SIPROTEC

Input / Output Unit with Local Control 6MD63

V4.6

Manual

C53000-G1840-C101-7

Disclaimer of liability

We have checked the text of this manual against the hardware and software described. 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 information in this manual is checked periodically, and necessary corrections will be included in future editions. We appreciate any suggested improvements.

We reserve the right to make technical improvements without notice.

Release 4.60.02

Preface

Purpose of this Manual

This manual describes the functions, operation, installation, and commissioning of the device 6MD63. In particular, one will find:

- Information regarding the configuration of the device extent and descriptions of device functions and settings → Chapter 2;
- Instructions for mounting and commissioning → Chapter 3,
- Compilation of technical data→ Chapter 4,
- As well as a compilation of the most significant data for experienced users in Appendix A.

General information about design, configuration, and operation of SIPROTEC® 4 devices is laid down in the SIPROTEC® System Description /1/.

Target Audience

Protection engineers, commissioning engineers, personnel concerned with adjustment, checking, and service of selective protective equipment, automatic and control facilities, and personnel of electrical facilities and power plants.

Applicability of this Manual

This manual is valid for: SIPROTEC® 4 Input / Output Unit with Local Control 6MD63; firmware version V4.6.

Indication of Conformity

CE	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 certain voltage limits (Low-voltage Directive 73/23/EEC). This conformity is proved by tests conducted by Siemens AG in accordance with Article 10 of the Council Directive in agreement with the generic standards EN 50081 and EN 61000-6-2 for EMC directive and with the standard EN 60255–6 for the low-voltage directive. This device was designed and produced for industrial use according to the EMC standard. The product conforms with the international standard of the series IEC 60255 and the German standard VDE 0435.

This product is UL-certified according to the Technical Data:

c UL us LISTED — IND. CONT. EQ. TYPE 1 76CA

c RU us — IND. CONT. EQ. TYPE 1 76CA

Additional Support

Should further information on the System SIPROTEC® 4 be desired or should particular problems arise which are not covered sufficiently for the purchaser's purpose, the matter should be referred to the local Siemens representative.

Training Courses

Individual course offerings may be found in our Training Catalogue, or questions may be directed to our training centre 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 warning terms and standard 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 particularly applies to 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!

When operating an electrical device, certain parts of the device inevitably have dangerous voltages.

Failure to observe these precautions can result in death, personal injury, or serious material damage.

Only qualified personnel shall work on and around this equipment. It must be 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.

Definition

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 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

To designate terms which refer in the text to information of the device or for the device, the following fonts are used:

`Parameter names`

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 operation software DIGSI®), are marked in bold letters of a monospace type style. This also applies to header bars for selection menus.

`3.280 feet (1,234A)`

Parameter addresses have the same character style as parameter names. Parameter addresses contain the suffix **A** in the overview tables if the parameter can only be set in DIGSI ® via the option **Display additional settings**.

`Parameter Conditions`

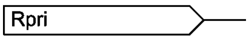
possible settings of text parameters, which may appear word-for-word in the display of the device or on the screen of a personal computer (with operation software DIGSI®), are additionally written in italics. This also applies to header bars for selection menus.

`“Annunciations”`

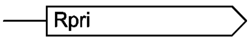
Designators for information, which may be output by the relay or required from other devices or from the switch gear, are marked in a monospace type style in quotation marks.

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

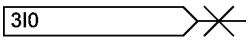
The following symbols are used in drawings:



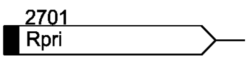
device-internal logical input signal



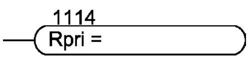
device-internal logical output signal



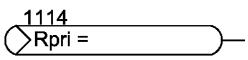
internal input signal of an analog quantity



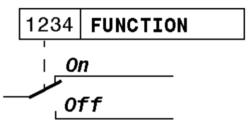
external binary input signal with number (binary input, input indication)



external binary output signal with number (device indication)

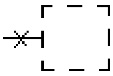


external binary output signal with number (device indication) used as input signal

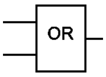


Example of a parameter switch designated **FUNCTION** with address 1234 and the possible settings **ON** and **OFF**

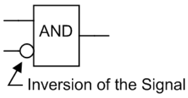
Besides these, graphical symbols are used according to IEC 60617-12 and IEC 60617-13 or symbols derived from these standards. Some of the most frequently used are listed below:



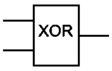
Input signal of an analogue quantity



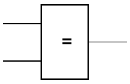
OR gate



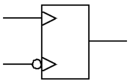
AND gate



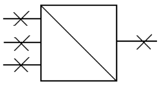
Exclusive OR gate (antivalence): output is active, if only **one** of the inputs is active



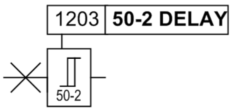
Coincidence gate (equivalence): output is active, if **both** inputs are active or inactive at the same time



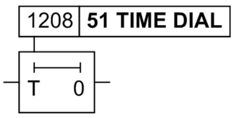
Dynamic inputs (edge-triggered) above with positive, below with negative edge



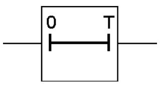
Formation of one analog output signal from a number of analog input signals



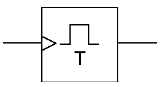
Limit stage with setting address and parameter designator (name)



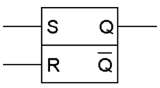
Timer (pickup delay T, example adjustable) with setting address and parameter designator (name)



Timer (dropout delay T, example non-adjustable)



Dynamic triggered pulse timer T (monoflop)



Static memory (RS-flipflop) with setting input (S), resetting input (R), output (Q) and inverted output ($\overline{Q}$)

Contents

Introduction 1

The SIPROTEC® 6MD63 device is introduced in this chapter. The device is presented in its application, characteristics, and scope of functions.

1.1 Overall Operation

The SIPROTEC® 6MD63 is a digital input/output unit with local control equipped with a powerful microprocessor. This provides fully numerical processing of all functions in the device, from the acquisition of the measured values up to the output of commands to the circuit breakers. Figure 1-1 shows the basic structure of the device.

Analog Inputs

The measuring inputs (MI) convert the currents and voltages coming from the instrument transformers and adapt them to the level appropriate for the internal processing of the device. The device is provided with 4 current and 3 voltage inputs. There are 3 current inputs for the input of phase currents. The 4th. input can be used for measuring the ground current I_N (current transformer starpoint or via a separate ground current transformer). The voltage inputs can either be used to measure the three phase-phase voltages, or two phase-phase voltages and the displacement voltage (e–n voltage). It is also possible to connect two phase-to-phase voltages. The analog input quantities are passed on to the input amplifiers (IA).

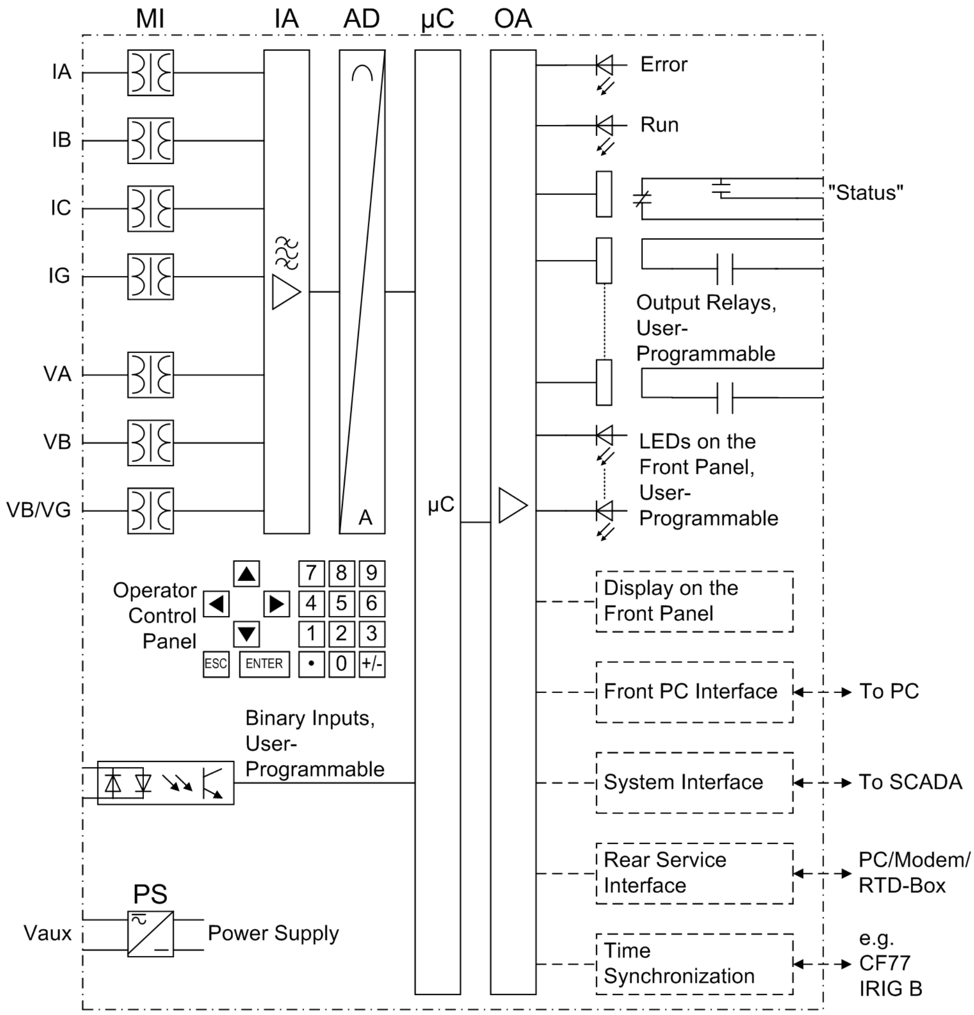


Figure 1-1 Hardware Structure of the 6MD63 numerical input/output unit

The input amplifier IA stage provides a high-resistance termination for the input quantities. It consists of filters that are optimized for measured-value processing with regard to bandwidth and processing speed.

The analog-to-digital (AD) stage consists of a multiplexor, an analog-to-digital (A/D) converter and of memory components for the transmission of digital signals to the microcomputer system.

Microcomputer System

The actual control functions and the control of the measured quantities are processed in the microcomputer system (μC). They especially consist of:

- Filtering and preparation of the measured quantities
- Continuous monitoring of the measured quantities
- Control of signals for the logic functions
- Output of control commands for switching devices
- Storage of messages,
- Management of the operating system and the associated functions such as data recording, real-time clock, communication, interfaces, etc.

Binary Inputs and Outputs

The computer system obtains external information through the binary input/output modules (inputs and outputs). The computer system obtains the information from the system (e.g. remote resetting) or the external equipment (e.g. blocking commands). Outputs are, in particular, commands to the switchgear units and annunciations for remote signalling of important events and statuses.

Front Elements

With devices with integrated or detached operator panel, information such as messages related to events, states, measured values and the functional status of the device are provided via light-emitting diodes (LEDs) and a display screen (LCD) on the front panel.

Integrated control and numeric keys in conjunction with the LCD facilitate interaction with the local device. Via these elements all information of the device such as configuration and setting parameters, operating messages and measured values can be accessed. Setting parameters may be changed in the same way.

In addition, control of circuit breakers and other equipment is possible from the front panel of the device.

Serial Interfaces

A serial **PC** interface at the front panel is provided for local communications with the device through a personal computer using the operating program DIGSI®. This facilitates a comfortable handling of all device functions.

A separate **service** interface can be provided for remote communications via a modem, or substation computer using DIGSI®. This interface is especially well suited for the fixed wiring of the devices to the PC or operation via a modem.

All data can be transferred to a central control or monitoring system via the serial **system interface.** This interface may be provided with various protocols and physical transmission schemes to suit the particular application.

A further interface is provided for the **time synchronization** of the internal clock via external synchronization sources.

Further communication protocols can be realized via additional interface modules.

Power Supply

The before-mentioned function elements and their voltage levels are supplied with power by a power supplying unit (Vaux or PS). Voltage dips may occur if the voltage supply system (substation battery) becomes short-circuited. Usually, they are bridged by a capacitor (see also Technical Data).

1.2 Application Scope

The SIPROTEC® 6MD63 is a numerical Input/Output Unit with Local Control equipped with control and monitoring functions.

The device includes the functions that are necessary for monitoring of circuit breaker positions, and control of the circuit breakers in straight bus applications or breaker-and-a-half configurations; therefore, the devices can be universally employed.

Control Functions

The device provides a control function which can be accomplished for activating and deactivating switchgears via integrated operator panel, system interface, binary inputs, and the serial port using a personal computer with DIGSI®.

The status of the primary equipment can be transmitted to the device via auxiliary contacts connected to binary inputs. The present status (or position) of the primary equipment can be displayed on the device, and used for interlocking or plausibility monitoring. The number of the operating equipment to be switched is limited by the binary inputs and outputs available in the device or the binary inputs and outputs allocated for the switch position indications. Depending on the primary equipment being controlled, one binary input (single point indication) or two binary inputs (double point indication) may be used for this process.

The capability of switching primary equipment can be restricted by a setting associated with switching authority (Remote or Local), and by the operating mode (interlocked/non-interlocked, with or without password request).

Processing of interlocking conditions for switching (e.g. system interlocking) can be established with the aid of integrated, user-configurable logic functions.

Messages and Measured Values

The operating messages provide information about conditions in the power system and the device. Measurement quantities and values that are calculated can be displayed locally and communicated via the serial interfaces.

Device messages can be allocated to a number of LEDs, externally processed via output contacts, linked with user-definable logic functions and/or issued via serial interfaces.

Communication

Serial interfaces are available for the communication with operating, control and memory systems.

A 9-pole DSUB socket at the front panel is used for local communication with a personal computer. By means of the SIPROTEC® 4 operating software DIGSI®, all operational and evaluation tasks can be executed via this **user** interface, such as specifying and modifying configuration parameters and settings, configuring user-specific logic functions, retrieving operational messages and measured values, inquiring device conditions and measured values, issuing control commands.

Depending on the individual ordering variant, additional interfaces are located at the rear side of the device. They serve to establish an extensive communication with other digital operating, control and memory components:

The **service** interface can be operated via electrical data lines or fiber optics and also allows communication via modem. For this reason, remote operation is possible via personal computer and the DIGSI® operating software, e.g. to operate several devices via a central PC.

The **system** interface ensures the central communication between the device and the substation controller. It can also be operated via data lines or fibre optic cables. For the data transfer Standard Protocols according IEC 60 870-5-103 are available via the system port. The integration of the devices into the substation automation systems SINAUT® LSA and SICAM® can also take place with this profile.

The EN-100-module allows the devices to be integrated in 100-Mbit-Ethernet communication networks in control and automation systems using protocols according to IEC61850. Besides control system integration, this interface enables DIGSI-communication and inter-relay communication via GOOSE.

Alternatively, a field bus coupling with PROFIBUS FMS is available for SIPROTEC® 4. The PROFIBUS FMS according to DIN 19 245 is an open communication standard that has particularly wide acceptance in process control and automation engineering, with especially high performance. A profile has been defined for the PROFIBUS communication that covers all of the information types required for protective and process control engineering. The integration of the devices into the power automation system SICAM® can also take place with this profile.

Besides the field-bus connection with PROFIBUS FMS, further couplings are possible with PROFIBUS DP and the protocols DNP3.0 and MODBUS. These protocols do not support all possibilities which are offered by PROFIBUS FMS.

1.3 Characteristics

General Characteristics

- Powerful 32-bit microprocessor system.
- Complete numerical processing and control of measured values, from the sampling of the analog input quantities to the initiation of outputs for, as an example, tripping or closing circuit breakers or other switchgear devices.
- Total electrical separation between the internal processing stages of the device and the external transformer, control, and DC supply circuits of the system because of the design of the binary inputs, outputs, and the DC or AC converters.
- Complete set of functions necessary for the proper control of feeders or busbars.
- Easy device operation through an integrated operator panel or by means of a connected personal computer running DIGSI.
- Continuous calculation and display of measured and metered values on the front of the device
- Storage of min/max measured values (slave pointer function) and storage of long-term mean values.
- Constant monitoring of the measurement quantities, as well as continuous self-diagnostics covering the hardware and software.
- Communication with SCADA or substation controller equipment via serial interfaces through the choice of data cable, modem, or optical fibers.
- Battery-buffered clock that can be synchronized with an IRIG-B (via satellite) or DCF77 signal, binary input signal, or system interface command.
- Statistics: Recording of the trip commands of the circuit breaker issued by the device.
- Operating Hours Counter: Tracking of operating hours of the equipment under load.
- Commissioning aids such as as connection check, direction determination, status indication of all binary inputs and outputs, easy check of system interface and influencing of information of the system interface during test operation.

Breaker Control

- Circuit breakers can be opened and closed via the process control keys (models with graphic displays only) or the programmable function keys on the front panel, through the system interface (e.g. by SICAM(r) or SCADA), or through the front PC interface using a personal computer with DIGSI(r) 4);
- Circuit breakers are monitored via the breaker auxiliary contacts;
- Plausibility monitoring of the circuit breaker position and check of interlocking conditions.

User-Defined Functions

- Freely programmable combination of internal and external signals for the implementation of user defined logic functions;
- All common Boolean operations are available for programming (AND, OR, NOT, Exclusive OR, etc.);
- Time delays and limit value inquiries;
- Processing of measured values, including zero suppression, adding a knee characteristic for a transducer input, and live-zero monitoring.

Phase Rotation

- Selectable phase rotation with a setting (static) or binary input (dynamic).

Monitoring Functions

- Availability of the device is greatly increased because of self-monitoring of the internal measurement circuits, power supply, hardware, and software;
- Monitoring of the current and voltage transformer secondary circuits by means of summation and symmetry checks;
- Phase rotation check.

RTD-Boxes

- Detection of any ambient temperatures or coolant temperatures by means of RTD-Boxes and external temperature sensors.

■

Functions 2

This chapter describes the numerous functions available in the SIPROTEC® 4 6MD63. It shows the setting possibilities for all the functions in maximum configuration. Instructions for deriving setting values and formulae, where required are provided.

Additionally, it may be defined which functions are to be used.

2.1 General

The function parameters can be modified using the operating or service interface with a personal computer using DIGSI®. The procedure is described in detail in the SIPROTEC ® System Description /1/.

2.1.1 Functional Scope

Functions that are not required can be disabled configuring the functional scope.

2.1.1.1 Description

Configuration of the Functional Scope

For 6MD63 the configuration of the functional scope is restricted to the temperature meters (RTD-boxes).

This additional function must be configured as enabled or disabled.

Functions configured as ***Disabled*** are not processed by the 6MD63. There are no annunciations, and corresponding settings (functions, limit values) are not queried during configuration.

Note

Available functions and default settings depend on the ordering code of the relay (see A.1).

2.1.1.2 Setting Notes

Setting of the Functional Scope

Configuration settings can be entered using a PC and the software program DIGSI and transferred via the front serial port or the rear service interface. The operation via DIGSI is explained in the SIPROTEC 4 System Description.

For changing configuration parameters in the device, password no. 7 is required (for parameter set). Without the password, the settings may be read, but may not be modified and transmitted to the device.

The functional scope with the available options is set in the **Functional Scope** dialog box to match plant requirements.

If you want to detect an ambient temperature or a coolant temperature, specify in address 190 **RTD-BOX INPUT** the port to which the RTD-box is connected. For 6MD63, **Port C** (service port) is used for this purpose. The number and transmission type of the temperature detectors (RTD = Resistance Temperature Detector) can be specified in address191 **RTD CONNECTION**: ***6 RTD simplex*** or ***6 RTD HDX*** (with one RTD-box) or ***12 RTD HDX*** (with two RTD-boxes). The settings have to comply with those of the RTD-box (see Subsection 2.3.2).

2.1.1.3 Settings

Addr.	Parameter	Setting Options	Default Setting	Comments
190	RTD-BOX INPUT	Disabled Port C	Disabled	External Temperature Input
191	RTD CONNECTION	6 RTD simplex 6 RTD HDX 12 RTD HDX	6 RTD simplex	Ext. Temperature Input Connection Type

2.1.2 Power System Data 1

2.1.2.1 Description

The device requires certain basic data regarding the protected equipment, so that the device can adapt to its desired application. Settings can only be performed in **Power System Data 1** using DIGSI.

Power System Data 1 comprises, e.g. nominal system data, nominal data of transformers, polarity ratios and their physical connections and similar. Furthermore, there are settings associated with all functions rather than a specific control or monitoring function. The following section discusses these parameters.

2.1.2.2 Setting Notes

General

To enter the Power System Data, use the operating program DIGSI.

Double-click on **Settings** and the desired selection options will be displayed. A dialog box with tabs **Power System Data 1**, Power System and CT's will open under VT's in which you can configure the individual parameters. Thus, the following descriptions are structured accordingly.

Nominal Frequency

The rated system frequency is set at address 214 **Rated Frequency**. The factory presetting in accordance with the model number must only be changed if the device will be employed for a purpose other than that which was planned when ordering.

Phase Rotation Reversal

Address 209 **PHASE SEQ.** is used to change the default phase sequence (***A B C*** for clockwise rotation), if your power system permanently has an anti-clockwise phase sequence (***A C B***). A temporary reversal of rotation is also possible using binary inputs (see Section 2.4.2).

Temperature Unit

Parameter settings allow to display the temperature values either in degree ***Celsius*** or in degree ***Fahrenheit*** under address 276 **TEMP. UNIT**.

Polarity of Current Transformers

At address 201 **CT Starpoint**, the polarity of the wye-connected current transformers is specified (the following figure applies correspondingly for two current transformers). This setting determines the measuring direction of the device (forwards = line direction). Modifying this setting also results in a polarity reversal of the ground current inputs I_N or I_{NS}.

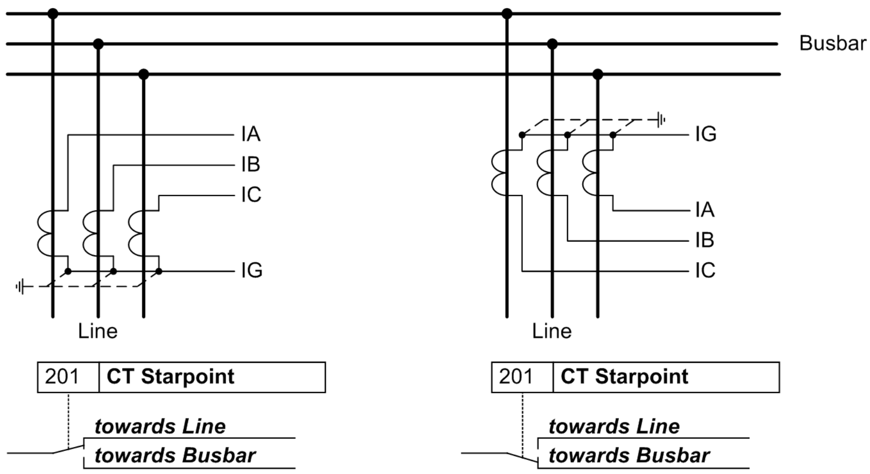


Figure 2-1 Polarity of current transformers

Voltage Connection

Address 213 specifies how the voltage transformers are connected. **VT Connect. 3ph** = ***Van, Vbn, Vcn*** means that three phase voltages in wye-connection are connected, **VT Connect. 3ph** = ***Vab, Vbc, VGnd*** signifies that two phase-to-phase voltages (V-connection) and V_N are connected. The latter setting is also selected when only two phase-to-phase voltage transformers are utilized or when only the displaced voltage (zero sequence voltage) is connected to the device.

Nominal Values of Current Transformers (CTs)

At addresses 204 **CT PRIMARY** and 205 **CT SECONDARY**, information is entered regarding the primary and secondary ampere ratings of the current transformers. It is important to ensure that the rated secondary current of the current transformer matches the rated current of the device, otherwise the device will incorrectly calculate primary data. At addresses 217 **Ignd-CT PRIM** and 218 **Ignd-CT SEC**, information is entered regarding the primary and secondary ampere rating of the current transformer. In case of normal connection (starpoint current connected to I_N-transformer) 217 **Ignd-CT PRIM** and 204 **CT PRIMARY** must be set to the same value.

Nominal Values of Voltage Transformers (VTs)

At addresses 202 **Vnom PRIMARY** and 203 **Vnom SECONDARY**, information is entered regarding the primary nominal voltage and secondary nominal voltage (phase-to-phase) of the connected voltage transformers.

Transformation Ratio of Voltage Transformers (VTs)

Address 206 **Vph / Vdelta** determines how the ground path of the voltage transformers is connected. This information is relevant for the detection of ground faults (in grounded systems and non-grounded systems) and measured-quantity monitoring.

If the voltage transformer set provides broken delta windings and if these windings are connected to the device, this must be specified accordingly in address 213 (see above margin heading "Voltage Connection"). Since transformation between voltage transformers usually is as follows:

$$\frac{V_{nomPrimary}}{\sqrt{3}} / \frac{V_{nomSecondary}}{\sqrt{3}} / \frac{N_{nomSecondary}}{3}$$

The factor V_{ph}/V_{delta} (secondary voltages, address 206 **Vph / Vdelta**) has the relation to 3/ √3 = √3 = 1.73 which must be used if the V_N voltage is connected. For other transformation ratios, i.e. the formation of the displacement voltage via an interconnected transformer set, the factor must be corrected accordingly.

2.1.2.3 Settings

Addresses which have an appended "A" can only be changed with DIGSI, under "Additional Settings".

Addr.	Parameter	Setting Options	Default Setting	Comments
201	CT Starpoint	towards Line towards Busbar	towards Line	CT Starpoint
202	Vnom PRIMARY	0.10 .. 800.00 kV	12.00 kV	Rated Primary Voltage
203	Vnom SECONDARY	100 .. 225 V	100 V	Rated Secondary Voltage (L-L)
204	CT PRIMARY	10 .. 50000 A	100 A	CT Rated Primary Current
205	CT SECONDARY	1A 5A	1A	CT Rated Secondary Current
206A	Vph / Vdelta	1.00 .. 3.00	1.73	Matching ratio Phase-VT To Open-Delta-VT
209	PHASE SEQ.	A B C A C B	A B C	Phase Sequence
213	VT Connect. 3ph	Van, Vbn, Vcn Vab, Vbc, VGnd	Van, Vbn, Vcn	VT Connection, three-phase
214	Rated Frequency	50 Hz 60 Hz	50 Hz	Rated Frequency
217	Ignd-CT PRIM	1 .. 50000 A	60 A	Ignd-CT rated primary current
218	Ignd-CT SEC	1A 5A	1A	Ignd-CT rated secondary current
276	TEMP. UNIT	Celsius Fahrenheit	Celsius	Unit of temperature measurement

2.1.2.4 Information List

No.	Information	Type of Information	Comments
5145	>Reverse Rot.	SP	>Reverse Phase Rotation
5147	Rotation ABC	OUT	Phase rotation ABC
5148	Rotation ACB	OUT	Phase rotation ACB

2.1.3 Power System Data 2

2.1.3.1 Description

The **Power System Data 2** includes settings associated with all functions rather than a specific control or monitoring function.

The **Power System Data 2** can be found in DIGSI using the function selection **setting groups A**.

Applications

If the primary reference voltage and the primary reference current of the system are set, the device is able to calculate and output the percentage operational measured values.

2.1.3.2 Setting Notes

Definition of Nominal Rated Values

At addresses 1101 **FullScaleVolt.** and 1102 **FullScaleCurr.**, the primary reference voltage (phase-to-phase) and reference current (phase) of the protected equipment is entered (e.g. motors). If these reference values match the primary values of the VT and CT rating, they correspond to the settings in address 202 and 204 (Subsection 2.1.2). They are generally used to show values referenced to full scale.

The settings for the **Power System Data 2** can be performed via the front panel or DIGSI.

Inversion of Measured Power Values / Metered Values

The directional values (power, power factor, work and related min., max., mean and thresholds), calculated in the operational measured values, are usually defined with positive direction towards the protected device. This requires that the connection polarity for the entire device was configured accordingly in the **P.System Data 1** (compare also "Polarity of Current Transformers", address 201). It is also possible to apply different settings to the “forward“ direction for the monitoring functions and the positive direction for the power etc., e.g. to have the active power supply (from the line to the busbar) displayed positively. To do so, set address 1108 **P,Q sign** to ***reversed***. If the setting is ***not reversed*** (default), the positive direction for the power etc. corresponds to the “forward“ direction for the monitoring functions.

2.1.3.3 Settings

Addr.	Parameter	Setting Options	Default Setting	Comments
1101	FullScaleVolt.	0.10 .. 800.00 kV	12.00 kV	Measurem:FullScaleVoltage(Equipm.rating)
1102	FullScaleCurr.	10 .. 50000 A	100 A	Measurem:FullScaleCurrent(Equipm.rating)
1108	P,Q sign	not reversed reversed	not reversed	P,Q operational measured values sign

2.1.3.4 Information List

No.	Information	Type of Information	Comments
16019	-	SP	-

2.1.4 Ethernet EN100-Modul

2.1.4.1 Functional Description

The **Ethernet EN100-Modul** enables integration of the 6MD63 in 100-Mbit communication networks in control and automation systems with the protocols according to IEC61850 standard (deliverable with version V4.60). This standard permits continuous communication of the devices without gateways and protocol converters. Even when installed in heterogeneous environments, SIPROTEC relays therefore provide for open and interoperable operation. Besides control system integration, this port enable DIGSI- and inter-relay communication.

2.1.4.2 Setting Notes

Interface Selection

No special settings are required for operating the Ethernet system interface module (IEC61850, **EN100-Modul 1**). If the ordered version of the device is equipped with such a module, it is automatically allocated to the interface available for it, namely ***Port B***.

2.1.4.3 Information List

No.	Information	Type of Information	Comments
009.0100	Failure Modul	IntSP	Failure EN100 Modul
009.0101	Fail Ch1	IntSP	Failure EN100 Link Channel 1 (Ch1)
009.0102	Fail Ch2	IntSP	Failure EN100 Link Channel 2 (Ch2)

2.2 Monitoring Functions

The device is equipped with extensive monitoring capabilities - both for hardware and software. In addition, the measured values are also constantly monitored for plausibility, therefore, the current transformer and voltage transformer circuits are largely integrated into the monitoring.

2.2.1 Measurement Supervision

2.2.1.1 General

The device monitoring extends from the measuring inputs to the binary outputs. Monitoring checks the hardware for malfunctions and impermissible conditions.

Hardware and software monitoring described in the following are enabled permanently. Settings (including the possibility to activate and deactivate the monitoring function) refer to monitoring of external transformers circuits.

2.2.1.2 Hardware Monitoring

Auxiliary and Reference Voltages

The processor voltage of 5 VDC is monitored by the hardware since if it goes below the minimum value, the processor is no longer functional. The device is under such a circumstance put out of operation. When the voltage returns, the processor system is restarted.

Failure of the supply voltage puts the device out of operation and a message is immediately generated by a dead contact. Brief auxiliary voltage interruptions of less than 50 ms do not disturb the readiness of the device (for nominal auxiliary voltage > 110 VDC).

The processor monitors the offset and reference voltage of the ADC (analog-digital converter). The device is put out of operation if the voltages deviate outside an allowable range, and persistent deviations are reported.

Buffer Battery

The buffer battery, which ensures operation of the internal clock and storage of counters and messages if the auxiliary voltage fails, is periodically checked for charge status. On its undershooting a minimum admissible voltage, the “`Fail Battery`” indication is issued.

Memory Components

All working memories (RAMs) are checked during start-up. If a fault occurs, the start is aborted and a LED starts flashing. During operation the memories are checked with the help of their checksum. For the program memory, the cross sum is formed cyclically and compared to the stored program cross sum.

For the settings memory, the cross sum is formed cyclically and compared to the cross sum that is freshly generated each time a setting process has taken place.

If a fault occurs the processor system is restarted.

Sampling

Sampling and the synchronization between the internal buffer components are constantly monitored. If any deviations cannot be removed by renewed synchronization, then the processor system is restarted.

2.2.1.3 Software Monitoring

Watchdog

For continuous monitoring of the program sequences, a time monitor is provided in the hardware (hardware watchdog) that expires upon failure of the processor or an internal program, and causes a complete restart of the processor system.

An additional software watchdog ensures that malfunctions during the processing of programs are discovered. This also initiates a restart of the processor system.

If such a malfunction is not cleared by the restart, an additional restart attempt is begun. After three unsuccessful restarts within a 30 second window of time, the device automatically removes the Input / Output unit itself from service and the red "Error" LED lights up. The readiness relay drops out and indicates "device malfunction" with its normally closed contact.

Offset Monitoring

This monitoring function checks all ring buffer data channels for corrupt offset replication of the analog/digital transformers and the analog input paths using offset filters. The eventual offset errors are detected using DC voltage filters and the associated samples are corrected up to a specific limit. If this limit is exceeded an indication is issued (191 “Error Offset”) that is part of the warn group annunciation (annunciation 160). As increased offset values affect the reliability of measurements taken, we recommend to send the device to the OEM plant for corrective action if this annunciation continuously occurs.

2.2.1.4 Monitoring of the Transformer Circuits

Interruptions or short circuits in the secondary circuits of the current and voltage transformers, as well as faults in the connections (important during commissioning!), are detected and reported by the device. The measured quantities are cyclically checked in the background for this purpose.

Measurement Value Acquisition – Currents

Up to four input currents are measured by the device. If the three phase currents and the earth fault current from the current transformer star point or a separated earth current transformer of the line to be protected are connected to the device, their digitised sum must be zero. Faults in the current circuit are recognised if

$$I_F = | i_A + i_B + i_C + k_I \cdot i_N | > \Sigma\ \mathbf{I\ THRESHOLD} \cdot I_{Nom} + \Sigma\ \mathbf{I\ FACTOR} \cdot I_{max}$$

The factor k_I takes into account a possible difference in the neutral current transformer ratio I_N (e.g. toroidal current transformer, see addresses 217, 218, 204 and 205):

$$k_I = \frac{\text{Ignd-CT PRIM} / \text{Ignd-CT SEC}}{\text{CT PRIMARY} / \text{CT SECONDARY}}$$

Σ **I THRESHOLD** and Σ **I FACTOR** are programmable settings. The component Σ **I FACTOR** $\cdot I_{max}$ takes into account the permissible current proportional ratio errors of the input transformer which are particularly prevalent during large short-circuit currents (Figure 2-2). The dropout ratio is about 97 %.This malfunction is reported as “Failure Σ I”.

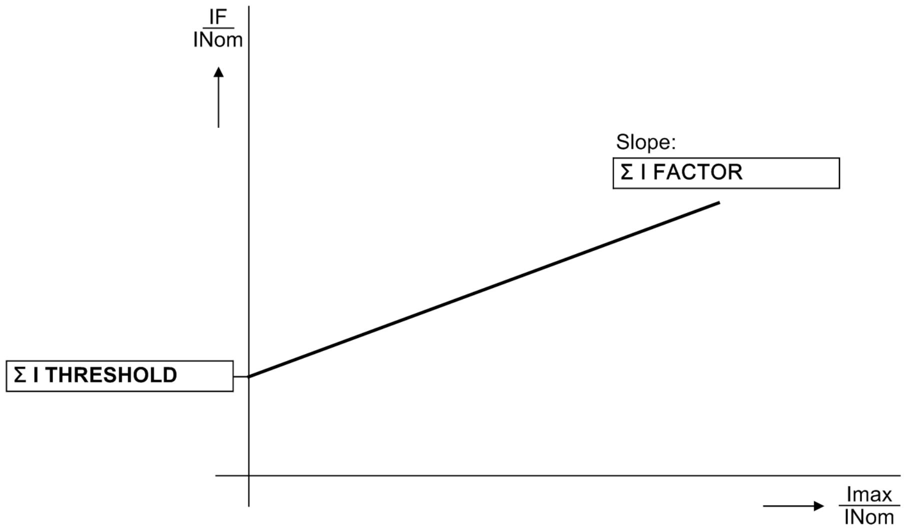


Figure 2-2 Current sum monitoring

Current Balance

During normal system operation, balance among the input currents is expected. The symmetry is monitored in the device by magnitude comparison. The smallest phase current is compared to the largest phase current. Imbalance is detected if $| I_{min} | / | I_{max} | <$ **BAL. FACTOR I**, as long as $I_{max} / I_{Nom} >$ **BALANCE I LIMIT** $/ I_{Nom}$.

Where I_{max} is the largest of the three phase currents and I_{min} the smallest. The balance factor **BAL. FACTOR I** represents the allowable asymmetry of the phase currents while the limit value **BALANCE I LIMIT** is the lower limit of the operating range of this monitoring (see Figure 2-3). Both parameters can be set. The dropout ratio is about 97%.

This imbalance is reported as “Fail I balance”.

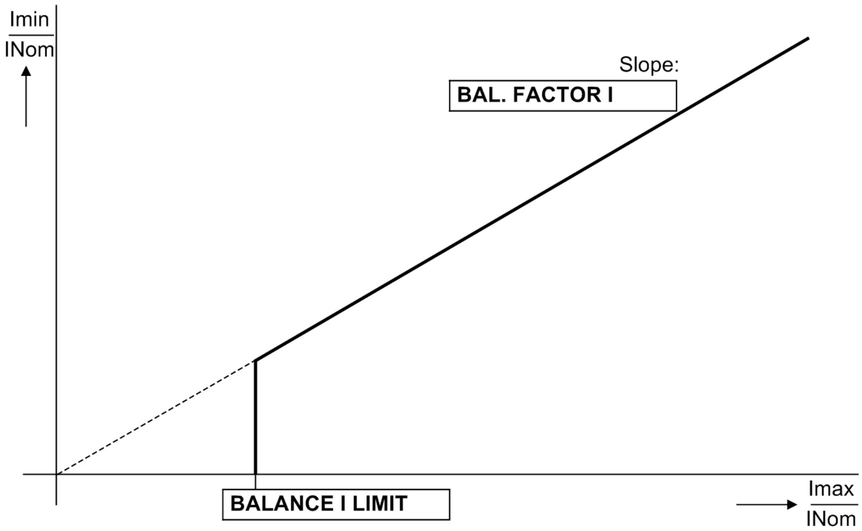


Figure 2-3 Current balance monitoring

Voltage Balance

During normal system operation (i.e. the absence of a fault), balance among the input voltages is expected. Because the phase-to-phase voltages are insensitive to ground connections, the phase-to-phase voltages are used for balance monitoring. If the device is connected to the phase-to-ground voltages, the phase-to-phase voltages are calculated on their basis. If the device is connected to two phase-to-phase voltages and the displacement voltage V_0, the third phase-to-phase voltage is calculated accordingly. From the phase-to-phase voltages, the device generates the rectified average values and checks the balance of their absolute values. The smallest phase voltage is compared with the largest phase voltage. Imbalance is recognized if:

$|V_{min}| / |V_{max}| <$ **`BAL. FACTOR V`**, as long as $|V_{max}| >$ **`BALANCE V-LIMIT`**. Where V_{max} is the highest of the three voltages and V_{min} the smallest. The balance factor **`BAL. FACTOR V`** is the measure for the imbalance of the voltages; the limit value **`BALANCE V-LIMIT`** is the lower limit of the operating range of this monitoring function (see Figure 2-4). Both parameters can be set. The dropout ratio is about 97%.

This imbalance is reported as “`Fail V balance`”.

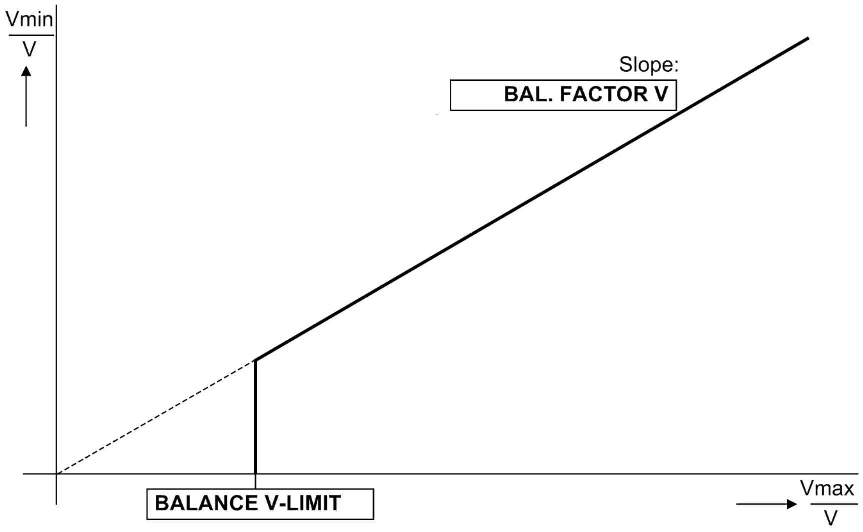


Figure 2-4 Voltage balance monitoring

Current and Voltage Phase Sequence

To detect swapped phase connections in the voltage and current input circuits, the phase sequence of the phase-to-phase measured voltages and the phase currents are checked by monitoring the sequence of same polarity zero transitions of the voltages.

Voltages: V_A before V_B before V_C and

Currents: $\underline{I}_A$ before $\underline{I}_B$ before $\underline{I}_C$

Verification of the voltage phase rotation is done when each measured voltage is at least

$|V_A|, |V_B|, |V_C| > 40\ V/\sqrt{3}$

Verification of the current phase rotation is done when each measured current is at least

$|\underline{I}_A|, |\underline{I}_B|, |\underline{I}_C| > 0.5\ I_{Nom}$.

For abnormal phase sequences, the messages “`Fail Ph. Seq. V`” or “`Fail Ph. Seq. I`” are issued, along with the switching of this message “`Fail Ph. Seq.`”.

For applications in which an opposite phase sequence is expected, the protective relay should be adjusted via a binary input or a programmable setting. If the phase sequence is changed in the device, phases B and C internal to the relay are reversed, and the positive and negative sequence currents are thereby exchanged (see also Section 2.4). This does not affect the phase-related messages, imbalance values, and measured values are.

2.2.1.5 Setting Notes

General

Measured value monitoring can be turned ***ON*** or ***OFF*** at address 8101 **MEASURE. SUPERV**.

Measured Value Monitoring

The sensitivity of the measured value monitor can be modified. Default values which are sufficient in most cases are present. If especially high operating asymmetry in the currents and/or voltages are to be expected during operation, or if it becomes apparent during operation that certain monitoring functions activate sporadically, then the setting should be less sensitive.

Address 8102 **BALANCE V-LIMIT** determines the limit voltage (phase-to-phase), above which the voltage balance monitor is effective. Address 8103 **BAL. FACTOR V** is the associated balance factor; that is, the slope of the balance characteristic curve.

Address 8104 **BALANCE I LIMIT** determines the limit voltage (phase-to-phase), above which the voltage balance monitor is effective. Address 8105 **BAL. FACTOR I** is the associated balance factor; that is, the slope of the balance characteristic curve.

Address 8106 Σ **I THRESHOLD** determines the limit current, above which the current sum monitor is activated (absolute portion, only relative to I_{Nom}). The relative portion (relative to the maximum conductor current) for activating the current sum monitor is set at address 8107 Σ **I FACTOR**.

Note

Current sum monitoring can operate properly only when the residual current of the protected line is fed to the fourth current input (I_N) of the relay.

Note

The connections of the ground paths and their adaption factors were set when configuring the general station data. These settings must be correct for the measured value monitoring to function properly.

2.2.1.6 Settings

The table indicates region-specific presettings. Column C (configuration) indicates the corresponding secondary nominal current of the current transformer.

Addr.	Parameter	C	Setting Options	Default Setting	Comments
8101	MEASURE. SUPERV		OFF ON	ON	Measurement Supervision
8102	BALANCE V-LIMIT		10 .. 100 V	50 V	Voltage Threshold for Balance Monitoring
8103	BAL. FACTOR V		0.58 .. 0.90	0.75	Balance Factor for Voltage Monitor
8104	BALANCE I LIMIT	1A	0.10 .. 1.00 A	0.50 A	Current Threshold for Balance Monitoring
		5A	0.50 .. 5.00 A	2.50 A	
8105	BAL. FACTOR I		0.10 .. 0.90	0.50	Balance Factor for Current Monitor
8106	Σ I THRESHOLD	1A	0.05 .. 2.00 A; ∞	0.10 A	Summated Current Monitoring Threshold
		5A	0.25 .. 10.00 A; ∞	0.50 A	
8107	Σ I FACTOR		0.00 .. 0.95	0.10	Summated Current Monitoring Factor

2.2.1.7 Information List

No.	Information	Type of Information	Comments
161	Fail I Superv.	OUT	Failure: General Current Supervision
162	Failure Σ I	OUT	Failure: Current Summation
163	Fail I balance	OUT	Failure: Current Balance
167	Fail V balance	OUT	Failure: Voltage Balance
170	VT FuseFail	OUT	VT Fuse Failure (alarm instantaneous)
171	Fail Ph. Seq.	OUT	Failure: Phase Sequence
175	Fail Ph. Seq. I	OUT	Failure: Phase Sequence Current
176	Fail Ph. Seq. V	OUT	Failure: Phase Sequence Voltage
197	MeasSup OFF	OUT	Measurement Supervision is switched OFF
6509	>FAIL:FEEDER VT	SP	>Failure: Feeder VT
6510	>FAIL: BUS VT	SP	>Failure: Busbar VT

2.2.2 Malfunction Responses of the Monitoring Functions

In the following malfunction responses of monitoring equipment are clearly listed.

2.2.2.1 Description

Malfunction Responses

Depending on the type of malfunction discovered, an annunciation is sent, a restart of the processor system is initiated, or the device is taken out of service. After three unsuccessful restart attempts, the device is taken out of service. The live status contact operates to indicate the device is malfunctioning. In addition, if the internal auxiliary supply is present, the red LED "ERROR" lights up at the front cover and the green "RUN" LED goes out. If the internal auxiliary voltage fails, then all LEDs are dark. Table 2-1 shows a summary of the monitoring functions and the malfunction responses of the relay.

Table 2-1 Summary of Malfunction Responses by the Relay

Monitoring	Possible Causes	Malfunction Response	Indication (No.)	Device
AC/DC supply voltage loss	External (aux. voltage) internal (converter)	Device not in operation	All LEDs dark	DOK[2] drops out
Internal supply voltages	Internal (power supply)	Device not in operation	LED ”ERROR"	DOK[2] drops out
Buffer battery	Internal (Buffer battery)	Message	“Fail Battery” (177)	
Hardware Watchdog	Internal (processor failure)	Device not in operation [1]	LED ”ERROR"	DOK[2] drops out
Software watchdog	internal (processor failure)	Restart attempt [1]	LED ”ERROR"	DOK[2] drops out
Working memory RAM	Internal (hardware)	Relay aborts restart, Device shutdown	LED flashes	DOK[2] drops out
Program memory RAM	Internal (hardware)	During boot sequence	LED ”ERROR"	DOK[2] drops out
		Detection during operation: Restart attempt [1]	LED ”ERROR"	
Settings memory	Internal (hardware)	Restart attempt [1]	LED ”ERROR"	DOK[2] drops out
Sampling frequency	Internal (hardware)	Device not in operation	LED ”ERROR"	DOK[2] drops out
Error in the I/O-board	Internal (hardware)	Device not in operation	“I/O-Board error” (178), LED ”ERROR"	DOK[2] drops out
Module error	Internal (hardware)	Device not in operation	“Error Board 1” to “Error Board 7” (178 to 189), LED ”ERROR"	DOK[2] drops out
Internal auxiliary voltage 5 V	Internal (hardware)	Device not in operation	“Error 5V” (144), LED ”ERROR"	DOK[2] drops out
0 V-Monitoring	Internal (hardware)	Device not in operation	“Error 0V” (145), LED ”ERROR"	DOK[2] drops out
Internal auxiliary voltage -5 V	Internal (hardware)	Device not in operation	“Error -5V” (146), LED ”ERROR"	DOK[2] drops out
Offset Monitoring	Internal (hardware)	Device not in operation	“Error Offset” (191)	DOK[2] drops out
Internal supply voltages	Internal (hardware)	Device not in operation	“Error PwrSupply” (147), LED ”ERROR"	DOK[2] drops out
Current Sum	Internal (measured value acquisition)	Message	“Failure Σ I” (162)	As allocated
Current Balance	External (power system or current transformer)	Annunciation	“Fail I balance” (163)	As allocated

Monitoring	Possible Causes	Malfunction Response	Indication (No.)	Device
Voltage balance	External (power system or voltage transformer)	Annunciation	“Fail V balance” (167)	As allocated
Voltage phase sequence	External (power system or connection)	Annunciation	“Fail Ph. Seq.” 171)	As allocated
Current phase sequence	External (power system or connection)	Annunciation	“Fail Ph. Seq. I” (175)	As allocated

1) After three unsuccessful restarts, the device is taken out of service.

2) DOK = "Device Okay" = Ready for service relay drops off, protection and control function are blocked.

Group Alarms

Certain messages of the monitoring functions are already combined to group alarms. A listing of the group alarms and their composition is given in the Appendix A.10.

2.3 Temperature Detection via RTD Boxes

Up to two temperature detection units (RTD-boxes) with 12 measuring sensors in total can be applied for temperature detection and are processed by the input/output device.

Applications

- In particular they enable the thermal status of motors, generators and transformers to be monitored. Rotating machines are additionally monitored for a violation of the bearing temperature thresholds. The temperatures are measured in different locations of the protected object by employing temperature sensors (RTD = Resistance Temperature Detector) and are transmitted to the device via one or two 7XV566 RTD-boxes.

2.3.1 Description

RTD-Box 7XV56

The RTD-box 7XV566 is an external device mounted on a standard DIN rail. It features 6 temperature inputs and one RS485 interface for communication with the input/output device. The RTD-box detects the coolant temperature of each measuring point from the resistance value of the temperature detectors (Pt 100, Ni 100 or Ni 120) connected via two- or three-wires and converts it to a digital value. The digital values are made available at a serial port.

Processing Temperatures

The transmitted raw temperature data is converted to a temperature in degrees Celsius or Fahrenheit. The conversion depends on the temperature sensor used.

For each temperature detector two thresholds decisions can be performed which are available for further processing. The user can make the corresponding allocations in the configuration matrix.

An alarm is issued for each temperature sensor in the event of a short-circuit or interruption in the sensor circuit.

The following figure shows the logic diagram for temperature processing.

The manual supplied with the RTD-box contains a connection diagram and dimensioned drawing.

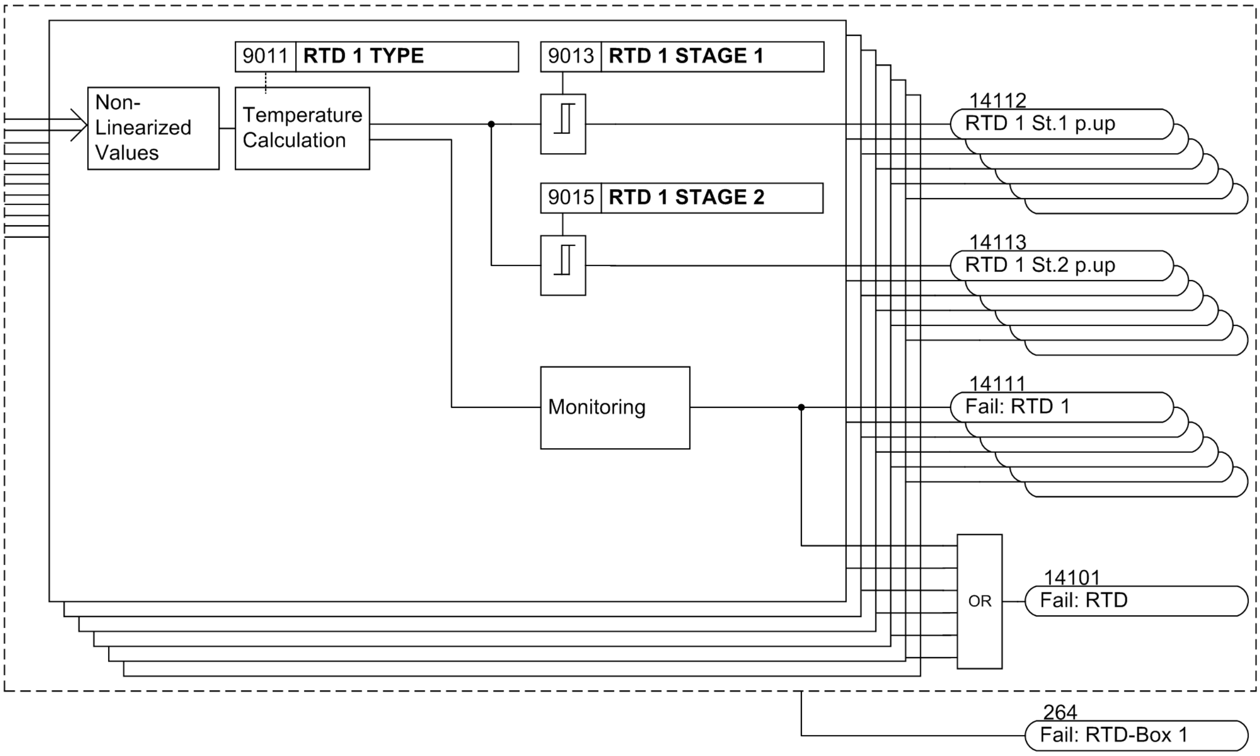


Figure 2-5 Logic diagram of the temperature processing for RTD-box 1

2.3.2 Setting Notes

General

Temperature detection is only effective and accessible if it was assigned to an interface during configuration. At address 190 **RTD-BOX INPUT** the RTD-box(es) was allocated to the interface at which it will be operated (port C). The number of sensor inputs and the communication mode were set at address 191 **RTD CONNECTION**. The temperature unit (°C or °F) was set in the **P.System Data 1** at address 276 **TEMP. UNIT**.

Device Settings

The settings are the same for each input and are here shown at the example of measuring input 1.

Set the type of temperature detector for RTD 1 (temperature sensor for measuring point 1) at address 9011 **RTD 1 TYPE**. You can choose between ***Pt 100*** Ω , ***Ni 120*** Ω and ***Ni 100*** Ω. If no temperature detector is available for RTD 1, set **RTD 1 TYPE** = ***Not connected***. This setting is only possible via DIGSI at **Additional Settings**.

Address 9012 **RTD 1 LOCATION** informs the device on the mounting location of RTD 1. You can choose between ***Oil***, ***Ambient***, ***Winding***, ***Bearing*** and ***Other***. This setting is only possible via DIGSI at **Additional Settings**.

Furthermore, you can set an alarm temperature and a tripping temperature. Depending on the temperature unit selected in the Power System Data (2.1.2 in address 276 **TEMP. UNIT**), the alarm temperature can be expressed in Celsius (°C) (address

9013 **RTD 1 STAGE 1**) or Fahrenheit (°F) (address 9014 **RTD 1 STAGE 1**). The tripping temperature is set at address 9015 **RTD 1 STAGE 2** in degree Celsius (°C) or degree Fahrenheit (°F) at address 9016 **RTD 1 STAGE 2**.

The settings for all other connected temperature detectors are made accordingly (see below in the table Settings for the RTD-boxes).

Settings on the RTD-Box

If temperature detectors are used with two-wire connection, the line resistance (for short-circuited temperature detector) must be measured and adjusted. For this purpose, select mode 6 in the RTD-box and enter the resistance value for the corresponding temperature detector (range 0 to 50.6 Ω). If a 3-wire connection is used, no further settings are required to this end.

A baudrate of 9600 bits/s ensures communication. Parity is even. The factory setting of the bus number is 0. Modifications at the RTD-box can be made in mode 7. The following convention applies:

Table 2-2 Setting the bus address at the RTD-box

Mode	Number of RTD-boxes	Address
simplex	1	0
half duplex	1	1
half duplex	2	1. RTD-box: 1
		2. RTD-box: 2

Further information is provided in the operating manual of the RTD-box.

Processing Measured Values and Messages

The RTD-box is visible in DIGSI as part of the 6MD63 device, i.e. messages and measured values appear in the configuration matrix just like those of internal functions, and can be masked and processed in the same way. Messages and measured values can thus be forwarded to the integrated user-defined logic (CFC) and interconnected as desired.

If it is desired that a message should appear in the event buffer, a cross must be entered in the intersecting box of column/row.

2.3.3 Settings

Addresses which have an appended "A" can only be changed with DIGSI, under "Additional Settings".

Addr.	Parameter	Setting Options	Default Setting	Comments
9011A	RTD 1 TYPE	Not connected Pt 100 Ω Ni 120 Ω Ni 100 Ω	Pt 100 Ω	RTD 1: Type
9012A	RTD 1 LOCATION	Oil Ambient Winding Bearing Other	Oil	RTD 1: Location
9013	RTD 1 STAGE 1	-50 .. 250 °C; ∞	100 °C	RTD 1: Temperature Stage 1 Pickup
9014	RTD 1 STAGE 1	-58 .. 482 °F; ∞	212 °F	RTD 1: Temperature Stage 1 Pickup
9015	RTD 1 STAGE 2	-50 .. 250 °C; ∞	120 °C	RTD 1: Temperature Stage 2 Pickup
9016	RTD 1 STAGE 2	-58 .. 482 °F; ∞	248 °F	RTD 1: Temperature Stage 2 Pickup
9021A	RTD 2 TYPE	Not connected Pt 100 Ω Ni 120 Ω Ni 100 Ω	Not connected	RTD 2: Type
9022A	RTD 2 LOCATION	Oil Ambient Winding Bearing Other	Other	RTD 2: Location
9023	RTD 2 STAGE 1	-50 .. 250 °C; ∞	100 °C	RTD 2: Temperature Stage 1 Pickup
9024	RTD 2 STAGE 1	-58 .. 482 °F; ∞	212 °F	RTD 2: Temperature Stage 1 Pickup
9025	RTD 2 STAGE 2	-50 .. 250 °C; ∞	120 °C	RTD 2: Temperature Stage 2 Pickup
9026	RTD 2 STAGE 2	-58 .. 482 °F; ∞	248 °F	RTD 2: Temperature Stage 2 Pickup
9031A	RTD 3 TYPE	Not connected Pt 100 Ω Ni 120 Ω Ni 100 Ω	Not connected	RTD 3: Type
9032A	RTD 3 LOCATION	Oil Ambient Winding Bearing Other	Other	RTD 3: Location
9033	RTD 3 STAGE 1	-50 .. 250 °C; ∞	100 °C	RTD 3: Temperature Stage 1 Pickup

Addr.	Parameter	Setting Options	Default Setting	Comments
9034	RTD 3 STAGE 1	-58 .. 482 °F; ∞	212 °F	RTD 3: Temperature Stage 1 Pickup
9035	RTD 3 STAGE 2	-50 .. 250 °C; ∞	120 °C	RTD 3: Temperature Stage 2 Pickup
9036	RTD 3 STAGE 2	-58 .. 482 °F; ∞	248 °F	RTD 3: Temperature Stage 2 Pickup
9041A	RTD 4 TYPE	Not connected Pt 100 Ω Ni 120 Ω Ni 100 Ω	Not connected	RTD 4: Type
9042A	RTD 4 LOCATION	Oil Ambient Winding Bearing Other	Other	RTD 4: Location
9043	RTD 4 STAGE 1	-50 .. 250 °C; ∞	100 °C	RTD 4: Temperature Stage 1 Pickup
9044	RTD 4 STAGE 1	-58 .. 482 °F; ∞	212 °F	RTD 4: Temperature Stage 1 Pickup
9045	RTD 4 STAGE 2	-50 .. 250 °C; ∞	120 °C	RTD 4: Temperature Stage 2 Pickup
9046	RTD 4 STAGE 2	-58 .. 482 °F; ∞	248 °F	RTD 4: Temperature Stage 2 Pickup
9051A	RTD 5 TYPE	Not connected Pt 100 Ω Ni 120 Ω Ni 100 Ω	Not connected	RTD 5: Type
9052A	RTD 5 LOCATION	Oil Ambient Winding Bearing Other	Other	RTD 5: Location
9053	RTD 5 STAGE 1	-50 .. 250 °C; ∞	100 °C	RTD 5: Temperature Stage 1 Pickup
9054	RTD 5 STAGE 1	-58 .. 482 °F; ∞	212 °F	RTD 5: Temperature Stage 1 Pickup
9055	RTD 5 STAGE 2	-50 .. 250 °C; ∞	120 °C	RTD 5: Temperature Stage 2 Pickup
9056	RTD 5 STAGE 2	-58 .. 482 °F; ∞	248 °F	RTD 5: Temperature Stage 2 Pickup
9061A	RTD 6 TYPE	Not connected Pt 100 Ω Ni 120 Ω Ni 100 Ω	Not connected	RTD 6: Type
9062A	RTD 6 LOCATION	Oil Ambient Winding Bearing Other	Other	RTD 6: Location

Addr.	Parameter	Setting Options	Default Setting	Comments
9063	RTD 6 STAGE 1	-50 .. 250 °C; ∞	100 °C	RTD 6: Temperature Stage 1 Pickup
9064	RTD 6 STAGE 1	-58 .. 482 °F; ∞	212 °F	RTD 6: Temperature Stage 1 Pickup
9065	RTD 6 STAGE 2	-50 .. 250 °C; ∞	120 °C	RTD 6: Temperature Stage 2 Pickup
9066	RTD 6 STAGE 2	-58 .. 482 °F; ∞	248 °F	RTD 6: Temperature Stage 2 Pickup
9071A	RTD 7 TYPE	Not connected Pt 100 Ω Ni 120 Ω Ni 100 Ω	Not connected	RTD 7: Type
9072A	RTD 7 LOCATION	Oil Ambient Winding Bearing Other	Other	RTD 7: Location
9073	RTD 7 STAGE 1	-50 .. 250 °C; ∞	100 °C	RTD 7: Temperature Stage 1 Pickup
9074	RTD 7 STAGE 1	-58 .. 482 °F; ∞	212 °F	RTD 7: Temperature Stage 1 Pickup
9075	RTD 7 STAGE 2	-50 .. 250 °C; ∞	120 °C	RTD 7: Temperature Stage 2 Pickup
9076	RTD 7 STAGE 2	-58 .. 482 °F; ∞	248 °F	RTD 7: Temperature Stage 2 Pickup
9081A	RTD 8 TYPE	Not connected Pt 100 Ω Ni 120 Ω Ni 100 Ω	Not connected	RTD 8: Type
9082A	RTD 8 LOCATION	Oil Ambient Winding Bearing Other	Other	RTD 8: Location
9083	RTD 8 STAGE 1	-50 .. 250 °C; ∞	100 °C	RTD 8: Temperature Stage 1 Pickup
9084	RTD 8 STAGE 1	-58 .. 482 °F; ∞	212 °F	RTD 8: Temperature Stage 1 Pickup
9085	RTD 8 STAGE 2	-50 .. 250 °C; ∞	120 °C	RTD 8: Temperature Stage 2 Pickup
9086	RTD 8 STAGE 2	-58 .. 482 °F; ∞	248 °F	RTD 8: Temperature Stage 2 Pickup
9091A	RTD 9 TYPE	Not connected Pt 100 Ω Ni 120 Ω Ni 100 Ω	Not connected	RTD 9: Type

Addr.	Parameter	Setting Options	Default Setting	Comments
9092A	RTD 9 LOCATION	Oil Ambient Winding Bearing Other	Other	RTD 9: Location
9093	RTD 9 STAGE 1	-50 .. 250 °C; ∞	100 °C	RTD 9: Temperature Stage 1 Pickup
9094	RTD 9 STAGE 1	-58 .. 482 °F; ∞	212 °F	RTD 9: Temperature Stage 1 Pickup
9095	RTD 9 STAGE 2	-50 .. 250 °C; ∞	120 °C	RTD 9: Temperature Stage 2 Pickup
9096	RTD 9 STAGE 2	-58 .. 482 °F; ∞	248 °F	RTD 9: Temperature Stage 2 Pickup
9101A	RTD10 TYPE	Not connected Pt 100 Ω Ni 120 Ω Ni 100 Ω	Not connected	RTD10: Type
9102A	RTD10 LOCATION	Oil Ambient Winding Bearing Other	Other	RTD10: Location
9103	RTD10 STAGE 1	-50 .. 250 °C; ∞	100 °C	RTD10: Temperature Stage 1 Pickup
9104	RTD10 STAGE 1	-58 .. 482 °F; ∞	212 °F	RTD10: Temperature Stage 1 Pickup
9105	RTD10 STAGE 2	-50 .. 250 °C; ∞	120 °C	RTD10: Temperature Stage 2 Pickup
9106	RTD10 STAGE 2	-58 .. 482 °F; ∞	248 °F	RTD10: Temperature Stage 2 Pickup
9111A	RTD11 TYPE	Not connected Pt 100 Ω Ni 120 Ω Ni 100 Ω	Not connected	RTD11: Type
9112A	RTD11 LOCATION	Oil Ambient Winding Bearing Other	Other	RTD11: Location
9113	RTD11 STAGE 1	-50 .. 250 °C; ∞	100 °C	RTD11: Temperature Stage 1 Pickup
9114	RTD11 STAGE 1	-58 .. 482 °F; ∞	212 °F	RTD11: Temperature Stage 1 Pickup
9115	RTD11 STAGE 2	-50 .. 250 °C; ∞	120 °C	RTD11: Temperature Stage 2 Pickup
9116	RTD11 STAGE 2	-58 .. 482 °F; ∞	248 °F	RTD11: Temperature Stage 2 Pickup

Addr.	Parameter	Setting Options	Default Setting	Comments
9121A	RTD12 TYPE	Not connected Pt 100 Ω Ni 120 Ω Ni 100 Ω	Not connected	RTD12: Type
9122A	RTD12 LOCATION	Oil Ambient Winding Bearing Other	Other	RTD12: Location
9123	RTD12 STAGE 1	-50 .. 250 °C; ∞	100 °C	RTD12: Temperature Stage 1 Pickup
9124	RTD12 STAGE 1	-58 .. 482 °F; ∞	212 °F	RTD12: Temperature Stage 1 Pickup
9125	RTD12 STAGE 2	-50 .. 250 °C; ∞	120 °C	RTD12: Temperature Stage 2 Pickup
9126	RTD12 STAGE 2	-58 .. 482 °F; ∞	248 °F	RTD12: Temperature Stage 2 Pickup

2.3.4 Information List

No.	Information	Type of Information	Comments
264	Fail: RTD-Box 1	OUT	Failure: RTD-Box 1
267	Fail: RTD-Box 2	OUT	Failure: RTD-Box 2
14101	Fail: RTD	OUT	Fail: RTD (broken wire/shorted)
14111	Fail: RTD 1	OUT	Fail: RTD 1 (broken wire/shorted)
14112	RTD 1 St.1 p.up	OUT	RTD 1 Temperature stage 1 picked up
14113	RTD 1 St.2 p.up	OUT	RTD 1 Temperature stage 2 picked up
14121	Fail: RTD 2	OUT	Fail: RTD 2 (broken wire/shorted)
14122	RTD 2 St.1 p.up	OUT	RTD 2 Temperature stage 1 picked up
14123	RTD 2 St.2 p.up	OUT	RTD 2 Temperature stage 2 picked up
14131	Fail: RTD 3	OUT	Fail: RTD 3 (broken wire/shorted)
14132	RTD 3 St.1 p.up	OUT	RTD 3 Temperature stage 1 picked up
14133	RTD 3 St.2 p.up	OUT	RTD 3 Temperature stage 2 picked up
14141	Fail: RTD 4	OUT	Fail: RTD 4 (broken wire/shorted)
14142	RTD 4 St.1 p.up	OUT	RTD 4 Temperature stage 1 picked up
14143	RTD 4 St.2 p.up	OUT	RTD 4 Temperature stage 2 picked up
14151	Fail: RTD 5	OUT	Fail: RTD 5 (broken wire/shorted)
14152	RTD 5 St.1 p.up	OUT	RTD 5 Temperature stage 1 picked up
14153	RTD 5 St.2 p.up	OUT	RTD 5 Temperature stage 2 picked up
14161	Fail: RTD 6	OUT	Fail: RTD 6 (broken wire/shorted)
14162	RTD 6 St.1 p.up	OUT	RTD 6 Temperature stage 1 picked up
14163	RTD 6 St.2 p.up	OUT	RTD 6 Temperature stage 2 picked up
14171	Fail: RTD 7	OUT	Fail: RTD 7 (broken wire/shorted)
14172	RTD 7 St.1 p.up	OUT	RTD 7 Temperature stage 1 picked up
14173	RTD 7 St.2 p.up	OUT	RTD 7 Temperature stage 2 picked up

No.	Information	Type of Information	Comments
14181	Fail: RTD 8	OUT	Fail: RTD 8 (broken wire/shorted)
14182	RTD 8 St.1 p.up	OUT	RTD 8 Temperature stage 1 picked up
14183	RTD 8 St.2 p.up	OUT	RTD 8 Temperature stage 2 picked up
14191	Fail: RTD 9	OUT	Fail: RTD 9 (broken wire/shorted)
14192	RTD 9 St.1 p.up	OUT	RTD 9 Temperature stage 1 picked up
14193	RTD 9 St.2 p.up	OUT	RTD 9 Temperature stage 2 picked up
14201	Fail: RTD10	OUT	Fail: RTD10 (broken wire/shorted)
14202	RTD10 St.1 p.up	OUT	RTD10 Temperature stage 1 picked up
14203	RTD10 St.2 p.up	OUT	RTD10 Temperature stage 2 picked up
14211	Fail: RTD11	OUT	Fail: RTD11 (broken wire/shorted)
14212	RTD11 St.1 p.up	OUT	RTD11 Temperature stage 1 picked up
14213	RTD11 St.2 p.up	OUT	RTD11 Temperature stage 2 picked up
14221	Fail: RTD12	OUT	Fail: RTD12 (broken wire/shorted)
14222	RTD12 St.1 p.up	OUT	RTD12 Temperature stage 1 picked up
14223	RTD12 St.2 p.up	OUT	RTD12 Temperature stage 2 picked up

2.4 Phase Rotation

A phase rotation feature via binary input and parameter is implemented in the 6MD63 device.

Applications

- Phase rotation ensures that all monitoring functions operate correctly even with anti-clockwise rotation, without the need for two phases to be reversed.

2.4.1 Description

General

Various functions of the 6MD63 only work correctly if the phase rotation of the voltages and currents is known, e.g. measurement quantity monitoring.

If an "acb" phase rotation is normal, the appropriate setting is made during configuration of the Power System Data.

If the phase rotation can change during operation (e.g. the direction of a motor must be routinely changed), then a changeover signal at the routed binary input for this purpose is sufficient to inform the input/output unit of the phase rotation reversal.

Logic

Phase rotation is permanently established at address 209 **PHASE SEQ.** (Power System Data). Via the exclusive-OR gate the binary input “>Reverse Rot.” inverts the sense of the phase rotation applied with the setting.

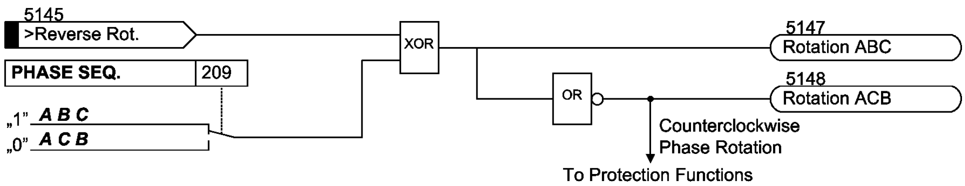


Figure 2-6 Message logic of the phase-sequence reversal

Influence on Monitoring Functions

The swapping of phases directly impacts the calculation of positive and negative sequence quantities, as well as phase-to-phase voltages via the subtraction of one phase-to-ground voltage from another and vice versa. Therefore, this function is vital so that phase detection messages and operating measurement values are correct. As stated before, this function influences some of the monitoring functions that issue messages if the defined and calculated phase rotations do not match.

2.4.2 Setting Notes

Programming Settings

The normal phase sequence is set at `209` (see Subsection 2.1.2.2). If, on the system side, phase rotation is temporarily changed, then these are communicated to the input/output unit using the binary input “`>Reverse Rot.`”, No. 5145

2.5 Command Processing

A control command process is integrated in the SIPROTEC ® 6MD63 to coordinate the operation of circuit breakers and other equipment in the power system.

Control commands can originate from four command sources:

- Local operation using the keypad of the device (except for variant without operator panel)
- Operation using DIGSI®
- Remote operation via network control center or substation controller (e.g. SICAM®)
- Automatic functions (e.g., using a binary input)

Switchgear with single and multiple busbars are supported. The number of switchgear devices to be controlled is, basically, limited by the number of binary inputs and outputs present. High security against inadvertent device operations can be ensured if interlocking checks are enabled. A standard set of optional interlocking checks is provided for each command issued to circuit breakers/switchgear.

2.5.1 Control Device

Devices with integrated or detached operator panel can control switchgear via the operator panel of the device. In addition, control can be executed via the operator interface using a personal computer and via the serial interface with a link to the substation control equipment.

Applications

- Switchgears with single and multiple busbars

Prerequisites

The number of switchgear devices to be controlled is limited by the

– Binary inputs present

– Binary outputs present

2.5.1.1 Description

Operation using the SIPROTEC® 4 Device

Commands can be initiated using the keypad on the local user interface of the relay. For this purpose, there are three independent keys located below the graphic display. The key CTRL causes the control display to appear in the LCD. Controlling of switchgears is only possible within this control display, since the two control keys OPEN and CLOSE only become active as long as the control display is present. The LCD must be changed back to the default display for other, non-control, operational modes.

The navigation keys ▲, ▼, ◀, ▶ are used to select the desired device in the Control Display. The I key or the O key is then pressed to convey the intended control command.

Consequently, the switch icon in the control display flashes in setpoint direction. At the lower display edge, the user is requested to confirm his switching operation via the ENTER key. Then a safety query appears. After the security check is completed, the ENTER key must be pressed again to carry out the command. If this confirmation is not performed within one minute, the setpoint flashing changes again to the corresponding actual status. Cancellation via the ESC key is possible at any time before the control command is issued.

During normal processing, the control display indicates the new actual status after the control command was executed and the message “`command end`” at the lower display edge. The indication “`FB reached`” is displayed briefly before the final indication in the case of switching commands with a feedback.

If the attempted command fails, because an interlocking condition is not met, then an error message appears in the display. The message indicates why the control command was not accepted (see also SIPROTEC® 4 System Description /1/). This message must be acknowledged with Enter before any further control commands can be issued.

Operation using the DIGSI®

Control switching devices can be performed via the operator control interface by means of the DIGSI® operating program installed on a PC.

The procedure to do so is described in the SIPROTEC® System Description /1/ (Control of Switchgear).

Operation using the SCADA Interface

Control of switching devices can be performed via the serial system interface and a connection to the switchgear control system. For this the required peripherals physically must exist both in the device and in the power system. Also, a few settings for the serial interface in the device are required (see SIPROTEC® System Description /1/).

Note

The switching commands (annunciations) listed in the following Information List are examples preset. As they are only examples they may be deleted or overwritten by the user.

2.5.1.2 Information List

No.	Information	Type of Information	Comments
-	52Breaker	CF_D12	52 Breaker
-	52Breaker	DP	52 Breaker
-	Disc.Swit.	CF_D2	Disconnect Switch
-	Disc.Swit.	DP	Disconnect Switch
-	GndSwit.	CF_D2	Ground Switch
-	GndSwit.	DP	Ground Switch
-	52 Open	IntSP	Interlocking: 52 Open
-	52 Close	IntSP	Interlocking: 52 Close
-	Disc.Open	IntSP	Interlocking: Disconnect switch Open
-	Disc.Close	IntSP	Interlocking: Disconnect switch Close
-	GndSw Open	IntSP	Interlocking: Ground switch Open
-	GndSw Cl.	IntSP	Interlocking: Ground switch Close
-	UnlockDT	IntSP	Unlock data transmission via BI
-	Q2 Op/Cl	CF_D2	Q2 Open/Close
-	Q2 Op/Cl	DP	Q2 Open/Close
-	Q9 Op/Cl	CF_D2	Q9 Open/Close

No.	Information	Type of Information	Comments
-	Q9 Op/Cl	DP	Q9 Open/Close
-	Fan ON/OFF	CF_D2	Fan ON/OFF
-	Fan ON/OFF	DP	Fan ON/OFF

2.5.2 Types of Commands

In conjunction with the power system control there are several command types that must be considered.

2.5.2.1 Description

Commands to the System

These are all commands that are directly output to the switchgear to change their process state:

- Switching commands for the control of circuit breakers (not synchronized), disconnectors and ground electrode,
- Step commands, e.g. raising and lowering transformer LTCs
- Set-point commands with configurable time settings, e.g. to control Petersen coils

Internal / Pseudo Commands

They do not directly operate binary outputs. They serve to initiate internal functions, simulate changes of state, or to acknowledge changes of state.

- Manual overriding commands to manually update information on process-dependent objects such as annunciations and switching states, e.g. if the communication with the process is interrupted. Manually overridden objects are flagged as such in the information status and can be displayed accordingly.
- Tagging commands are issued to establish internal settings, e.g. deleting / presetting the switching authority (remote vs. local), a parameter set changeover, data transmission block to the SCADA interface, and measured value set-points.
- Acknowledgment and resetting commands for setting and resetting internal buffers or data states.
- Information status command to set/reset the additional information "information status" of a process object, such as:
  - Input blocking
  - Output Blocking

2.5.3 Command Processing

Safety mechanisms in the command sequence ensure that a switch command can only be released after a thorough check of preset criteria has been successfully concluded. Standard Interlocking checks are provided for each individual control command. Additionally, user-defined interlocking conditions can be programmed separately for each command. The actual execution of the command is also monitored afterwards. The overall command task procedure is described in brief in the following list:

2.5.3.1 Description

Check Sequence

Please observe the following:

- Command Entry, e.g. using the keypad on the local user interface of the device
  - Check Password → Access Rights
  - Check Switching Mode (interlocking activated/deactivated) → Selection of Deactivated Interlocking Recognition.
- User configurable interlocking checks
  - Switching Authority
  - Device Position Check (set vs. actual comparison)
  - Interlocking, Zone Controlled (logic using CFC)
  - System Interlocking (centrally, using SCADA system or substation controller)
  - Double Operation (interlocking against parallel switching operations)
  - Protection blocking (blocking of switching operations by protective functions, not relevant for 6MD63)
- Fixed Command Checks
  - Internal Process Time (software watch dog which checks the time for processing the control action between initiation of the control and final close of the relay contact).
  - Setting Modification in Process (if setting modification is in process, commands are denied or delayed)
  - Operating equipment enabled as output (if an operating equipment component was configured, but not configured to a binary input, the command is denied)
  - Output Block (if an output block has been programmed for the circuit breaker, and is active at the moment the command is processed, then the command is denied)
  - Board Hardware Error
  - Command in Progress (only one command can be processed at a time for one operating equipment, object-related Double Operation Block)
  - 1-of-n-check (for schemes with multiple assignments, such as relays contact sharing a common terminal a check is made if a command is already active for this set of output relays).

Monitoring the Command Execution

The following is monitored:

- Interruption of a command because of a Cancel Command
- Running Time Monitor (feedback message monitoring time)

2.5.4 Interlocking

System interlocking is executed by the user-defined logic (CFC).

2.5.4.1 Description

Switchgear interlocking checks in a SICAM/SIPROTEC system are normally divided in the following groups:

- System interlocking relies on the system data base in the substation or central control system,
- Bay interlocking relies on the object data base (feedbacks) of the bay unit.
- Cross-bay interlocking via GOOSE messages directly between bay units and protection relays (with the introduction of IEC61850, V4.60; GOOSE information exchange will be accomplished via EN100-module).

The extent of the interlocking checks is determined by the configuration of the relay. To obtain more information about GOOSE, please refer to the SIPROTEC System Description /1/.

Switching objects that require system interlocking in a central control system are assigned to a specific parameter inside the bay unit (via configuration matrix only possible for Profibus FMS to SICAM SAS).

For all commands, operation with interlocking (normal mode) or without interlocking (Interlocking OFF) can be selected:

- for local commands, by activation of "Normal/Interlocking OFF"-key switch or changing the configuration via password,
- for automatic commands, via command processing by CFC and deactivated interlocking recognition,
- for local / remote commands, using an additional interlocking disable command, via Profibus.

Interlocked / Non-Interlocked Switching

The configurable command checks in the SIPROTEC 4 devices are also called "standard interlocking". These checks can be activated via DIGSI (interlocked switching/tagging) or deactivated (non-interlocked).

Deactivated interlock switching means the configured interlocking conditions are not checked in the relay.

Interlocked switching means that all configured interlocking conditions are checked within the command processing. If a condition could not be fulfilled, the command will be rejected by a message with a minus added to it (e.g. "**CO-**"), immediately followed by message.

The following table shows the possible types of commands in a switching device and their corresponding annunciations. For the device the messages designated with *) are displayed in the event logs, for DIGSI they appear in spontaneous messages.

Type of Command	Control	Cause	Message
Control issued	Switching	CO	CO+/–
Manual tagging (positive / negative)	Manual tagging	MT	MT+/–
Information state command, Input blocking	Input blocking	ST	ST+/– *)
Information state command, Output blocking	Output Blocking	ST	ST+/– *)
Cancel command	Cancel	CA	CA+/–

The "plus" appearing in the message is a confirmation of the command execution. The command execution was as expected, in other words positive. The minus sign means a negative confirmation, the command was rejected. Possible command feedbacks and their causes are dealt with in the SIPROTEC 4 System Description. The following figure shows operational indications relating to command execution and operation response information for successful switching of the circuit breaker.

The check of interlocking can be programmed separately for all switching devices and tags that were set with a tagging command. Other internal commands such as manual entry or abort are not checked, i.e. carried out independent of the interlocking.

```
EVENT LOG
---------------------
19.06.01 11:52:05,625
QO           CO+ Close

19.06.01 11:52:06,134
QO           FB+ Close
```

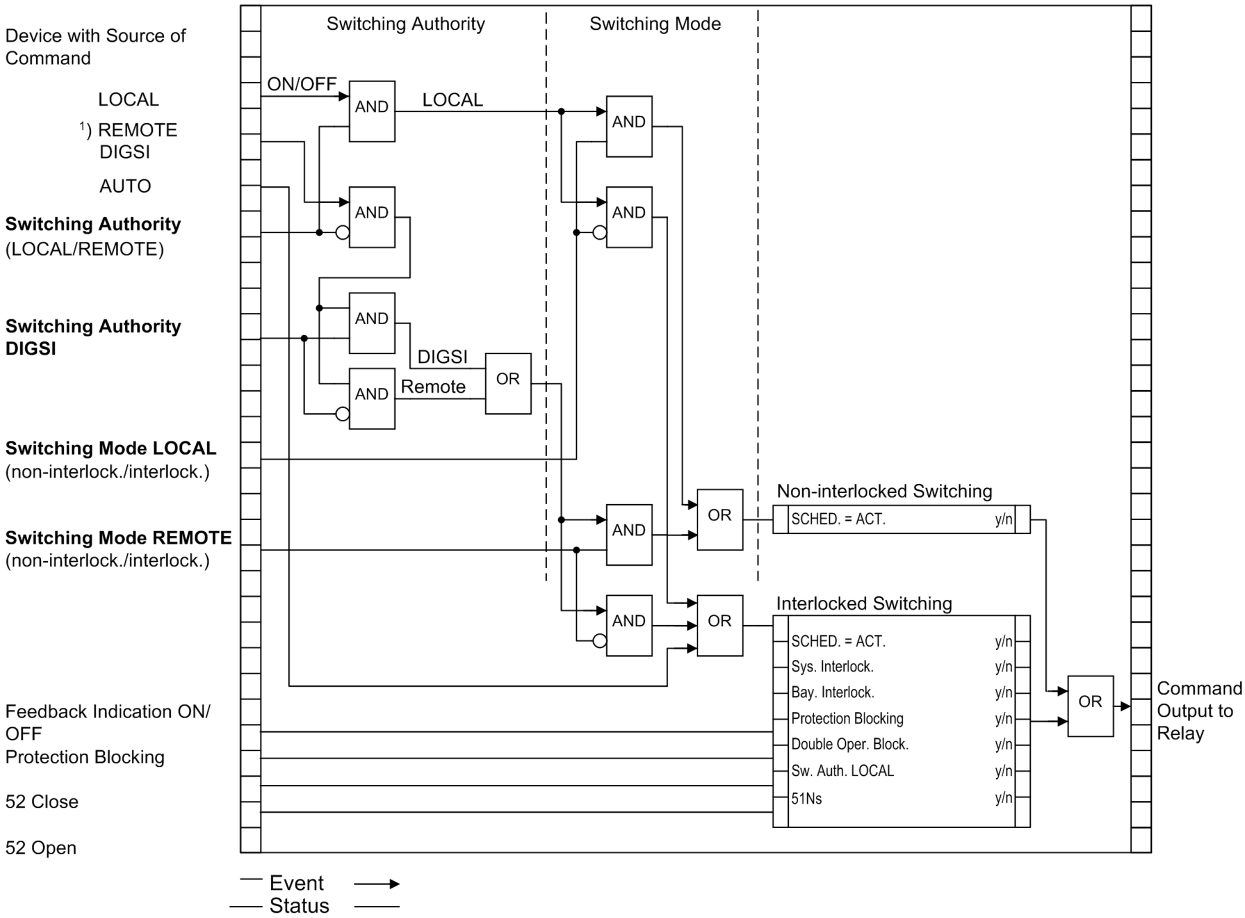
Figure 2-7 Example of an Operational Annunciation for Switching Circuit Breaker 52 (QO)

Standard Interlocking Defaults (fixed programming)

The standard interlockings contain the following fixed programmed tests for each switching device, which can be individually enabled or disabled using parameters:

- Device Status Check (set = actual): The switching command is rejected, and an error indication is displayed if the circuit breaker is already in the set position. If this check is enabled, then it works whether interlocking, e.g. zone controlled, is activated or deactivated. This condition is checked in both interlocked and non-interlocked status modes.
- System Interlocking: To check the power system interlocking, a local command is transmitted to the central unit with Switching Authority = LOCAL. A switching device that is subject to system interlocking cannot be switched by DIGSI.
- Zone Controlled /Bay Interlocking: Logic links in the device which were created via CFC are interrogated and considered during interlocked switching.
- Blocked by Protection: This interlocking option enabled for devices with integrated protection functions has no significance and no effect on the 6MD63 device version.
- Double Operation Block: Parallel switching operations are interlocked against one another; while one command is processed, a second cannot be carried out.
- Switching Authority LOCAL: A control command from the user interface of the device (command with command source LOCAL) is only allowed if the Key Switch (for devices without key switch via configuration) is set to LOCAL.

- Switching Authority DIGSI: Switching commands that are issued locally or remotely via DIGSI (command with command source DIGSI) are only allowed if remote control is admissible for the device (by key switch or configuration). If a DIGSI-PC communicates with the device, it deposits here its virtual device number (VD). Only commands with this VD (when Switching Authority = REMOTE) will be accepted by the device. Remote switching commands will be rejected.
- Switching Authority REMOTE: A remote control command (command with command source REMOTE) is only allowed if the Key Switch (for devices without key switch via configuration) is set to REMOTE.



[1]) Source REMOTE also includes SAS.
(LOCAL Command using substation controller
REMOTE Command using remote source such as SCADA through controller to device.)

Figure 2-8 Standard interlocking arrangements

1) The source of command REMOTE closes the source LOCAL with ON. (LOCAL: Command using a substation automation and control system in the station, REMOTE: Command using the telecontrol engineering for substation control and control system and of substation control and control system for the device)

2) Release from testing of interlocking conditions

3) Not relevant for 6MD63

The following figure shows the configuration of the interlocking conditions using DIGSI.

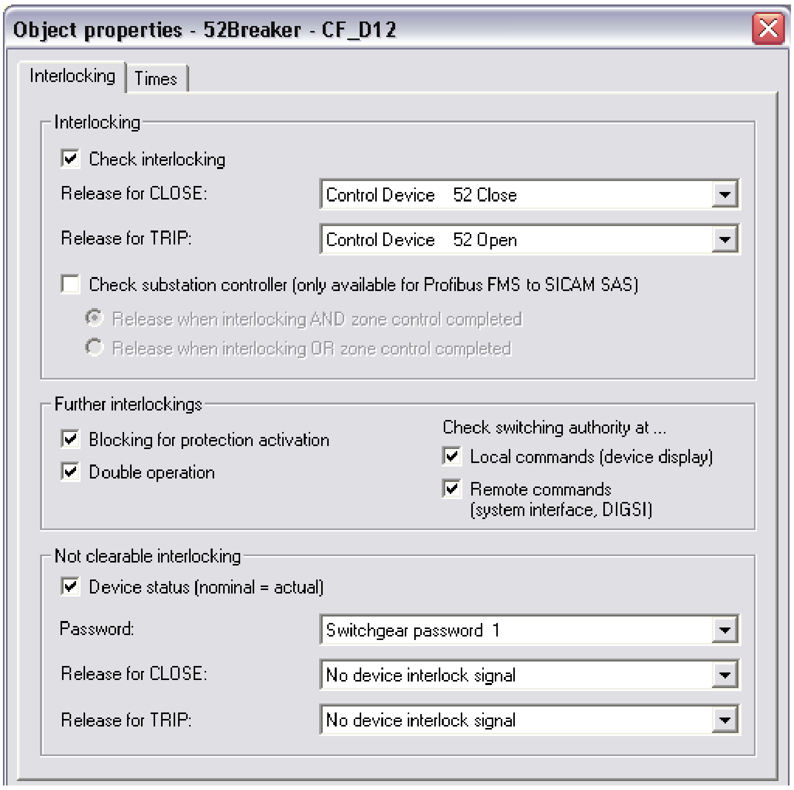


Figure 2-9 DIGSI® dialog box for setting the interlocking conditions

For devices with operator panel the display shows the configured interlocking reasons. They are marked by letters explained in the following table.

Table 2-3 Command types and corresponding messages

Interlocking Commands	Abbrev.	Message
Switching authority	L	L
System interlocking	SI	A
Zone controlled	Z	Z
SET= ACTUAL (switch direction check)	S	I
Protection blockage	B [1)]	B [1)]

[1)] Not relevant for 6MD63

The following figure shows all interlocking conditions (which usually appear in the display of the device) for three switchgear items with the relevant abbreviations explained in the previous table. All parameterized interlocking conditions are indicated.

```
Interlocking      01/03
-----------------------
Q0 Close/Open S - Z P B
Q1 Close/Open S - Z P B

Q8 Close/Open S - Z P B
```

Figure 2-10 Example of configured interlocking conditions

Control Logic using CFC

For the bay interlocking a control logic can be structured via the CFC. Via specific release conditions the information "released” or "bay interlocked” are available (e.g. object "52 Close" and "52 Open" with the data values: ON / OFF).

Switching Authority (for devices with operator panel)

The interlocking condition "Switching Authority" serves to determine the switching authorization. It enables the user to select the authorized command source. For devices with operator panel the following switching authority ranges are defined in the following priority sequence:

- LOCAL
- DIGSI
- REMOTE

The object "Switching Authority" serves to interlock or enable LOCAL control, but not REMOTE or DIGSI commands. The 6MD63 is equipped with two key switches. The top switch is reserved for the switching authority. The position "Local" enables local control, the position "Remote" enables remote control.

The "Switching authority DIGSI" is used for interlocking and allows commands to be initiated using DIGSI. Commands are allowed for both remote and a local DIGSI connection. When a (local or remote) DIGSI–PC logs on to the device, it enters its Virtual Device Number (VD). The device only accepts commands having that VD (with switching authority = OFF or REMOTE). When the DIGSI PC logs off, the VD is cancelled.

Commands are checked for their source SC and the device settings, and compared to the information set in the objects "Switching authority" and "Switching authority DIGSI".

Configuration

Switching authority available:	y/n (create appropriate object)
Switching authority available DIGSI:	y/n (create appropriate object)
Specific device (e.g. switching device):	Switching authority LOCAL (check for Local status): y/n
Specific device (e.g. switching device):	”Switching authority REMOTE" (check for LOCAL, REMOTE, or DIGSI commands): y/n

Table 2-4 Interlocking logic

Current Switching Authority Status	Switching Authority DIGSI	Command issued with SC[3]=LOCAL	Command issued from SC=LOCAL or REMOTE	Command issued from SC=DIGSI
LOCAL	Not registered	Allowed	interlocked [2] - "switching authority LOCAL"	Interlocked - "DIGSI not registered"
LOCAL	Registered	Allowed	Interlocked [2] - "switching authority LOCAL"	Interlocked [2] - "switching authority LOCAL"
REMOTE	Not registered	Interlocked [1] - "switching authority REMOTE"	Allowed	Interlocked - "DIGSI not registered"
REMOTE	Registered	Interlocked [1] - "switching authority DIGSI"	Interlocked [2] - "switching authority DIGSI"	Allowed

[1] also "Allowed" for: ”switching” authority LOCAL (check for Local status): is not marked
[2] also "Allowed" for: ”Switching” authority REMOTE (check for LOCAL, REMOTE, or DIGSI status): is not marked
[3] SC = Source of command

SC = Auto SICAM:

Commands that are initiated internally (command processing in the CFC) are not subject to switching authority and are therefore always "allowed".

Switching Authority (for devices without operator panel)

The dongle cable sets the switching authority of the device to "REMOTE". The specifications of the previous section apply.

Switching Mode (for devices with operator panel)

The switching mode determines whether selected interlocking conditions will be activated or deactivated at the time of the switching operation.

The following switching modes (local) are defined:

- Local commands (SC = LOCAL)
  - Interlocked (normal), or
  - Non-interlocked switching.

The 6MD63 is equipped with two key switches. The bottom switch is reserved for the switching mode. The "Normal" position allows interlocked switching while the "Interlocking OFF" position allows non-interlocked switching.

The following switching modes (remote) are defined:

- Remote or DIGSI commands (SC = LOCAL, REMOTE, or DIGSI)
  - Interlocked, or
  - Non-interlocked switching. Here, deactivation of interlocking is accomplished via a separate command. The position of the key-switch is irrelevant.
  - For commands from CFC (SC = AUTO SICAM), please observe the notes in the DIGSI CFC manual /3/ (component: BOOL to command).

Switching Mode (for devices without operator panel)

The dongle cable sets the switching mode of the device to "Normal". The specifications of the previous section apply.

Zone Controlled / Field Interlocking

Zone controlled / field interlocking (e.g. via CFC) includes the verification that predetermined switchgear position conditions are satisfied to prevent switching errors (e.g. disconnector vs. ground switch, ground switch only if no voltage applied) as well as verification of the state of other mechanical interlocking in the switchgear bay (e.g. High Voltage compartment doors).

Interlocking conditions can be programmed separately, for each switching device, for device control CLOSE and/or OPEN.

The enable information with the data "switching device is interlocked (OFF/NV/FLT) or enabled (ON)" can be set up,

- directly, using a single point or double point indication, key-switch, or internal indication (marking), or
- by means of a control logic via CFC.

When a switching command is initiated, the actual status is scanned cyclically. The assignment is done via "Release object CLOSE/OPEN".

System Interlocking

Substation Controller (System interlocking) involves switchgear conditions of other bays evaluated by a central control system (only possible for Profibus FMS to SICAM SAS).

Double Activation Blockage

Parallel switching operations are interlocked. As soon as the command has arrived all command objects subject to the interlocking are checked to know whether a command is being processed. While the command is being executed, interlocking is enabled for other commands.

Blocking by Protection

This interlocking option enabled for devices with integrated protection functions has no significance and no effect on the 6MD63 device version.

Device Status Check(set=actual)

For switching commands, a check takes place whether the selected switching device is already in the set/actual position (set/actual comparison). This means, if a circuit breaker is already in the CLOSED position and an attempt is made to issue a closing command, the command will be refused, with the operating message "set condition equals actual condition". If the circuit breaker/switchgear device is in the intermediate position, then this check is not performed.

Bypassing Interlocks

Bypassing configured interlocks at the time of the switching action happens device-internal via interlocking recognition in the command job or globally via so-called switching modes.

- SC=LOCAL
  - The switching modes "interlocked (latched)" or "non-interlocked (unlatched)" can be set via the key switch. The position "Interlocking OFF" corresponds to non-interlocked switching and serves the special purpose of unlocking the standard interlocks.
- REMOTE and DIGSI
  - Commands issued by SICAM or DIGSI are unlocked via a global switching mode REMOTE. A separate job order must be sent for the unlocking. The unlocking applies only for one switching operation and for command caused by the same source.
  - Job order: command to object "Switching mode REMOTE", ON
  - Job order: switching command to "switching device"
- Derived command via CFC (automatic command, SC=Auto SICAM):
  - Behaviour configured in the CFC block ("BOOL to command").

2.5.5 Command Logging

During the processing of the commands, independent of the further message routing and processing, command and process feedback information are sent to the message processing centre. These messages contain information on the cause. With the corresponding allocation (configuration) these messages are entered in the event list, thus serving as a report.

Prerequisites

A listing of possible operating messages and their meaning as well as the command types needed for tripping and closing of the switchgear or for raising and lowering of transformer taps are described in the SIPROTEC 4 System Description.

2.5.5.1 Description

Acknowledgement of Commands to the Device Front

All messages with the source of command LOCAL are transformed into a corresponding response and shown in the display of the device.

Acknowledgement of commands to Local / Remote / Digsi

The acknowledgement of messages with source of command Local/ Remote/DIGSI are sent back to the initiating point independent of the routing (configuration on the serial digital interface).

The acknowledgement of commands is therefore not executed by a response indication as it is done with the local command but by ordinary command and feedback information recording.

Monitoring of Feedback Information

The processing of commands monitors the command execution and timing of feedback information for all commands. At the same time the command is sent, the monitoring time is started (monitoring of the command execution). This time controls whether the device achieves the required final result within the monitoring time. The monitoring time is stopped as soon as the feedback information arrives. If no feedback information arrives, a response "Timeout command monitoring time" appears and the process is terminated.

Commands and information feedback are also recorded in the event list. Normally the execution of a command is terminated as soon as the feedback information (**FB+**) of the relevant switchgear arrives or, in case of commands without process feedback information, the command output resets and a message is output.

The "plus" sign appearing in a feedback information confirms that the command was successful. The command was as expected, in other words positive. The "minus" is a negative confirmation and means that the command was not executed as expected.

Command Output and Switching Relays

The command types needed for tripping and closing of the switchgear or for raising and lowering of transformer taps are described in the configuration section of the SIPROTEC 4 System Description /1/ .

2.6 Auxiliary Functions

Chapter Auxiliary Functions describes the general device functions.

2.6.1 Message Processing

The device is designed to perform message processing:

Applications

- LED Display and Binary Outputs (Output Relays)
- Information via Display Field or Personal Computer
- Information to a Control Center

Prerequisites

The SIPROTEC® 4 System Description gives a detailed description of the configuration procedure (see /1/).

2.6.1.1 LED Display and Binary Outputs (Output relays)

Important events and conditions are displayed, using LEDs at the front panel of the relay. The device furthermore has output relays for remote indication. All LEDs and binary outputs indicating specific messages can be freely configured. The relay is delivered with a default setting. The Appendix of this manual deals in detail with the delivery status and the allocation options.

The output relays and the LEDs may be operated in a latched or unlatched mode (each may be individually set).

The latched conditions are protected against loss of the auxiliary voltage. They are reset:

- On site by pressing the LED key on the relay,
- Remotely using a binary input configured for that purpose,
- Using one of the serial interfaces,
- Automatically at the beginning of a new pickup.

State indication messages should not be latched. Also, they cannot be reset until the criterion to be reported has reset. This applies to messages from monitoring functions, or similar.

A green LED displays operational readiness of the relay ("RUN“), and cannot be reset. It goes out if the self-check feature of the microprocessor recognizes an abnormal occurrence, or if the auxiliary voltage is lost.

When auxiliary voltage is present, but the relay has an internal malfunction, then the red LED ("ERROR") lights up and the processor blocks the relay.

2.6.1.2 Information on the Integrated Display (LCD) or Personal Computer

Events and conditions can be read out on the display at the front cover of the relay. Using the front PC interface or the rear service interface, a personal computer can be connected, to which the information can be sent.

The relay is equipped with several event buffers, for operational messages, circuit breaker statistics, etc., which are protected against loss of the auxiliary voltage by a buffer battery. These messages can be displayed on the LCD at any time by selection via the keypad or transferred to a personal computer via the serial service or PC interface. Readout of messages during operation is described in detail in the SIPROTEC® 4 System Description.

Classification of Messages

The messages are categorized as follows:

- Operational messages; messages generated while the device is operating: Information regarding the status of device functions, measured data, power system data, control command logs etc.
- Messages of "Statistics": they include a counter for the trip commands initiated by the device, i.e. reclose commands.

A complete list of all message and output functions with their associated information number that can be generated by the device with the maximum functional scope can be found in the Appendix. It also indicates where each indication can be sent to. If functions are not present in a not fully equipped version of the device, or are configured to ***Disabled***, then the associated indications cannot appear.

Operational Messages (Buffer: Event Log)

The operational messages contain information that the device generates during operation and about operational conditions. Up to 200 operational messages are recorded in chronological order in the device. New messages are appended at the end of the list. If the memory is used up, then the oldest message is scrolled out of the list by a new message.

General Interrogation

The general interrogation which can be retrieved via DIGSI enables the current status of the SIPROTEC® 4 device to be read out. All messages requiring general interrogation are displayed with their present value.

Spontaneous Messages

The spontaneous messages displayed using DIGSI reflect the present status of incoming information. Each new incoming message appears immediately, i.e. the user does not have to wait for an update or initiate one.

2.6.1.3 Information to a Substation Control Centre

If the device has a serial system interface, stored information may additionally be transferred via this interface to a centralized control and storage device. Transmission is possible via different transmission protocols.

2.6.2 Statistics

The number of trips initiated by the 6MD63 as well as the operating hours under load is counted. The counts are protected against loss of auxiliary supply.

2.6.2.1 Description

Number of Trips

In order to count the number of trips of the 6MD63, the position of the circuit breaker must be monitored via breaker auxiliary contacts and binary inputs of the 6MD63. Hereby it is necessary that the internal pulse counter is allocated in the matrix to a binary input that is controlled by the circuit breaker OPEN position. The pulse count value "Number of TRIPs CB" can be found in the "Statistics" group if the option "Measured and Metered Values Only" was enabled in the configuration matrix.

Interrupted Currents

The summation of accumulated currents for faults – general performance of protection devices – is not applicable for control units. Therefore, no summation is performed in the 6MD63, though the corresponding statistic counters are displayed in the device display and DIGSI.

Operating Hours Counter

The operating hours under load are summed. A current criterion serves to detect the load status. It is fulfilled when a fixed current threshold ($I > 0.04 \cdot I_{Nom}$) has been exceeded in at least one of the three phases.

2.6.2.2 Setting Notes

Reading/Setting/Resetting Counters

The SIPROTEC® 4 System Description describes how to read out the statistical counters via the device front panel or DIGSI. Setting or resetting of these statistical counters takes place under the menu item **ANNUNCIATIONS** —> **STATISTIC** by overwriting the counter values displayed.

2.6.2.3 Information List

No.	Information	Type of Information	Comments
-	#of TRIPs=	PMV	Number of TRIPs=
409	>BLOCK Op Count	SP	>BLOCK Op Counter
1020	Op.Hours=	VI	Counter of operating hours

2.6.3 Measurement

A series of measured values and the values derived from them are permanently available for call up on site, or for data transfer.

Applications

- Information on the actual status of the system
- Conversion from secondary values into primary values and percentages

Prerequisites

Apart from the secondary values, the device is able to indicate the primary values and percentages of the measured values.

A precondition for correct display of the primary and percentage values is complete and correct entry of the nominal values for the instrument transformers and the protected equipment as well as current and voltage transformer ratios in the ground paths when configuring the device. The following table shows the formulas which are the basis for the conversion from secondary values into primary values and percentages.

2.6.3.1 Display of Measured Values

Table 2-5 Conversion formulae between secondary values ad primary/percentage values

Measured Values	secondary	primary	%
I_A, I_B, I_C, I_1, I_2	**I_{sec}**	$\frac{\text{CT PRIMARY}}{\text{CT SECONDARY}} \cdot I_{SEC.}$	$\frac{I_{prim.}}{\text{FullScaleCurr.}}$
$I_N = 3 \cdot I_0$ (calculated)	$I_{N\ sec}$	$\frac{\text{CT PRIMARY}}{\text{CT SECONDARY}} \cdot I_{NSEC.}$	$\frac{I_{N prim.}}{\text{FullScaleCurr.}}$
I_N = measured value of I_N input	$I_{N\ sec}$	$\frac{\text{Ignd} - \text{CT PRIM}}{\text{Ignd} - \text{CT SEC}} \cdot I_{N\ SEC.}$	$\frac{I_{N prim.}}{\text{FullScaleCurr.}}$
V_A, V_B, V_C, V_0, V_1, V_2,	$V_{Ph\text{-}N\ sec.}$	$\frac{\text{Vnom PRIMARY}}{\text{Vnom SECONDARY}} \cdot V_{\phi g\ SEC.}$	$\frac{V_{prim.}}{\text{FullScaleVolt.}/(\sqrt{3})}$
V_{A-B}, V_{B-C}, V_{C-A}	$V_{Ph\text{-}Ph\ sec.}$	$\frac{\text{Vnom PRIMARY}}{\text{Vnom SECONDARY}} \cdot V_{\phi\phi\ SEC.}$	$\frac{V_{prim.}}{\text{FullScaleVolt.}}$
VN	VN sec.	$\text{Vph}/\text{Vdelta} \cdot \frac{\text{Vnom PRIMARY}}{\text{Vnom SECONDARY}} \cdot V_{N\ SEC.}$	$\frac{V_{prim.}}{\sqrt{3} \cdot \text{FullScaleVolt.}}$
P, Q, S (P and Q phase-segregated)	No secondary measured values		$\frac{\text{Power}_{prim.}}{\sqrt{3} \cdot (\text{FullScaleVolt.}) \cdot (\text{FullScaleCurr.})}$

Measured Values	second-ary	primary	%
I_A, I_B, I_C, I_1, I_2	I_{sec}	$\frac{\text{CT PRIMARY}}{\text{CT SECONDARY}} \cdot I_{SEC.}$	$\frac{I_{prim.}}{\text{FullScaleCurr.}}$
Power Factor (phase-segregated)	cos φ	cos φ	cos $\varphi \cdot 100$ in %
frequency	f in Hz	f in Hz	$\frac{\text{f in Hz}}{f_{Nom}} \cdot 100$

Table 2-6 Legend for the conversion formulae

Parameter	Address	Parameter	Address
Vnom PRIMARY	202	Ignd-CT PRIM	217
Vnom SECONDARY	203	Ignd-CT SEC	218
CT PRIMARY	204	FullScaleVolt.	1101
CT SECONDARY	205	FullScaleCurr.	1102
Vph / Vdelta	206		

Depending on the type of device ordered and the device connections, some of the operating measured values listed below may not be available. The phase–to–ground voltages are either measured directly, if the voltage inputs are connected phase–to–ground, or they are calculated from the phase–to–phase voltages V_{A-B} and V_{B-C} and the displacement voltage V_N.

The displacement voltage V_N is either measured directly or calculated from the phase-to-ground voltages:

$V_N = 3V_0/(V_{ph} / V_{delta})$ with $3V_0 = (V_a + V_b + V_c)$

V_{ph}/V_{delta} = Transformation adjustment for ground input voltage (setting 0206A)

Please note that value V_0 is indicated in the operational measured values.

The ground current I_N is either measured directly or calculated from the conductor currents:

$$I_N = \frac{3 \cdot I_0}{I_{gnd\text{-}CT}/(CT)}$$

with $3I_0 = (I_a + I_b + I_c)$

$I_{gnd\text{-}CT}$ = Parameter 0217 or 0218

CT = Parameter 0204 or 0205

2.6.3.2 Inversion of Measured Power Values

If required, different settings can be applied to the "forward" direction for the monitoring functions and the positive direction for the directional values (power, power factor, work and related min., max., mean and thresholds), calculated in the operational measured values (see **P.System Data 2** and Chapter 4). To do so, set address 1108 **P,Q sign** to ***reversed***. If the setting is ***not reversed*** (default), the positive direction for the power etc. corresponds to the “forward“ direction for the monitoring functions.

2.6.3.3 Transfer of Measured Values

Measured values can be transferred via the interfaces to a central control and storage unit.

2.6.3.4 Information List

No.	Information	Type of Information	Comments
268	Superv.Pressure	OUT	Supervision Pressure
269	Superv.Temp.	OUT	Supervision Temperature
601	Ia =	MV	Ia
602	Ib =	MV	Ib
603	Ic =	MV	Ic
604	In =	MV	In
605	I1 =	MV	I1 (positive sequence)
606	I2 =	MV	I2 (negative sequence)
621	Va =	MV	Va
622	Vb =	MV	Vb
623	Vc =	MV	Vc
624	Va-b=	MV	Va-b
625	Vb-c=	MV	Vb-c
626	Vc-a=	MV	Vc-a
627	VN =	MV	VN
629	V1 =	MV	V1 (positive sequence)
630	V2 =	MV	V2 (negative sequence)
641	P =	MV	P (active power)
642	Q =	MV	Q (reactive power)
644	Freq=	MV	Frequency

No.	Information	Type of Information	Comments
645	S =	MV	S (apparent power)
831	3Io =	MV	3Io (zero sequence)
832	Vo =	MV	Vo (zero sequence)
901	PF =	MV	Power Factor
991	Press =	MVU	Pressure
992	Temp =	MVU	Temperature
996	Td1=	MV	Transducer 1
997	Td2=	MV	Transducer 2
1068	Θ RTD 1 =	MV	Temperature of RTD 1
1069	Θ RTD 2 =	MV	Temperature of RTD 2
1070	Θ RTD 3 =	MV	Temperature of RTD 3
1071	Θ RTD 4 =	MV	Temperature of RTD 4
1072	Θ RTD 5 =	MV	Temperature of RTD 5
1073	Θ RTD 6 =	MV	Temperature of RTD 6
1074	Θ RTD 7 =	MV	Temperature of RTD 7
1075	Θ RTD 8 =	MV	Temperature of RTD 8
1076	Θ RTD 9 =	MV	Temperature of RTD 9
1077	Θ RTD10 =	MV	Temperature of RTD10
1078	Θ RTD11 =	MV	Temperature of RTD11
1079	Θ RTD12 =	MV	Temperature of RTD12

2.6.4 Average Measurements

Long-term averages are calculated and output by the 6md63.

2.6.4.1 Description

Long-term Averages

The long-term averages of the three phase currents I_x, the positive sequence component I_1 of the three phase currents, and the real power P, reactive power Q, and apparent power S are calculated and memorized. Averages are indicated in primary values.

For the long-term averages mentioned above, the length of the time window for averaging and the frequency with which it is updated can be set. The associated minimum and maximum values can be reset, using binary inputs or by using the integrated control panel in the DIGSI operating program.

The values are updated in intervals of > 0.3 s and < 1 s.

2.6.4.2 Setting Notes

Average Calculation

The selection of the time period for measured value averaging is set with parameter 8301 **DMD Interval** at **MEASUREMENT**. The first number specifies the averaging time window in minutes while the second number gives the number of subdivisions of updates within the time window. ***15 Min., 3 Subs***, for example, means: Time average generation occurs for all measured values that arrive within 15 minutes. The output is updated every 15/3 = 5 minutes.

With address 8302 **DMD Sync.Time**, the starting time for the averaging window set under address 8301 is determined. This setting determines if the window should start on the hour (***On The Hour***) or 15 minutes later (***15 After Hour***) or 30 minutes / 45 minutes after the hour (***30 After Hour 45 After Hour***).

If the settings for averaging are changed, then the measured values stored in the buffer are deleted, and new results for the average calculation are only available after the set time period has passed.

2.6.4.3 Settings

Addr.	Parameter	Setting Options	Default Setting	Comments
8301	DMD Interval	15 Min., 1 Sub 15 Min., 3 Subs 15 Min.,15 Subs 30 Min., 1 Sub 60 Min., 1 Sub 60 Min.,10 Subs 5 Min., 5 Subs	60 Min., 1 Sub	Demand Calculation Intervals
8302	DMD Sync.Time	On The Hour 15 After Hour 30 After Hour 45 After Hour	On The Hour	Demand Synchronization Time

2.6.4.4 Information List

No.	Information	Type of Information	Comments
833	I1 dmd=	MV	I1 (positive sequence) Demand
834	P dmd =	MV	Active Power Demand
835	Q dmd =	MV	Reactive Power Demand
836	S dmd =	MV	Apparent Power Demand
963	Ia dmd=	MV	I A demand
964	Ib dmd=	MV	I B demand
965	Ic dmd=	MV	I C demand

2.6.5 Min/Max Measurement Setup

Minimum and maximum values are calculated by the device and can be read out with the point of time (date and time of the last update).

2.6.5.1 Description

Minimum and Maximum Values

The minimum and maximum values for the three phase currents I_x, the three phase-to-ground voltages V_{x-g}, the three phase-to-phase voltages V_{xy}, the positive sequence components I_1 and V_1, the displacement voltage V_0, the real power P, reactive power Q, and apparent power S, the frequency, and the power factor cos φ, primary values are recorded including the date and time they were last updated.

Additionally, minimum and maximum values for the long-term averages, including also the date and time they were last updated, are made available in primary values.

The values are updated in intervals of > 0.3 s and < 1 s.

The minimum and maximum values are listed with the date and time of the latest update. Using binary inputs, operating via the integrated control panel or the operating program DIGSI 4, the maximum and minimum values can be reset. In addition, the reset can also take place cyclically, beginning with a pre-selected point in time.

2.6.5.2 Setting Notes

Minimum and Maximum Values

The tracking of minimum and maximum values can be reset automatically at a programmable point in time. To select this feature, address 8311 **MinMax cycRESET** should be set to ***YES***. The point in time when reset is to take place (the minute of the day in which reset will take place) is set at address 8312 **MiMa RESET TIME**. The reset cycle in days is entered at address 8313 **MiMa RESETCYCLE**, and the beginning date of the cyclical process, from the time of the setting procedure (in days), is entered at address 8314 **MinMaxRES.START**.

2.6.5.3 Settings

Addr.	Parameter	Setting Options	Default Setting	Comments
8311	MinMax cycRESET	NO YES	YES	Automatic Cyclic Reset Function
8312	MiMa RESET TIME	0 .. 1439 min	0 min	MinMax Reset Timer
8313	MiMa RESETCYCLE	1 .. 365 Days	7 Days	MinMax Reset Cycle Period
8314	MinMaxRES.START	1 .. 365 Days	1 Days	MinMax Start Reset Cycle in

2.6.5.4 Information List

No.	Information	Type of In-formation	Comments
395	>I MinMax Reset	SP	>I MIN/MAX Buffer Reset
396	>I1 MiMaReset	SP	>I1 MIN/MAX Buffer Reset
397	>V MiMaReset	SP	>V MIN/MAX Buffer Reset
398	>VphphMiMaRes	SP	>Vphph MIN/MAX Buffer Reset
399	>V1 MiMa Reset	SP	>V1 MIN/MAX Buffer Reset
400	>P MiMa Reset	SP	>P MIN/MAX Buffer Reset
401	>S MiMa Reset	SP	>S MIN/MAX Buffer Reset
402	>Q MiMa Reset	SP	>Q MIN/MAX Buffer Reset
403	>Idmd MiMaReset	SP	>Idmd MIN/MAX Buffer Reset
404	>Pdmd MiMaReset	SP	>Pdmd MIN/MAX Buffer Reset
405	>Qdmd MiMaReset	SP	>Qdmd MIN/MAX Buffer Reset
406	>Sdmd MiMaReset	SP	>Sdmd MIN/MAX Buffer Reset
407	>Frq MiMa Reset	SP	>Frq. MIN/MAX Buffer Reset
408	>PF MiMaReset	SP	>Power Factor MIN/MAX Buffer Reset
837	IAdmdMin	MVT	I A Demand Minimum
838	IAdmdMax	MVT	I A Demand Maximum
839	IBdmdMin	MVT	I B Demand Minimum
840	IBdmdMax	MVT	I B Demand Maximum
841	ICdmdMin	MVT	I C Demand Minimum
842	ICdmdMax	MVT	I C Demand Maximum
843	I1dmdMin	MVT	I1 (positive sequence) Demand Minimum
844	I1dmdMax	MVT	I1 (positive sequence) Demand Maximum
845	PdMin=	MVT	Active Power Demand Minimum
846	PdMax=	MVT	Active Power Demand Maximum
847	QdMin=	MVT	Reactive Power Minimum
848	QdMax=	MVT	Reactive Power Maximum
849	SdMin=	MVT	Apparent Power Minimum
850	SdMax=	MVT	Apparent Power Maximum
851	Ia Min=	MVT	Ia Min
852	Ia Max=	MVT	Ia Max
853	Ib Min=	MVT	Ib Min
854	Ib Max=	MVT	Ib Max
855	Ic Min=	MVT	Ic Min
856	Ic Max=	MVT	Ic Max
857	I1 Min=	MVT	I1 (positive sequence) Minimum
858	I1 Max=	MVT	I1 (positive sequence) Maximum
859	Va-nMin=	MVT	Va-n Min
860	Va-nMax=	MVT	Va-n Max
861	Vb-nMin=	MVT	Vb-n Min
862	Vb-nMax=	MVT	Vb-n Max
863	Vc-nMin=	MVT	Vc-n Min
864	Vc-nMax=	MVT	Vc-n Max
865	Va-bMin=	MVT	Va-b Min
867	Va-bMax=	MVT	Va-b Max

No.	Information	Type of Information	Comments
868	Vb-cMin=	MVT	Vb-c Min
869	Vb-cMax=	MVT	Vb-c Max
870	Vc-aMin=	MVT	Vc-a Min
871	Vc-aMax=	MVT	Vc-a Max
872	Vn Min =	MVT	V neutral Min
873	Vn Max =	MVT	V neutral Max
874	V1 Min =	MVT	V1 (positive sequence) Voltage Minimum
875	V1 Max =	MVT	V1 (positive sequence) Voltage Maximum
876	Pmin=	MVT	Active Power Minimum
877	Pmax=	MVT	Active Power Maximum
878	Qmin=	MVT	Reactive Power Minimum
879	Qmax=	MVT	Reactive Power Maximum
880	Smin=	MVT	Apparent Power Minimum
881	Smax=	MVT	Apparent Power Maximum
882	fmin=	MVT	Frequency Minimum
883	fmax=	MVT	Frequency Maximum
884	PF Max=	MVT	Power Factor Maximum
885	PF Min=	MVT	Power Factor Minimum

2.6.6 Set Points for Measured Values

SIPROTEC® devices allow limit points (set points) to be set for some measured and metered values. If, during operation, a value reaches one of these set-points, the device generates an alarm which is indicated as an operational message. This can be configured to LEDs and/or binary outputs, transferred via the ports and interconnected in DIGSI® CFC. In addition you can use DIGSI® CFC to configure set points for further measured and metered values and allocate these via the DIGSI® device matrix. In contrast to the actual protection functions of a protection device the limit value monitoring function operates in the background; therefore it may not pick up if measured values are changed spontaneously in the event of a fault and if protection functions are picked up. Furthermore, since a message is only issued when the set point limit is repeatedly exceeded, the set point monitoring functions do not react as fast as protection functions trip signals.

Applications

- This monitoring scheme operates in the background and uses multiple repeated measurements. Before de-energization, as the case may be, is provoked by external protection devices, the scheme may not pick up when measured values are suddenly changed due to a fault.

2.6.6.1 Description

Limit Value Monitoring

Ex works, the following individual set point levels are configured:

- **IAdmd>**: Exceeding a preset maximum average value in Phase A;
- **IBdmd>**: Exceeding a preset maximum average value in Phase B;
- **ICdmd>**: Exceeding a preset maximum average value in Phase C;
- **I1dmd>**: Exceeding a preset maximum average of the positive sequence current;
- **|Pdmd|>**: Exceeding a preset maximum average active power.
- **|Qdmd|>**: Exceeding a preset maximum average reactive power;
- **Sdmd>**: Exceeding a preset maximum average of the apparent power;
- **Temp>**: Exceeding a preset temperature (if measuring transducer available);
- **Pressure<**: Falling below a preset pressure (if measuring transducer available);
- **IL<**: Falling below a preset current in any phase;
- **|cos**φ **|<**: Falling below a preset power factor.

2.6.6.2 Setting Notes

Set Points

Setting is performed in the DIGSI configuration Matrix under **Settings**, **Masking I/O (Configuration Matrix)**. Set the filter "Measured and Metered Values Only" and select the configuration group "Set Points (MV)". Here, default settings may be changed or new set points defined.

Settings must be applied in percent and usually refer to nominal values of the device.

2.6.6.3 Information List

<table>
<tr><th>No.</th><th>Information</th><th>Type of Information</th><th>Comments</th></tr>
<tr><td>-</td><td>I Admd></td><td>LV</td><td>I A dmd></td></tr>
<tr><td>-</td><td>I Bdmd></td><td>LV</td><td>I B dmd></td></tr>
<tr><td>-</td><td>I Cdmd></td><td>LV</td><td>I C dmd></td></tr>
<tr><td>-</td><td>I1dmd></td><td>LV</td><td>I1dmd></td></tr>
<tr><td>-</td><td>|Pdmd|></td><td>LV</td><td>|Pdmd|></td></tr>
<tr><td>-</td><td>|Qdmd|></td><td>LV</td><td>|Qdmd|></td></tr>
<tr><td>-</td><td>|Sdmd|></td><td>LV</td><td>|Sdmd|></td></tr>
<tr><td>-</td><td>Press<</td><td>LVU</td><td>Pressure<</td></tr>
<tr><td>-</td><td>Temp></td><td>LVU</td><td>Temp></td></tr>
<tr><td>-</td><td>37-1</td><td>LV</td><td>37-1 under current</td></tr>
<tr><td>-</td><td>|PF|<</td><td>LV</td><td>|Power Factor|<</td></tr>
<tr><td>270</td><td>SP. Pressure<</td><td>OUT</td><td>Set Point Pressure<</td></tr>
<tr><td>271</td><td>SP. Temp></td><td>OUT</td><td>Set Point Temp></td></tr>
<tr><td>273</td><td>SP. I A dmd></td><td>OUT</td><td>Set Point Phase A dmd></td></tr>
<tr><td>274</td><td>SP. I B dmd></td><td>OUT</td><td>Set Point Phase B dmd></td></tr>
<tr><td>275</td><td>SP. I C dmd></td><td>OUT</td><td>Set Point Phase C dmd></td></tr>
<tr><td>276</td><td>SP. I1dmd></td><td>OUT</td><td>Set Point positive sequence I1dmd></td></tr>
<tr><td>277</td><td>SP. |Pdmd|></td><td>OUT</td><td>Set Point |Pdmd|></td></tr>
<tr><td>278</td><td>SP. |Qdmd|></td><td>OUT</td><td>Set Point |Qdmd|></td></tr>
</table>

No.	Information	Type of In-formation	Comments
279	SP. |Sdmd|>	OUT	Set Point |Sdmd|>
284	SP. 37-1 alarm	OUT	Set Point 37-1 Undercurrent alarm
285	SP. PF(55)alarm	OUT	Set Point 55 Power factor alarm

2.6.7 Set Points for Statistic

2.6.7.1 Description

For the statistical counters, limit values may be entered and a message is generated as soon as they are reached. The message can be allocated to both output relays and LEDs.

2.6.7.2 Setting Notes

Setting/Resetting

Set-points for the statistic counter are entered in the DIGSI menu item **Annunciation** → **Statistic** into the submenu **Set Points for Statistic**. Double-click to display the corresponding contents in another window. By overwriting the previous value you can change the settings (please refer to the SIPROTEC 4 System Description).

2.6.7.3 Information List

No.	Information	Type of In-formation	Comments
-	OpHour>	LV	Operating hours greater than
272	SP. Op Hours>	OUT	Set Point Operating Hours

2.6.8 Energy Metering

Metered values for active and reactive energy are determined by the device. They can be called up at the front of the device, read out via the operating interface using a PC with DIGSI, or transferred to a central master station via the system interface.

2.6.8.1 Description

Metered Values for Active and Reactive Energy

Metered values of the real power W_p and reactive power (W_q) are acquired in kilowatt, megawatt or gigawatt hours primary or in kVARh, MVARh or GVARh primary, separately according to the input (+) and output (–), or capacitive and inductive. The measured-value resolution can be configured. The signs of the measured values depend on the setting of address 1108 **P,Q sign**.

2.6.8.2 Setting Notes

Meter Resolution Settings

Parameter 8315 **MeterResolution** can be used to maximize the resolution of the metered energy values by ***Factor 10*** or ***Factor 100*** compared to the ***Standard*** setting.

2.6.8.3 Settings

Addr.	Parameter	Setting Options	Default Setting	Comments
8315	MeterResolution	Standard Factor 10 Factor 100	Standard	Meter resolution

2.6.8.4 Information List

No.	Information	Type of Information	Comments
-	Meter res	IntSP_Ev	Reset meter
888	Wp(puls)	PMV	Pulsed Energy Wp (active)
889	Wq(puls)	PMV	Pulsed Energy Wq (reactive)
924	WpForward	MVMV	Wp Forward
925	WqForward	MVMV	Wq Forward
928	WpReverse	MVMV	Wp Reverse
929	WqReverse	MVMV	Wq Reverse

2.6.9 Commissioning Aids

Device data sent to a central or master computer system during test mode or commissioning can be influenced. There are tools for testing the system interface and the binary inputs and outputs of the device.

Applications

- Test Mode
- Commissioning

Prerequisites

To be able to use the commissioning aids described below, the following must apply:

– The device must be equipped with an interface;

– The device has to be connected to a control center.

2.6.9.1 Description

Test Messages to the SCADA Interface during Test Operation

If the device is connected to a central or main computer system via the SCADA interface, then the information that is transmitted can be influenced.

Depending on the type of protocol, all messages and measured values transferred to the central control system can be identified with an added message "test operation"-bit while the device is being tested on site (test mode). This identification prevents the messages from being incorrectly interpreted as resulting from an actual power system disturbance or event. As another option, all messages and measured values normally transferred via the system interface can be blocked during the testing ("block data transmission").

Data transmission block can be accomplished by controlling binary inputs, by using the operating panel on the device, or with a PC and DIGSI via the operator interface.

The SIPROTEC 4 System Description describes in detail how to activate and deactivate test mode and blocked data transmission.

Checking the System Interface

If the device features a system port and uses it to communicate with the control center, the DIGSI device operation can be used to test if messages are transmitted correctly.

A dialog box shows the display texts of all messages which were allocated to the system interface in the configuration matrix. In another column of the dialog box you can specify a value for the messages you intend to test (e.g. ON/OFF). Having entered password no. 6 (for hardware test menus) a message can then be generated. The corresponding message is issued and can be read out either from the event log of the SIPROTEC 4 device or from the substation control system.

The procedure is described in detail in Chapter "Mounting and Commissioning".

Checking the Binary Inputs and Outputs

The binary inputs, outputs, and LEDs of a SIPROTEC 4 device can be individually and precisely controlled in DIGSI. This feature can be used, for example, to verify control wiring from the device to substation equipment (operational checks), during start-up.

A dialog box shows all binary inputs and outputs and LEDs of the device with their present status. The operating equipment, commands, or messages that are configured (masked) to the hardware components are displayed also. After entering password no. 6 (for hardware test menus), it is possible to switch to the opposite status in another column of the dialog box. Thus, you can energize every single output relay to check the wiring between 6MD63 and the system without having to create the alarm allocated to it.

The procedure is described in detail in Chapter "Mounting and Commissioning".

■

Mounting and Commissioning 3

This chapter is intended for experienced commissioning staff. The staff must be familiar with the commissioning of protection and control systems, with the management of power systems and with the relevant safety rules and guidelines. Hardware modifications that might be needed in certain cases are explained. The primary tests require the protected object (line, transformer, etc.) to carry load.

3.1 Mounting and Connections

General

WARNING!

Warning of improper transport, storage, installation, and application of the device.

Non-observance of these precautions can result in death, personal injury or serial material damage.

Trouble free and safe use of this device depends on proper transport, storage, installation, and application of the device according to the warnings in this instruction manual.

Of particular importance are the general installation and safety regulations for work in a high-voltage environment (for example, ANSI, IEC, EN, DIN, or other national and international regulations). These regulations must be observed.

3.1.1 Configuration Information

Prerequisites

For installation and connections the following conditions must be met:

The rated device data has been tested as recommended in the SIPROTEC® System Description /1/. The compliance with these data is verified with the Power System Data.

Connections

Terminal assignments are shown in Appendix A.2. Connection examples for current and voltage transformer circuits are provided in Appendix, Section A.3. The device can either be connected with three phase-ground voltages (connection mode **VT Connect. 3ph** = ***Van, Vbn, Vcn***), or with two phase-phase voltages and V_{delta} (also called the displacement voltage) from open delta VTs as (connection mode **VT Connect. 3ph** = ***Vab, Vbc, VGnd***). For the latter, only two phase-phase voltages or the displacement voltage V_{delta} can be connected. In the device settings, the appropriate voltage connection must be entered in address 213, in **P.System Data 1**.

Since the voltage inputs of the 6MD63 device have an operating range from 0 to 170 V, this means that phase-to-phase voltages can be assessed in connection of phase-to-ground voltages up to $\sqrt{3} \cdot 170$ V = 294 V, in the second case up to 170 V.

Binary Inputs and Outputs

The configuration options of the binary inputs and outputs, i.e. the individual adaptation to the system conditions is described in the SIPROTEC® System Description /1/. The connections to the system are dependent on this actual configuration. The default settings of the device are listed in Appendix A, Section A.5. Check also whether the labelling corresponds to the allocated message functions.

3.1.2 Hardware Modifications

3.1.2.1 General

Hardware modifications concerning, for instance, nominal currents, the control voltage for binary inputs or termination of serial interfaces might be necessary. Follow the procedure described in this section, whenever hardware modifications are done.

Power Supply Voltage

There are different power supply voltage ranges for the auxiliary voltage (refer to the Ordering Information in Appendix A.1). The power supplies of the variants for DC 60/110/125 V and DC 110/125/220 V, AC 115/230 V are largely interchangeable by modifying the position of the jumpers. The assignment of these jumpers to the nominal voltage ranges and their spatial arrangement on the PCB are described in Section 3.1.2.3. Location and ratings of the miniature fuse and the buffer battery are also shown. When the relays are delivered, these jumpers are set according to the name-plate sticker. Generally, they need not be altered.

Live Status Contact

The life contact of devices 6MD63 is a changeover contact, i.e. either the NC position or the NO position can be connected to the device terminals via a jumper (X40). The assignment of the jumpers to the contact type and the spatial arrangement of the jumper are described in Section 3.1.2.3.

Nominal Currents

The input transformers of the devices are set to a nominal current of 1 A or 5 A by burden switching. Jumpers are set according to the name-plate sticker. The assignment of the jumpers to the nominal current and the spatial arrangement of the jumpers are described in Section 3.1.2.3.

Jumpers X61, X62 and X63 must be set for the same nominal current, i.e. there must be one jumper for each input transformer, and the common jumper X 60.

Jumper X64 for the ground path is set to 1 A or 5 A (depending on the ordered variant) irrespective of the other jumper positions.

Note

If nominal current ratings are changed exceptionally, then the new ratings must be registered in addresses 205 **CT SECONDARY**/218 **Ignd-CT SEC** in the Power System Data (see Subsection 2.1.2.2).

Control Voltage for Binary Inputs

When the device is delivered from the factory, the binary inputs are set to operate with a voltage that corresponds to the rated DC voltage of the power supply. In general, to optimize the operation of the inputs, the pick-up voltage of the inputs should be set to most closely match the actual control voltage being used.

A jumper position is changed to adjust the pickup voltage of a binary input. The assignment of the jumpers to the binary inputs and their spatial arrangement are described in the following sections.

Exchanging Interfaces

Only serial interfaces of devices for panel and cubicle flush mounting as well as of mounting devices with detached operator panel or without operator panel are exchangeable. Which interfaces can be exchanged, and how this is done, is described in Subsection 3.1.2.4 under the margin heading “Exchanging Interface Modules”.

Configuration RS232/RS485

When the device is delivered from the factory, the serial interfaces are matched to the ordered version according to the 11th and 12th figure of the ordering code of the device (or to the additional information of the ordering code). The configuration to a RS232 or RS485 interface is determined by jumpers on the interface module. The physical arrangement of the jumpers is described in Subsection 3.1.2.4, under the margin heading “RS232 Interface” and “RS485/RS232/Profibus”.

Configuration IEC 61850 Ethernet (EN 100)

The interface module does not feature any jumpers. Its use does not require any hardware adaptations.

Terminating of SerialInterfaces

If the device is equipped with a serial RS485 interface or PROFIBUS, they must be terminated with resistors at the last device on the bus to ensure reliable data transmission. Therefore the RS485 or PROFIBUS interface module are provided with terminating resistors that can be connected to the system by means of jumpers. The physical arrangement of the jumpers on the interface modules is described in Subsection 3.1.2.4 under the margin heading “RS485/RS232/Profibus” and “PROFIBUS (FMS/DP) DNP3.0/Modbus”. Both jumpers must always be plugged identically.

As delivered from the factory, the resistors are switched out.

Spare Parts

Spare parts can be the buffer battery that provides for storage of the data in the battery-buffered RAM when the supply voltage fails, and the miniature fuse of the internal power supply. Their spatial position is shown in the figures of the processor boards (Figure 3-3 and 3-4). The ratings of the fuse are printed on the board next the fuse itself. When exchanging the battery or the fuse, please observe the information in the /1/, Chapter “Maintenance” and “Corrective Action / Repairs”.

3.1.2.2 Disassembly

Disassembly of the Device

Note

It is assumed for the following steps that the device is not operative.

Work on the Printed Circuit Boards

Caution!

Caution when changing jumper settings that affect nominal values of the device

As a consequence, the ordering number (MLFB) and the ratings that are stated on the nameplate do no longer match the actual device properties.

If such changes are necessary, the changes should be clearly and fully noted on the device. Self adhesive stickers are available that can be used as replacement name-plates.

To perform work on the printed circuit boards, such as checking or moving switching elements or exchanging modules, proceed as follows:

- Prepare the working area. Provide a grounded mat for protecting components subject to damage from electrostatic discharges (ESD). The following equipment is needed:
  - screwdriver with a 5 to 6 mm wide tip,
  - a Philips screwdriver size 1,
  - 5 mm socket or nut driver.
- Unfasten the screw-posts of the D-subminiature connectors on the back panel at location “A” and/or “C”. This is not necessary if the device is designed for surface mounting.
- If the device has more communication interfaces at locations “A”, “C” and/or “B” on the rear, the screws located diagonally to the interfaces must be removed. This is not necessary if the device is designed for surface mounting.
- Remove the four or six caps on the front cover and loosen the screws that become accessible.
- Carefully take off the front cover. With device versions with a detached operator panel it is possible to remove the front cover of the device right after having un-screwed all screws.

Work on the Plug Connectors

Caution!

Mind electrostatic discharges

Non–observance can result in minor personal injury or property damage.

When handling with plug connectors, electrostatic discharges may emerge by previously touching an earthed metal surface must be avoided.

Do not plug or withdraw interface connections under power!

When performing work on plug connectors, proceed as follows:

- Disconnect the ribbon cable between the front cover and the B-CPU board (No. 1 in Figures 3-1 and 3-2) at the front cover side. Press the top latch of the plug connector up and the bottom latch down so that the plug connector of the ribbon cable is pressed out. This action does not apply to the device version with detached operator panel. However, on the central processor unit B-CPU (No. 1) the 7-pole plug connector X16 behind the D-subminiture connector and the plug connector of the ribbon cable (connected to the 68-pole plug connector on the rear side) must be removed.
- Disconnect the ribbon cables between the B–CPU unit (No. 1) and the input/output printed circuit boards B–I/O (No. 2) and (No. 3).
- Remove the boards and set them on the grounded mat to protect them from ESD damage. In the case of the device variant for panel surface mounting, please be aware of the fact that a certain amount of force is required to remove the B-CPU board due to the existing plug connector.
- Check the jumpers in accordance with Figures 3-3 to 3-6 and the following information, and as the case may be change or remove them.

The arrangement of the boards are shown in Figures 3-1 and 3-2.

Board Arrangement 6MD63

The following figure shows the arrangement of the modules for device 6MD63 with housing size $^1/_2$. The subsequencing figure illustrates housing size $^1/_1$.

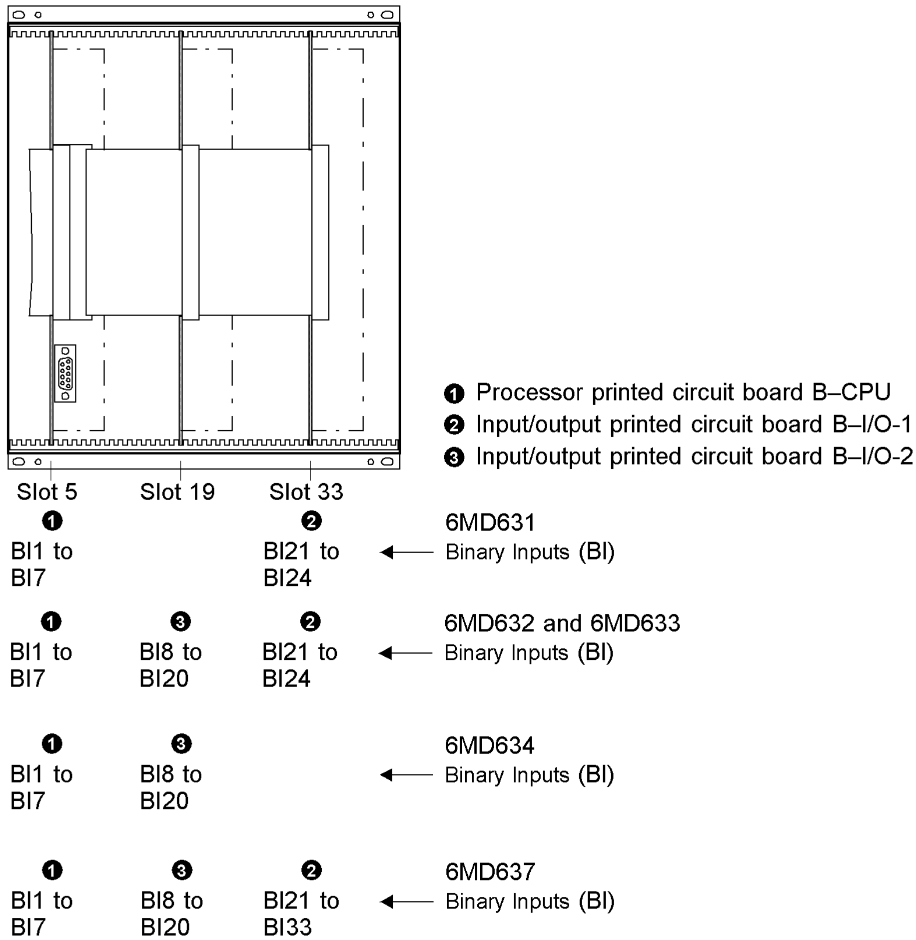


Figure 3-1 Front view of the 6MD63 with housing size $^{1}/_{2}$ after removal of the front cover (simplified and scaled down)

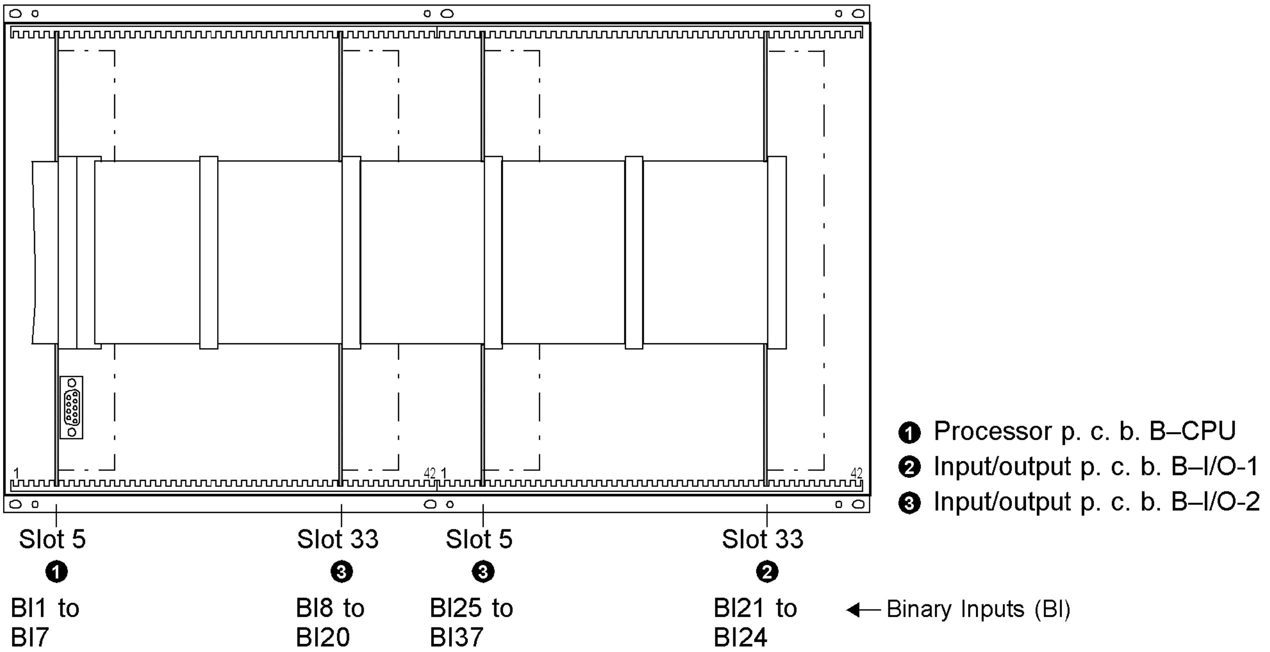


Figure 3-2 Front view of the 6MD635 and 6MD636 with housing size $^1/_1$ after removal of the front cover (simplified and scaled down)

3.1.2.3 Switching Elements on the Printed Circuit Boards

Processor Board B–CPU for 6MD63.../DD

There are two different releases available of the B–CPU board with a different arrangement and setting of the jumpers. The following figure depicts the layout of the printed circuit board B-CPU for devices up to release .../DD. The location and ratings of the miniature fuse (F1) and of the buffer battery (G1) are shown in the following figure.

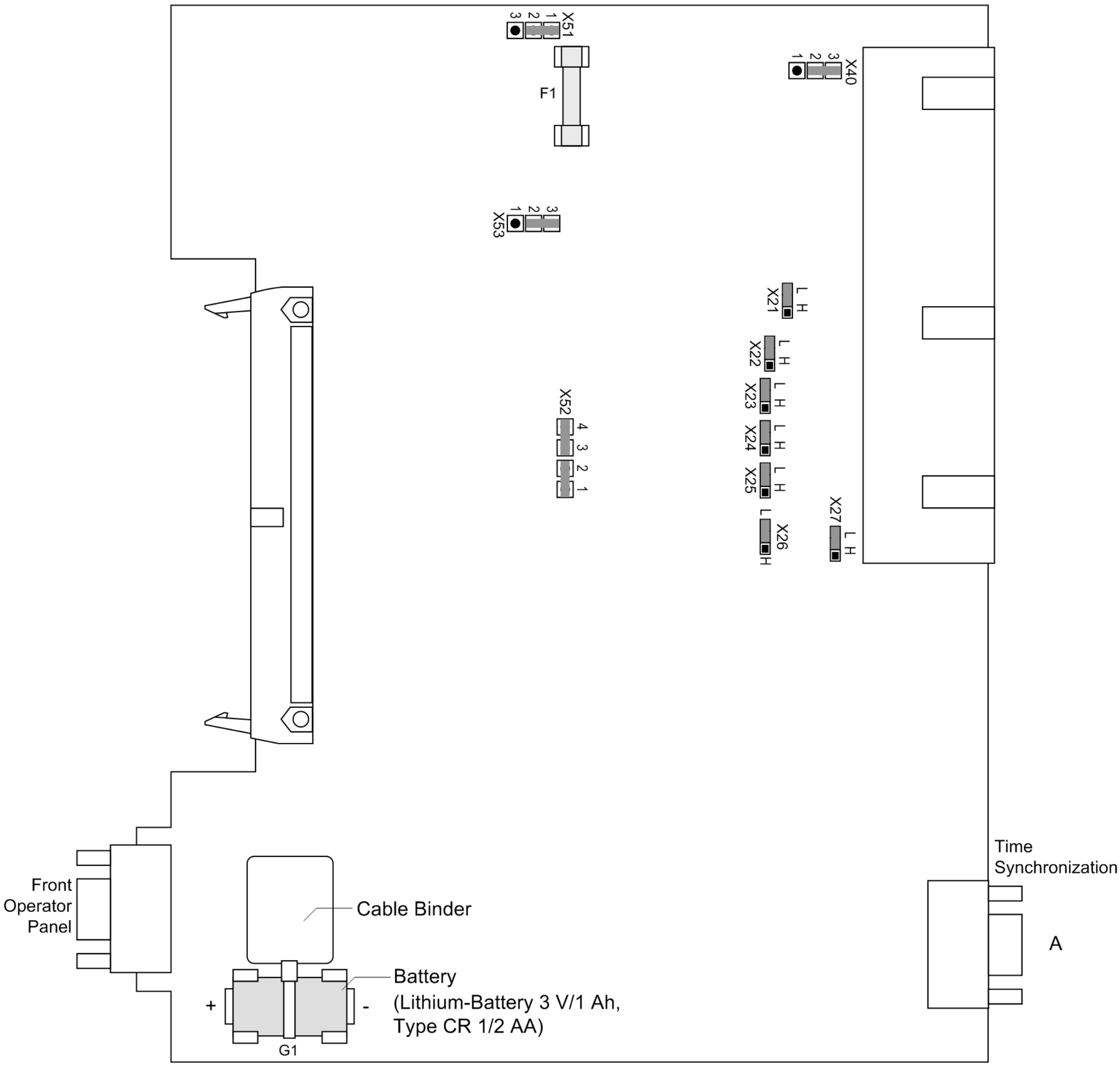


Figure 3-3 Processor printed circuit board B–CPU for devices up to release.../DD with jumpers settings required for the board configuration

For devices up to release 6MD63.../DD the jumpers for the set nominal voltage of the integrated power supply are checked in accordance with Table 3-1, the quiescent state of the life contact in accordance with Table 3-2 and the selected pickup voltages of the binary inputs BI1 through BI7 in accordance with Table 3-3.

Power Supply

There is no 230 VAC power supply available for 6MD63.../DD.

Table 3-1 Jumper settings for nominal voltage of the integrated **power supply** on the processor board B-CPU for 6MD63.../**DD**.

Jumper	Nominal Voltage		
	60 to 125 VDC	**110 to 250 VDC, 115 VAC**	**24/48 VDC**
X51	1-2	2-3	Jumpers X51 to X53 are not used
X52	1-2 and 3-4	2-3	
X53	1-2	2-3	
	interchangeable		cannot be changed

Life Status Contact

Table 3-2 Jumper settings for the quiescent state of the **life contact** on the B–CPU processor PCB for 6MD63.../**DD** devices.

Jumper	Open in the quiescent state	Closed in the quiescent state	Presetting
X40	1-2	2-3	2-3

Pickup voltages of BI1 to BI7

Table 3-3 Jumper settings for the **pickup voltages** of binary inputs BI1 to BI7 on the processor board B-CPU for 6MD63.../**DD**

Binary Inputs	Jumper	19 VDC Pickup [1)]	88 VDC Pickup [2)]
BI1	X21	L	H
BI2	X22	L	H
BI3	X23	L	H
BI4	X24	L	H
BI5	X25	L	H
BI6	X26	L	H
BI7	X27	L	H

[1)] Factory settings for devices with power supply voltages of 24 VDC to 125 VDC

[2)] Factory settings for devices with power supply voltages of 110 VDC to 220 VDC and 115 VAC

Processor Board B–CPU for 6MD63.../EE

The following figure depicts the layout of the printed circuit board for devices up to release .../EE. The location and ratings of the miniature fuse (F1) and of the buffer battery (G1) are shown in the following figure.

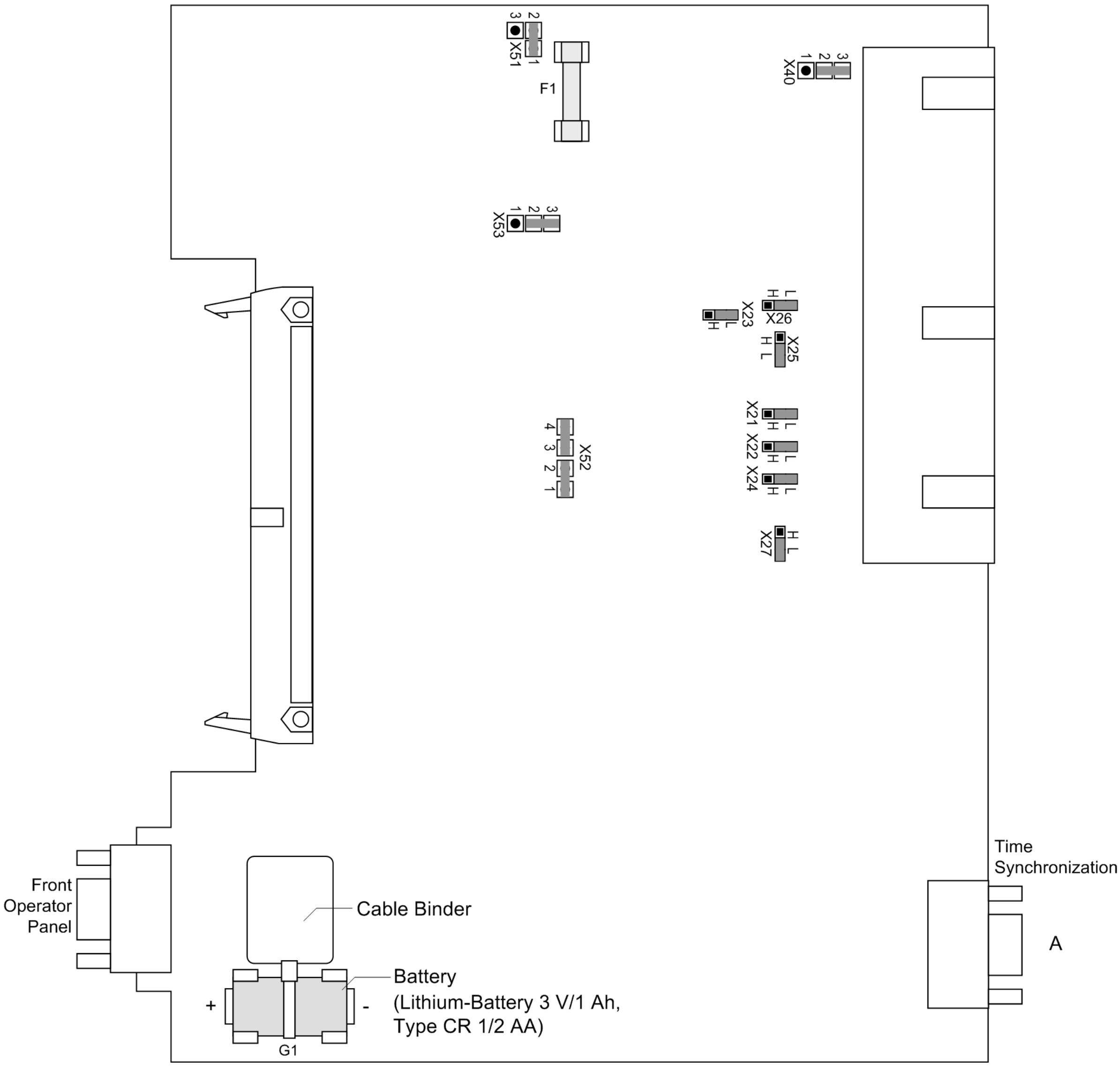


Figure 3-4 Processor printed circuit board B–CPU for devices .../EE and higher with jumpers settings required for the board configuration

For devices of release 6MD63.../EE and higher, the jumpers for the set nominal voltage of the integrated power supply are checked in accordance with Table 3-4, the quiescent state of the life contact in accordance with Table 3-5 and the selected control voltages of binary inputs BI1 through BI7 in accordance with Table 3-6.

Power Supply

There is a 230 VAC power supply available for 6MD63.../EE.

Table 3-4 Jumper settings for the nominal voltage of the integrated **power supply** on the processor board B-CPU for 6MD63.../**EE**.

Jumper	Nominal Voltage		
	60/110/125 VDC	220/250 VDC 115/230 VAC	24/48 VDC
X51	1-2	2-3	1-2
X52	1-2 and 3-4	2-3	None
X53	1-2	2-3	None
	interchangeable		cannot be changed

Life Status Contact

Table 3-5 Jumper setting for the quiescent state of the **life contact** on the processor board B-CPU for devices 6MD63.../**EE**

Jumper	Open in the quiescent state	Closed in the quiescent state	Presetting
X40	1-2	2-3	2-3

Pickup Voltages of BI1 to BI7

Table 3-6 Jumper settings for the **pickup voltages** of binary inputs BI1 to BI7 on the processor board B-CPU for 6MD63.../**EE**

Binary Inputs	Jumper	19 VDC Pickup [1)]	88 VDC Pickup [2)]
BI1	X21	L	H
BI2	X22	L	H
BI3	X23	L	H
BI4	X24	L	H
BI5	X25	L	H
BI6	X26	L	H
BI7	X27	L	H

[1)] Factory settings for devices with power supply voltages of 24 VDC to 125 VDC
[2)] Factory settings for devices with power supply voltages of 220 / 250 VDC and 115/230 VAC

Input/Output Board B-I/O-1

The layout of the printed circuit board for the input/output board B–I/O-1 is illustrated in the following figure.

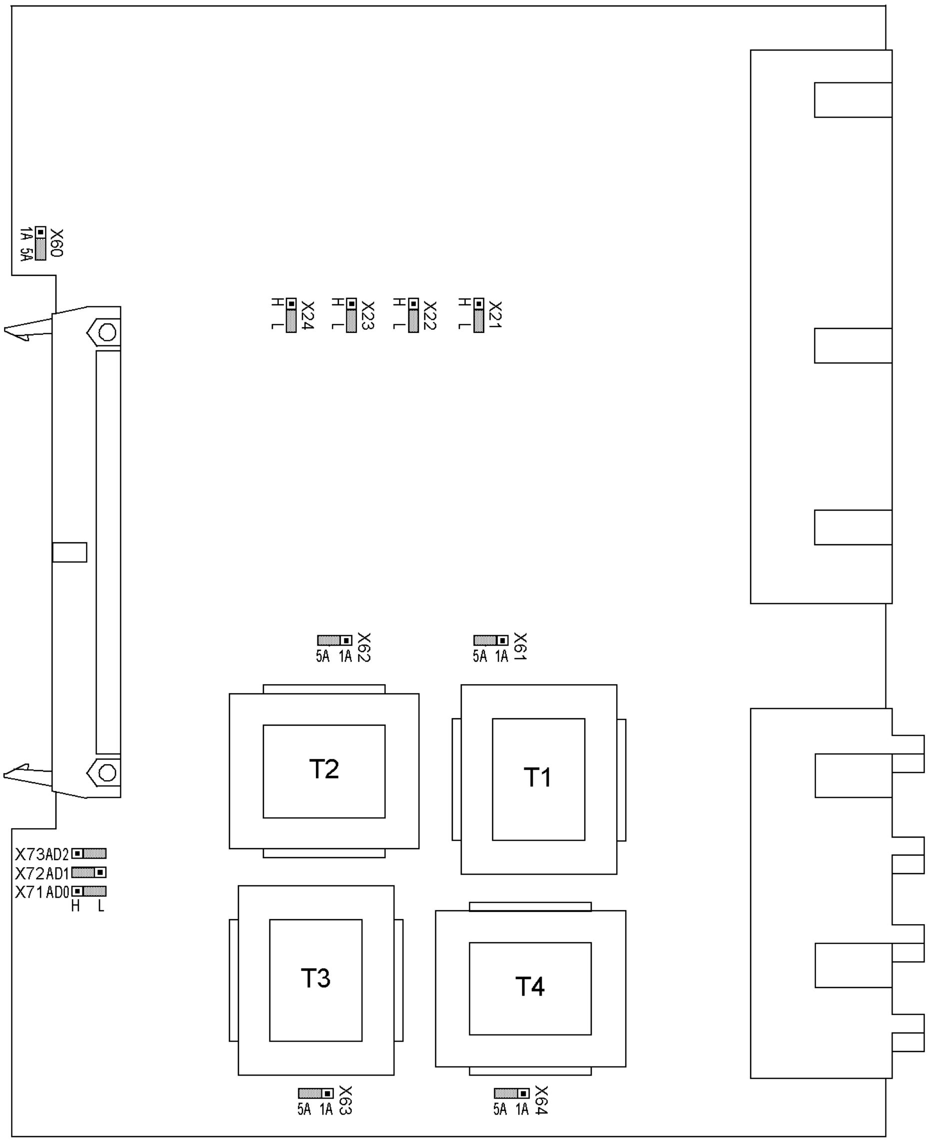


Figure 3-5 Input/output board B–I/O-1 with representation of the jumper settings required for the board configuration

The set nominal currents of the current input transformers and the selected operating voltage of binary inputs BI21 to BI24 according to Table 3-7 are checked. The jumpers X60 to X63 must all be set to the same nominal current, i.e. one jumper (X61 to X63) for each input transformer of the phase currents and additionally the common jumper X60. The jumper X64 determines the nominal current for the input I_N and may thus have a setting that deviates from that of the phase currents.

Pickup Voltages of BI21 to BI24

Table 3-7 Jumper settings for the **pickup voltages** of the binary inputs BI21 to BI24 on the input/output board B-I/O-1

Binary Inputs	Jumper	19 VDC Pickup 1)	88 VDC Pickup 2)
BI21	X21	L	H
BI22	X22	L	H
BI23	X23	L	H
BI24	X24	L	H

1) Factory settings for devices with power supply voltages of 24 VDC to 125 VDC

2) Factory settings for devices with power supply voltages of 220 / 250 VDC and 115/230 VAC

Bus Address

Jumpers X71, X72 and X73 on the B-I/O-1 board serve to set up the bus address. The jumpers must not be changed. Table 3-8 shows the factory settings for the jumpers.

Table 3-8 Jumper settings input/output board B-I/O-1

Jumper	Housing size $^1/_2$ and $^1/_1$
X71	L
X72	H
X73	L

Input/Output Board B-I/O-2

The layout of the PCB for the input/output module B–I/O–2 is illustrated in figure 3-6

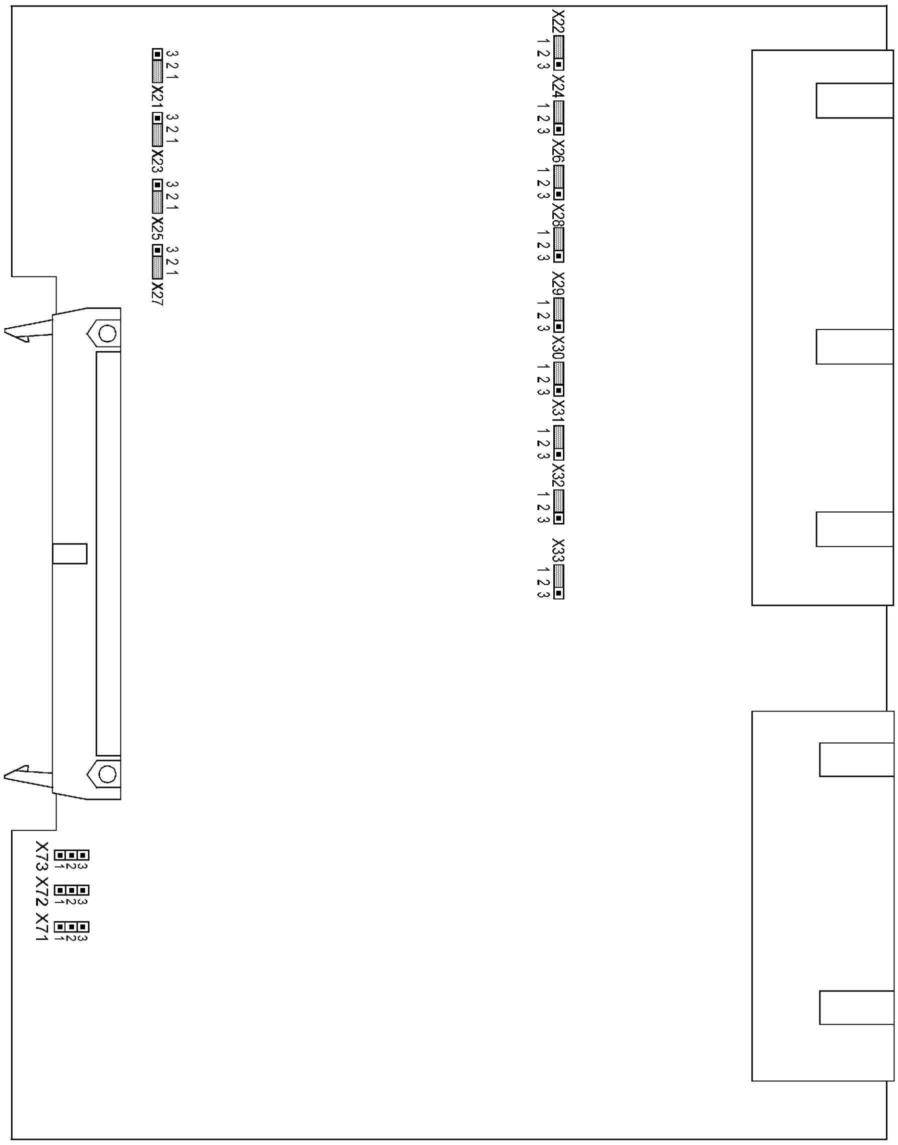


Figure 3-6 Input/output board B-I/O-2 with representation of the jumper settings required for the board configuration

The selected pickup voltages of the binary inputs BI8 through BI20, and BI25 through BI37, are checked in accordance with Table 3-9.

Control voltages of Binary Inputs BI8 to BI20, BI25 to BI37

Table 3-9 Jumper settings for **pickup voltages** of the binary inputs BI8 to BI20 and BI25 to BI37 on the input/output board B–I/O-2

Binary Input		Jumper	19 VDC Pickup [1]	88 VDC Pickup [2]
BI8	BI25	X	1-2	2-3
BI9	BI26	X	1-2	2-3
BI10	BI27	X	1-2	2-3
BI11	BI28	X24	1-2	2-3
BI12	BI29	X25	1-2	2-3
BI13	BI30	X26	1-2	2-3
BI14	BI31	X27	1-2	2-3
BI15	BI32	X28	1-2	2-3
BI16	BI33	X29	1-2	2-3
BI17	BI34	X30	1-2	2-3
BI18	BI35	X31	1-2	2-3
BI19	BI36	X32	1-2	2-3
BI20	BI37	X33	1-2	2-3

1) Factory settings for devices with power supply voltages of 24 VDC to 125 VDC

2) Factory settings for devices with power supply voltages of 220 / 250 VDC and 115/230 VAC

Bus Address

Jumpers X71, X72 and X73 on the B-I/O-2 board serve to set up the bus address. The jumpers must not be changed. The following table lists the jumper presettings.

Table 3-10 Jumper settings input/output board B-I/O-2

Jumper	Housing size $^1/_2$	Housing size $^1/_1$	
		Mounting location 33	Mounting location 5
X71	2-3	1-2	1-2
X72	1-2	2-3	1-2
X73	1-2	2-3	2-3

3.1.2.4 Interface Modules

Exchanging Inter-faceModules

The interface modules are located on the processor printed circuit boards B-CPU (No.1 in Figure 3-1 and 3-2) of the devices 6MD63. The following figure shows the printed circuit board and the arrangement of the modules.

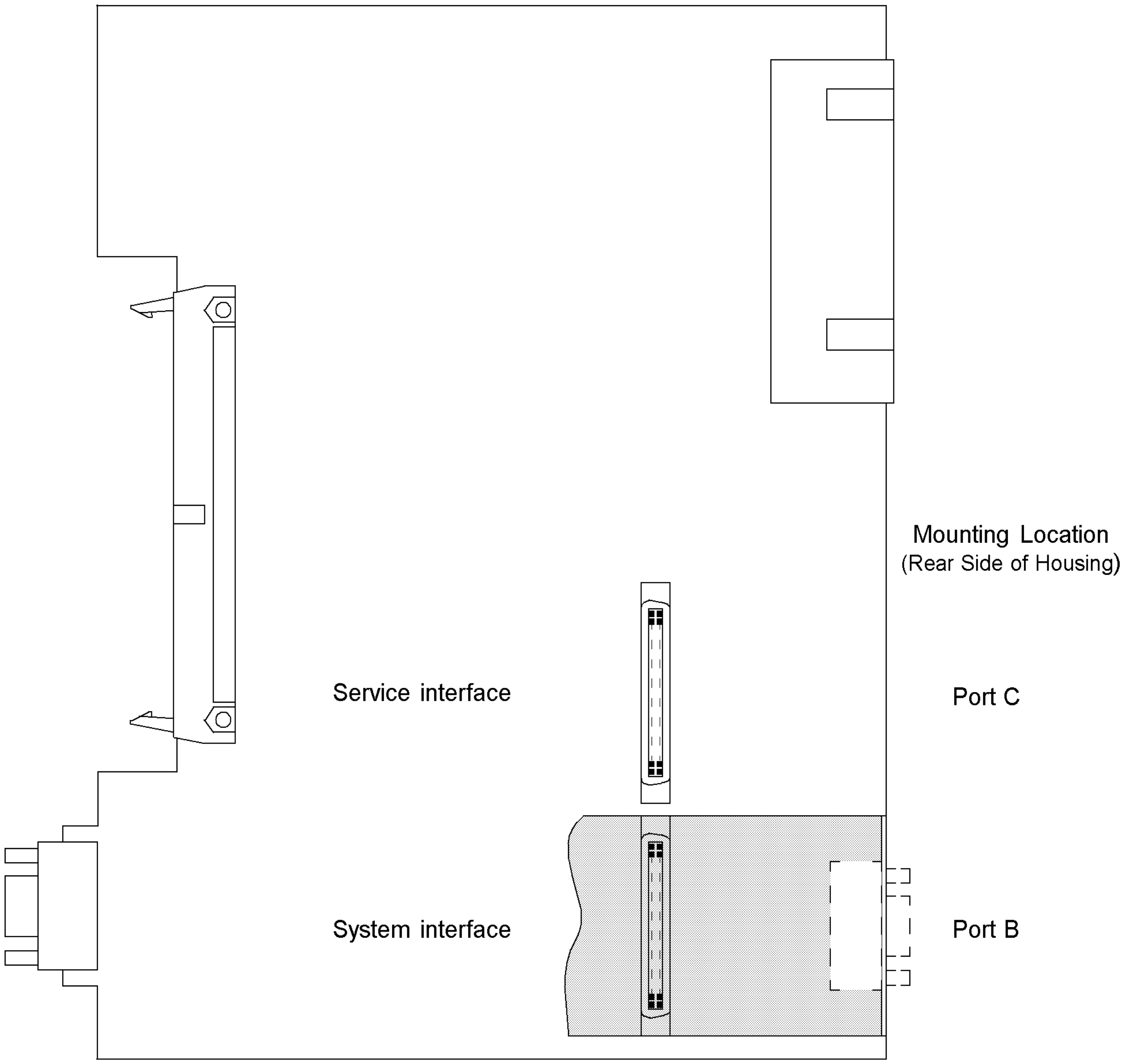


Figure 3-7 Processor printed circuit board B–CPU with interface modules

Please note the following:

- Only interface modules of devices with flush-mounting case as well as of mounting devices with detached operator panel or without operator panel can be exchanged. Interface modules of devices in surface mounting housings with two-tier terminals must be exchanged in our manufacturing centre.
- Use only interface modules that can be ordered in our facilities via the order key (see also Appendix, Section A.1).
- You may have to ensure the termination of the interfaces featuring bus capability according to margin heading “Termination”.

Table 3-11 Exchangeable interface modules

Interface	Mounting location / interface	Exchange module
System Interface	B	RS232
		RS 485
		FO 820 nm
		PROFIBUS FMS RS485
		PROFIBUS FMS Double ring
		PROFIBUS FMS Single ring
		PROFIBUS DP RS485
		PROFIBUS DP Double ring
		Modbus RS 485
		Modbus 820 nm
		DNP 3.0 RS 485
		DNP 3.0 820 nm
		IEC 61850, Ethernet electrical
DIGSI® /Modem Interface/RTD-box	C	RS232
		RS 485
		FO 820 nm

The order numbers of the exchange modules can be found in the Appendix in Section A.1, Accessories.

RS232 Interface

Interface RS232 can be modified to interface RS485 and vice versa, according to Figure 3-9.

Figure 3-7 shows the printed circuit board B–CPU and the interface modules.

Figure 3-8 shows the location of the jumpers of interface RS232 on the interface module.

Surface-mounted devices with fiber optics connection have their fiber optics module fitted in the console housing. The fiber optics module is controlled via a RS232 interface module at the associated CPU interface slot. For this application type the jumpers X12 and X13 on the RS232 module are plugged in position 2-3.

Jumper	Terminating Resistors Disconnected
X3	1-2 *)
X4	1-2 *)

*) Default Setting

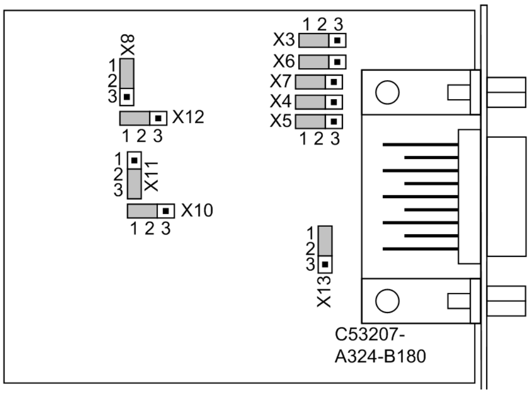


Figure 3-8 Location of the jumpers for configuration of RS232

Terminating resistors are not required. They are disconnected.

Jumper X11 enables the **CTS feature (Clear to Send - flow control)**, which is important for modem communication.

Table 3-12 Jumper setting for **CTS (Clear to Send)** on the interface board

Jumper	/CTS from interface RS232	/CTS controlled by /RTS
X11	1-2	2-3 [1)]

1) Default Setting

Jumper setting 2-3: The connection to the modem is usually established with star coupler or fiber-optic converter. Therefore the modem control signals according to RS232 standard DIN 66020 are not available. Modem signals are not required since the connection to the SIPROTEC® 4 devices is always operated in the half-duplex mode. Please use connection cable with order number 7XV5100-4.

Jumper setting 2-3 is equally required when using the RTD boxes in half-duplex operation.

Jumper setting 1-2: This setting makes the modem signals available, i. e. for a direct RS232 connection between the SIPROTEC® 4 device and the modem. This setting can be selected optionally. We recommend to use a standard RS232 modem connection cable (converter 9-pin to 25-pin).

Note

For a direct connection to DIGSI ® with interface RS232, jumper X11 must be plugged in position 2-3.

RS485 Interface

Interface RS485 can be modified to interface RS232 and vice versa (see Figures 3-8 and 3-9).

The following figure shows the location of the jumpers of interface RS485 on the interface module.

Jumper	Terminating Resistors	
	Connected	Disconnected
X3	2-3	1-2 *)
X4	2-3	1-2 *)

*) Default Setting

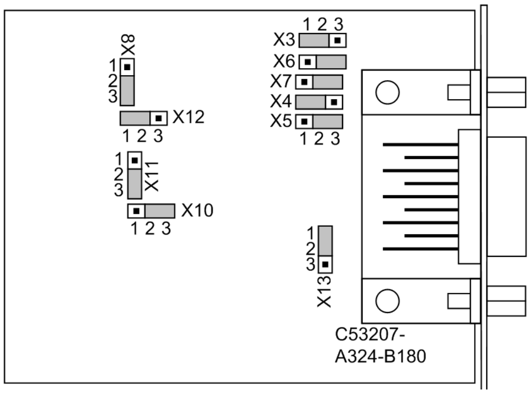


Figure 3-9 Position of terminating resistors and the plug-in jumpers for configuration of the RS485 interface

PROFIBUS (FMS/DP) DNP3.0/Modbus

Jumper	Terminating Resistors	
	Connected	Disconnected
X3	1-2	2-3 *)
X4	1-2	2-3 *)

*) Default Setting

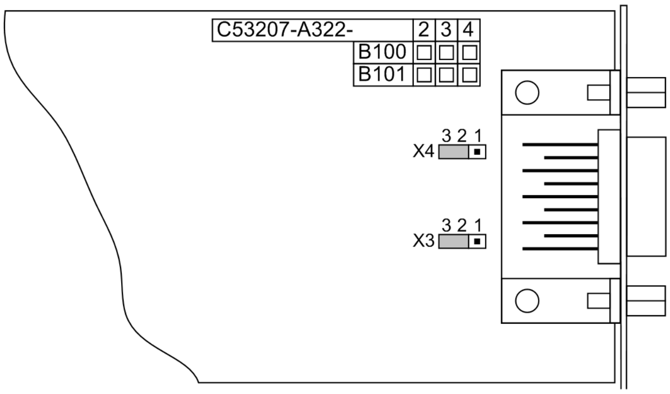


Figure 3-10 Position of the plug-in jumpers for the configuration of the terminating resistors at the Profibus (FMS and DP), DNP 3.0 and Modbus interfaces.

IEC 61850 Ethernet (EN 100)

The interface module does not feature any jumpers. Its use does not require any hardware adaptations.

Termination

For bus-capable interfaces a termination is necessary at the bus for each last device, i.e. termination resistors must be connected.

The terminating resistors are located on the RS485 or PROFIBUS (FMS/DP) and DNP3.0 and Modbus interface module that is mounted to the processor module B–CPU (No. 1 in Figure 3-1 and 3-2).

With default setting, jumpers are plugged in such a way that terminating resistors are disconnected. For the configuration of the terminating resistors both jumpers have to be plugged in the same way.

The terminating resistors can also be connected externally (e.g. to the terminal block). In this case, the terminating resistors located on the RS485 or PROFIBUS interface module must be switched off.

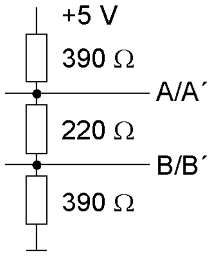


Figure 3-11 Termination of the RS485 interface (external)

3.1.2.5 Reassembly

To reassemble the device, proceed as follows:

- Carefully insert the boards into the case. The mounting locations are shown in Figures 3-1 and 3-2. For the model of the device designed for surface mounting, use the metal lever to insert the processor board B-CPU. The installation is easier with the lever.
- First plug the plug connectors of the ribbon cable into the input/output boards B-I/O and then onto the processor board B-CPU. Do not bend any connector pins! Do not use force!
- Insert the plug connector of the ribbon cable between the processor board CPU and the front cover into the socket of the front cover. This action does not apply to the device version with detached operator panel. Instead the plug connector of the ribbon cable connected to a 68-pole plug connector on the rear side of the device must be plugged into the plug connector of the processor circuit board B–CPU. The 7-pole X16 connector belonging to the ribbon cable must be plugged behind the D-subminiature female connector. The plugging position is not relevant in this context as the connection is protected against polarity reversal.
- Press the latches of the plug connectors together.
- Replace the front cover and secure to the housing with the screws.
- Mount the covers.
- Re-fasten the interfaces on the rear of the device housing. This activity is not necessary if the device is designed for surface mounting.

3.1.3 Installation

3.1.3.1 Panel Flush Mounting

Depending on the version, the device housing can be $^1/_2$ or $^1/_1$. For the $^1/_3$ housing size (Figure 3-12), there are 4 covers and 4 holes. For the $^1/_1$ housing size (Figure 3-13) there are 6 covers and 6 holes.

- Remove the 4 covers at the corners of the front cover, for size $^1/_1$ the 2 covers located centrally at the top and bottom also have to be removed. Thus the 4 respectively 6 slots in the mounting flange are revealed and can be accessed.
- Insert the device into the panel cut-out and fasten it with four or six screws. For dimensions refer to Section 4.6.
- Mount the four or six covers.
- Connect the ground on the rear plate of the device to the protective ground of the panel. Using at least one M4 screw. The cross-sectional area of the ground wire must be equal to the cross-sectional area of any other control conductor connected to the device. The cross-section of the ground wire must be at least 2.5 mm ^{2}.
- Connections are realized via the plug terminals or screw terminals on the rear side of the device in accordance to the circuit diagram. When using forked lugs for direct connections or screw terminal, the screws, before having inserted the lugs and wires, must be tightened in such a way that the screw heads are even with the terminal block. A ring lug must be centered in the connection chamber, in such a way that the screw thread fits in the hole of the lug. Section /1/ has pertinent information regarding wire size, lugs, bending radii, etc.

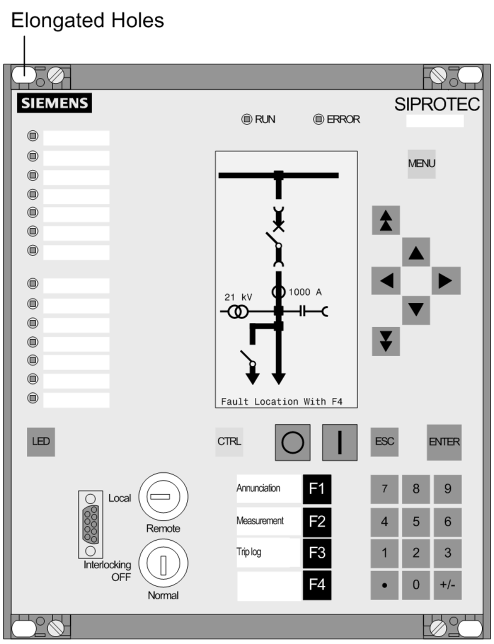


Figure 3-12 Panel flush mounting of a 6MD63 (housing size $^1/_2$)

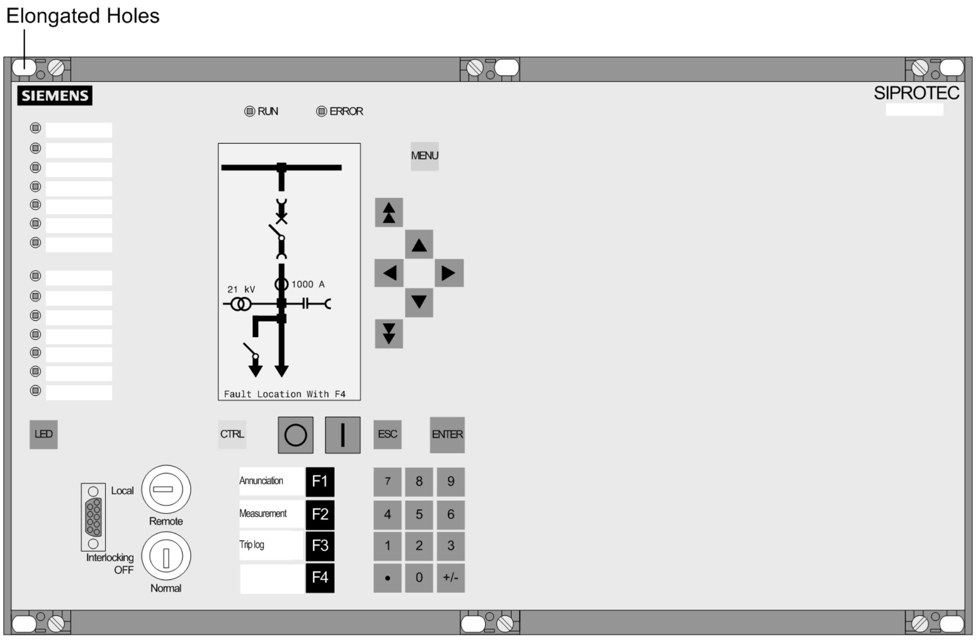


Figure 3-13 Panel flush mounting of a 6MD63 (housing size $^1/_1$)

3.1.3.2 Rack Mounting and Cubicle Mounting

To install the device in a frame or cubicle, two mounting brackets are required. The ordering codes are stated in the Appendix, Section A.1.

For the $^{1}/_{2}$ housing size (Figure 3-14) there are 4 covers and 4 holes. For the $^{1}/_{1}$ housing size (Figure 3-15) there are 6 covers and 6 holes.

- Loosely screw the two mounting brackets in the rack or cubicle with four screws.
- Remove the 4 covers at the corners of the front cover, for size $^{1}/_{1}$ the 2 covers located centrally at the top and bottom also have to be removed. Thus the 4 respectively 6 elongated holes in the mounting flange are revealed and can be accessed.
- Fasten the device to the mounting brackets with four or six screws.
- Mount the four or six covers.
- Tighten the mounting brackets to the rack or cubicle using eight screws.
- Connect the ground on the rear plate of the device to the protective ground of the panel. Using at least one M4 screw. The cross-sectional area of the ground wire must be equal to the cross-sectional area of any other control conductor connected to the device. The cross-section of the ground wire must be at least 2.5 mm ^{2}.
- Connections are realized via the plug terminals or screw terminals on the rear side of the device in accordance to the circuit diagram. When using forked lugs for direct connections or screw terminal, the screws, before having inserted the lugs and wires, must be tightened in such a way that the screw heads are even with the terminal block. A ring lug must be centered in the connection chamber, in such a way that the screw thread fits in the hole of the lug. The SIPROTEC® System Description /1/ has pertinent information regarding wire size, lugs, bending radii, etc.

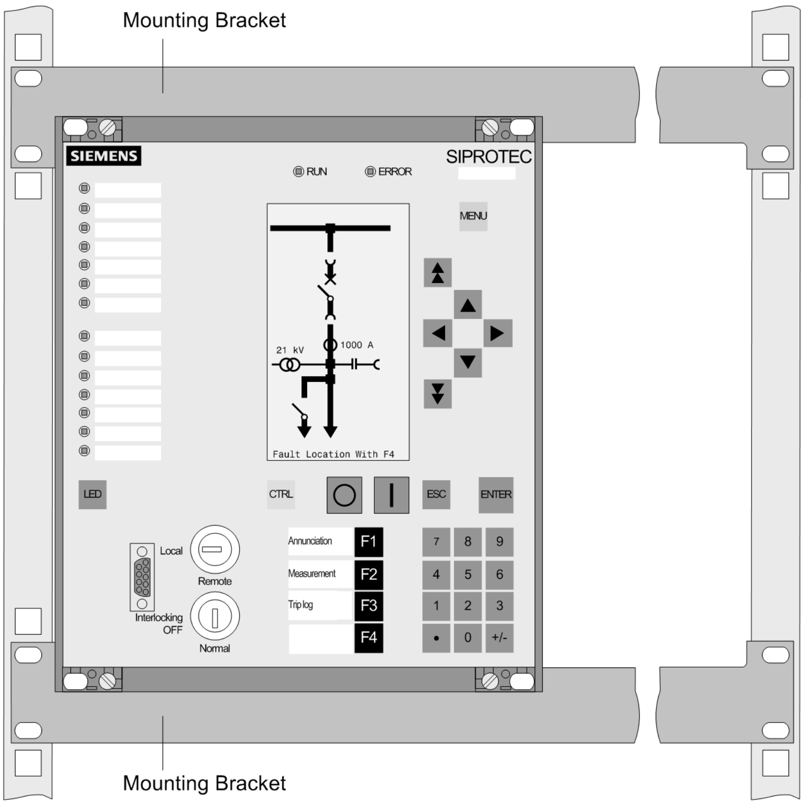


Figure 3-14 Installing a 6MD63 in a rack or cubicle (housing size $^{1}/_{2}$)

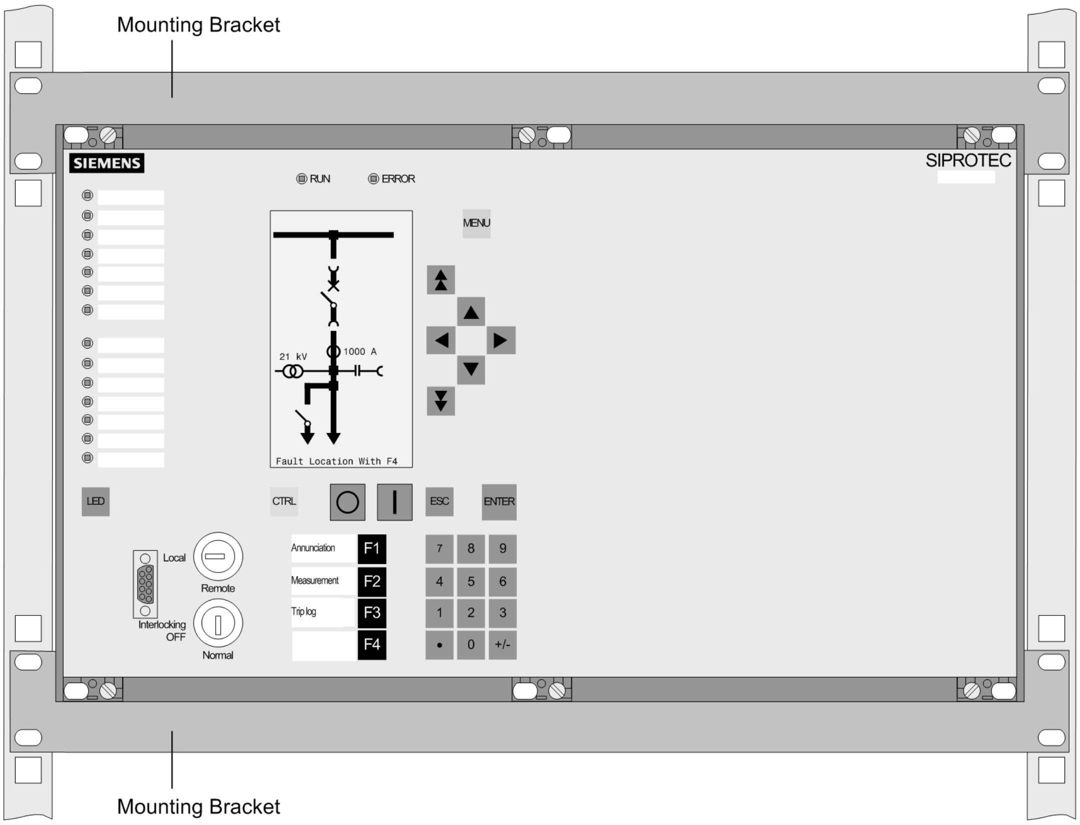


Figure 3-15 Installing a 6MD63 in a rack or cubicle (housing size $^1/_1$)

3.1.3.3 Panel Surface Mounting

For panel surface mounting of the **device** proceed as follows:

- Secure the device to the panel with four screws. For dimensions refer to Section 4.6.
- Connect the ground of the device to the protective ground of the panel. The cross-sectional area of the ground wire must be equal to the cross-sectional area of any other control conductor connected to the device. The cross-section of the ground wire must be at least 2.5 mm ^{2}.
- Connect solid, low-impedance operational grounding (cross-sectional area = 2.5 mm^2) to the grounding surface on the side. Use at least one M4 screw for the device ground.
- Connections according to the circuit diagram via screw terminals, connections for optical fibres and electrical communication modules via the inclined housings. The SIPROTEC® System Description /1/ has pertinent information regarding wire size, lugs, bending radii, etc.

3.1.3.4 Mounting with Detached Operator Panel

Caution!

Be careful when removing or plugging the connector between device and detached operator panel

Non–observance of the following measure can result in property damage. Without the cable the device is not ready for operation!

Do never pull or plug the connector between the device and the detached operator panel during operation while the device is alive!

For mounting the **device** proceed as follows:

- Fasten device of housing size $^1/_2$ with 6 screws and device of housing size $^1/_1$ with 10 screws. For dimensions refer to Section 4.6.
- Connect the ground on the rear plate of the device to the protective ground of the panel. Using at least one M4 screw. The cross-sectional area of the ground wire must be equal to the cross-sectional area of any other control conductor connected to the device. The cross-section of the ground wire must be at least 2.5 mm ^{2}.
- Connections are realized via the plug terminals or screw terminals on the rear side of the device according to the circuit diagram. When using forked lugs for direct connections or screw terminal, the screws, before having inserted the lugs and wires, must be tightened in such a way that the screw heads are even with the terminal block. A ring lug must be centered in the connection chamber, in such a way that the screw thread fits in the hole of the lug. The SIPROTEC® System Description /1/ has pertinent information regarding wire size, lugs, bending radii, etc.

For mounting the **operator panel** please observe the following:

- Remove the 4 covers on the corners of the front plate. This exposes the 4 elongated holes in the mounting bracket.
- Insert the operator panel into the panel cut-out and fasten with four screws. For dimensions refer to Section 4.6.
- Replace the 4 covers.
- Connect the ground on the rear plate of the operator control element to the protective ground of the panel using at least one M4 screw. The cross-sectional area of the ground wire must be equal to the cross-sectional area of any other control conductor connected to the device. The cross-section of the ground wire must be at least 2.5 mm ^{2}.
- Connect the operator panel to the device. Furthermore, plug the 68-pin connector of the cable belonging to the operator panel into the corresponding connection at the rear side of the device (see SIPROTEC® System Description /1/).

3.1.3.5 Mounting without Operator Panel

For mounting the **device** proceed as follows:

- Fasten device of housing size $^1/_2$ with 6 screws and device of housing size $^1/_1$ with 10 screws. For dimensions refer to Section 4.6.
- Connect the ground on the rear plate of the device to the protective ground of the panel. Using at least one M4 screw. The cross-sectional area of the ground wire must be equal to the cross-sectional area of any other control conductor connected to the device. The cross-section of the ground wire must be at least 2.5 mm ^{2}.
- Connections are realized via the plug terminals or screw terminals on the rear side of the device in accordance to the circuit diagram. When using forked lugs for direct connections or screw terminal, the screws, before having inserted the lugs and wires, must be tightened in such a way that the screw heads are even with the terminal block. A ring lug must be centered in the connection chamber, in such a way that the screw thread fits in the hole of the lug. The SIPROTEC® System Description provides information on wire size, lugs, bending radii, etc. which must be observed.

Caution!

Be careful when pulling or plugging the dongle cable

Non–observance of the following measures can result in minor personal injury or property damage:

Never pull or plug the dongle cable while the device is alive! Without the cable the device is not ready for operation!

The connector of the dongle cable at the device must always be plugged during operation!

For mounting the **D-subminiature connector of the dongle cable** please observe the following:

- Plug the 9-pin connector of the dongle cable with the connecting parts into the control panel or the cubicle door according to the following figure. For dimensions of the panel flush or cubicle door cutout see Section 4.6.
- Plug the 68-pin connector of the cable into the corresponding connection at the rear side of the device.

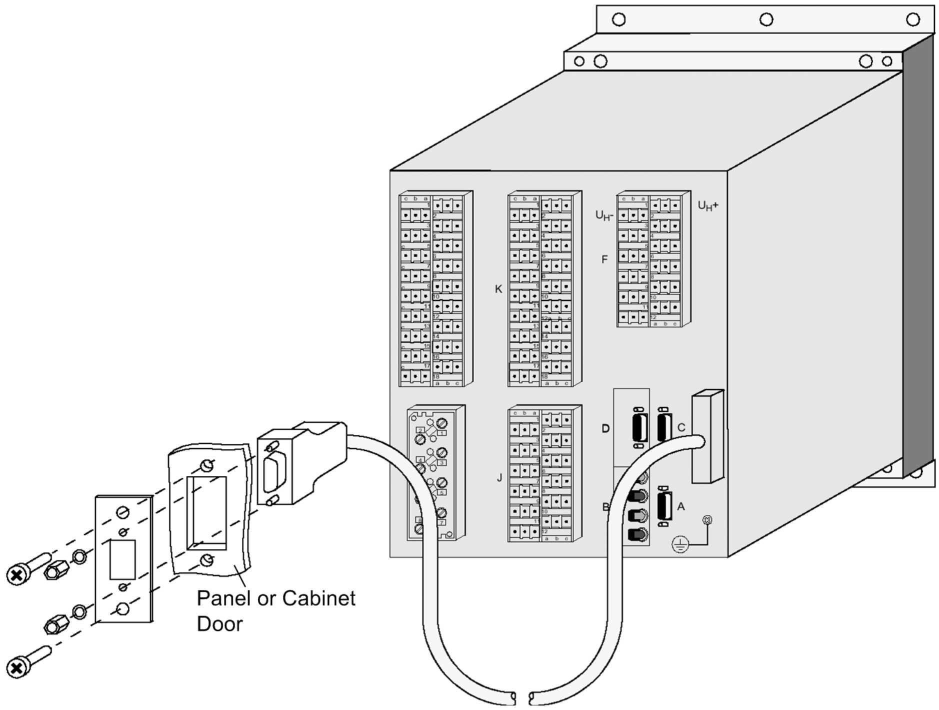


Figure 3-16 Plugging the subminiature connector of the dongle cable into the control panel or cabinet door (example housing size $^1/_2$)

3.2 Checking Connections

3.2.1 Checking Data Connections of Serial Interfaces

Pin assignments

The following tables illustrate the pin assignments of the various serial device interfaces and of the time synchronization interface. The position of the connections can be seen in the following figure.

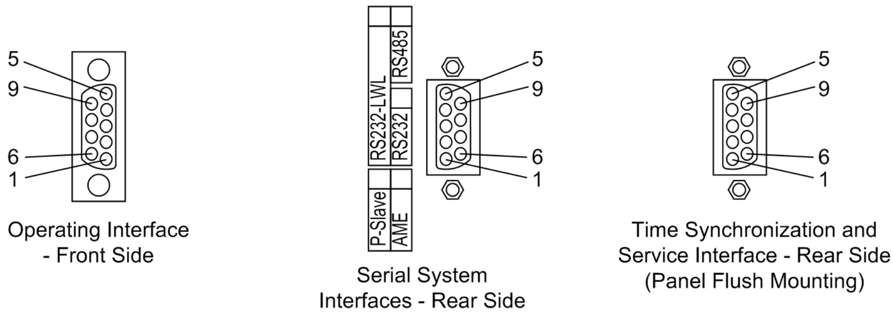


Figure 3-17 9-pin D-subminiature female connectors

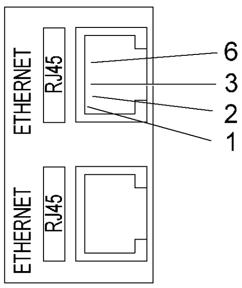


Figure 3-18 Ethernet connection

Operator Interface

When the recommended communication cable is used, correct connection between the SIPROTEC® 4 device and the PC is automatically ensured. See the Appendix for an ordering description of the cable.

Service Interface

Check the data connection if the service (port C) is used to communicate with the device via fix wiring or a modem. If the service port is used as input for one or two RTD-boxes, verify the interconnection according to one of the connection examples given in the Appendix A.3.

System Interface

For versions equipped with a serial interface to a control center, the user must check the data connection. The visual check of the assignment of the transmission and reception channels is of particular importance. With RS232 and fibre optic interfaces, each connection is dedicated to one transmission direction. Therefore the output of one device must be connected to the input of the other device and vice versa.

With data cables, the connections are designated according to DIN 66020 and ISO 2110:

- TxD = Data Transmit
- RxD = Data Receive
- $\overline{\text{RTS}}$ = Request to Send
- $\overline{\text{CTS}}$ = Clear to Send
- GND = Signal/Chassis Ground

The cable shield is to be grounded at **both ends**. For extremely EMC environments, the GND may be connected via a separate individually shielded wire pair to improve immunity to interference. The following table list the assignments of the D-subminiature connector for the various serial interfaces.

Table 3-13 Assignments of the connectors to the various interfaces

Pin No.	RS232	RS485	PROFIBUS FMS Slave, RS485	Modbus RS485	Ethernet EN 100
			PROFIBUS DP Slave, RS485	DNP3.0 RS485	
1	Shield (with shield ends electrically connected)				Tx+
2	RxD	–	–	–	Tx–
3	TxD	A/A' (RxD/TxD-N)	B/B' (RxD/TxD-P)	A	Rx+
4	–	–	CNTR-A (TTL)	RTS (TTL level)	—
5	GND	C/C' (GND)	C/C' (GND)	GND1	—
6	–	–	+5 V (max. load with 100 mA)	VCC1	Rx–
7	$\overline{\text{RTS}}$	– [1]	–	–	—
8	$\overline{\text{CTS}}$	B/B' (RxD/TxD-P)	A/A' (RxD/TxD-N)	B	—
9	–	–	–	–	not available

[1] Pin 7 also carries the RTS signal with RS232 level when operated as RS485 interface. Pin 7 must therefore not be connected!

Termination

The RS485 interfaces are capable of half-duplex service with the signals A/A' and B/B' with a common reference potential C/C' (GND). Verify that only the last device on the bus has the terminating resistors connected, and that the other devices on the bus do not. The jumpers for the terminating resistors are on the interface module RS485 (Figure 3-9) or on the Profibus module RS485 (Figure 3-10). It is also possible that the terminating resistors are arranged externally, e.g. on the connection module (Figure 3-11). In this case, the terminating resistors located on the module must be disconnected.

If the bus is extended, make sure again that only the last device on the bus has the terminating resistors switched-in, and that all other devices on the bus do not.

Time Synchronization Interface

It is optionally possible to process 5 V-, 12 V- or 24 V- time synchronization signals, provided that they are carried to the inputs named in the following table.

Table 3-14 D-SUB socket assignment of the time synchronization interface

Pin No.	Description	Signal Meaning
1	P24_TSIG	Input 24 V
2	P5_TSIG	Input 5 V
3	M_TSIG	Return Line
4	–[1]	–[1]
5	SHIELD	Shield Potential
6	–	–
7	P12_TSIG	Input 12 V
8	P_TSYNC[1]	Input 24 V[1]
9	SHIELD	Shield Potential

[1] assigned, but not used

Optical Fibers

WARNING!

Laser injection!

Do not look directly into the fiber-optic elements!

Signals transmitted via optical fibers are unaffected by interference. The fibers guarantee electrical isolation between the connections. Transmit and receive connections are represented by symbols.

The character idle state for the optical fiber interface is “Light off”. If the character idle state is to be changed, use the operating program DIGSI, as described in the SIPROTEC® 4 System Description.

RTD-box (Resistance Temperature Detector)

If one or two 7XV566 temperature meters are connected, check their connections to the port (port C).

Verify also the termination: The terminating resistors must be connected to 6MD63 (see Section 3.2, "Termination").

For information on the 7XV566 refer to the instruction manual of 7XV566. Check the transmission settings at the temperature meter. Besides the baudrate and the parity observe also the bus number.

For connection of RTD-box(es) proceed as follows:

- For connection of **1** RTD-box 7XV566:

  Bus number = **0** (to be set at 7XV566).
- For connection of **2** RTD-boxes 7XV566:

  Bus number = **1** for the 1st RTD-box (to be set at 7XV566 for RTD 1 to 6), bus number = **2** for the 2nd RTD-box (to be set at 7XV566 for RTD 7 to 12).

3.2.2 Checking Power Plant Connections

Before the device is energized for the first time, it should be in the final operating environment for at least 2 hours to equalize the temperature, to avoid humidity and condensation. Connections are checked with the device at its final location. The plant must first be switched off and grounded.

WARNING!

Warning of dangerous voltages

Non-observance of the following measures can result in death, personal injury or substantial property damage.

Therefore, only qualified people who are familiar with and adhere to the safety procedures and precautionary measures should perform the inspection steps.

Caution!

Be careful when operating the device on a battery charger without a battery

Non-observance of the following measure can lead to unusually high voltages and consequently, the destruction of the device.

Do not operate the device on a battery charger without a connected battery. (Limit values can be found in the Technical Data).

Before the device is energized for the first time, the device should be in the final operating environment for at least 2 hours to equalize the temperature, to minimize humidity and avoid condensation. Connections are checked with the device at its final location. The plant must first be switched off and grounded.

Proceed as follows in order to check the system connections:

- Protective switches for the power supply and the measured voltages must be opened.
- Check the continuity of all current and voltage transformer connections against the system and connection diagrams:
  - Are the current transformers grounded properly?
  - Are the polarities of the current transformers the same?
  - Is the phase relationship of the current transformers correct?
  - Are the voltage transformers grounded properly?
  - Are the polarities of the voltage transformers correct?
  - Is the phase relationship of the voltage transformers correct?
  - Is the polarity for current input IN correct (if used)?
  - Is the polarity for voltage input VN correct (if used for broken delta winding)?

- The short-circuit feature of the current circuits of the device are to be checked. This may be performed with an ohmmeter or other test equipment for checking continuity.
  - Remove the front panel of the device (see also Figure 3-1 and 3-2).
  - Remove the ribbon cable connected to the I/O board with the measured current inputs (No. 2 in Figure 3-1 and 3-2). Furthermore, remove the printed circuit board so that there is no more contact anymore with the plug-in terminal of the housing.
  - At the terminals of the device, check continuity for each pair of terminals that receives current from the CTs.
  - Firmly re-insert the board again. Carefully connect the ribbon cable. Do not bend any connector pins! Do not use force!
  - At the terminals of the device, again check continuity for each pair of terminals that receives current from the CTs.
  - Attach the front panel and tighten the screws.
- Connect an ammeter in the supply circuit of the power supply. A range of about 2.5 A to 5 A for the meter is appropriate.
- Switch on m.c.b. for auxiliary voltage (supply protection), check the voltage level and, if applicable, the polarity of the voltage at the device terminals or at the connection modules.
- The current input should correspond to the power input in neutral position of the device. The measured steady state current should be insignificant. Transient movement of the ammeter merely indicates the charging current of capacitors.
- Remove the voltage from the power supply by opening the supply circuit of the power supply.
- Disconnect the measuring test equipment; restore the normal power supply connections.
- Remove the voltage from the power supply by closing the supply circuit of the power supply.
- Close the protective switches for the voltage transformers.
- Verify that the voltage phase rotation at the device terminals is correct.
- Open the protective switches for the voltage transformers and the power supply.
- Check the trip and close circuits to the power system circuit breakers.
- Verify that the control wiring to and from other devices is correct.
- Check the signalling connections.
- Close the protective switches.

3.3 Commissioning

WARNING!

Warning of dangerous voltages when operating an electrical device

Non-observance of the following measures can result in death, personal injury or substantial property damage.

Only qualified people shall work on and around this device. They must be 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 device is to be grounded to the substation ground 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 (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, unless otherwise specified.

DANGER!

Hazardous voltages during interruptions in secondary circuits of current transformers

Non-observance of the following measure will result in death, severe personal injury or substantial property damage.

Short-circuit the current transformer secondary circuits before current connections to the device are opened.

For the commissioning switching operations have to be carried out. A prerequisite for the prescribed tests is that these switching operations can be executed without danger. They are accordingly not meant for operational checks.

WARNING!

Warning of dangers evolving from improper primary tests

Non-observance of the following measures can result in death, personal injury or substantial property damage.

Primary test may only be carried out by qualified personnel, who are familiar with the commissioning of protection systems, the operation of the plant and the safety rules and regulations (switching, earthing, etc.).

3.3.1 Test Mode and Transmission Block

If the device is connected to a central or main computer system via the SCADA interface, then the information that is transmitted can be influenced. This is only possible with some of the protocols available (see Table “Protocol-dependent functions” in the Appendix A.6).

If **Test mode** is set ON, then a message sent by a SIPROTEC® device to the main system has an additional test bit. This bit allows the message to be recognized as resulting from testing and not an actual fault or power system event. Furthermore it can be determined by activating the **Transmission block** that no annunciation at all are transmitted via the system interface during test mode.

The SIPROTEC® System Description /1/ describes how to activate and deactivate test mode and blocked data transmission. Note that when DIGSI® is being used, the program must be in the **Online** operating mode for the test features to be used.

3.3.2 Testing System Ports

Prefacing Remarks

If the device features a system interface and uses it to communicate with the control center, the DIGSI device operation can be used to test if messages are transmitted correctly. This test option should however definitely not be used while the device is in service on a live system.

DANGER!

Danger evolving from operating the equipment (e.g. circuit breakers, disconnectors) by means of the test function

Non-observance of the following measure will result in death, severe personal injury or substantial property damage.

Equipment used to allow switching such as circuit breakers or disconnectors is to be checked only during commissioning. Do not under any circumstances check them by means of the testing mode during “real” operation performing transmission and reception of messages via the system interface.

Note

After termination of the test mode, the device will reboot. Thereby, all annunciation buffers are erased. If required, these buffers should be extracted with DIGSI® prior to the test.

The interface test is carried out Online using DIGSI®:

- Open the **Online** directory by double-clicking; the operating functions for the device appear.
- Click on **Test**; the function selection appears in the right half of the screen.
- Double-click in the list view on **Generate Indications**. The dialog box **Generate Indications** opens (see the following figure).

Structure of the Test Dialog Box

In the column **Indication** the display texts of all annunciations are displayed which were allocated to the system interface in the matrix. In the column **Status Scheduled** the user has to define the value for the messages to be tested. Depending on annunciation type, several input fields are offered (e.g. "`annunciation coming`" / "`annunciation going`"). By clicking on one of the fields you can select the desired value from the pull-down menu.

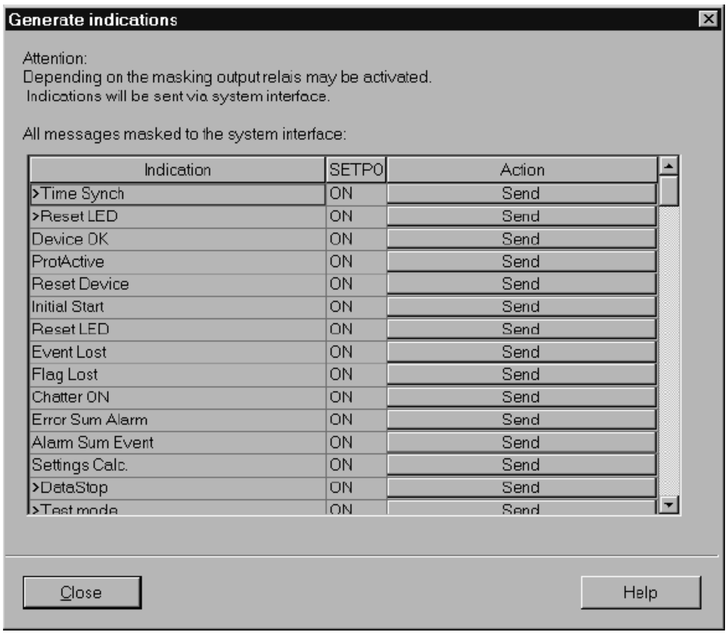


Figure 3-19 System interface test with dialog box: Generate annunciations — example

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 correct entry of the password, individual annunciations can be initiated. To do so, click on the button **Send** on the corresponding line. The corresponding annunciation is issued and can be read out either from the event log of the SIPROTEC® 4 device or from the substation control system.

As long as the window is open, further tests can be performed.

Test in Message Direction

For all information that is transmitted to the central station test in **Status Scheduled** the desired options in the list which appears:

- Make sure that each checking process is carried out carefully without causing any danger (see above and refer to DANGER!)
- Click on Send in the function to be tested and check whether the transmitted information reaches the central station and shows the desired reaction. Data which are normally linked via binary inputs (first character “>”) are likewise indicated to the central power system with this procedure. The function of the binary inputs itself is tested separately.

Exiting the Test Mode

To end the System Interface Test, click on **Close**. The device is briefly out of service while the start-up routine is executed. The dialogue box closes.

Test in Command Direction

The information transmitted in command direction must be indicated by the central station. Check whether the reaction is correct.

3.3.3 Checking the Status of Binary Inputs and Outputs

Prefacing Remarks

The binary inputs, outputs, and LEDs of a SIPROTEC® 4 device can be individually and precisely controlled in DIGSI®. This feature is used, for example, to verify control wiring from the device to plant equipment (operational checks), during commissioning. This test option should however definitely “not” be used while the device is in service on a live system.

DANGER!

Danger evolving from operating the equipment (e.g. circuit breakers, disconnectors) by means of the test function

Non-observance of the following measure will result in death, severe personal injury or substantial property damage.

Equipment used to allow switching such as circuit breakers or disconnectors is to be checked only during commissioning. Do not under any circumstances check them by means of the testing mode during “real” operation performing transmission and reception of messages via the system interface.

Note

After termination of the hardware test, the device will reboot. Thereby, all annunciation buffers are erased. If required, these buffers should be extracted with DIGSI® prior to the test.

The hardware test can be done using DIGSI® in the online operating mode:

- Open the **Online** directory by double-clicking; the operating functions for the device appear.
- Click on **Test**; the function selection appears in the right half of the screen.
- Double-click in the list view on **Hardware Test**. The dialog box of the same name opens (see the following figure).

Structure of the Test Dialogue Box

The dialog box is classified into three groups: **BI** for binary inputs, **BO** for output relays and **LED** for light-emitting diodes. On the left of each of these groups is an accordingly labelled button. By double-clicking a button, information regarding the associated group can be shown or hidden.

In the column **Actual** the present (physical) state of the hardware component is displayed. Indication is made by symbols. The physical scheduled states of the binary inputs and outputs are indicated by an open or closed switch symbol, the LEDs by a dark or illuminated LED symbol.

The opposite state of each element is displayed in the column **Scheduled**. The display is made in plain text.

The right-most column indicates the commands or messages that are configured (masked) to the hardware components.

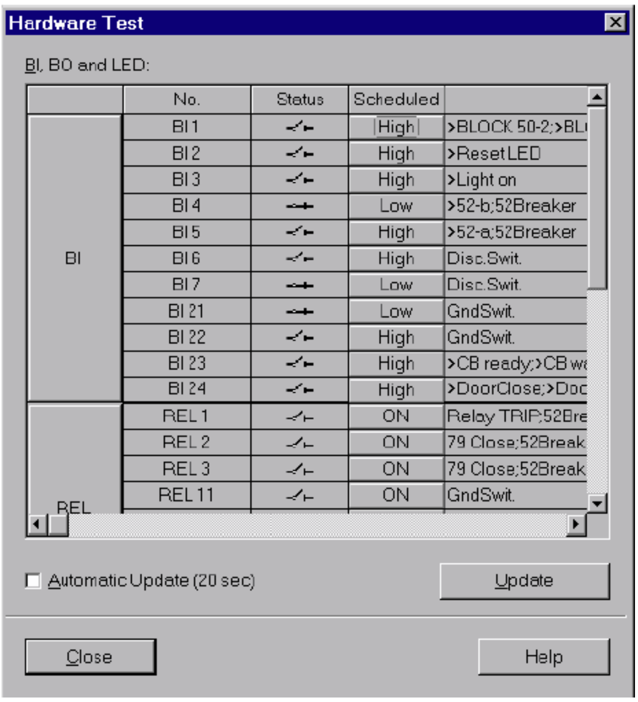


Figure 3-20   Test of the Binary Inputs and Outputs — Example

Changing the Operating State

To change the operating state of a hardware component, click on the associated button in the **Scheduled** column.

Password No. 6 (if activated during configuration) will be requested before the first hardware modification is allowed. After entry of the correct password a condition change will be executed. Further condition changes remain possible while the dialog box is open.

Test of the Binary Outputs

Each individual output relay can be energized allowing a check of the wiring between the output relay of the 6MD63 and the system, without having to generate the message that is assigned to the relay. As soon as the first change of state for any of the output relays is initiated, all output relays are separated from the internal device functions, and can only be operated by the hardware test function. This means, that e.g. a TRIP command coming from a control command from the operator panel to an output relay cannot be executed.

Proceed as follows in order to check the output relay :

- Ensure that the switching of the output relay can be executed without danger (see above under DANGER!).
- Each output relay must be tested via the corresponding **Scheduled**-cell in the dialog box.
- Finish the testing (see margin title below “Exiting the Procedure”), so that during further testings no unwanted switchings are initiated.

Test of the Binary Inputs

To test the wiring between the plant and the binary inputs of the 6MD63 the condition in the system which initiates the binary input must be generated and the response of the device checked.

To do so, the dialog box **Hardware Test** must be opened again to view the physical state of the binary inputs. The password is not yet required.

Proceed as follows in order to check the binary inputs:

- Each state in the plant which causes a binary input to pick up must be generated.
- The response of the device must be checked in the **Actual** column of the dialog box. To do this, the dialog box must be updated. The options may be found below under the margin heading “Updating the Display”.
- Finish the testing (see margin heading below “Exiting the Procedure”).

If, however, the effect of a binary input must be checked without carrying out any switching in the plant, it is possible to trigger individual binary inputs with the hardware test function. As soon as the first state change of any binary input is triggered and the password no. 6 has been entered, all binary inputs are separated from the plant and can only be activated via the hardware test function.

Test of the LEDs

The LEDs may be tested in a similar manner to the other input/output components. As soon as the first state change of any LED has been triggered, all LEDs are separated from the internal device functionality and can only be controlled via the hardware test function. This implies that no LED can be switched on anymore by e.g. a device function or operation of the LED reset key.

Updating the Display

During the opening of the dialog box **Hardware Test** the operating states of the hardware components which are current at this time are read in and displayed.

An update occurs:

- for each hardware component, if a command to change the condition is successfully performed,
- for all hardware components if the **Update** button is clicked,
- for all hardware components with cyclical updating (cycle time is 20 seconds) if the **Automatic Update (20sec)** field is marked.

Exiting the Test Mode

To end the hardware test, click on **Close**. The dialog box closes. The device becomes unavailable for a brief start-up period immediately after this. Then all hardware components are returned to the operating conditions determined by the plant settings.

3.3.4 Testing User-Defined Functions

CFC Logic

The device has a vast capability for allowing functions to be defined by the user, especially with the CFC logic. Any special function or logic added to the device must be checked.

Naturally, general test procedures cannot be given. Rather, the configuration of these user-defined functions and the necessary associated conditions must be known and verified. Possible interlocking conditions of switching devices (circuit breakers, disconnectors, ground switch) are of particular importance. They must be considered and tested.

3.3.5 Current, Voltage, and Phase Rotation Testing

≥ 10 % of Load Current

The connections of the current and voltage transformers are tested using primary quantities. Secondary load current of at least 10 % of the nominal current of the device is necessary. The line is energized and will remain in this state during the measurements.

With proper connections of the measuring circuits, none of the measured-values supervision elements in the device should pick up. If an element detects a problem, the causes which provoked it may be viewed in the Event Log.

If current or voltage summation errors occur, check the matching factors.

Messages from the symmetry monitoring could occur because there actually are asymmetrical conditions in the network. If these asymmetrical conditions are normal service conditions, the corresponding monitoring functions should be made less sensitive.

Values

Currents and voltages can be seen in the display field at the front of the device or the operator interface via a PC. They can be compared to the quantities measured by an independent source, as primary and secondary quantities.

If the measured values are not plausible, the connection must be checked and corrected after the line has been isolated and the current transformer circuits have been short-circuited. The measurements must then be repeated.

Phase Rotation

The phase rotation must correspond to the configured phase rotation, in general a clockwise phase rotation. If the system has an anti-clockwise phase rotation, this must have been considered when the power system data was set (address 209 **PHASE SEQ.**). If the phase rotation is incorrect, the alarm “Fail Ph. Seq.” (171) is generated. The measured value phase allocation must be checked and corrected, if required, after the line has been isolated and current transformers have been short-circuited. The measurement must then be repeated.

Voltage Transformer-Protective Switch

The VT mcb of the feeder (if used) must be opened. The measured voltages in the operational measured values appear with a value close to zero (small measured voltages are of no consequence).

Check in the spontaneous messages that the VT mcb trip was entered (message “>FAIL:FEEDER VT” “ON” in the spontaneous messages). Beforehand it has to be assured that the position of the VT mcb is connected to the device via a binary input.

Close the VT mcb again: The above annunciations appear under the spontaneous annunciations as “OFF”, i.e. “>FAIL:FEEDER VT” “OFF”.

If one of the events does not appear, the connection and routing of these signals must be checked.

If the “ON” state and the “OFF” state are swapped, the contact type (H-active or L-active) must be checked and remedied.

Switch off the protected power line.

3.3.6 Direction Test with Load Current

≥ 10 % of Load Current

The correct connection of the current and voltage transformers are tested via the protected line using the load current. For this purpose, connect the line. The load current the line carries must be at least $0.1 \cdot I_{Nom}$. The load current should be in-phase or lagging the voltage (resistive or resistive-inductive load). The direction of the load current must be known. If there is a doubt, network or ring loops should be opened. The line remains energized during the test.

The direction can be derived directly from the operational measured values. Initially the correlation of the measured load direction with the actual direction of load flow is checked. In this case the normal situation is assumed whereby the forward direction (measuring direction) extends from the busbar towards the line (see the following figure).

P positive, if active power flows into the line,

P negative, if active power flows towards the busbar,

Q positive, if reactive power flows into the line,

Q negative, if reactive power flows toward the busbar.

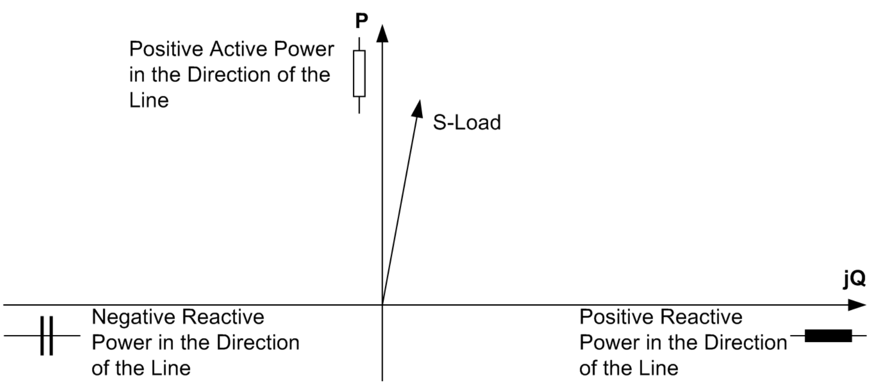


Figure 3-21 Apparent Load Power

If power values are negative, the assignment of the direction between current transformer and voltage transformer set does not correspond with the direction configured in address 201 **CT Starpoint**. If applicable, change the configuration of the parameter 201. If the power continues being incorrect, there must be an error in the transformer wiring (e.g. cyclical phase swap) which has to be rectified.

3.3.7 Checking the Temperature Measurement via RTD-Box

After the termination of the RS485 interface and the setting of the bus address in the device have been verified according to Section 3.2, the measured temperature values and thresholds can be checked.

If temperature sensors are used with 2-phase connection you must first determine the line resistance for the temperature detector being short-circuited. Select mode 6 at the RTD-Box and enter the resistance value you have determined for the corresponding sensor (range: 0 to 50.6 Ω).

When using the preset 3-phase connection for the temperature detectors no further entry must be made.

For checking the measured temperature values the temperature detectors are replaced by settable resistances (e.g. precision resistance decade) and the correct assignment of the resistance value and the displayed temperature for 2 or 3 temperature values from the following table are verified.

Table 3-15 Assignment of the resistance value and the temperature of the sensors

Temperature in °F	Temperature in °C	Ni 100 DIN 43760	Ni 120 DIN 34760	Pt 100 IEC 751
–50	–58	74.255	89.106	80.3062819
–40	–40	79.1311726	94.9574071	84.270652
–30	–22	84.1457706	100.974925	88.2216568
–20	–4	89.2964487	107.155738	92.1598984
–10	14	94.581528	113.497834	96.085879
0	32	100	120	100
10	50	105.551528	126.661834	103.902525
20	68	111.236449	133.483738	107.7935
30	86	117.055771	140.466925	111.672925
40	104	123.011173	147.613407	115.5408
50	122	129.105	154.926	119.397125
60	140	135.40259	162.408311	123.2419
70	158	141.720613	170.064735	127.075125
80	176	148.250369	177.900442	130.8968
90	194	154.934473	185.921368	134.706925
100	212	161.7785	194.1342	138.5055
110	230	168.788637	202.546364	142.292525
120	248	175.971673	211.166007	146.068
130	266	183.334982	220.001979	149.831925
140	284	190.88651	229.063812	153.5843
150	302	198.63475	238.3617	157.325125
160	320	206.58873	247.906476	161.0544
170	338	214.757989	257.709587	164.772125

Temperature in °F	Temperature in °C	Ni 100 DIN 43760	Ni 120 DIN 34760	Pt 100 IEC 751
180	356	223.152552	267.783063	168.4783
190	374	231.782912	278.139495	172.172925
200	392	240.66	288.792	175.856
210	410	249.79516	299.754192	179.527525
220	428	259.200121	311.040145	183.1875
230	446	268.886968	322.664362	186.835925
240	464	278.868111	334.641733	190.4728
250	482	289.15625	346.9875	194.098125

Temperature thresholds that are configured in the device can be checked by slowly approaching the resistance value.

3.3.8 Trip/Close Tests for the Configured Operating Devices

Control by Local Command

If the configured operating devices were not switched sufficiently in the hardware test already described, all configured switching devices must be switched on and off from the device via the integrated control element. The feedback information of the circuit breaker position injected via binary inputs is read out at the device and compared with the actual breaker position. With 6MD63 this is easy to do with the control display.

The switching procedure is described in the SIPROTEC ® System Description /1/. The switching authority must be set in correspondence with the source of commands used. The switching mode can be selected from interlocked and non-interlocked switching. Please take note that non-interlocked switching can be a safety hazard.

DANGER!

A test cycle successfully started by the automatic reclosure function can lead to the closing of the circuit breaker!

Non-observance of the following statement will result in death, severe personal injury or substantial property damage.

Be fully aware that OPEN-commands sent to the circuit breaker can result in a trip-close-trip event of the circuit breaker by an external reclosing device.

Control from a Remote Control Center

If the device is connected to a remote substation via a system interface, the corresponding switching tests may also be checked from the substation. Please also take into consideration that the switching authority is set in correspondence with the source of commands used.

3.4 Final Preparation of the Device

Firmly tighten all screws. Tighten all terminal screws, including those that are not used.

Caution!

Inadmissable tightening torques

Non–observance of the following measure can result in minor personal injury or property damage.

The tightening torques must not be exceeded as the threads and terminal chambers may otherwise be damaged!

The settings should be checked again, if they were changed during the tests. Check if all power system data, control and auxiliary functions to be found with the configuration parameters are set correctly (Section 2). All desired functions must be set to **ON**. Keep a copy of all of the in-service settings on a PC.

Check the internal clock of the device. If necessary, set the clock or synchronize the clock if the element is not automatically synchronized. For assistance, refer to the SIPROTEC® System Description /1/

The annunciation buffers are deleted under **MAIN MENU** → **Annunciations** → **Set/Reset**, so that future information will only apply for actual events and states (see also /1/). The counters in the switching statistics should be reset to the values that were existing prior to the testing (see also SIPROTEC® System Description /1/).

The counters of the operational measured values (e.g. operation counter, if available) are reset under **Main Menu** → **Measurement** → **Reset**.

Press the `ESC` key (several times if necessary), to return to the default display. The default display appears in the display box (e.g. the display of operational measured values).

Clear the LEDs on the front panel by pressing the `LED` key, so that they only show real events and states. In this context, also output relays probably memorized are reset. Pressing the `LED` key also serves as a test for the LEDs on the front panel because they should all light when the button is pushed. Any LEDs that are lit after the clearing attempt are displaying actual conditions.

The green “RUN” LED must be on. The red “ERROR” LED must be off.

If test switches are available, then these must be in the operating position.

The device is now ready for operation.

■

Technical Data 4

This chapter provides the technical data of the SIPROTEC® 6MD63 device and its individual functions, including the limit values that under no circumstances may be exceeded. The electrical and functional data for the maximum functional scope are followed by the mechanical data with dimensional drawings.

4.1 General Device Data

4.1.1 Analog Inputs

Current Inputs

Nominal Frequency	f_{Nom}	50 Hz or 60 Hz	(adjustable)
Nominal Current	I_{Nom}	1 A or 5 A	
Burden per Phase and Ground Path			
- at I_{Nom} = 1 A		Approx. 0.05 VA	
- at I_{Nom} = 5 A		Approx. 0.3 VA	
AC Current Overload Capability			
- Thermal (rms)		$100 \cdot I_{Nom}$ for 1 s $30 \cdot I_{Nom}$ for 10 s $4 \cdot I_{Nom}$ continuous	
- Dynamic (peak value)		$250 \cdot I_{Nom}$ (half-cycle)	

Voltage Inputs

Secondary Nominal Voltage		100 V to 225 V
Measuring Range		0 V to 170 V
Burden	at 100 V	Approx. 0.3 VA
AC Voltage Input Overload Capacity		
- thermal (rms)		230 V continuous

Measuring Transducer Inputs

Input Current	0 mA DC to 20 mA DC
Input Resistance	10 Ω
Power Consumption	5.8 mW at 24 mA

4.1.2 Power Supply Voltage

Direct Voltage

Voltage Supply via Integrated Converter		
Rated auxiliary DC V_{Aux}	24/48 VDC	60/110/125 VDC
Permissible Voltage Ranges	19 to 58 VDC	48 to 150 VDC
Rated auxiliary DC V_{Aux}	110/125/220/250 V DC	
Permissible Voltage Ranges	88 to 300 VDC	
Permissible AC ripple voltage, peak to peak, IEC 60255-11	≤ 15 % of the auxiliary voltage	
Power Consumption	Quiescent	Energized
6MD631	Approx. 4 W	Approx. 10 W
6MD632, 6MD633, 6MD634	Approx. 5.5 W	Approx. 16 W
6MD635, 6MD636, 6MD637	Approx. 7 W	Approx. 20 W
Bridging Time for Failure/Short Circuit, IEC 60255-11	≥ 50 ms with V ≥ 110 VDC	
	≥ 20 ms with V ≥ 24 VDC	

Alternating Voltage

Voltage Supply via Integrated Converter		
Nominal auxiliary voltage AC V_{Aux}	115 VAC	230 VAC
Permissible Voltage Ranges	92 to 132 VAC	184 to 265 VAC
Power Consumption		
Quiescent	Approx. 6 VA	Approx. 6 VA
Energized, Maximum	Approx. 20 VA	Approx. 20 VA
Bridging Time for Failure/Short Circuit	≥ 200 ms	

4.1.3 Binary Inputs and Outputs

Binary Inputs

Variant	Number	
6MD631*-	11 (configurable)	
6MD632*-	24 (configurable)	
6MD633*-	20 (configurable)	
6MD634*-	20 (configurable)	
6MD635*-	37 (configurable)	
6MD636*-	33 (configurable)	
6MD637*-	33 (configurable)	
Rated Voltage Range	24 VDC to 250 VDC, bipolar	
Binary input	BI1....6; BI8....19; BI25....36	BI7; BI20....24; BI37
Current Consumption (independent of the control voltage)	Approx. 0.9 mA	Approx. 1.8 mA
Pickup Times	Approx. 9 ms	Approx. 4 ms
Switching Thresholds	Switching Thresholds, adjustable voltage range with jumpers	
For Nominal Voltages	24/48 VDC and 60/110/125 VDC	V high ≥ 19 VDC V low ≤ 10 VDC
For Nominal Voltages	110/125/220/250 VDC and 115/230 VAC	V high ≥ 88 VDC V low ≤ 60 VDC
For Nominal Voltages (only for modules with 3 switching thresholds)	220/250 VDC	V high ≥ 176 VDC V low ≤ 132 VDC
Maximum Permissible Voltage	300 VDC	
Impulse Filter on Input	220 nF at 220 V with recovery time > 60 ms	

Output Relay

Output Relay for Commands/Annunciations, Alarm Relay[1]) High-duty relay[2])			
Number and Information	According to the order variant (allocatable)		
Order Variant	NO contact[1])	NO/NC selectable[1])	High-duty relay[2])
6MD631*-	8	1	–
6MD632*-	11	1	4
6MD633*-	11	1	4
6MD634*-	6	1	4
6MD635*-	14	1	8
6MD636*-	14	1	8
6MD637*-	9	1	8
Switching Capability MAKE	1000 W/VA [1])		–
Switching Capability BREAK	30 VA 40 W resistive 25 W at L/R ≤ 50 ms		– – –

Switching Voltage	250 VDC		250 VDC
Permissible Current per Contact (continuous)	5 A		—
Permissible Current per Contact (close and hold)	30 A for 0.5 S (NO contact)		
Permissible Current per Contact on Common Path	5 A continuous 30 A for 0.5 S (NO contact)		— —
Max. Switching Capability for 30 s At 28 V to 250 V at 24 V	 — —		 1000 W 2) 500 W
Permissible Relative Closing Time	–		1– %
Operating Time, Approx.	8 ms	8 ms	—
1) UL-listed with the following nominal values:			
	120 VAC	Pilot duty, B300	
	240 VAC	Pilot duty, B	
	240 VAC	5 A General Purpose	
	24 VDC	5 A General Purpose	
	48 VDC	0.8 A General Purpose	
	240 VDC	0.1 A General Purpose	
	120 VAC	1/6 hp (4.4 FLA)	
	240 VAC	1/2 hp (4.9 FLA)	
2) UL-listed with the following nominal values:			
	240 VDC	1.6 FLA	
	120 VDC	3.2 FLA	
	60 VDC	5.5 FLA	

4.1.4 Communication Interfaces

Operator Interface

Connection	front side, non-isolated, RS232, 9 pin DSUB socket for connecting a personal computer
Operation	With DIGSI®
Transmission Speed	Min. 4.800 Baud; max. 115, 200 Baud; Factory Setting: 38 400 Baud; Parity: HE'D
Maximum Distance of Transmission	49.2 feet (15 m)

Service-/Modem Interface

	RS232/RS 485/FO according to the ordering variant	Isolated interface for data transfer for operation using the DIGSI® or for connection to a RTD-box
RS232		
	Connection for panel flush mounting housing	Rear panel, slot “C”, 9-pole D-SUB miniature connector shielded data cable
	Connection for Panel Surface-Mounted Housing	In the housing at the case bottom; shielded data cable
	Test Voltage	500 V; 50 Hz
	Transmission Speed	min. 4 800 Baud; max. 115 200 Baud; Factory setting 38,400 Baud
	Maximum Distance of Transmission	49.2 feet (15 m)
RS485		
	Connection for panel flush mounting housing	Rear panel, mounting location “C”, 9-pole -DSUB miniature connector shielded data cable
	Connection for Panel Surface-Mounted Housing	In the housing at the case bottom; shielded data cable
	Test Voltage	500 V; 50 Hz
	Transmission Speed	min. 4,800 Baud; max. 115,200 Baud; Factory setting 38,400 Baud
	Maximum Distance of Transmission	3.280 feet (1000 m)
Fibre Optical Link (FO)		
	Fibre Optical Link (FO)	ST-Connector
	Connection for panel flush mounting housing	Rear panel, mounting location “C”
	Connection for panel surface-mounted housing	In the housing on the case bottom
	Optical wavelength	λ = 820 nm
	Laser Class 1 according to EN 60825-1/-2	using glass fiber 50/125 µm or using glass fiber 62.5/125 µm
	Permissible optical link signal attenuation	max. 8 dB, with glass fiber 62.5/125 µm
	Maximum distance of transmission	max. 0.93 miles (1.5 km)
	Character idle state	Configurable; factory setting “Light off”

System Interface

IEC 60870-5-103		
	RS 232/RS 485/FO according to the ordering variant	Isolated interface for data transfer to a master terminal
RS232		
	Connection for flush-mounted housing	Rear panel, mounting location “B” 9-pole D-SUB miniature connector
	Connection for panel surface mounting housing	At the housing mounted case on the case bottom
	Test Voltage	500 V; 50 Hz
	Transmission Speed	Min. 4 800 Baud; max. 38 400 Baud; Factory setting 9 600 Baud
	Maximum Distance of Transmission	49.2 feet (15 m)
RS485		
	Connection for flush-mounted housing	Rear panel, mounting location “B” 9-pole D-SUB miniature connector
	Connection for panel surface mounting housing	At the housing mounted case on the case bottom
	Test Voltage	500 V; 50 Hz
	Transmission Speed	Min. 4 800 Baud; max. 38 400 Baud; Factory setting 9 600 Baud
	Maximum Distance of Transmission	Max. 0.62 miles (1 km)
Fibre Optical Link (FO)		
	FO connector type	ST connector
	Connection for flush-mounting housing	Rear panel, mounting location “B”
	Connection for panel surface mounting housing	At the housing mounted case on the case bottom
	Optical Wavelength	λ = 820 nm
	Laser Class 1 according to EN 60825-1/-2	Using glass fiber 50/12 μm or using glass fiber 62.5/125 μm
	Permissible Optical Link Signal Attenuation	Max. 8 dB, with glass fiber 62.5/125 μm
	Maximum Distance of Transmission	Max. 0.93 miles (1,5 km)
	Character Idle State	Configurable: factory setting “Light off”
PROFIBUS RS485 (FMS and DP)		
	Connection for flush-mounting housing	Rear panel, mounting location “B” 9-pole D-SUB miniature connector
	Connection for panel surface mounting housing	At the housing mounted case on the case bottom
	Test Voltage	500 V; 50 Hz
	Transmission Speed	Up to 1.5 MBd
	Maximum Distance of Transmission	1.000 m / 3280 feet at ≤ 93.75 kBd 500 m / 1640 feet at ≤ 187.5 kBd 200 m / 656 feet with≤ 1.5 MBd

PROFIBUS FO (FMS and DP)		
	FO connector type	ST-Connector single ring / double ring according to the order for FMS; for DP only double ring available
	Connection for flush-mounting housing	Rear panel, mounting location “B”
	Connection for panel surface mounting housing	At the housing mounted case on the case bottom
	Transmission Speed	Up to 1.5 MBd
	Recommended:	> 500 kBd with normal casing ≤ 57 600 Bd at Detached Operator Panel
	Optical Wavelength	λ = 820 nm
	Laser class I acc. to EN 60825-1/-2	Using glass fiber 50/125 μm or using glass fiber 62.5/125 μm
	Permissible Optical Link Signal Attenuation	Max. 8 dB, with glass fiber 62.5/125 μm
	Maximum Distance of Transmission	Max. 0.62 miles (1.5 km)
DNP3.0 / MODBUS RS485		
	Connection for flush-mounting housing	Rear panel, mounting location “B” 9-pole D-SUB miniature connector
	Connection for panel surface mounting housing	At the housing mounted case on the case bottom
	Test Voltage	500 V; 50 Hz
	Transmission Speed	Up to 19,200 Bd
	Maximum Distance of Transmission	Max. 0.62 miles (1 km)
DNP3.0 / MODBUS Fibre Optical Link		
	FO connector type	ST–Connector Receiver/Transmitter
	Connection for flush-mounting housing	Rear panel, mounting location “B”
	Connection for surface-mounting case	At the housing mounted case on the case bottom
	Transmission Speed	Up to 19.200 Bd
	Optical Wavelength	λ = 820 nm
	Laser class I acc. to EN 60825-1/-2	Using glass fiber 50/125 μm or using glass fiber 62.5/125 μm
	Permissible Optical Link Signal Attenuation	Max. 8 dB, with glass fiber 62.5/125 μm
	Maximum Distance of Transmission	Max. 0.93 miles (1.5 km)
Ethernet electrical (EN 100) for IEC61850, DIGSI and inter-relay communication via GOOSE		
	Connection for flush-mounted case	rear side, mounting location “B” 2 x RJ45 socket contact 100BaseT acc. to IEEE802.3
	Connection for panel surface-mounted housing	not available
	Test voltage (reg. socket)	500 V; 50 Hz
	Transmission speed	100 MBit/s
	Bridgeable distance	65.62 feet (20 m)

Time Synchronization Interface

Time synchronization	DCF 77/IRIG B-Signal (Telegram Format IRIG-B000)		
Connection for flush- mounted case	Rear panel, mounting location “A” 9-pole D-SUB miniature female connector		
for surface mounting housing	at the double-deck terminal on the case bottom		
Signal nominal voltages	selectable 5 V, 12 V or 24 V		
Signal levels and Burdens for DCF 77 and IRIG B (format IRIG-B000)			
	Nominal signal voltage		
	5 V	12 V	24 V
V_{IHigh}	6.0 V	15.8 V	31 V
V_{ILow}	1.0 V at I_{ILow} = 0.25 mA	1.4 V at I_{ILow} = 0.25 mA	1.9 V at I_{ILow} = 0.25 mA
I_{IHigh}	4.5 mA to 9.4 mA	4.5 mA to 9.3 mA	4.5 mA to 8.7 mA
R_I	890 Ω at V_I = 4 V	1930 Ω at V_I = 8.7 V	3780 Ω at V_I = 17 V
	640 Ω at V_I = 6 V	1700 Ω at V_I = 15.8 V	3560 Ω at V_I = 31 V

4.1.5 Electrical Tests

Specifications

Standards:	IEC 60255 (product standards) ANSI/IEEE Std C37.90.0/.1/.2 UL 508 DIN 57435 Part 303 See also standards for individual tests

Insulation Test

Standards:	IEC 60255-5 and IEC 60870-2-1
High Voltage Test (routine test) All circuits except power supply, Binary Inputs, Communication Interface and Time Synchronization Interfaces	2.5 kV (rms), 50 Hz
High Voltage Test (routine test) Auxiliary Voltage and Binary Inputs	3.5 kV DC
High Voltage Test (routine test) Only Isolated Communication and Time Synchronization Interfaces	500 V (rms), 50 Hz
Impulse Voltage Test (type test) All Circuits Except Communication and Time Synchronization Interfaces, Class III	5 kV (peak value); 1.2/50 µs; 0.5 J; 3 positive and 3 negative impulses at intervals of 1 s

EMC Tests for Immunity (Type Tests)

Standards:	IEC 60255-6 and -22 (product standards) EN 50082-2 (generic standard) DIN 57435 Part 303
High frequency test IEC 60255-22-1, Class III and VDE 0435 part 303, class III	2.5 kV (peak); 1 MHz; τ = 15 μs; 400 surges per s; test duration 2 s; R_i = 200 Ω
Electrostatic discharge IEC 60255-22-2, 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
Exposure to HF field, non-modulated IEC 60255-22-3 (report), Class III	10 V/m; 27 MHz to 500 MHz
Irradiation with HF field, amplitude modulated IEC 61000-4-3, Class III	10 V/m; 80 MHz to 1000 MHz; 80 % AM; 1 kHz
Irradiation with HF field, pulse modulated IEC 61000-4-3/ENV 50 204, Class III	10 V/m; 900 MHz; repetition frequency 200 Hz; duty cycle of 50 %
Fast Transient Disturbance Variables / Burst IEC 60255-22-4 and IEC 61000-4-4, Class IV	4 kV; 5/50 ns; 5 kHz; burst length = 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 Auxiliary voltage Measuring inputs, binary inputs, relay outputs	Impulse: 1.2/50 μs Common mode: 2 kV; 12 Ω; 9 μF Diff. mode:1 kV; 2 Ω; 18 μF Common mode: 2 kV; 42Ω; 0. 5 μF diff. mode: 1 kV; 42Ω; 0. 5 μF
HF on lines, amplitude-modulated IEC 61000-4-6, Class III	10 V; 150 kHz to 80 MHz; 80 % AM; 1 kHz
Power System Frequency Magnetic Field IEC 61000-4-8, Class IV IEC 60255-6	30 A/m continuous; 300 A/m for 3 s; 50 Hz 0.5 mT; 50 Hz
Oscillatory Surge Withstand Capability ANSI/IEEE Std C37.90.1	2.5 to 3 kV (peak value); 1 to 1.5 MHz; damped oscillation; 50 surges per s; test duration 2 s; R_i = 150 Ω to 200 Ω
Fast Transient Surge Withstand Cap. ANSI/IEEE Std C37.90.1	4 kV to 5 kV: 10/150 ns: 50 pulses per s; both polarities: test duration 2 s: R_i = 80 Ω
Radiated Electromagnetic Interference ANSI/IEEE C37.90.2	35 V/m; 25 MHz to 1000 MHz
Damped Oscillations 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

EMC Tests for Noise Emission (Type Test)

Standard:	EN 50081-* (generic standard)
Radio Noise Voltage to Lines, Only Power Supply Voltage IEC-CISPR 22	150 kHz to 30 MHz Limit Class B
Interference field strength IEC-CISPR 22	30 MHz to 1000 MHz Limit Class B

Harmonic Currents on the Network Lead at 230 VAC IEC 61000-3-2	Device is to be assigned Class D; (applies only for devices with > 50 VA power consumption)
Voltage fluctuations and flicker on the network incoming feeder at 230 VAC IEC 61000-3-3	Limits are observed

4.1.6 Mechanical Stress Tests

Vibration and Shock Stress During Stationary Operation

Standards:	IEC 60255-21 and IEC 60068
Oscillation IEC 60255-21-1, Class 2; IEC 60068-2-6	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.
Shock IEC 60255-21-2, Class 1; IEC 60068-2-27	Semi-sinusoidal 5 g acceleration, duration 11 ms, each 3 shocks in both directions of the 3 axes
Seismic Vibration IEC 60255-21-3, Class 1; IEC 60068-3-3	Sinusoidal 1 Hz to 8 Hz: ±3.5 mm amplitude (horizontal axis) 1 Hz to 8 Hz: ±1.5 mm amplitude (vertical axis) 8 Hz to 35 Hz: 1 g acceleration (horizontal axis) 8 Hz to 35 Hz: 0.5 g acceleration (vertical axis) Frequency sweep 1 octave/min 1 cycle in 3 orthogonal axes

Vibration and Shock Stress During Transport

Standards:	IEC 60255-21 and IEC 60068
Oscillation IEC 60255-21-1, Class 2; IEC 60068-2-6	Sinusoidal 5 Hz to 8 Hz: ± 7.5 mm amplitude; 8 Hz to 15 Hz: 2 g acceleration Frequency sweep 1 octave/min 20 cycles in 3 orthogonal axes
Shock IEC 60255-21-2, Class 1; IEC 60068-2-27	Semi-sinusoidal 15 g acceleration, duration 11 ms, each 3 shocks (in both directions of the 3 axes)
Continuous Shock IEC 60255-21-2, Class 1; IEC 60068-2-29	Semi-sinusoidal 10 g acceleration, duration 16 ms, each 1000 shocks (in both directions of the 3 axes)
Note: All stress test data apply for devices in factory packaging.	

4.1.7 Climatic Stress Tests

Temperatures[1])

Standards:	IEC 60255-6
Type tested (acc. IEC 60086-2-1 and -2, Test Bd, for 16 h)	–13 °F to +185 °F or –25 °C to +85 °C
Permissible temporary operating temperature (tested for 96 h)	– 4 °F to +158 °F or –20 °C to +70 °C (legibility of display may be restricted from +131 °F or +55 °C)
Recommended permanent operating temperature (acc. to IEC 60255-6)	23 °F to +131 °F or –5 °C to +55 °C
Limiting Temperatures for Storage	–13 °F to +131 °F or –25 °C to +55 °C
Limiting temperatures for transport	–13 °F to +185 °F or –25 °C to +70 °C
Store and transport the device with factory packing!	
[1]) UL–certified according to Standard 508 (Industrial Control Equipment):	
Limiting temperatures for normal operation (i.e. output relays not energized)	–4 °F to +158 °F or –20 °C to +70 °C
Limiting temperatures with maximum load (max. cont. permissible energization of inputs and outputs)	23 °F to +104 °F or –5 °C to +40 °C

Humidity

Permissible humidity	Mean value per year ≤ 75 % relative humidity; on 56 days of the year up to 93 % relative humidity; condensation must be avoided!
Siemens recommends that all devices be installed such that they are not exposed to direct sunlight, nor subject to large fluctuations in temperature that may cause condensation to occur.	

4.1.8 Service Conditions

The protective device is designed for use in an industrial environment and an electrical utility environment. Proper installation procedures should be followed to ensure electromagnetic compatibility (EMC).

In addition, the following is recommended:

- All contacts and relays that operate in the same cubicle, cabinet, or relay panel as the numerical protective device should, as a rule, be equipped with suitable surge suppression components.
- For substations with operating voltages of 100 kV and above, all external cables should be shielded with a conductive shield grounded at both ends. For substations with lower operating voltages, no special measures are normally required.
- Do not withdraw or insert individual modules or boards while the protective device is energized. In withdrawn condition, some components are electrostatically endangered; during handling the ESD standards (for **E**lectrostatic **S**ensitive **D**evices) must be observed. They are not endangered when inserted into the case.

4.1.9 Certifications

UL Listing		UL recognition	
6MD63**-*B***-****	Models with threaded terminals	6MD63**-*A***-****	Models with plug–in terminals
6MD63**-*C***-****		6MD63**-*D***-****	
6MD63**-*E***-****		6MD63**-*G***-****	
6MD63**-*F***-****			

4.1.10 Construction

Case	7XP20
Dimensions	See dimensional drawings, Section 4.6
Weight (maximum number of components) approx.	
In surface mounting, housing size $^1/_2$	15.4 pounds (7.5 kg)
In surface mounting, housing size $^1/_1$	33.1 pounds (15 kg)
In flush mounting, housing size $^1/_2$	14.3 pounds (6.5 kg)
In flush mounting, housing size $^1/_1$	29 pounds (13 kg)
In housing for detached operator panel, housing size $^1/_2$	18 pounds (8.0 kg)
In housing for detached operator panel, housing size $^1/_1$	33.1 pounds (15 kg)
Detached operator panel	4.41 pounds (2.5 kg)
Degree of protection acc. to IEC 60529	
For the equipment	
In the surface mounting housing	IP 51
In flush mounting housing and in model with detached operator panel	
– front	IP 51
– rear	IP 50
For personal protection	IP 2x with cover cap
UL-certification conditions	“For use on a Flat Surface of a Type 1 Enclosure”

4.2 Breaker Control

Number of Controlled Switching Devices	Depends on the number of binary inputs and outputs available
Interlocking	Freely programmable interlocking
Messages	Feedback messages; closed, open, intermediate position
Control Commands	Single command / double command
Switching Command to Circuit Breaker	1-, $1^1/_2$ - and 2-pole
Programmable Logic Controller	PLC logic, graphic input tool
Local Control	Control via menu control assignment of function keys
Remote Control	Using Communications Interfaces Using a substation automation and control system (e.g. SICAM) Using DIGSI® (e.g. via Modem)

4.3 RTD Boxes for Overload Detection

Temperature Detectors

Connectable RTD-boxes	1 or 2
Number of temperature detectors per RTD-box	Max. 6
Type of measurement	Pt 100 Ω or Ni 100 Ω or Ni 120 Ω selectable 2 or 3 phase connection
Mounting identification	“Oil” or “Ambient” or “Stator” or “Bearing” or “Other”

Operational Measured Values

Number of Measuring Points		maximal of 12 temperature measuring points
	Temperature Unit	°C or °F, adjustable
	Measuring Range - for Pt 100 - for Ni 100 - for Ni 120	 –199 °C to 800 °C (–326 °F to 1472 °F) –54 °C to 278 °C (–65 °F to 532 °F) –52 °C to 263 °C (–62 °F to 505 °F)
	Resolution	1 °C or 1 °F
	Tolerance	± 0.5 % of measured value ± 1 digit

Thresholds for Indications

For each measuring point:		
Stage 1	–58 °F to 482 °F or –50 °C to 250 °C or ∞ (no indication) oder ∞ (keine Meldung)	(in increments of 1 °C) (in increments of 1 °F)
Stage 2	–58 °F to 482 °F or –50 °C to 250 °C or ∞ (no indication) or ∞ (no indication)	(in increments of 1 °C) (in increments of 1 °F)

4.4 User-Defined Functions (CFC)

Function Modules and Possible Assignments to Task Levels

Function Module	Description	Run-Time Level			
		MW_ BEARB	PLC1_ BEARB	PLC_ BEARB	SFS_ BEARB
ABSVALUE	Magnitude calculation	X	—	—	—
ADD	addition	X	X	X	X
ALARM	Alarm clock	X	X	X	X
AND	AND - Gate	X	X	X	X
BLINK	Blink-Baustein	X	X	X	X
BOOL_TO_CO	Boolean to Control (conversion)	—	X	X	—
BOOL_TO_DL	Boolean to Double Point (conversion)	—	X	X	X
BOOL_TO_IC	Bool to internal SI, conversion	—	X	X	X
BUILD_DI	Create Double Point annunciation	—	X	X	X
CMD_CANCEL	Command cancelled	X	X	X	X
CMD_CHAIN	Switching sequence	—	X	X	—
CMD_INF	Command information	—	—	—	X
COMPARE	Metered value compar-ison	X	X	X	X
CONNECT	Connection	—	X	X	X
COUNTER	Counter	X	X	X	X
D_FF	D- Flipflop	—	X	X	X
D_FF_MEMO	status memory for restart	X	X	X	X
DI_TO_BOOL	Double Point to Boolean (conversion)	—	X	X	X
DINT_TO_REAL	Adapter	X	X	X	X
DIV	division	X	X	X	X
DM_DECODE	Decode double point indication	X	X	X	X
DYN_OR	dynamic or	X	X	X	X
INT_TO_REAL	Conversion	X	X	X	X
LIVE_ZERO	Live-zero, non linear Curve	X	—	—	—
LONG_TIMER	Timer (max.1193h)	X	X	X	X
LOOP	Feedback loop	X	X	X	X
LOWER_SETPOINT	Lower limit	X	—	—	—
MUL	multiplication	X	X	X	X
NAND	NAND - Gate	X	X	X	X
NEG	Negator	X	X	X	X
NOR	NOR - Gate	X	X	X	X
OR	OR - Gate	X	X	X	X
POI_ZW_ST_LNK	— — —	X	X	X	X

Function Module	Description	Run-Time Level			
		MW_ BEARB	PLC1_ BEARB	PLC_ BEARB	SFS_ BEARB
POO_ZW_ST_LNK	— — —	X	X	X	X
REAL_TO_DINT	Adapter	X	X	X	X
REAL_TO_INT	Conversion	X	X	X	X
RISE_DETECT	Rise detector	X	X	X	X
RS_FF	RS- Flipflop	—	X	X	X
SQUARE_ROOT	root extractor	X	X	X	X
SR_FF	SR- Flipflop	—	X	X	X
SUB	substraction	X	X	X	X
TIMER	Timer	—	X	X	—
TIMER_SHORT	Simple timer	—	X	X	—
UPPER_SETPOINT	Upper limit	X	—	—	—
X_OR	XOR - Gate	X	X	X	X
ZERO_POINT	Zero supression	X	—	—	—

General Limits

Designation	Limit	Comments
Maximum number of all CFC charts considering all task levels	32	When the limit is exceeded, an error message is output by the device. Consequently, the device is put into monitoring mode. The red ERROR-LED lights up.
Maximum number of all CFC charts considering one task level	16	Only Error Message (record in device fault log, evolving fault in processing procedure)
Maximum number of all CFC inputs considering all charts	400	When the limit is exceeded, an error message is output by the device. Consequently, the device is put into monitoring mode. The red ERROR-LED lights up.
Maximum number of inputs of one chart for each task level (number of unequal information items of the left border per task level)	400	Only fault annunciation (record in device fault log); here the number of elements of the left border per task level is counted. Since the same information is indicated at the border several times, only unequal information is to be counted.
Maximum number of reset-resistant flipflops D_FF_MEMO	350	When the limit is exceeded, an error message is output by the device. Consequently, the device is put into monitoring mode. The red ERROR-LED lights up.

Device-specific Limits

Designation	Limit	Comments
Maximum number of synchronous changes of chart inputs per task level	50	When the limit is exceeded, an error message is output by the device. Consequently, the device is put into monitoring mode. The red ERROR-LED lights up.
Maximum number of chart outputs per task level	150	

Additional Limits

Additional limits [1] for the following CFC blocks:			
Sequence Level	**Maximum Number of Modules in the Task Levels**		
	TIMER[2) 3)]	TIMER_SHORT[2) 3)]	CMD_CHAIN
NW_NEAR	—	—	—
LP_NEAR	15	30	20
PLAN_NEAR			
S_NEAR	—	—	—

1) When the limit is exceeded, an error message is output by the device. Consequently, the device starts monitoring. The red ERROR-LED lights up.

2) The following condition applies for the maximum number of timers: (2 · number of TIMER + number of TIMER_SHORT) < 30. TIMER and TIMER_SHORT hence share the available timer resources within the frame of this inequation. The limit does not apply to the LONG_TIMER.

3) The time values for the blocks TIMER and TIMER_SHORT must not be selected shorter than the time resolution of the device, as the blocks will not then start with the starting pulse.

Maximum Number of TICKS in the Task Levels

Task Level	Limit in TICKS [1]
MW_BEARB (Measured Value Processing)	2536
PLC1_BEARB (Slow PLC Processing)	300
PLC_BEARB (Fast PLC Processing)	130
SFS_BEARB (Interlocking)	2173

1) When the sum of TICKS of all blocks exceeds the limits before-mentioned, an error message is output by CFC.

Processing Times in TICKS required by the Individual Elements

Element		Number of TICKS
Module, basic requirement		5
Each input from the 3rd additional input for generic blocks		1
Connection to an input signal		6
Connection to an output signal		7
Additional for each chart		1
Switching sequence	CM_CHAIN	34
status memory for restart	D_OFF_MEMO	6
Feedback loop	LOOP	8
Decode double point indication	DM_DECODE	8
dynamic or	D_OR	6
addition	ADD	26
substraction	SUB	26
multiplication	MU	26
division	IV	54
root extractor	SQUARE_ROOT	83

Configurable in Matrix

In addition to the defined presetting, indications and mesaured values can be freely configured to buffers, presettings can be removed. Not including important, explicitely defined indications such as general indication.

4.5 Additional Functions

Operational Measured Values

Currents I_A; I_B; I_C Positive sequence component I_1 Negative sequence component I_2 I_G or 3I0	in A (kA) primary and in A secondary or in % I_{Nom}
Range Tolerance 1)	10 % to 200 % I_{Nom} 1 % of measured value, or 0.5 % I_{Nom}
Phase-to-ground voltages V_{A-N}, V_{B-N}, V_{C-N} Phase-to-phase voltages V_{A-B}, V_{B-C}, V_{C-A} V_N or V_0 Positive Sequence Component V_1 Negative Sequence Component V_2	in kV primary, in V secondary or in % of V_{Nom}
Range Tolerance 1)	10 % to 120 % of V_{Nom} 1 % of measured value, or 0.5 % of V_{Nom}
S, apparent power	in kVAr (MVAr or GVAr) primary and in % of S_{Nom}
Range Tolerance 1)	0 % to 120 % S_{Nom} 2 % of S_{Nom} For V/V_{Nom} and I/I_{Nom} = 50 to 120 %
P, Active Power	with sign, total and phase-segregated in kW (MW or GW) primary and in % S_{Nom}
Range Tolerance 1)	0 % to 120 % S_{Nom} 3 % of S_{Nom} For V/V_{Nom} and I/I_{Nom} = 50 to 120 % and $\lvert \cos \varphi \rvert$ = 0.707 to 1 With $S_{Nom} = \sqrt{3} \cdot V_{Nom} \cdot I_{Nom}$
Q, Reactive Power	with sign, total and phase-segregated in kVAr (MVAr or GVAr) primary and in % S_{Nom}
Range Tolerance 1)	0 % to 120 % S_{Nom} 3 % of S_{Nom} For V/V_{Nom} and I/I_{Nom} = 50 to 120 % and $\lvert \sin \varphi \rvert$ = 0.707 to 1 With $S_{Nom} = \sqrt{3} \cdot V_{Nom} \cdot I_{Nom}$
cos φ, power factor	total and phase-segregated
Range Tolerance 1)	–1 to +1 5 % for $\lvert \cos \varphi \rvert \geq 0.707$
Frequencies f	in Hz
Range Tolerance 1)	f_{Nom} ± 5 Hz 20 mHz

Measuring transducer		
	Operating Range Accuracy Range Tolerance [1]	0 mA to 24 mA 1 mA to 20 mA 1.5%, relative to nominal value of 20 mA
	For Standard Usage of the Measurement Transducer for Pressure and Temperature Monitoring:	
	Operating Measured Value Pressure	Pressure in hPa
	Operating Range (Presetting)	0 hPa to 1200 hPa
	Operating Measured Value Temperature	Temp in °C
	Operating Range (Presetting)	0 °C to 240 °C
	Operating Range (Presetting)	0 °C to 240 °C
RTD-Box		See section (RTD-Boxes for Temperature Detection)

[1] At nominal frequency

Long-Term Averages

Time Window	5, 15, 30 or 60 minutes
Frequency of Updates	Adjustable
Long-Term Averages	
of Currents of Real Power of Reactive Power of Apparent Power	I_{Admd}; I_{Bdmd}; I_{Cdmd}; I_{1dmd} in A (kA) P_{dmd} in W (kW, MW) Q_{dmd} in VAr (kVAr, MVAr) S_{dmd} in VAr (kVAr, MVAr)

Min / Max Report

Report of Measured Values	With date and time
Reset automatic	Time of day adjustable (in minutes, 0 to 1439 min) Time frame and starting time adjustable (in days, 1 to 365 days, and ∞)
Reset manual	Using binary input Using keypad Using communication
Min/Max Values for Current	I_A; I_B; I_C; I_1 (positive sequence component)
Min/Max Values for Voltages	V_{A-N}; V_{B-N}; V_{C-N} V_1 (positive sequence component); V_{A-B}; V_{B-C}; V_{C-A}
Min/Max Values for Power	S, P; Q, cos φ; frequency
Min/Max Values for Mean Values	I_{Admd}; I_{Bdmd}; I_{Cdmd}; I_{1dmd} (positive sequence component); S_{dmd}; P_{dmd}; Q_{dmd}

Local Measured Values Monitoring

Current Asymmetry	I_{max}/I_{min} > balance factor, for $I > I_{balance\ limit}$
Voltage Asymmetry	V_{max}/V_{min} > balance factor, for $V > V_{lim}$
Current Sum	$\| i_A + i_B + i_C + k_I \cdot i_N \|$ > limit value, with $k_I = \dfrac{\text{Ignd-CT PRIM} / \text{Ignd-CT SEC}}{\text{CT PRIMARY} / \text{CT SECONDARY}}$
Current Phase Sequence	Clockwise (ABC) / counter-clockwise (ACB)
Voltage Phase Sequence	Clockwise (ABC) / counter-clockwise (ACB)
Limit Value Monitoring	I_A > limit value I_{Admd}> I_B > limit value I_{Bdmd}> I_C > limit value I_{Cdmd}> I_1 > limit value I_{1dmd}> I_L< limit value I_L< cos φ < lower limit value |cos φ |< P > limit value of real power |P_{dmd} | > Q > limit value of reactive power | Q_{dmd} | > S > limit value of apparent power S_{dmd} > Pressure < lower limit value Press< Temperature > limit value Temp>

Time Stamping

Resolution for Event Log	1 ms
Maximum Time Deviation (Internal Clock)	0.01 %
Battery	Lithium battery 3 V/1 Ah, type CR 1/2 AA Message “`Battery Fault`” for insufficient battery charge

Energy meter

Meter Values for Energy Wp, Wq (real and reactive energy)	In kWh (MWh or GWh) and in kVARh (MVARh or GVARh)
Range Tolerance [1]	28 bit or 0 to 2 68 435 455 decimal for IEC 60870-5-103 (VDEW protocol) 31 bit or 0 to 2 147 483 647 decimal for other protocols (other than VDEW) ≤ 5 % for $I > 0{,}5\ I_{Nom}$, $V > 0.5\ V_{Nom}$ and | cos φ | ≥ 0.707

[1] At nominal frequency

Invertable Measured Power Values

Directly affected measured values		Indirectly affected measured values[1)]	
641 “P =”	Measured value P (Active Power)	834 “P dmd =”	Mean value P =
642 “Q =”	Measured value Q (Reactive Power)	835 “Q dmd =”	Mean value Q =
901 “PF =”	cos (PHI) power factor =	845 “PdMin=”	Minimum of mean value P =
		846 “PdMax=”	Maximum of mean value P =
		847 “QdMin=”	Minimum of mean value Q =
		848 “QdMax=”	Maximum of mean value Q =
		876 “Pmin=”	Minimum of active power P =
		877 “Pmax=”	Maximum of active power P =
		878 “Qmin=”	Minimum of reactive value Q =
		879 “Qmax=”	Maximum of reactive value Q =
		884 “PF Max=”	Maximum of cos (PHI) power factor =
		885 “PF Min=”	Minimum of cos (PHI) power factor =

1) through dependence on the directly affected measured values

Statistics

Saved Number of Trips	Up to 9 digits

Operating Hours Counter

Display Range	Up to 7 digits
Criterion	Current exceeds an adjustable current threshold ($I \geq 0.04 \cdot I_{Nom}$)

Commissioning Startup Aids

Phase Rotation Field Check Operational measured values Circuit Breaker / Switching Device Test

IEC 61850 GOOSE (inter-relay communication)

The communication service GOOSE of IEC 61850 is qualified for switchgear interlocking.

Clock

Time Synchronization		DCF 77/ IRIG B-Signal (telegram format IRIG-B000) Binary Input Communication
Operating Modes for Time Tracking		
No.	Operating Mode	Explanations
1	Internal	Internal synchronization using RTC (default)
2	IEC 60870-5-103	External synchronization using system interface (IEC 60870-5-103)
3	PROFIBUS FMS	External synchronization using PROFIBUS interface
4	Time signal IRIG B	External synchronization using IRIG B
5	Time signal DCF77	External synchronization using DCF 77
6	Time signal Sync. box	External synchronization using SIMEAS Sync. box
7	Pulse via binary input	External synchronization with pulse via binary input
8	Field bus (DNP, Modbus)	External synchronization using field bus
9	NTP (IEC 61850)	External synchronization using system interface (IEC 61850)

4.6 Dimensions

4.6.1 Panel Flush and Cubicle Mounting (Housing Size $^1/_2$)

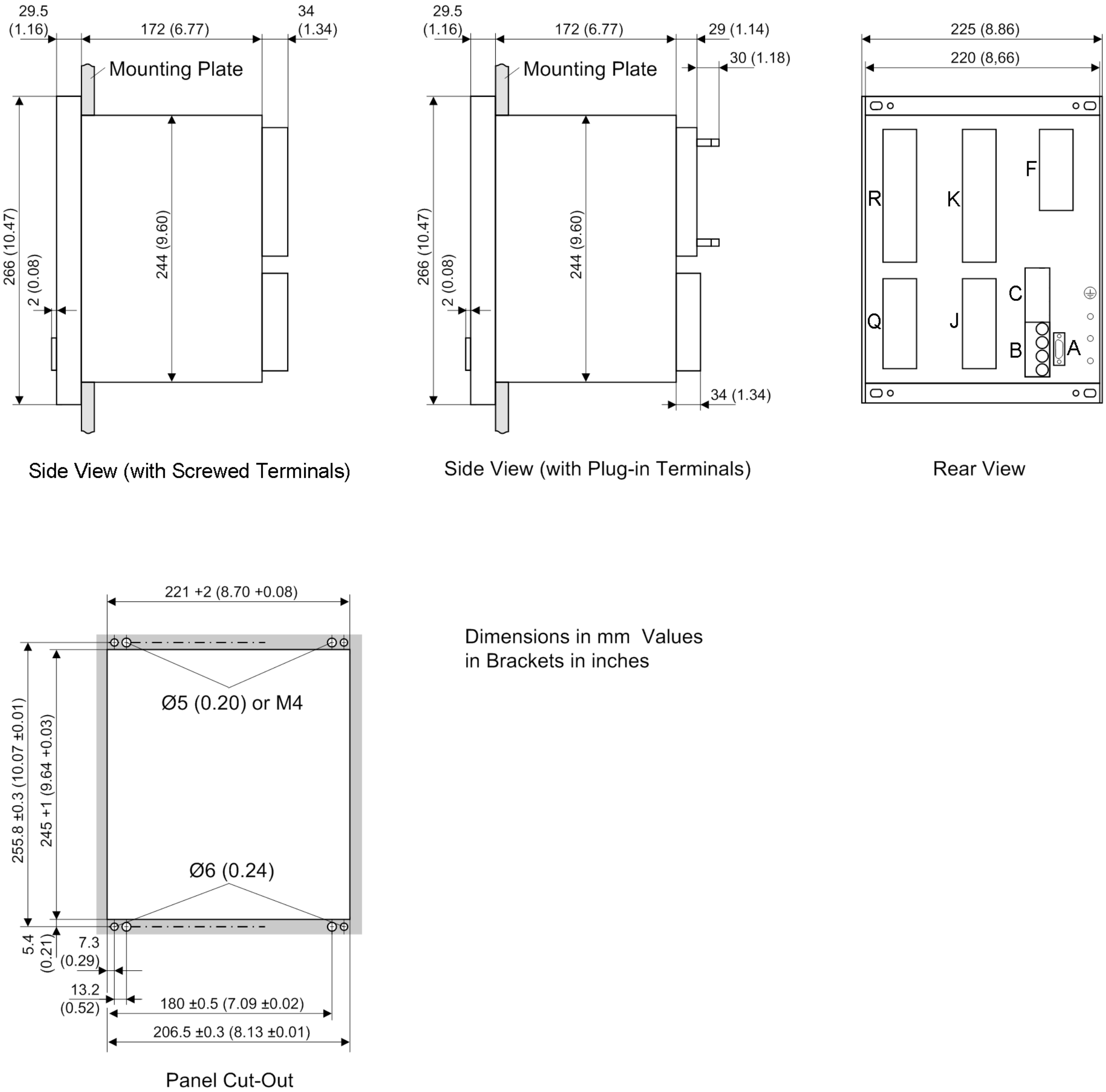


Figure 4-1 Dimensional drawing of a 6MD63 for panel flush or cubicle mounting (housing size $^1/_2$)

4.6.2 Panel Flush and Cubicle Mounting (Housing Size $^{1}/_{1}$)

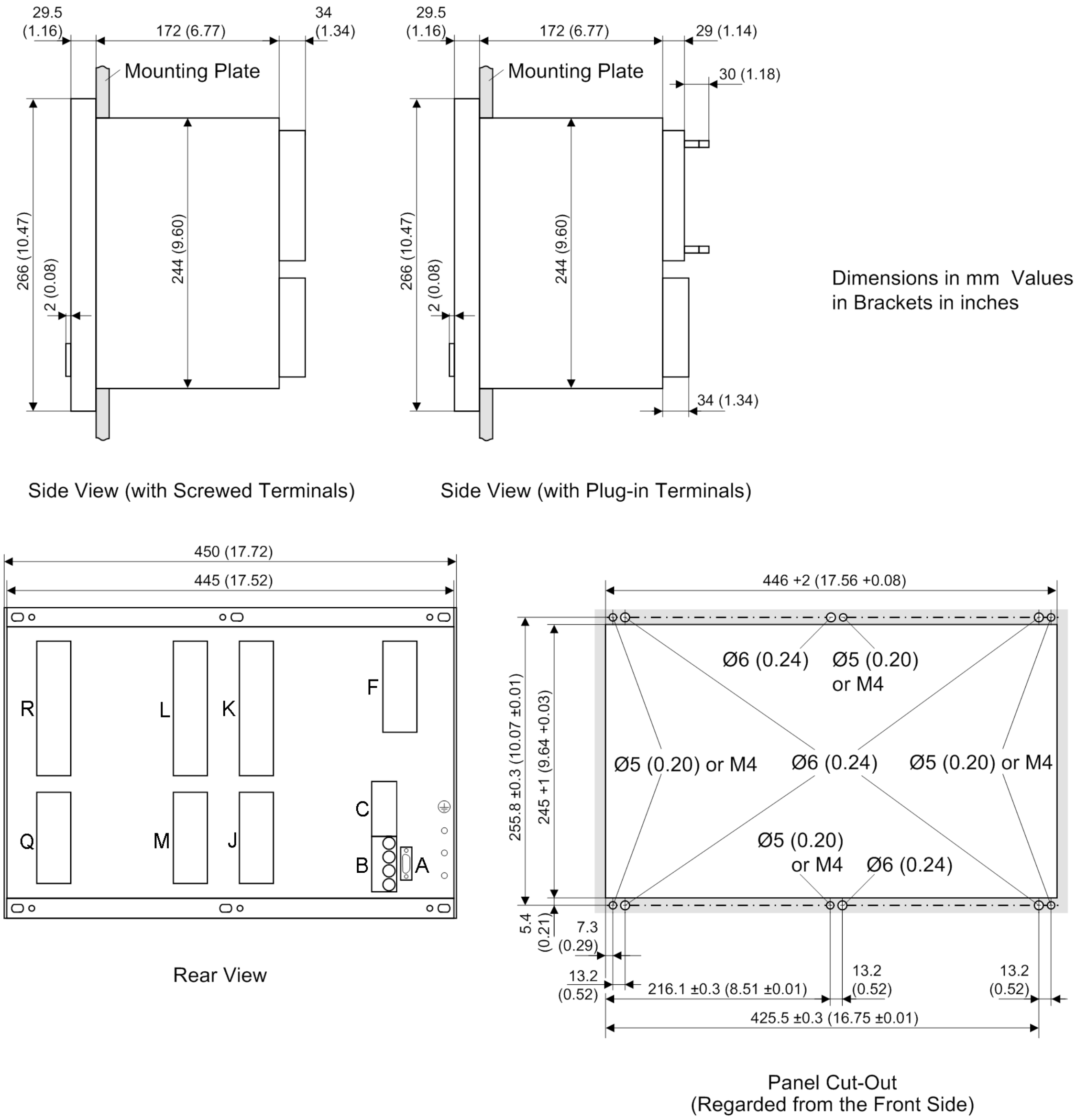


Figure 4-2 Dimensional drawing of a 6MD63 for panel flush or cubicle mounting (housing size $^{1}/_{1}$)

4.6.3 Panel Surface Mounting (Housing Size $^1/_2$)

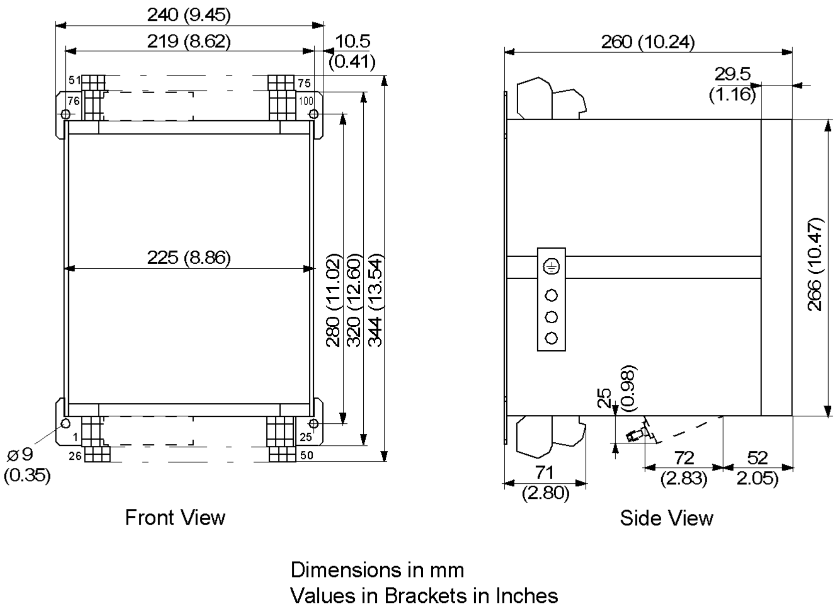


Figure 4-3 Dimensional drawing for panel surface mounting (housing size $^1/_2$)

4.6.4 Panel Surface Mounting (Housing Size $^1/_1$)

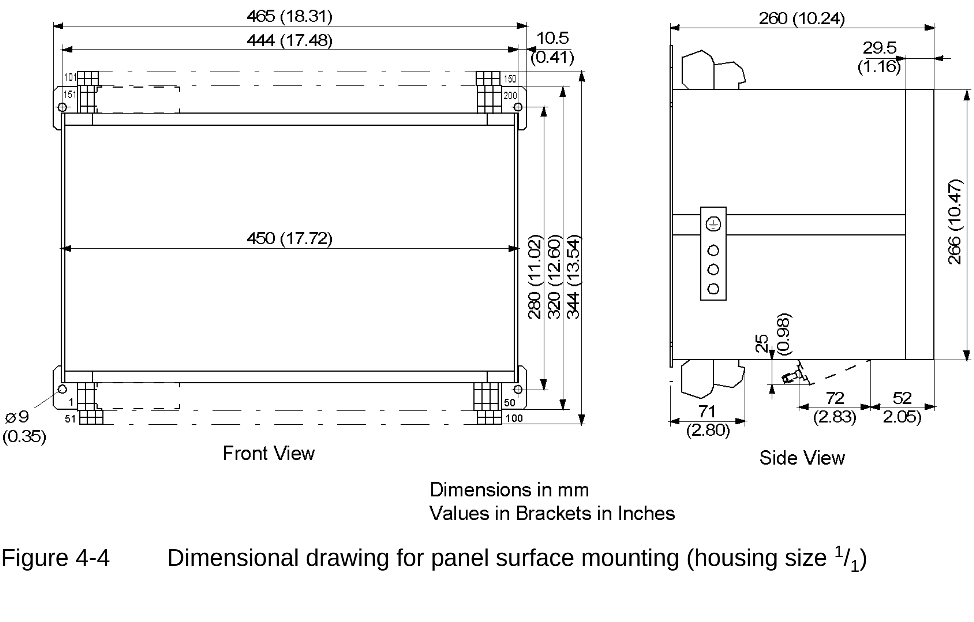


Figure 4-4 Dimensional drawing for panel surface mounting (housing size $^1/_1$)

4.6.5 Panel Surface Mounting with Detached Operator Panel or without Operator Panel (Housing Size $^1/_2$)

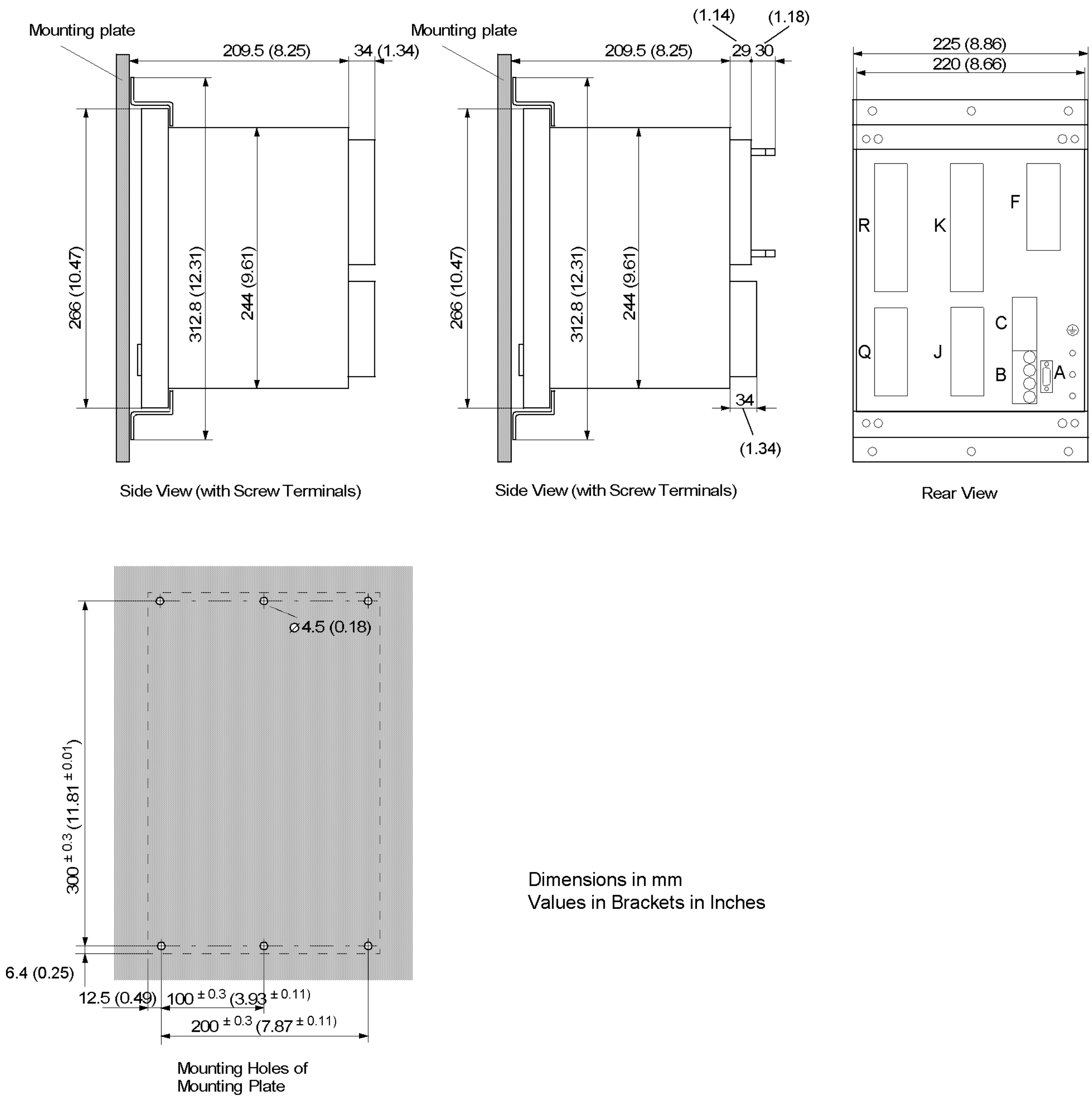


Figure 4-5 Dimensions of a 6MD63 for panel surface mounting with detached operator panel or without operator panel (housing size $^1/_2$)

4.6.6 Panel Surface Mounting with Detached Operator Panel or without Operator Panel (Housing Size $^1/_1$)

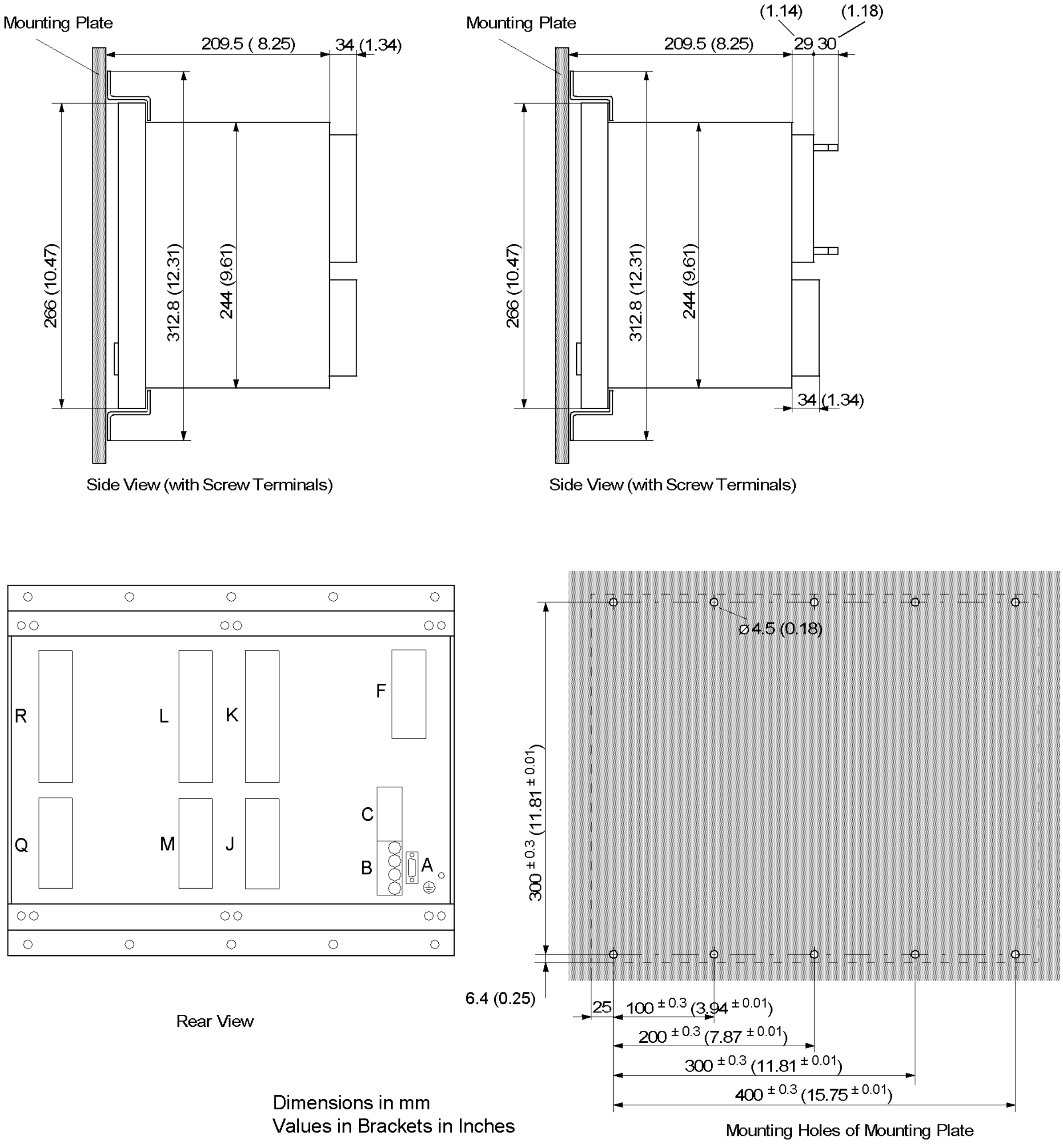


Figure 4-6 Dimensions of a 6MD63 for panel surface mounting with detached operator panel or without operator panel (housing size $^1/_1$)

4.6.7 Detached Operator Panel

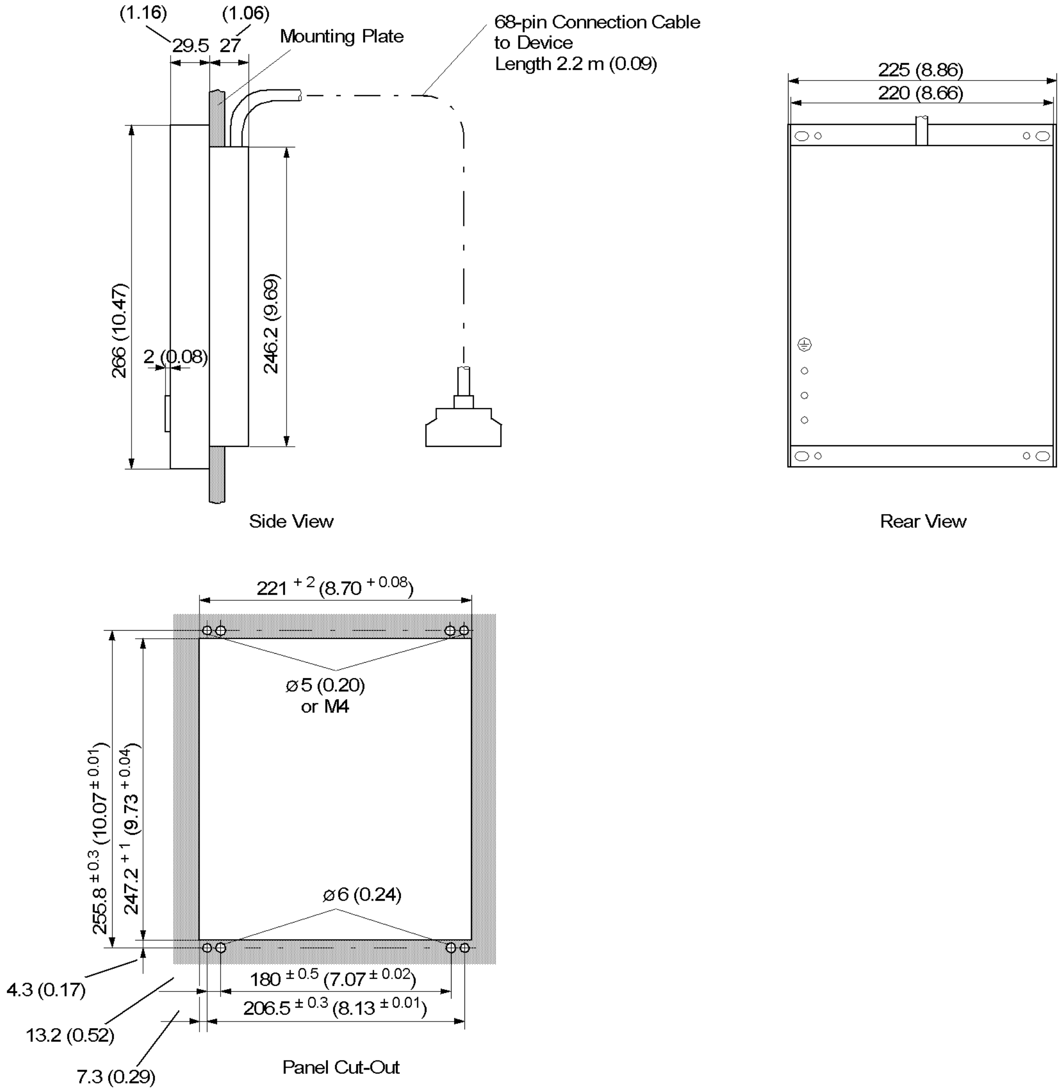


Figure 4-7 Dimensional drawing of a detached operator panel

4.6.8 D-Subminiature Connector of Dongle Cable (Panel Flush or Cubicle Door Cutout)

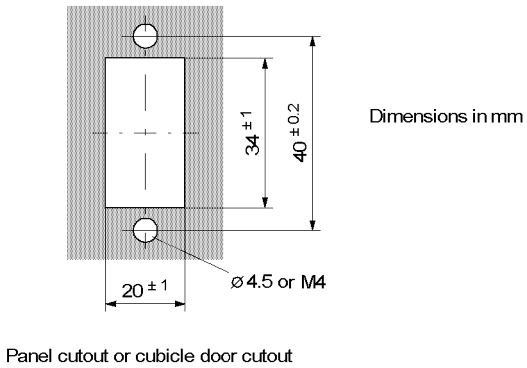


Figure 4-8 Dimensions of panel flush or cubicle door cutout of D-subminiature female connector of dongle cable

■

Appendix A

This appendix is primarily a reference for the experienced user. This section provides ordering information for the models of this device. Connection diagrams for indicating the terminal connections of the models of this device are included. Following the general diagrams are diagrams that show the proper connections of the devices to primary equipment in many typical power system configurations. Tables with all settings and all information available in this device equipped with all options are provided. Default settings are also given.

A.1 Ordering Information and Accessories

A.1.1 Ordering Information

A.1.1.1 6MD63 V4.6 (current release.../EE)

Input /Output Unit with Local Control						6	7		8	9	10	11	12		13	14	15	16		Supplementary		
	6	**M**	**D**	**6**	**3**			–						–		**A**	**A**	**0**	+			

Housing, Binary Inputs and Outputs, Measuring Transducer	Pos. 6
Housing $^{1}/_{2}$ 19", 11 BI, 8 BO, 1 Live Status Contact	1
Housing $^{1}/_{2}$ 19", 24 BI, 11 BO, 2 High-duty relays (4 Contacts), 1 Live Status Contact	2
Housing $^{1}/_{2}$ 19", 20 BI, 11 BO, 2 TD, 2 High-duty relays (4 Contacts), 1 Live Status Contact	3
Housing $^{1}/_{2}$ 19", 20 BI, 6 BO, 2 High-duty relays (4 Contacts), 1 Live Status Contact (only available if "0" is at position 7)	4
Housing $^{1}/_{1}$ 19", 37 BI, 14 BO, 4 High-duty relays (8 Contacts), 1 Live Status Contact	5
Housing $^{1}/_{1}$ 19", 33 BI, 14 BO, 2 TD, 4 High-duty relays (8 Contacts), 1 Live Status Contact	6
Housing $^{1}/_{2}$ 19", 33 BI, 9 BO, 4 High-duty relays (8 Contacts), 1 Live Status Contact (only available if "0" is at position 7)	7

Nominal Current	Pos. 7
no analog measurement quantities (only available if "4" or "7" is at position 6)	0
I_{Ph} = 1 A, I_N = 1 A	1
I_{Ph} = 5 A, I_N = 5 A	5

Power Supply, Binary Input, Pickup Threshold Setting	Pos. 8
24 to 48 VDC, Binary Input Threshold 19 VDC	2
60 to 125 VDC, Binary Input Threshold 19 VDC	4
110 to 250 VDC, 115 to 230 VAC, Binary Input Threshold 88 VDC	5

Construction	Pos. 9
Surface-mounting case, plug-in terminals, detached operator panel Installation in a low-voltage compartment	A
Surface mounting case for panel, 2 tier terminals top/bottom	B
Surface-mounting case, screw-type terminals (direct connection / ring and spade lugs), detached operator panel, installation in a low voltage compartment	C
Flush mounting case, plug-in terminals (2/3-pin connector)	D
Flush mounting case, screw-type terminals (direct connection / ring and spade lugs)	E
Surface-mounting case, screw-type terminals (direct connection / ring and spade lugs), without operator panel, installation in a low-voltage compartment	F
Surface-mounting case, plug-in terminals, without operator panel Installation in a low-voltage compartment	G

Region-specific Default / Language Settings and Function Versions	**Pos.10**
Region DE, 50 Hz, IEC, Language German (Language can be changed)	A
Region World, 50/60 Hz, IEC/ANSI, Language English (Language can be changed)	B
Region US, 60 Hz, ANSI, Language American English (Language can be changed)	C
Region FR, 50/60 Hz, IEC/ANSI, Language French(Language can be changed)	D
Region World, 50/60 Hz, IEC/ANSI, Language Spanish (Language can be changed)	E

System Interface (Rear Side, Port B)	**Pos.11**
No system interface	0
IEC-Protocol, electrical RS232	1
IEC-Protocol, electrical RS485	2
IEC-Protocol, Optical, 820 nm, ST-Connector	3
Profibus FMS Slave, electrical RS485	4
Profibus FMS Slave, Optical, Single Ring, ST-Connector [1)]	5 [1)]
Profibus FMS Slave, Optical, Double Ring, ST-Connector [1)]	6 [1)]
For further interface options see Additional Information in the following	9

Additional information to further system interfaces (device rear, port B)	**Supple-mentary**
Profibus DP Slave, RS485	+ L 0 A
Profibus DP Slave, 820 nm, Optical Double Ring, ST–Connector [1)]	+ L 0 B [1)]
Modbus RS485	+ L 0 D
Modbus, 820 nm, Optical, ST–Connector [2)]	+ L 0 E [2)]
DNP3.0, RS485	+ L 0 G
DNP3.0, 820 nm, Optical, ST–Connector [2)]	+ L 0 H [2)]
IEC 61850, Ethernet electrical, double, RJ45-Connector (EN 100) [3)]	+ L 0 R [3)]
IEC 61850, Ethernet optical, double, ST-Connector (EN 100) [2)4)]	+ L 0 S [2)4)]

[1)] Cannot be delivered in connection with 9th digit = "B". If the optical interface is required you must order the following: 11th digit = 4 (RS485) and in addition, the associated converter

[2)] Cannot be delivered in connection with 9th digit = "B".

[3)] In the surface mounting case with 2 tier terminals as of January 2005

[4)] Deliverable as of April 2005

Converter	Order No.	Use
SIEMENS OLM[1)]	6GK1502–2CB10	For single ring
SIEMENS OLM[1)]	6GK1502–3CB10	For double ring

[1)] The converter requires an operating voltage of 24 VDC. If the available operating voltage is > 24 VDC the additional power supply 7XV5810–0BA00 is required.

DIGSI 4/Modem Interface (Rear Side, Port C)	Pos.12
No DIGSI interface at the back	0
DIGSI/Modem, electrical RS232	1
DIGSI, Modem, RTD-Box [1], Electrical RS485	2
DIGSI 4, Modem, RTD-Box [1], Optical 820 nm, ST-Connector [2]	3

[1] RTD-box 7XV5662–*AD10

[2] If you want to run the RTD-Box at an optical interface, you need also the RS485–FO–converter 7XV5650–0*A00.

Measuring	Pos.13
without measuring values	0
Slave pointer, Average values, Min/Max values (Only available if “1” or “5” is at position 7)	2

A.1.2 Accessories

Exchangeable Interface Modules

Name	Order No.
RS232	C53207-A351-D641-1
RS485	C53207-A351-D642-1
FO 820 nm	C53207-A351-D643-1
Profibus FMS RS485	C53207-A351-D603-1
Profibus FMS double ring	C53207-A351-D606-1
Profibus FMS single ring	C53207-A351-D609-1
Profibus DP RS485	C53207-A351-D611-1
Profibus DP double ring	C53207-A351-D613-1
Modbus RS485	C53207-A351-D621-1
Modbus 820 nm	C53207-A351-D623-1
DNP 3.0 RS485	C53207-A351-D631-3
DNP 3.0 820 nm	C53207-A351-D633-3
Ethernet electrical (EN 100)	C53207–A351–D675–1

RTD-Box (Resistance Temperature Detector)

Name	Order No.
RTD-box, Vaux = 24 to 60 V AC/DC	7XV5662–2AD10–0000
RTD-box, Vaux = 90 to 240 V AC/DC	7XV5662–5AD10–0000

RS485/Fibre Optic Converter

RS485/Fibre Optic Converter	Order No.
820 nm; FC–Connector	7XV5650–0AA00
820 nm; with ST–Connector	7XV5650–0BA00

Terminal Block Covering Caps

Covering cap for terminal block type	Order No.
18 pin voltage terminal, 12 pin current terminal block	C73334-A1-C31-1
12-terminal voltage, 8-terminal current block	C73334-A1-C32-1

Short Circuit Links

Short circuit links for terminal type	Order No.
Voltage terminal, 18-terminal, or 12-terminal	C73334-A1-C34-1
Current terminal,12-terminal, or 8-terminal	C73334-A1-C33-1

Female Plugs

Connector Type	Order No.
2-pin	C73334-A1-C35-1
3-pin	C73334-A1-C36-1

Mounting Rail for 19"- Racks

Name	Order No.
Angle Strip (Mounting Rail)	C73165-A63-C200-3

Battery

Lithium battery 3 V/1 Ah, type CR 1/2 AA	Order No.
VARTA	6127 101 501

Interface Cable

Interface cable between PC or SIPROTEC device	Order No.
Cable with 9-pin male/female connections	7XV5100-4

Operating Software DIGSI® 4

DIGSI® protection operation and configuration software 4	Order No.
DIGSI® 4, basic version with licenses for 10 PCs	7XS5400-0AA00
DIGSI® 4, complete version with all option packages	7XS5402-0AA0

Display Editor

Software for creating basic and power system control pictures (option package of the complete version of DIGSI® 4)	Order No.
Display Editor 4; Full version with license for 10 PCs	7XS5420-0AA0

Graphic Tools

Graphic Tools 4	Order No.
Full version with license for 10 PCs	7XS5430-0AA0

DIGSI REMOTE 4

Software for remotely operating protective devices via a modem (and possibly a star connector) using DIGSI® 4 (option package of the complete version of DIGSI® 4)	Order No.
DIGSI REMOTE 4; Full version with license for 10 PCs; Language: German	7XS5440-1AA0

SIMATIC CFC 4

Graphical software for setting interlocking (latching) control conditions and creating additional functions (option package of the complete version of DIGSI® 4)	Order No.
SIMATIC CFC 4; Full version with license for 10 PCs	7XS5450-0AA0

A.2 Terminal Assignments

A.2.1 Panel Flush and Cubicle Mounting

6MD631*-*D/E

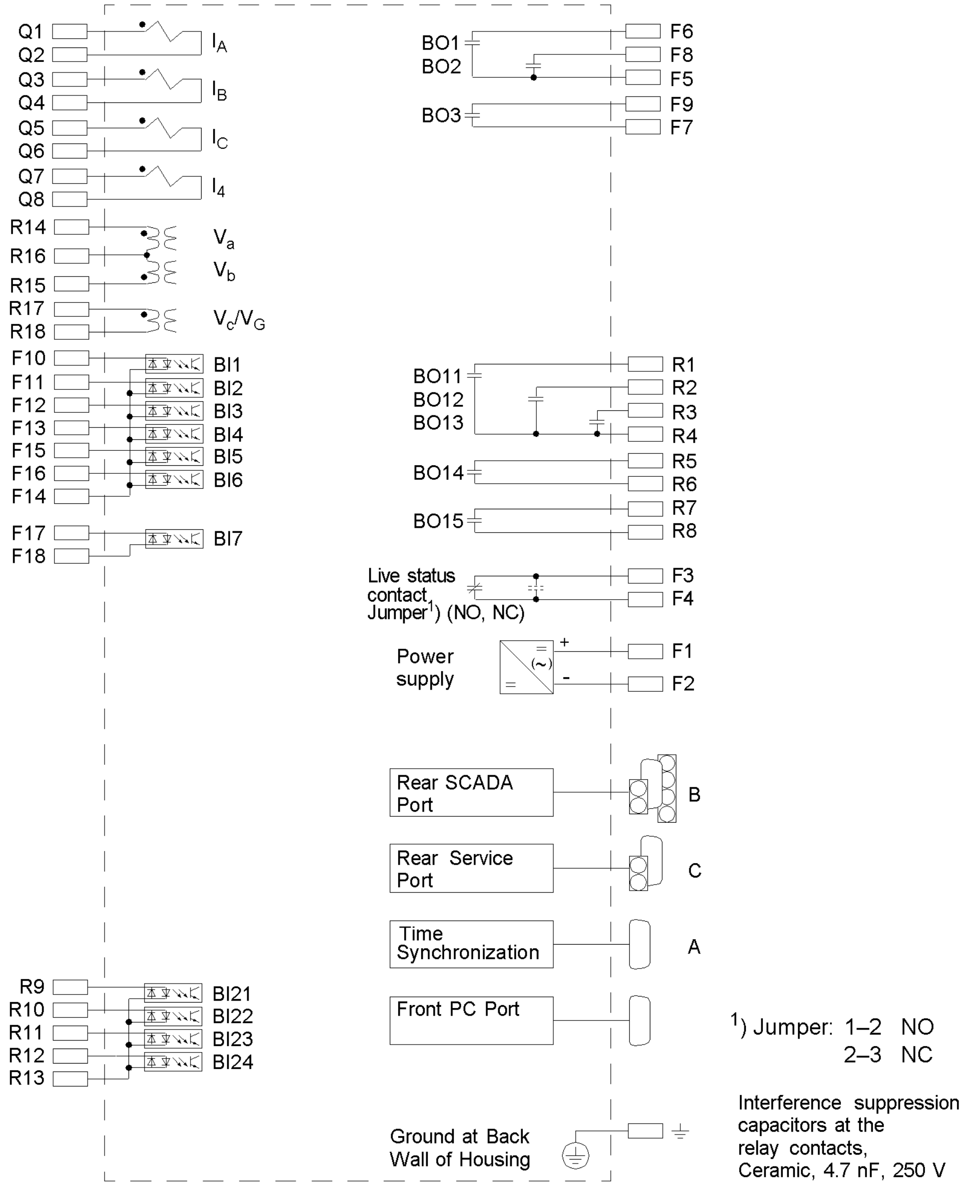


Figure A-1 Connection diagram for 6MD631*-*D/E (panel flush mounting)

6MD632*-*D/E

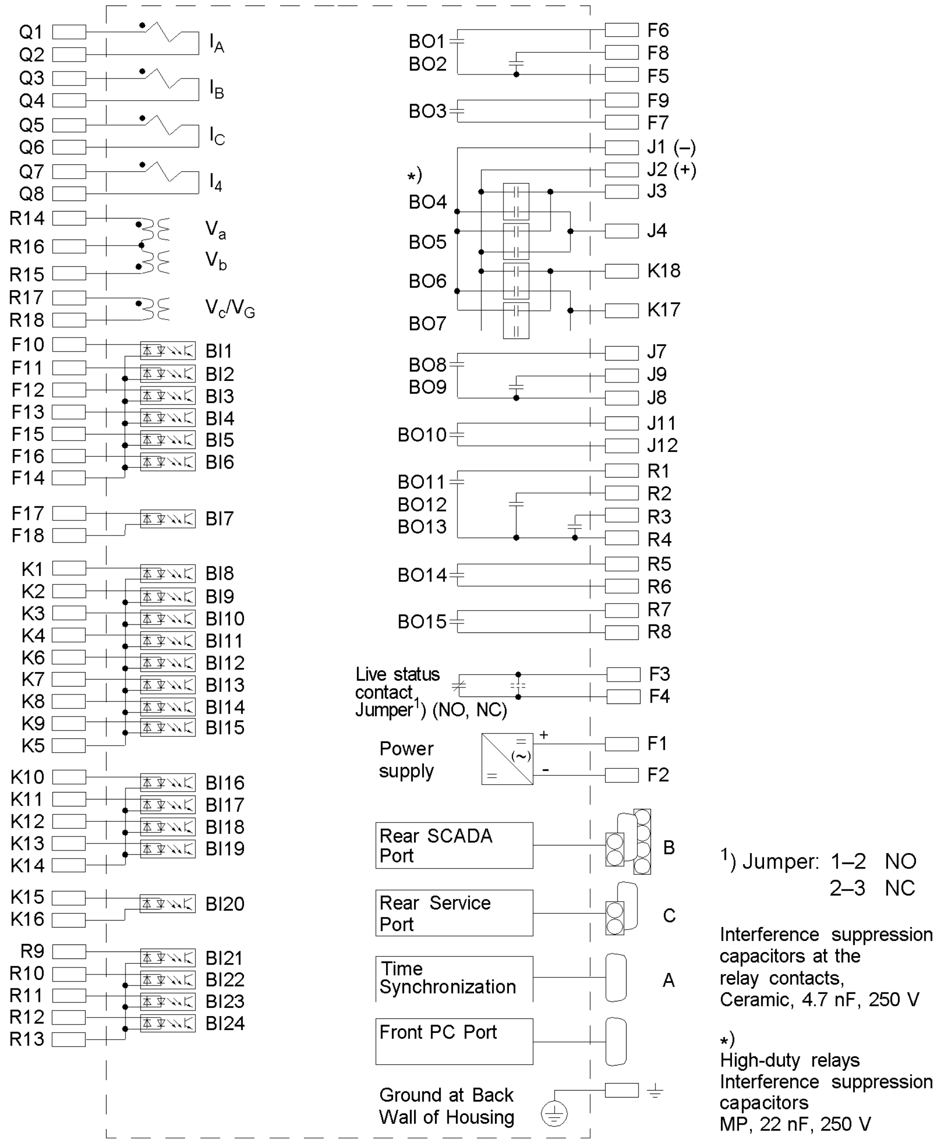


Figure A-2 Connection diagram for 6MD632*-*D/E (panel flush mounting or cubicle mounting)

6MD633*-*D/E

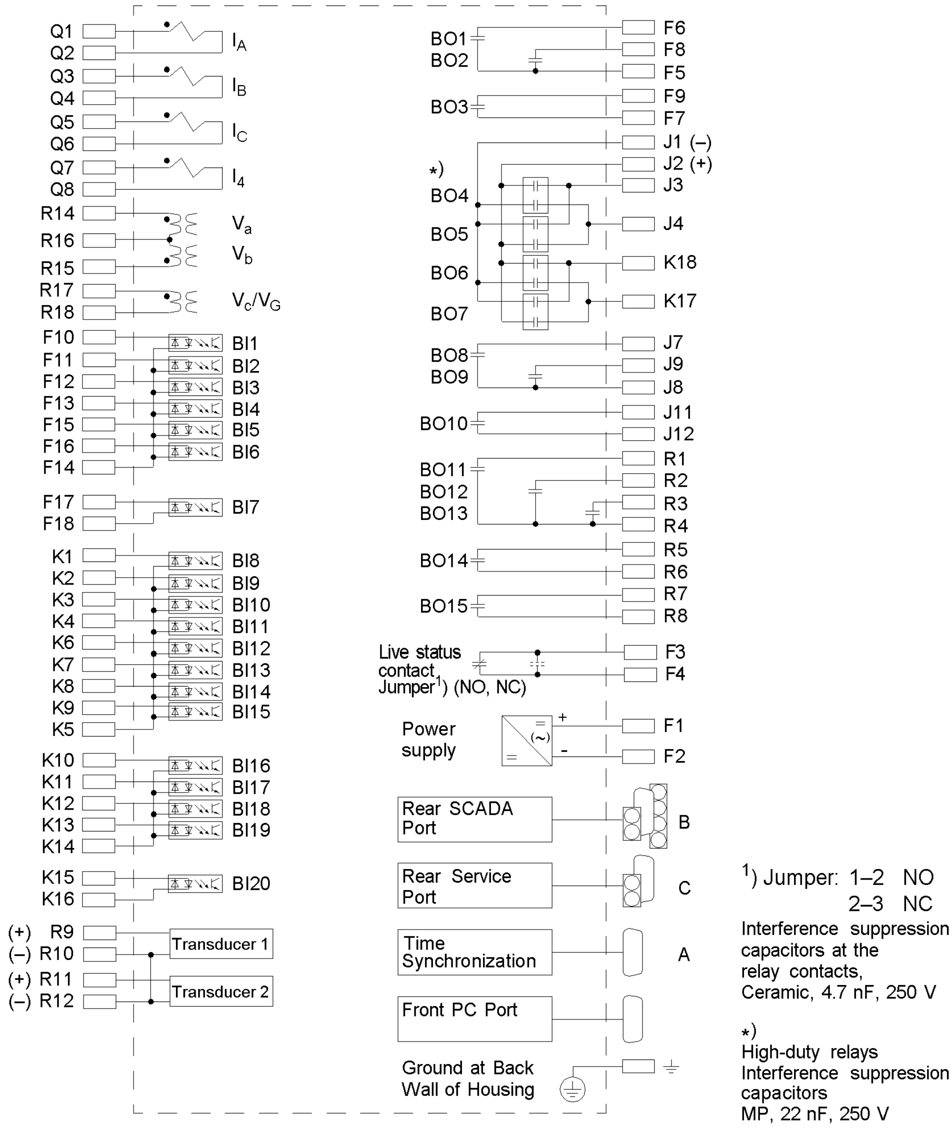


Figure A-3 Connection diagram for 6MD633*-*D/E (panel flush mounting or cubicle mounting)

6MD634*-*D/E

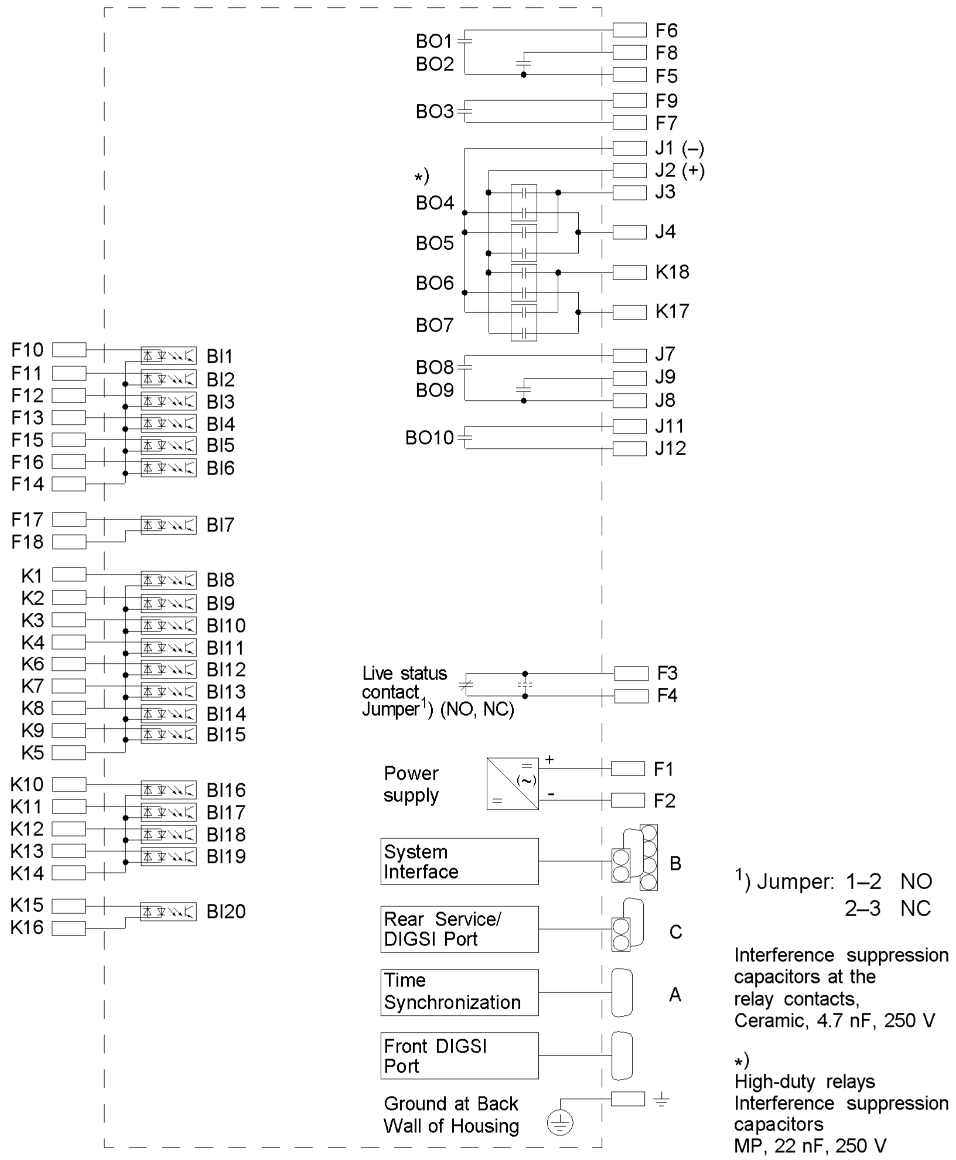


Figure A-4 Connection diagram for 6MD634*-*D/E (panel flush mounting or cubicle mounting)

6MD635*-*D/E

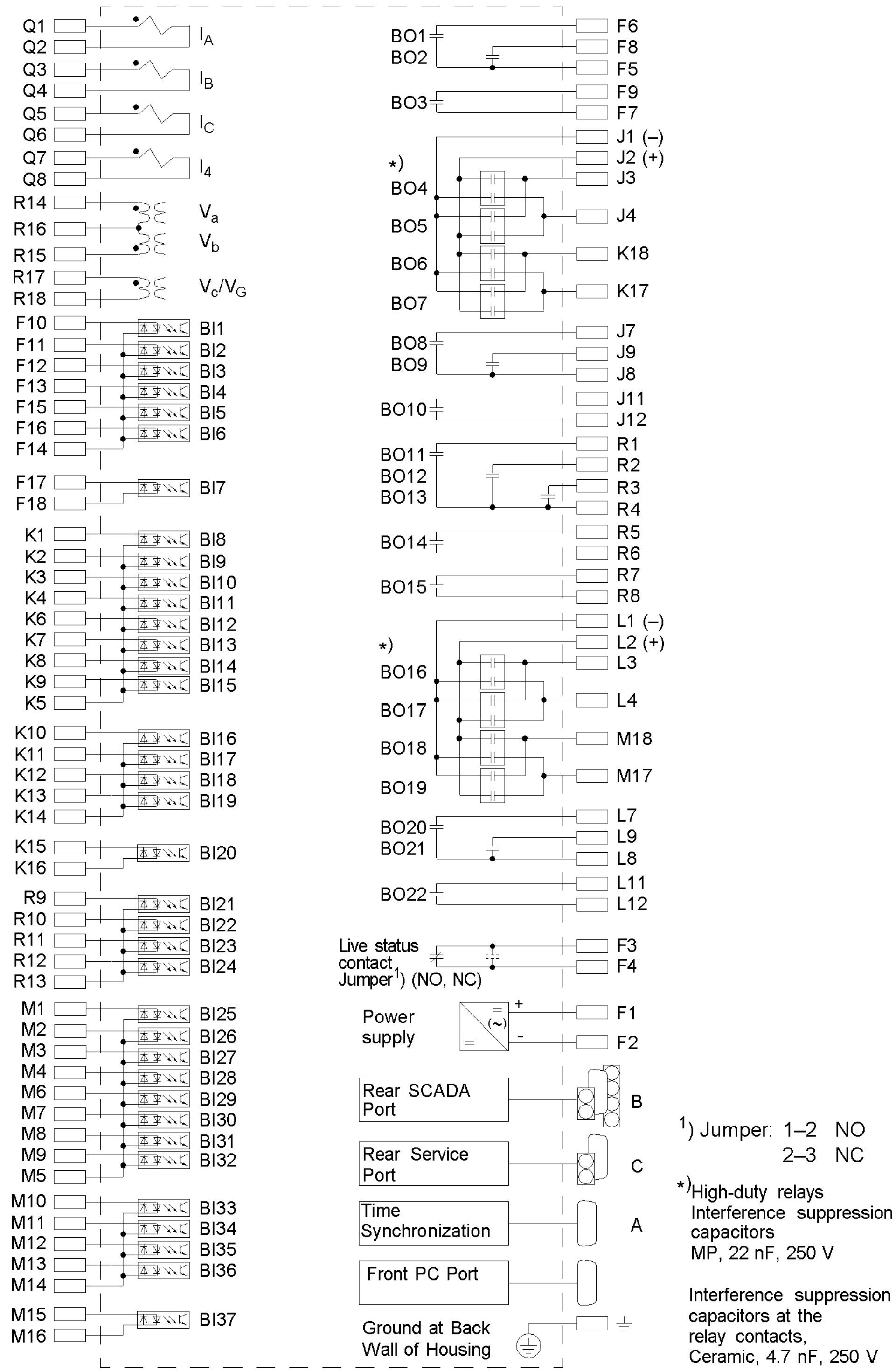


Figure A-5 Connection diagram for 6MD635*-*D/E (panel flush mounting or cubicle mounting)

6MD636*-*D/E

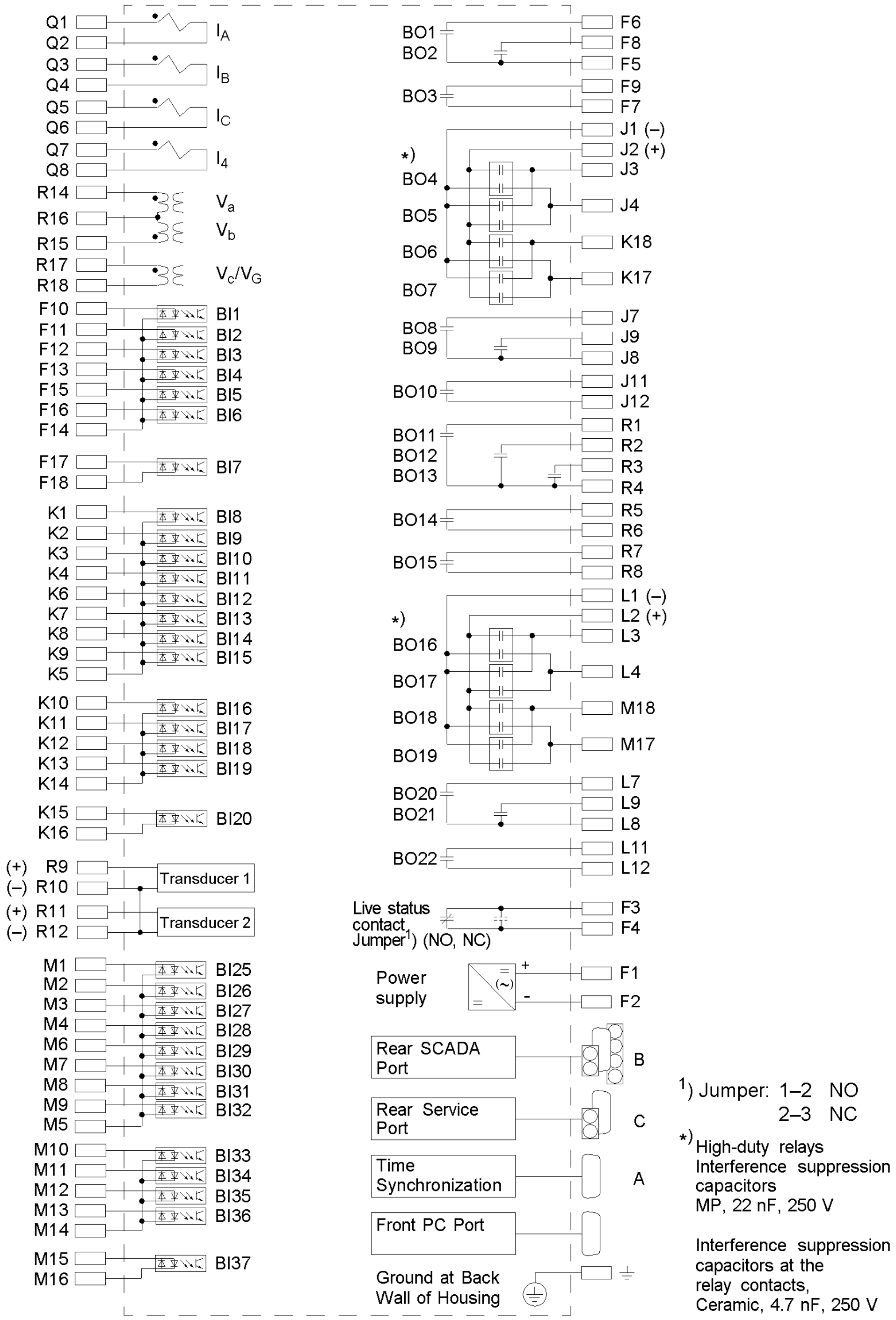


Figure A-6 Connection diagram for 6MD636*-*D/E (panel flush mounting or cubicle mounting)

6MD637*-*D/E

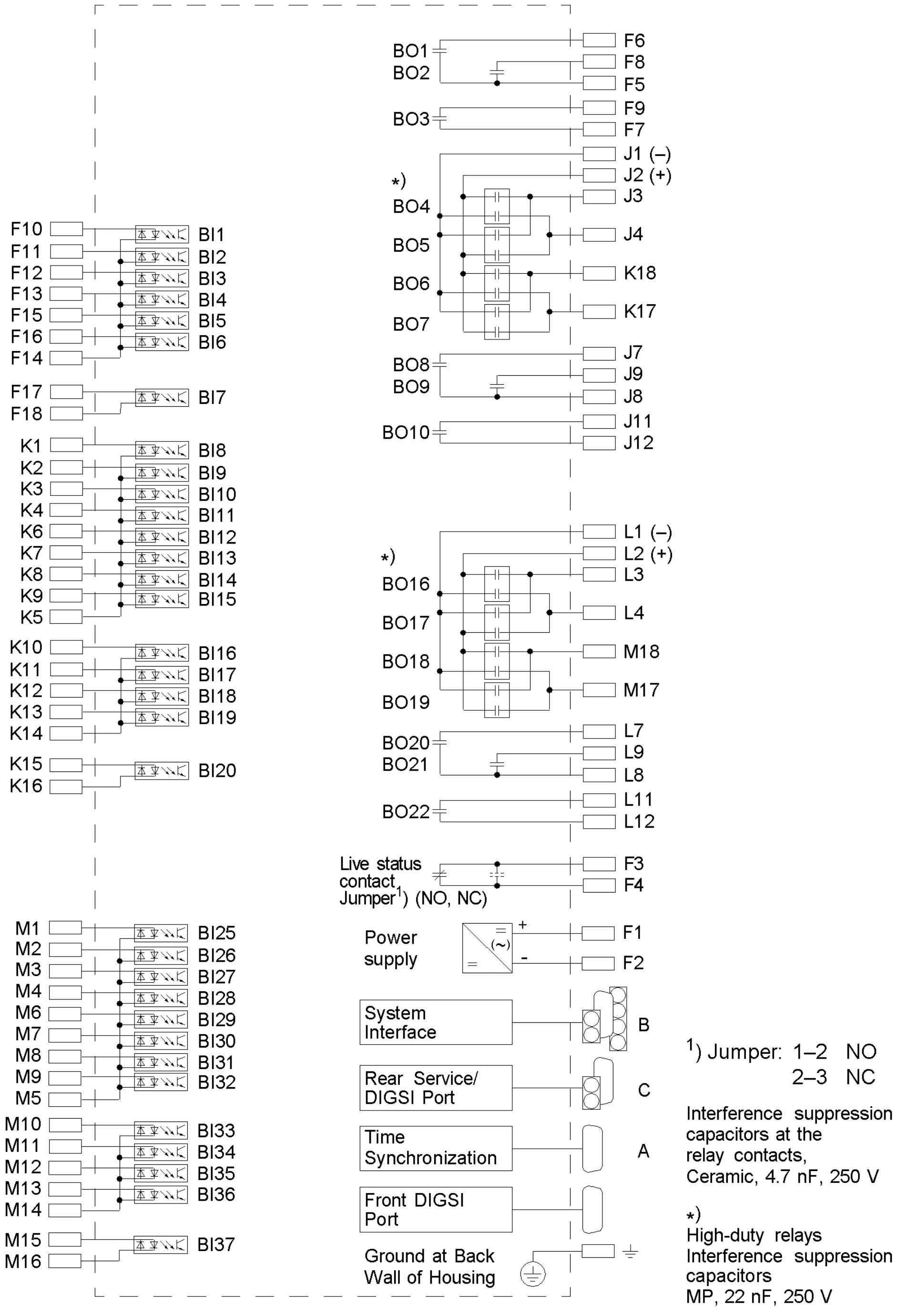


Figure A-7 Connection diagram for 6MD637*-*D/E (panel flush mounting or cubicle mounting)

A.2.2 Panel Surface Mounting

6MD631*-*B

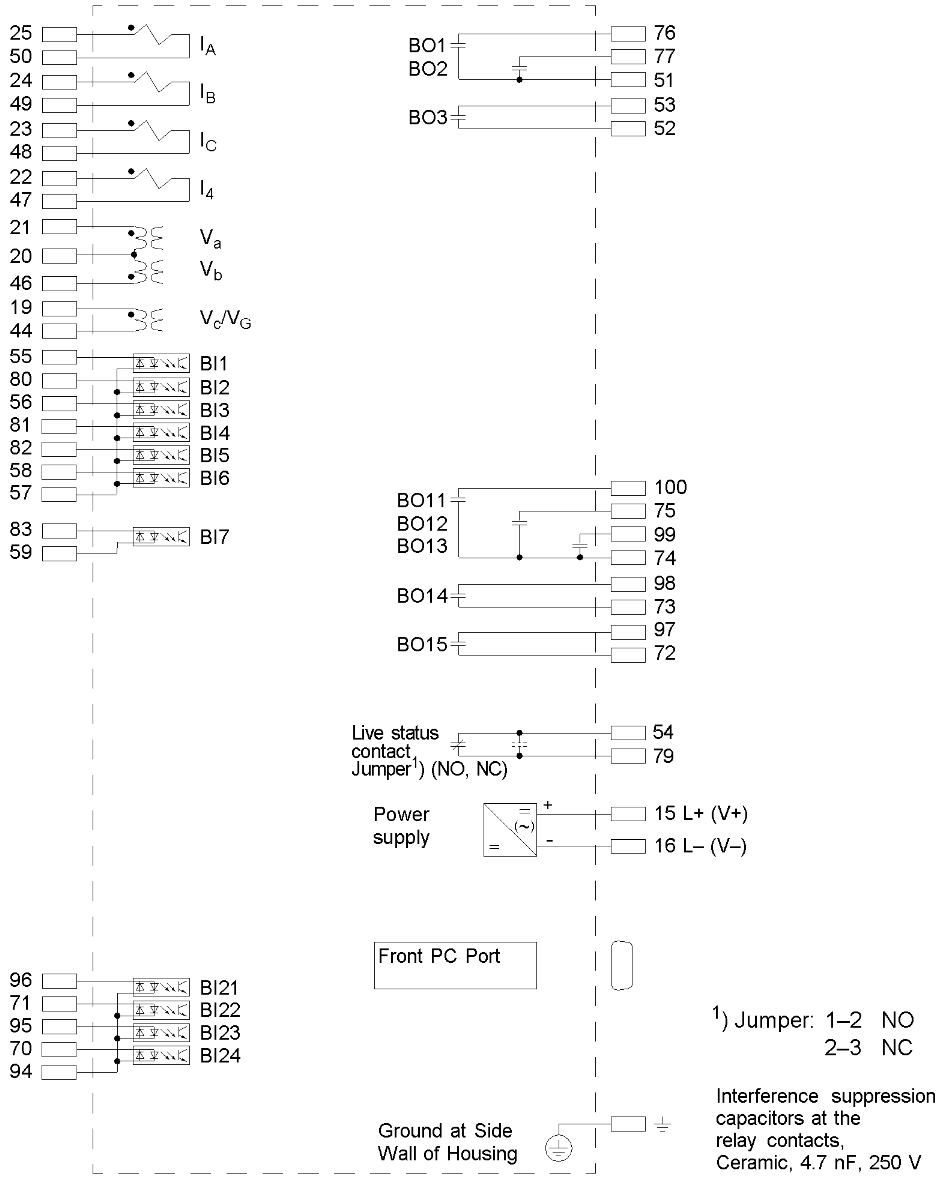


Figure A-8 Connection diagram for 6MD631*-*B (panel surface mounting)

6MD632*-*B

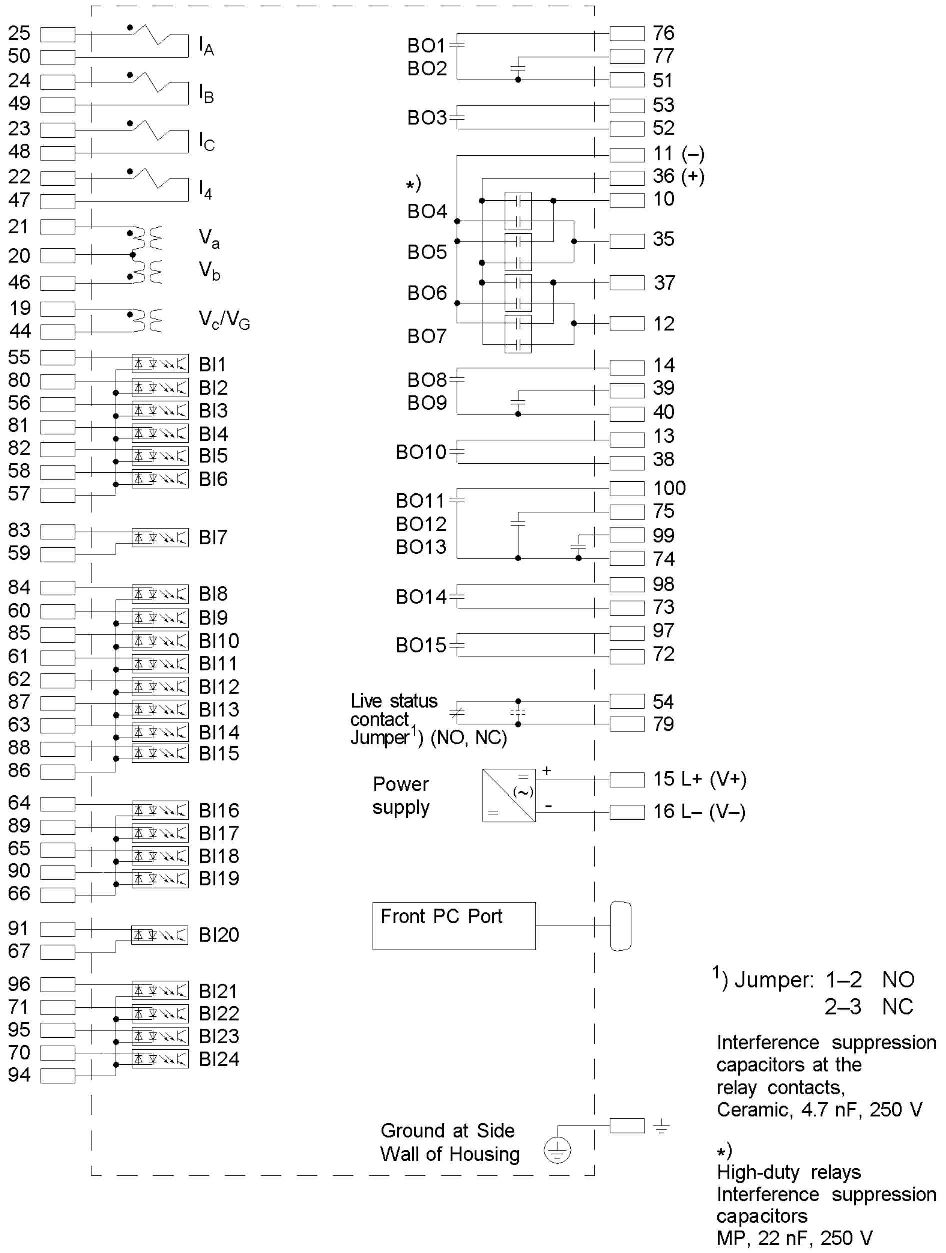


Figure A-9 Connection diagram for 6MD632*-*B (panel surface mounting)

6MD633*-*B

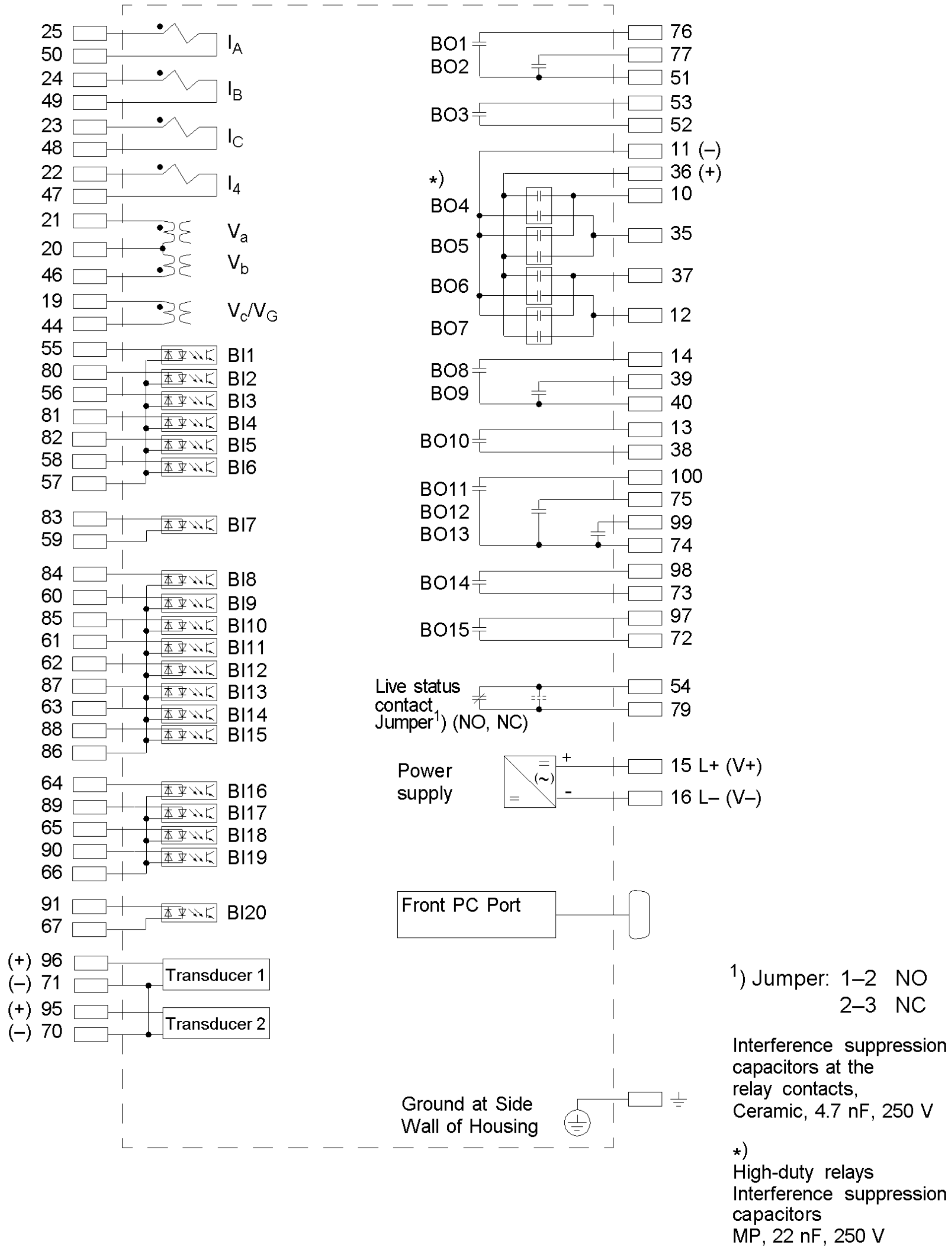


Figure A-10 Connection diagram for 6MD633*-*B (panel surface mounting)

6MD634*-*B

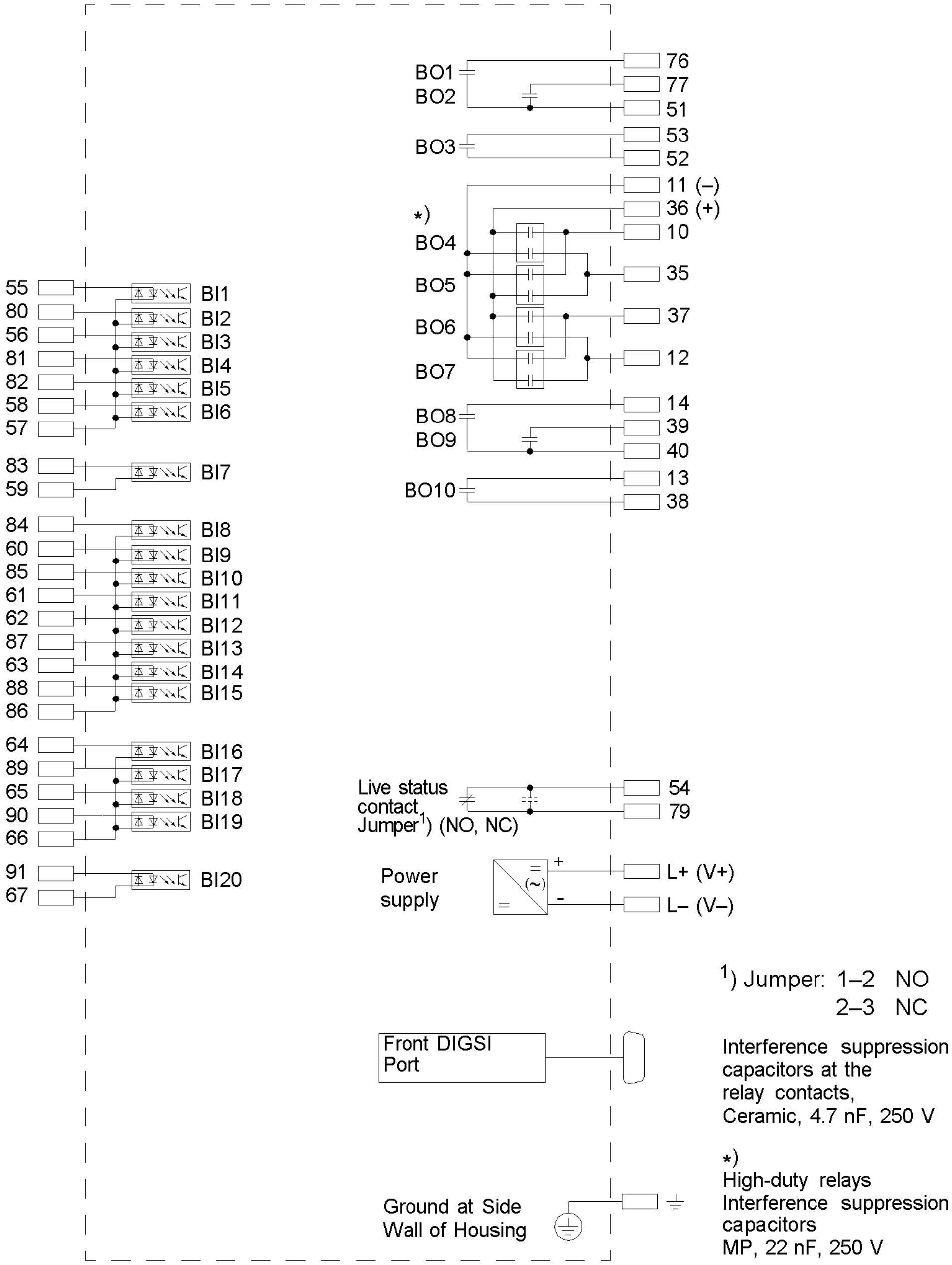


Figure A-11 Connection diagram for 6MD634*-*B (panel surface mounting)

6MD637*-*B

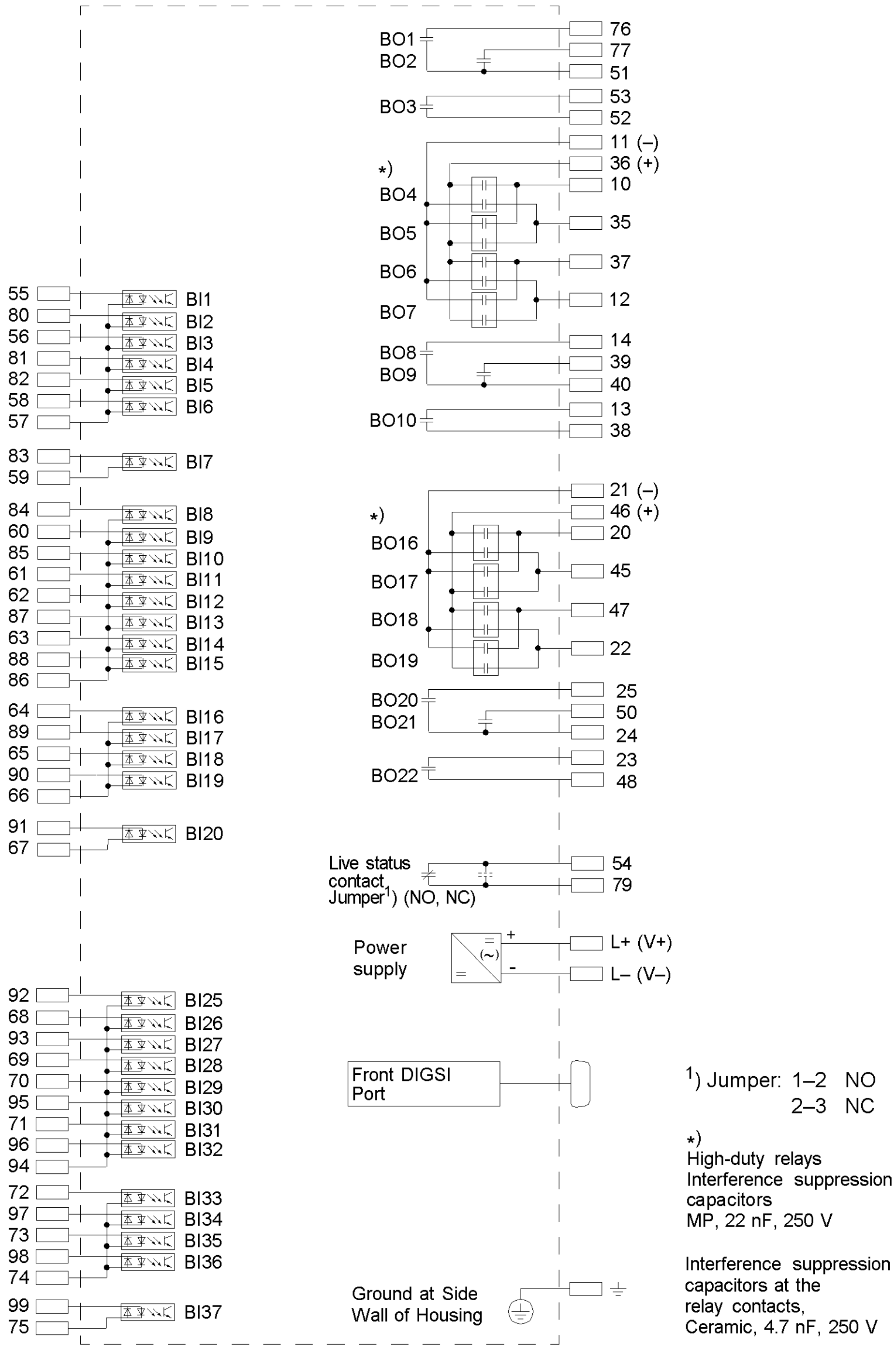


Figure A-12 Connection diagram for 6MD637*-*B (panel surface mounting)

6MD631/2/3/4/7*-*B (up to release .../CC)

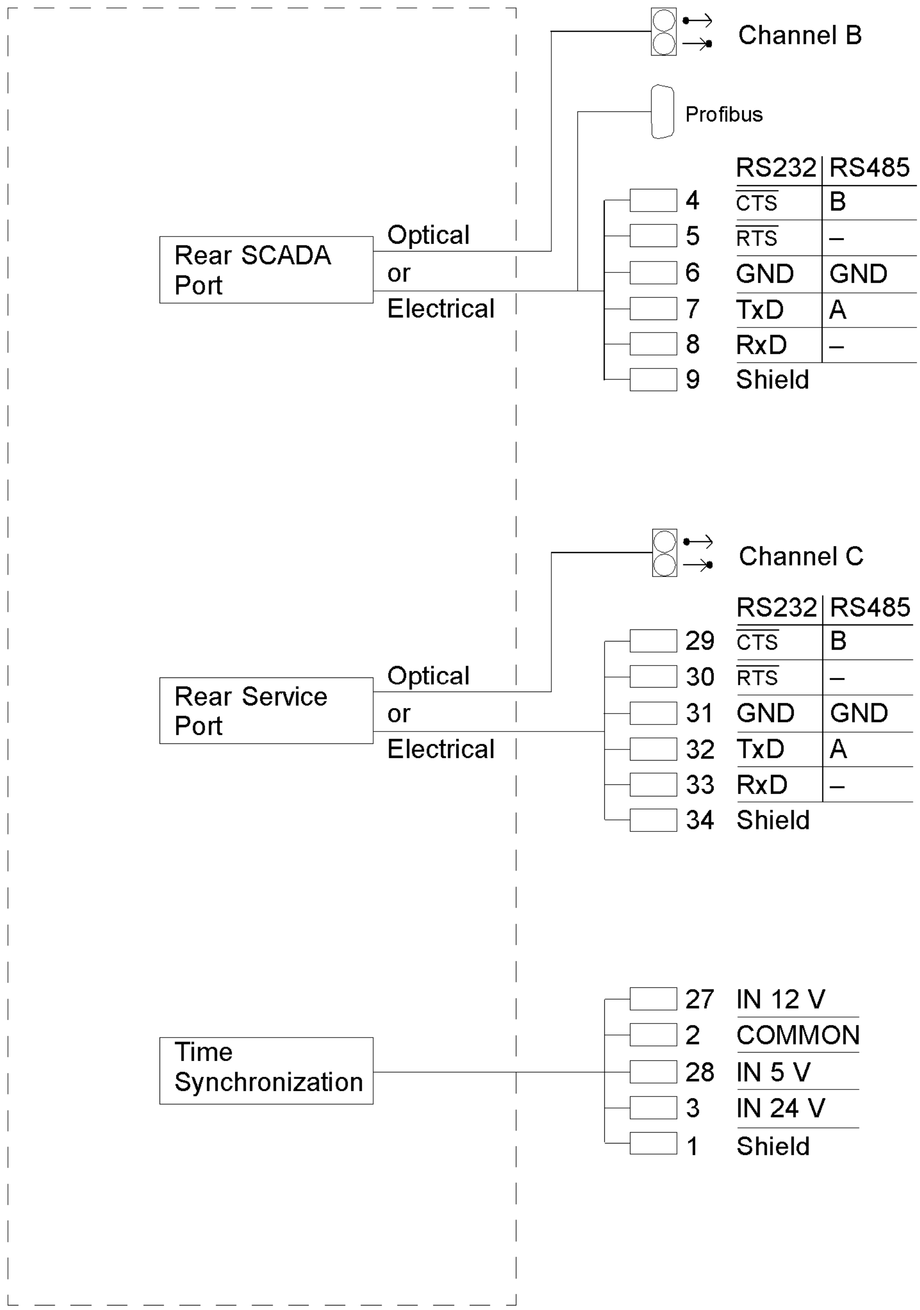


Figure A-13 Connection diagram 6MD631/2/3/4/7*-*B up to release .../CC (panel surface mounting)

6MD631/2/3/4/7*-*B (release .../DD and higher)

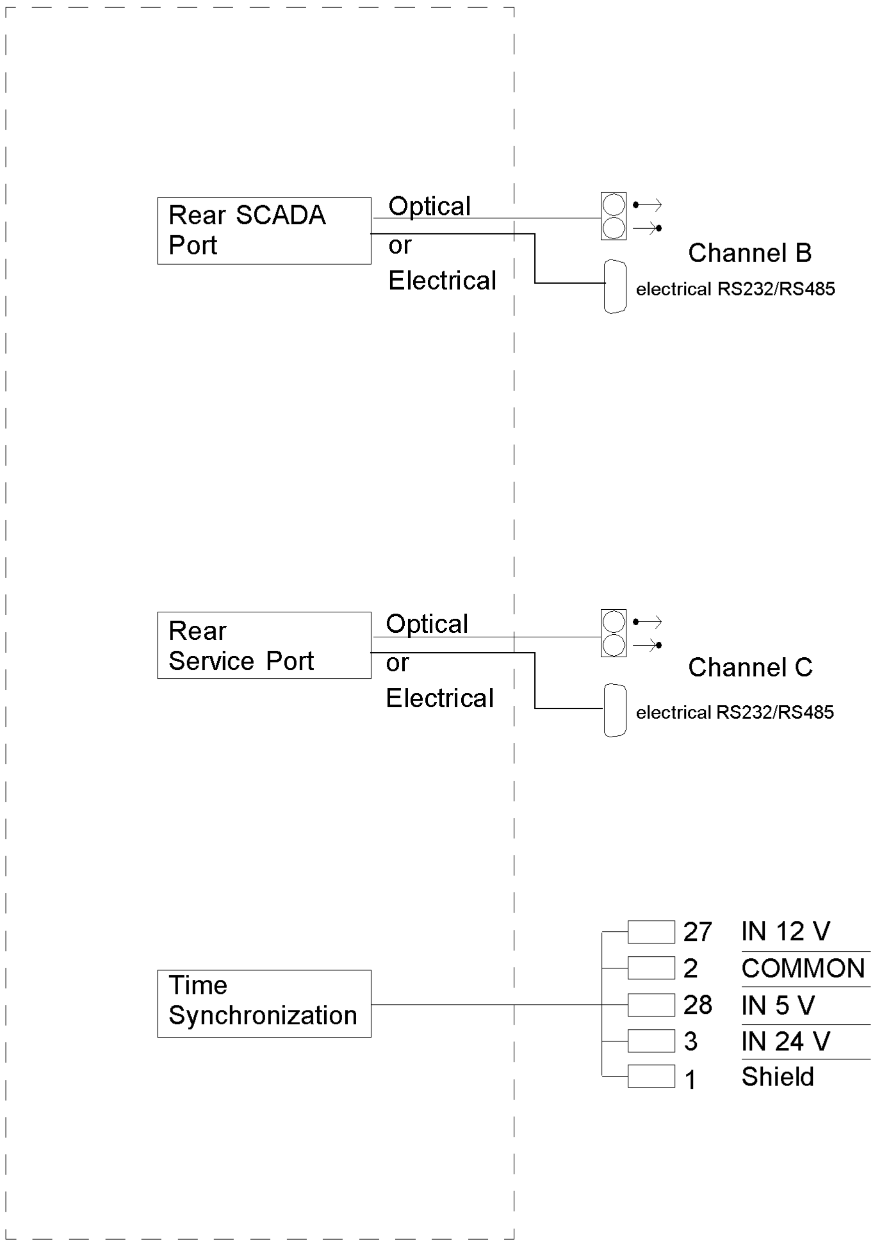


Figure A-14 Connection diagram for 6MD631/2/3/4/7*-*B up to release .../DD (panel surface mounting)

6MD635*-*B

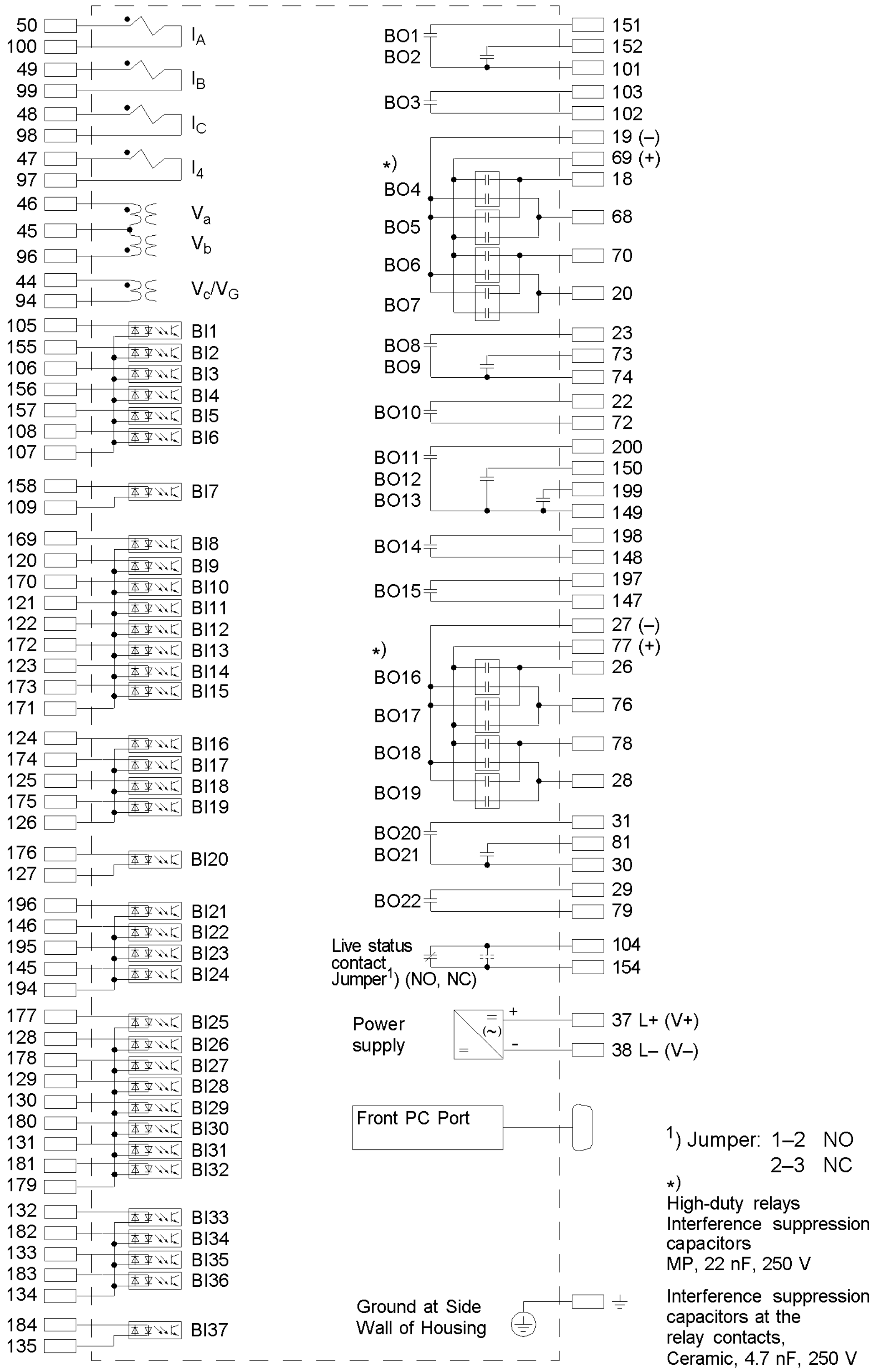


Figure A-15 Connection diagram for 6MD635*-*B (panel surface mounting)

6MD636*-*B

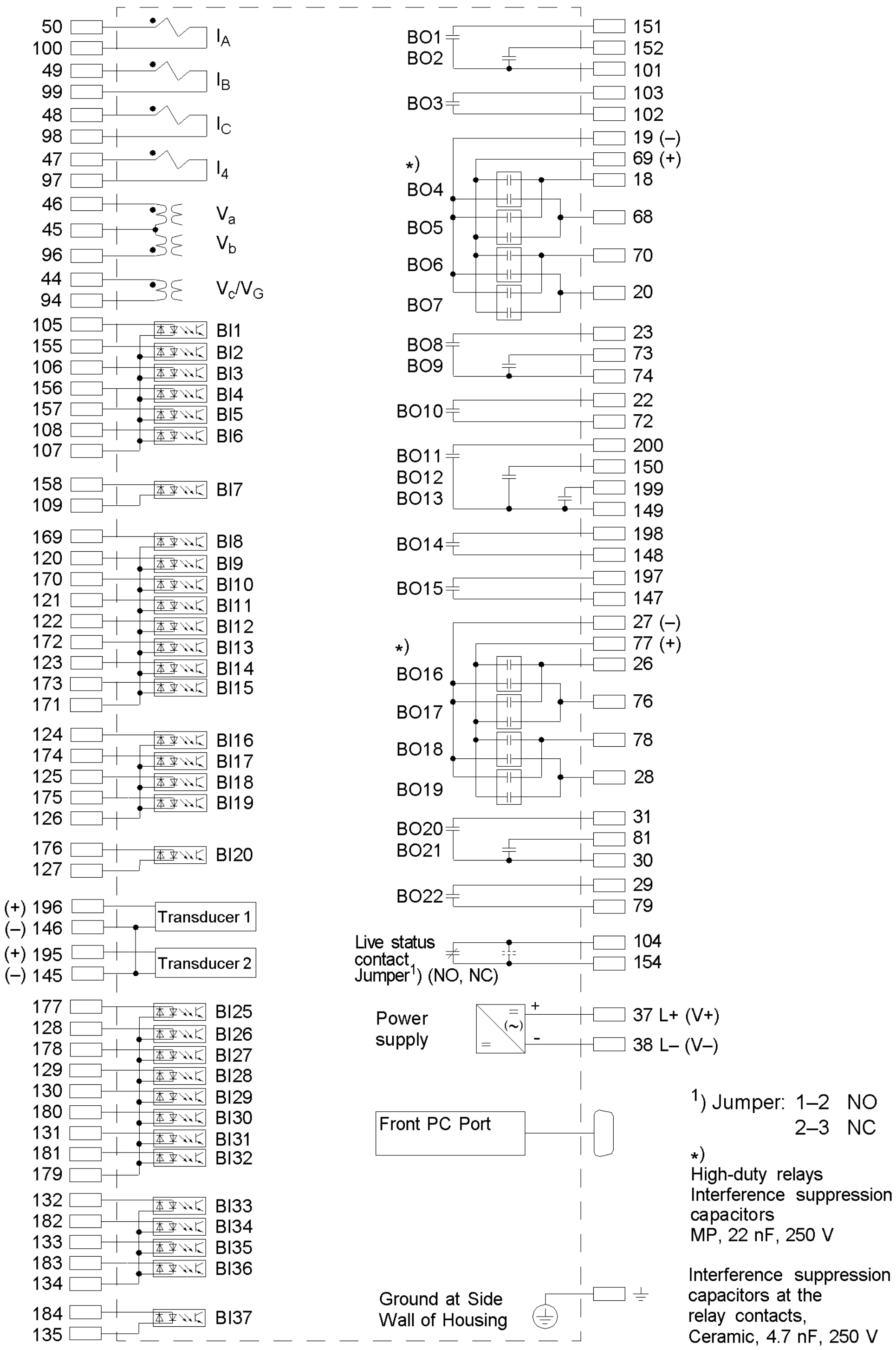


Figure A-16 Connection diagram for 6MD636*-*B (panel surface mounting)

6MD635/6*-*B (up to release .../CC)

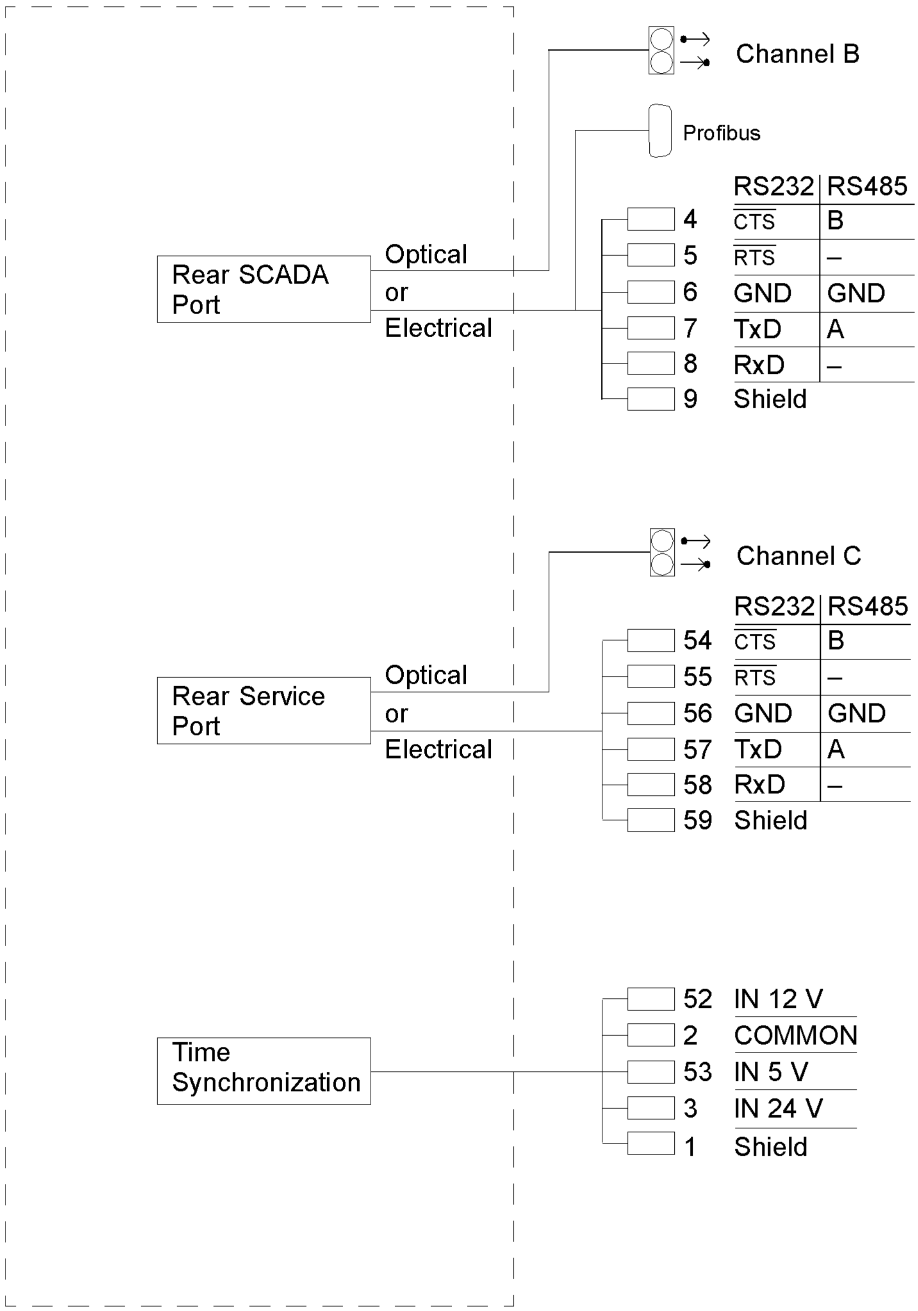


Figure A-17 Connection diagram for 6MD635/6*-*B up to release .../CC (panel surface mounting)

6MD635/6*-*B (release .../DD and higher)

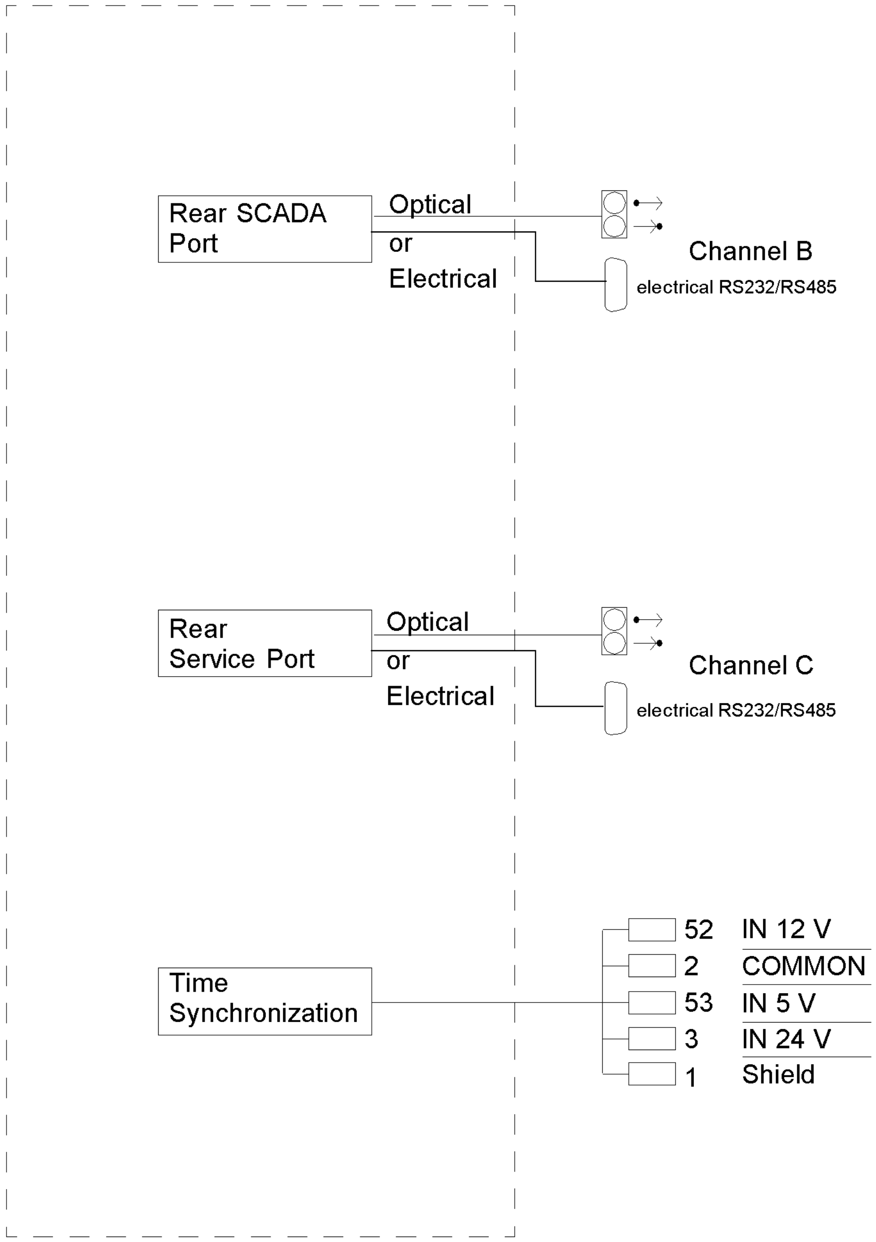


Figure A-18 Connection diagram for 6MD635/6*-*B up to release .../DD (panel surface mounting)

A.2.3 Device with Detached Operator Panel

6MD631*-*A/C

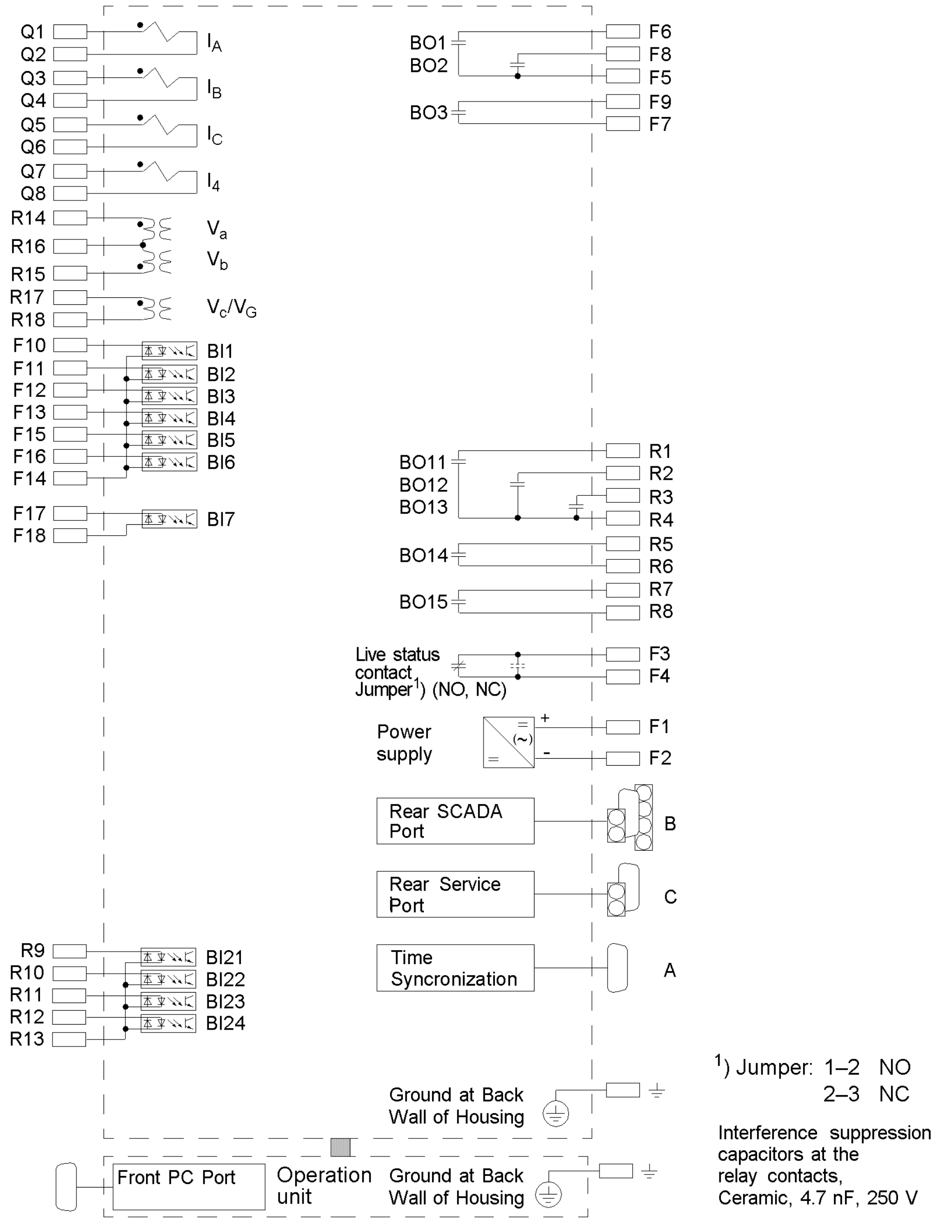


Figure A-19 Connection diagram for 6MD631*-*A/C (panel surface mounting with detached operator panel)

6MD632*-*A/C

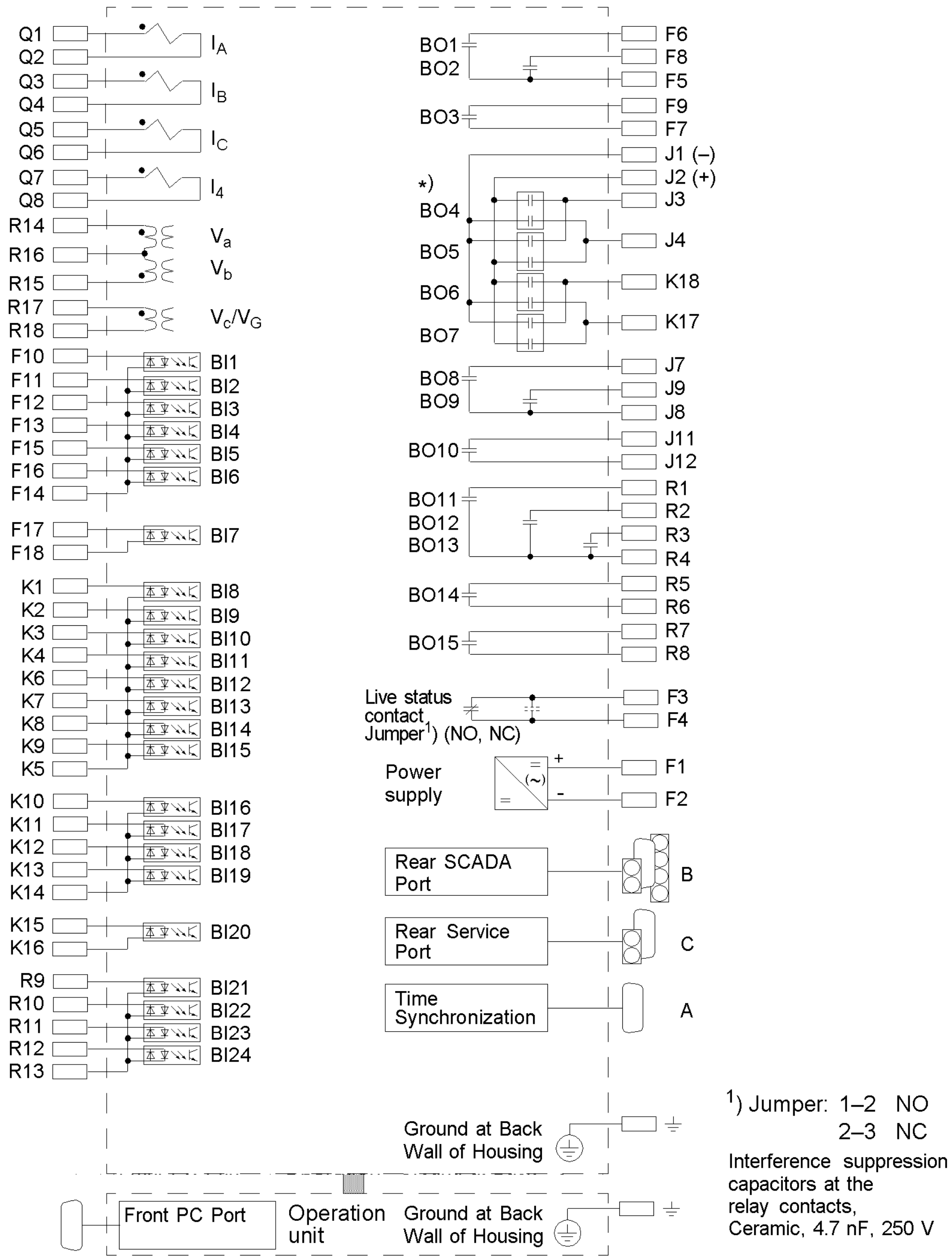


Figure A-20 Connection diagram for 6MD632*-*A/C (panel surface mounting with detached operator panel)

6MD633*-*A/C

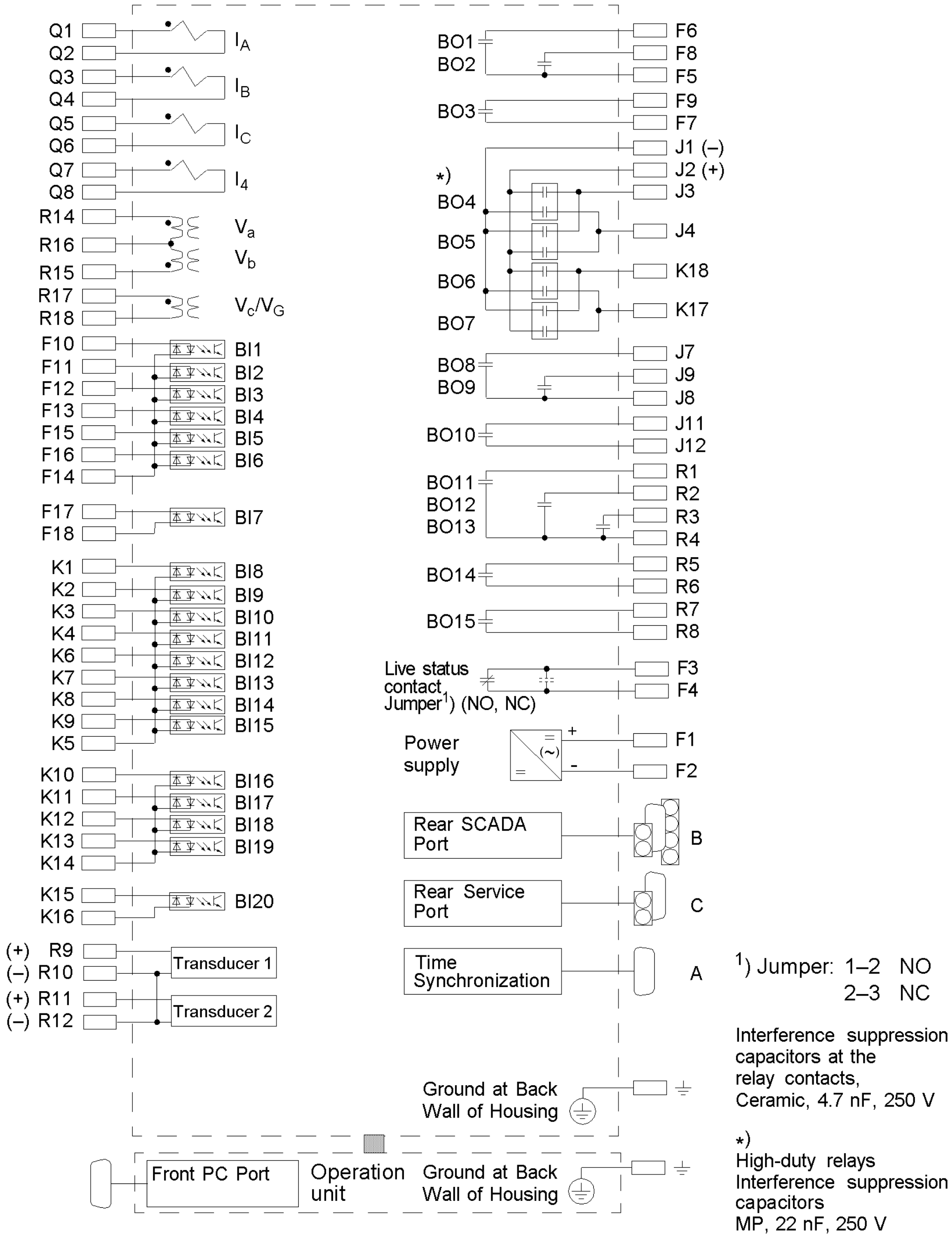


Figure A-21 Connection diagram for 6MD633*-*A/C (panel surface mounting with detached operator panel)

6MD634*-*A/C

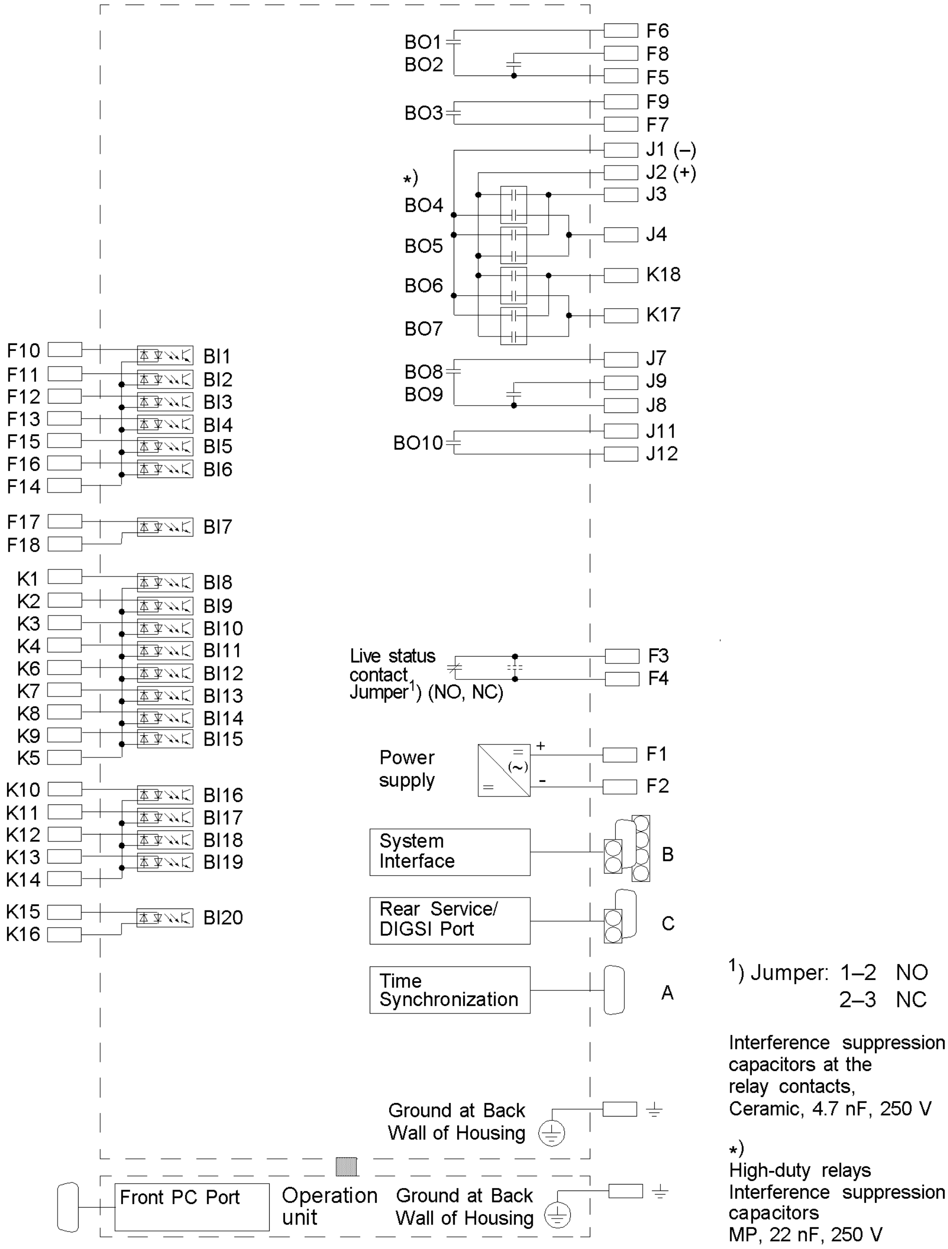


Figure A-22 Connection diagram for 6MD634*-*A/C (panel surface mounting with detached operator panel)

6MD635*-*A/C

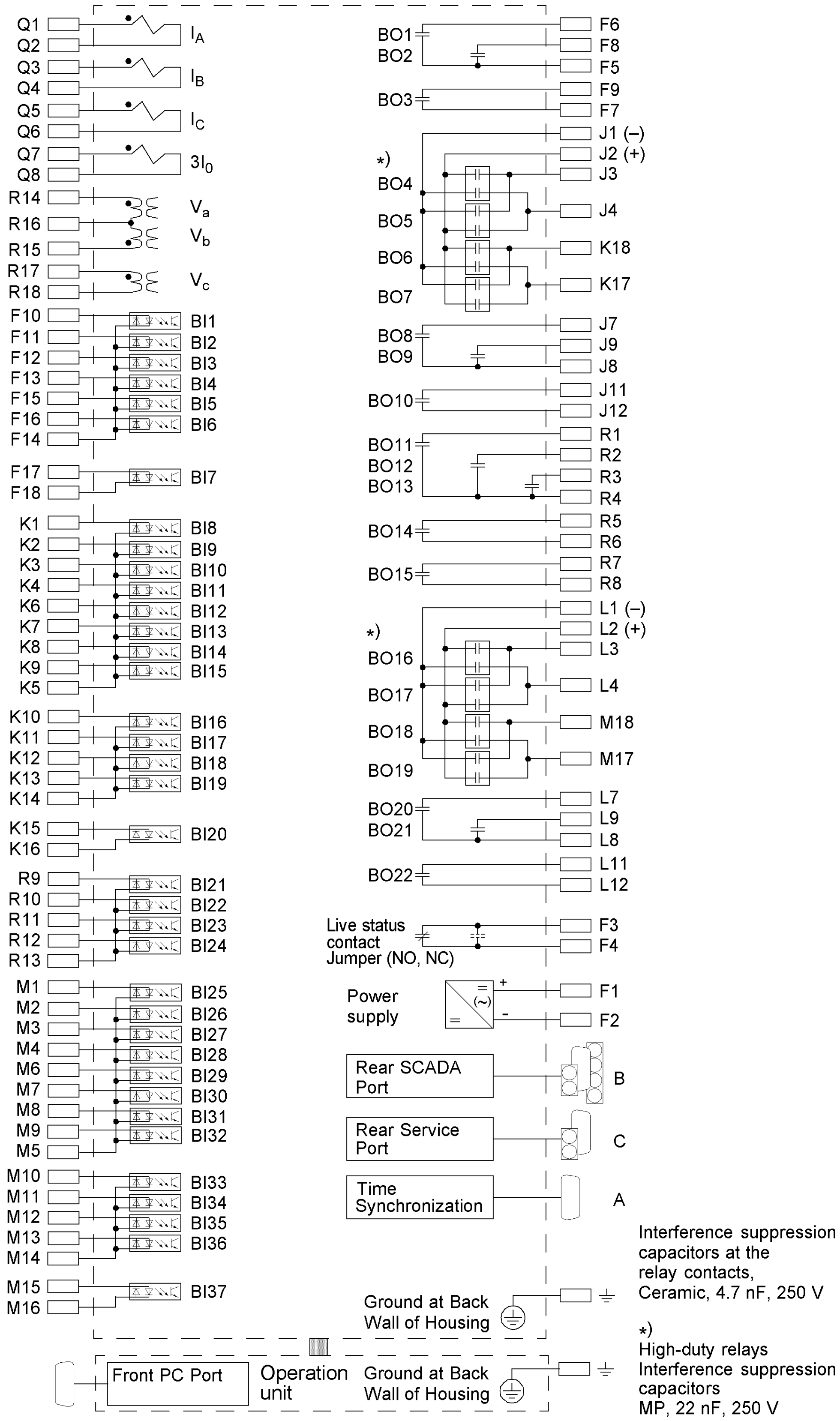


Figure A-23 Connection diagram for 6MD635*-*A/C (panel surface mounting with detached operator panel)

6MD636*-*A/C

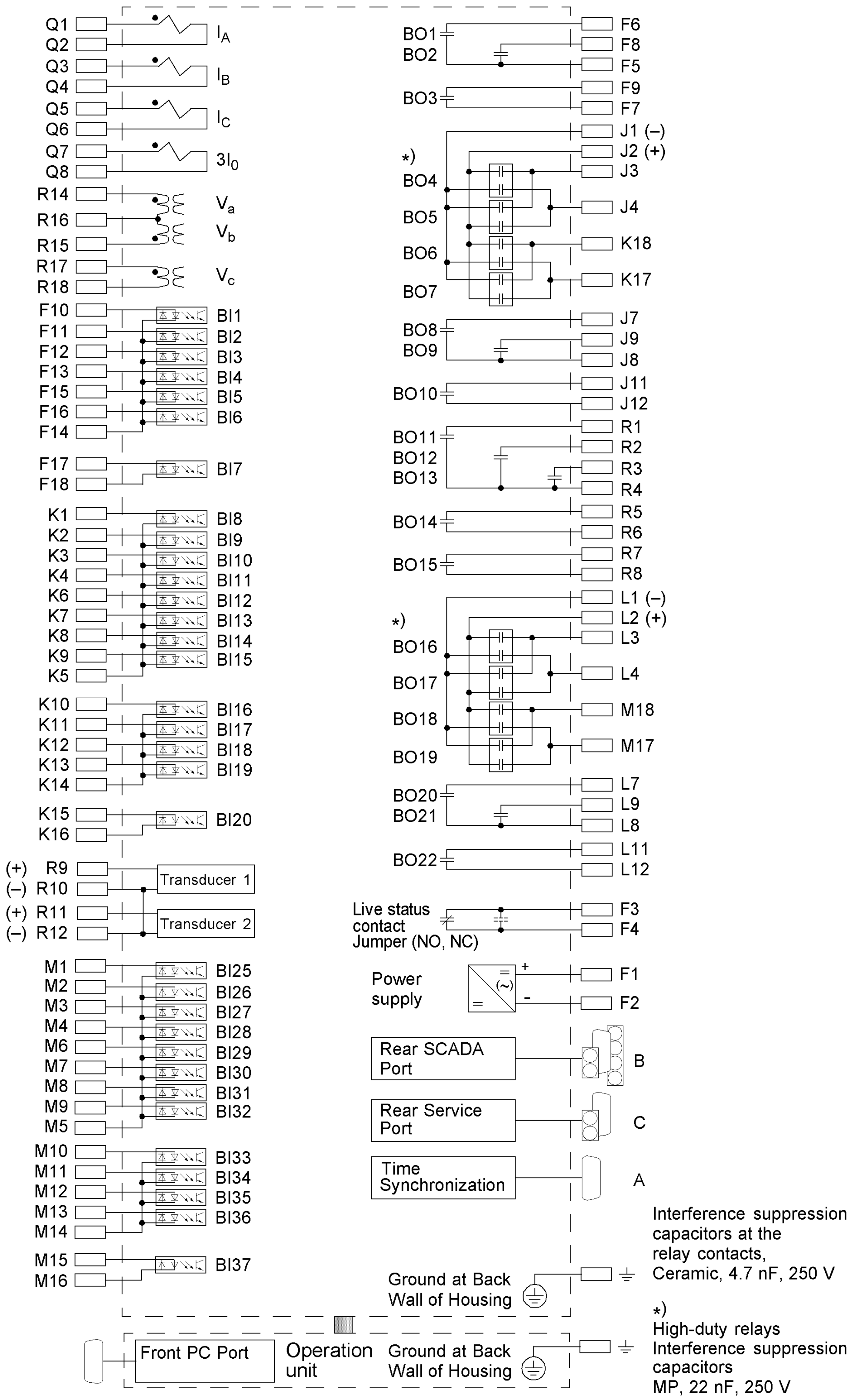
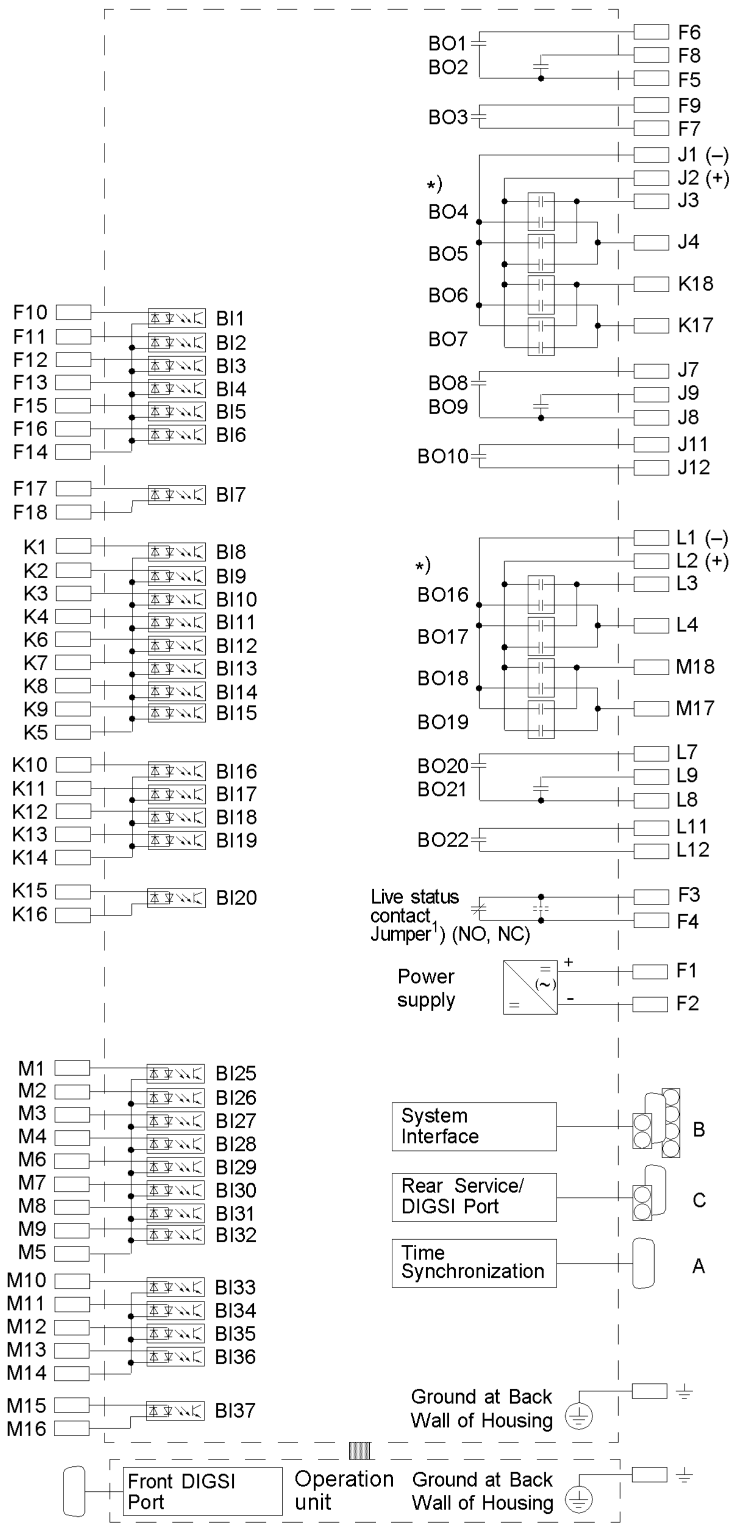


Figure A-24 Connection diagram for 6MD636*-*A/C (panel surface mounting with detached operator panel)

6MD637*-*A/C



[1]) Jumper: 1–2 NO
2–3 NC

Interference suppression capacitors at the relay contacts, Ceramic, 4.7 nF, 250 V

*)
High-duty relays
Interference suppression capacitors
MP, 22 nF, 250 V

Figure A-25 Connection diagram for 6MD637*-*A/C (panel surface mounting with detached operator panel)

A.2.4 Mounting without Operator Panel

6MD631*-*F/G

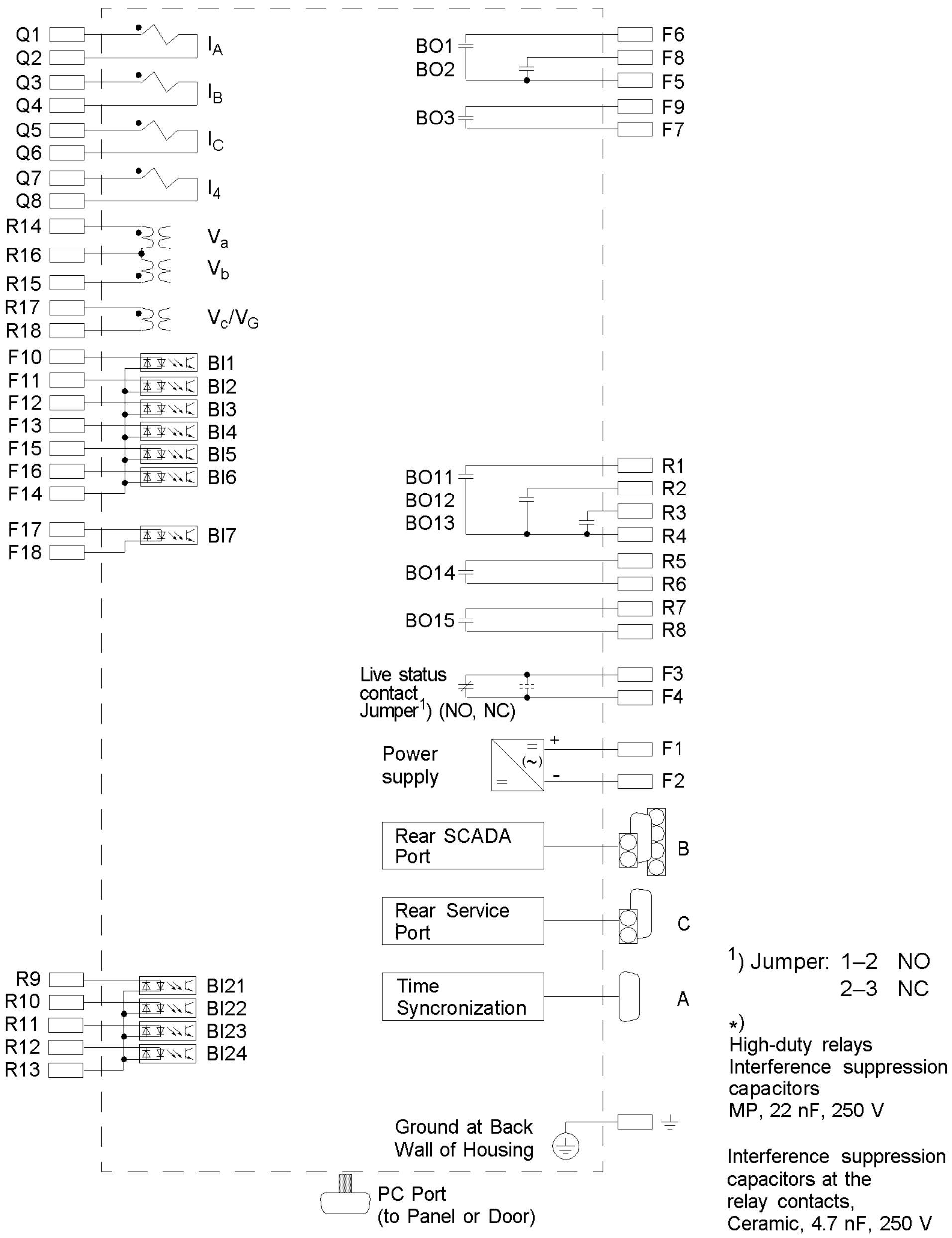


Figure A-26 Connection diagram for 6MD631*-*F/G (devices for panel surface mounting without operator panel)

6MD632*-*F/G

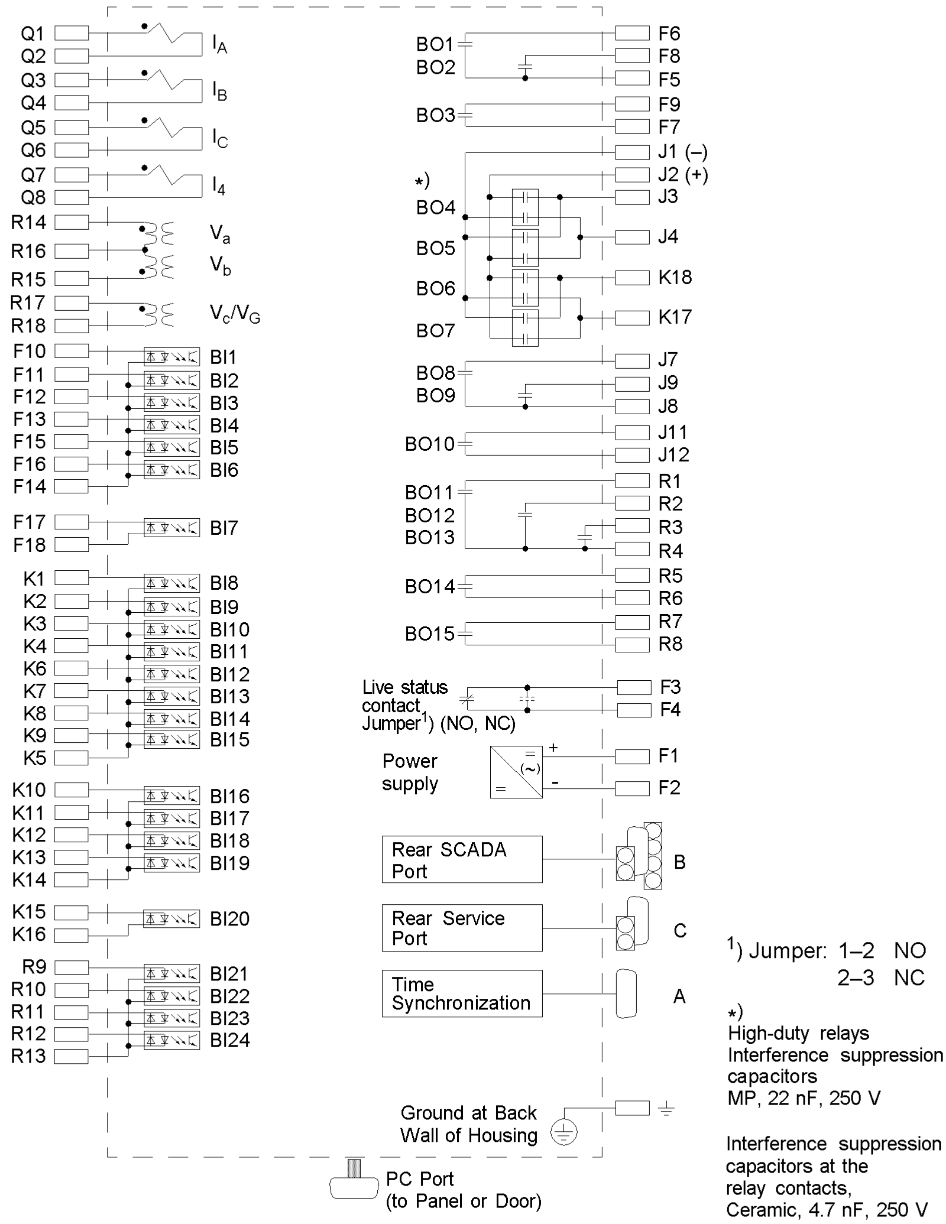


Figure A-27 Connection diagram for 6MD632*-*F/G (devices for panel surface mounting without operator panel)

6MD633*-*F/G

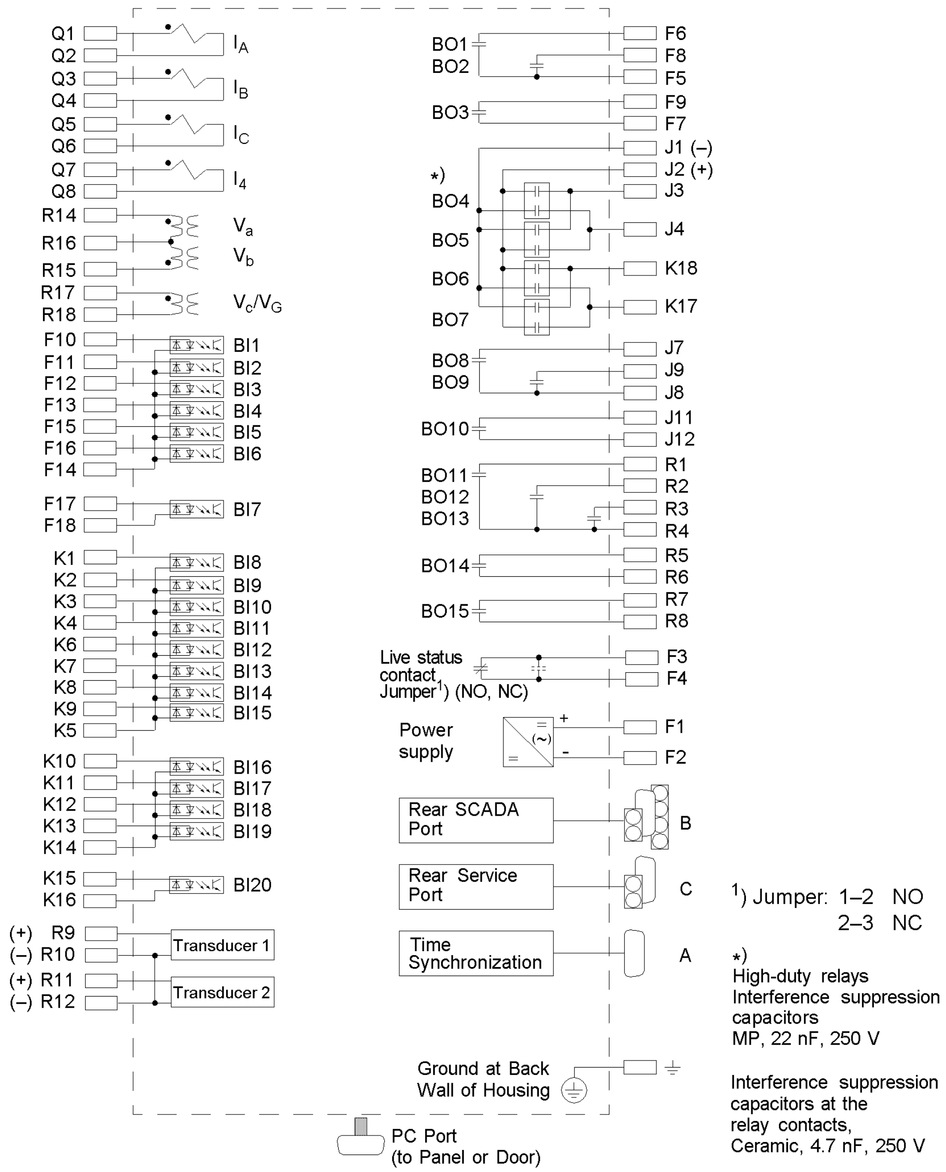


Figure A-28 Connection diagram for 6MD633*-*F/G (devices for panel surface mounting without operator panel)

6MD634*-*F/G

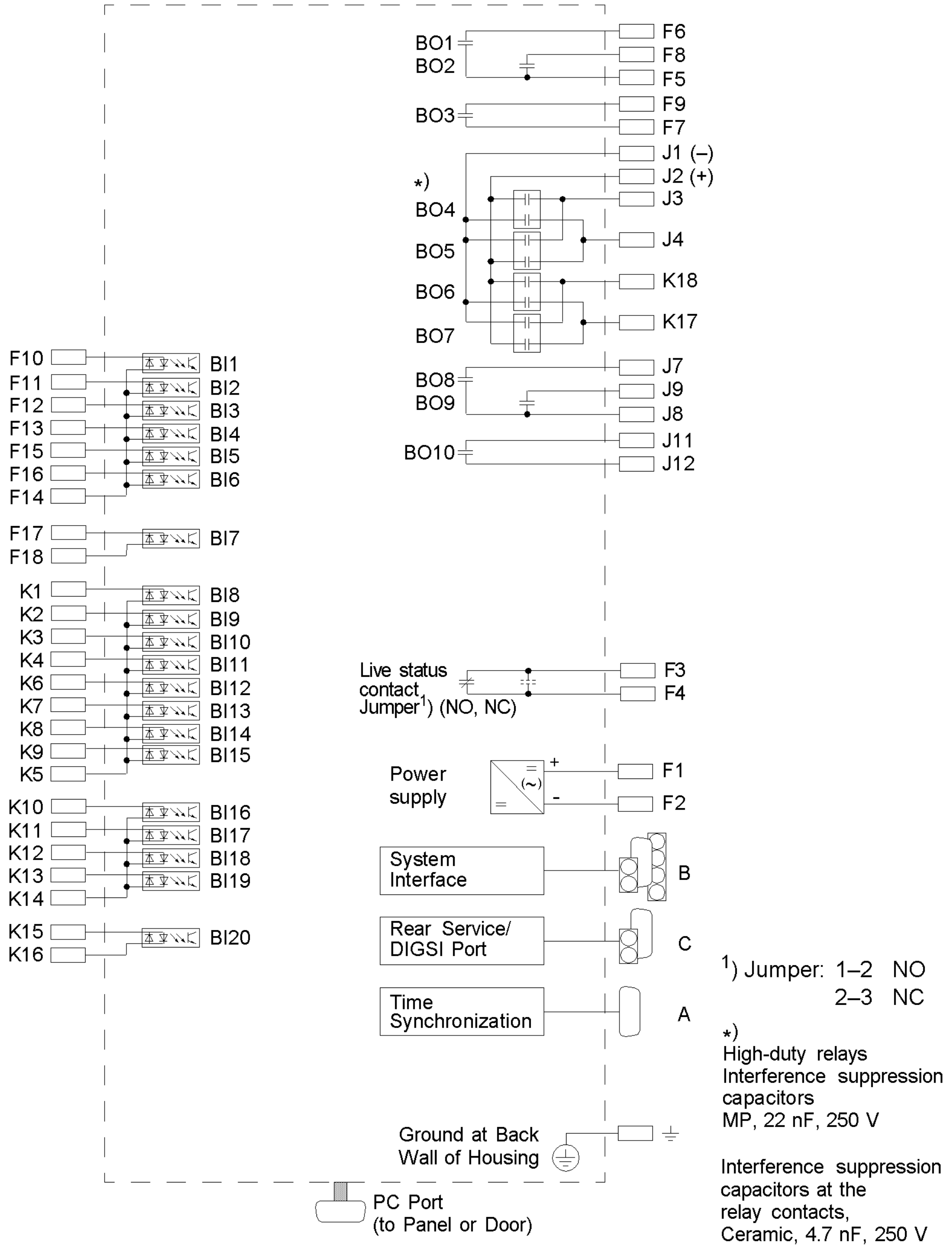
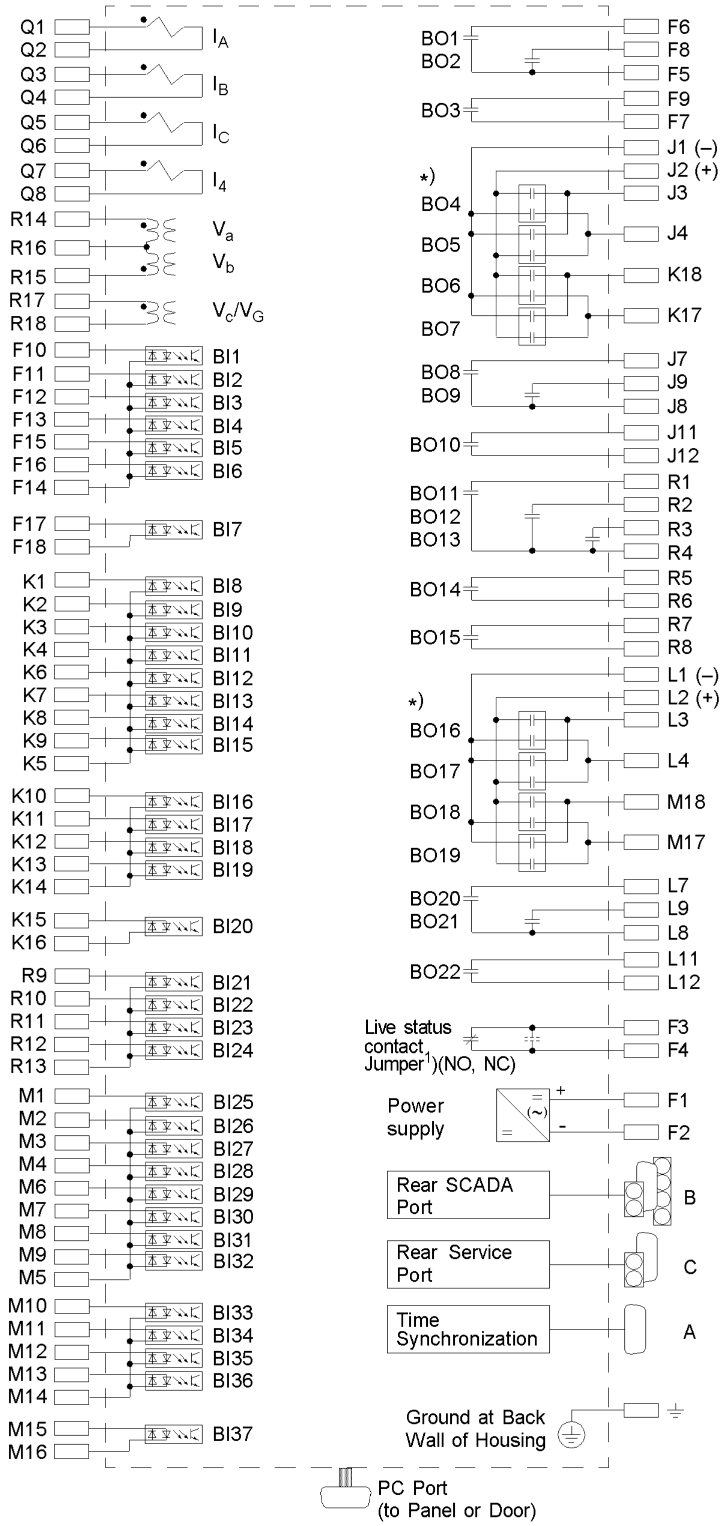


Figure A-29 Connection diagram for 6MD634*-*F/G (devices for panel surface mounting without operator panel)

6MD635*-*F/G



1) Jumper: 1–2 NO
2–3 NC

*)
High-duty relays
Interference suppression capacitors
MP, 22 nF, 250 V

Interference suppression capacitors at the relay contacts,
Ceramic, 4.7 nF, 250 V

Figure A-30 Connection diagram for 6MD635*-*F/G (devices for panel surface mounting without operator panel)

6MD636*-*F/G

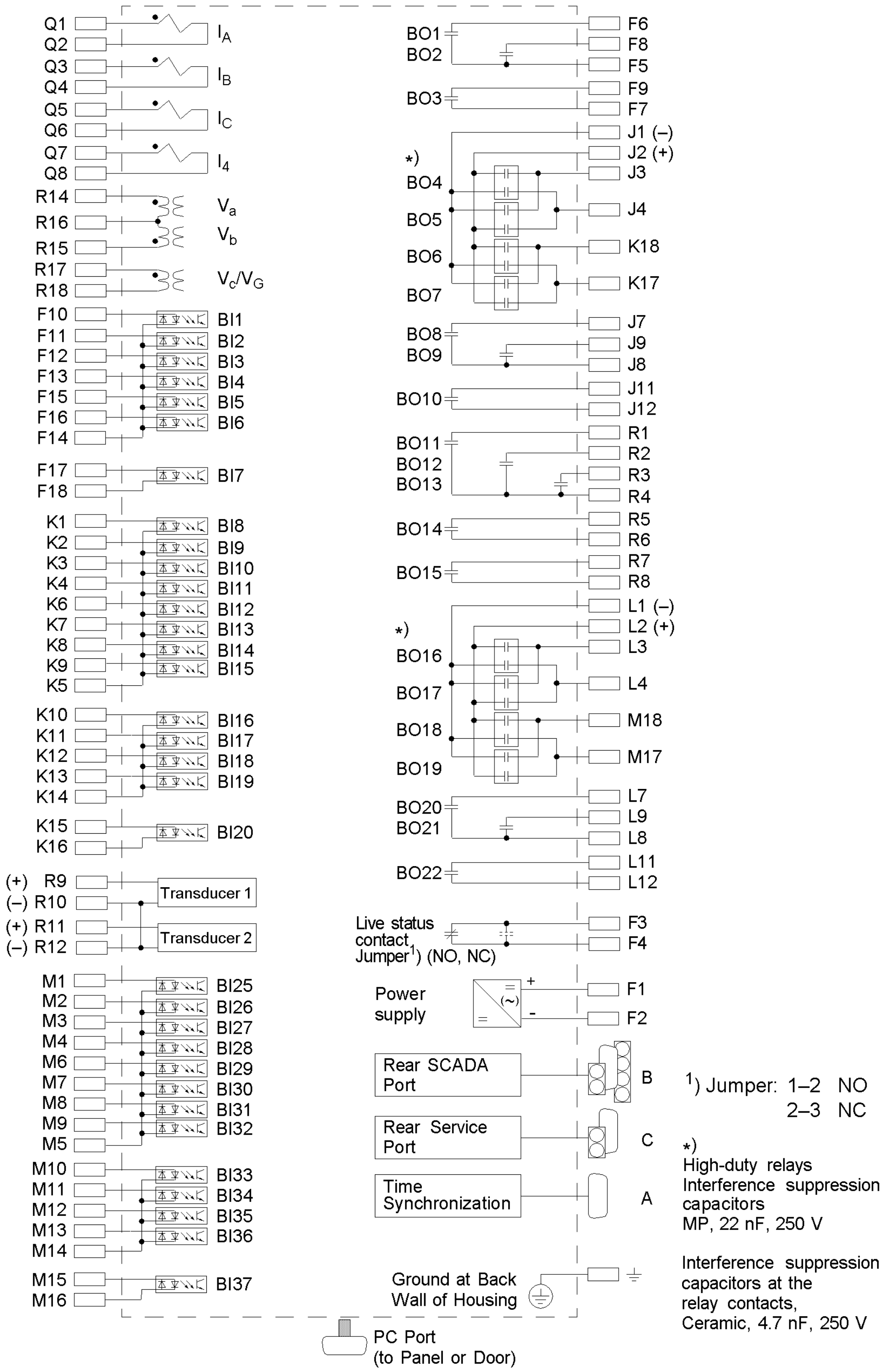


Figure A-31 Connection diagram for 6MD636*-*F/G (devices for panel surface mounting without operator panel)

6MD637*-*F/G

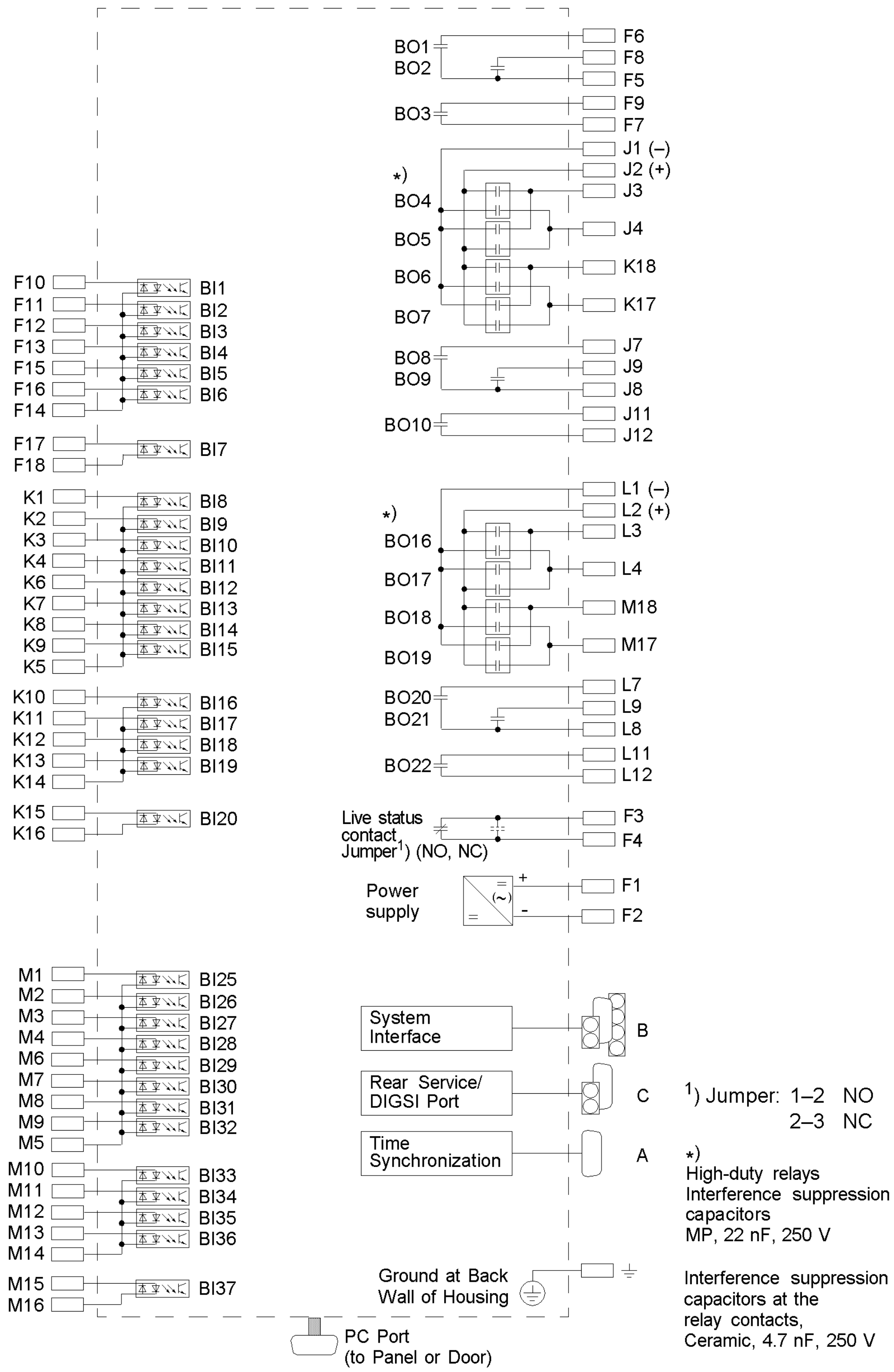


Figure A-32 Connection diagram for 6MD637*-*F/G (devices for panel surface mounting without operator panel)

A.2.5 Connector Assignment

On the Interfaces

	RS232	RS485	Profibus FMS Slave, RS485 Profibus DP Slave, RS485	Modbus, RS485 DNP3.0, RS485	Ethernet RS232
1	Shield (with Shield Ends Electrically Connected)				Tx+
2	RxD	—	—	—	Tx-
3	TxD	A/A' (RxD/TxD-N)	B/B' (RxD/TxD-P)	A	Rx+
4	—	—	CNTR-A (TTL)	RTS (TTL Level)	—
5	GND	C/C' (GND)	C/C' (GND)	GND1	—
6	—	—	+5 V (max. Load <100 mA)	VCC1	Rx-
7	RTS	—*)	—	—	—
8	CTS	B/B' (RxD/TxD-P)	A/A' (RxD/TxD-N)	B	—
9	—	—	—	—	

*) Pin 7 also may carry the RS232 RTS signal to an RS485 interface.
Pin 7 must therefore not be connected!

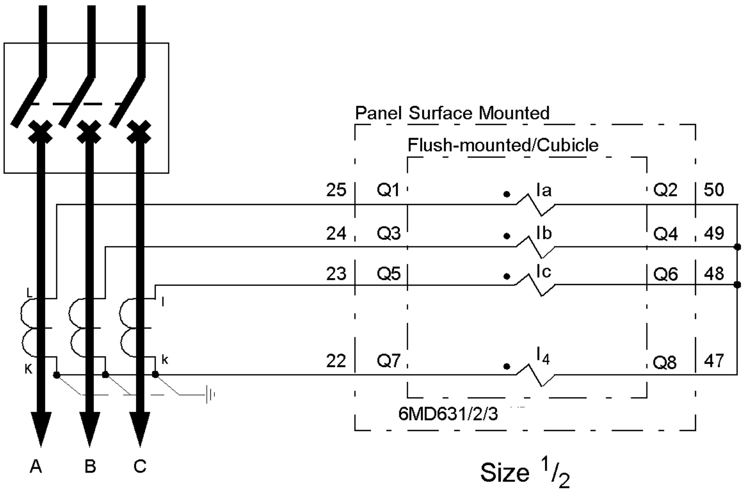
On the Time Synchronization Interface

Pin-No.	Designation	Signal Meaning
1	P24_TSIG	Input 24 V
2	P5_TSIG	Input 5 V
3	M_TSIG	Return Line
4	—*)	—*)
5	Screen	Screen Potential
6	—	—
7	P12_TSIG	Input 12 V
8	P_TSYNC*)	Input 24 V*)
9	Screen	Screen Potential

*)assigned, but not available

A.3 Connection Examples

A.3.1 Current and Voltage Transformers



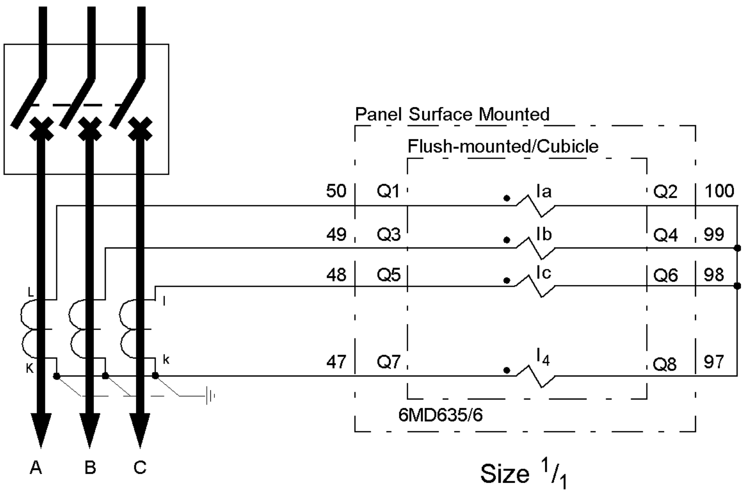


Figure A-33 Current connections to three current transformers with a starpoint connection for ground current, normal circuit layout

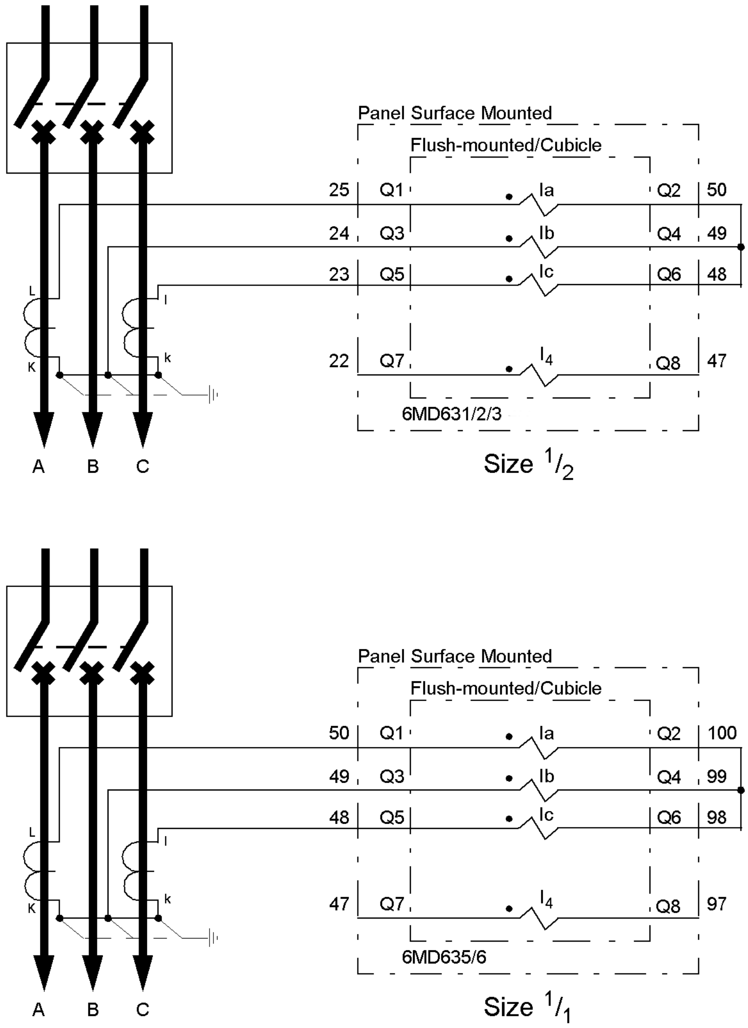
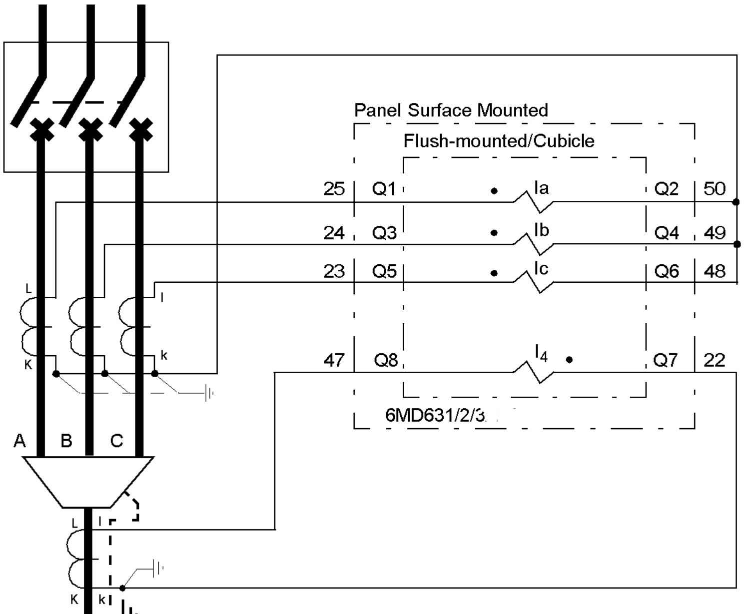


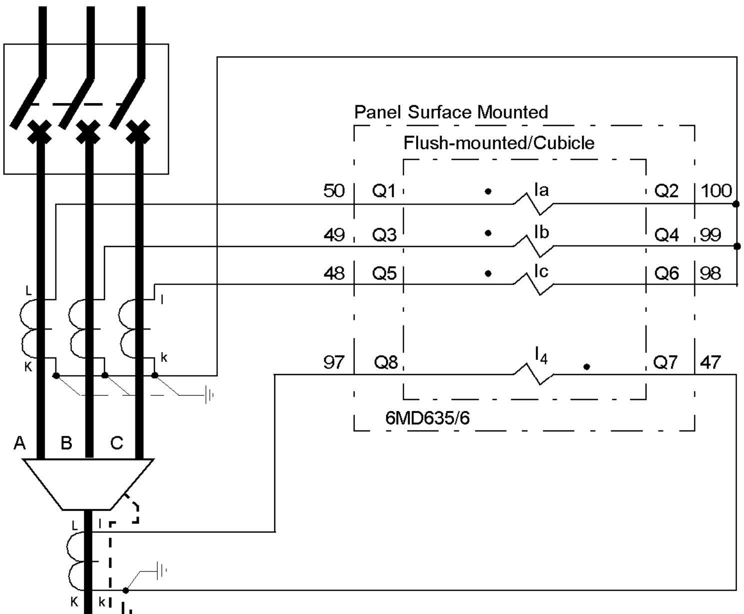
Figure A-34 Current connections to two current transformers - only for ungrounded or compensated networks



Important! Cable shield grounding must be done on the cable side!

Note: Change of Address 0201 setting changes polarity of $3I_0$ Current Input !

Size $^1/_2$

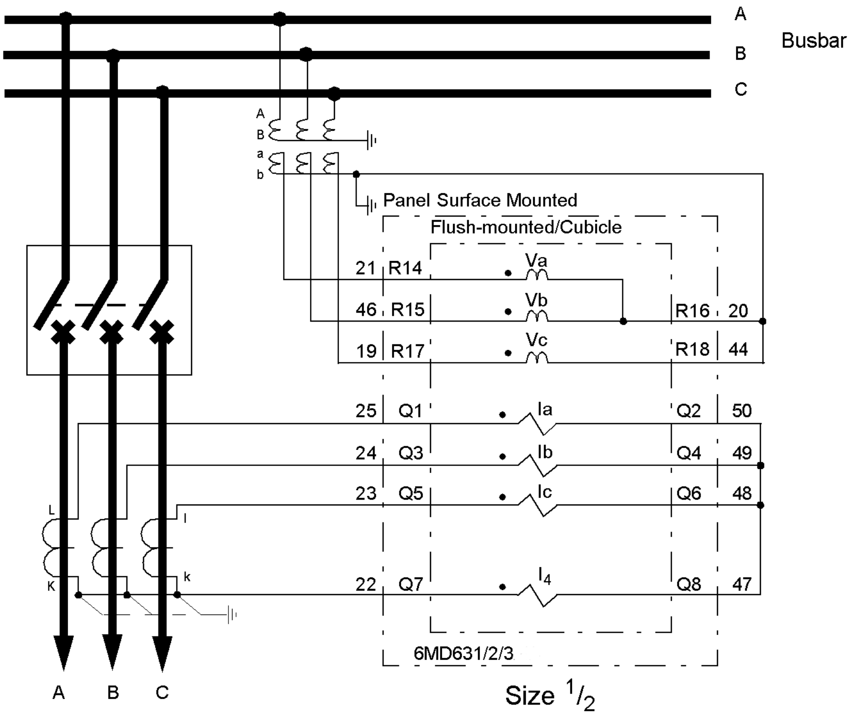


Important! Cable shield grounding must be done on the cable side!

Note: Change of Address 0201 setting changes polarity of $3I_0$ Current Input !

Size $^1/_1$

Figure A-35 Current connections to three current transformers and a core balance neutral current transformer for ground current – preferred for effectively or low-resistance grounded networks



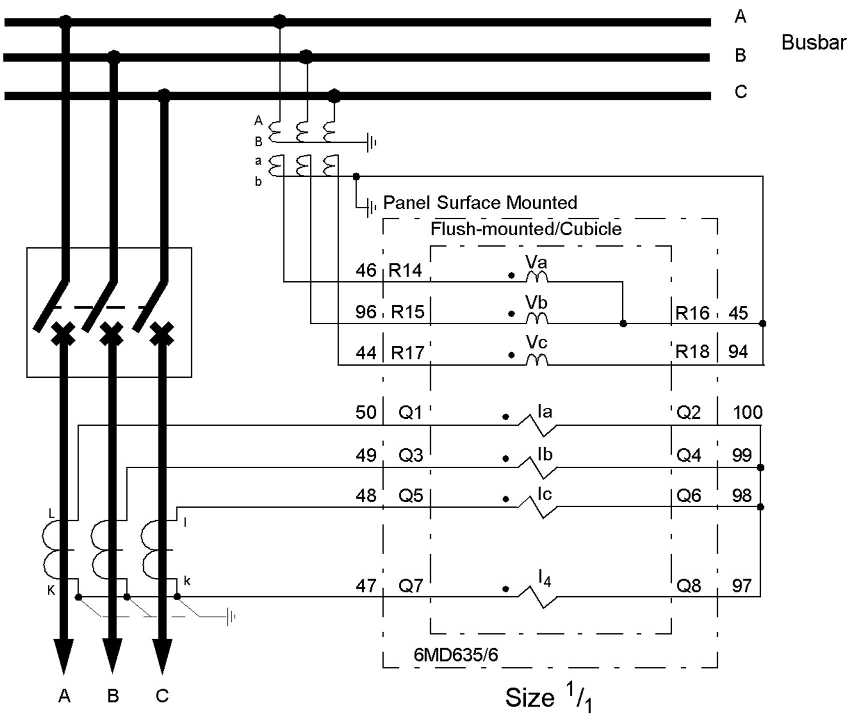


Figure A-36 Current and voltage connections to three current transformers and three voltage transformers (phase-ground), normal circuit layout

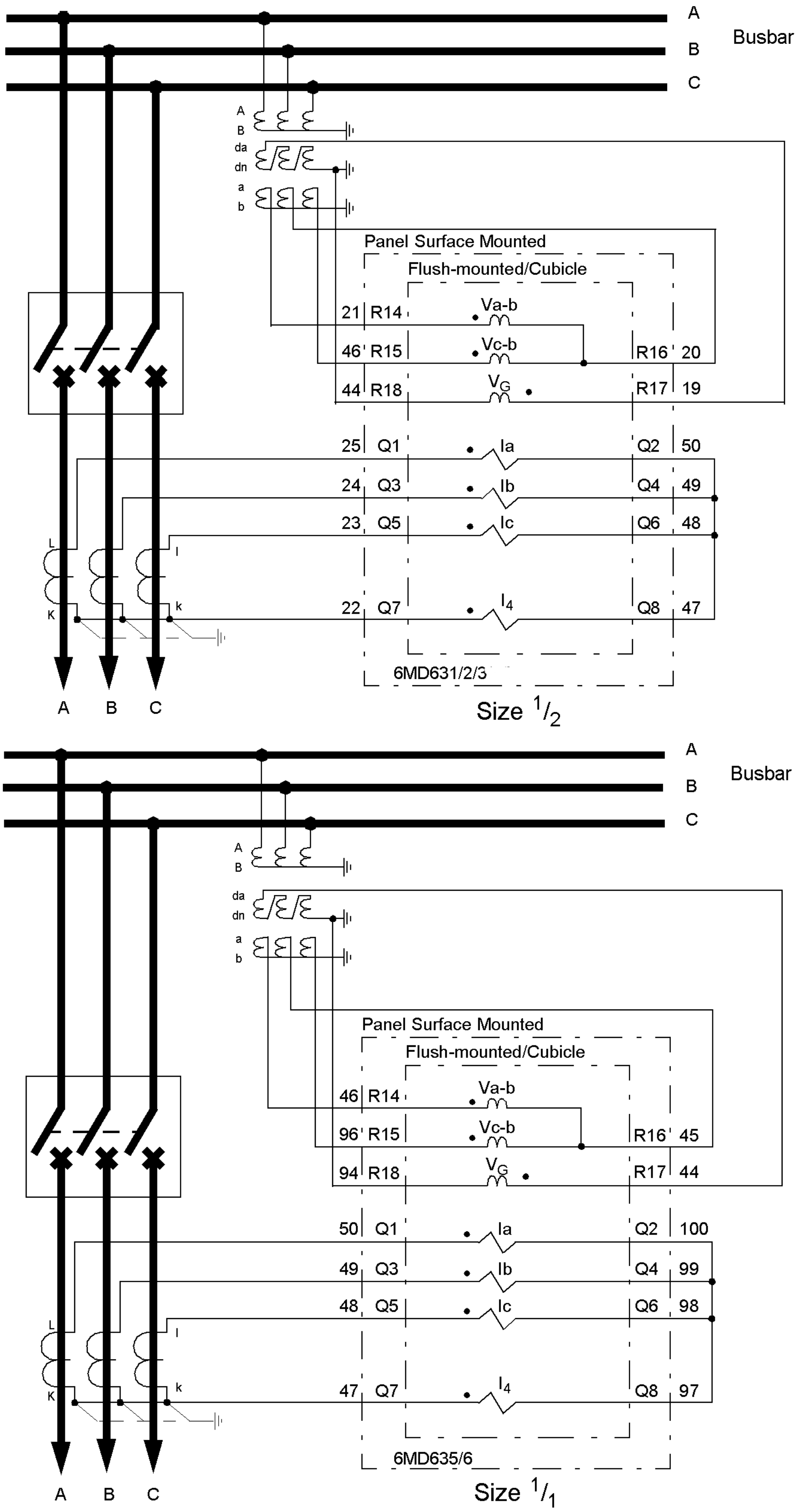
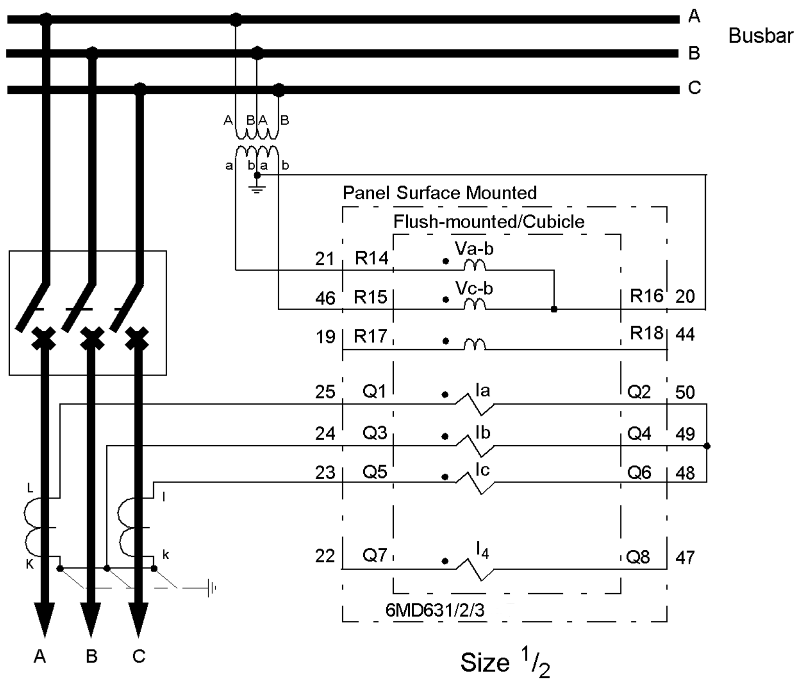


Figure A-37 Current and voltage connections to three current transformers, two voltage transformers (phase-phase) and open delta VT for V4



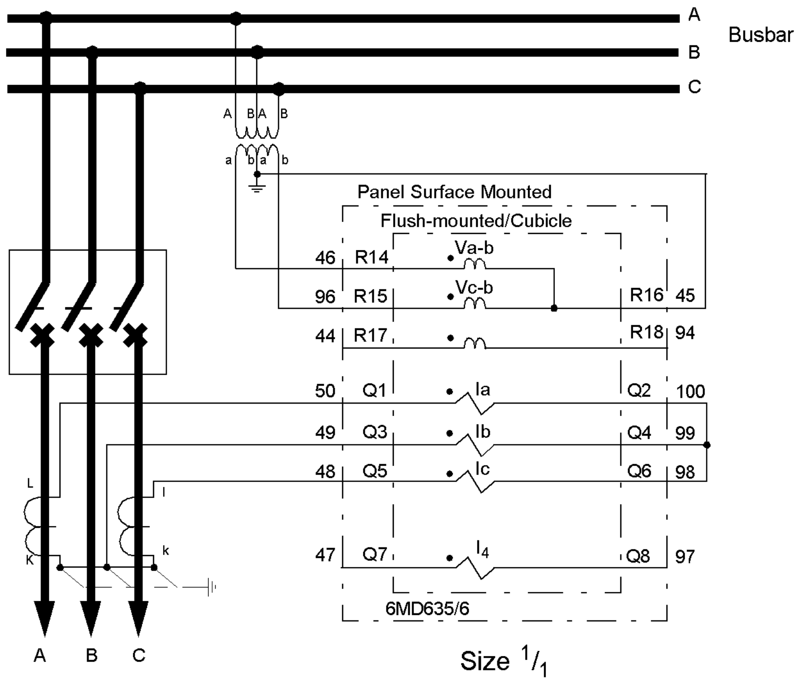
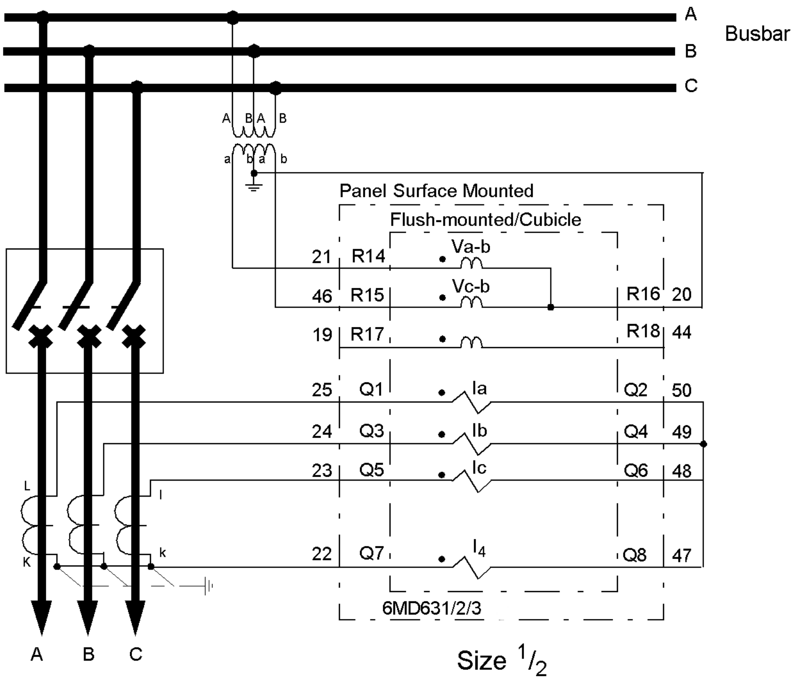


Figure A-38 Current and voltage connections to two current transformers and two V-connected voltage transformers, for ungrounded or compensated networks



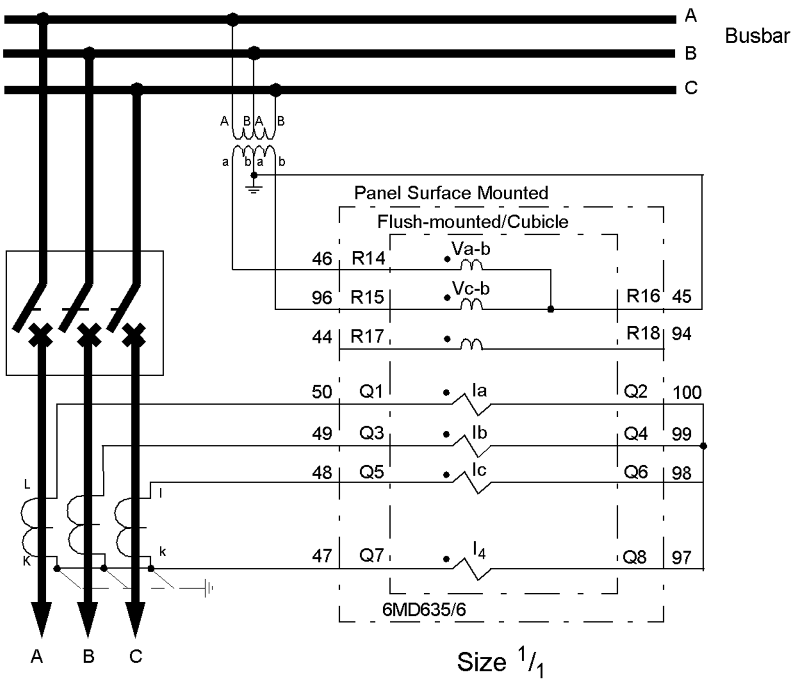


Figure A-39 Current connections to three current transformers with a starpoint connection for ground current, two V-connected voltage transformers - only for ungrounded or compensated networks

A.3.2 Connection Examples for RTD-boxes

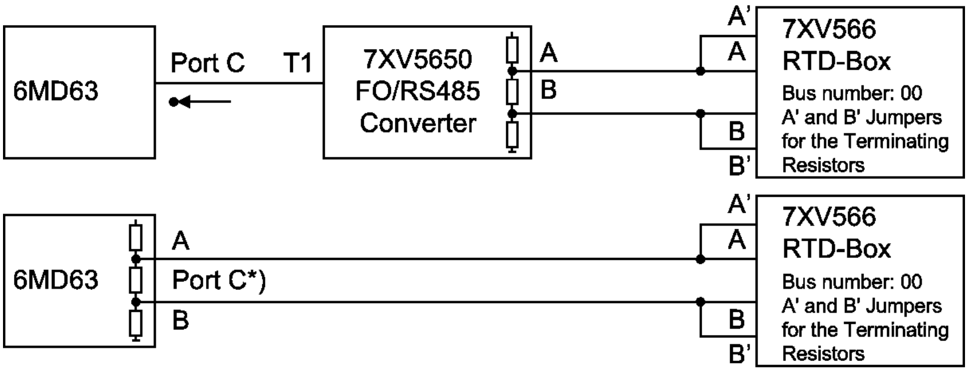


Figure A-40 Simplex operation with one RTD-Box; above: optical design (1 FOs); below: Design with RS485

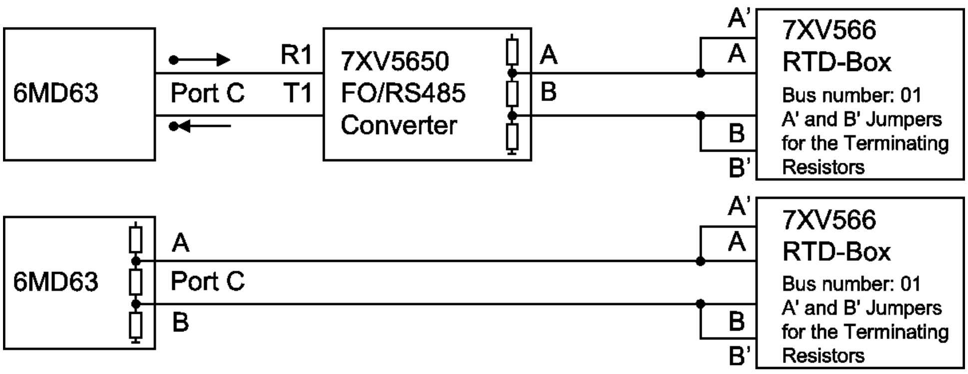


Figure A-41 Half-duplex with one RTD-Box; above: optical design (1 FOs); below: design with RS485

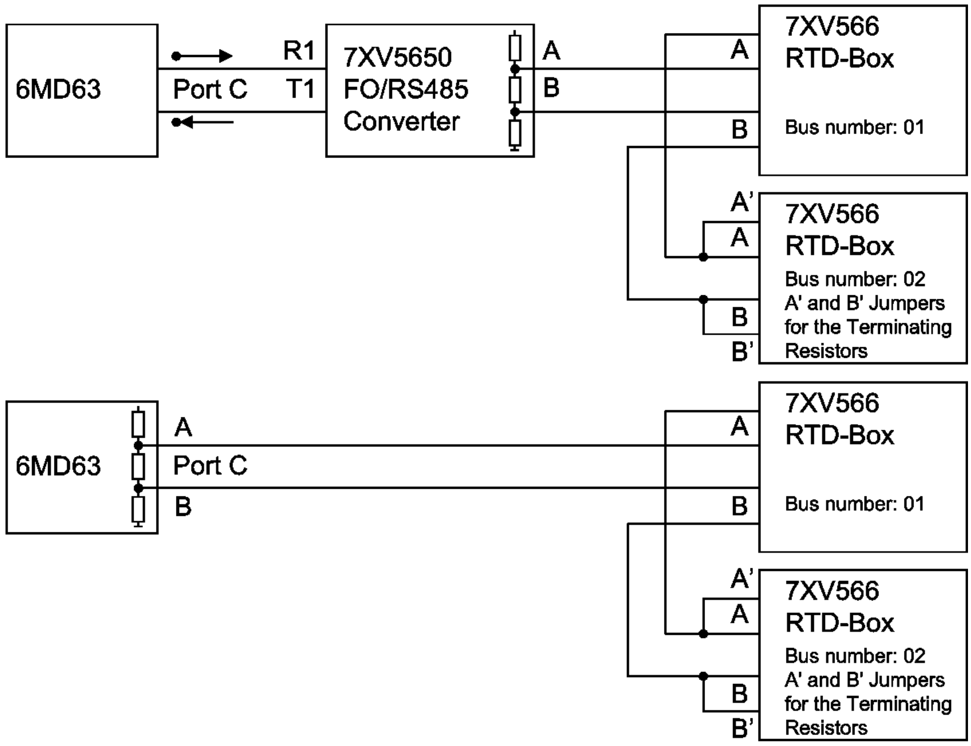


Figure A-42 Half-duplex with two RTD-Box; above: optical design (2 FOs); below: design with RS485

A.4 Current Transformer Requirements

The requirements for phase current transformers are usually determined by the overcurrent time protection, particularly by the high-current element settings. Besides, there is a minimum requirement based on experience.

The recommendations are given according to the standard IEC 60044-1.

The standards IEC 60044-6, BS 3938 and ANSI/IEEE C 57.13 are referred to for converting the requirement into the knee-point voltage and other transformer classes.

A.4.1 Accuracy limiting factors

Effective and Rated Accuracy Limiting Factor

Required minimum effective accuracy limiting factor	$$K_{ALF'} = \frac{50-2_{PU}}{I_{pNom}}$$ but at least 20	
	with	
	$K_{ALF'}$	Minimum effective accuracy limiting factor
	$50\text{-}2_{PU}$	Primary pickup value of the high-current element
	I_{pNom}	Primary nominal transformer current
Resulting rated accuracy limiting factor	$$K_{ALF} = \frac{R_{BC}+R_{Ct}}{R_{BN}+R_{Ct}} \cdot K_{ALF'}$$	
	with	
	K_{ALF}	Rated accuracy limiting factor
	R_{BC}	Connected burden resistance (device and cables)
	R_{BN}	Nominal burden resistance
	R_{Ct}	Transformer internal burden resistance

Calculation example according to IEC 60044–1

I_{sNom} = 1 A $K_{ALF'}$ = 20 R_{BC} = 0.6 Ω (device and cables) R_{Ct} = 3 Ω R_{BN} = 5 Ω (5 VA)	$$K_{ALF} = \frac{0.6+3}{5+3} \cdot 20 = 9$$ K_{ALF} set to 10, so that: 5P10, 5 VA
with I_{sNom} = secondary transformer nominal current	

A.4.2 Class conversion

Table A-1 Conversion into other classes

British Standard BS 3938	$$V_k = \frac{(R_{Ct} + R_{BN}) \cdot I_{sNom}}{1.3} \cdot K_{ALF}$$
ANSI/IEEE C 57.13, class C	$$V_{s.t.max} = 20 \cdot I_{sNom} \cdot R_{BN} \cdot \frac{K_{ALF}}{20}$$ I_{sNom} = 5 A (typical value)
IEC 60044-6 (transient response), class TPS	$$V_{al} = K \cdot K_{SSC} \cdot (R_{Ct} + R_{BN}) \cdot I_{sNom}$$ $K \approx 1$ $K_{SSC} \approx K_{ALF}$
Classes TPX, TPY, TPZ	Calculated as in Chapter A.4.1 where: $K_{SSC} \approx K_{ALF}$ T_P depending on power system and specified closing sequence
	with
	V_k — Knee-point voltage
	R_{Ct} — Internal burden resistance
	R_{BN} — Nominal burden resistance
	I_{sNom} — secondary nominal transformer current
	K_{ALF} — Rated accuracy limiting factor
	$V_{s.t.max}$ — sec. terminal volt. at 20 I_{pNom}
	V_{al} — sec. magnetization limit voltage
	K — Dimensioning factor
	K_{SSC} — Factor symmetr. Rated fault current
	T_P — Primary time constant

A.4.3 Cable core balance current transformer

General

The requirements to the cable core balance current transformer are determined by the function „sensitive ground fault detection“.

The recommendations are given according to the standard IEC 60044-1.

Requirements

Transformation ratio, typical It may be necessary to select a different transformation ratio to suit the specific power system and thus the amount of the maximum ground fault current.	60 / 1
Accuracy limiting factor	FS = 10
Power	2.5 VA

Class accuracy

Table A-2 Minimum required class accuracy depending on neutral grounding and function operating principle

Starpoint	isolated	compensated	high-resistance grounded
Function directional	Class 1	Class 1	Class 1
Function non-directional	Class 3	Class 1	Class 3

For extremely small ground fault currents it may become necessary to correct the angle at the device (see function description of „sensitive ground fault detection“).

A.5 Default Settings

When the device leaves the factory, a large number of LED indications, binary inputs and outputs as well as function keys are already preset. They are summarized in the following tables.

A.5.1 LEDs

Table A-3 LED Indication Presettings

LEDs	Default function	Function No.	Description
LED1	Not configured	1	No Function configured
LED2	Not configured	1	No Function configured
LED3	Not configured	1	No Function configured
LED4	Not configured	1	No Function configured
LED5	Not configured	1	No Function configured
LED6	Not configured	1	No Function configured
LED7	Not configured	1	No Function configured
LED8	Brk OPENED		Breaker OPENED
LED9	>Door open		>Cabinet door open
LED10	>CB wait		>CB waiting for Spring charged
LED11	Not configured	1	No Function configured
LED12	Not configured	1	No Function configured
LED13	Not configured	1	No Function configured
LED14	Not configured	1	No Function configured

A.5.2 Binary Input

Table A-4 Binary input presettings for all devices and ordering variants

Binary Input	Default function	Function No.	Description
BI1	Not configured	1	No Function configured
BI2	>Reset LED	5	>Reset LED
BI3	>Light on		>Back Light on
BI4	52Breaker		52 Breaker
BI5	52Breaker		52 Breaker
BI6	Disc.Swit.		Disconnect Switch
BI7	Disc.Swit.		Disconnect Switch

Table A-5 Further binary input presettings for 6MD631*-

Binary Input	Default function	Function No.	Description
BI21	GndSwit.		Ground Switch
BI22	GndSwit.		Ground Switch
BI23	>CB ready		>CB ready Spring is charged
BI24	>DoorClose		>Door closed

Table A-6 Further binary input presettings for 6MD632*- 6MD633*- 6MD634*- 6MD635*- 6MD636*- 6MD637*-

Binary Input	Default function	Function No.	Description
BI8	GndSwit.		Ground Switch
BI9	GndSwit.		Ground Switch
BI11	>CB ready		>CB ready Spring is charged
BI12	>DoorClose		>Door closed

A.5.3 Binary Output

Table A-7 Output Relay Presettings for All Devices and Ordering Variants

Binary Output	Default function	Function No.	Description
BO1	52Breaker		52 Breaker
BO2	52Breaker		52 Breaker
BO3	52Breaker		52 Breaker

Table A-8 Further Output Relay Presettings for 6MD631*- 6MD632*- 6MD633*- 6MD635*- 6MD636*-

Binary Output	Default function	Function No.	Description
BO11	GndSwit.		Ground Switch
BO12	GndSwit.		Ground Switch
BO13	Disc.Swit.		Disconnect Switch
BO14	Disc.Swit.		Disconnect Switch

Table A-9 Further Output Relay Presettings for 6MD634*- 6MD637*-

Binary Output	Default function	Function No.	Description
BO7	GndSwit.		Ground Switch
BO8	GndSwit.		Ground Switch
BO9	Disc.Swit.		Disconnect Switch
BO10	Disc.Swit.		Disconnect Switch

A.5.4 Function Keys

Table A-10 Applies to All Devices and Ordered Variants

Function Keys	Default function	Function No.	Description
F1	Display of operational indications	-	-
F2	Display of the primary operational measured values	-	-
F3	Not connected	-	-
F4	Not connected	-	-

A.5.5 Default Display

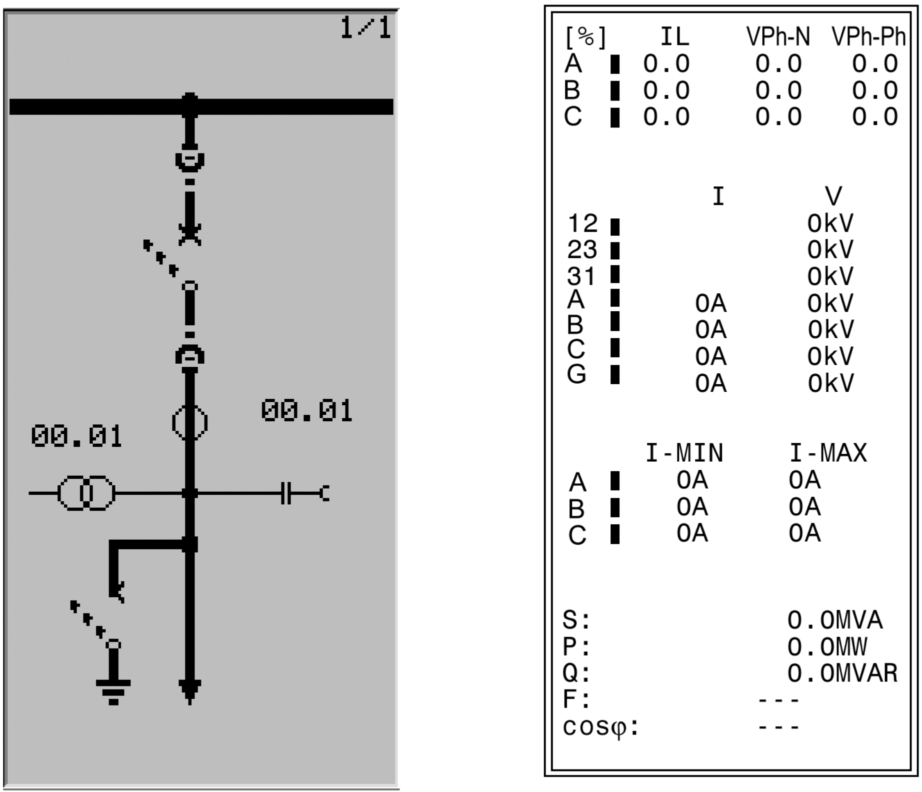


Figure A-43 Default displays for graphic display

A.5.6 Pre-defined CFC Charts

Some CFC Charts are already supplied with the SIPROTEC device. Depending on the variant the following charts may be implemented:

Device and System Logic

The NEGATOR block assigns the input signal “`DataStop`” directly to an output. This is not directly possible without the interconnection of this block.

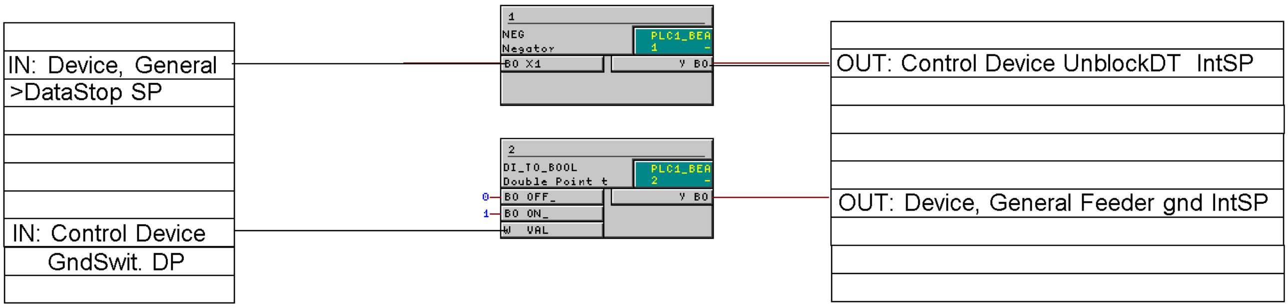


Figure A-44 Logical Link between Input and Output

Transducer 20 mA Input

For device variants with integrated measurement transducers, monitoring switching for the measured quantities supplied by the measurement transducers for pressure and temperature is provided:

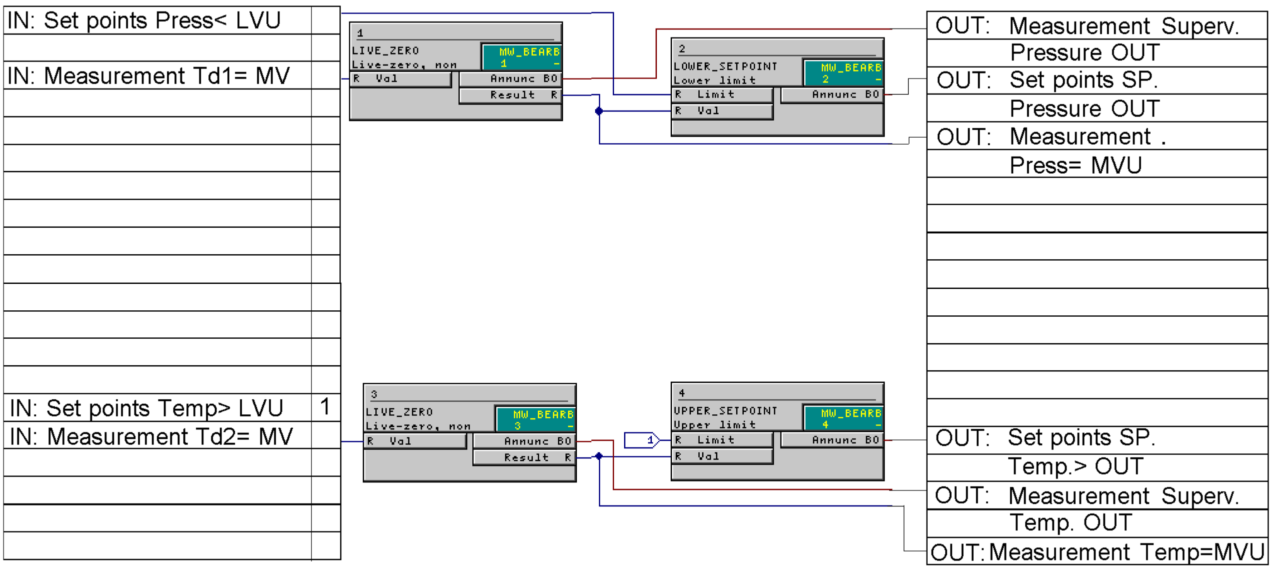


Figure A-45 Processing of the measured quantities supplied by the integrated measurement transducers for pressure and temperature

Interlocking Standard Interlocking for three switching devices (52, Disc. and GndSw):

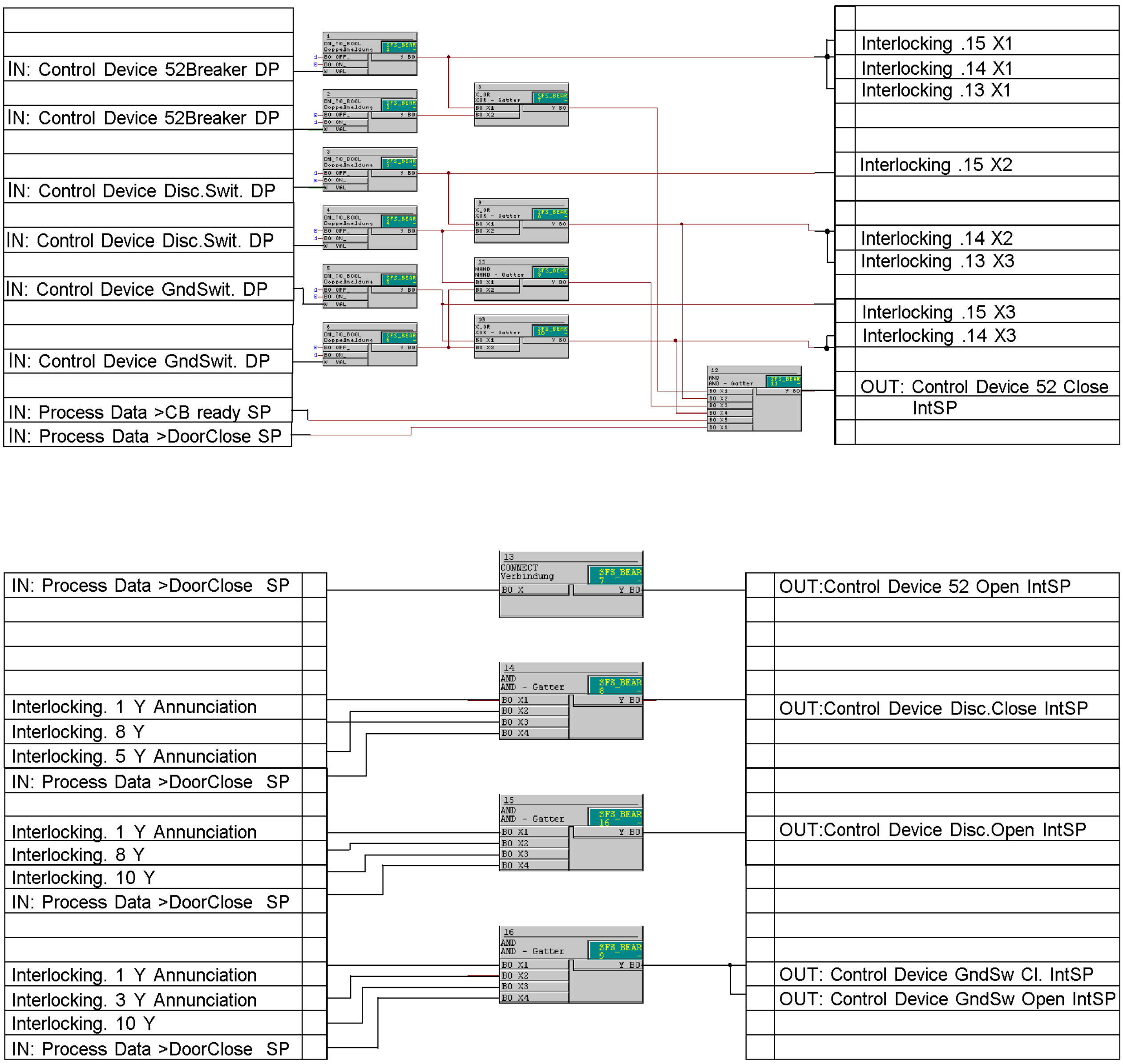


Figure A-46 Standard Interlocking For Circuit Breaker, Disconnector and Ground Switch

Set points MV Using modules on the running sequence ”measured value processing", a low current monitor for the three phase currents is implemented. The output message is set high as soon as one of the three phase currents falls below the set threshold:

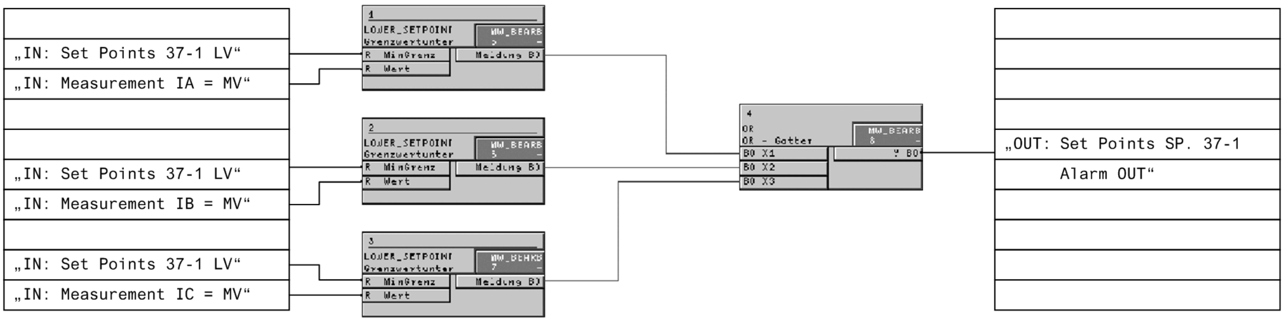


Figure A-47 Undercurrent monitoring

Blocks of the task level "MW_BEARB" (measured value processing) are used to implement the overcurrent monitoring and the power monitoring.

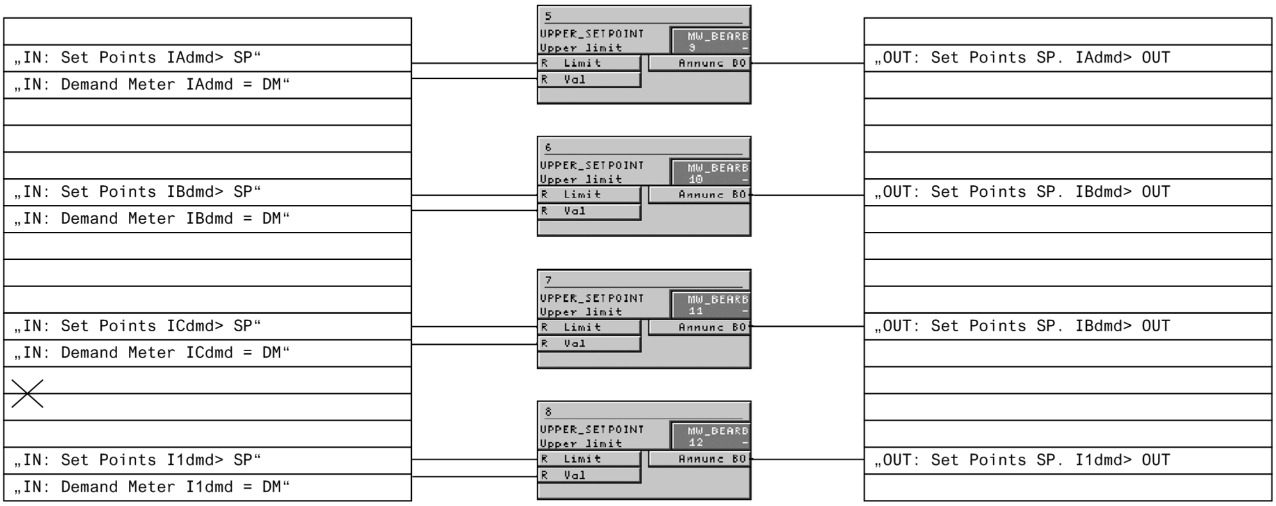


Figure A-48 Overcurrent monitoring

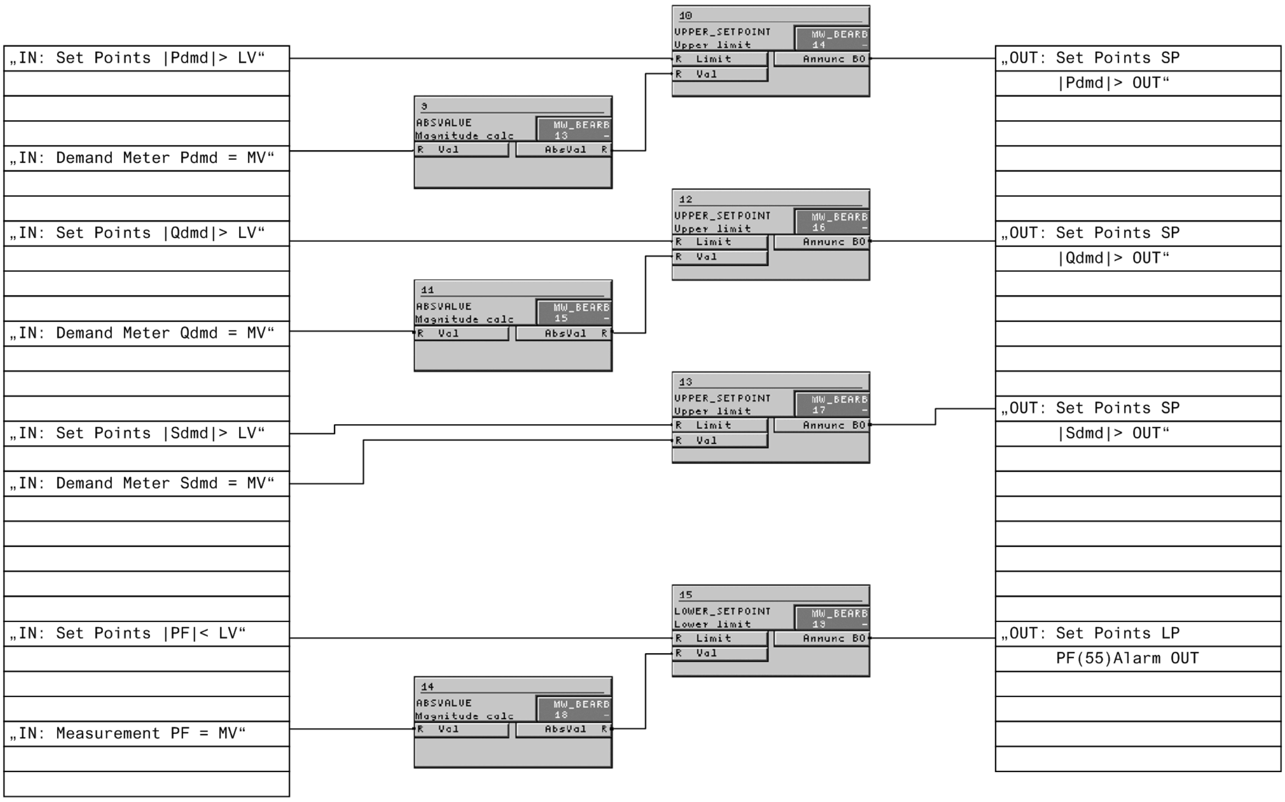


Figure A-49 Power monitoring

A.6 Protocol-dependent Functions

Protocol → Function ↓	IEC 60870–5–103	IEC 61850 Ethernet (EN 100)	PROFIBUS DP	PROFIBUS FMS	DNP3.0 1) Modbus ASCII/RTU 2)	Additional Service Interface (optional)
Operational Measured Values	Yes	Yes	Yes	Yes	Yes	Yes
Metered Values	Yes	Yes	Yes	Yes	Yes	Yes
Remote Protection Setting	No Only via additional service interface	No. Only via additional service interface	No. Only via additional service interface	Yes	No. Only via additional service interface	Yes
User-defined Indications and Switching Objects	Yes	Yes	Pre-defined “User-defined messages” in CFC	Yes	Pre-defined “User-defined messages” in CFC	Yes
Time Synchronization	Via Protocol; DCF77/IRIG B; Interface; Binary Inputs	Via protocol (NTP); DCF77/IRIG B; Interface; Binary Inputs	Via DCF77/IRIG B; Interface; Binary Inputs	Via protocol; DCF77/IRIG B Interface; Binary Inputs	Via protocol1); DCF77/IRIG B; Interface; Binary Inputs	—
Messages with Time Stamp	Yes	Yes	No	Yes	Yes1) No2)	Yes
Commissioning Aids						
Measured Value Indication Blocking	Yes	Yes	No	Yes	No	Yes
Creating Test Messages	Yes	Yes	No	Yes	No	Yes
Physical Mode	Asynchronous	Synchronous	Asynchronous	Asynchronous	Asynchronous	—
Transmission Mode	Cyclically/Event	Cyclically/Event	Cyclically	Cyclically/Event	Cyclically/Event1) cyclically2)	—
Baud rate	4800 to 38400	Up to 100 MBaud	Up to 1.5 MBaud	Up to 1.5 MBaud	2400 to 19200	4800 to 115200
Type	RS232 RS485 Fiber-optic cables	Ethernet TP	RS485 Optical fiber - Double ring	RS485 Optical fiber - Simple ring - Double ring	RS485 Optical fiber	RS232 RS485 Optical fiber

A.7 Functional Scope

Addr.	Parameter	Setting Options	Default Setting	Comments
190	RTD-BOX INPUT	Disabled Port C	Disabled	External Temperature Input
191	RTD CONNECTION	6 RTD simplex 6 RTD HDX 12 RTD HDX	6 RTD simplex	Ext. Temperature Input Connection Type

A.8 Settings

Addresses which have an appended "A" can only be changed with DIGSI, under "Additional Settings".

The table indicates region-specific presettings. Column C (configuration) indicates the corresponding secondary nominal current of the current transformer.

Addr.	Parameter	Function	C	Setting Options	Default Setting	Comments
201	CT Starpoint	P.System Data 1		towards Line towards Busbar	towards Line	CT Starpoint
202	Vnom PRIMARY	P.System Data 1		0.10 .. 800.00 kV	12.00 kV	Rated Primary Voltage
203	Vnom SECONDARY	P.System Data 1		100 .. 225 V	100 V	Rated Secondary Voltage (L-L)
204	CT PRIMARY	P.System Data 1		10 .. 50000 A	100 A	CT Rated Primary Current
205	CT SECONDARY	P.System Data 1		1A 5A	1A	CT Rated Secondary Current
206A	Vph / Vdelta	P.System Data 1		1.00 .. 3.00	1.73	Matching ratio Phase-VT To Open-Delta-VT
209	PHASE SEQ.	P.System Data 1		A B C A C B	A B C	Phase Sequence
213	VT Connect. 3ph	P.System Data 1		Van, Vbn, Vcn Vab, Vbc, VGnd	Van, Vbn, Vcn	VT Connection, three-phase
214	Rated Frequency	P.System Data 1		50 Hz 60 Hz	50 Hz	Rated Frequency
217	Ignd-CT PRIM	P.System Data 1		1 .. 50000 A	60 A	Ignd-CT rated primary current
218	Ignd-CT SEC	P.System Data 1		1A 5A	1A	Ignd-CT rated secondary current
276	TEMP. UNIT	P.System Data 1		Celsius Fahrenheit	Celsius	Unit of temperature measurement
616	Port	EN100-Modul 1		Disabled Port B	Disabled	Communication Port
1101	FullScaleVolt.	P.System Data 2		0.10 .. 800.00 kV	12.00 kV	Measurem:FullScaleVoltage(Equipm.rating)
1102	FullScaleCurr.	P.System Data 2		10 .. 50000 A	100 A	Measurem:FullScaleCurrent(Equipm.rating)
1108	P,Q sign	P.System Data 2		not reversed reversed	not reversed	P,Q operational measured values sign
8101	MEASURE. SUPERV	Measurem.Superv		OFF ON	ON	Measurement Supervision
8102	BALANCE V-LIMIT	Measurem.Superv		10 .. 100 V	50 V	Voltage Threshold for Balance Monitoring
8103	BAL. FACTOR V	Measurem.Superv		0.58 .. 0.90	0.75	Balance Factor for Voltage Monitor
8104	BALANCE I LIMIT	Measurem.Superv	1A	0.10 .. 1.00 A	0.50 A	Current Threshold for Balance Monitoring
			5A	0.50 .. 5.00 A	2.50 A	
8105	BAL. FACTOR I	Measurem.Superv		0.10 .. 0.90	0.50	Balance Factor for Current Monitor
8106	Σ I THRESHOLD	Measurem.Superv	1A	0.05 .. 2.00 A; ∞	0.10 A	Summated Current Monitoring Threshold
			5A	0.25 .. 10.00 A; ∞	0.50 A	
8107	Σ I FACTOR	Measurem.Superv		0.00 .. 0.95	0.10	Summated Current Monitoring Factor
8301	DMD Interval	Demand meter		15 Min., 1 Sub 15 Min., 3 Subs 15 Min.,15 Subs 30 Min., 1 Sub 60 Min., 1 Sub 60 Min.,10 Subs 5 Min., 5 Subs	60 Min., 1 Sub	Demand Calculation Intervals
8302	DMD Sync.Time	Demand meter		On The Hour 15 After Hour 30 After Hour 45 After Hour	On The Hour	Demand Synchronization Time
8311	MinMax cycRESET	Min/Max meter		NO YES	YES	Automatic Cyclic Reset Function

Addr.	Parameter	Function	C	Setting Options	Default Setting	Comments
8312	MiMa RESET TIME	Min/Max meter		0 .. 1439 min	0 min	MinMax Reset Timer
8313	MiMa RESETCYCLE	Min/Max meter		1 .. 365 Days	7 Days	MinMax Reset Cycle Period
8314	MinMaxRES.START	Min/Max meter		1 .. 365 Days	1 Days	MinMax Start Reset Cycle in
8315	MeterResolution	Energy		Standard Factor 10 Factor 100	Standard	Meter resolution
9011A	RTD 1 TYPE	RTD-Box		Not connected Pt 100 Ω Ni 120 Ω Ni 100 Ω	Pt 100 Ω	RTD 1: Type
9012A	RTD 1 LOCATION	RTD-Box		Oil Ambient Winding Bearing Other	Oil	RTD 1: Location
9013	RTD 1 STAGE 1	RTD-Box		-50 .. 250 °C; ∞	100 °C	RTD 1: Temperature Stage 1 Pickup
9014	RTD 1 STAGE 1	RTD-Box		-58 .. 482 °F; ∞	212 °F	RTD 1: Temperature Stage 1 Pickup
9015	RTD 1 STAGE 2	RTD-Box		-50 .. 250 °C; ∞	120 °C	RTD 1: Temperature Stage 2 Pickup
9016	RTD 1 STAGE 2	RTD-Box		-58 .. 482 °F; ∞	248 °F	RTD 1: Temperature Stage 2 Pickup
9021A	RTD 2 TYPE	RTD-Box		Not connected Pt 100 Ω Ni 120 Ω Ni 100 Ω	Not connected	RTD 2: Type
9022A	RTD 2 LOCATION	RTD-Box		Oil Ambient Winding Bearing Other	Other	RTD 2: Location
9023	RTD 2 STAGE 1	RTD-Box		-50 .. 250 °C; ∞	100 °C	RTD 2: Temperature Stage 1 Pickup
9024	RTD 2 STAGE 1	RTD-Box		-58 .. 482 °F; ∞	212 °F	RTD 2: Temperature Stage 1 Pickup
9025	RTD 2 STAGE 2	RTD-Box		-50 .. 250 °C; ∞	120 °C	RTD 2: Temperature Stage 2 Pickup
9026	RTD 2 STAGE 2	RTD-Box		-58 .. 482 °F; ∞	248 °F	RTD 2: Temperature Stage 2 Pickup
9031A	RTD 3 TYPE	RTD-Box		Not connected Pt 100 Ω Ni 120 Ω Ni 100 Ω	Not connected	RTD 3: Type
9032A	RTD 3 LOCATION	RTD-Box		Oil Ambient Winding Bearing Other	Other	RTD 3: Location
9033	RTD 3 STAGE 1	RTD-Box		-50 .. 250 °C; ∞	100 °C	RTD 3: Temperature Stage 1 Pickup
9034	RTD 3 STAGE 1	RTD-Box		-58 .. 482 °F; ∞	212 °F	RTD 3: Temperature Stage 1 Pickup
9035	RTD 3 STAGE 2	RTD-Box		-50 .. 250 °C; ∞	120 °C	RTD 3: Temperature Stage 2 Pickup
9036	RTD 3 STAGE 2	RTD-Box		-58 .. 482 °F; ∞	248 °F	RTD 3: Temperature Stage 2 Pickup
9041A	RTD 4 TYPE	RTD-Box		Not connected Pt 100 Ω Ni 120 Ω Ni 100 Ω	Not connected	RTD 4: Type
9042A	RTD 4 LOCATION	RTD-Box		Oil Ambient Winding Bearing Other	Other	RTD 4: Location
9043	RTD 4 STAGE 1	RTD-Box		-50 .. 250 °C; ∞	100 °C	RTD 4: Temperature Stage 1 Pickup

Addr.	Parameter	Function	C	Setting Options	Default Setting	Comments
9044	RTD 4 STAGE 1	RTD-Box		-58 .. 482 °F; ∞	212 °F	RTD 4: Temperature Stage 1 Pickup
9045	RTD 4 STAGE 2	RTD-Box		-50 .. 250 °C; ∞	120 °C	RTD 4: Temperature Stage 2 Pickup
9046	RTD 4 STAGE 2	RTD-Box		-58 .. 482 °F; ∞	248 °F	RTD 4: Temperature Stage 2 Pickup
9051A	RTD 5 TYPE	RTD-Box		Not connected Pt 100 Ω Ni 120 Ω Ni 100 Ω	Not connected	RTD 5: Type
9052A	RTD 5 LOCATION	RTD-Box		Oil Ambient Winding Bearing Other	Other	RTD 5: Location
9053	RTD 5 STAGE 1	RTD-Box		-50 .. 250 °C; ∞	100 °C	RTD 5: Temperature Stage 1 Pickup
9054	RTD 5 STAGE 1	RTD-Box		-58 .. 482 °F; ∞	212 °F	RTD 5: Temperature Stage 1 Pickup
9055	RTD 5 STAGE 2	RTD-Box		-50 .. 250 °C; ∞	120 °C	RTD 5: Temperature Stage 2 Pickup
9056	RTD 5 STAGE 2	RTD-Box		-58 .. 482 °F; ∞	248 °F	RTD 5: Temperature Stage 2 Pickup
9061A	RTD 6 TYPE	RTD-Box		Not connected Pt 100 Ω Ni 120 Ω Ni 100 Ω	Not connected	RTD 6: Type
9062A	RTD 6 LOCATION	RTD-Box		Oil Ambient Winding Bearing Other	Other	RTD 6: Location
9063	RTD 6 STAGE 1	RTD-Box		-50 .. 250 °C; ∞	100 °C	RTD 6: Temperature Stage 1 Pickup
9064	RTD 6 STAGE 1	RTD-Box		-58 .. 482 °F; ∞	212 °F	RTD 6: Temperature Stage 1 Pickup
9065	RTD 6 STAGE 2	RTD-Box		-50 .. 250 °C; ∞	120 °C	RTD 6: Temperature Stage 2 Pickup
9066	RTD 6 STAGE 2	RTD-Box		-58 .. 482 °F; ∞	248 °F	RTD 6: Temperature Stage 2 Pickup
9071A	RTD 7 TYPE	RTD-Box		Not connected Pt 100 Ω Ni 120 Ω Ni 100 Ω	Not connected	RTD 7: Type
9072A	RTD 7 LOCATION	RTD-Box		Oil Ambient Winding Bearing Other	Other	RTD 7: Location
9073	RTD 7 STAGE 1	RTD-Box		-50 .. 250 °C; ∞	100 °C	RTD 7: Temperature Stage 1 Pickup
9074	RTD 7 STAGE 1	RTD-Box		-58 .. 482 °F; ∞	212 °F	RTD 7: Temperature Stage 1 Pickup
9075	RTD 7 STAGE 2	RTD-Box		-50 .. 250 °C; ∞	120 °C	RTD 7: Temperature Stage 2 Pickup
9076	RTD 7 STAGE 2	RTD-Box		-58 .. 482 °F; ∞	248 °F	RTD 7: Temperature Stage 2 Pickup
9081A	RTD 8 TYPE	RTD-Box		Not connected Pt 100 Ω Ni 120 Ω Ni 100 Ω	Not connected	RTD 8: Type
9082A	RTD 8 LOCATION	RTD-Box		Oil Ambient Winding Bearing Other	Other	RTD 8: Location
9083	RTD 8 STAGE 1	RTD-Box		-50 .. 250 °C; ∞	100 °C	RTD 8: Temperature Stage 1 Pickup

Addr.	Parameter	Function	C	Setting Options	Default Setting	Comments
9084	RTD 8 STAGE 1	RTD-Box		-58 .. 482 °F; ∞	212 °F	RTD 8: Temperature Stage 1 Pickup
9085	RTD 8 STAGE 2	RTD-Box		-50 .. 250 °C; ∞	120 °C	RTD 8: Temperature Stage 2 Pickup
9086	RTD 8 STAGE 2	RTD-Box		-58 .. 482 °F; ∞	248 °F	RTD 8: Temperature Stage 2 Pickup
9091A	RTD 9 TYPE	RTD-Box		Not connected Pt 100 Ω Ni 120 Ω Ni 100 Ω	Not connected	RTD 9: Type
9092A	RTD 9 LOCATION	RTD-Box		Oil Ambient Winding Bearing Other	Other	RTD 9: Location
9093	RTD 9 STAGE 1	RTD-Box		-50 .. 250 °C; ∞	100 °C	RTD 9: Temperature Stage 1 Pickup
9094	RTD 9 STAGE 1	RTD-Box		-58 .. 482 °F; ∞	212 °F	RTD 9: Temperature Stage 1 Pickup
9095	RTD 9 STAGE 2	RTD-Box		-50 .. 250 °C; ∞	120 °C	RTD 9: Temperature Stage 2 Pickup
9096	RTD 9 STAGE 2	RTD-Box		-58 .. 482 °F; ∞	248 °F	RTD 9: Temperature Stage 2 Pickup
9101A	RTD10 TYPE	RTD-Box		Not connected Pt 100 Ω Ni 120 Ω Ni 100 Ω	Not connected	RTD10: Type
9102A	RTD10 LOCATION	RTD-Box		Oil Ambient Winding Bearing Other	Other	RTD10: Location
9103	RTD10 STAGE 1	RTD-Box		-50 .. 250 °C; ∞	100 °C	RTD10: Temperature Stage 1 Pickup
9104	RTD10 STAGE 1	RTD-Box		-58 .. 482 °F; ∞	212 °F	RTD10: Temperature Stage 1 Pickup
9105	RTD10 STAGE 2	RTD-Box		-50 .. 250 °C; ∞	120 °C	RTD10: Temperature Stage 2 Pickup
9106	RTD10 STAGE 2	RTD-Box		-58 .. 482 °F; ∞	248 °F	RTD10: Temperature Stage 2 Pickup
9111A	RTD11 TYPE	RTD-Box		Not connected Pt 100 Ω Ni 120 Ω Ni 100 Ω	Not connected	RTD11: Type
9112A	RTD11 LOCATION	RTD-Box		Oil Ambient Winding Bearing Other	Other	RTD11: Location
9113	RTD11 STAGE 1	RTD-Box		-50 .. 250 °C; ∞	100 °C	RTD11: Temperature Stage 1 Pickup
9114	RTD11 STAGE 1	RTD-Box		-58 .. 482 °F; ∞	212 °F	RTD11: Temperature Stage 1 Pickup
9115	RTD11 STAGE 2	RTD-Box		-50 .. 250 °C; ∞	120 °C	RTD11: Temperature Stage 2 Pickup
9116	RTD11 STAGE 2	RTD-Box		-58 .. 482 °F; ∞	248 °F	RTD11: Temperature Stage 2 Pickup
9121A	RTD12 TYPE	RTD-Box		Not connected Pt 100 Ω Ni 120 Ω Ni 100 Ω	Not connected	RTD12: Type
9122A	RTD12 LOCATION	RTD-Box		Oil Ambient Winding Bearing Other	Other	RTD12: Location
9123	RTD12 STAGE 1	RTD-Box		-50 .. 250 °C; ∞	100 °C	RTD12: Temperature Stage 1 Pickup

Addr.	Parameter	Function	C	Setting Options	Default Setting	Comments
9124	RTD12 STAGE 1	RTD-Box		-58 .. 482 °F; ∞	212 °F	RTD12: Temperature Stage 1 Pickup
9125	RTD12 STAGE 2	RTD-Box		-50 .. 250 °C; ∞	120 °C	RTD12: Temperature Stage 2 Pickup
9126	RTD12 STAGE 2	RTD-Box		-58 .. 482 °F; ∞	248 °F	RTD12: Temperature Stage 2 Pickup

A.9 Information List

Indications for IEC 60 870-5-103 are always reported ON / OFF if they are subject to general interrogation for IEC 60 870-5-103. If not, they are reported only as ON.

New user-defined indications or such reassigned 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 (“.._Ev”). Further information on messages can be found in detail in the SIPROTEC® 4 System Description, Order No. E50417-H1176-C151.

In columns “Event Log”, “Trip Log” and “Ground Fault Log” the following applies:

UPPER CASE NOTATION “ON/OFF”: definitely set, not allocatable

lower case notation “on/off”: preset, allocatable

*: not preset, allocatable

<blank>: neither preset nor allocatable

In column “Marked in Oscill.Record” the following applies:

UPPER CASE NOTATION “M”: definitely set, not allocatable

lower case notation “m”: preset, allocatable

*: not preset, allocatable

<blank>: neither preset nor allocatable

No.	Description	Function	Type of Information	Log Buffers				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	Relay	Chatter Suppression	Type	Information Number	Data Unit	General Interrogation
-	>Back Light on (>Light on)	Device, General	SP	on off	*		*	LED	BI		BO					
-	Reset LED (Reset LED)	Device, General	IntSP	on	*		*	LED			BO		160	19	1	No
-	Stop data transmission (DataStop)	Device, General	IntSP	on off	*		*	LED			BO		160	20	1	Yes
-	Test mode (Test mode)	Device, General	IntSP	on off	*		*	LED			BO		160	21	1	Yes
-	Feeder GROUNDED (Feeder gnd)	Device, General	IntSP	*	*		*	LED			BO					
-	Breaker OPENED (Brk OPENED)	Device, General	IntSP	*	*		*	LED			BO					
-	Hardware Test Mode (HWTestMod)	Device, General	IntSP	on off	*		*	LED			BO					
-	Clock Synchronization (SynchClock)	Device, General	IntSP _Ev	*	*		*									
-	Error FMS FO 1 (Error FMS1)	Device, General	OUT	on off	*			LED			BO					
-	Error FMS FO 2 (Error FMS2)	Device, General	OUT	on off	*			LED			BO					
-	Disturbance CFC (Distur.CFC)	Device, General	OUT	on off	*			LED			BO					
-	Control Authority (Cntrl Auth)	Cntrl Authority	DP	ON OFF				LED					101	85	1	Yes
-	Controlmode LOCAL (ModeLOCAL)	Cntrl Authority	DP	ON OFF				LED					101	86	1	Yes

No.	Description	Function	Type of Information	Log Buffers				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	Relay	Chatter Suppression	Type	Information Number	Data Unit	General Interrogation
-	Controlmode REMOTE (ModeREMOTE)	Cntrl Authority	IntSP	ON OFF				LED								
-	52 Breaker (52Breaker)	Control Device	CF_D12	on off							BO		240	160	20	
-	52 Breaker (52Breaker)	Control Device	DP	on off					BI			CB	240	160	1	Yes
-	Disconnect Switch (Disc.Swit.)	Control Device	CF_D2	on off							BO		240	161	20	
-	Disconnect Switch (Disc.Swit.)	Control Device	DP	on off					BI			CB	240	161	1	Yes
-	Ground Switch (GndSwit.)	Control Device	CF_D2	on off							BO		240	164	20	
-	Ground Switch (GndSwit.)	Control Device	DP	on off					BI			CB	240	164	1	Yes
-	Interlocking: 52 Open (52 Open)	Control Device	IntSP				*									
-	Interlocking: 52 Close (52 Close)	Control Device	IntSP				*									
-	Interlocking: Disconnect switch Open (Disc.Open)	Control Device	IntSP				*									
-	Interlocking: Disconnect switch Close (Disc.Close)	Control Device	IntSP				*									
-	Interlocking: Ground switch Open (GndSw Open)	Control Device	IntSP				*									
-	Interlocking: Ground switch Close (GndSw Cl.)	Control Device	IntSP				*									
-	Unlock data transmission via BI (UnlockDT)	Control Device	IntSP				*									
-	Q2 Open/Close (Q2 Op/Cl)	Control Device	CF_D2	on off							BO		240	162	20	
-	Q2 Open/Close (Q2 Op/Cl)	Control Device	DP	on off					BI			CB	240	162	1	Yes
-	Q9 Open/Close (Q9 Op/Cl)	Control Device	CF_D2	on off							BO		240	163	20	
-	Q9 Open/Close (Q9 Op/Cl)	Control Device	DP	on off					BI			CB	240	163	1	Yes
-	Fan ON/OFF (Fan ON/OFF)	Control Device	CF_D2	on off							BO		240	175	20	
-	Fan ON/OFF (Fan ON/OFF)	Control Device	DP	on off					BI			CB	240	175	1	Yes
-	>CB ready Spring is charged (>CB ready)	Process Data	SP	*			*	LED	BI		BO	CB				
-	>Door closed (>DoorClose)	Process Data	SP	*			*	LED	BI		BO	CB				
-	>Cabinet door open (>Door open)	Process Data	SP	on off			*	LED	BI		BO	CB	101	1	1	Yes
-	>CB waiting for Spring charged (>CB wait)	Process Data	SP	on off			*	LED	BI		BO	CB	101	2	1	Yes
-	>No Voltage (Fuse blown) (>No Volt.)	Process Data	SP	ON OFF			*	LED	BI		BO	CB	160	38	1	Yes
-	>Error Motor Voltage (>Err Mot V)	Process Data	SP	on off			*	LED	BI		BO	CB	240	181	1	Yes
-	>Error Control Voltage (>ErrCntrlV)	Process Data	SP	on off			*	LED	BI		BO	CB	240	182	1	Yes
-	>SF6-Loss (>SF6-Loss)	Process Data	SP	on off			*	LED	BI		BO	CB	240	183	1	Yes
-	>Error Meter (>Err Meter)	Process Data	SP	on off			*	LED	BI		BO	CB	240	184	1	Yes

No.	Description	Function	Type of In-for-matio n	Log Buffers				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	Relay	Chatter Suppression	Type	Information Number	Data Unit	General Interrogation
-	>Transformer Temperature (>Tx Temp.)	Process Data	SP	on off			*	LED	BI		BO	CB	240	185	1	Yes
-	>Transformer Danger (>Tx Danger)	Process Data	SP	on off			*	LED	BI		BO	CB	240	186	1	Yes
-	Reset meter (Meter res)	Energy	IntSP _Ev	ON					BI							
-	Error Systeminterface (SysIn-tErr.)	Protocol	IntSP	on off				LED			BO					
-	Threshold Value 1 (ThreshVal1)	Thresh.-Switch	IntSP	on off				LED		FC TN	BO	CB				
1	No Function configured (Not con-figured)	Device, General	SP	*	*											
2	Function Not Available (Non Exis-tent)	Device, General	SP	*	*											
3	>Synchronize Internal Real Time Clock (>Time Synch)	Device, General	SP_E v	*	*			LED	BI		BO		135	48	1	Yes
5	>Reset LED (>Reset LED)	Device, General	SP	*	*		*	LED	BI		BO		135	50	1	Yes
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	IntDP	on off	*											
009.0102	Failure EN100 Link Channel 2 (Ch2) (Fail Ch2)	EN100-Modul 1	IntDP	on off	*											
15	>Test mode (>Test mode)	Device, General	SP	*	*		*	LED	BI		BO		135	53	1	Yes
16	>Stop data transmission (>DataStop)	Device, General	SP	*	*		*	LED	BI		BO		135	54	1	Yes
51	Device is Operational and Pro-tecting (Device OK)	Device, General	OUT	on off	*		*	LED			BO		135	81	1	Yes
55	Reset Device (Reset Device)	Device, General	OUT	on	*		*									
56	Initial Start of Device (Initial Start)	Device, General	OUT	on	*		*	LED			BO		160	5	1	No
67	Resume (Resume)	Device, General	OUT	on	*		*	LED			BO					
68	Clock Synchronization Error (Clock SyncError)	Device, General	OUT	on off	*		*	LED			BO					
69	Daylight Saving Time (DayLight-SavTime)	Device, General	OUT	on off	*		*	LED			BO					
70	Setting calculation is running (Settings Calc.)	Device, General	OUT	on off	*		*	LED			BO		160	22	1	Yes
71	Settings Check (Settings Check)	Device, General	OUT	*	*		*	LED			BO					
72	Level-2 change (Level-2 change)	Device, General	OUT	on off	*		*	LED			BO					
73	Local setting change (Local change)	Device, General	OUT	*	*		*									
110	Event lost (Event Lost)	Device, General	OUT_ Ev	on	*			LED			BO		135	130	1	No
113	Flag Lost (Flag Lost)	Device, General	OUT	on	*		m	LED			BO		135	136	1	Yes
125	Chatter ON (Chatter ON)	Device, General	OUT	on off	*		*	LED			BO		135	145	1	Yes
140	Error with a summary alarm (Error Sum Alarm)	Device, General	OUT	on off	*		*	LED			BO		160	47	1	Yes
144	Error 5V (Error 5V)	Device, General	OUT	on off	*		*	LED			BO					
145	Error 0V (Error 0V)	Device, General	OUT	on off	*		*	LED			BO					
146	Error -5V (Error -5V)	Device, General	OUT	on off	*		*	LED			BO					

No.	Description	Function	Type of Information	Log Buffers				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	Relay	Chatter Suppression	Type	Information Number	Data Unit	General Interrogation
147	Error Power Supply (Error Pwr-Supply)	Device, General	OUT	on off	*		*	LED			BO					
160	Alarm Summary Event (Alarm Sum Event)	Device, General	OUT	on off	*		*	LED			BO		160	46	1	Yes
161	Failure: General Current Supervision (Fail I Superv.)	Measurem.Superv	OUT	on off	*		*	LED			BO		160	32	1	Yes
162	Failure: Current Summation (Failure Σ I)	Measurem.Superv	OUT	on off	*		*	LED			BO		135	182	1	Yes
163	Failure: Current Balance (Fail I balance)	Measurem.Superv	OUT	on off	*		*	LED			BO		135	183	1	Yes
167	Failure: Voltage Balance (Fail V balance)	Measurem.Superv	OUT	on off	*		*	LED			BO		135	186	1	Yes
170	VT Fuse Failure (alarm instantaneous) (VT FuseFail)	Measurem.Superv	OUT	on off	*		*	LED			BO					
171	Failure: Phase Sequence (Fail Ph. Seq.)	Measurem.Superv	OUT	on off	*		*	LED			BO		160	35	1	Yes
175	Failure: Phase Sequence Current (Fail Ph. Seq. I)	Measurem.Superv	OUT	on off	*		*	LED			BO		135	191	1	Yes
176	Failure: Phase Sequence Voltage (Fail Ph. Seq. V)	Measurem.Superv	OUT	on off	*		*	LED			BO		135	192	1	Yes
177	Failure: Battery empty (Fail Battery)	Device, General	OUT	on off	*		*	LED			BO					
178	I/O-Board Error (I/O-Board error)	Device, General	OUT	on off	*		*	LED			BO					
183	Error Board 1 (Error Board 1)	Device, General	OUT	on off	*		*	LED			BO					
184	Error Board 2 (Error Board 2)	Device, General	OUT	on off	*		*	LED			BO					
185	Error Board 3 (Error Board 3)	Device, General	OUT	on off	*		*	LED			BO					
186	Error Board 4 (Error Board 4)	Device, General	OUT	on off	*		*	LED			BO					
187	Error Board 5 (Error Board 5)	Device, General	OUT	on off	*		*	LED			BO					
188	Error Board 6 (Error Board 6)	Device, General	OUT	on off	*		*	LED			BO					
189	Error Board 7 (Error Board 7)	Device, General	OUT	on off	*		*	LED			BO					
191	Error: Offset (Error Offset)	Device, General	OUT	on off	*		*	LED			BO					
192	Error:1A/5Ajumper different from setting (Error1A/5Awrong)	Device, General	OUT	on off	*											
193	Alarm: NO calibration data available (Alarm NO calibr)	Device, General	OUT	on off	*		*	LED			BO					
197	Measurement Supervision is switched OFF (MeasSup OFF)	Measurem.Superv	OUT	on off	*		*	LED			BO		135	197	1	Yes
220	Error: Range CT Ph wrong (CT Ph wrong)	Device, General	OUT	on off	*											
236.2127	- (-)	Device, General	IntSP	on off	*	*	*	LED			BO					
264	Failure: RTD-Box 1 (Fail: RTD-Box 1)	RTD-Box	OUT	ON OFF	*		*	LED			BO					
267	Failure: RTD-Box 2 (Fail: RTD-Box 2)	RTD-Box	OUT	ON OFF	*		*	LED			BO					
268	Supervision Pressure (Superv.Pressure)	Measurement	OUT	on off			*	LED			BO					

No.	Description	Function	Type of Information	Log Buffers				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	Relay	Chatter Suppression	Type	Information Number	Data Unit	General Interrogation
269	Supervision Temperature (Superv.Temp.)	Measurement	OUT	on off			*	LED			BO					
270	Set Point Pressure< (SP. Pressure<)	Set Points(MV)	OUT	on off			*	LED			BO					
271	Set Point Temp> (SP. Temp>)	Set Points(MV)	OUT	on off			*	LED			BO					
272	Set Point Operating Hours (SP. Op Hours>)	SetPoint(Stat)	OUT	on off			*	LED			BO		135	229	1	Yes
273	Set Point Phase A dmd> (SP. I A dmd>)	Set Points(MV)	OUT	on off			*	LED			BO		135	230	1	Yes
274	Set Point Phase B dmd> (SP. I B dmd>)	Set Points(MV)	OUT	on off			*	LED			BO		135	234	1	Yes
275	Set Point Phase C dmd> (SP. I C dmd>)	Set Points(MV)	OUT	on off			*	LED			BO		135	235	1	Yes
276	Set Point positive sequence I1dmd> (SP. I1dmd>)	Set Points(MV)	OUT	on off			*	LED			BO		135	236	1	Yes
277	Set Point |Pdmd|> (SP. |Pdmd|>)	Set Points(MV)	OUT	on off			*	LED			BO		135	237	1	Yes
278	Set Point |Qdmd|> (SP. |Qdmd|>)	Set Points(MV)	OUT	on off			*	LED			BO		135	238	1	Yes
279	Set Point |Sdmd|> (SP. |Sdmd|>)	Set Points(MV)	OUT	on off			*	LED			BO		135	239	1	Yes
284	Set Point 37-1 Undercurrent alarm (SP. 37-1 alarm)	Set Points(MV)	OUT	on off			*	LED			BO		135	244	1	Yes
285	Set Point 55 Power factor alarm (SP. PF(55)alarm)	Set Points(MV)	OUT	on off			*	LED			BO		135	245	1	Yes
320	Warn: Limit of Memory Data exceeded (Warn Mem. Data)	Device, General	OUT	on off	*		*	LED			BO					
321	Warn: Limit of Memory Parameter exceeded (Warn Mem. Para.)	Device, General	OUT	on off	*		*	LED			BO					
322	Warn: Limit of Memory Operation exceeded (Warn Mem. Oper.)	Device, General	OUT	on off	*		*	LED			BO					
323	Warn: Limit of Memory New exceeded (Warn Mem. New)	Device, General	OUT	on off	*		*	LED			BO					
395	>I MIN/MAX Buffer Reset (>I MinMax Reset)	Min/Max meter	SP	ON			*		BI		BO					
396	>I1 MIN/MAX Buffer Reset (>I1 MiMaReset)	Min/Max meter	SP	ON			*		BI		BO					
397	>V MIN/MAX Buffer Reset (>V MiMaReset)	Min/Max meter	SP	ON			*		BI		BO					
398	>Vphph MIN/MAX Buffer Reset (>VphphMiMaRes)	Min/Max meter	SP	ON			*		BI		BO					
399	>V1 MIN/MAX Buffer Reset (>V1 MiMa Reset)	Min/Max meter	SP	ON			*		BI		BO					
400	>P MIN/MAX Buffer Reset (>P MiMa Reset)	Min/Max meter	SP	ON			*		BI		BO					
401	>S MIN/MAX Buffer Reset (>S MiMa Reset)	Min/Max meter	SP	ON			*		BI		BO					
402	>Q MIN/MAX Buffer Reset (>Q MiMa Reset)	Min/Max meter	SP	ON			*		BI		BO					
403	>Idmd MIN/MAX Buffer Reset (>Idmd MiMaReset)	Min/Max meter	SP	ON			*		BI		BO					
404	>Pdmd MIN/MAX Buffer Reset (>Pdmd MiMaReset)	Min/Max meter	SP	ON			*		BI		BO					
405	>Qdmd MIN/MAX Buffer Reset (>Qdmd MiMaReset)	Min/Max meter	SP	ON			*		BI		BO					

No.	Description	Function	Type of Information	Log Buffers				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	Relay	Chatter Suppression	Type	Information Number	Data Unit	General Interrogation
406	>Sdmd MIN/MAX Buffer Reset (>Sdmd MiMaReset)	Min/Max meter	SP	ON			*		BI		BO					
407	>Frq. MIN/MAX Buffer Reset (>Frq MiMa Reset)	Min/Max meter	SP	ON			*		BI		BO					
408	>Power Factor MIN/MAX Buffer Reset (>PF MiMaReset)	Min/Max meter	SP	ON			*		BI		BO					
409	>BLOCK Op Counter (>BLOCK Op Count)	Statistics	SP	on off			*	LED	BI		BO					
1020	Counter of operating hours (Op.Hours=)	Statistics	VI													
5145	>Reverse Phase Rotation (>Reverse Rot.)	P.System Data 1	SP	on off	*		*	LED	BI		BO					
5147	Phase rotation ABC (Rotation ABC)	P.System Data 1	OUT	on off	*		*	LED			BO		70	128	1	Yes
5148	Phase rotation ACB (Rotation ACB)	P.System Data 1	OUT	on off	*		*	LED			BO		70	129	1	Yes
6509	>Failure: Feeder VT (>FAIL:FEEDER VT)	Measurem.Superv	SP	on off	*		*	LED	BI		BO		74	9	1	Yes
6510	>Failure: Busbar VT (>FAIL: BUS VT)	Measurem.Superv	SP	on off	*		*	LED	BI		BO		74	10	1	Yes
14101	Fail: RTD (broken wire/shorted) (Fail: RTD)	RTD-Box	OUT	ON OFF	*		*	LED			BO					
14111	Fail: RTD 1 (broken wire/shorted) (Fail: RTD 1)	RTD-Box	OUT	ON OFF	*		*	LED			BO					
14112	RTD 1 Temperature stage 1 picked up (RTD 1 St.1 p.up)	RTD-Box	OUT	ON OFF	*		*	LED			BO					
14113	RTD 1 Temperature stage 2 picked up (RTD 1 St.2 p.up)	RTD-Box	OUT	ON OFF	*		*	LED			BO					
14121	Fail: RTD 2 (broken wire/shorted) (Fail: RTD 2)	RTD-Box	OUT	ON OFF	*		*	LED			BO					
14122	RTD 2 Temperature stage 1 picked up (RTD 2 St.1 p.up)	RTD-Box	OUT	ON OFF	*		*	LED			BO					
14123	RTD 2 Temperature stage 2 picked up (RTD 2 St.2 p.up)	RTD-Box	OUT	ON OFF	*		*	LED			BO					
14131	Fail: RTD 3 (broken wire/shorted) (Fail: RTD 3)	RTD-Box	OUT	ON OFF	*		*	LED			BO					
14132	RTD 3 Temperature stage 1 picked up (RTD 3 St.1 p.up)	RTD-Box	OUT	ON OFF	*		*	LED			BO					
14133	RTD 3 Temperature stage 2 picked up (RTD 3 St.2 p.up)	RTD-Box	OUT	ON OFF	*		*	LED			BO					
14141	Fail: RTD 4 (broken wire/shorted) (Fail: RTD 4)	RTD-Box	OUT	ON OFF	*		*	LED			BO					
14142	RTD 4 Temperature stage 1 picked up (RTD 4 St.1 p.up)	RTD-Box	OUT	ON OFF	*		*	LED			BO					
14143	RTD 4 Temperature stage 2 picked up (RTD 4 St.2 p.up)	RTD-Box	OUT	ON OFF	*		*	LED			BO					
14151	Fail: RTD 5 (broken wire/shorted) (Fail: RTD 5)	RTD-Box	OUT	ON OFF	*		*	LED			BO					
14152	RTD 5 Temperature stage 1 picked up (RTD 5 St.1 p.up)	RTD-Box	OUT	ON OFF	*		*	LED			BO					
14153	RTD 5 Temperature stage 2 picked up (RTD 5 St.2 p.up)	RTD-Box	OUT	ON OFF	*		*	LED			BO					
14161	Fail: RTD 6 (broken wire/shorted) (Fail: RTD 6)	RTD-Box	OUT	ON OFF	*		*	LED			BO					
14162	RTD 6 Temperature stage 1 picked up (RTD 6 St.1 p.up)	RTD-Box	OUT	ON OFF	*		*	LED			BO					

No.	Description	Function	Type of Information	Log Buffers: Event Log ON/OFF	Trip (Fault) Log ON/OFF	Ground Fault Log ON/OFF	Marked in Oscill. Record	Configurable in Matrix: LED	Binary Input	Function Key	Relay	Chatter Suppression	IEC 60870-5-103: Type	Information Number	Data Unit	General Interrogation
14163	RTD 6 Temperature stage 2 picked up (RTD 6 St.2 p.up)	RTD-Box	OUT	ON OFF	*		*	LED			BO					
14171	Fail: RTD 7 (broken wire/shorted) (Fail: RTD 7)	RTD-Box	OUT	ON OFF	*		*	LED			BO					
14172	RTD 7 Temperature stage 1 picked up (RTD 7 St.1 p.up)	RTD-Box	OUT	ON OFF	*		*	LED			BO					
14173	RTD 7 Temperature stage 2 picked up (RTD 7 St.2 p.up)	RTD-Box	OUT	ON OFF	*		*	LED			BO					
14181	Fail: RTD 8 (broken wire/shorted) (Fail: RTD 8)	RTD-Box	OUT	ON OFF	*		*	LED			BO					
14182	RTD 8 Temperature stage 1 picked up (RTD 8 St.1 p.up)	RTD-Box	OUT	ON OFF	*		*	LED			BO					
14183	RTD 8 Temperature stage 2 picked up (RTD 8 St.2 p.up)	RTD-Box	OUT	ON OFF	*		*	LED			BO					
14191	Fail: RTD 9 (broken wire/shorted) (Fail: RTD 9)	RTD-Box	OUT	ON OFF	*		*	LED			BO					
14192	RTD 9 Temperature stage 1 picked up (RTD 9 St.1 p.up)	RTD-Box	OUT	ON OFF	*		*	LED			BO					
14193	RTD 9 Temperature stage 2 picked up (RTD 9 St.2 p.up)	RTD-Box	OUT	ON OFF	*		*	LED			BO					
14201	Fail: RTD10 (broken wire/shorted) (Fail: RTD10)	RTD-Box	OUT	ON OFF	*		*	LED			BO					
14202	RTD10 Temperature stage 1 picked up (RTD10 St.1 p.up)	RTD-Box	OUT	ON OFF	*		*	LED			BO					
14203	RTD10 Temperature stage 2 picked up (RTD10 St.2 p.up)	RTD-Box	OUT	ON OFF	*		*	LED			BO					
14211	Fail: RTD11 (broken wire/shorted) (Fail: RTD11)	RTD-Box	OUT	ON OFF	*		*	LED			BO					
14212	RTD11 Temperature stage 1 picked up (RTD11 St.1 p.up)	RTD-Box	OUT	ON OFF	*		*	LED			BO					
14213	RTD11 Temperature stage 2 picked up (RTD11 St.2 p.up)	RTD-Box	OUT	ON OFF	*		*	LED			BO					
14221	Fail: RTD12 (broken wire/shorted) (Fail: RTD12)	RTD-Box	OUT	ON OFF	*		*	LED			BO					
14222	RTD12 Temperature stage 1 picked up (RTD12 St.1 p.up)	RTD-Box	OUT	ON OFF	*		*	LED			BO					
14223	RTD12 Temperature stage 2 picked up (RTD12 St.2 p.up)	RTD-Box	OUT	ON OFF	*		*	LED			BO					
16019	- (-)	P.System Data 2	SP	on off	*		*	LED	BI		BO					

A.10 Group Alarms

No.	Description	Function No.	Description
140	Error Sum Alarm	144 145 146 147 177 178 183 184 185 186 187 188 189	Error 5V Error 0V Error -5V Error PwrSupply Fail Battery I/O-Board error Error Board 1 Error Board 2 Error Board 3 Error Board 4 Error Board 5 Error Board 6 Error Board 7
160	Alarm Sum Event	162 163 167 171 175 176 191	Failure Σ I Fail I balance Fail V balance Fail Ph. Seq. Fail Ph. Seq. I Fail Ph. Seq. V Error Offset
161	Fail I Superv.	162 163	Failure Σ I Fail I balance

A.11 Measured Values

No.	Description	Function	IEC 60870-5-103					Configurable in Matrix		
			Type	Information Number	Compatibility	Data Unit	Position	CFC	Control Display	Default Display
-	I A dmd> (I Admd>)	Set Points(MV)	-	-	-	-	-	CFC	CD	DD
-	I B dmd> (I Bdmd>)	Set Points(MV)	-	-	-	-	-	CFC	CD	DD
-	I C dmd> (I Cdmd>)	Set Points(MV)	-	-	-	-	-	CFC	CD	DD
-	I1dmd> (I1dmd>)	Set Points(MV)	-	-	-	-	-	CFC	CD	DD
-	|Pdmd|> (|Pdmd|>)	Set Points(MV)	-	-	-	-	-	CFC	CD	DD
-	|Qdmd|> (|Qdmd|>)	Set Points(MV)	-	-	-	-	-	CFC	CD	DD
-	|Sdmd|> (|Sdmd|>)	Set Points(MV)	-	-	-	-	-	CFC	CD	DD
-	Pressure< (Press<)	Set Points(MV)	-	-	-	-	-	CFC	CD	DD
-	Temp> (Temp>)	Set Points(MV)	-	-	-	-	-	CFC	CD	DD
-	37-1 under current (37-1)	Set Points(MV)	-	-	-	-	-	CFC	CD	DD
-	|Power Factor|< (|PF|<)	Set Points(MV)	-	-	-	-	-	CFC	CD	DD
-	Number of TRIPs= (#of TRIPs=)	Statistics	-	-	-	-	-	CFC	CD	DD
-	Operating hours greater than (OpHour>)	SetPoint(Stat)	-	-	-	-	-	CFC	CD	DD
601	Ia (Ia =)	Measurement	240	148	Yes	9	1	CFC	CD	DD
			134	137	No	9	1			
602	Ib (Ib =)	Measurement	240	148	Yes	9	2	CFC	CD	DD
			134	137	No	9	2			
603	Ic (Ic =)	Measurement	240	148	Yes	9	3	CFC	CD	DD
			134	137	No	9	3			
604	In (In =)	Measurement	240	147	Yes	3	1	CFC	CD	DD
			134	137	No	9	4			
605	I1 (positive sequence) (I1 =)	Measurement	-	-	-	-	-	CFC	CD	DD
606	I2 (negative sequence) (I2 =)	Measurement	-	-	-	-	-	CFC	CD	DD
621	Va (Va =)	Measurement	240	148	Yes	9	4	CFC	CD	DD
			134	137	No	9	5			
622	Vb (Vb =)	Measurement	240	148	Yes	9	5	CFC	CD	DD
			134	137	No	9	6			
623	Vc (Vc =)	Measurement	240	148	Yes	9	6	CFC	CD	DD
			134	137	No	9	7			
624	Va-b (Va-b=)	Measurement	134	137	No	9	8	CFC	CD	DD
625	Vb-c (Vb-c=)	Measurement	134	137	No	9	9	CFC	CD	DD
626	Vc-a (Vc-a=)	Measurement	134	137	No	9	10	CFC	CD	DD
627	VN (VN =)	Measurement	240	147	Yes	3	2	CFC	CD	DD
629	V1 (positive sequence) (V1 =)	Measurement	-	-	-	-	-	CFC	CD	DD
630	V2 (negative sequence) (V2 =)	Measurement	-	-	-	-	-	CFC	CD	DD
641	P (active power) (P =)	Measurement	240	148	Yes	9	7	CFC	CD	DD
			134	137	No	9	11			
642	Q (reactive power) (Q =)	Measurement	134	137	No	9	12	CFC	CD	DD
644	Frequency (Freq=)	Measurement	134	137	No	9	13	CFC	CD	DD
645	S (apparent power) (S =)	Measurement	-	-	-	-	-	CFC	CD	DD
831	3Io (zero sequence) (3Io =)	Measurement	-	-	-	-	-	CFC	CD	DD
832	Vo (zero sequence) (Vo =)	Measurement	-	-	-	-	-	CFC	CD	DD
833	I1 (positive sequence) Demand (I1 dmd=)	Demand meter	-	-	-	-	-	CFC	CD	DD
834	Active Power Demand (P dmd =)	Demand meter	-	-	-	-	-	CFC	CD	DD

No.	Description	Function	IEC 60870-5-103					Configurable in Matrix		
			Type	Information Number	Compatibility	Data Unit	Position	CFC	Control Display	Default Display
835	Reactive Power Demand (Q dmd =)	Demand meter	-	-	-	-	-	CFC	CD	DD
836	Apparent Power Demand (S dmd =)	Demand meter	-	-	-	-	-	CFC	CD	DD
837	I A Demand Minimum (IAdmdMin)	Min/Max meter	-	-	-	-	-	CFC	CD	DD
838	I A Demand Maximum (IAdmdMax)	Min/Max meter	-	-	-	-	-	CFC	CD	DD
839	I B Demand Minimum (IBdmdMin)	Min/Max meter	-	-	-	-	-	CFC	CD	DD
840	I B Demand Maximum (IBdmdMax)	Min/Max meter	-	-	-	-	-	CFC	CD	DD
841	I C Demand Minimum (ICdmdMin)	Min/Max meter	-	-	-	-	-	CFC	CD	DD
842	I C Demand Maximum (ICdmdMax)	Min/Max meter	-	-	-	-	-	CFC	CD	DD
843	I1 (positive sequence) Demand Minimum (I1dmdMin)	Min/Max meter	-	-	-	-	-	CFC	CD	DD
844	I1 (positive sequence) Demand Maximum (I1dmdMax)	Min/Max meter	-	-	-	-	-	CFC	CD	DD
845	Active Power Demand Minimum (PdMin=)	Min/Max meter	-	-	-	-	-	CFC	CD	DD
846	Active Power Demand Maximum (PdMax=)	Min/Max meter	-	-	-	-	-	CFC	CD	DD
847	Reactive Power Minimum (QdMin=)	Min/Max meter	-	-	-	-	-	CFC	CD	DD
848	Reactive Power Maximum (QdMax=)	Min/Max meter	-	-	-	-	-	CFC	CD	DD
849	Apparent Power Minimum (SdMin=)	Min/Max meter	-	-	-	-	-	CFC	CD	DD
850	Apparent Power Maximum (SdMax=)	Min/Max meter	-	-	-	-	-	CFC	CD	DD
851	Ia Min (Ia Min=)	Min/Max meter	-	-	-	-	-	CFC	CD	DD
852	Ia Max (Ia Max=)	Min/Max meter	-	-	-	-	-	CFC	CD	DD
853	Ib Min (Ib Min=)	Min/Max meter	-	-	-	-	-	CFC	CD	DD
854	Ib Max (Ib Max=)	Min/Max meter	-	-	-	-	-	CFC	CD	DD
855	Ic Min (Ic Min=)	Min/Max meter	-	-	-	-	-	CFC	CD	DD
856	Ic Max (Ic Max=)	Min/Max meter	-	-	-	-	-	CFC	CD	DD
857	I1 (positive sequence) Minimum (I1 Min=)	Min/Max meter	-	-	-	-	-	CFC	CD	DD
858	I1 (positive sequence) Maximum (I1 Max=)	Min/Max meter	-	-	-	-	-	CFC	CD	DD
859	Va-n Min (Va-nMin=)	Min/Max meter	-	-	-	-	-	CFC	CD	DD
860	Va-n Max (Va-nMax=)	Min/Max meter	-	-	-	-	-	CFC	CD	DD
861	Vb-n Min (Vb-nMin=)	Min/Max meter	-	-	-	-	-	CFC	CD	DD
862	Vb-n Max (Vb-nMax=)	Min/Max meter	-	-	-	-	-	CFC	CD	DD
863	Vc-n Min (Vc-nMin=)	Min/Max meter	-	-	-	-	-	CFC	CD	DD
864	Vc-n Max (Vc-nMax=)	Min/Max meter	-	-	-	-	-	CFC	CD	DD
865	Va-b Min (Va-bMin=)	Min/Max meter	-	-	-	-	-	CFC	CD	DD
867	Va-b Max (Va-bMax=)	Min/Max meter	-	-	-	-	-	CFC	CD	DD
868	Vb-c Min (Vb-cMin=)	Min/Max meter	-	-	-	-	-	CFC	CD	DD
869	Vb-c Max (Vb-cMax=)	Min/Max meter	-	-	-	-	-	CFC	CD	DD
870	Vc-a Min (Vc-aMin=)	Min/Max meter	-	-	-	-	-	CFC	CD	DD
871	Vc-a Max (Vc-aMax=)	Min/Max meter	-	-	-	-	-	CFC	CD	DD
872	V neutral Min (Vn Min =)	Min/Max meter	-	-	-	-	-	CFC	CD	DD
873	V neutral Max (Vn Max =)	Min/Max meter	-	-	-	-	-	CFC	CD	DD
874	V1 (positive sequence) Voltage Minimum (V1 Min =)	Min/Max meter	-	-	-	-	-	CFC	CD	DD
875	V1 (positive sequence) Voltage Maximum (V1 Max =)	Min/Max meter	-	-	-	-	-	CFC	CD	DD
876	Active Power Minimum (Pmin=)	Min/Max meter	-	-	-	-	-	CFC	CD	DD
877	Active Power Maximum (Pmax=)	Min/Max meter	-	-	-	-	-	CFC	CD	DD
878	Reactive Power Minimum (Qmin=)	Min/Max meter	-	-	-	-	-	CFC	CD	DD
879	Reactive Power Maximum (Qmax=)	Min/Max meter	-	-	-	-	-	CFC	CD	DD
880	Apparent Power Minimum (Smin=)	Min/Max meter	-	-	-	-	-	CFC	CD	DD
881	Apparent Power Maximum (Smax=)	Min/Max meter	-	-	-	-	-	CFC	CD	DD

No.	Description	Function	IEC 60870-5-103					Configurable in Matrix		
			Type	Information Number	Compatibility	Data Unit	Position	CFC	Control Display	Default Display
882	Frequency Minimum (fmin=)	Min/Max meter	-	-	-	-	-	CFC	CD	DD
883	Frequency Maximum (fmax=)	Min/Max meter	-	-	-	-	-	CFC	CD	DD
884	Power Factor Maximum (PF Max=)	Min/Max meter	-	-	-	-	-	CFC	CD	DD
885	Power Factor Minimum (PF Min=)	Min/Max meter	-	-	-	-	-	CFC	CD	DD
888	Pulsed Energy Wp (active) (Wp(puls))	Energy	133	55	No	205	-	CFC	CD	DD
889	Pulsed Energy Wq (reactive) (Wq(puls))	Energy	133	56	No	205	-	CFC	CD	DD
901	Power Factor (PF =)	Measurement	134	137	No	9	14	CFC	CD	DD
924	Wp Forward (WpForward)	Energy	133	51	No	205	-	CFC	CD	DD
925	Wq Forward (WqForward)	Energy	133	52	No	205	-	CFC	CD	DD
928	Wp Reverse (WpReverse)	Energy	133	53	No	205	-	CFC	CD	DD
929	Wq Reverse (WqReverse)	Energy	133	54	No	205	-	CFC	CD	DD
963	I A demand (Ia dmd=)	Demand meter	-	-	-	-	-	CFC	CD	DD
964	I B demand (Ib dmd=)	Demand meter	-	-	-	-	-	CFC	CD	DD
965	I C demand (Ic dmd=)	Demand meter	-	-	-	-	-	CFC	CD	DD
991	Pressure (Press =)	Measurement	-	-	-	-	-	CFC	CD	DD
992	Temperature (Temp =)	Measurement	-	-	-	-	-	CFC	CD	DD
996	Transducer 1 (Td1=)	Measurement	134	136	No	9	1	CFC	CD	DD
997	Transducer 2 (Td2=)	Measurement	134	136	No	9	2	CFC	CD	DD
1068	Temperature of RTD 1 (Θ RTD 1 =)	Measurement	134	146	No	9	1	CFC	CD	DD
1069	Temperature of RTD 2 (Θ RTD 2 =)	Measurement	134	146	No	9	2	CFC	CD	DD
1070	Temperature of RTD 3 (Θ RTD 3 =)	Measurement	134	146	No	9	3	CFC	CD	DD
1071	Temperature of RTD 4 (Θ RTD 4 =)	Measurement	134	146	No	9	4	CFC	CD	DD
1072	Temperature of RTD 5 (Θ RTD 5 =)	Measurement	134	146	No	9	5	CFC	CD	DD
1073	Temperature of RTD 6 (Θ RTD 6 =)	Measurement	134	146	No	9	6	CFC	CD	DD
1074	Temperature of RTD 7 (Θ RTD 7 =)	Measurement	134	146	No	9	7	CFC	CD	DD
1075	Temperature of RTD 8 (Θ RTD 8 =)	Measurement	134	146	No	9	8	CFC	CD	DD
1076	Temperature of RTD 9 (Θ RTD 9 =)	Measurement	134	146	No	9	9	CFC	CD	DD
1077	Temperature of RTD10 (Θ RTD10 =)	Measurement	134	146	No	9	10	CFC	CD	DD
1078	Temperature of RTD11 (Θ RTD11 =)	Measurement	134	146	No	9	11	CFC	CD	DD
1079	Temperature of RTD12 (Θ RTD12 =)	Measurement	134	146	No	9	12	CFC	CD	DD

■

Literature

/1/ SIPROTEC 4 System Description; E50417-H1176-C151-A5

/2/ SIPROTEC DIGSI, Start UP; E50417-G1176-C152-A2

/3/ DIGSI CFC, Manual; E50417-H1176-C098-A5

/4/ SIPROTEC SIGRA 4, Manual; E50417-H1176-C070-A3

Glossary

Battery — The buffer battery ensures that specified data areas, flags, timers and counters are retained retentively.

Bay controllers — Bay controllers are devices with control and monitoring functions without protective functions.

Bit pattern indication — Bit pattern indication is a processing function by means of which items of digital process information applying across several inputs can be detected together in parallel and processed further. The bit pattern length can be specified as 1, 2, 3 or 4 bytes.

BP_xx — → Bit pattern indication (Bitstring Of x Bit), x designates the length in bits (8, 16, 24 or 32 bits).

C_xx — Command without feedback

CF_xx — Command with feedback

CFC — Continuous Function Chart. CFC is a graphics editor with which a program can be created and configured by using ready-made blocks.

CFC blocks — Blocks are parts of the user program delimited by their function, their structure or their purpose.

Chatter blocking — A rapidly intermittent input (for example, due to a relay contact fault) is switched off after a configurable monitoring time and can thus not generate any further signal changes. The function prevents overloading of the system when a fault arises.

Combination devices — Combination devices are bay devices with protection functions and a control display.

Combination matrix — DIGSI V4.6 and higher allows up to 32 compatible SIPROTEC 4 devices to communicate with each other in an inter-relay communication network (IRC). The combination matrix defines which devices exchange which information.

Communication branch — A communications branch corresponds to the configuration of 1 to n users which communicate by means of a common bus.

Communication reference CR — The communication reference describes the type and version of a station in communication by PROFIBUS.

Component view In addition to a topological view, SIMATIC Manager offers you a component view. The component view does not offer any overview of the hierarchy of a project. It does, however, provide an overview of all the SIPROTEC 4 devices within a project.

COMTRADE Common Format for Transient Data Exchange, format for fault records.

Container If an object can contain other objects, it is called a container. The object Folder is an example of such a container.

Control display The display which is displayed on devices with a large (graphic) display after you have pressed the control key is called the control display. It contains the switchgear that can be controlled in the feeder with status display. It is used to perform switching operations. Defining this diagram is part of the configuration.

Data pane → The right-hand area of the project window displays the contents of the area selected in the → navigation window, for example indications, measured values, etc. of the information lists or the function selection for the device configuration.

DCF77 The extremely precise official time is determined in Germany by the "Physikalisch-Technischen-Bundesanstalt PTB" in Braunschweig. The atomic clock unit of the PTB transmits this time via the long-wave time-signal transmitter in Mainflingen near Frankfurt/Main. The emitted time signal can be received within a radius of approx. 1,500 km from Frankfurt/Main.

Device container In the Component View, all SIPROTEC 4 devices are assigned to an object of type Device container. This object is a special object of DIGSI Manager. However, since there is no component view in DIGSI Manager, this object only becomes visible in conjunction with STEP 7.

Double command Double commands are process outputs which indicate 4 process states at 2 outputs: 2 defined (for example ON/OFF) and 2 undefined states (for example intermediate positions)

Double-point indication Double-point indications are items of process information which indicate 4 process states at 2 inputs: 2 defined (for example ON/OFF) and 2 undefined states (for example intermediate positions).

DP → Double-point indication

DP_I → Double point indication, intermediate position 00

Drag-and-drop Copying, moving and linking function, used at graphics user interfaces. Objects are selected with the mouse, held and moved from one data area to another.

Electromagnetic compatibility Electromagnetic compatibility (EMC) is the ability of an electrical apparatus to function fault-free in a specified environment without influencing the environment unduly.

EMC → Electromagnetic compatibility

ESD protection	ESD protection is the total of all the means and measures used to protect electrostatic sensitive devices.
ExBPxx	External bit pattern indication via an ETHERNET connection, device-specific → Bit pattern indication
ExC	External command without feedback via an ETHERNET connection, device-specific
ExCF	External command with feedback via an ETHERNET connection, device-specific
ExDP	External double point indication via an ETHERNET connection, device-specific → Double-point indication
ExDP_I	External double point indication via an ETHERNET connection, intermediate position 00, device-specific → Double-point indication
ExMV	External metered value via an ETHERNET connection, device-specific
ExSI	External single point indication via an ETHERNET connection, device-specific → Single point indication
ExSI_F	External single point indication via an ETHERNET connection, device-specific → Transient information, → Single point indication
Field devices	Generic term for all devices assigned to the field level: Protection devices, combination devices, bay controllers.
Floating	→ Without electrical connection to the → ground.
FMS communication branch	Within an FMS communication branch the users communicate on the basis of the PROFIBUS FMS protocol via a PROFIBUS FMS network.
Folder	This object type is used to create the hierarchical structure of a project.
General interrogation (GI)	During the system start-up the state of all the process inputs, of the status and of the fault image is sampled. This information is used to update the system-end process image. The current process state can also be sampled after a data loss by means of a GI.
GPS	Global Positioning System. Satellites with atomic clocks on board orbit the earth twice a day in different parts in approx. 20,000 km. They transmit signals which also contain the GPS universal time. The GPS receiver determines its own position from the signals received. From its position it can derive the running time of a satellite and thus correct the transmitted GPS universal time.

GOOSE message GOOSE messages (Generic Object Oriented Substation Event) according to IEC 61850 are data packets which are cyclic transferred event-controlled via the Ethernet communication system. They serve for direct information exchange among the relays. This mechanism implements cross-communication between bay units.

Ground The conductive ground whose electric potential can be set equal to zero at every point. In the area of ground electrodes the ground can have a potential deviating from zero. The term "Ground reference plane" is often used for this state.

Grounding Grounding means that a conductive part is to connect via an grounding system to the → ground.

Grounding Grounding is the total of all means and measured used for grounding.

Hierarchy level Within a structure with higher-level and lower-level objects a hierarchy level is a container of equivalent objects.

HV field description The HV project description file contains details of fields which exist in a ModPara-project. The actual field information of each field is memorized in a HV field description file. Within the HV project description file, each field is allocated such a HV field description file by a reference to the file name.

HV project description All the data is exported once the configuration and parameterisation of PCUs and sub-modules using ModPara has been completed. This data is split up into several files. One file contains details about the fundamental project structure. This also includes, for example, information detailing which fields exist in this project. This file is called a HV project description file.

ID Internal double point indication → Double-point indication

ID_S Internal double point indication intermediate position 00, → Double-point indication

IEC International Electrotechnical Commission

IEC address Within an IEC bus a unique IEC address has to be assigned to each SIPROTEC 4 device. A total of 254 IEC addresses are available for each IEC bus.

IEC communication branch Within an IEC communication branch the users communicate on the basis of the IEC60-870-5-103 protocol via an IEC bus.

Initialization string An initialization string comprises a range of modem-specific commands. These are transmitted to the modem within the framework of modem initialization. The commands can, for example, force specific settings for the modem.

Inter relay communication → IRC combination

IRC combination Inter Relay Communication, IRC, is used for directly exchanging process information between SIPROTEC 4 devices. You require an object of type IRC combination to configure an Inter Relay Communication. Each user of the combination and all the necessary communication parameters are defined in this object. The type and scope of the information exchanged among the users is also stored in this object.

IRIG-B Time signal code of the Inter-Range Instrumentation Group

IS Internal single point indication → Single point indication

IS_F Single-point indication fleeting → Transient information, → Single point indication

ISO 9001 The ISO 9000 ff range of standards defines measures used to ensure the quality of a product from the development stage to the manufacturing stage.

Link address The link address gives the address of a V3/V2 device.

List view The right pane of the project window displays the names and icons of objects which represent the contents of a container selected in the tree view. Because they are displayed in the form of a list, this area is called the list view.

LV Limit value

LVU Limit value, user-defined

Master Masters may send data to other users and request data from other users. DIGSI operates as a master.

Metered value Metered values are a processing function with which the total number of discrete similar events (counting pulses) is determined for a period, usually as an integrated value. In power supply companies the electrical work is usually recorded as a metered value (energy purchase/supply, energy transportation).

MLFB number MLFB is the abbreviation for "MaschinenLesbare FabrikateBezeichnung" (machine-readable product designation). This is the equivalent of an order number. The type and version of a SIPROTEC 4 device are coded in the order number.

Modem connection This object type contains information on both partners of a modem connection, the local modem and the remote modem.

Modem profile A modem profile consists of the name of the profile, a modem driver and may also comprise several initialization commands and a user address. You can create several modem profiles for one physical modem. To do so you need to link various initialization commands or user addresses to a modem driver and its properties and save them under different names.

Modems Modem profiles for a modem connection are saved in this object type.

MV	Measured value
MVMV	Metered value which is formed from the measured value
MVT	Measured value with time
MVU	Measured value, user-defined
Navigation pane	The left pane of the project window displays the names and symbols of all containers of a project in the form of a folder tree.
Object	Each element of a project structure is called an object in DIGSI.
Object properties	Each object has properties. These might be general properties that are common to several objects. An object can also have specific properties.
Off-line	In Off-line mode a link with the SIPROTEC 4 device is not necessary. You work with data which are stored in files.
OI_F	Output indication fleeting → Transient information
On-line	When working in On-line mode, there is a physical link to a SIPROTEC 4 device which can be implemented in various ways. This link can be implemented as a direct connection, as a modem connection or as a PROFIBUS FMS connection.
OUT	Output indication
Parameter set	The parameter set is the set of all parameters that can be set for a SIPROTEC 4 device.
Phone book	User addresses for a modem connection are saved in this object type.
PMV	Pulse metered value
Process bus	It is possible a direct communication with the SICAM HV-modules with devices featuring a process bus interface. The process bus interface is equipped with an Ethernet module.
PROFIBUS	PROcess FIeld BUS, the German process and field bus standard, as specified in the standard EN 50170, Volume 2, PROFIBUS. It defines the functional, electrical, and mechanical properties for a bit-serial field bus.
PROFIBUS address	Within a PROFIBUS network a unique PROFIBUS address has to be assigned to each SIPROTEC 4 device. A total of 254 PROFIBUS addresses are available for each PROFIBUS network.

Project Content-wise, a project is the image of a real power supply system. Graphically, a project is represented by a number of objects which are integrated in a hierarchical structure. Physically, a project consists of a series of folders and files containing project data.

Protection devices All devices with a protective function and no control display.

Reorganizing Frequent addition and deletion of objects gives rise to memory areas that can no longer be used. By cleaning up projects, you can release these memory areas again. However, a clean up also reassigns the VD addresses. The consequence of that is that all SIPROTEC 4 devices have to be reinitialised.

RIO file Relay data Interchange format by Omicron.

RSxxx-interface Serial interfaces RS232, RS422/485

SCADA Interface Rear serial interface on the devices for connecting to a control system via IEC or PROFIBUS.

Service port Rear serial interface on the devices for connecting DIGSI (for example, via modem).

Setting parameters General term for all adjustments made to the device. Parameterization jobs are executed by means of DIGSI or, in some cases, directly on the device.

SI → Single point indication

SI_F → Single-point indication fleeting → Transient information, → Single point indication

SICAM SAS Modularly structured station control system, based on the substation controller → SICAM SC and the SICAM WinCC operator control and monitoring system.

SICAM SC Substation Controller. Modularly structured substation control system, based on the SIMATIC M7 automation system.

SICAM WinCC The SICAM WinCC operator control and monitoring system displays the state of your network graphically, visualizes alarms, interrupts and indications, archives the network data, offers the possibility of intervening manually in the process and manages the system rights of the individual employee.

Single command Single commands are process outputs which indicate 2 process states (for example, ON/OFF) at one output.

Single point indication Single indications are items of process information which indicate 2 process states (for example, ON/OFF) at one output.

SIPROTEC The registered trademark SIPROTEC is used for devices implemented on system base V4.

SIPROTEC 4 device	This object type represents a real SIPROTEC 4 device with all the setting values and process data it contains.
SIPROTEC 4 variant	This object type represents a variant of an object of type SIPROTEC 4 device. The device data of this variant may well differ from the device data of the source object. However, all variants derived from the source object have the same VD address as the source object. For this reason they always correspond to the same real SIPROTEC 4 device as the source object. Objects of type SIPROTEC 4 variant have a variety of uses, such as documenting different operating states when entering parameter settings of a SIPROTEC 4 device.
Slave	A slave may only exchange data with a master after being prompted to do so by the master. SIPROTEC 4 devices operate as slaves.
Time stamp	Time stamp is the assignment of the real time to a process event.
Topological view	DIGSI Manager always displays a project in the topological view. This shows the hierarchical structure of a project with all available objects.
Transformer Tap Indication	Transformer tap indication is a processing function on the DI by means of which the tap of the transformer tap changer can be detected together in parallel and processed further.
Transient information	A transient information is a brief transient → single-point indication at which only the coming of the process signal is detected and processed immediately.
Tree view	The left pane of the project window displays the names and symbols of all containers of a project in the form of a folder tree. This area is called the tree view.
TxTap	→ Transformer Tap Indication
User address	A user address comprises the name of the station, the national code, the area code and the user-specific phone number.
Users	DIGSI V4.6 and higher allows up to 32 compatible SIPROTEC 4 devices to communicate with each other in an inter-relay communication network. The individual participating devices are called users.
VD	A VD (Virtual Device) includes all communication objects and their properties and states that are used by a communication user through services. A VD can be a physical device, a module of a device or a software module.
VD address	The VD address is assigned automatically by DIGSI Manager. It exists only once in the entire project and thus serves to identify unambiguously a real SIPROTEC 4 device. The VD address assigned by DIGSI Manager must be transferred to the SIPROTEC 4 device in order to allow communication with DIGSI Device Editor.
VFD	A VFD (Virtual Field Device) includes all communication objects and their properties and states that are used by a communication user through services.

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