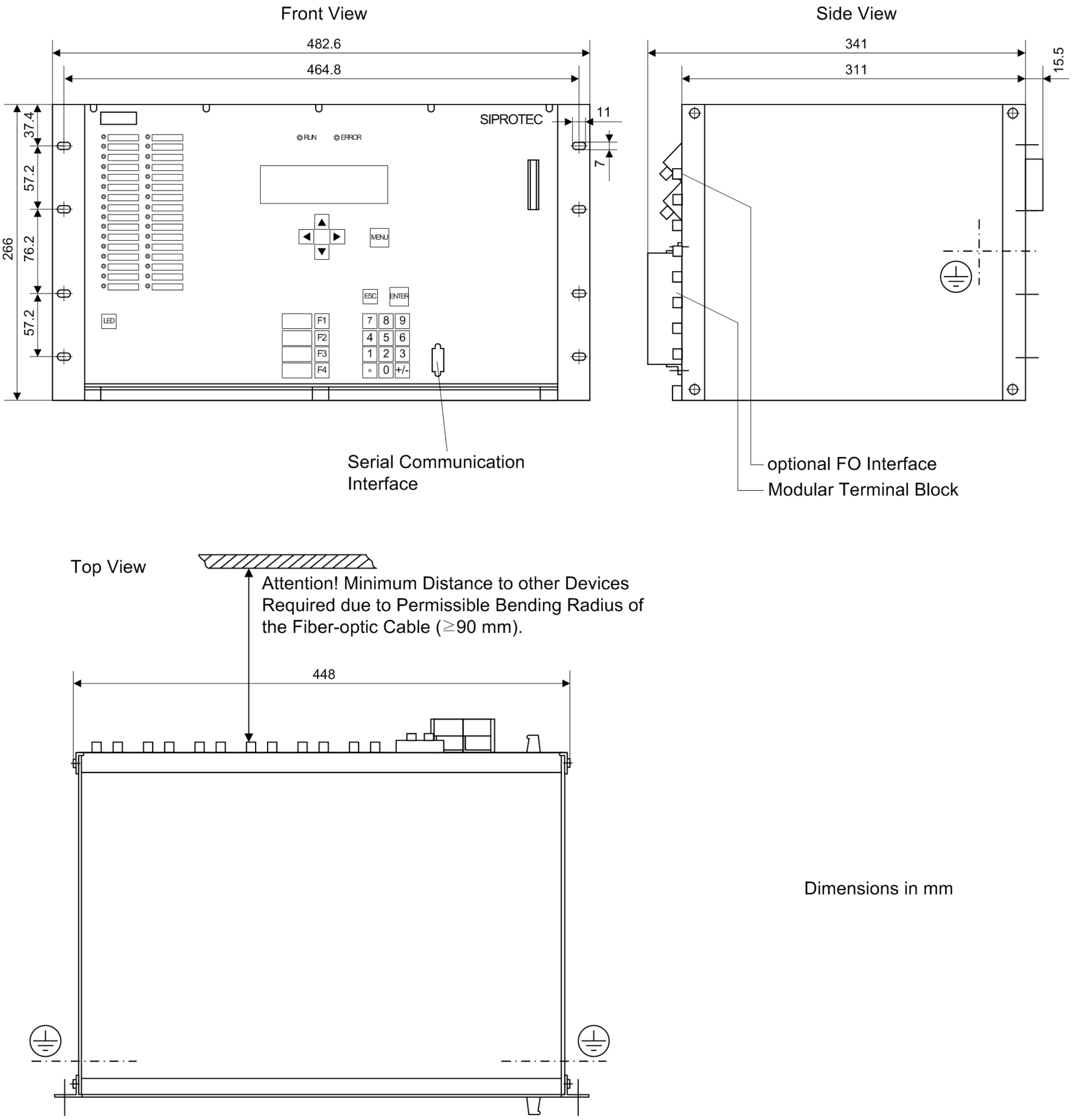


Figure 9-2 Mechanical dimensions of the subrack

If you use the optionally available spacer angles, the installation depth will be reduced by 40 mm.

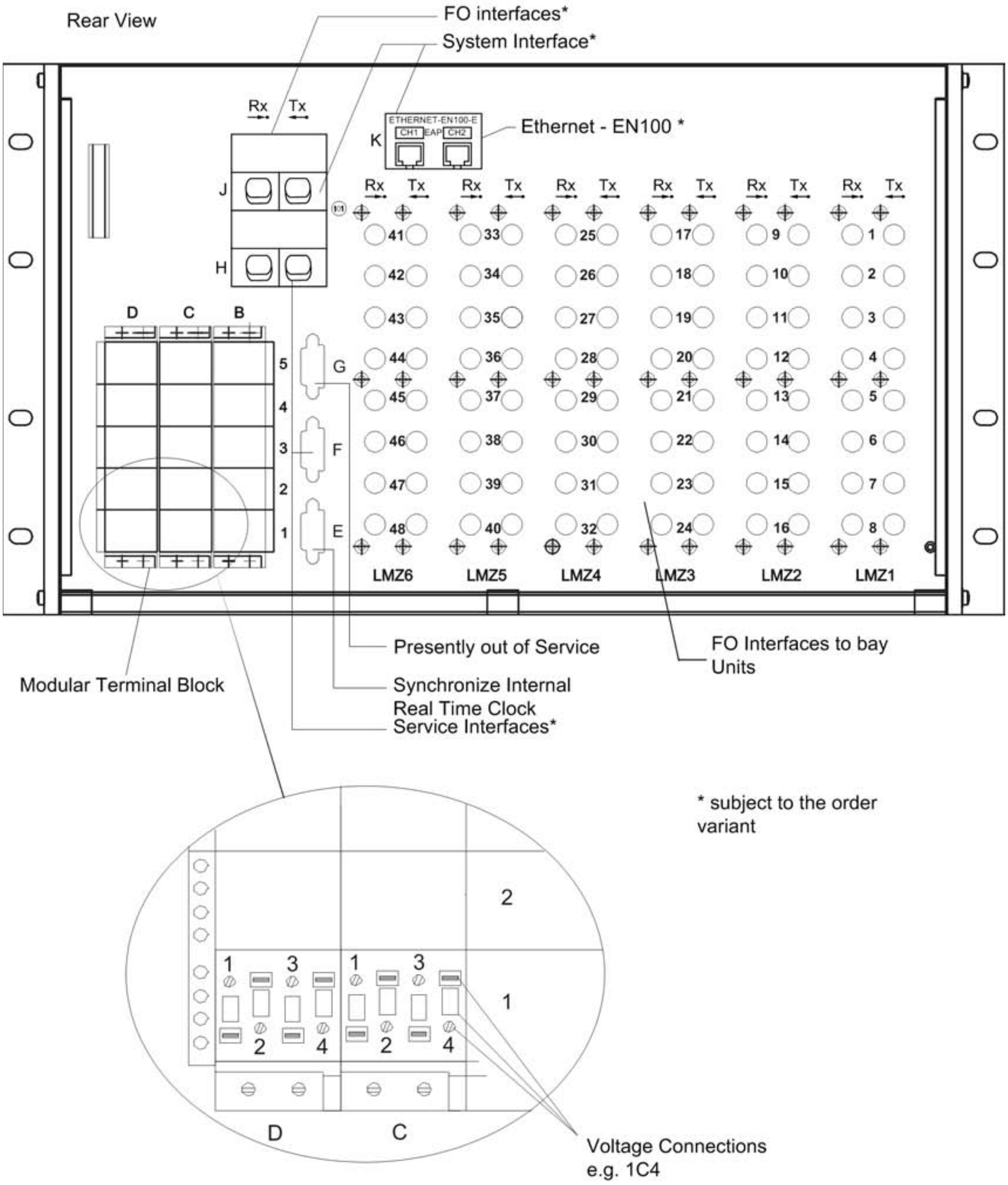


Figure 9-3 Connection plugs (rear view) of the subrack

9.3.2 Bay Unit

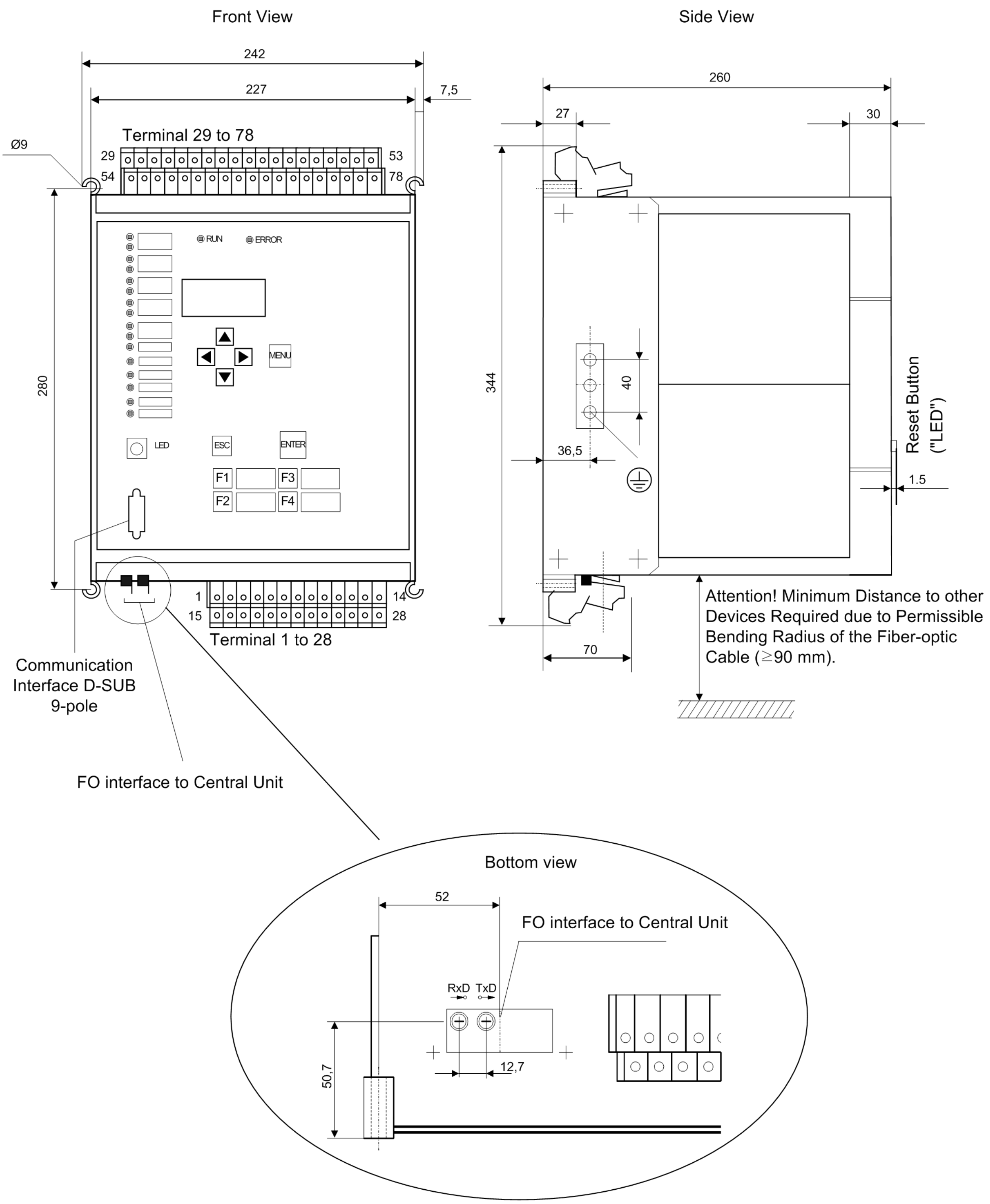


Figure 9-4 Dimensional drawing of 7XP20 for panel surface mounting 7SS523 (all dimensions in mm)

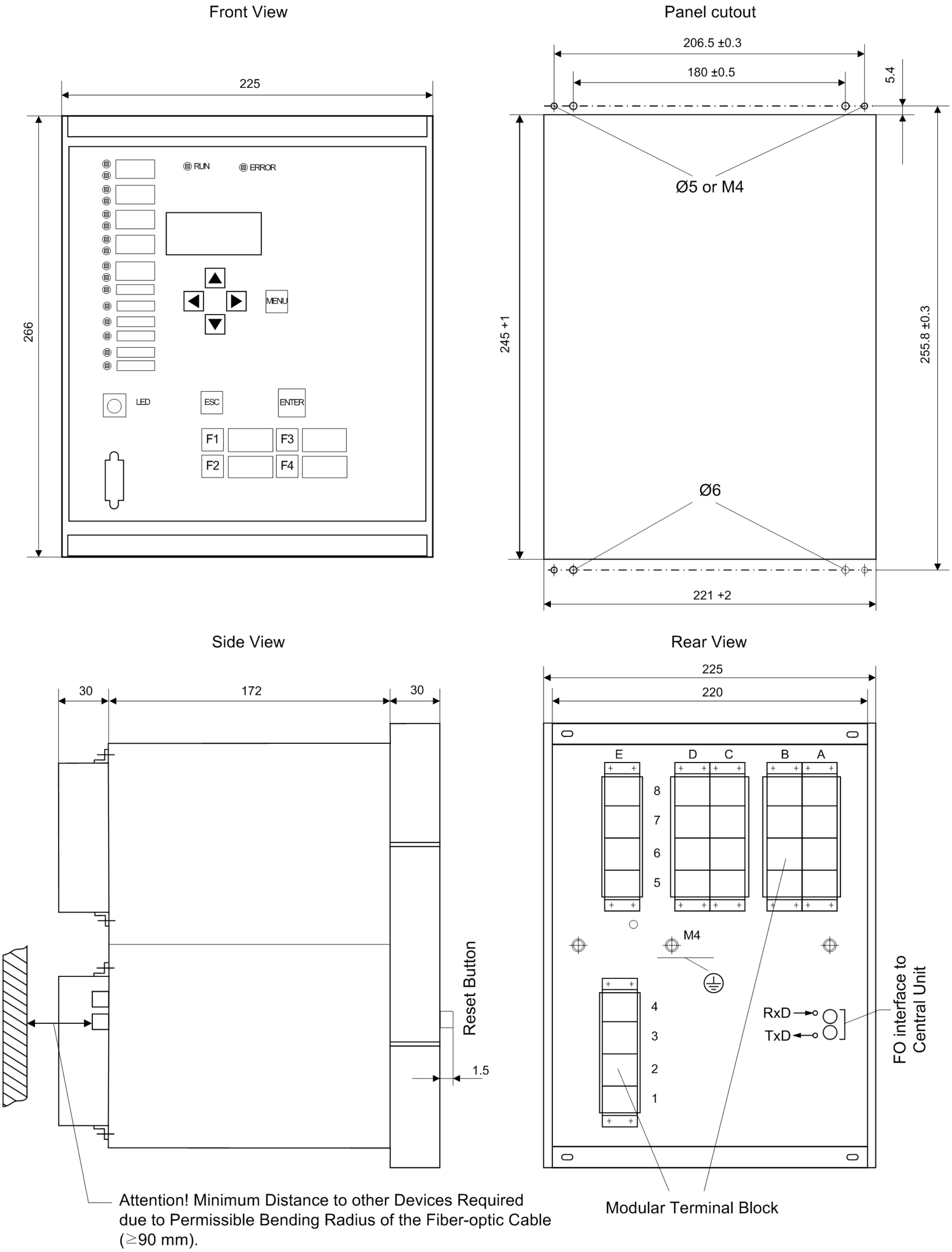


Figure 9-5 Dimensional drawing of 7XP20 for panel or cubicle flush mounting 7SS523 (all dimensions in mm)

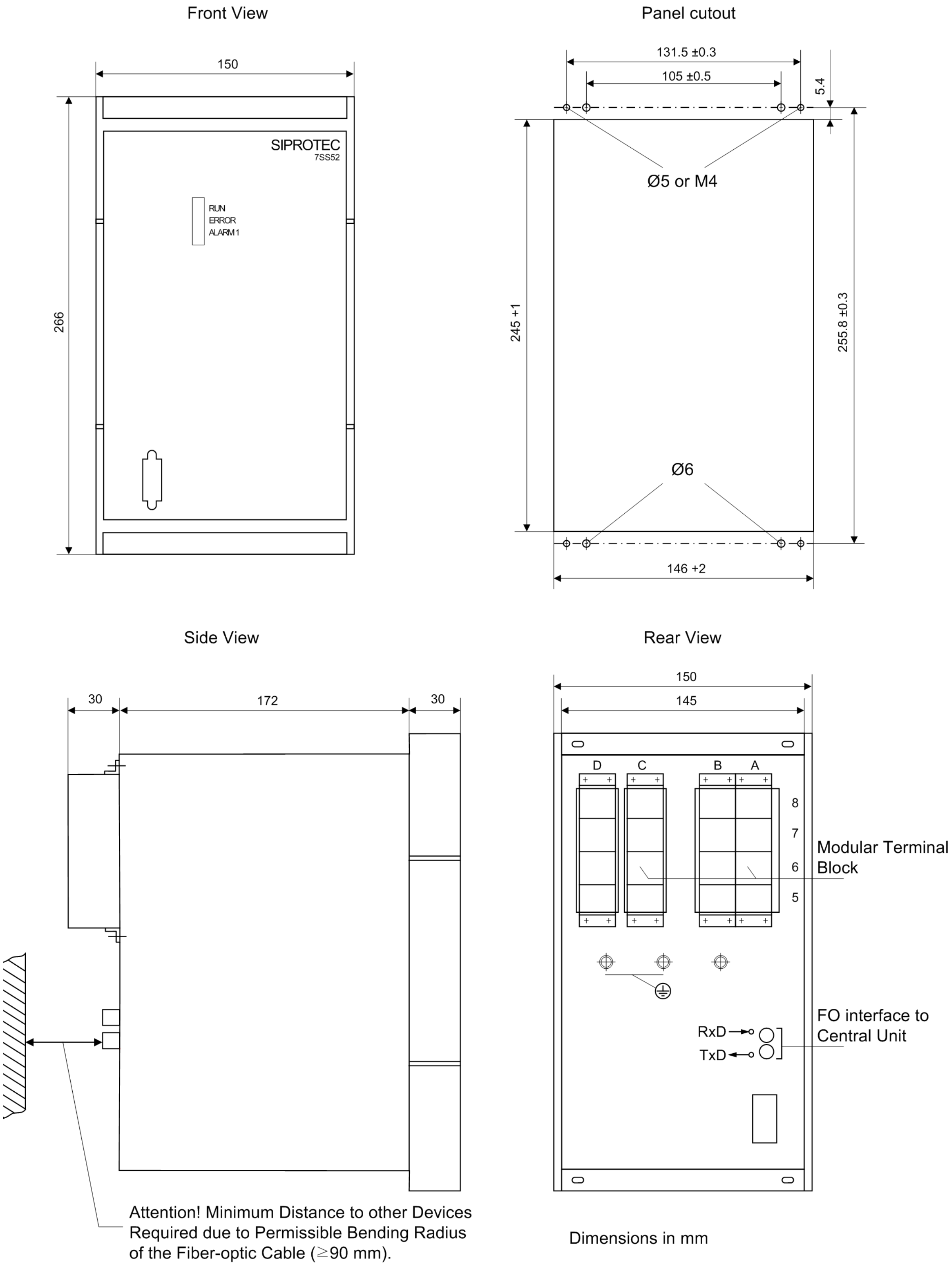


Figure 9-6 Dimensional drawing of 7XP20 for panel or cubicle flush mounting 7SS525 (all dimensions in mm)

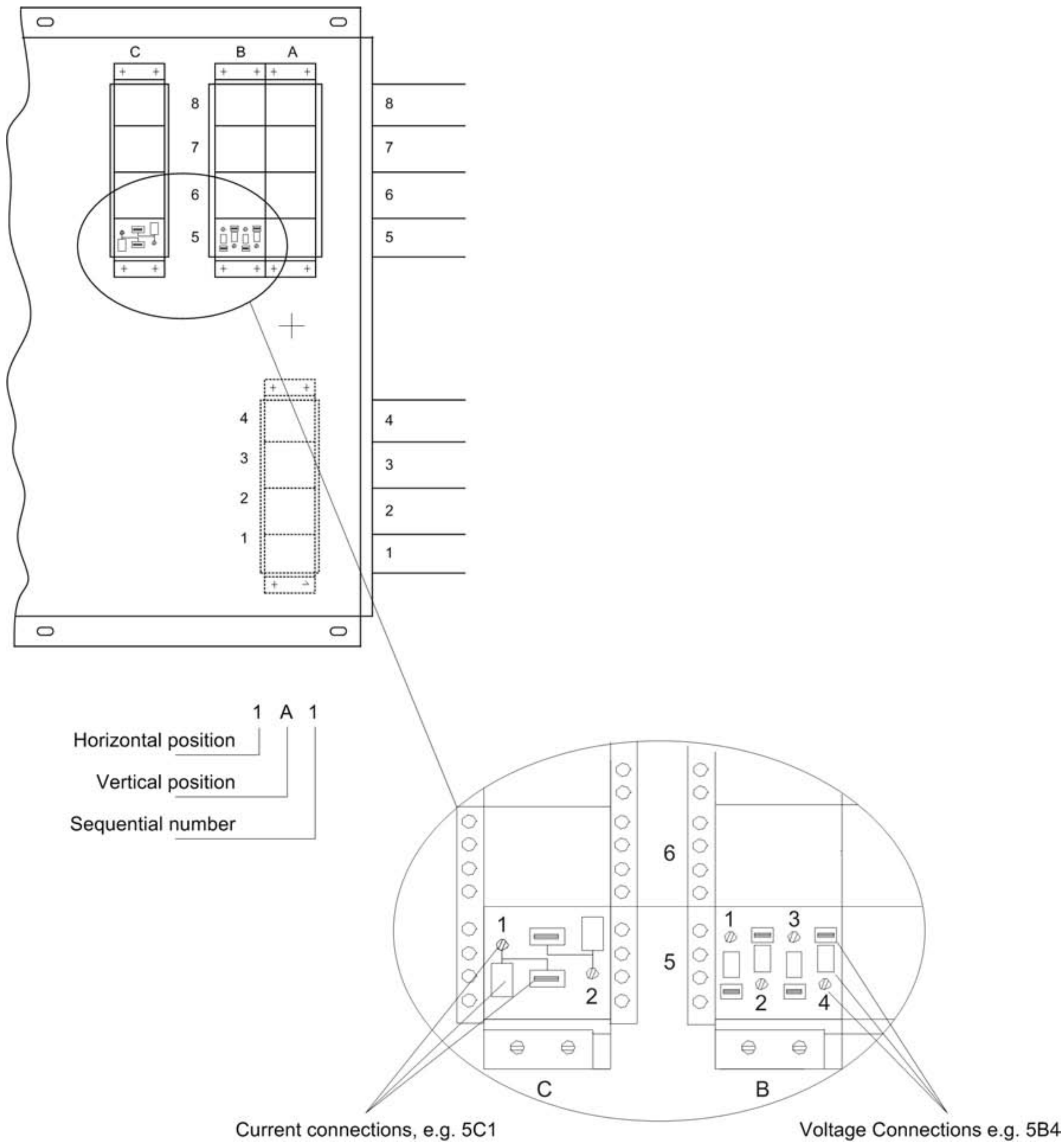


Figure 9-7 Connection plugs (rear view) for flush-mounted casing 7SS523

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.

A.1 Data for Selection and Ordering

Table A-1, page 336 to Table A-3, page 338 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

Distributed busbar and breaker failure protection SIPROTEC 7SS52 V4 CENTRAL UNIT	Order No. **7SS52 ❑ 0 - ❑ ❑ ❑ ❑ ❑ - 1 ❑ A 0**
System version	
50/60 Hz V4	**2**
Rated auxiliary voltage of converters	
DC 48, 60 V	**3**
DC 110, 125 V	**4**
DC 220, 250 V	**5**
Mechanical design	
in subrack ES902 C (SIPAC)	**A**
Communication language	
Region DE, Language German (Lang. changeable)	**A**
Region World, Language English (UK) (Lang. changeable)	**B**
Region US, Language English (US) (Lang. changeable)	**C**
Region World, Language French (Lang. changeable)	**D**
Region World, Language Spanish (Lang. changeable)	**E**
Region World, Language Italian (Lang. changeable)	**F**
Region World, Language Russian (Lang. changeable)	**G**
System interface	
no interface	**0**
Protocol IEC 60870-5-103, optical 820 nm, ST plugs	**3**
Additional protocols, see additional information L	**9**
Service interface (Terminal block on the rear)	

Table A-1 Selection and ordering data for central unit

	Order No.
Distributed busbar and breaker failure protection SIPROTEC 7SS52 V4 CENTRAL UNIT	**7SS52 ❑ 0 - ❑ ❑ ❑ ❑ ❑ - 1 ❑ A 0**
Service interface (rear port)	
DIGSI 4, electrical RS232	**1**
DIGSI 4, electrical RS485	**2**
DIGSI 4, optical 820 nm, ST plug	**3**
Fitted for	
8 bays	**A**
16 bays	**B**
24 bays	**C**
32 bays	**D**
40 bays	**E**
48 bays	**F**

Additional information L, further protocols (port K)	Position	21	22	
IEC 61850, electrical with EN100		0	R	

A.1.2 Bay Units

Table A-2 Selection and ordering data for bay unit 7SS523

	Order No.
Distributed busbar and breaker failure protection SIPROTEC 7SS52 V4 BAY UNIT	**7SS52 ❑ ❑ - ❑ ❑ A 0 1 - ❑ A A 1**
System version	
50/60 Hz V3.*	**3**
16.7 Hz V3.*	**7**
Rated current at 50/60 Hz	
1 A	**1**
5 A	**5**
Rated auxiliary voltage of converters	
DC 48 V	**2**
DC 60 to 250 V	**5**
Mechanical design in casing	
in casing 7XP20 for flush mounting in panel / cubicle	**C**
in casing 7XP20 for surface mounting on panel	**D**
in casing 7XP20 for flush mounting without plastic cover	**E**
Ancillary functions	
without	**0**
with overcurrent time protection	**1**

Table A-3 Selection and ordering data for bay unit 7SS525

	Order No. 7SS52 5 ❑ - 5 F A 0 1 - ❑ A A 1
Distributed busbar and breaker failure protection SIPROTEC 7SS52 V4 BAY UNIT	
System version	
50/60 Hz V3.*	**5**
Rated current at 50/60 Hz	
1 A	**1**
5 A	**5**
Rated auxiliary voltage of converters	
DC 48 to 250 V	**5**
Mechanical design in casing	
in casing 7XP20 for flush mounting without plastic cover	**F**
Ancillary functions	
without	**0**
with overcurrent time protection	**1**

A.1.3 Accessories

Table A-4 Accessories for Central Unit

Accessories	
The following accessories are contained in the delivery of the central unit:	• CD with firmware, manuals, labeling software • Extraction handle for printed circuit boards • FO Simplex indoor cable, length 0.2 m (2 pieces) • FO coupler • Self-adhesive labeling film • Torx-socket wrench insert T8, T10, T20 • Buffer battery (see also Table A-6, page 339) • Plastic rings for FO cables
A plastic bag that is attached to the rear of the device contains the following accessories:	• Plug-in jumpers for boards
Upgrade kit for EN100 module (release FF and higher)	**C53207-A351-D677-1**
Spacer angles for central unit with mounting sketch	**C53207-A361-B701-1**
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	**C53207-A361-D702-1**
PO damping rings (120 pcs.) as well as coding and test plugs (plug 10 x 2,54 + 25 x 5,08 mm)	**C53207-A361-D703-1**
Coding plugs (100 pcs. 5,08 mm)	**C53207-A361-D704-1**

Table A-5 Ordering data for PC communication software DIGSI

ANCILLARY COMPONENTS	Order No..
PC communication software DIGSI, Basic German, English	**7 X S 5 4 0 0 - 0 A A 0 0**
PC communication software DIGSI, Professional (Basic and all optional packets, incl. SIGRA) German, English	**7 X S 5 4 0 2 - 0 A A 0 0**
DIGSI REMOTE Software for the remote control of protection devices via modem with DIGSI German, English	**7 X S 5 4 4 0 - 0 A A 0 0**
SIGRA Software for the graphical visualization, analysis and evaluation of fault records German, English	**7 X S 5 4 1 0 - 0 A A 0 0**
Connection cable protection device -PC (9-pole; D-SUB)	**7 X V 5 1 0 0 - 4**

Table A-6 Selection and ordering data for spare parts

Spare parts for the 7SS52 V4 distributed busbar and breaker failure protection	Order No.
Buffer battery for central and bay unit Lithium battery 3 V / 1 Ah, Type CR 1/2 AA	 **6 1 2 7 1 0 1 5 0 1**
Processor boards Central Unit ZPS2-SBK 1) D-CPU 2)	 **6 M A 3 5 2 3 - 0 A A 0 0** **6 M A 3 5 4 2 - 0 A A 0 0**
Input/output board Central Unit EAZ	 **6 M A 3 2 6 2 - 0 B A 0 1**
Electrical/optical converter module Central Unit LMZ	 **6 M A 3 2 6 3 - 0 A A 1 0**
Power supply Central Unit DC 48/60 V DC 110/125 V DC 220/250 V	 **6 M A 1 8 9 0 - 1 C C 1 3 B B** **6 M A 1 8 9 0 - 1 C C 1 4 B B** **6 M A 1 8 9 0 - 1 C C 1 5 B B**

1) The ZPS-SK boards and ZPS-BSZ boards differ from the board ZPS-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

Table A-7 Selection and ordering data for FO connections

ANCILLARY COMPONENTS **Fiber-optic connections central unit - bay units**	Order No.
FO-Duplex outdoor cable 2G62,5/125, 2 fibers, ST-plugs on both sides	**6XV8100- 0 B D 4 1 - ❑ ❑ ❑ 0**
FO-Duplex indoor cable 2G62,5/125, 2 fibers, ST-plugs on both sides	**6XV8100- 0 B E 4 1 - ❑ ❑ ❑ 0**
100 meter lengths	
Length 0 m	**0**
Length 100 m	**1**
Length 200 m	**2**
Length 300 m	**3**
Length 400 m	**4**
Length 500 m	**5**
Length 600 m	**6**
Length 700 m	**7**
Length 800 m	**8**
Length 900 m	**9**
10 meter lengths:	
Length 0 m	**A**
Length 10 m	**B**
Length 20 m	**C**
Length 30 m	**D**
Length 40 m	**E**
Length 50 m	**F**
Length 60 m	**G**
Length 70 m	**H**
Length 80 m	**J**
Length 90 m	**K**
1 meter lengths:	
Length 0 m	**A**
Length 1 m	**B**
Length 2 m	**C**
Length 3 m	**D**
Length 4 m	**E**
Length 5 m	**F**
Length 6 m	**G**
Length 7 m	**H**
Length 8 m	**J**
Length 9 m	**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 Stabilization Factor k

In a first step, the relationship between the point (in time) at which saturation occurs and the stabilization 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 341):

$2\ I_{scc\ max} \sin \omega T_S \times k \geq I_{scc\ max}$ (1) or

$2 \sin \omega T_S \times k \geq 1$ (2)

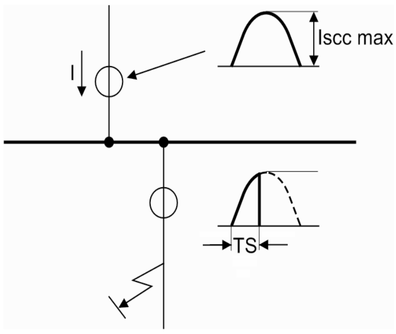
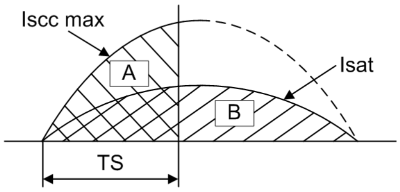


Figure A-1 Short-circuit on a feeder with CT saturation

To determine the point in time T_S at which saturation occurs, the burdening factor K_b must be considered.



$I_{sat} = I_{pn} * K'_{ssc}$
$K_b = I_{scc\ max} / I_{sat}$

Figure A-2 Current/time characteristic

If the CT is burdened with $I_{scc\ max} = K_b I_{sat}$, it will saturate after time T_S, with area A being equal to area B.

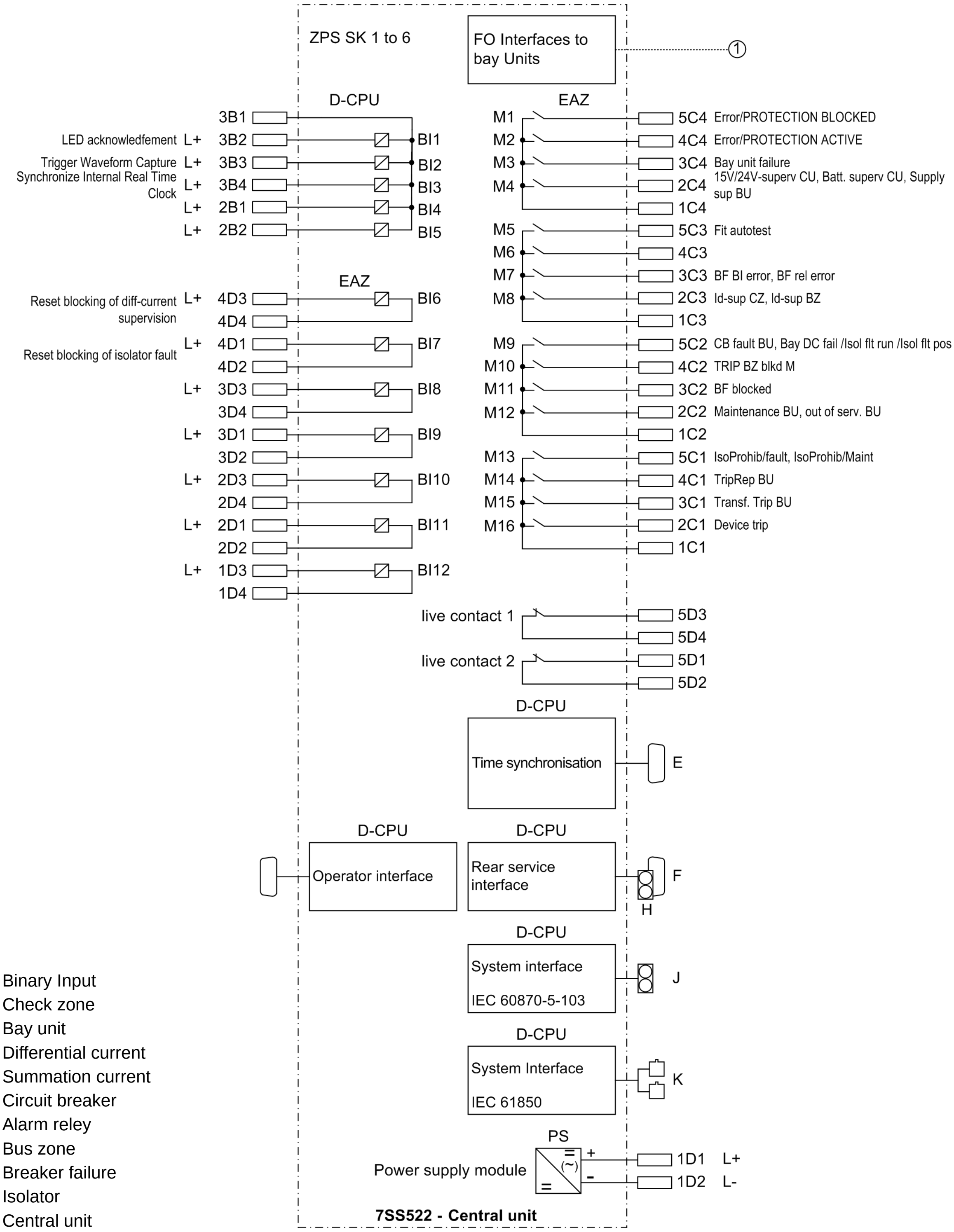
i.e. $$\int_0^{\omega Ts} (I_{scc\ max} \cdot \sin \omega t) = \int_0^{\pi} (I_{sat} \cdot \sin \omega t) \quad (3)$$

$K_b (1 - \cos \omega T_S) = 2$ (4)

If inequation (2) and equation (4) are combined, the result is the minimum selectable stabilization factor k:

$$k > \frac{K_b}{4 \cdot \sqrt{K_b - 1}} \quad \text{for } K_b \geq 2 (5)$$

A.3 Connection Diagrams



Legend:

BI:	Binary Input
CZ:	Check zone
BU:	Bay unit
I-DIFF:	Differential current
I-SUM:	Summation current
CB:	Circuit breaker
M:	Alarm reley
BZ:	Bus zone
BF:	Breaker failure
ISO:	Isolator
CU:	Central unit

Figure A-3 Connection diagram central unit (continued in Figure A-4, page 343)

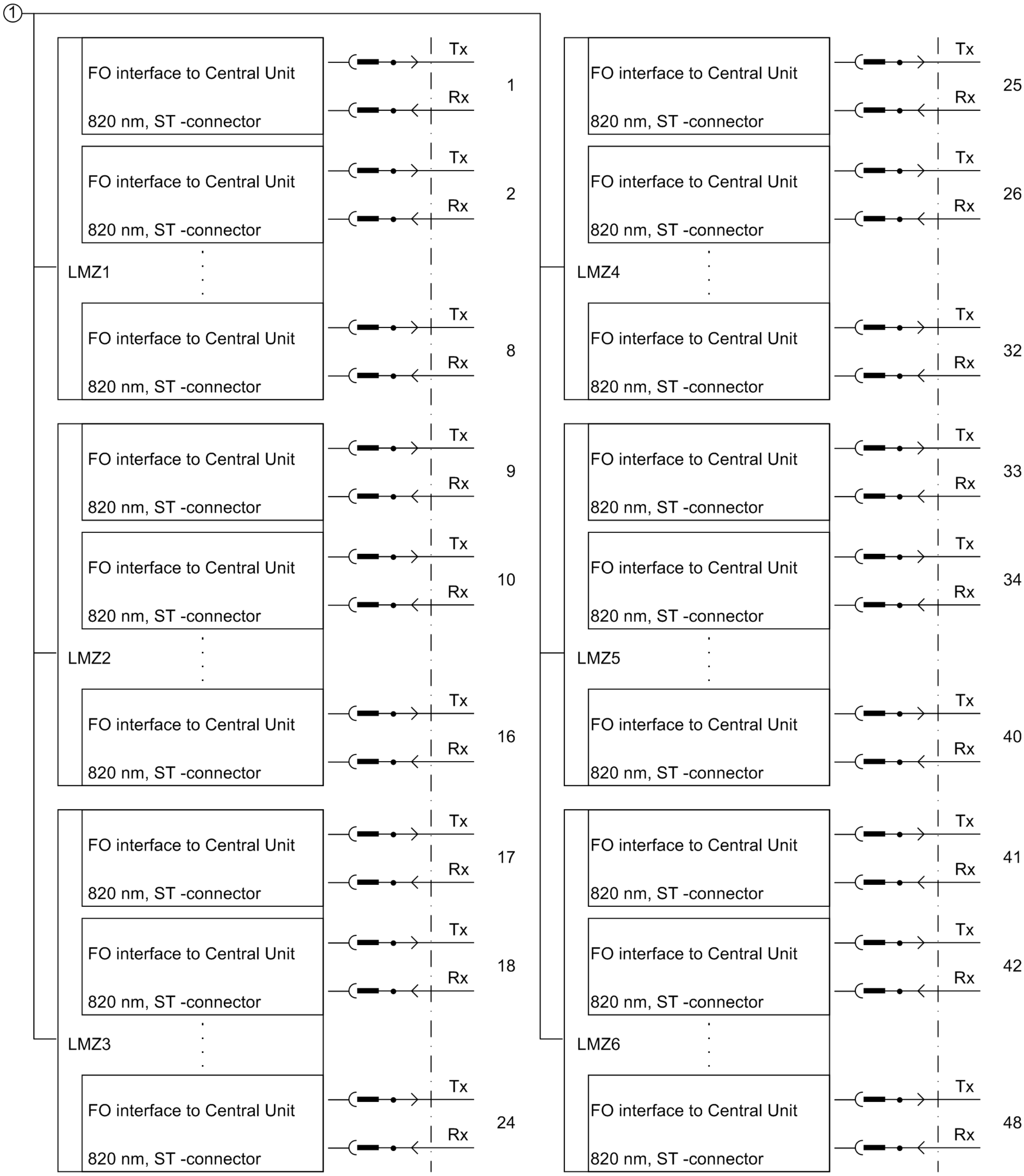


Figure A-4 Connection diagram central unit (continued from Figure A-3, page 342)

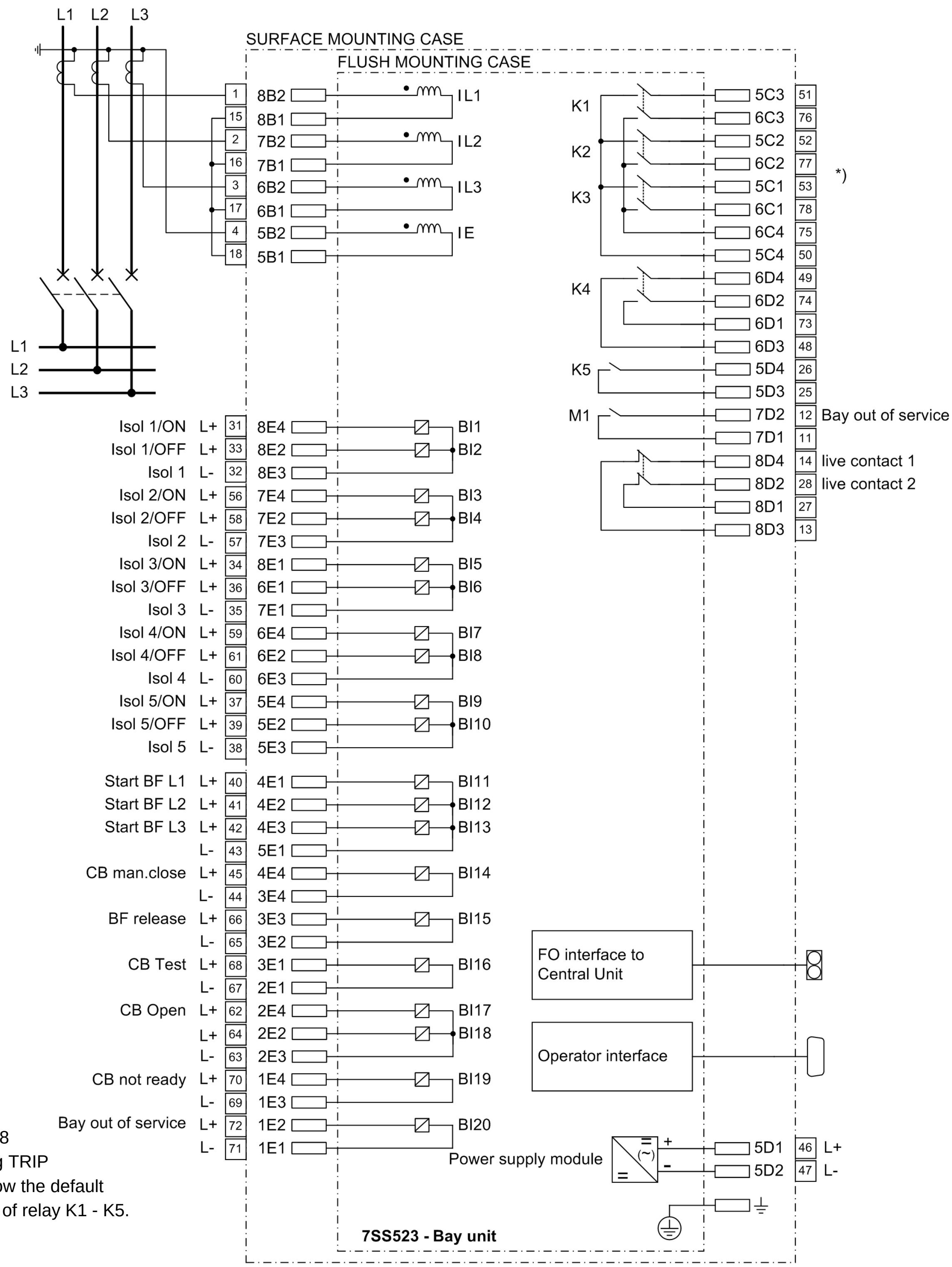
D-SUB Connectors

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 –●⟶ for transmit (output) and ⟶● for receive (input).

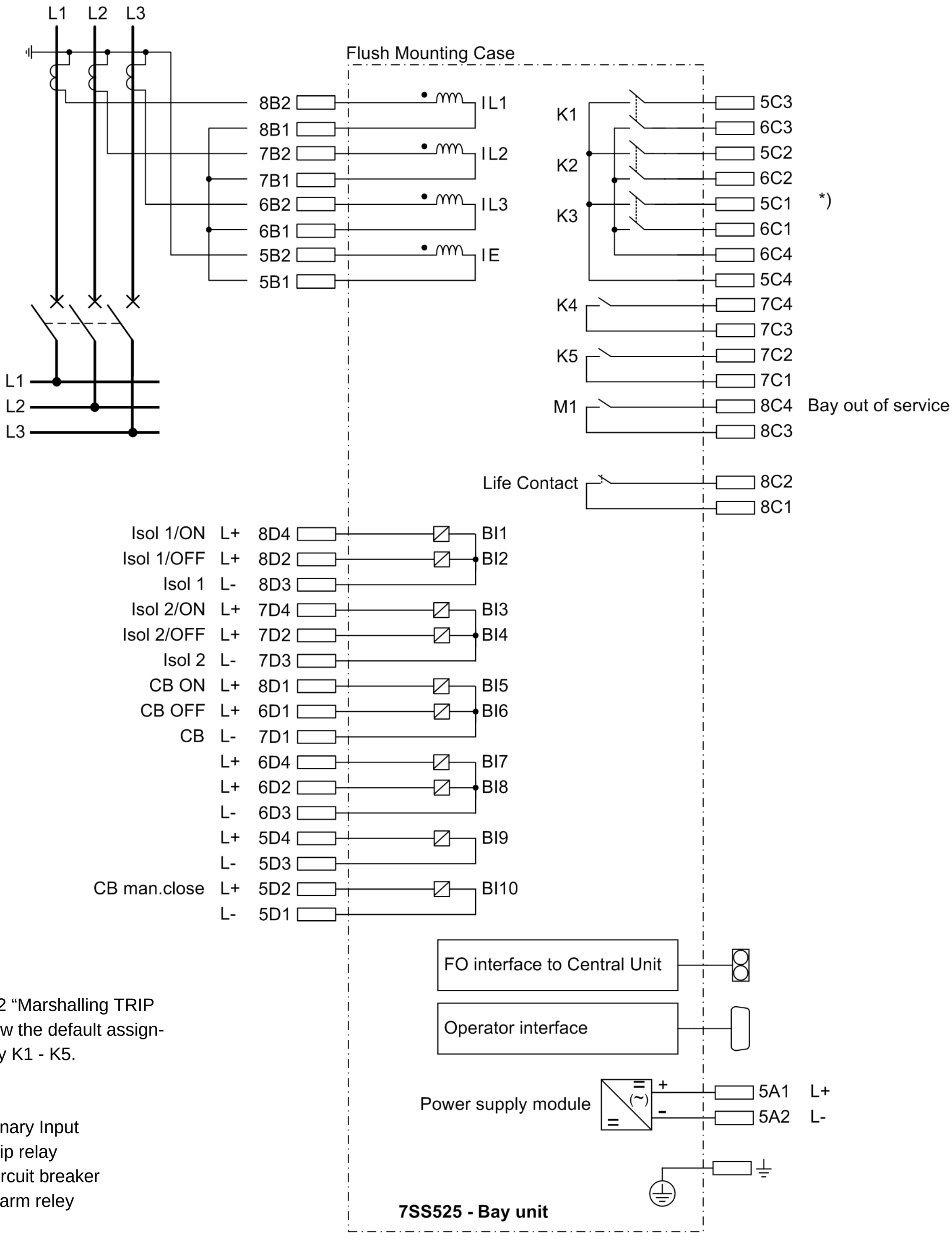


*) Table A-28 “Marshalling TRIP RELAY” show the default assignment of relay K1 - K5.

Legend:

BI:	Binary Input
K:	Trip relay
CB:	Circuit breaker
M:	Alarm reley
BF:	Breaker failure

Figure A-5 Connection diagram bay unit 7SS523



*) Table A-32 “Marshalling TRIP RELAY” show the default assignment of relay K1 - K5.

Legend:

BI:	Binary Input
K:	Trip relay
CB:	Circuit breaker
M:	Alarm reley

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 Settings – Central Unit

A.4.1 Settings of the ZPS Modules

ZPS module up to release 7SS52 ../GG

There are two different releases of the ZPS modules available. Figure A-7, page 348 shows the layout of the printed circuit board for devices up to release 7SS522.../GG, whereas Figure A-8, page 350 depicts the layout for devices of release 7SS52.../HH and higher.

The ZPS modules are a component of the central unit. They can be used as master (ZBS-SBK) or slave (ZPS-BSZ or ZPS-SK) in the multi-processor system. The C53207-A361-B12-1 module can be applied universally as ZPS-SK, ZPS-SBK and ZPS-BSZ. The C53207-A361-B112-1 module has no communication controller and can thus only be used as ZPS-SBK and ZPS-BSZ module. For an unequivocal definition of the task, the respective module is coded by means of switches.

The location of the code switches and the jumpers on the module is depicted in figure Figure A-7, page 348. The settings can be taken from the tables A-8, page 349 and A-9, page 349.

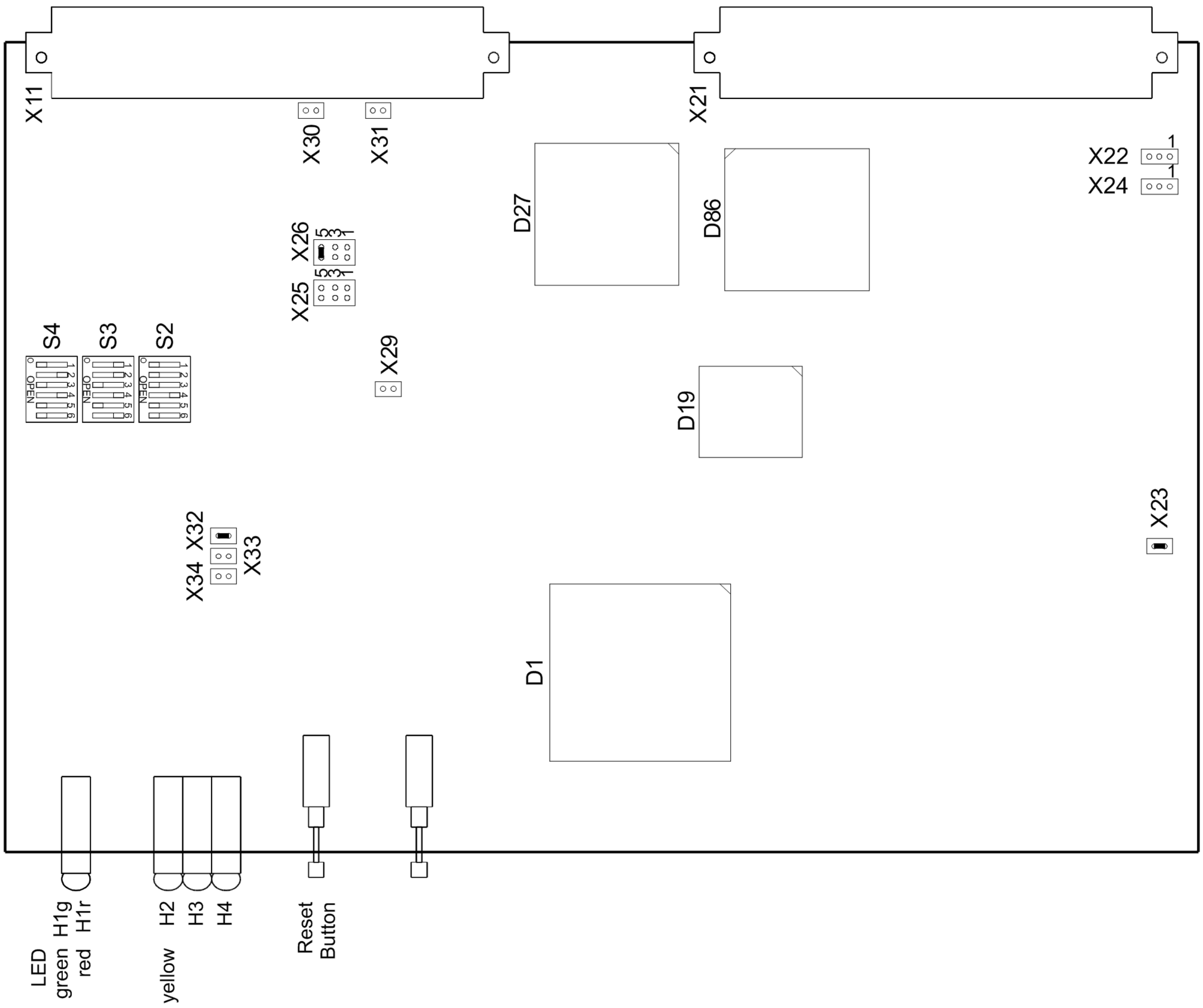


Figure A-7 Location of the coding switches and jumpers on the ZPS module

It is recommended to verify the switch positions and jumpers before fitting the module. In Table A-8, page 349 and Table A-9, page 349 of the appendix the settings are listed.

Table A-8 Jumper settings for the ZPS module

	ZPS Functions									
Jumper	**SBK**	**BSZ 1**	**BSZ 2**	**BSZ 3**	**SK 1**	**SK 2**	**SK 3**	**SK 4**	**SK 5**	**SK 6**
X22	off	off	off	off	off	off	off	off	off	off
X23	on	on	on	on	on	on	on	on	on	on
X24	off	off	off	off	off	off	off	off	off	off
X25	5 - 6	off	off	off	off	off	off	off	off	off
X26	off	5 - 6	5 - 6	5 - 6	5 - 6	5 - 6	5 - 6	5 - 6	5 - 6	5 - 6
X29	on	off	off	off	off	off	off	off	off	off
X30	off	off	off	off	off	off	off	off	off	off
X31	off	off	off	off	off	off	off	off	off	off
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

Table A-9 Coding switch settings for the ZPS module

	ZPS Functions									
Switch	**SBK**	**BSZ 1**	**BSZ 2**	**BSZ 3**	**SK 1**	**SK 2**	**SK 3**	**SK 4**	**SK 5**	**SK 6**
S2										
S2.1	off	off	off	off	off	off	off	off	off	off
S2.2	off	off	off	off	off	off	off	off	off	off
S2.3	off	off	off	off	off	off	off	off	off	off
S2.4	off	on	on	on	on	on	on	on	on	on
S2.5	off	off	off	off	off	off	off	off	off	off
S2.6	off	off	off	off	off	off	off	off	off	off
S3										
S3.1	off	on	on	on	on	on	on	on	on	on
S3.2	off	off	on	off	on	off	on	off	on	off
S3.3	off	on	on	off	off	on	on	off	off	on
S3.4	off	off	off	on	on	on	on	off	off	off
S3.5	off	off	off	off	off	off	off	on	on	on
S3.6	off	on	on	on	on	on	on	on	on	on
S4										
S4.1	off	off	off	off	off	off	off	off	off	off
S4.2	off	off	on	off	on	off	on	off	on	off
S4.3	off	on	on	off	off	on	on	off	off	on
S4.4	off	off	off	on	on	on	on	off	off	off
S4.5	off	off	off	off	off	off	off	on	on	on
S4.6	off	off	off	off	off	off	off	off	off	off

ZPS2 module of release 7SS52 ../ 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.

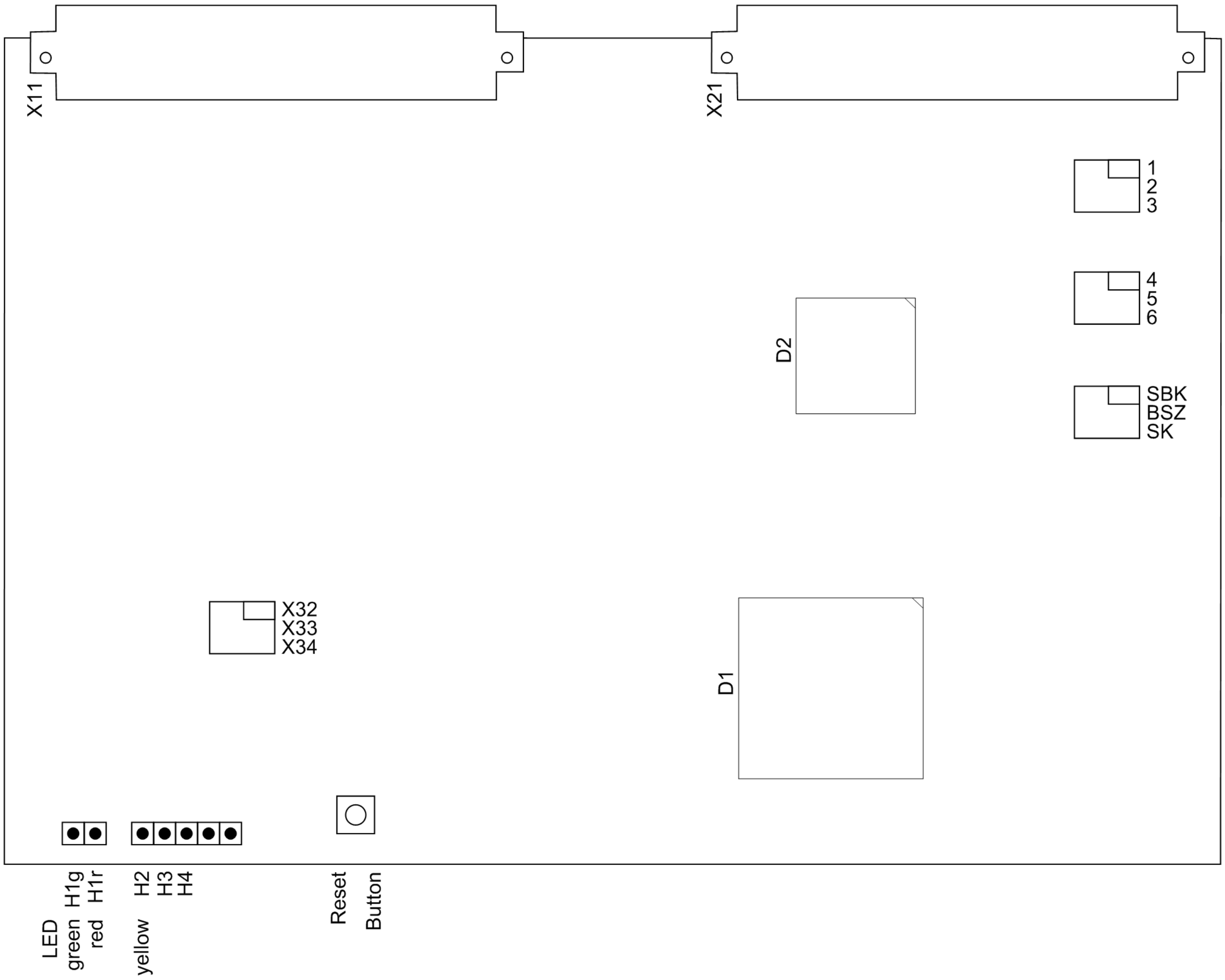


Figure A-8 Location of the jumpers on the ZPS2 module

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-10, page 351 of the Appendix.

Table A-10 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

A.4.2 Settings of the EAZ Module

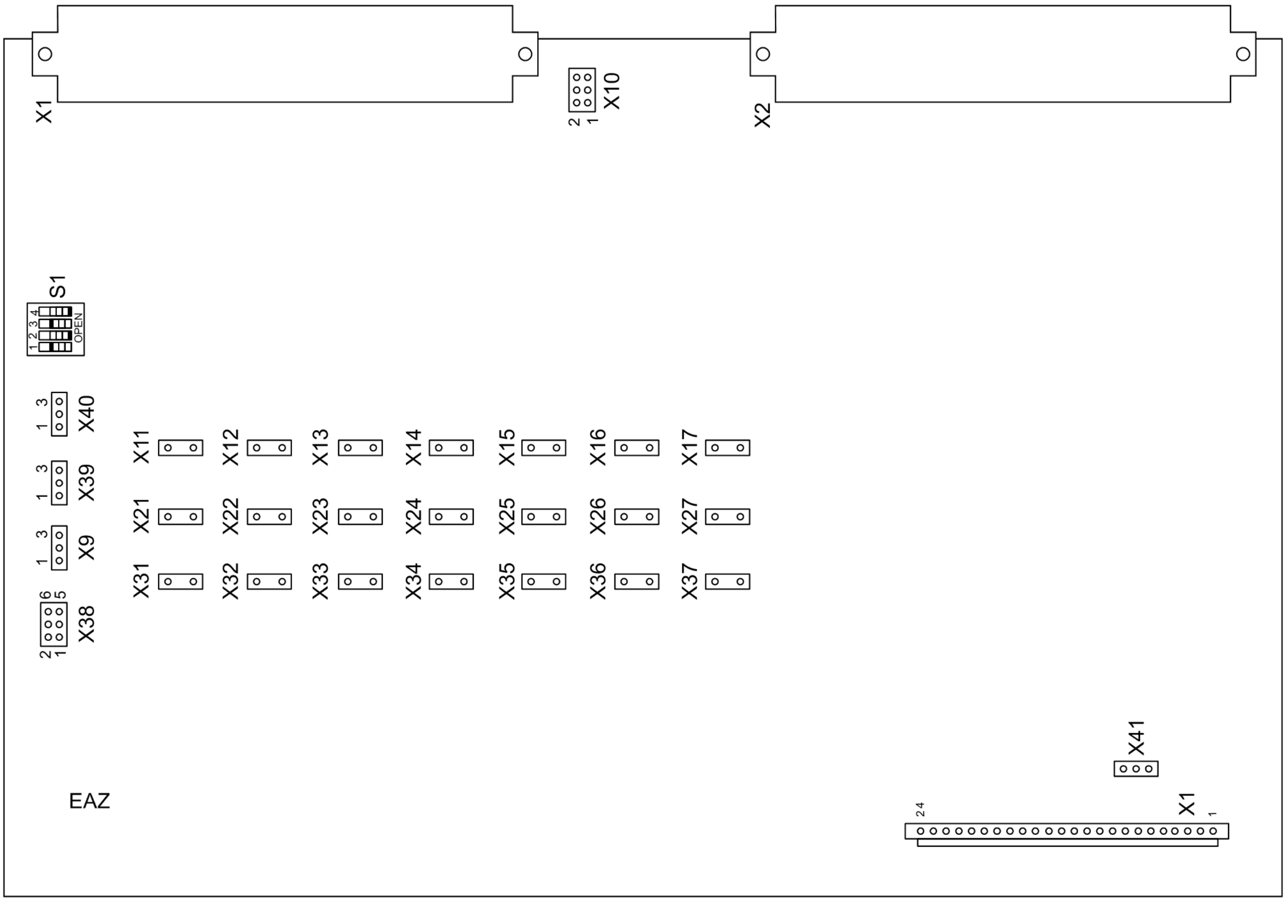


Figure A-9 Jumper layout on the EAZ module

Table A-11 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-12, page 353)
X21 to X27	
X31 to X37	
X38	5-6
X39	1-2
X40	2-3
X41	1-2

Table A-12 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 1)
BI1 to BI5 (on module D-CPU, Table A-15, page 355)				
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-13 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 Jumper Settings of the D-CPU Module

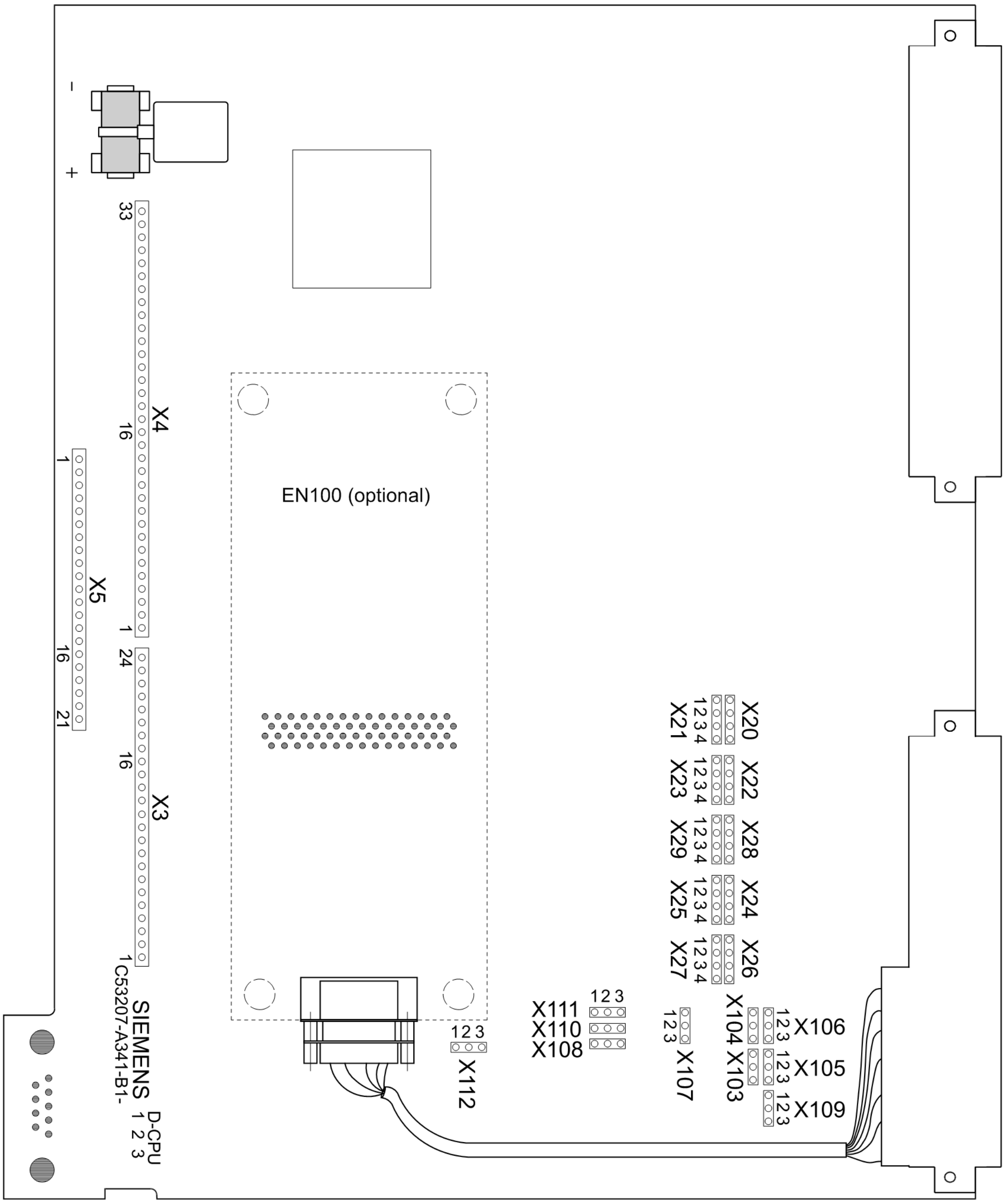


Figure A-10 Location of the jumpers on the D-CPU module

The service port can be configured as RS232, RS485 or as optical interface. Insert the jumpers according to Table A-14, page 355.

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-14 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 he terminating resistors off

Table A-15 Jumper settings (binary inputs) for the D-CPU module

Connector	**Binary-inputs**	**Jumper**			
		24 V	**60 V**	**110 V**	**220V 1)**
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-12, page 353)				

1) Delivery setting

A.5 Jumper Settings – Bay Unit

A.5.1 Settings of the PFE Module

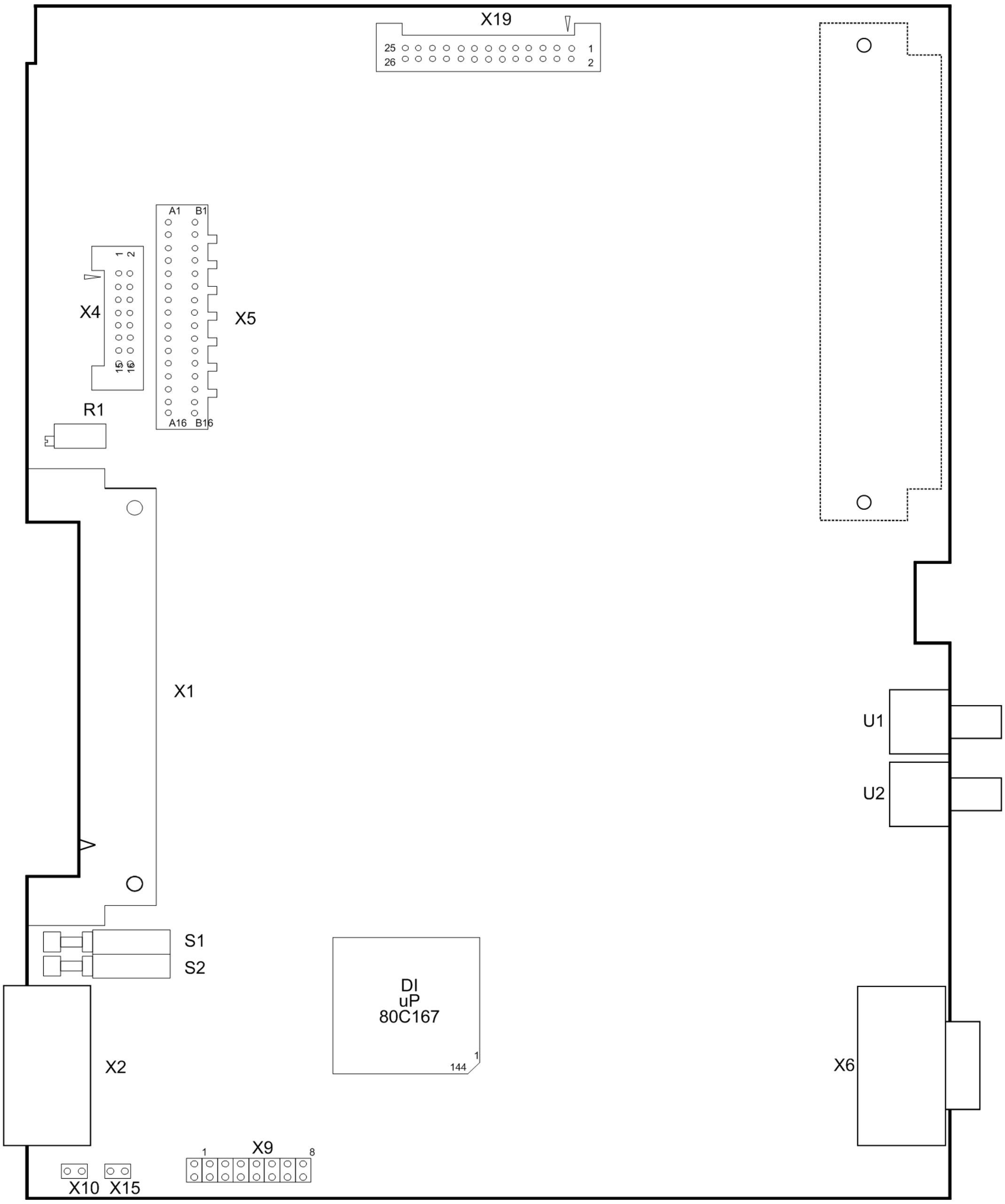


Figure A-11 Location of the jumpers on the PFE module

Table A-16 Jumper settings for the PFE module

Connector	Jumper
X9	Not installed
X10	Not installed
X15	Not installed

A.5.2 Settings of the SVW Module

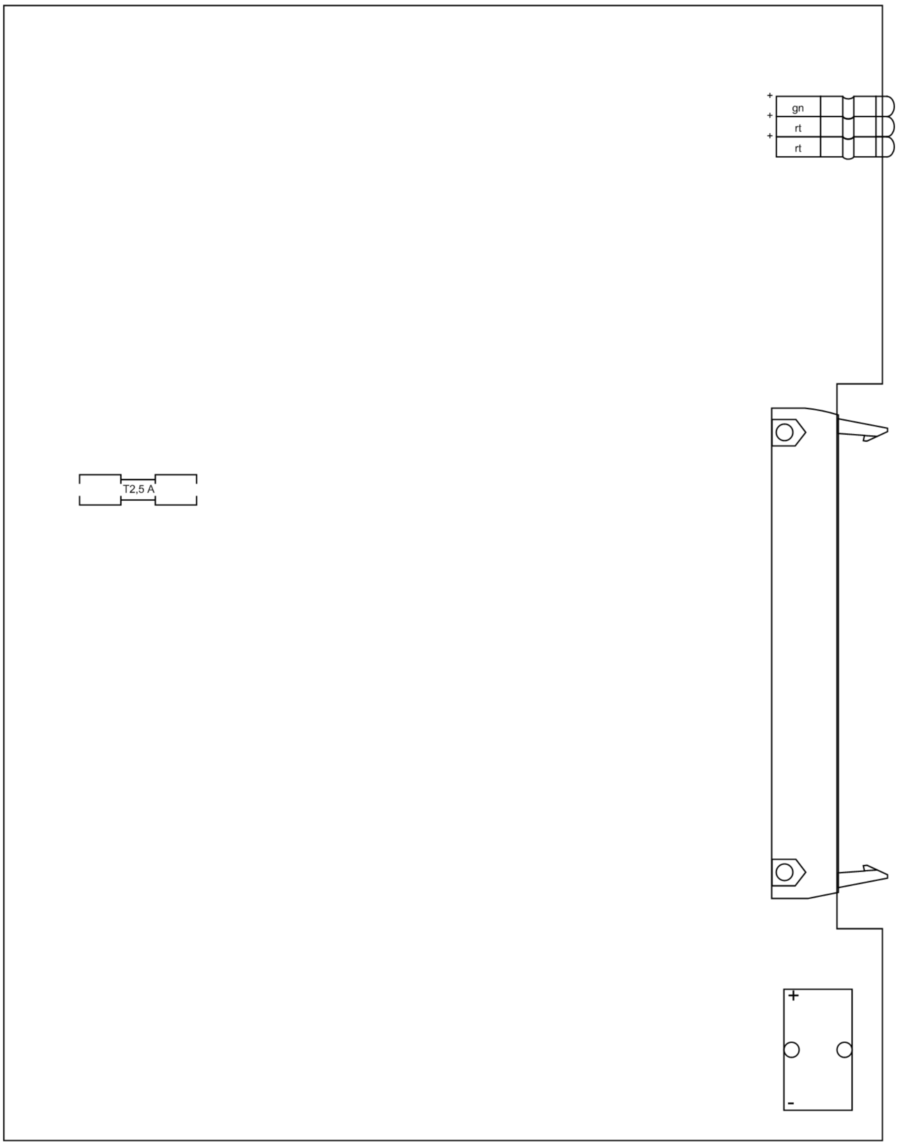


Figure A-12 No jumpers on the SVW module

A.5.3 Settings of the SAF Module

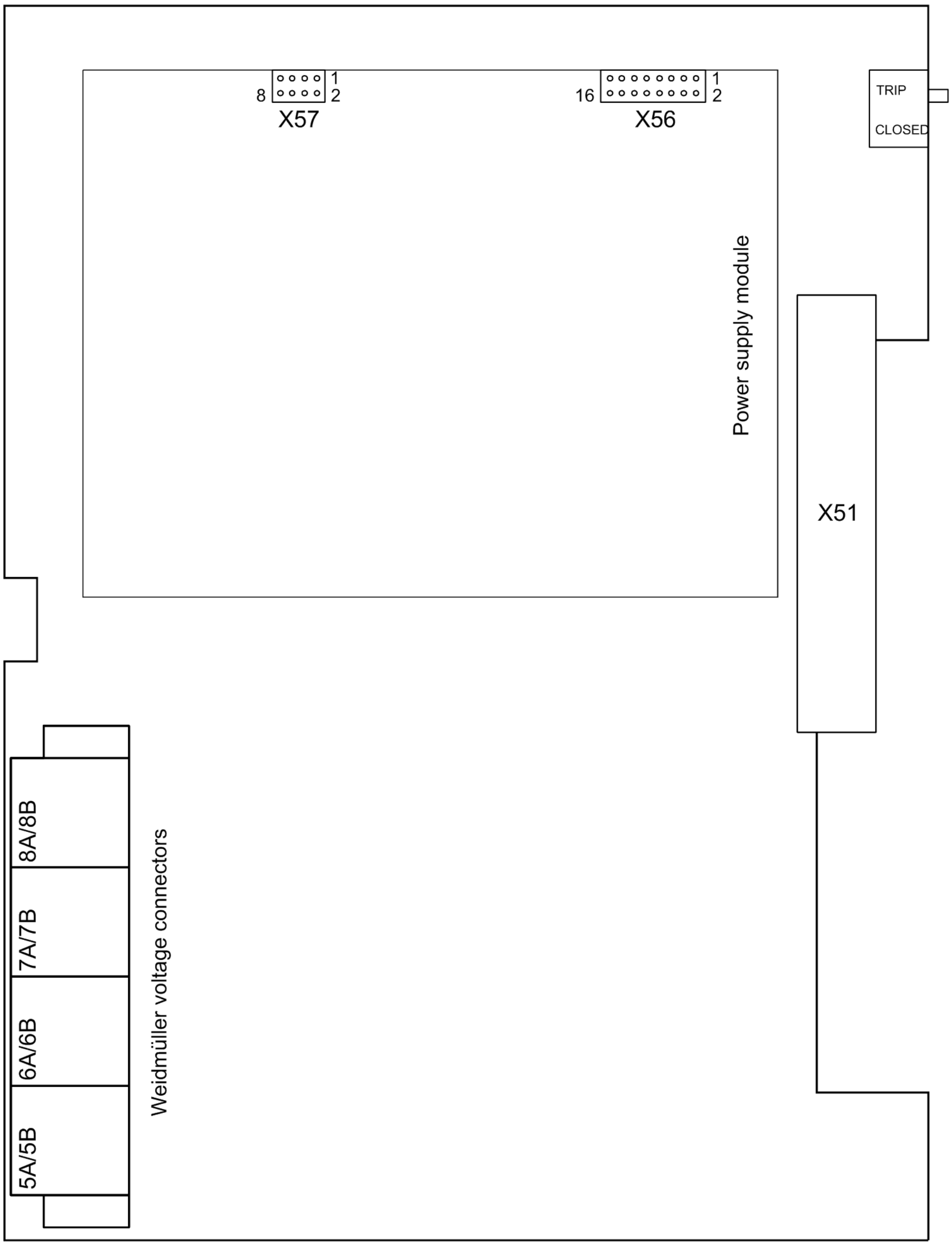


Figure A-13 No jumpers on the SAF module

A.5.4 Settings of the AFE Module

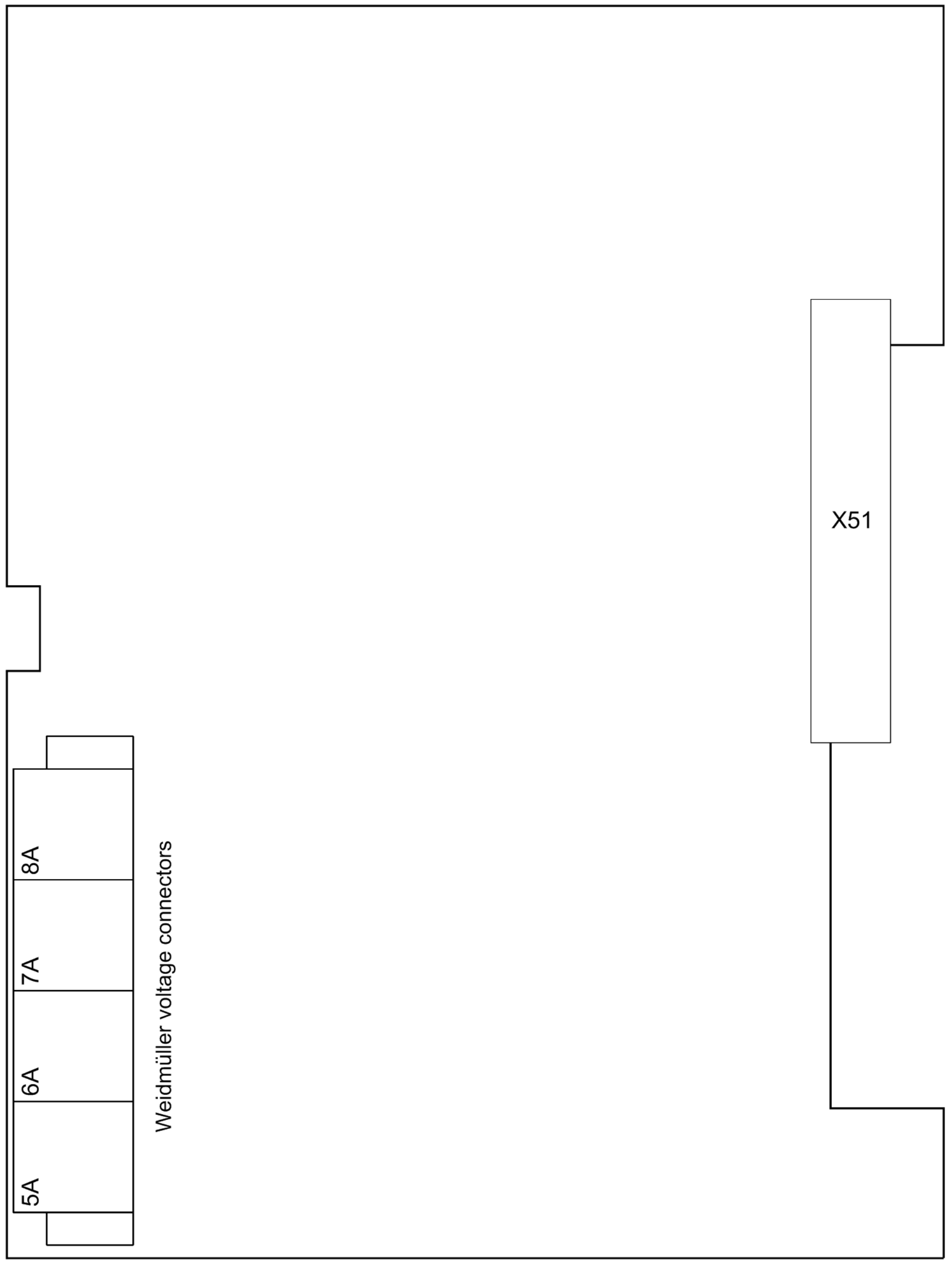


Figure A-14 No jumpers on the AFE module

A.5.5 Settings of the EFE Module

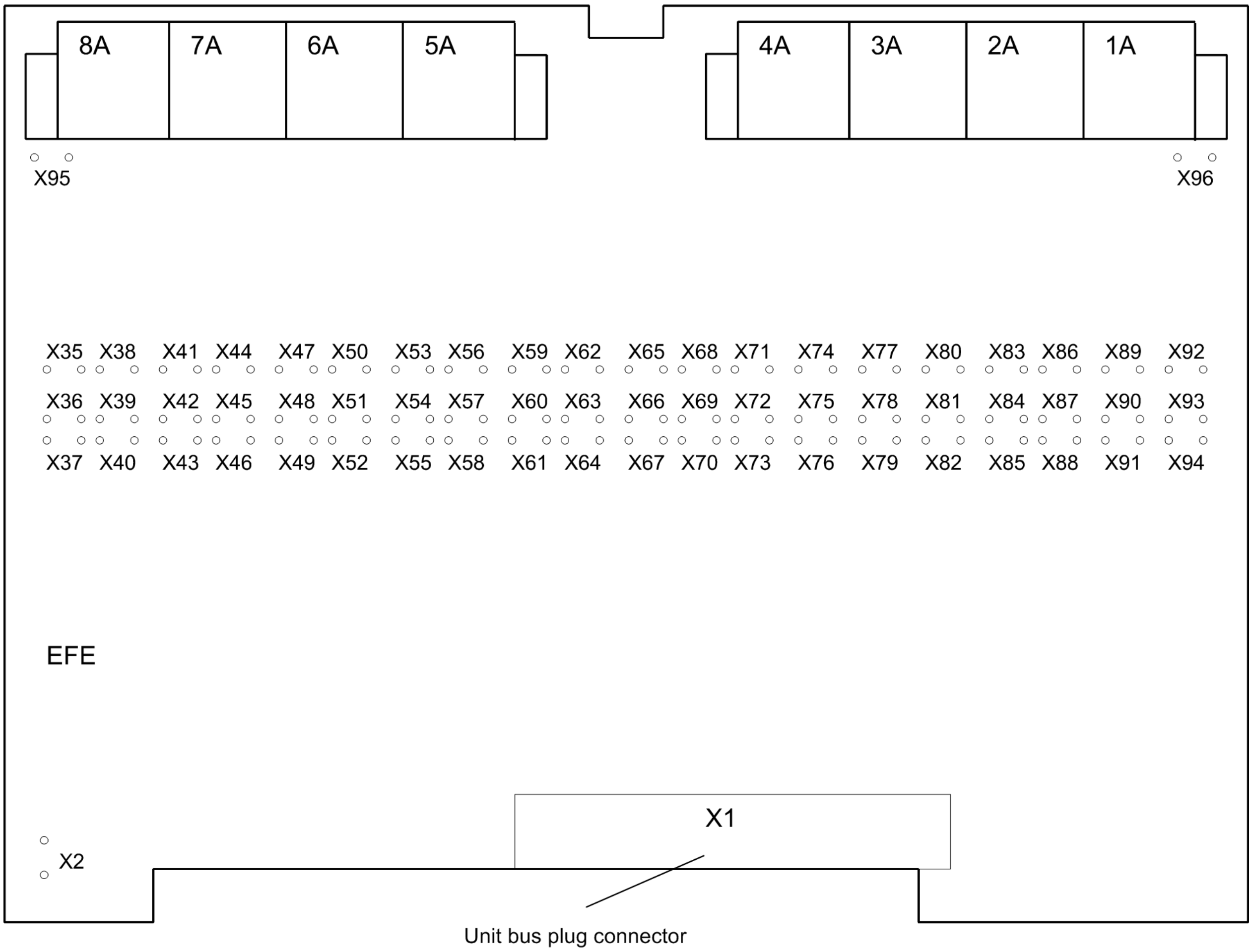


Figure A-15 Location of the jumpers on the EFE module

Table A-17 Jumper settings for the EFE module

Connector	Jumper
X35 to X94	Jumpers for the voltage setting, see Table A-18, page 361
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 1)
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 Settings of the EFE_10 Module

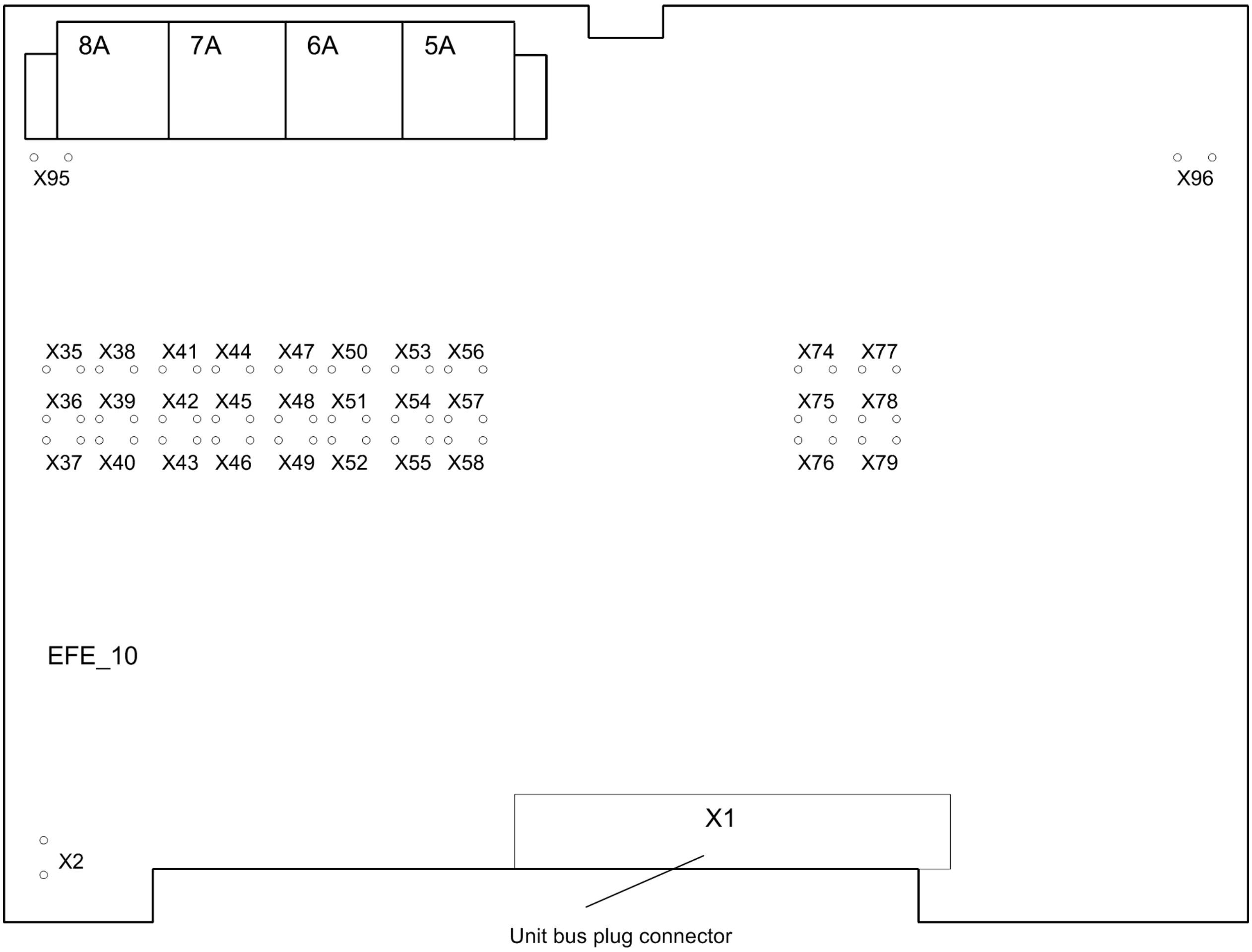


Figure A-16 Location of the jumpers on the EFE_10 module

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 363
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 1)**
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	X79	X78	X77	-
BI 10	X76	X75	X74	-

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 • Alarm and Measured Value Transmission Blocking • Creating test annunciations • Acknowledging LED	 Yes Yes Yes	 Yes Yes 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 NO	NO	Combi-Coupler
112	Bay status	BU@	out of service in service 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 1-ch w sup 2-ch w/o sup 2-ch w sup	1-ch w sup	Binary input mode / supervision BF
115	BF OP MODE	BU@	non existent external BZ unbalance trip rep/unbal I>query trip rep/I>quer	BZ unbalance	Operation mode BF
116	BF I<	BU@	ON OFF	OFF	Low-current mode BF
117	TRIP REP. MODE	BU@	1pole 3pole	1pole	TRIP repeat mode
118	I> BF	BU@	0.10 .. 2.00 I/In	0.50 I/In	Current threshold for BF
119	I> BF-EF	BU@	0.05 .. 2.00 I/In	0.25 I/In	Current threshold for BF - EF
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 OFF	OFF	End fault protection
151A	Maint. Iso1	BU@	YES NO	YES	Maintenance for Isolator 1
152A	Maint. Iso2	BU@	YES NO	YES	Maintenance for Isolator 2
153A	Maint. Iso3	BU@	YES NO	YES	Maintenance for Isolator 3
154A	Maint. Iso4	BU@	YES NO	YES	Maintenance for Isolator 4
155A	Maint. Iso5	BU@	YES NO	YES	Maintenance for Isolator 5
156A	Maint. CB	BU@	YES NO	YES	Maintenance for CB
5104	FREQUENCY	P.System Data 1	50 Hz 60 Hz	50 Hz	Nominal frequency
5108A	Test mode SK	Protec. general	OFF ON	OFF	Test mode for module SK
5111A	Language BU	Protec. general	German English French Spanish Italian Russian	English	Language of bay units
5112A	OutEn BU-TEST	Protec. general	NO YES	NO	Output enable bay unit under test

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 NO	YES	Selective protection for transfer busbar
6101	STAB FAC:BZ	BB Protection	0.10 .. 0.80	0.65	Stabilizing 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	Stabilizing factor - CZ
6104	Id> CZ	BB Protection	0.20 .. 4.00 I/Ino	1.00 I/Ino	Diff-current threshold - CZ
6106	Tmin TRIP	Protec. general	0.01 .. 32.00 sec	0.15 sec	Minimum duration of TRIP command
6108A	Is< BZ.EF	BB Protection	0.00 .. 25.00 I/Ino	5.00 I/Ino	Stabilizing current threshold - BZ.EF
6109A	Id> BZ.EF	BB Protection	0.05 .. 4.00 I/Ino	0.25 I/Ino	Diff-current threshold - BZ.EF
6110A	Is< CZ.EF	BB Protection	0.00 .. 25.00 I/Ino	4.50 I/Ino	Stabilizing current threshold - CZ.EF
6111A	Id> CZ.EF	BB Protection	0.05 .. 4.00 I/Ino	0.25 I/Ino	Diff-current threshold - CZ.EF
6201	STAB FAC:BF	BF-Protection	0.00 .. 0.80	0.50	Stabilizing factor BF protection
6202A	Is< BF.EF	BF-Protection	0.00 .. 25.00 I/In	5.00 I/In	Stabilizing current threshold - BF.EF
6301	ISOL TIME	Monitoring	1.00 .. 180.00 sec	7.00 sec	Limit value isolator time
6302	ISOL Malfunct	Monitoring	alarm only blocking block./release block./acknow.	alarm only	Reaction on isolator malfunction
6303	ISOL DC FAIL	Monitoring	OLD ON	OLD	Treatment isolator status on DC fail
6304	ISOL ST 1/1	Monitoring	OLD ON	OLD	Treatment isolator status not plausible
6305	BLOCKING MODE	Monitoring	zone/phase protection	zone/phase	Blocking mode on failure
6306	DIFF SUPERV	Monitoring	ON 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 blocking block./release	blocking	Diff-current supervision mode -BZ
6311	DIF SUP mode CZ	Monitoring	alarm only blocking block./release	alarm only	Diff-current supervision mode -CZ
6312A	ZERO CR SUPERV	Monitoring	ON OFF	ON	Zero crossing supervision
6313A	I> ZERO CR	Monitoring	0.15 .. 4.00 I/Ino	0.50 I/Ino	Threshold for zero crossing supervi- sion
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 blocked	released	Control release for bay units
6320A	EF charact.	Protec. general	released blocked	blocked	Earth fault characteristic switchover
6401A	fault rec mode	Osc. Fault Rec.	global central 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
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 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 OFF	ON	O/C protection for phase faults
1202	I>>	O/C Protection Phases	0.05..25.00 I/I_N	2.00 I/I_N	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 YES	NO	Measurement repetition
1211	CHARACTER.	O/C Protection Phases	NORMAL INVERSE VERY INVERSE EXTREMELY INVERS.	NORMAL INVERSE	Characteristic of the O/C stage Ip
1212	I>	O/C Protection Phases	0.05.. 25.00 I/I_N	1.00 I/I_N	Pick-up value of the overcurrent stage I>
1213	T-I>	O/C Protection Phases	0.00..60.00 s infinite	0.50 s	Trip time delay of the overcurrent stage I>
1214	Ip	O/C Protection Phases	0.10..4.00 I/I_N	1.00 I/I_N	Pick-up value inverse time O/C stage Ip
1215	T-Ip	O/C Protection Phases	0.05..10.00 s 0 infinite	0.50 s	Trip time delay inverse time O/C stage Ip
1216	RMS FORMAT	O/C Protection Phases	FUNDAMENTAL TRUE RMS	FUNDAMENTAL	RMS format for inverse time O/C protection
1221	MAN.CLOSE	O/C Protection Phases	I>> UNDELAYED I>/Ip UNDELAYED 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 OFF	ON	O/C protection for earth faults
1502	IE>>	O/C Protection Earth	0.05..25.00 I/I_N	0.50 I/I_N	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 NO	NO	Measurement repetition
1511	CHARACTER.	O/C Protection Earth	NORMAL INVERSE VERY INVERSE EXTREMELY INVERS	NORMAL INVERS	Characteristic of the O/C stage IEp
1512	IE>	O/C Protection Earth	0.05..25.00 I/I_N	0.20 I/I_N	Pick-up value of the overcurrent stage IE>
1513	T-IE>	O/C Protection Earth	0.00..60.00 s infinite	0.50 s	Trip time delay of the overcurrent stage IE>
1514	IEp	O/C Protection Earth	0.10..4.00 I/I_N	0.10 I/I_N	Pick-up value inverse time O/C stage IEp
1515	T-IEp	O/C Protection Earth	0.05..10.00 s 0 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 TRUE RMS	FUNDAMENTAL	RMS format for inverse time O/C protection
1521	MAN.CLOSE	O/C Protection Earth	IE>> UNDELAYED IE>/IEp UNDELAY. 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 YES	0.00 s	Processing of annunciation 1 by central unit
2812	ANNUN2byCU	User Logic Functions	NO YES	0.00 s	Processing of annunciation 2 by central unit
2813	ANNUN3byCU	User Logic Functions	NO YES	0.00 s	Processing of annunciation 3 by central unit
2814	ANNUN4byCU	User Logic Functions	NO 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 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_N	0.50 I/I_N	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-protec.ext.start
4302	BLOCKAGE	Tests			Switch off the blockage of BF-protec.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. statis-tics			Number of trip commands issued
5607	ΣIL1/In=	CB operat. statis-tics			Summated current tripped IL1/In
5608	ΣIL2/In=	CB operat. statis-tics			Summated current tripped IL3/In
5609	ΣIL3/In=	CB operat. statis-tics			Summated current tripped IL2/In
5610	IL1/In=	CB operat. statis-tics			Last trip current IL1/In
5611	IL2/In=	CB operat. statis-tics			Last trip current IL2/In
5612	IL3/In=	CB operat. statis-tics			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 ENGLISH FRANCAIS ESPANOL ITALIANO PYCCK.	ENGLISH	Language
7120	OPER.1st L.	Integrated Operation	IL1, IL2, IL3, IE I-DIFF. L1, I-DIFF. L2, I-DIFF. L3 I-RESTR. L1, I-RESTR. 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 PRIMARY 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 I-DIFF. L1, I-DIFF. L2, I-DIFF. L3 I-RESTR. L1, I-RESTR. 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 SECONDARY 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 I-DIFF. L1, I-DIFF. L2, I-DIFF. L3 I-RESTR. L1, I-RESTR. 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 Operationg	PRIMARY SECONDARY 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 I-DIFF. L1, I-DIFF. L2, I-DIFF. L3 I-RESTR. L1, I-RESTR. 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 SECONDARY 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 ASCII	DIGSI V3	Data format for PC-interface
7215	PC BAUDRATE	PC/System Interfaces	1200 BAUD 2400 BAUD 4800 BAUD 9600 BAUD 19200 BAUD	9600 BAUD	Transmission baud rate for PC-interface
7216	PC PARITY	PC/System Interfaces	DIGSI V3 NO 2 STOP NO 1 STOP	DIGSI V3	Parity and stop-bits for PC-interface
7221	SYS INTERF.	PC/System Interfaces	VDEW COMPATIBLE VDEW EXTENDED DIGSI V3	DIGSI V3	Data format for system-interface
7222	SYS MEASUR.	PC/System Interfaces	VDEW COMPATIBLE VDEW EXTENDED	VDEW COMPATIBLE	Measurement format for system-interface
7227	SYS-SWITCH	PC/System Interfaces	NO YES	NO	Online-switch VDEW-DIGSI enabled
7233	SYS SUBV.T	PC/System Interfaces	1.. 600 s infinite	120 s	Supervision time for system-interface
7235	SYS-PARAMET	PC/System Interfaces	NO YES	NO	Parameterizing via system-interface
7402	INITIATION	Fault Recordings	STORAGE BY FD. STORAGE BY TRIP 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 recordingl

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 infinite	0.40 s	Storage time by initiation via binary input
7432	T-KEYBOARD	Fault Record-ingsg	0.10..5.00 s	0.40 s	Storage time by initiation via key-board
7812	CHARAC. PH	SCOPE OF FUNCTIONS	DEFINITE TIME INVERSE TIME	DEFINITE TIME	Characteristic O/C protection phas-es
7815	CHARAC. E	SCOPE OF FUNCTIONS	DEFINITE TIME INVERSE TIME	DEFINITE TIME	Characteristic O/C protection earth
7899	FREQUENCY	SCOPE OF FUNCTIONS	50 Hz 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 cur-rents

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:fdefinitely 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: fdefinitely 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. Isolator 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 n	Information Number m	Type	Effective Information 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 annuciations 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 ofIn-for-matio n	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 (>DataStop)	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 (DayLightSavTime)	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	Isolator fault alarm (Isol flt alarm)	Monitoring	OUT	*	*		*	LED			BO		194	186	1	Yes
10426	Failure of isolator aux. voltage (g.a.) (Bay DC fail G)	Monitoring	OUT	*	*		*	LED			BO		194	185	1	Yes
10427	Isolator fault: run time (group alarm) (Isol flt run G)	Monitoring	OUT	*	*		*	LED			BO		194	184	1	Yes
10428	Isolator position faulty (group alarm) (Isol 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	Timing error BF input (group alarm) (BF BI error G)	BF-Protection	OUT	*	*		*	LED			BO		194	181	1	Yes
10435	Timing error BF release (group alarm) (BF rel error 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	Timing error BF impulse input (g.a.) (BF ImpBI errorG)	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	*	*		*	LED			BO					
10445	Device Trip (group alarm) (Device trip G)	BB Protection	OUT	*	*		m	LED			BO		194	170	2	Yes

FNo.	Description	Function	Type ofIn-for-matio n	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 isolator fault (>Reset IsoMalBl)	Monitoring	SP	on	*		*	LED	BI		BO		194	222	1	Yes
10466	Reset blocking of isolator fault (Reset IsoMalBl)	Monitoring	OUT	on	*		*	LED			BO					
10467	Blocking of isolator fault reset (IsoMalBl Reset)	Monitoring	OUT_ Ev	on	*			LED			BO					
10470	Isolator oper. prohibited (isol.fault) (IsoProhib/fault)	Monitoring	OUT	on off	*		*	LED			BO		194	187	1	Yes
10471	Isolator oper. prohibited (group alarm) (IsoProhib 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 re-lease)	BB Protection	OUT	on off	*		*	LED			BO		194	178	1	Yes
10478	>Earth fault characteristic active (>EF charact.)	BB Protection	SP	on off	*		*	LED	BI		BO		194	160	1	Yes
10479	Earth fault characteristic active (EF charact.)	BB Protection	OUT	on off	*		*	LED			BO		194	161	1	Yes
10486	Timing error trip release (TripRel-Err)	Monitoring	OUT	*	*		*	LED			BO		194	179	1	Yes
10487	>TRIP-Release for external command (>TRIP-Release)	BB Protection	SP	on off	*		*	LED	BI		BO		194	159	1	Yes

FNo.	Description	Function	Type ofIn-for-matio n	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					
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					
009.0102	Failure EN100 Link Channel 2 (Ch2) (Fail Ch2)	EN100-Modul 1	IntSP	on off	*		*	LED			BO					
176.1061	$00 out of service (OutOfServ $00)	BU@	OUT	on off	*		*	LED			BO		195	6	1	Yes
176.1062	$00 isolator maintenance (Maint-en. $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	Timing error BF input $00 L1 (BF-BIErr$00 L1)	BU@	OUT	on off	*		*	LED			BO		195	18	1	Yes
176.1092	Timing error BF input $00 L2 (BF-BIErr$00 L2)	BU@	OUT	on off	*		*	LED			BO		195	19	1	Yes
176.1093	Timing error BF input $00 L3 (BF-BIErr$00 L3)	BU@	OUT	on off	*		*	LED			BO		195	20	1	Yes
176.1094	Timing error BF input $00 3pole (BFBIErr$00 3P)	BU@	OUT	on off	*		*	LED			BO		195	21	1	Yes
176.1101	Timing error BF release $00 1P (BFRlErr$00 1P)	BU@	OUT	on off	*		*	LED			BO		195	23	1	Yes
176.1102	Timing error BF release $00 3P (BFRlErr$00 3P)	BU@	OUT	on off	*		*	LED			BO		195	24	1	Yes
176.1104	Timing error BF pulse $00 (BF-PulsErr $00)	BU@	OUT	on off	*		*	LED			BO		195	17	1	Yes
176.1110	$01 Isolator $02 ($01 $02) [1)]	BU@	DP	*	*		*	LED			BO		195	25	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
176.1112	Fault: run time $01 isol. $02 (FltR $01 $02)	BU@	OUT	on	*		*	LED			BO		195	35	1	Yes
176.1113	Fault: dist.pos. $01 isol. $02 (FltP $01 $02)	BU@	OUT	on	*		*	LED			BO		195	30	1	Yes
176.1115	$01 Isolator $02 ($01 $02) [1)]	BU@	DP	*	*		*	LED			BO		195	26	1	Yes
176.1117	Fault: run time $01 isol. $02 (FltR $01 $02)	BU@	OUT	on	*		*	LED			BO		195	36	1	Yes
176.1118	Fault: dist.pos. $01 isol. $02 (FltP $01 $02)	BU@	OUT	on	*		*	LED			BO		195	31	1	Yes
176.1120	$01 Isolator $02 ($01 $02) [1)]	BU@	DP	*	*		*	LED			BO		195	27	1	Yes
176.1122	Fault: run time $01 isol. $02 (FltR $01 $02)	BU@	OUT	on	*		*	LED			BO		195	37	1	Yes
176.1123	Fault: dist.pos. $01 isol. $02 (FltP $01 $02)	BU@	OUT	on	*		*	LED			BO		195	32	1	Yes
176.1125	$01 Isolator $02 ($01 $02) [1)]	BU@	DP	*	*		*	LED			BO		195	28	1	Yes
176.1127	Fault: run time $01 isol. $02 (FltR $01 $02)	BU@	OUT	on	*		*	LED			BO		195	38	1	Yes
176.1128	Fault: dist.pos. $01 isol. $02 (FltP $01 $02)	BU@	OUT	on	*		*	LED			BO		195	33	1	Yes
176.1130	$01 Isolator $02 ($01 $02) [1)]	BU@	DP	*	*		*	LED			BO		195	29	1	Yes
176.1132	Fault: run time $01 isol. $02 (FltR $01 $02)	BU@	OUT	on	*		*	LED			BO		195	39	1	Yes
176.1133	Fault: dist.pos. $01 isol. $02 (FltP $01 $02)	BU@	OUT	on	*		*	LED			BO		195	34	1	Yes
176.1134	Failure isolator 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 (BatSu-perv $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

FNo.	Description	Function	Type of Information	Log-Buffer: Event Log On/Off	Log-Buffer: Trip (Fault) Log On/Off	Log-Buffer: Ground Fault Log On/Off	Log-Buffer: Marked in Oscill. Record	Configurable in Matrix: LED	Configurable in Matrix: Binary Input	Configurable in Matrix: Function Key	Configurable in Matrix: Binary Output	Configurable in Matrix: Chatter Blocking	IEC 60870-5-103: Type	IEC 60870-5-103: Information No.	IEC 60870-5-103: Data Unit	IEC 60870-5-103: General Interrogation
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	Timing error back-up BF inp $00 (BFBU BIEr $00)	BU@	OUT	on off	*		*	LED			BO		195	61	1	Yes
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	Blocked by fault $03 ($03 blkd Flt)	Protection Zone	OUT	on off	*		*	LED			BO		207	6	2	Yes
177.1334	>Block $03 (>Blk $03)	Protection Zone	SP	on off	*		*	LED	BI		BO	CB				
177.1335	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 BlkTrip)	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

FNo.	Description	Function	Type ofIn-for-mation	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
177.1360	>Trip command for $03 (>Trip $03)	Protection Zone	SP	on off	*		*	LED	BI		BO	CB				
177.1361	Timing error ext. Trip command $03 (TripBIErr $03)	Protection Zone	OUT	*	on		*	LED			BO					
177.1362	No release of Trip command $03 (noTripRel $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 (FltRecSta)	Osc. Fault Rec.	IntSP	on off	*		m	LED			BO		135	208	1	No
-	Hardware Test Mode (HWTest-Mod)	Device	IntSP	on off	*		*	LED			BO					
-	Reset LED (Reset LED)	Device	IntSP	on	*		*	LED			BO		194	19	1	No
-	Stop data transmission (DataS-top)	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	Binary Input I Binary Output O (LED, alarm relay) Trip Relay T	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
100	Wrong SW-vers	Wrong software-version	on								
101	Wrong dev. ID	Wrong device identification	on								
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							
116	E.F. Buff.Over	E/F buffer overflow									
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

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	Binary Input I Binary Output O (LED, alarm relay) Trip Relay T	Data Unit	Compatible Annunciation	General Interrogation	Annunc. for Fault Rec. Buffer (Tagged)	Type (p: Corresponds to parameter “Function type“)	Information Number
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						
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 IL1 =	M								
602	IL2 =	Current in phase IL2 =	M								
603	IL3 =	Current in phase IL3 =	M								
604	IE =	Earth current =	M								
651	IL1 =	Current in phase IL1 =	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						

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	Binary Input I Binary Output O (LED, alarm relay) Trip Relay T	Data Unit	Compatible Annunciation	General Interrogation	Annunc. for Fault Rec. Buffer (Tagged)	Type (p: Corresponds to parameter "Function type")	Information Number
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
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

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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
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

FNo.	Short Text	Logical Function	Log Buffers		Configurable in Matrix	IEC 60870-5-103					
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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
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	BB intertrip	Busbar protection: 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						

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7672	IDL1 =	BZ: Differential current phase L1	M								
7673	IDL2 =	BZ: Differential current phase L2	M								
7674	IDL3 =	BZ: Differential current phase L3	M								
7675	ISL1 =	BZ: Stabilising current phase L1	M								
7676	ISL2 =	BZ: Stabilising current phase L2	M								
7677	ISL3 =	BZ: Stabilising current phase L3	M								
7678	IDL1 =	BZ: Differential current phase L1	M								
7679	IDL2 =	BZ: Differential current phase L2	M								
7680	IDL3 =	BZ: Differential current phase L3	M								
7681	ISL1 =	BZ: Stabilising current phase L1	M								
7682	ISL2 =	BZ: Stabilising current phase L2	M								
7683	ISL3 =	BZ: Stabilising current phase L3	M								
7684	IL1=	Current in phase L1 =	M								
7685	IL2=	Current in phaset L2 =	M								
7686	IL3=	Current in phase L3 =	M								
7687	IE=	Earth current IE =	M								
7689	TR flt,Trp.po	Relay control circuit flt.,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	TR1flt,Trp.np	Relay1 control circuit flt.,no trip pos	on/off		OT	1		GI		194	145
7692	TR2flt,Trp.np	Relay2 control circuit flt.,no trip pos	on/off		OT	1		GI		194	146
7693	TR3flt,Trp.np	Relay3 control circuit flt.,no trip pos	on/off		OT	1		GI		194	147
7694	TR4flt,Trp.np	Relay4 control circuit flt.,no trip pos	on/off		OT	1		GI		194	148
7695	TR5flt,Trp.np	Relay5 control circuit flt.,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

Abbreviations

$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. Isolator or circuit breaker)
$03 Name of the bus zone

BUnn Bay number 01 to 48

BSZz Modules for protection processing BSZ1, BSZ2, BSZ3

Ln Phase L1, L2, L3

BZnn Bus zone 01 to12

Isoln Isolator 1 to 5

Group Alarm		Alarm		
FNo.	**Description**	**FNo.**	**Logical function**	**Relates to**
10476	Error with protection blocking	10455	Bay unit failure	BUnn
		10425	Isolator fault alarm [1]	BUnn, Isoln
		10443	BZ blocked selective (g. a.)	BZnn
		10410	Diff-current superv. CZ (group alarm) [2]	Ln
		10415	Diff-current superv. BZ (group alarm) [3]	BZnn, Ln, BSZ2/3
		176.1171	15V supply supervision $00	BUnn
		176.1172	5V supply supervision $00	BUnn
		176.1173	0V supply supervision $00	BUnn
		10423	Measured value superv. BU (group alarm)	BUnn
		10444	Blocking by supervision zero crossing (Block ZeroCross)	BZnn
10475	Error without protection blocking	10425	Isolator fault alarm [4]	BUnn, Isoln
		10410	Diff-current superv. CZ (group alarm)[5]	Ln
		10415	Diff-current superv. BZ (group alarm) [6]	BZn, 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	BUnn
10445	Device Trip	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

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	Timing error BF input	176.1091	Timing error BF input $00 L1	BUnn
		176.1092	Timing error BF input $00 L2	BUnn
		176.1093	Timing error BF input $00 L3	BUnn
		176.1096	Timing error BF input $00 3pole	BUnn
10435	Timing error BF release	176.1101	Timing error BF release $00 1pole	BUnn
		176.1102	Timing error BF release $00 3pole	BUnn
10437	Timing error BF impulse input	176.1104	Timing error BF impulse input $00	BUnn
10453	Bay out of service	176.1061	Bay $00 out of service	BUnn
10454	Maintenance of bay	176.1062	$00 isolator maintenance	BUnn
10471	Isolator oper. prohibited	176.1062	$00 isolator 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	Blocked by fault $03	BZnn
10425	Isolator fault alarm	10426	Failure of isolator aux. voltage (g.a.) [1]	BUnn
		10427	Isolator fault: run time (group alarm) [1]	BUnn, Isoln
		10428	Isolator position faulty (group alarm) [1]	BUnn, Isoln
10427	Isolator fault: run time	176.1112	Fault: run time $01 isolator $02	BUnn
		176.1117	Fault: run time $01 isolator $02	BUnn
		176.1122	Fault: run time $01 isolator $02	BUnn
		176.1127	Fault: run time $01 isolator $02	BUnn
		176.1132	Fault: run time $01 isolator $02	BUnn
10428	Isolator position faulty (group alarm)	176.1113	Fault: dist. position $01 isolator $02	BUnn
		176.1118	Fault: dist. position $01 isolator $02	BUnn
		176.1123	Fault: dist. position $01 isolator $02	BUnn
		176.1128	Fault: dist. position $01 isolator $02	BUnn
		176.1133	Fault: dist. position $01 isolator $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
10423	Measured value superv. BU	176.1175	Measured value superv. $00	BUnn
10429	Failure in auto testing	176.1190	Failure in automatic testing $00	BUnn

1 If Parameter **ISOL Malfunct**(**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 **ISOL Malfunct** (**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 o***alarm only*** .

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 cur-rents	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 Comments

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

Column Function: Checkzone I_d, I_s is not allocateable 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 395.

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 IsoMalBl	10465	>Reset blocking of isolator 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 M	10455	Bay unit failure
3	Meas sup BU M	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 M	10424	Supply voltage superv. BU
5	Flt autotest M	10429	Failure in auto testing
6	not assigned	–	not assigned
7	BF ImpBI errorM	10437	Timing error BF impulse input
	BF rel error M	10435	Timing error BF release
	BF BI error M	10434	Timing error BF input
8	Id-sup CZ M	10410	Diff-current superv. CZ
	Id-sup BZ M	10415	Diff-current superv. BZ

Relay	Annunciation	FNo.	Comments
9	CB fault M	10456	Circuit breaker fault
	Bay DC fail M	10426	Failure of isolator aux. voltage
	Isol flt run M	10427	Isolator fault: run time
	Isol flt pos M	10428	Isolator position faulty
	Isol flt alarm	10425	Isolator fault alarm
10	TRIP blocked	10442	TRIP commands blocked
11	BF blocked	10432	Breaker Failure Protection blocked
12	Maintenance M	10454	Maintenance of bay
	out of serv. M	10453	Bay out of service
13	IsoProhib/fault	10470	Isolator oper. prohibited
	IsoProhib G	10471	Isolator oper. prohibited
14	TripRep BU M	10450	Trip repeat BU
15	Transf. Trip M	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 M	10455	Bay unit failure
	Meas sup BU M	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 M	10424	Supply voltage superv. BU
5	Flt autotest M	10429	Failure in auto testing
6	not assigned	–	not assigned
7	BF ImpBI errorM	10437	Timing error BF impulse input
	BF rel error M	10435	Timing error BF release
	BF BI error M	10434	Timing error BF input
8	Id-sup CZ M	10410	Diff-current superv. CZ
	Id-sup BZ M	10415	Diff-current superv. BZ

LED	Annunciation	FNo	Comments
9	CB fault M	10456	Circuit breaker fault
	Bay DC fail M	10426	Failure of isolator aux. voltage
	Isol flt run M	10427	Isolator fault: run time
	Isol flt pos M	10428	Isolator position faulty
	Isol flt alarm	10425	Isolator fault alarm
10	TRIP blocked	10442	TRIP commands blocked
11	BF blocked	10432	Breaker Failure Protection blocked
12	Maintenance M	10454	Maintenance of bay
	out of serv. M	10453	Bay out of service
13	IsoProhib/fault	10470	Isolator oper. prohibited
	IsoProhib G	10471	Isolator oper. prohibited
14	TripRep BU M	10450	Trip repeat BU
15	Transf. Trip M	10433	Breaker Failure/Transfer Trip
16	Device trip M	10445	Device Trip
17	Trip L1 M	10446	Trip command L1
18	Trip L2 M	10447	Trip command L2
19	Trip L3 M	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, annunciations 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 398 to Table A-30, page 400.

Table A-26 Marshalling of the binary inputs of the bay unit 7SS523

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	>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 INPUT16	>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 CBF Trip L123 CBF Trp.rp.3p CBF Trp.rp.L1 CB Test L1 O/C Gen.Trip	7631 7643 7632 7633 7636 1791	Busbar protection: Trip in phase L123 CBF protection: Trip L123 CBF protection: Trip repeat phase L123 CBF protection: Trip repeat phase L1 Circuit breaker test: Trip phase L1 O/C general trip command
6402	TRIP RELAY 2	BB Trip L123 CBF Trip L123 CBF Trp.rp.3p CBF Trp.rp.L2 CB Test L2 O/C Gen.Trip	7631 7643 7632 7634 7637 1791	Busbar protection: Trip in phase L123 CBF protection: Trip L123 CBF protection: Trip repeat phase L123 CBF protection: Trip repeat phase L2 Circuit breaker test: Trip phase L2 O/C general trip command
6403	TRIP RELAY 3	BB Trip L123 CBF Trip L123 CBF Trp.rp.3p CBF Trp.rp.L3 CB Test L3 O/C Gen.Trip	7631 7643 7632 7635 7638 1791	Busbar protection: Trip in phase L123 CBF protection: Trip L123 CBF protection: Trip repeat phase L123 CBF protection: Trip repeat phase L3 Circuit breaker test: Trip phase L3 O/C general trip command
6404	TRIP RELAY 4	BB Trip L123 CBF Trip L123 CBF Trp.rp.3p CBF Trp.rp.L1 CBF Trp.rp.L2 CBF Trp.rp.L3 CB Test L1 CB Test L2 CB Test L3 O/C Gen.Trip	7631 7643 7632 7633 7634 7635 7636 7637 7638 1791	Busbar protection: Trip in phase L123 CBF protection: Trip L123 CBF protection: Trip repeat phase L123 CBF protection: Trip repeat phase L1 CBF protection: Trip repeat phase L2 CBF protection: Trip repeat phase L3 Circuit breaker test: Trip phase L1 Circuit breaker test: Trip phase L2 Circuit breaker test: Trip phase L3 O/C general trip command
6405	TRIP RELAY 5	BB intertrip End-Flt. Trip	7639 7644	Busbar protection: Intertrip 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 CBF Trip L123 CBF Trp.rp.3p CBF Trp.rp.L1 CBF Trp.rp.L2 CBF Trp.rp.L3 CB Test L1 CB Test L2 CB Test L3 relay Trip	m m m m m m m m m m	7631 7643 7632 7633 7634 7635 7636 7637 7638 0511	Busbar protection: Trip in phase L123 CBF protection: Trip L123 CBF protection: Trip repeat phase L123 CBF protection: Trip repeat phase L1 CBF protection: Trip repeat phase L2 CBF protection: Trip repeat phase L3 Circuit breaker test: Trip phase L1 Circuit breaker test: Trip phase L2 Circuit breaker test: Trip phase L3 General trip of device
6315	LED 15	BB intertrip End-Flt. Trip	m m	7639 7644	Busbar protection: Intertrip 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, annunciations 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 401 to Table A-33, page 402.

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 CBF Trip L123 CBF Trp.rp.3p CBF Trp.rp.L1 CB Test L1 O/C Gen.Trip	7631 7643 7632 7633 7636 1791	Busbar protection: Trip in phase L123 CBF protection: Trip L123 CBF protection: Trip repeat phase L123 CBF protection: Trip repeat phase L1 Circuit breaker test: Trip phase L1 O/C general trip command
6402	TRIP RELAY 2	BB Trip L123 CBF Trip L123 CBF Trp.rp.3p CBF Trp.rp.L2 CB Test L2 O/C Gen.Trip	7631 7643 7632 7634 7637 1791	Busbar protection: Trip in phase L123 CBF protection: Trip L123 CBF protection: Trip repeat phase L123 CBF protection: Trip repeat phase L2 Circuit breaker test: Trip phase L2 O/C general trip command
6403	TRIP RELAY 3	BB Trip L123 CBF Trip L123 CBF Trp.rp.3p CBF Trp.rp.L3 CB Test L3 O/C Gen.Trip	7631 7643 7632 7635 7638 1791	Busbar protection: Trip in phase L123 CBF protection: Trip L123 CBF protection: Trip repeat phase L123 CBF protection: Trip repeat phase L3 Circuit breaker test: Trip phase L3 O/C general trip command
6404	TRIP RELAY 4	BB Trip L123 CBF Trip L123 CBF Trp.rp.3p CBF Trp.rp.L1 CBF Trp.rp.L2 CBF Trp.rp.L3 CB Test L1 CB Test L2 CB Test L3 O/C Gen.Trip	7631 7643 7632 7633 7634 7635 7636 7637 7638 1791	Busbar protection: Trip in phase L123 CBF protection: Trip L123 CBF protection: Trip repeat phase L123 CBF protection: Trip repeat phase L1 CBF protection: Trip repeat phase L2 CBF protection: Trip repeat phase L3 Circuit breaker test: Trip phase L1 Circuit breaker test: Trip phase L2 Circuit breaker test: Trip phase L3 O/C general trip command
6405	TRIP RELAY 5	BB intertrip End-Flt. Trip	7639 7644	Busbar protection: Intertrip 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

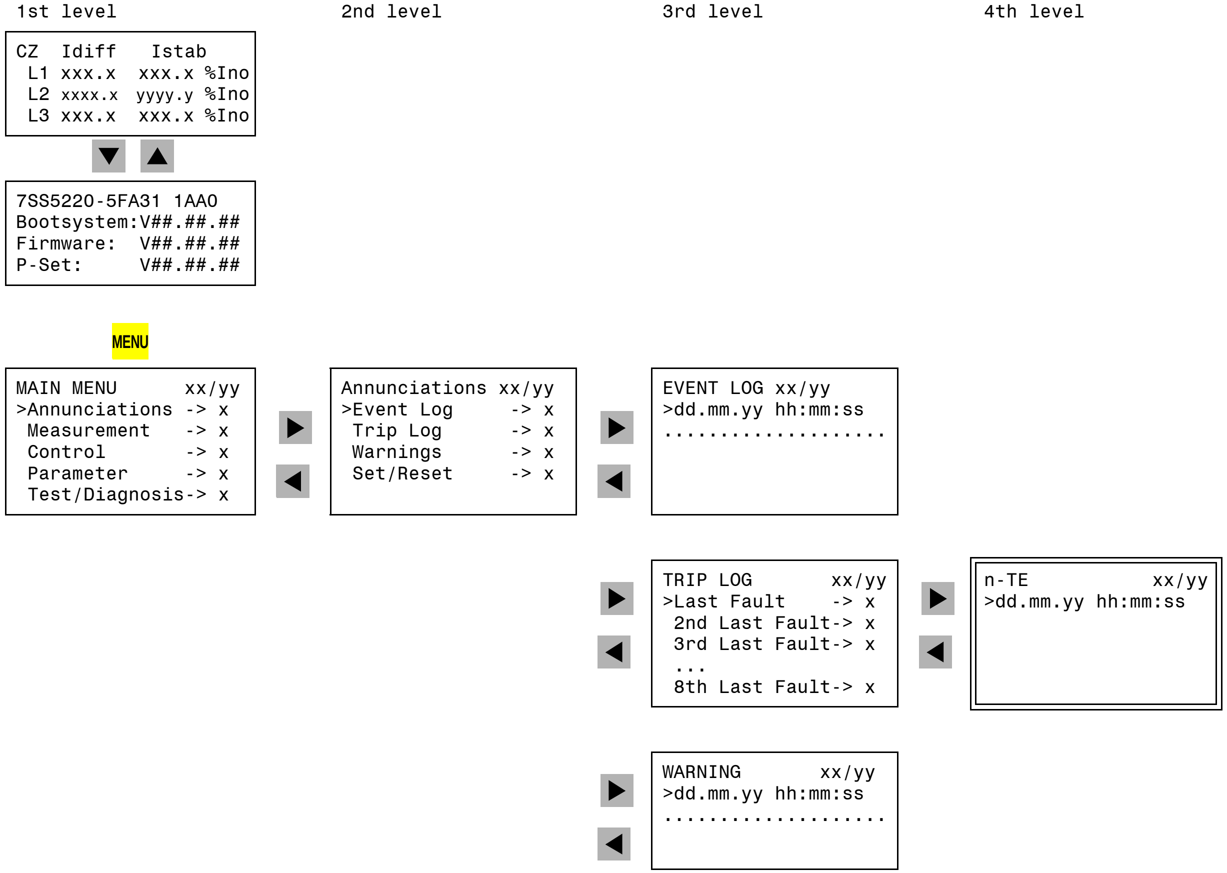


Table A-35 Navigation tree of the central unit

```
1st level          2nd level               3rd level               4th level               5th level

Main Menu          Annunciations           SET/RESET      xx/yy
                                           >Event Log     -> x
                                            Trip Log      -> x

                   Measurement xx/yy       Operation.PRI           BU I PRI        xx/nn   BUxx           xx/nn
                   >Operation.pri -> x     >BU I pri      -> xx    >BU01           -> xx   >BUxx IL1=     ###A
                    PERCENT       -> x                              ...                     BUxx IL2=     ###A
                                                                   BUxx           -> xx     BUxx IL3=     ###A

                                           PERCENT xx/yy           CZ ID,IS        xx/yy
                                           >CZ Id,Is     -> xx     >CZ Id L1=    ##%Ino
                                            BZ Id,Is     -> xx      CZ Id L2=    ##%Ino
                                            BU I         -> xx      CZ Id L3=    ##%Ino
                                            BU I norm    -> xx      CZ Is L1=    ##%Ino
                                                                    CZ Is L2=    ##%Ino
                                                                    CZ Is L3=    ##%Ino

                                                                   BZ ID,IS        xx/yy   BZyy           xx/nn
                                                                   >BZ01            ->xx   >BZyy Id L1=  ##%Ino
                                                                    ...                     BZyy Id L2=  ##%Ino
                                                                    BZyy            ->xx    BZyy Id L3=  ##%Ino
                                                                                            BZyy Is L1=  ##%Ino
                                                                                            BZyy Is L2=  ##%Ino
                                                                                            BZyy Is L3=  ##%Ino

                                                                   BU I     xx/nn          BUxx           xx/nn
                                                                   >BU01           -> xx   >BUxx IL1=      ##%
                                                                    ...                     BUxx IL2=      ##%
                                                                    BUxx           -> xx    BUxx IL =      ##%

                                                                   BU I     xx/nn          BUxx           xx/nn
                                                                   >BU01           -> xx   >BUxx IL1=     ##%Ino
                                                                    ...                     BUxx IL2=     ##%Ino
                                                                    BUxx           -> xx    BUxx IL =     ##%Ino
```

Table A-35 Navigation tree of the central unit

```
1st level        2nd level               3rd level               4th level               5th level
```

Main Menu

Control

```
Control        xx/yy
>Taggings       -> x
 Interlock      -> x
```

Taggings

```
Taggings       xx/yy
>Display        -> x
 Set            -> x
```

```
Display xx/yy
>TRIP blocking  OFF
 Blocking
 BF             OFF
```

```
SET xx/yy
>TRIP blocking  OFF
 Blocking BF    OFF
```

```
Interlock xx/yy
>TRIP blocking   - -
 Blocking BF     - -
```

```
PARAMETER      xx/yy
>Device Config. -> x
 Masking (I/O)  -> x
 Substat. Data  -> x
 Param. Group   -> x
 Fault Recording-> x
 BU             -> x
 Setup/Extras   -> x
```

```
Device Config. xx/yy
```

```
Masking (I/O)  xx/yy
>Binary Inputs  -> x
 LED            -> x
 Binary Output  -> x
```

```
Binary Inputs  xx/yy
>Binary Input1  -> -
 ...
 Binary Input12 -> -
```

```
LED            xx/yy
>LED 1          -> -
 ...
 LED 32         -> -
```

Table A-35 Navigation tree of the central unit

1st level	2nd level	3rd level	4th level	5th level
			Binary Outputs xx/yy >Binary Output1 -> - ... Binary Output16-> -	
Main Menu	Parameter	Subst. Data 5104 Frequency ## Hz		
		Param. Group xx/yy >General -> x BB Prot. -> x BF Prot. -> x BU -> x Supervision -> x	General xx/yy 6106 Tmin TRIP #.##s	
			General xx/yy 5401 PROT.TR BUS released	
			General xx/yy 6318 CRTL REL BU >released	
			BB PROT. xx/yy 6101 STAB FAC BZ >#.##	
			BB PROT. xx/yy 6102 Id> BZ >#.##I/Ino	

Table A-35 Navigation tree of the central unit

1st level	2nd level	3rd level	4th level	5th level
Main Menu	Parameter	Param.Group		

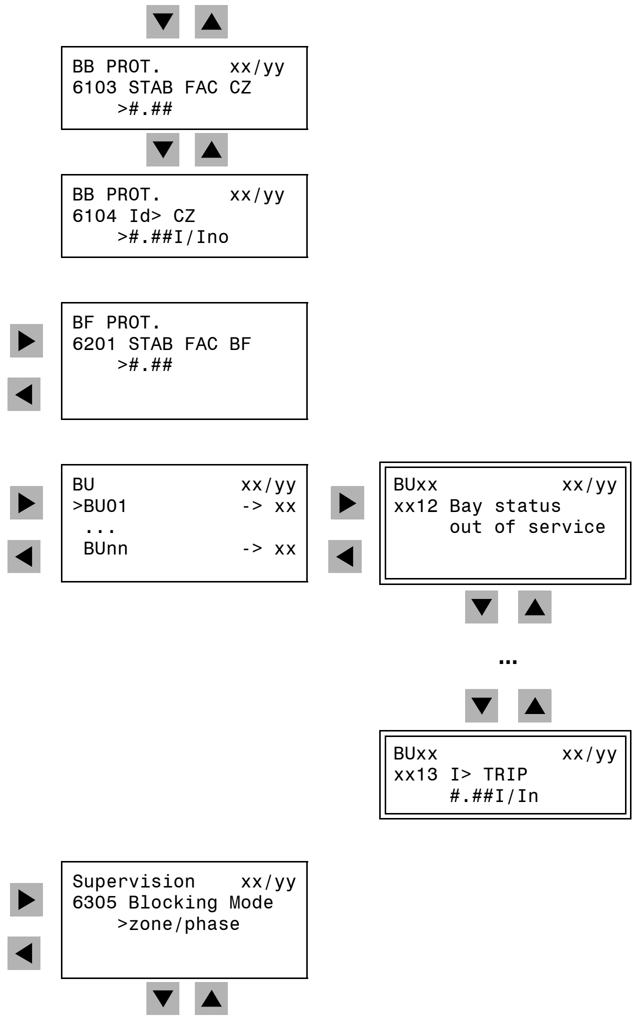


Table A-35 Navigation tree of the central unit

1st level	2nd level	3rd level	4th level	5th level
Main Menu	Parameter	Param. Group	Supervision xx/yy 6306 DIFF.SUPERV >ON	
			Supervision xx/yy 6308 Id> SUPERV BZ >#.##I/Ino	
			Supervision xx/yy 6309 Id> SUPERV CZ >#.##I/Ino	
			Supervision xx/yy 6310 DIF SUP mode BZ blocking	
			Supervision xx/yy 6311 DIF SUP mode CZ alarm only	
			Supervision xx/yy 6307 TIdiff SUPERV >#.##s	
			Supervision xx/yy 6301 ISOL RUN TIME >#.##s	
			Supervision xx/yy 6303 ISOL DC FAIL >old isolator status	

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 6304 ISOL ST 1/1 >old isolator status	
			Supervision xx/yy 6302 ISOL Malfunct alarm only	
			Supervision xx/yy 6316 I> MAN TRIP #.##I/In	
		Osc.Fault Rec. xx/yy 6404 MAX. LENGTH >#.##s		
		Osc.Fault Rec. xx/yy 6405 PRE.TRIG.TIME >#.##s		
		Osc.Fault Rec. xx/yy 6406 POST REC TIME >#.##s		
		Osc.Fault Rec. xx/yy 6407 BinIn CAPT. TIME >#.##s		

Table A-35 Navigation tree of the central unit

```
1st level              2nd level              3rd level              4th level              5th level
```

1st level: Main Menu

2nd level: Parameter

3rd level:

```
BU             xx/yy
>BU01          -> xx
 ...
 BUnn          -> xx
```

4th level:

```
BUxx
xx12 Bay status
    >out of service
```

3rd level:

```
SETUP/EXTRAS   xx/yy
>Date/Time     -> x
 Clock Setup   -> x
 Serial Ports  -> x
 Device #      -> x
 MLFB/Version  -> x
 Contrast      -> x
```

4th level:

```
Date/Time
Status:  -- NS ER ST
>DD.MM.YYY hh:mm:ss
Diff. time:--------
```

```
CLOCK SETUP    xx/yy
Source         >T103
Error Time   >100min
Offset         >2min
```

```
Serial Ports   xx/yy
>PC port        -> x
 System port    -> x
 Service port   -> x
```

5th level:

```
PC PORT        xx/yy
 Phys.Addr.     >254
 Baud rate>19200Baud
 Parity         >8E1
 Gaps         >#.##s
```

```
SYSTEM PORT
>IEC 60870-5-103 ->x
```

```
SERVICE PORT   xx/yy
 Phys.Addr.     >254
 Baud rate>19200Baud
 Parity         >8E1
 Gaps        >#.##s
```

6th level for SYSTEM PORT

```
IEC 60870-5-103xx/yy
Phys.Addr.     >254
Baud rate>19200Baud
Parity         >8E1
Gaps         >#.##s
OFF-Sig.  Light>off
```

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
		BLK DATA TRANS Blk Data Trans >OFF		
Main Menu	Test/Diagnosis			
		Hardware Test HWTestMod >OFF		
		Osc.Fault Rec. FltRecSta >ON		
		Set/Reset xx/yy >Event Log x TRIP log x Reset Id-Block x Reset IsoMalBl x		

4 Fault

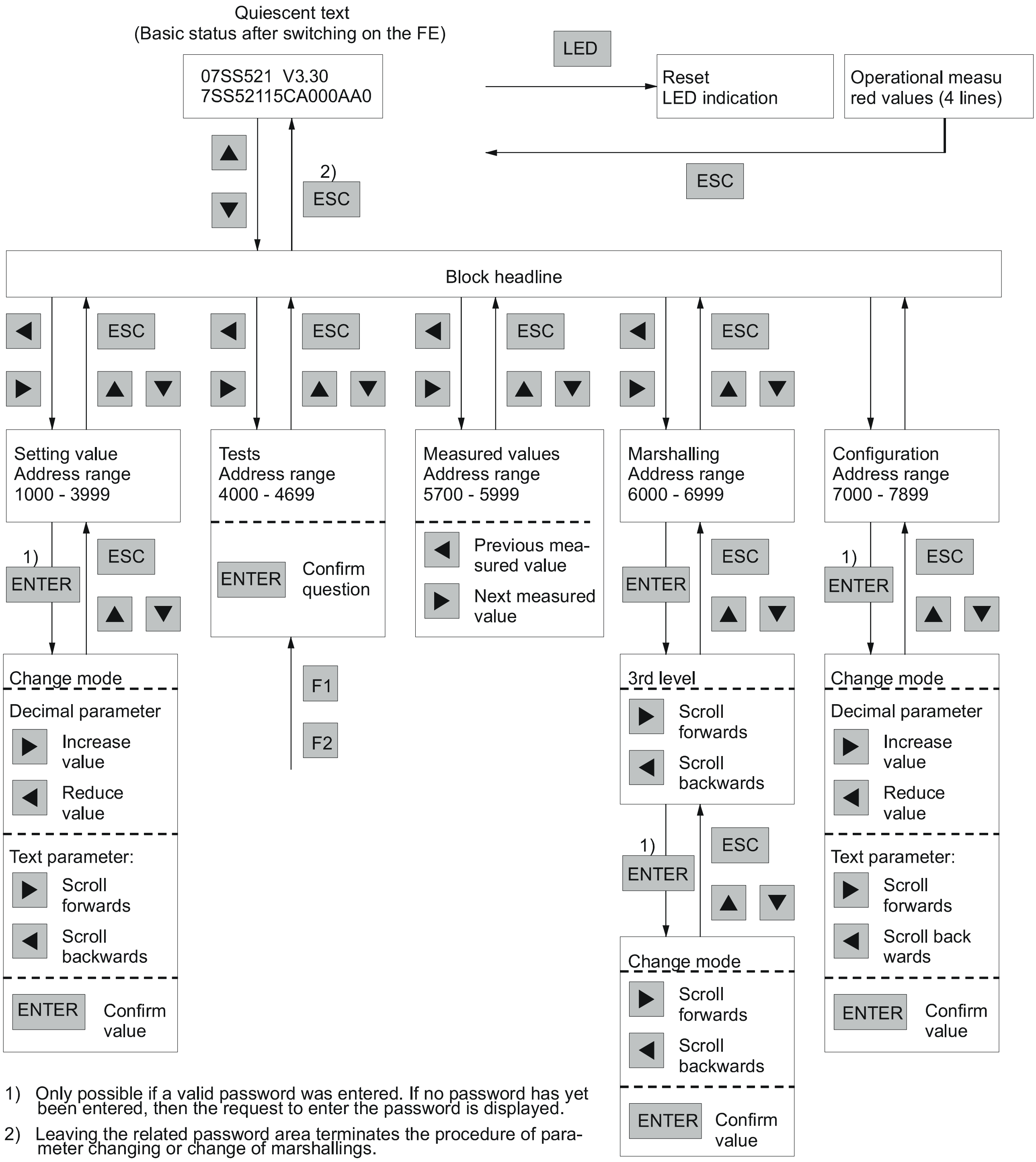
```
Device TRIP
Transf. TRIP M
```

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.



1) Only possible if a valid password was entered. If no password has yet been entered, then the request to enter the password is displayed.

2) Leaving the related password area terminates the procedure of parameter changing or change of marshallings.

Figure A-17 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
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-A8

/2/ SIPROTEC DIGSI 4, Start-Up
E50417-G1176-C152-A4

/3/ DIGSI CFC, Manual
E50417-H1176-C098-A9

/4/ SIPROTEC SIGRA 4, Manual
E50417-H1176-C070-A4

/5/ Ethernet & IEC 61850 Start UP
E50417-F1100-C324-A1

/6/ SIPROTEC Distributed Busbar/Breaker Failure Protection
IEC 61850 PIXIT
C53000-G1176-C180-2

Index

R

S

To

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Dept. PTD EA D TC25

D-90459 Nürnberg

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Corrections/Suggestions

Subject to technical alteration

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