MiCOM C232

Compact Bay Unit for Control and Monitoring with Protection Functions

Version -302-401/402/403/404-603

Technical Manual

C232/EN M/A23

Volume 1.2

3.18 Limit Value Monitoring (Function Group LIMIT)

Disabling or enabling limit value monitoring

Limit value monitoring can be disabled or enabled from the integrated local control panel.

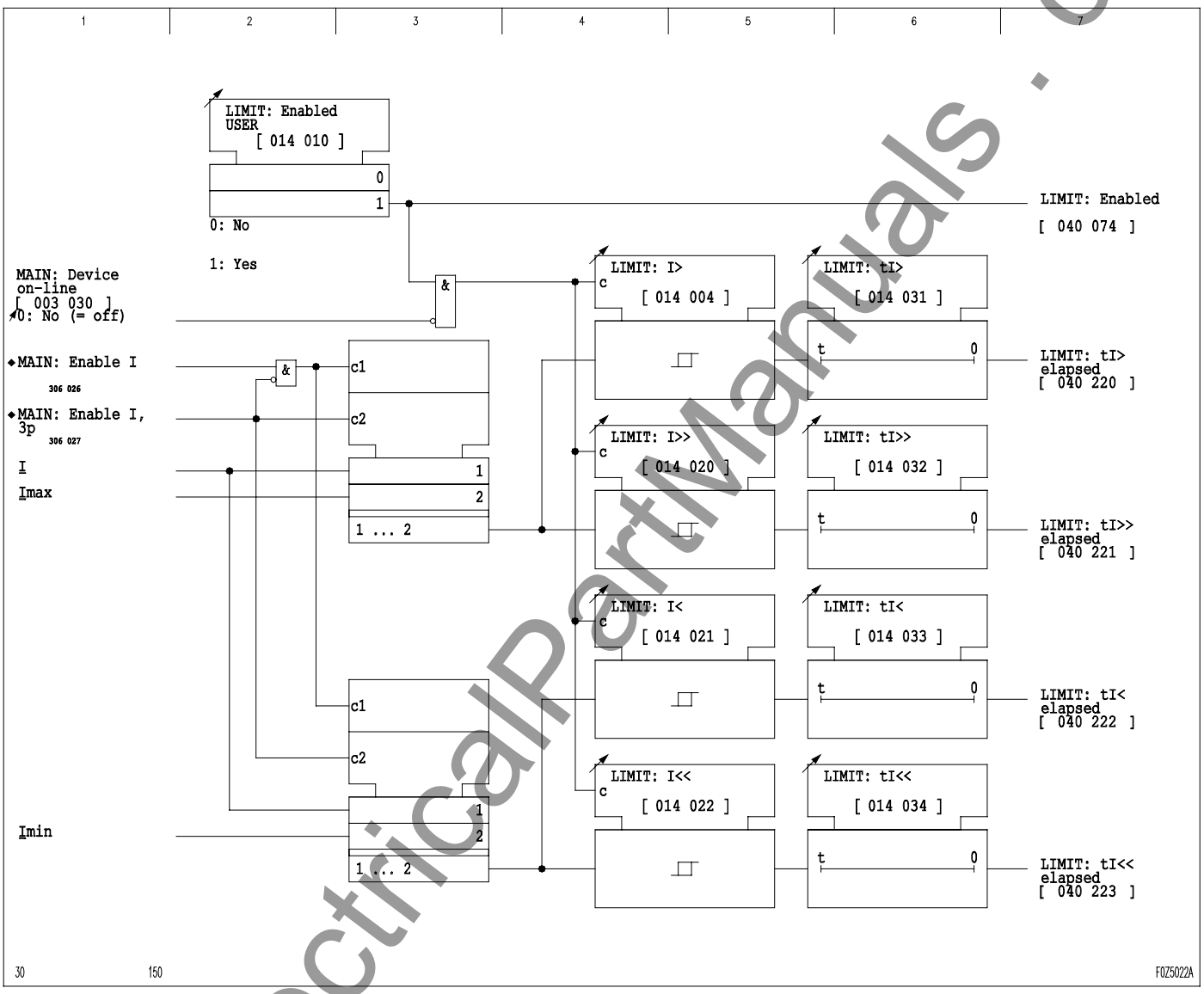
Monitoring phase currents and phase voltages

The C232 offers the possibility of monitoring the following measured values to determine if they exceed a set upper limit value or fall below a set lower limit value:

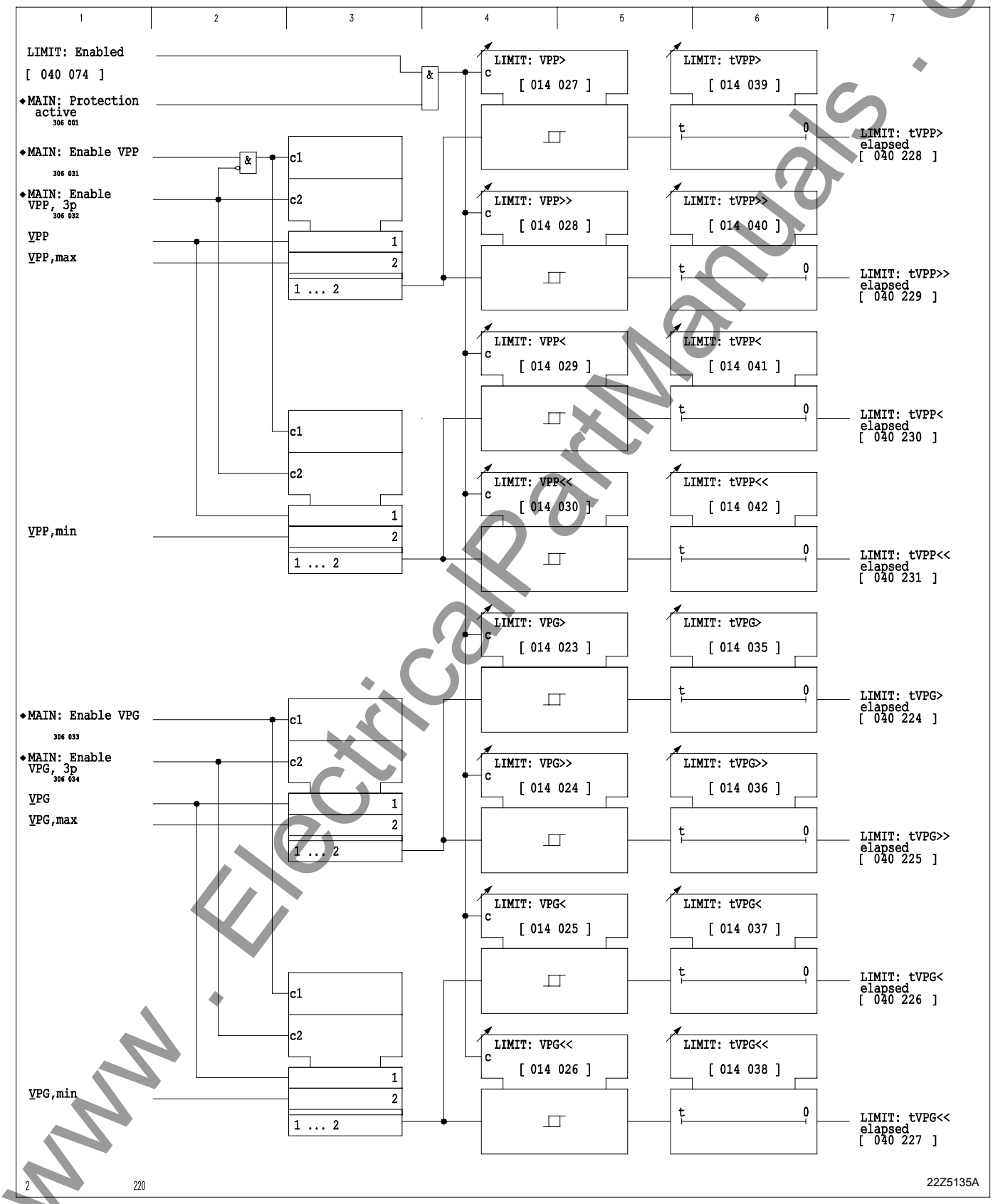
- □ Maximum phase current
- □ Minimum phase current
- □ Maximum phase-to-phase voltage
- □ Minimum phase-to-phase voltage
- □ Maximum phase-to-ground voltage
- □ Minimum phase-to-ground voltage

If one of the measured values exceeds or falls below one of the set upper or lower limit values, respectively, then a signal is issued once a set time period has elapsed.

If only one voltage transformer is fitted, the C232 needs to be informed via the setting MAIN: M.v.asg. bay/station which voltage (phase-to-ground or phase-to-phase voltage) is connected. Depending on this setting, the triggers for the monitoring of the phase-to-ground or phase-to-phase voltages are enabled. If three current or voltage transformers are fitted then either the variables of one three-phase system can be monitored or, alternatively, single-pole monitoring of the current or voltage of different transformers is possible.



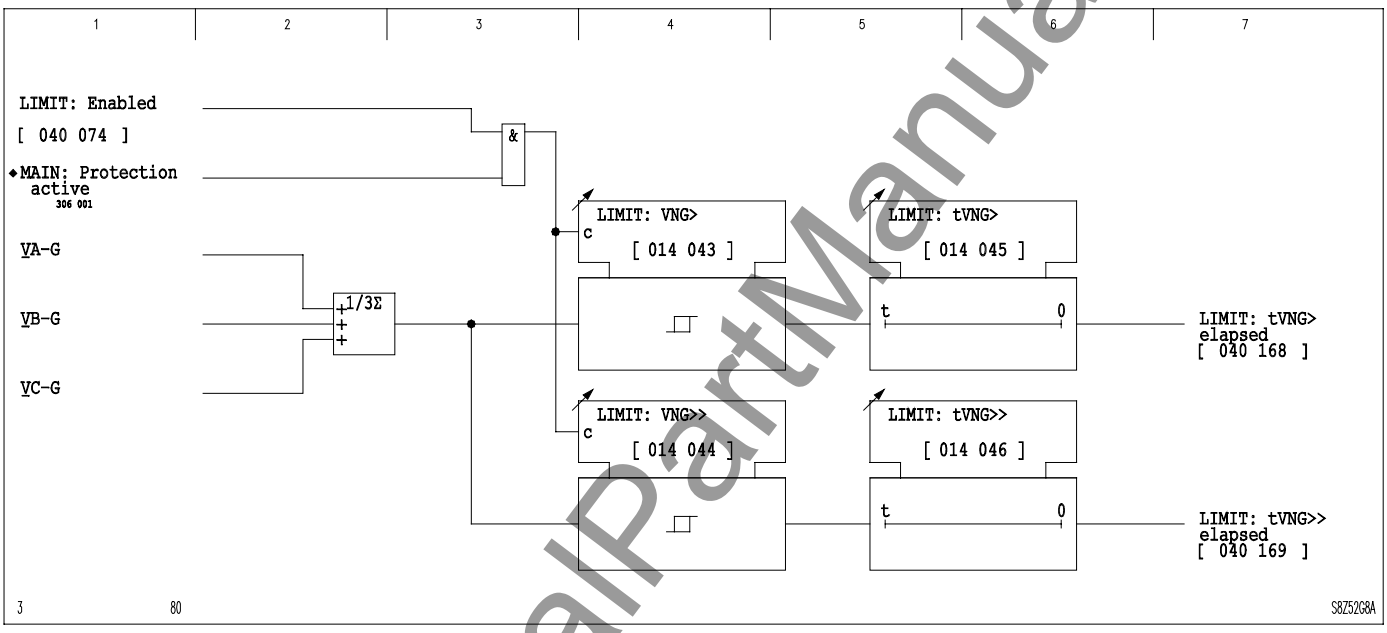
3-93 Limit value monitoring of minimum and maximum phase current



3-94 Limit value monitoring of maximum and minimum phase-to-phase voltage and maximum and minimum phase-to-ground voltage

Monitoring the neutral-displacement voltage

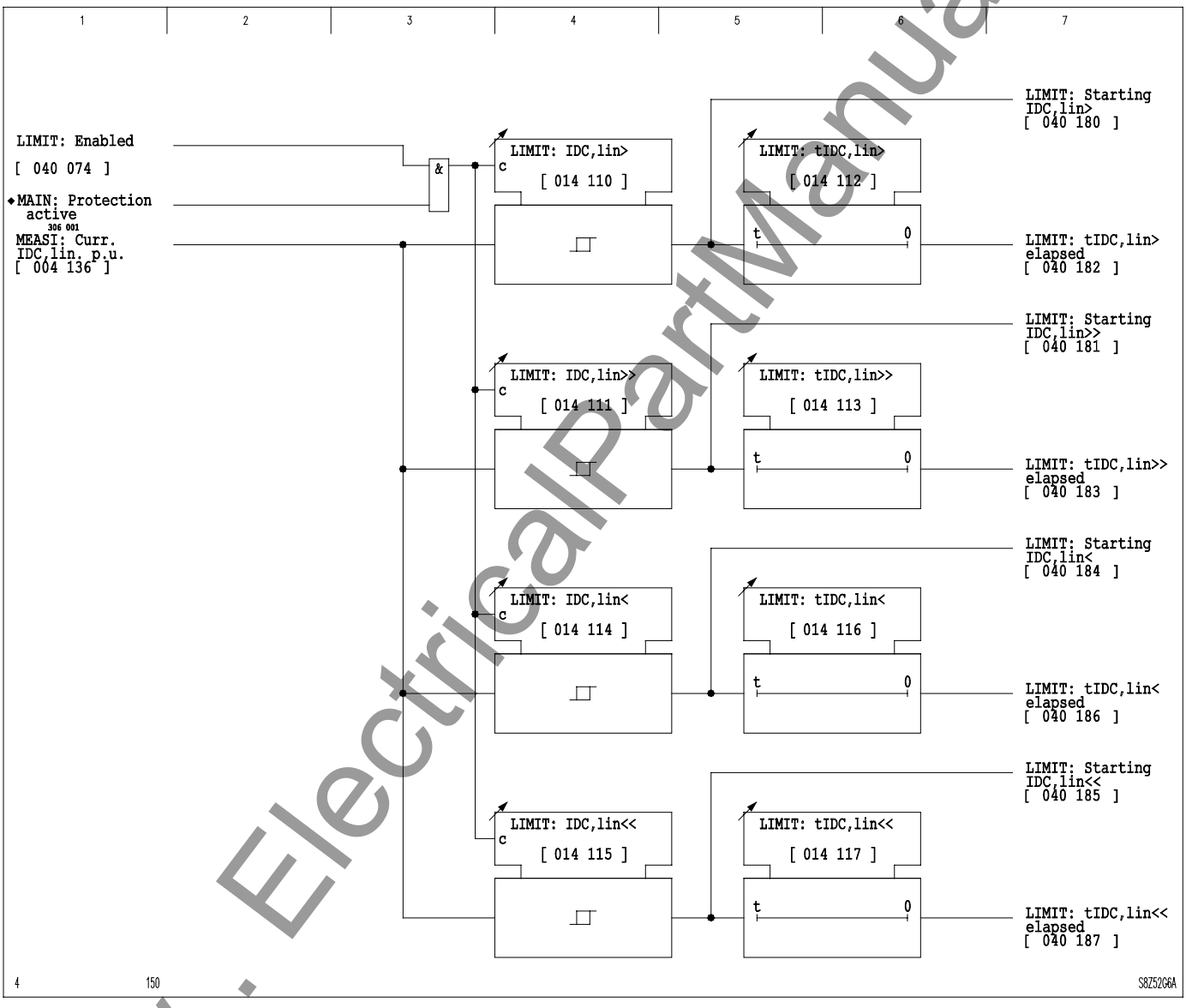
The neutral-displacement voltage calculated from the three phase-to-ground voltages is monitored by two stages to determine whether it exceeds set thresholds. If the thresholds are exceeded, a signal is issued after the set timer stage has elapsed.



3-95 Monitoring the neutral-displacement voltage

Monitoring the linearized measured DC values

The direct current that is linearized by analog measured data input is monitored by two stages to determine if it exceeds or falls below set thresholds. If it exceeds or falls below the thresholds, a signal is issued once a set time period has elapsed.



3-96 Monitoring the linearized direct current

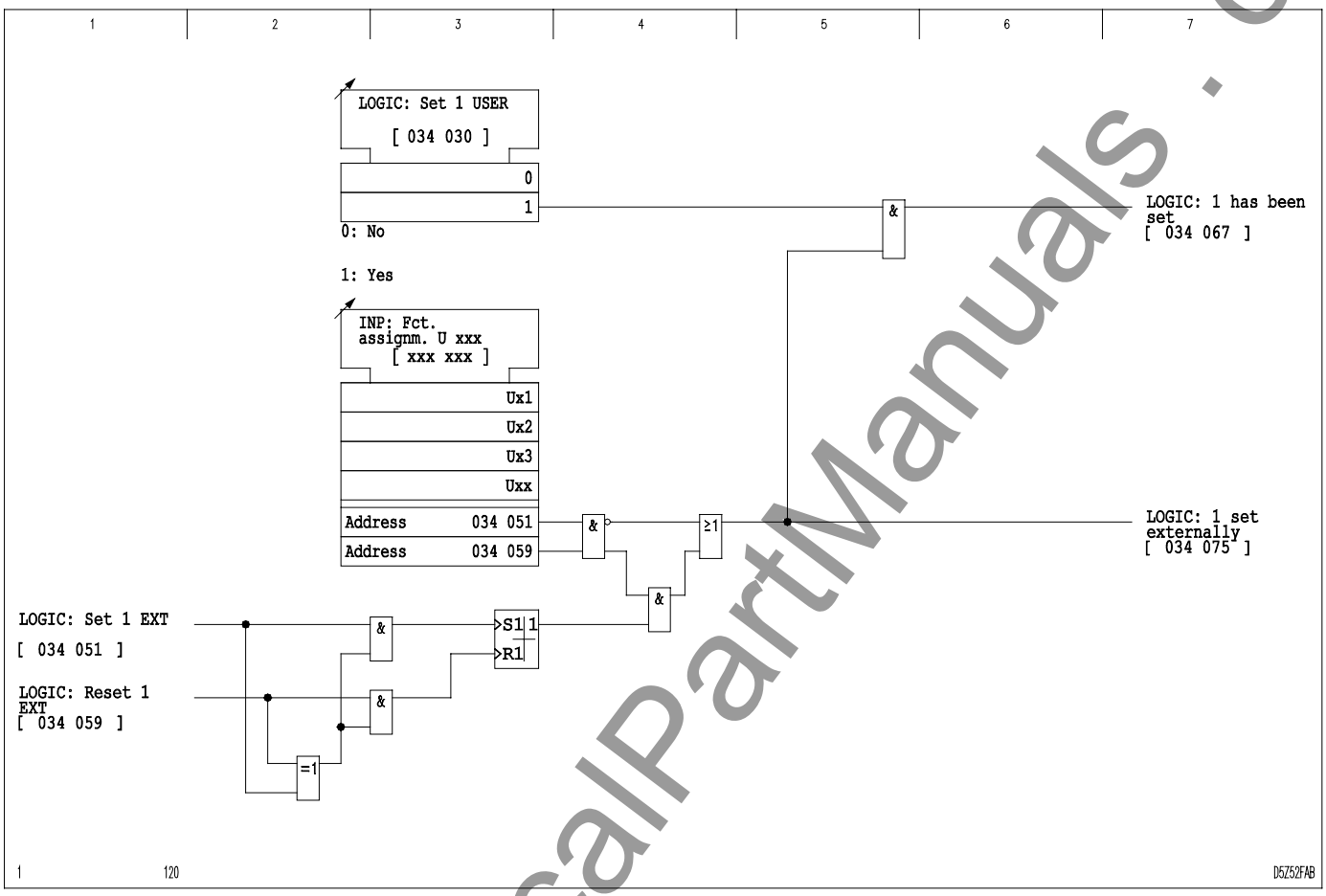
3.19 Programmable Logic (Function Group LOGIC)

Programmable (or user-configurable) logic enables the user to link binary signals within a framework of Boolean equations.

Binary signals in the C232 can be linked by logical 'OR' or 'AND' operations or by additional 'NOT' operations by setting LOGIC: Fct. assignm. outp. n, where n = 1 to 32. The Boolean equations need to be defined without the use of brackets. The following rule applies to the operators: 'NOT' before 'AND' before 'OR'.

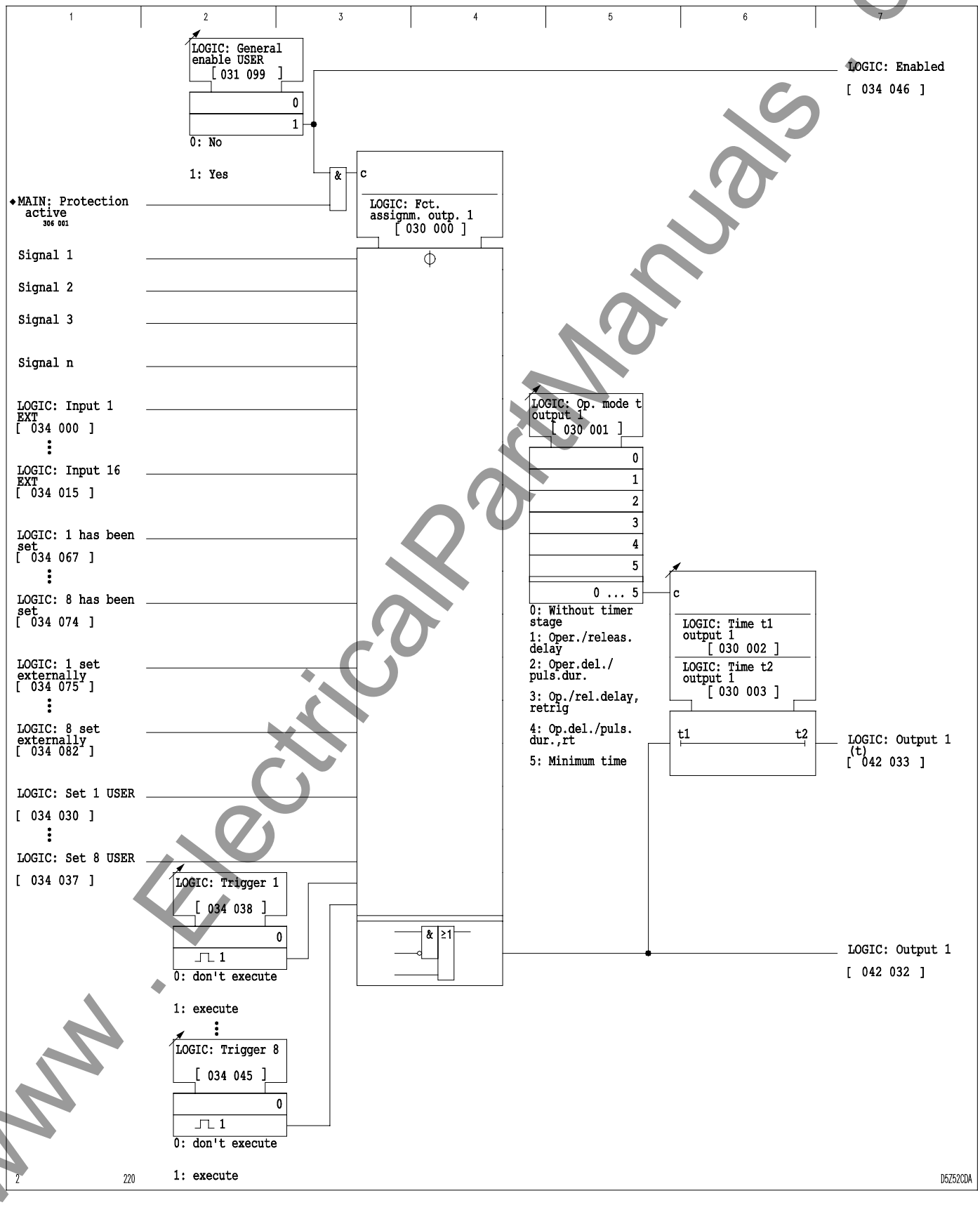
A maximum of 32 elements can be processed in one Boolean equation. In addition to the signals generated by the C232, initial conditions for governing the equations can be set from the local control panel, through binary signal inputs, or through the serial interfaces.

Logical operations can be controlled through the binary signal inputs in different ways. The binary input signals LOGIC: Input n EXT (n = 1 to 16) have an updating function, whereas the input signals LOGIC: Set n EXT (n = 1 to 8) are stored. The logic can only be controlled from the binary signal inputs that are configured for LOGIC: Set n EXT if the corresponding reset input (LOGIC: Reset n EXT) has also been configured for a binary signal input. If only one or neither of the two functions is configured, then this is interpreted as 'Logic externally set'. If the input signals of the two binary signal inputs are implausible (such as when they both have a logic value of '1'), then the last plausible state remains stored in memory.



3-97 Control of logic operations via setting parameters or stored input signals

The LOGIC: Trigger n signal is a ‘triggering function’ that causes a 100 ms pulse to be issued.

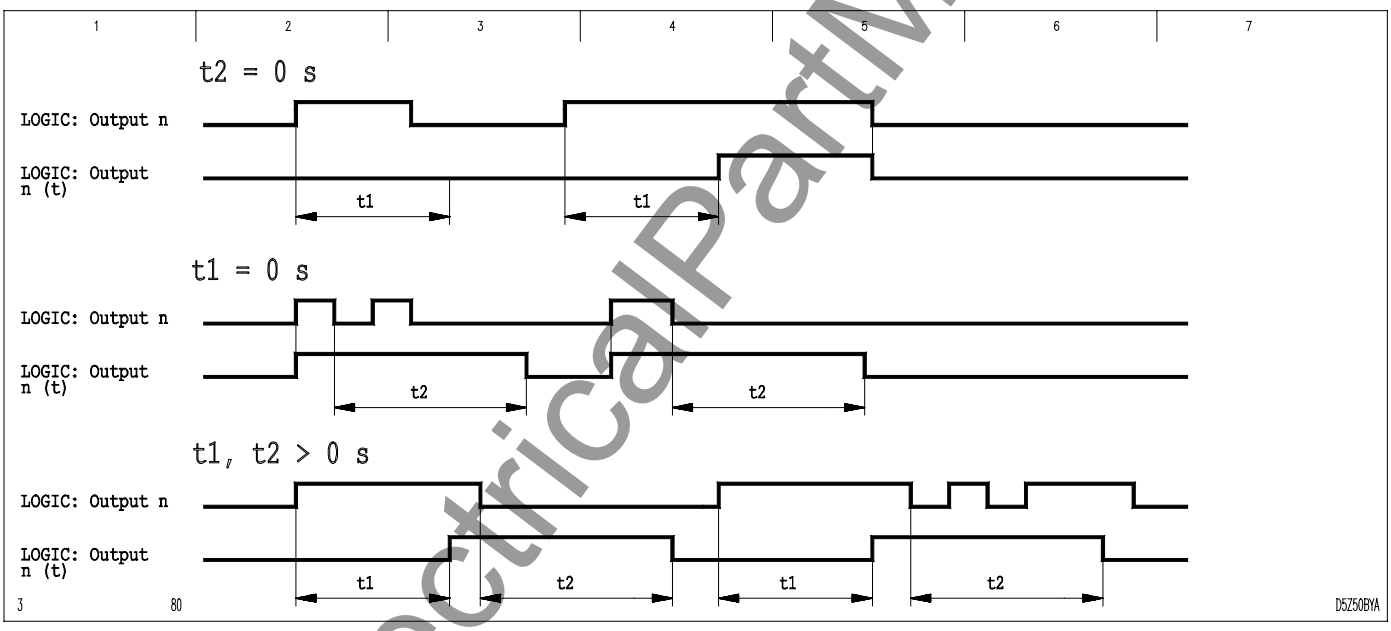


3-98 Setting options for programmable logic (shown here for output 1)

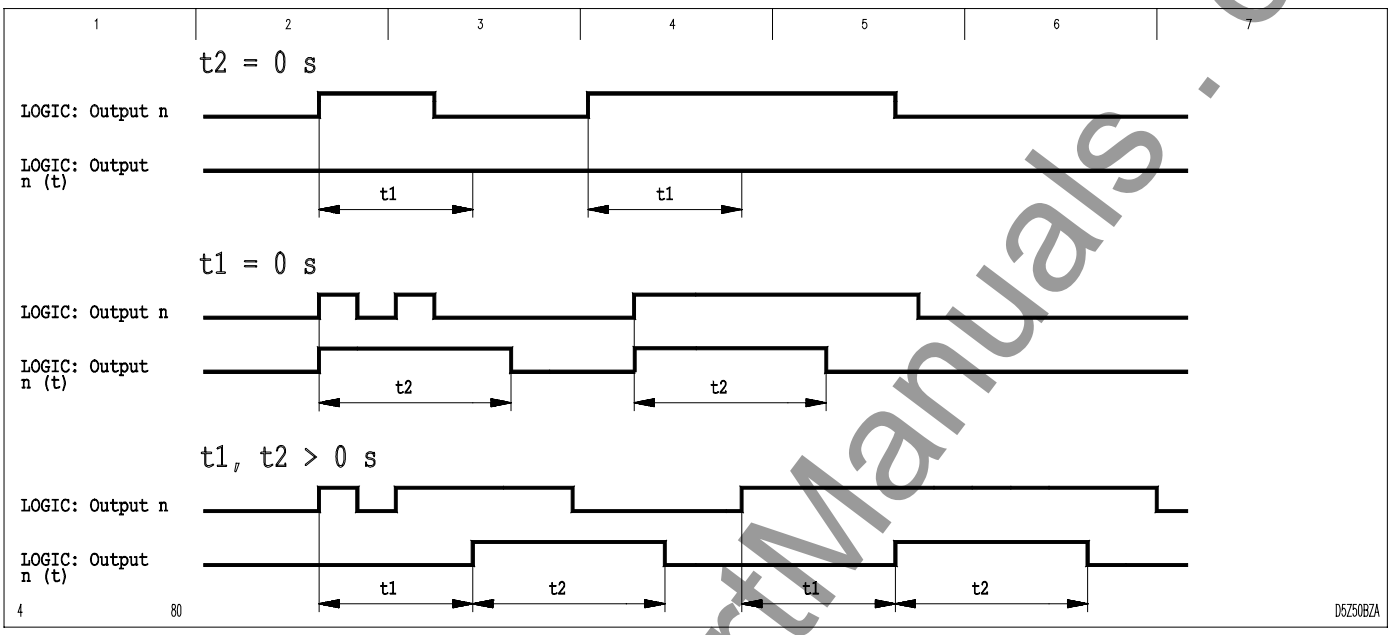
The output signal of one equation can be processed as the input signal for another higher-order equation, and this makes it possible to have a sequence of interlinked Boolean equations. The equations are processed in the sequence defined by the order of each equation so that the end result of a sequence of interlinked Boolean equations is given by the highest-order equation.

The output signal of each equation is fed to a separate timer stage that has two timer elements and a choice of operating modes. This offers the possibility of assigning a freely configurable time characteristic to the output signal of each Boolean equation. In the *Minimum time* operating mode, the setting of timer stage t2 has no effect. Figures 3-99 to 3-103 show the time characteristics for the various timer stage operating modes.

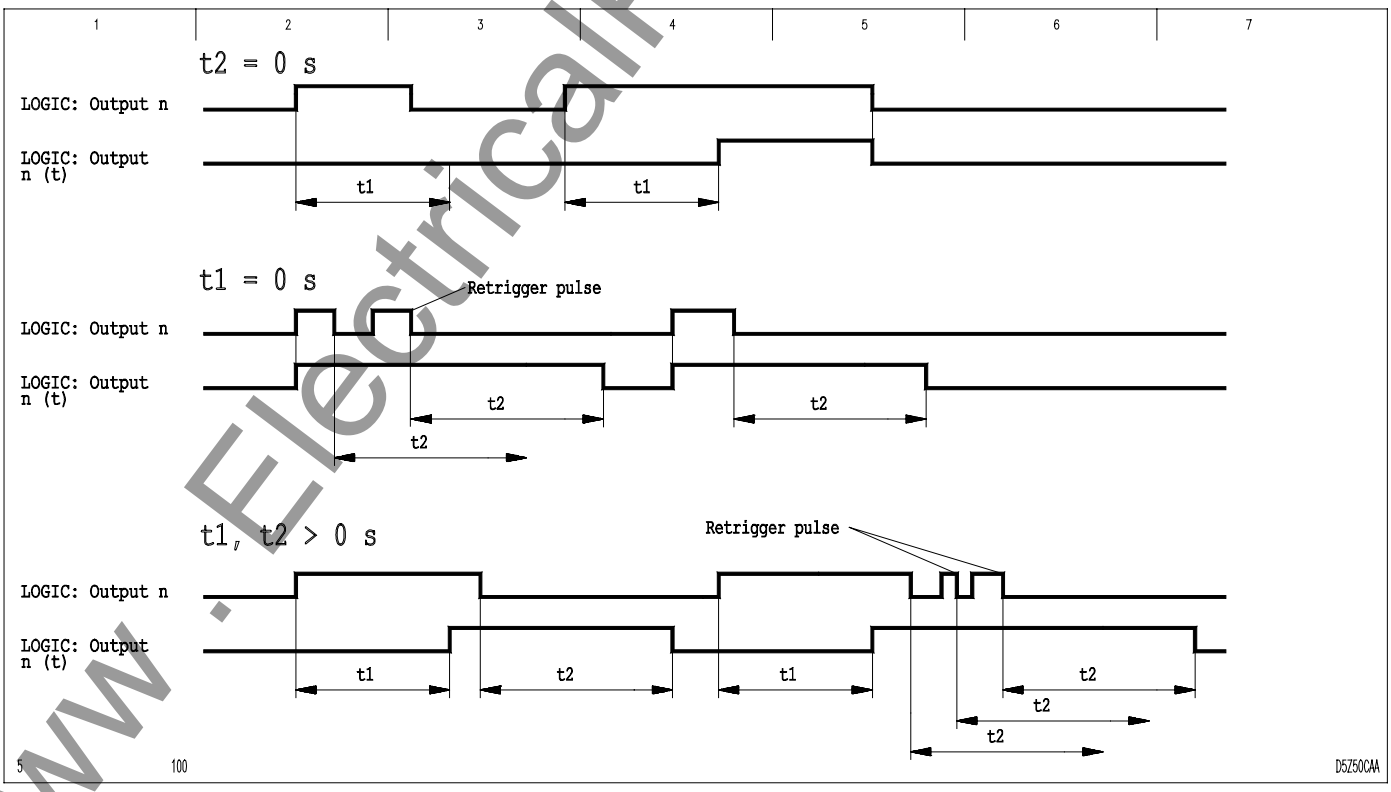
Note: If the unit is set to “off-line“, the equations are not processed and all outputs are set to a logic value of '0'.



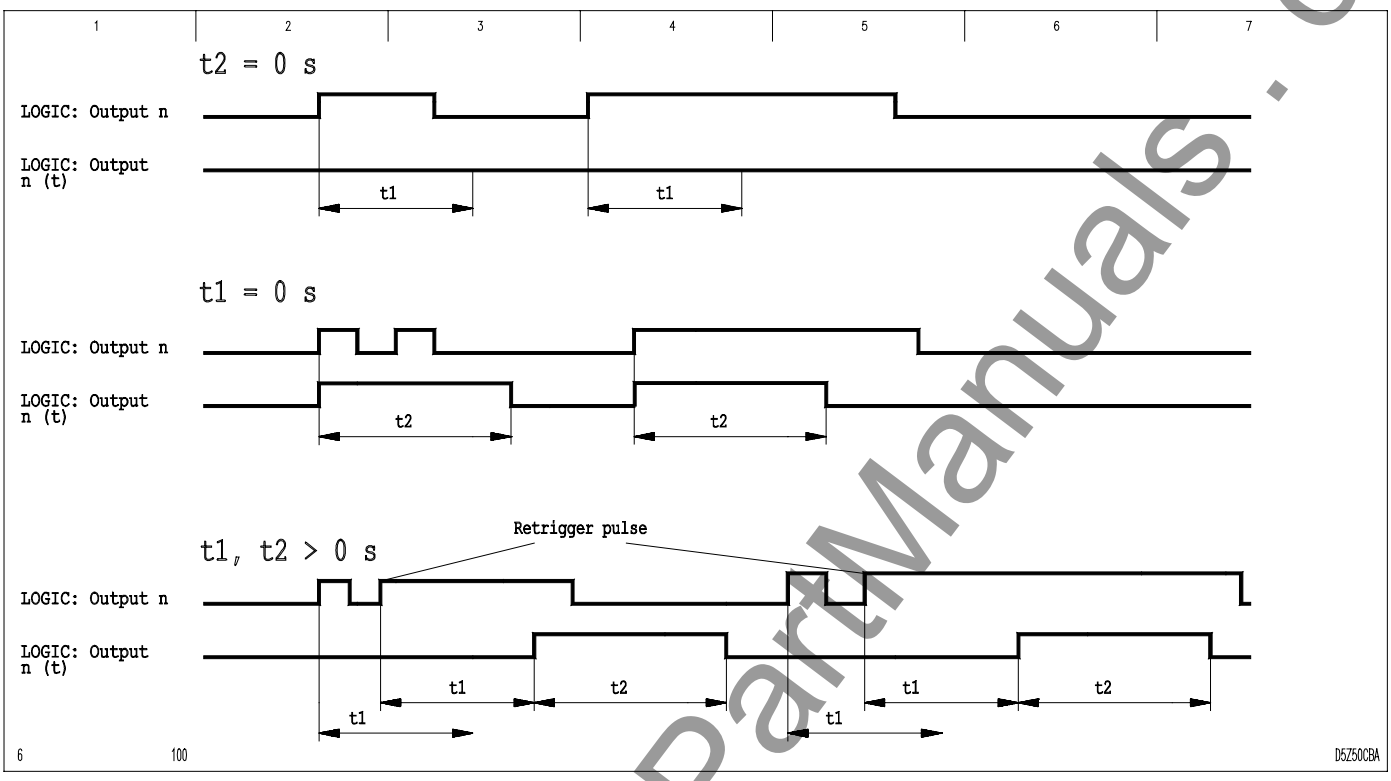
3-99 Operating mode 1: Operate/release delay



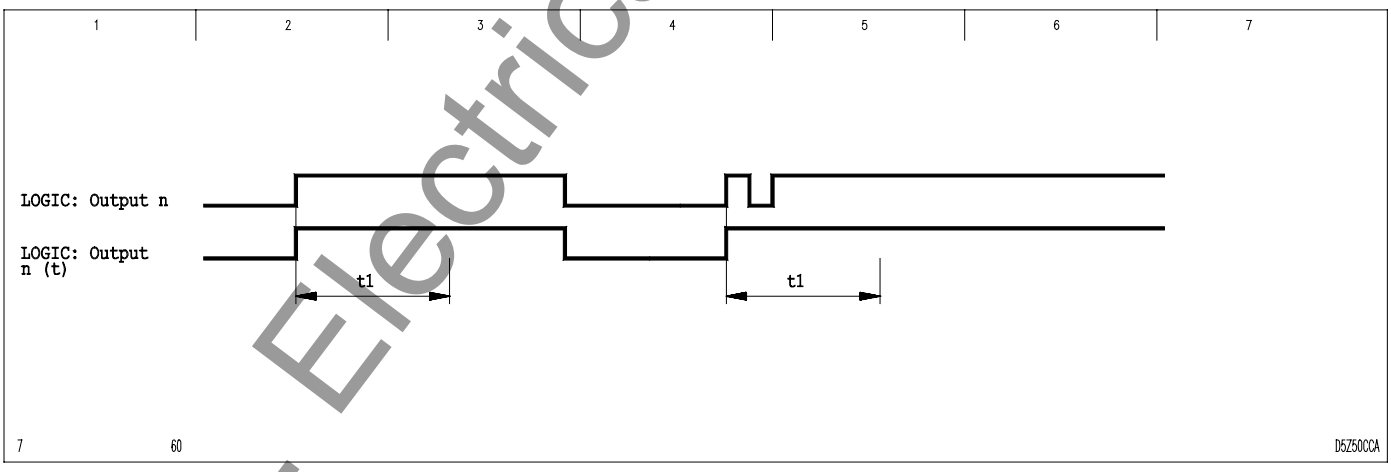
3-100 Operating mode 2: Operate-delay/pulse duration



3-101 Operating mode 3: Operate/release delay, retriggerable

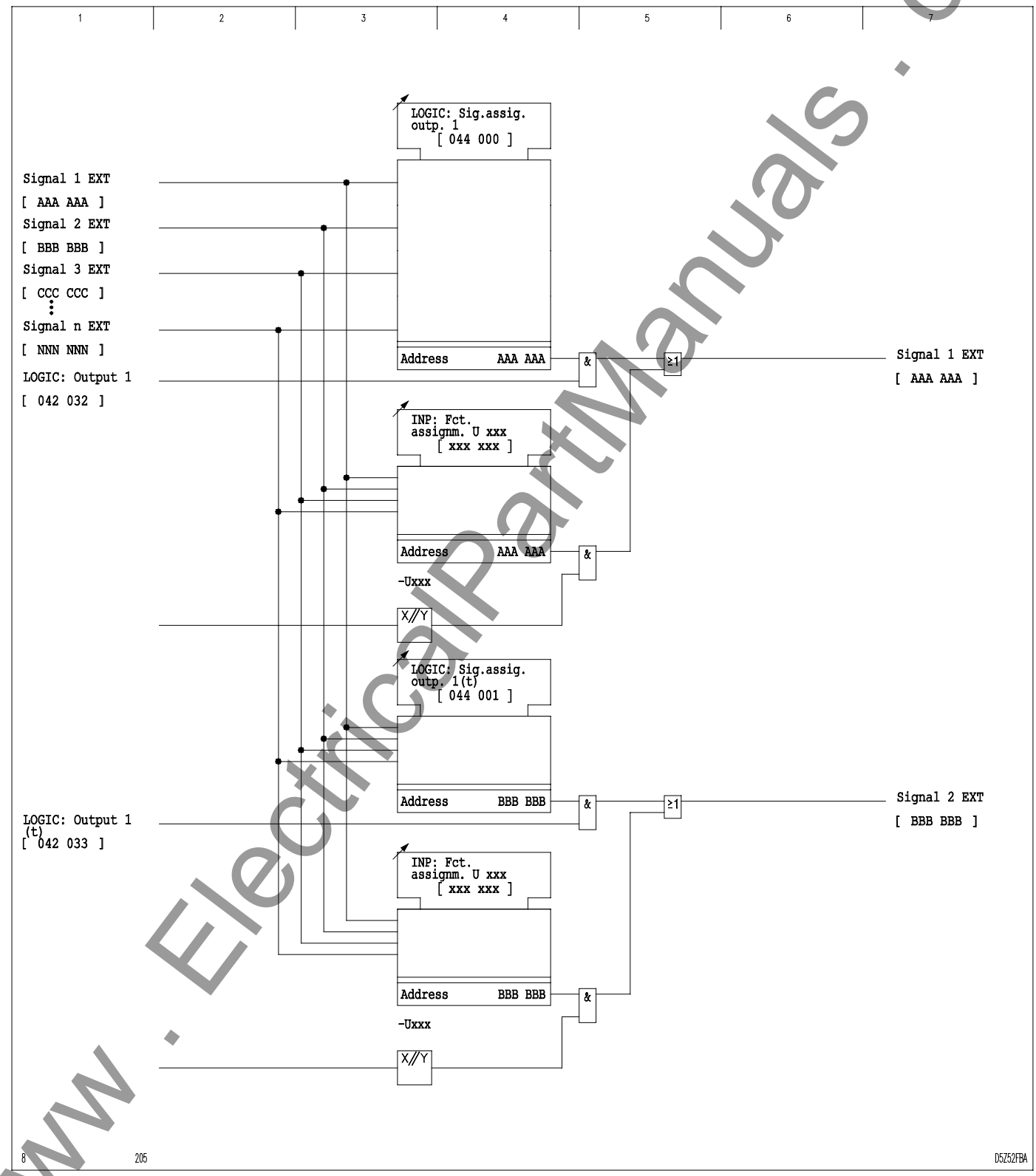


3-102 Operating mode 4: Operate-delay/pulse duration, retriggerable



3-103 Operating mode 5: Minimum time

Through appropriate configuration, it is possible to assign the function of a binary input signal to each output of a logic operation. The output of the logic operation then has the same effect as if the binary signal input to which this function has been assigned were triggered.



3-104 Signal assignment to outputs of Boolean equations

3.20 Control and Monitoring of Switchgear Units (Function Groups DEV01 to DEV10)

The C232 is designed for the control of up to 6 switchgear units. The topology of a switchbay with its switchgear units is defined by the bay type.

Defining the bay type

With the selection of the bay type, the user defines the following properties:

- ☐ Manually operated switchgear units with position signals to be processed
- ☐ Switchgear units to be controlled and signaled by the C232
- ☐ The bay interlock equations for the Open / Close control of the switchgear units, for operation with or without station interlock
- ☐ Binary inputs required for switchgear units with direct motor control
- ☐ Outputs required for switchgear units with direct motor control

When the bay type is selected, the binary inputs for the switchgear position signals and the output relays for the control commands are configured automatically if MAIN: Auto-assignment I/O is set to *Yes*. If set to *No*, the user will need to carry out this configuration. The list of bay types in the Appendix shows which binary inputs and output relays have been assigned signals or commands for control of the switchgear units in the case of automatic configuration.

The setting options for the C232 and the different possibilities for integrating a switchgear unit into the functional sequence of the C232 (processing position signals only or controlling and signaling) will be explained below, using one switchgear unit as an example. Function group DEV01 will be used throughout in this example.
If a signal is identified in the function diagrams by function group “COMM1:” and a blank address [--- ---], this means that it is a signal to or from the communication interface and that no address has been assigned to it. The signals listed in the function plans as ‘signal 1’ to ‘signal n’ are specified in the configuration tables of the Address List.

3.20.1 Processing of Position Signals for Manually Operated Switchgear

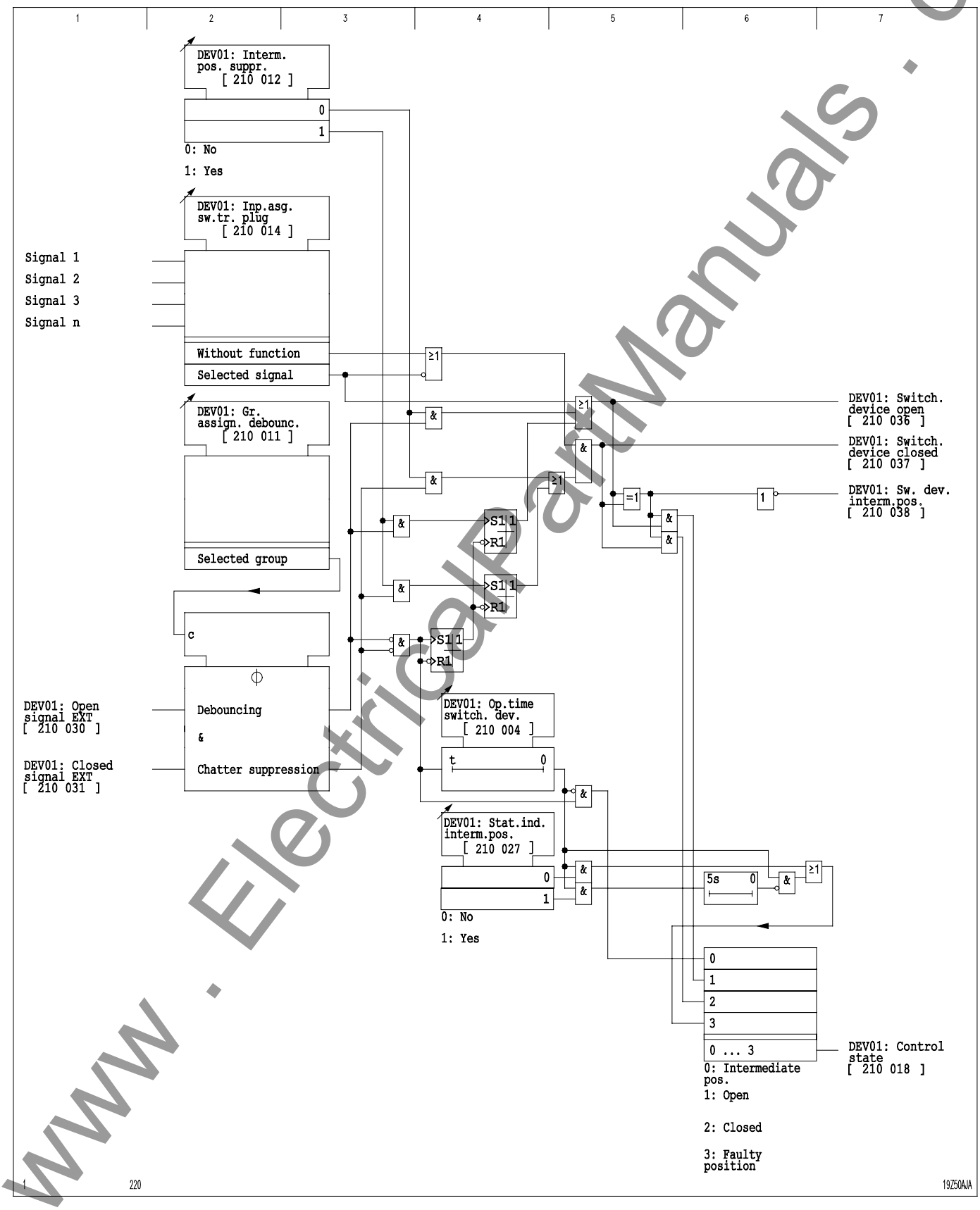
The position signals ‘Open’ and ‘Closed’ are assigned to binary signal inputs. The signals conditioned by debouncing and chatter suppression (see: ‘Main Functions of the C232’) are used for further processing. If no logic value of '1' is present at any of the two binary signal inputs, the running time monitoring is started. For the duration of the running time or until the switching device is back to a defined position - either ‘Open’ or ‘Closed’ - the signal ‘Intermediate position’ is issued.

If DEV01: Interm. pos. suppr. is set to *Yes*, the previous switching device position will continue to be signaled while the switching device is moving. Once the switching device has reached its new position, the updated position is signaled.

The signal ‘Faulty position’ is issued if the switching device does not return to the ’Open’ or ‘Closed’ position once the running time monitoring has elapsed. If DEV01: Stat.ind.interm.pos. is set to *yes*, a delay time of 5 s is started. If there is no position signal once the timer stage has elapsed, the state actually present at the binary inputs will be signaled.

Switch truck

For switchgear units mounted on switch trucks with switch truck plugs, there is the possibility of configuring a single-pole signal as status signal from the switch truck plug. If such a configuration has been assigned, the position signal of the associated switching device is set to ‘Open’ while the input has a logic value of '1'.



3-105 Processing of position signals for manually operated switchgear

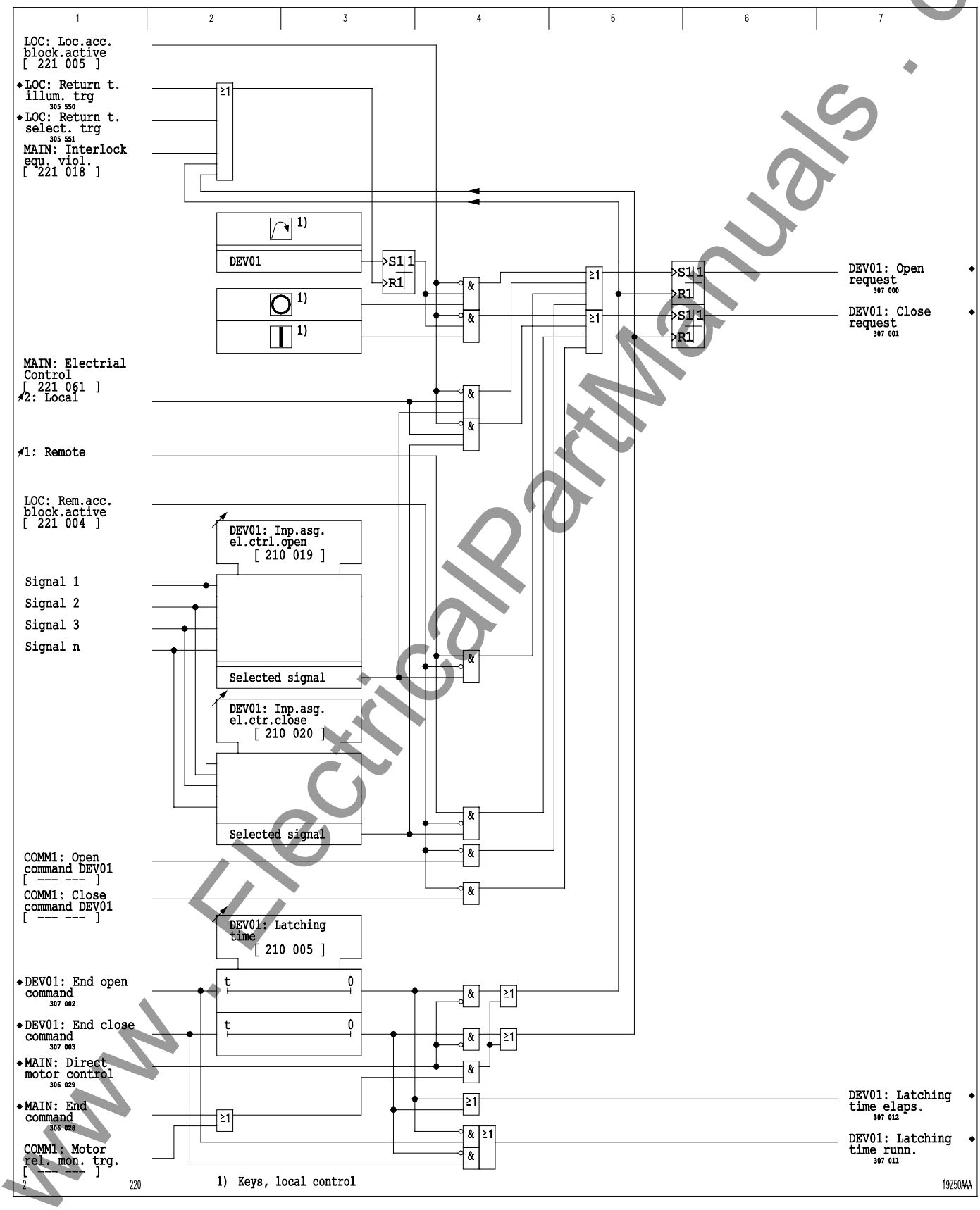
3.20.2 Functional Sequence for Controllable Switchgear Units

Local or remote control of external devices

Switchgear units can be controlled remotely or locally. The Selection of the Control Point is described in the section entitled “Configuration of the Bay Panel and of the Measured Value Panels; Selection of the Control Point (Function Group LOC)”. Usually, remote control is effected via the communication interface, local control via the local control panel keys. Moreover, the switching devices can be controlled remotely via binary inputs configured appropriately (configuration via DEVxx: Inp .asg. el. ctrl. open or DEVxx: Inp. asg. el. ctr. close). The setting MAIN: Electrical control determines whether the inputs function as remote or local control points.

Selection of the switching device to be controlled and generation of the switching request

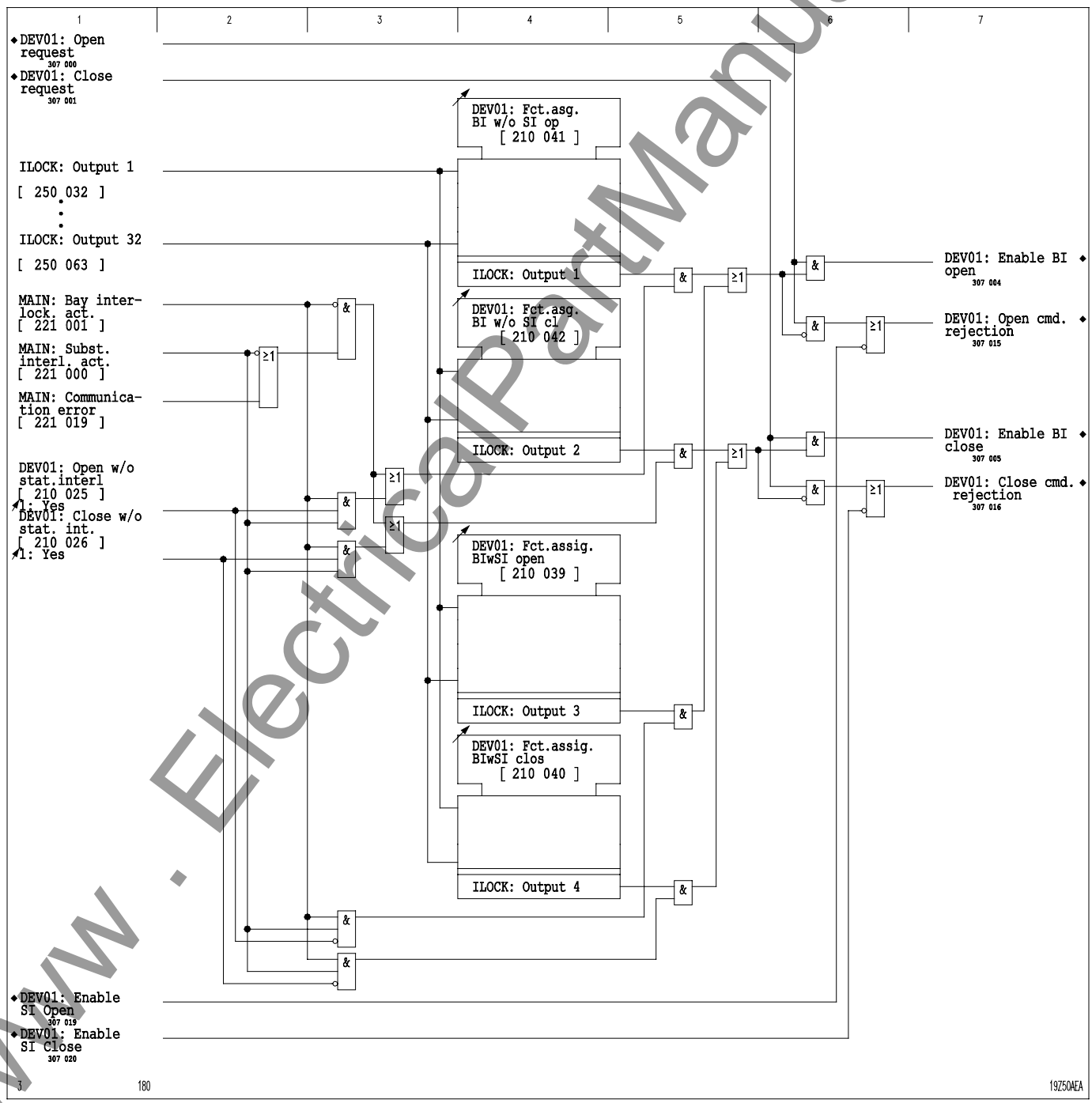
The switchgear unit to be controlled is selected and the switching command is sent to the selected switchgear unit. This can be effected via the local control panel using the selection key and pressing the ‘Open’ or ‘Close’ key to generate the switching request. For control via the binary inputs, the appropriate control inputs need to be configured for the switchgear units to be controlled. For control via the serial interface, the control command ‘Open’ or ‘Close’ also addresses the switchgear unit to be controlled.



3-106 Generating the switching request

Enabling of the switching commands

Before a switching command is executed, the C232 checks the interlocking equations defined in the interlocking logic to determine whether the switching command is permissible. Bay interlock equations for operation with or without station interlock can be defined. The assignment of the output of the interlocking logic to a switching command determines the interlocking equation that defines, for example, the conditions for the open command for operation without station interlock.

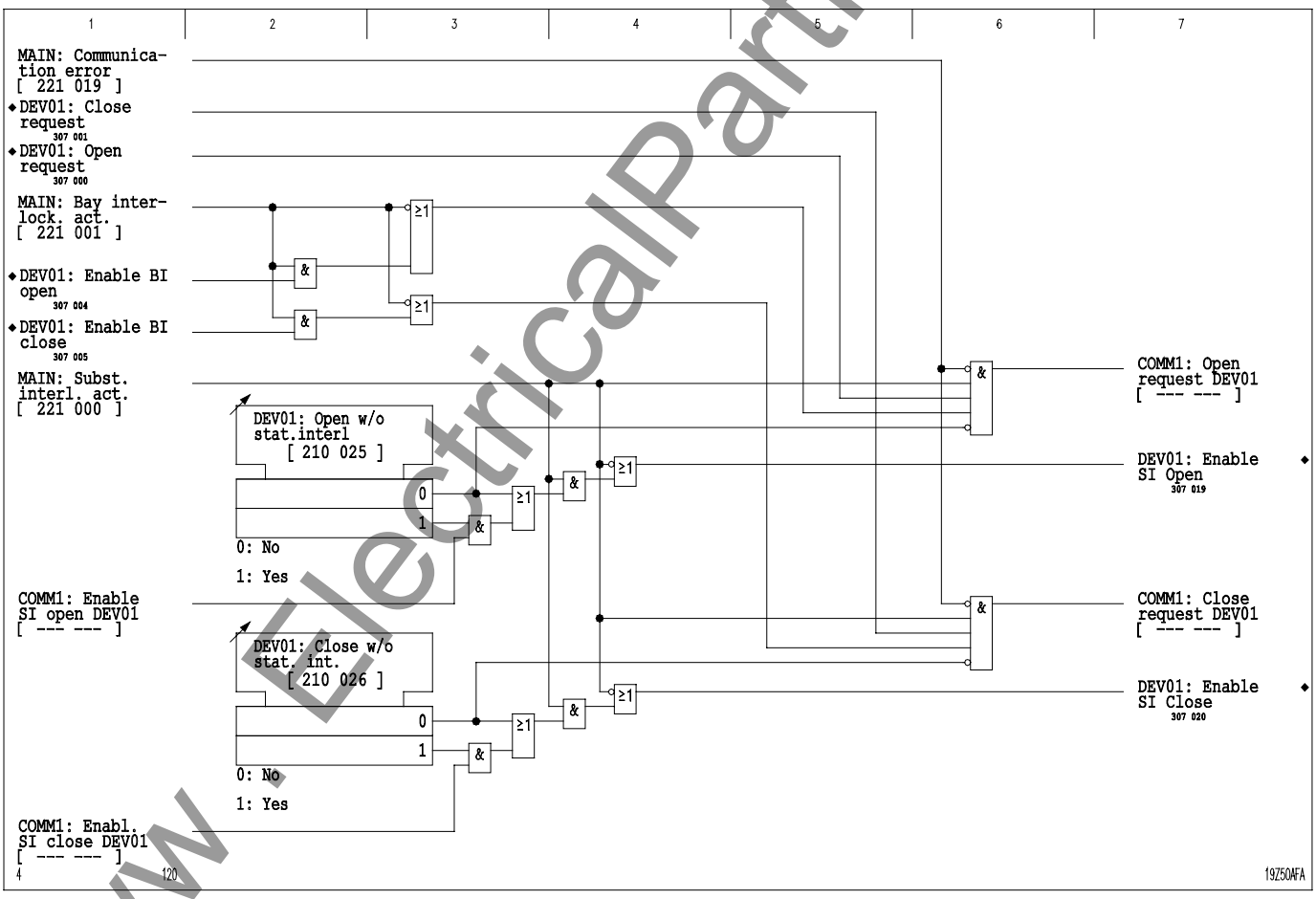


3-107 Assignment of the equations of the interlocking logic to the switching commands; enabling of the switching commands by the bay interlock

Bay interlock for operation with station interlock

For the station interlock equations to be interrogated, there needs to be communication with substation control level. If the C232 detects a communication error or if there is no communication interface, there will be an automatic switch to bay interlock without station interlock.

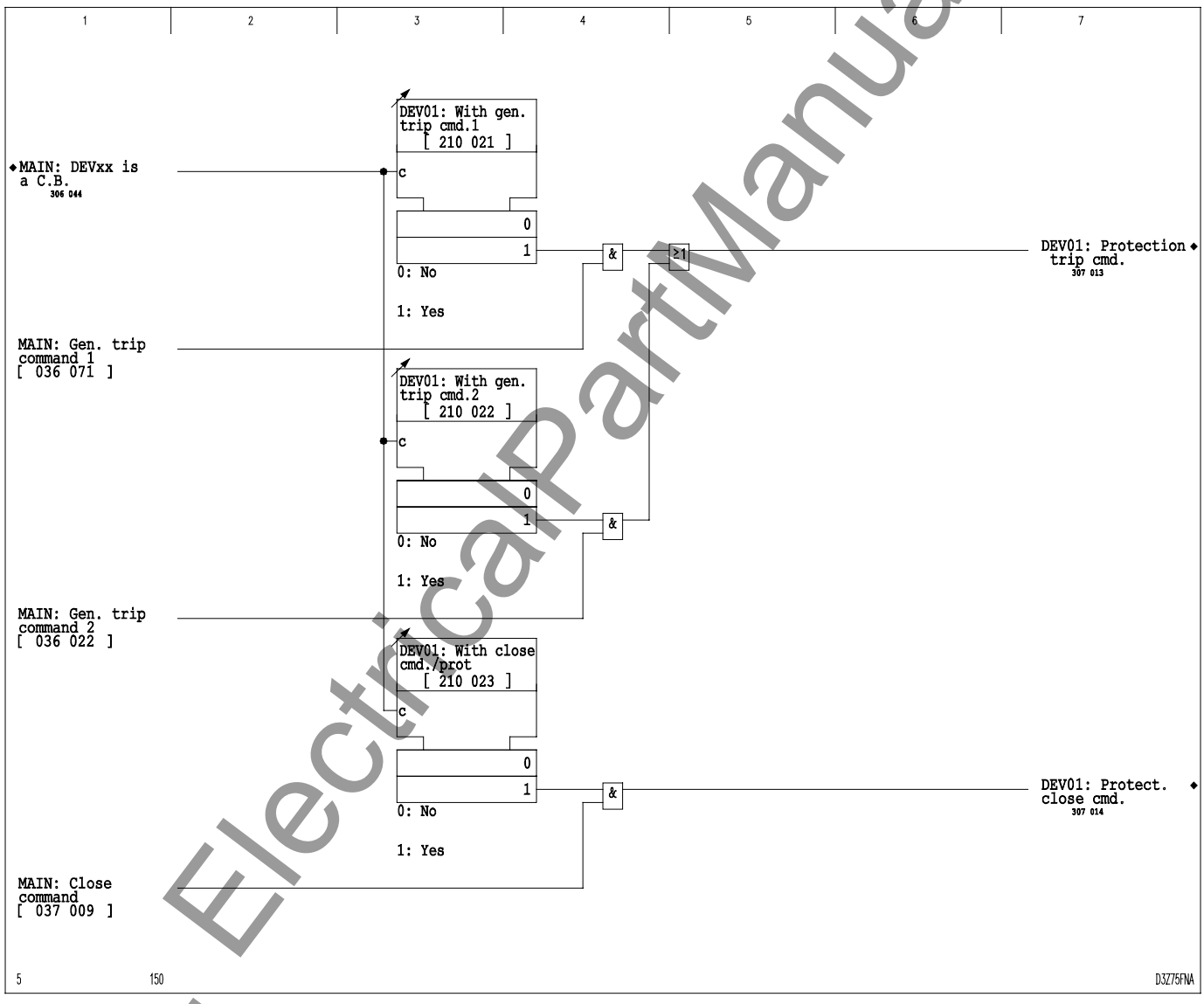
If there is to be a check on the bay and station interlock, the bay interlock will be checked first. If bay interlocking issues a switching enable, a switching request will be sent to substation control level. At substation control level, there will then be a check as to whether - taking into account the station interlock equations - it is permissible to switch. If substation control level also issues an enabling command, the switching operation is carried out provided that the enable from the bay interlock is still present. Optionally, the 'Open' or 'Close' switching operation can be carried out without checking the station interlock equations. In this case, the bay interlock equations defined for operation without station interlock equations will be consulted.



3-108 Enabling of the switching commands by the station interlock

Linking the protection commands to the switching commands

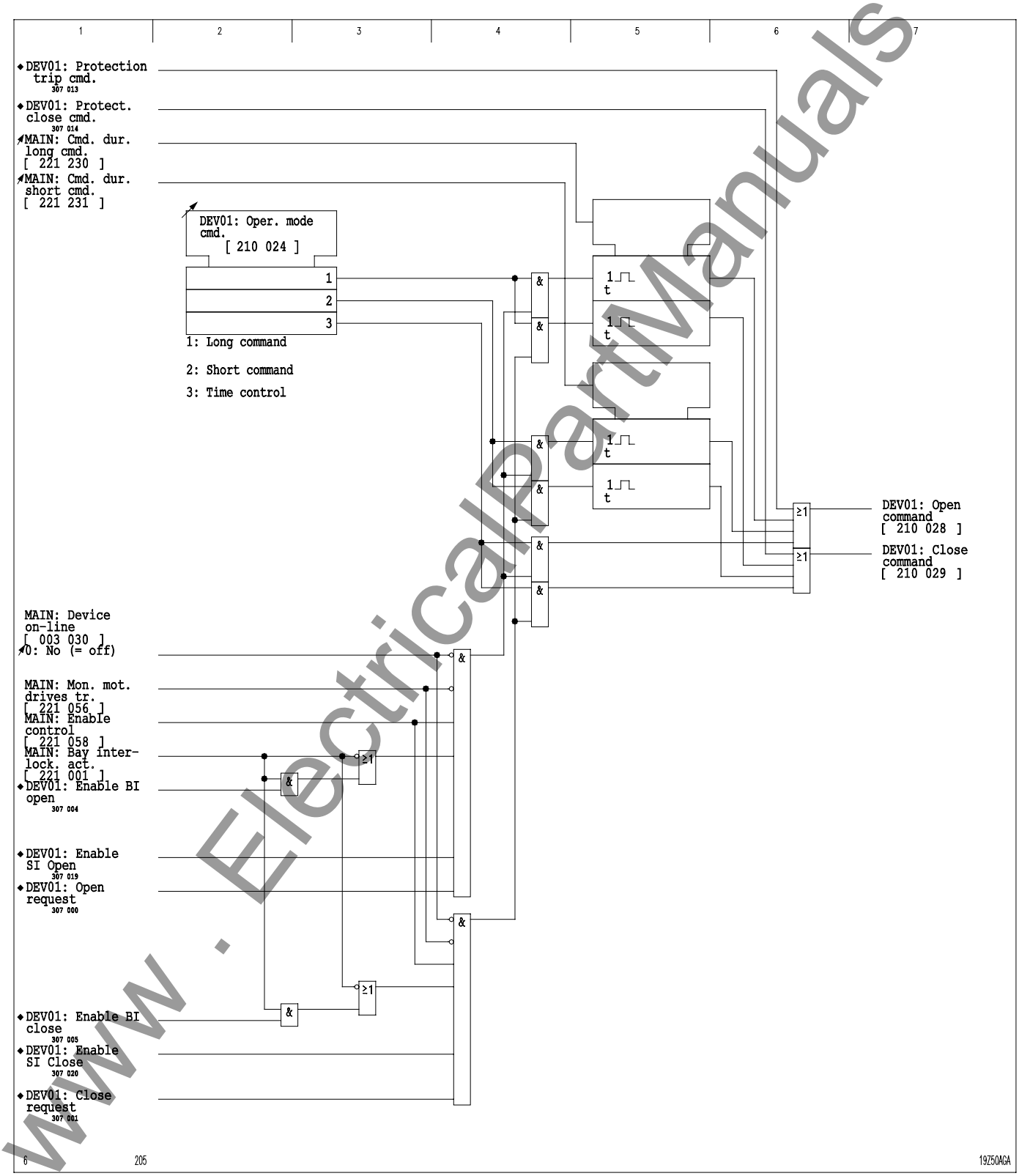
For circuit breakers, the open command can be linked to the protection trip signal. The close command can be linked to the close command of the protection functions. The bay type defines which of the switchgear units are circuit breakers. The trip or close commands of the protection functions are executed directly without a check on the interlocking equations.



3-109 Linking to the protection commands

Issue of the switching commands

The operating mode set for the commands determines whether they are issued for the set times or whether are issued in accordance with time control.



3-110 Issue of the switching commands

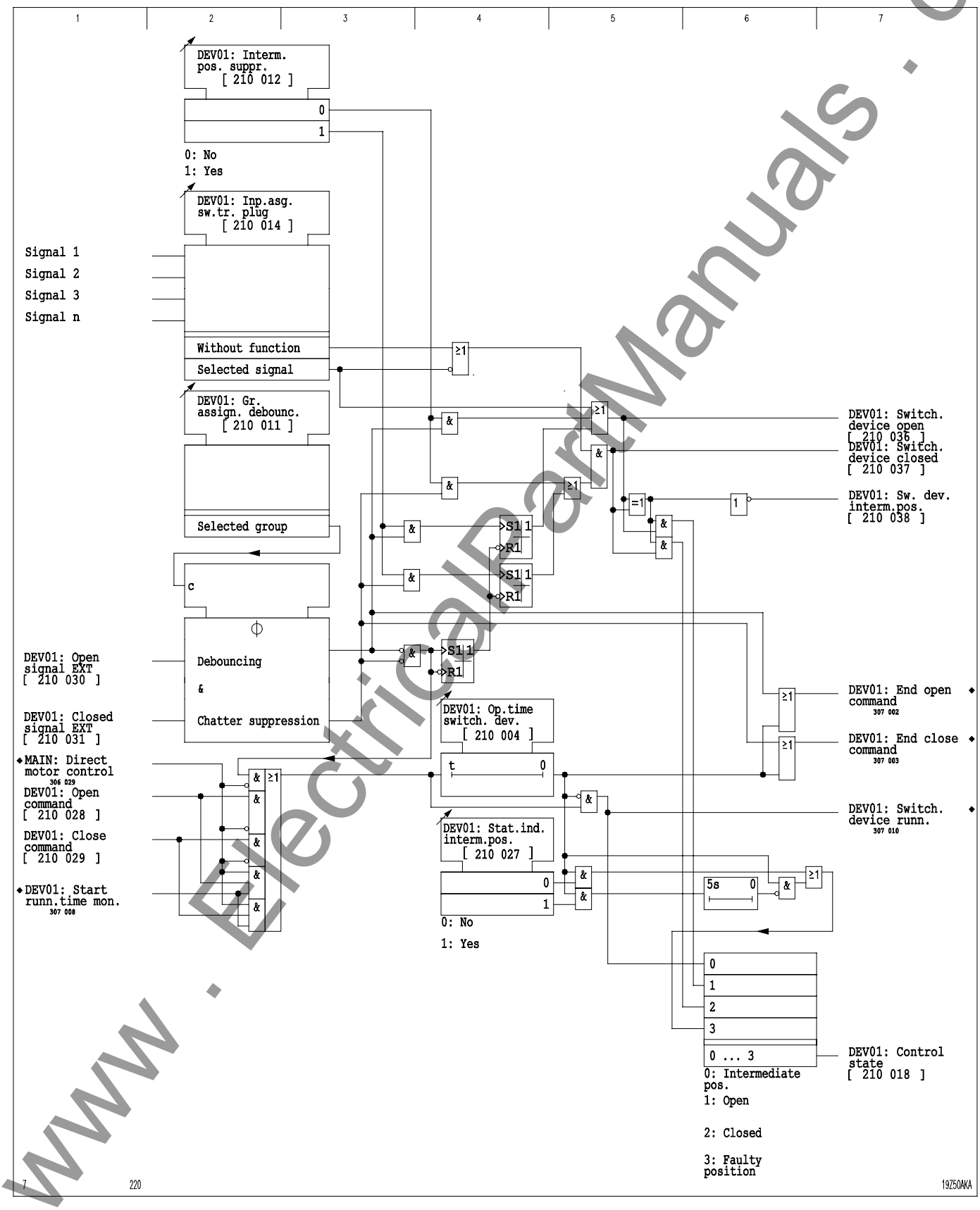
Time control of the switching commands

As the switching command ends, the running time monitoring of the switching device is started. The C232 anticipates a status signal - ‘Open’ or ‘Closed’ to be issued by the switching device within the monitoring time. The status signal of the switchgear position comes in via appropriately configured binary inputs of the C232 where debouncing and chatter suppression can be set. (For a description of ‘debouncing’ and ‘chatter suppression’ see the section entitled “Main Functions of the C232 (Function Group MAIN)”.) For the duration of the running time or until the switching device is back to a defined position - either ‘Open’ or ‘Closed’ - the signal ‘Intermediate position’ is issued.

If DEV01: Interm. pos. suppr. is set to *Yes*, the previous switching device position will continue to be signaled while the switching device is moving. Once the switching device has reached its new position, the updated position is signaled.
The signal ‘Faulty position’ is issued if the switching device does not return to the ’Open’ or ‘Closed’ position once the running time monitoring has elapsed. If DEV01: Stat.ind.interm.pos. is set to *yes*, a delay time of 5 s is started. If there is no position signal once the timer stage has elapsed, the state actually present at the binary inputs will be signaled.
As soon as the status signal - 'Open' or 'Closed' is issued or at the end of the running time monitoring, the control command ends - once the set latching time has (see also Figure 3-106).

Switch truck

For switchgear units mounted on switch trucks with switch truck plugs, there is the possibility of configuring a single-pole signal as status signal from the switch truck plug. If such a configuration has been assigned, the position signal of the associated switching device is set to ‘Open’ while the input has a logic value of '1'.



3-111 Monitoring the switching commands

Time control for direct motor control

The control sequence applied above applies to all switchgear units operated via an 'Open' - or 'Close' - contact. For bays with direct motor control of switch disconnectors, disconnectors or grounding switches, the following modified control sequence described below applies to the motor-operated switchgear units. The List of Bay Types shows which bay types are defined for direct motor control. In the chapter on 'Installation and Connection', an example for the connection of a bay with direct motor control is illustrated.

If a bay type with direct motor control is selected, a binary input for the status signal of the motor relay and one output relay each for triggering the motor relay and the shunt windings will be configured. In the example illustrated in Figure 3-112, the single-pole command CMD_1: Command C012 is defined for control of the motor relay, the single-pole command CMD_1: Command C011 is defined for control of the shunt windings. The single-pole signal SIG_1: Signal S012 (debounced and conditioned by chatter suppression) is defined for the status signal of the motor relay.

As the control command -'Open' or 'Close' - is transmitted, the output relays configured for 'motor relay' and 'shunt winding' are triggered. At the same time, the C232 starts a set monitoring time, during which the status signal of the motor relay needs to be issued. If this is not the case then the control command and the output relays configured for 'motor relay' and 'shunt winding' will be reset. Furthermore, a signal will be sent to substation control level.

If the status signal of the motor relay starts within the monitoring time, the running time monitoring of the switchgear unit is started with the status signal of the motor relay. The monitoring of the control command will then be carried out as for electromechanically operated switchgear units.

As soon as the status signal - 'Open' or 'Closed' is issued or at the end of the running time monitoring of the switchgear unit, the motor relay is reset - once the set latching time has elapsed (see also Figure 3-106). As the motor relay is reset, the monitoring time of the motor relay is restarted. Once this monitoring time has elapsed, the control commands 'Open' or 'Close' will be terminated.

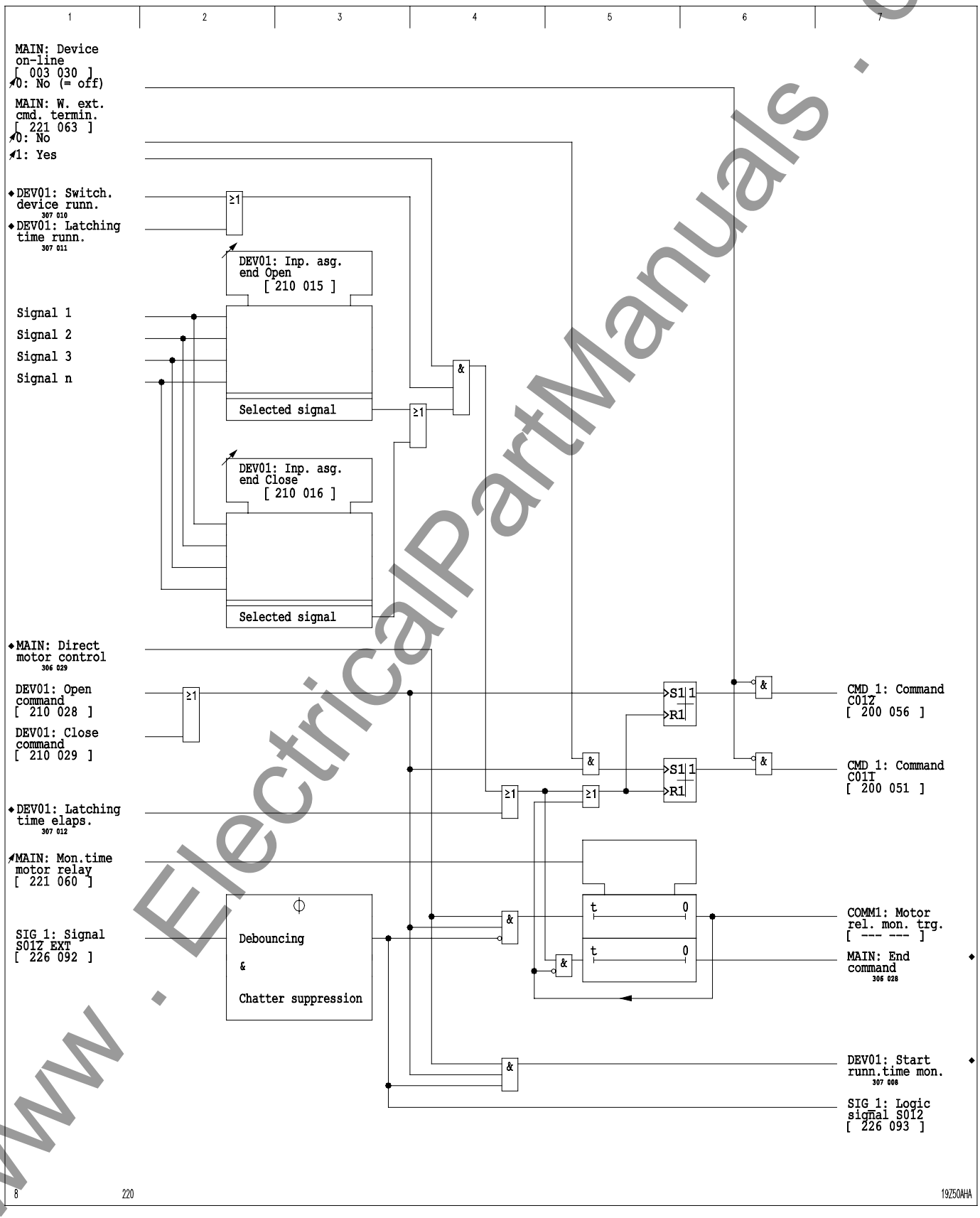
Time control for direct motor control with external command termination

For bay types that are defined for direct motor control, it is possible to intervene in the control sequence of motor-operated switchgear units by way of external terminating contacts. To do so, the user must set the C232 by selecting *'Yes'* at MAIN: W. ext. cmd. termin. and must configure binary signal inputs for connection to terminating contacts.

As the 'Open' or 'Close' control command is transmitted, the output relay configured for 'motor relay' will be triggered. At the same time, the C232 starts a set monitoring time, during which the status signal of the motor relay needs to be issued. If this is not the case then the control command and the output relays configured for 'motor relay' will be reset. Furthermore, a signal will be sent to substation control level.

If the status signal of the motor relay starts within the monitoring time, the running time monitoring of the switchgear unit is started with the status signal of the motor relay. The monitoring of the control command will then be carried out as for electromechanically operated switchgear units.

The motor relay is reset if the external termination command is issued while the switchgear unit's running time monitoring function is elapsing or during the latching time. Once the latching time has elapsed, the motor relay is reset in any case. As the motor relay is reset, the monitoring time of the motor relay is restarted. Once this monitoring time has elapsed, the control commands 'Open' or 'Close' will be terminated.



3-112 Triggering and monitoring the motor relay

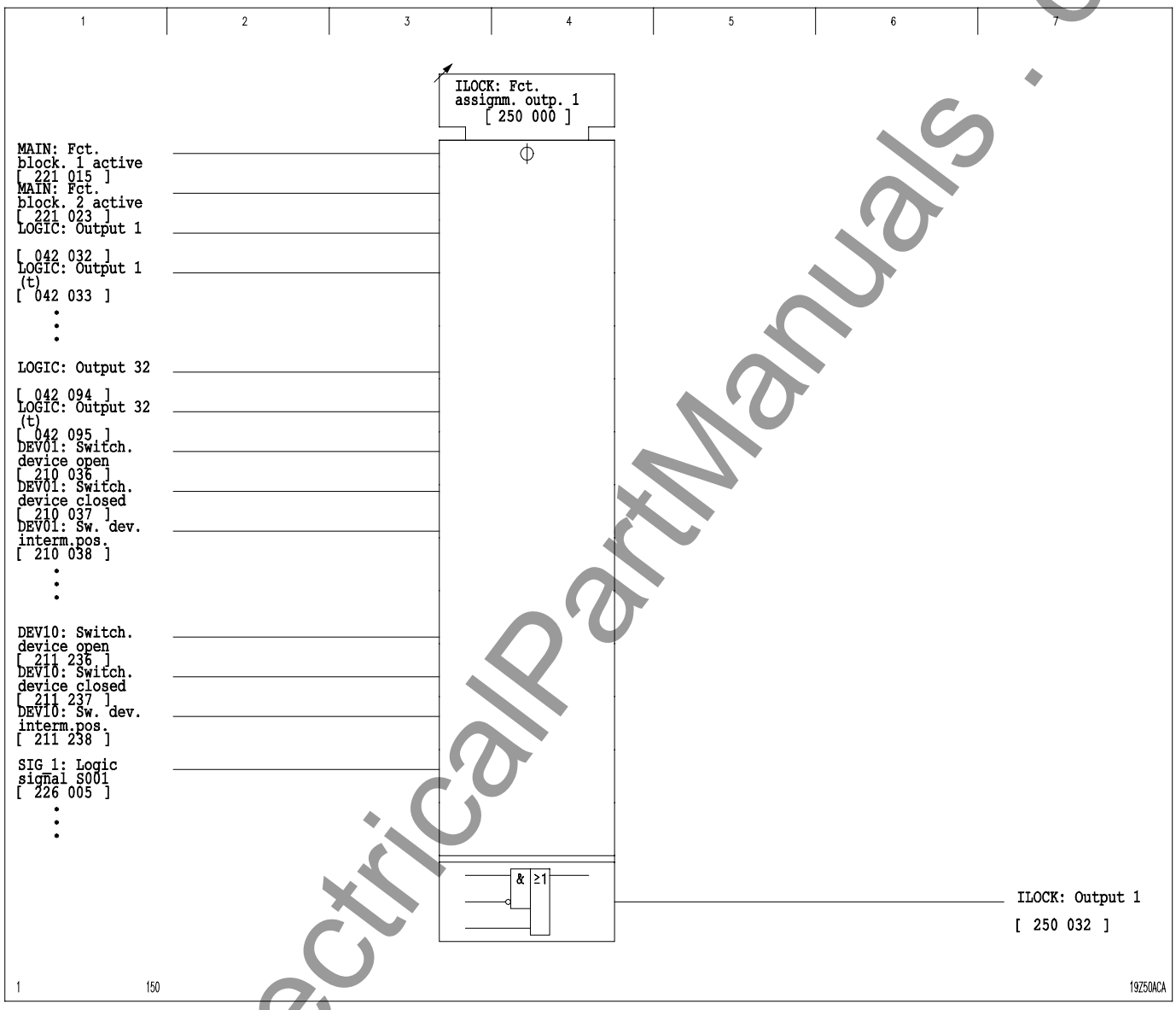
3.21 Interlocking Logic (Function Group ILOCK)

The switching commands to the controllable switchgear units of the bay are not enabled until the interlock conditions have been checked. The interlocks are defined in the form of Boolean equations in the interlocking logic function.

The choice of the bay type automatically defines the bay interlock conditions (or equations) for the 'Open' and 'Close' operations of the individual switchgear units in the bay. Different conditions are defined for the bay interlock equations for operation with or without station interlock (see the section entitled "List of Bay Types" in the Appendix). These automatically defined interlock conditions - determined by the choice of bay type - can be modified by the users at any time to fit their station requirements. For the bay interlock, the following signals acquired by the C232 are linked by logic operations:

- Function blocks 1 and 2
- The programmable logic outputs
- The signals from binary inputs after debouncing and chatter suppression
- The position signals of the switchgear units after debouncing and chatter suppression

A maximum of 32 equations with 32 equation elements each are available for definition of the interlock conditions. The Boolean equations need to be defined without the use of brackets. The following rule applies to the operators: 'NOT' before 'AND' before 'OR'. The output signal of one equation can be processed as the input signal for another higher-order equation, and this makes it possible to have a sequence of interlinked Boolean equations.



3-113 Interlocking logic illustrated for equation 1

3.22 Single-Pole Commands (Function Group CMD_1)

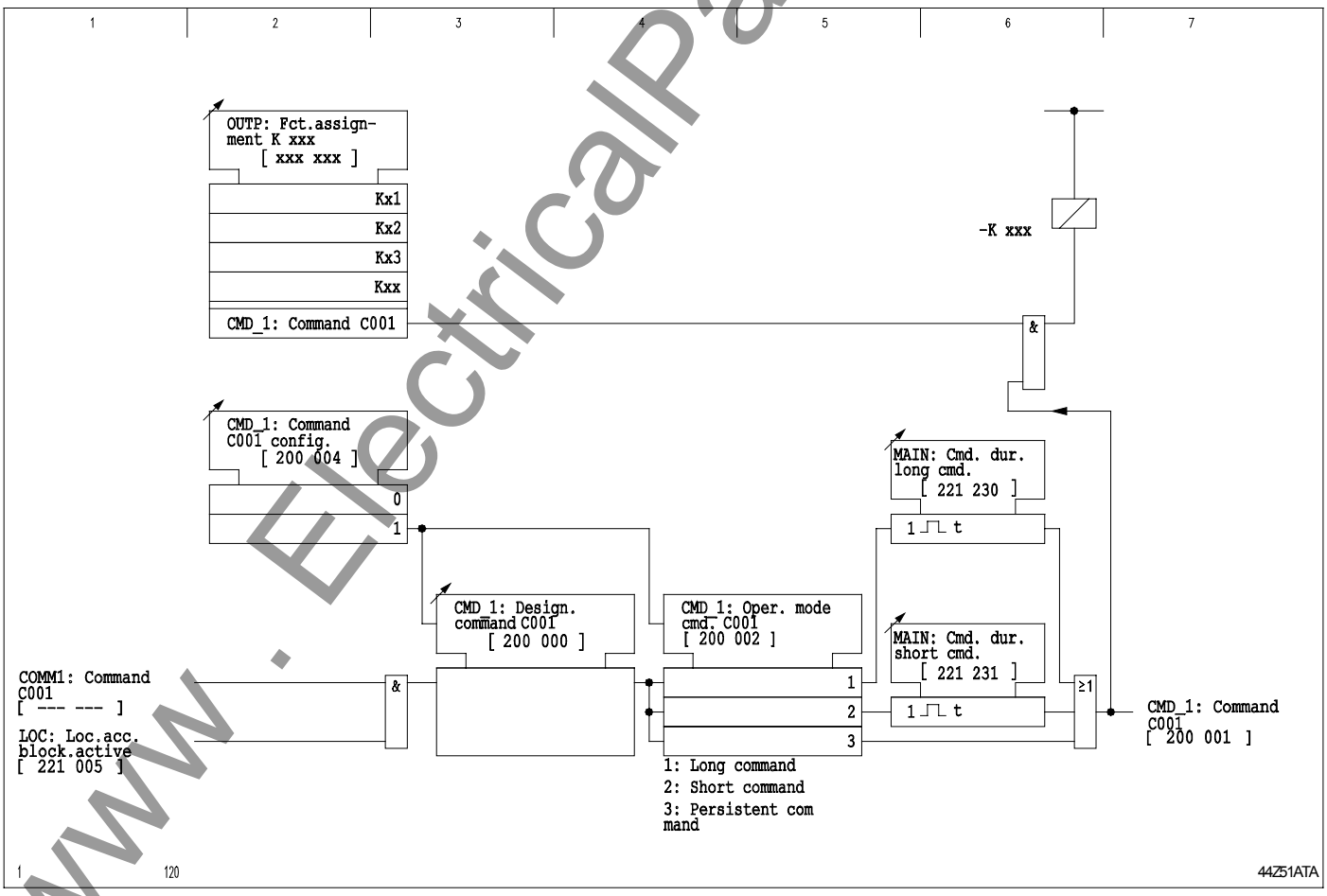
Commands can be sent to the P139 through the communication interface. If the P139 receives the command, then the appropriately configured output relay is triggered and a signal is issued - provided that remote control has been enabled.

The user may select the operating mode for any single-pole command. The following settings are possible:

- Long command
- Short command
- Persistent command

If the user selects either a long or a short command, then the output relay is only triggered for the time period set at MAIN: Cmd. dur. long cmd. or MAIN: Cmd. dur. short cmd.

The following figure shows the setting options and the functional sequence for command C001. Equivalent considerations apply to all other single-pole commands.



3-114 Functional sequence for single-pole commands, illustrated for command C001

3.23 Single-Pole Signals (Function Group SIG_1)

Binary, single-pole signals from the station can be transmitted by the C232 to the control station through appropriately configured binary signal inputs.

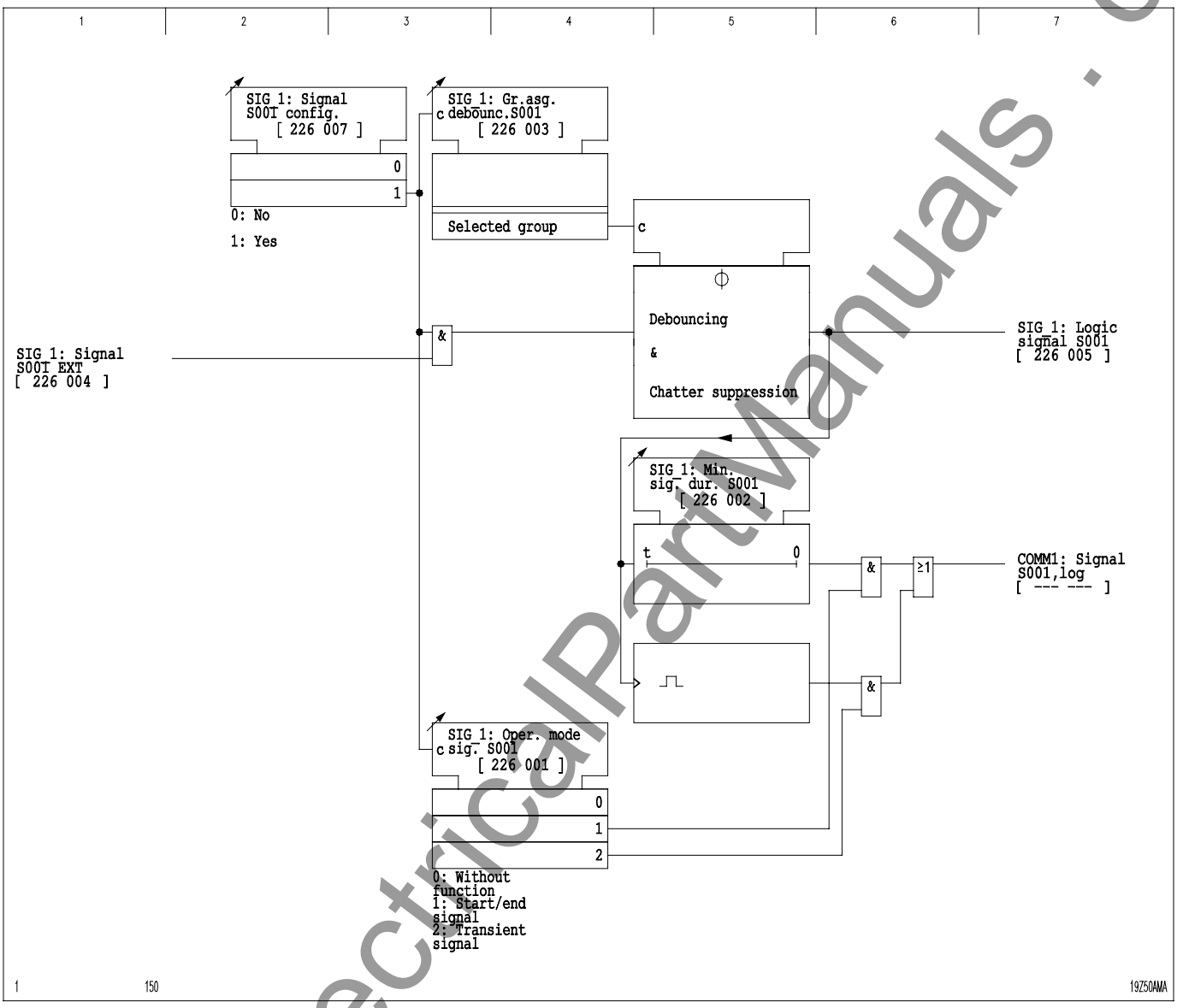
The input signal is conditioned by debouncing and chatter suppression (see: 'Main Functions of the C232). The conditioned signal is then available as SIG_1: Logic signal xxx.

Signaling characteristics can be defined through the communication interface by setting the operating mode. The following settings are possible:

- □ Without function:
- □ Start/end signal
- □ Transient signal

If the setting is *Without function*, then no telegram is sent when there is a state change at the binary input. If the setting is *Start/end signal* then a telegram is sent each time there is a state change. The requirement for sending the 'start' signal is that the logic '1' signal be available for the set minimum time. If the setting is *Transient signal,* telegrams are only sent if there is a state change from logic '0' to logic '1'.

The following figure shows the setting options and the functional sequence for signal S001. Equivalent considerations apply to all other single-pole signals.



3-115 Functional sequence for single-pole signals, illustrated for signal S001

3.24 Binary Counts (Function Group COUNT)

The C232 has one binary counter which counts the positive edges at an appropriately configured binary signal input. The signal to be counted can be debounced.

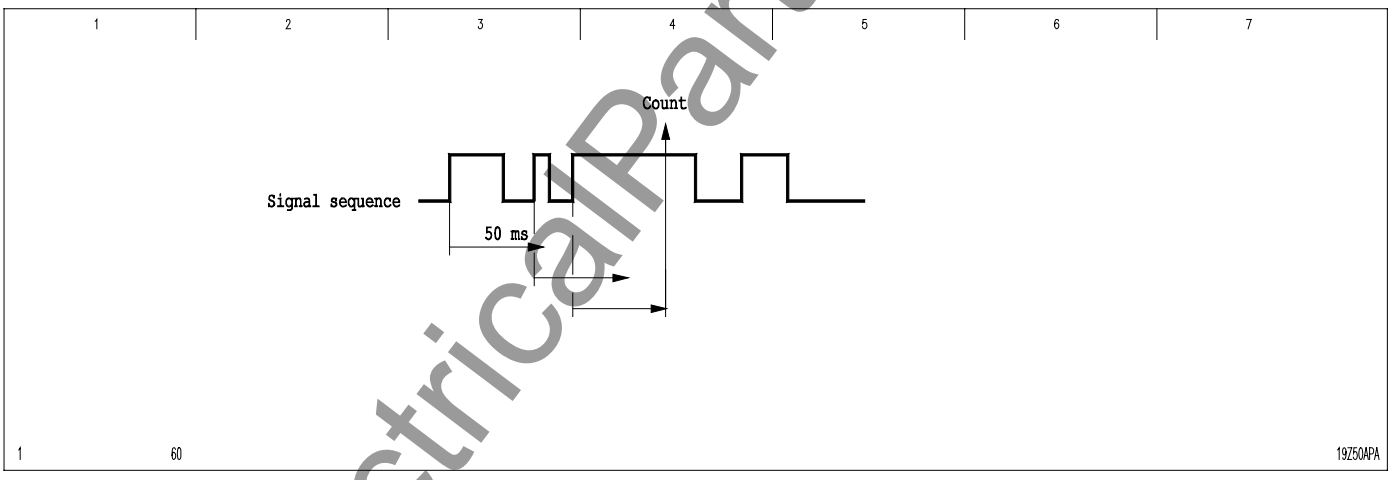
Enabling or disabling the counting function

The counting function can be disabled or enabled from the integrated local control panel.

Debouncing

The first positive pulse edge of the signal to be counted starts a timer stage running for the duration of the set debouncing time. Each positive pulse edge during the debouncing time retriggers the timer stage. If the signal is stable until the set debouncing time has elapsed, it is counted.

If the signal has not changed its state from the occurrence of the first pulse edge to the elapsing of the set debouncing time, it is not counted.



3-116 Signal sequence for debouncing
set debouncing time: 50 ms

Counting function

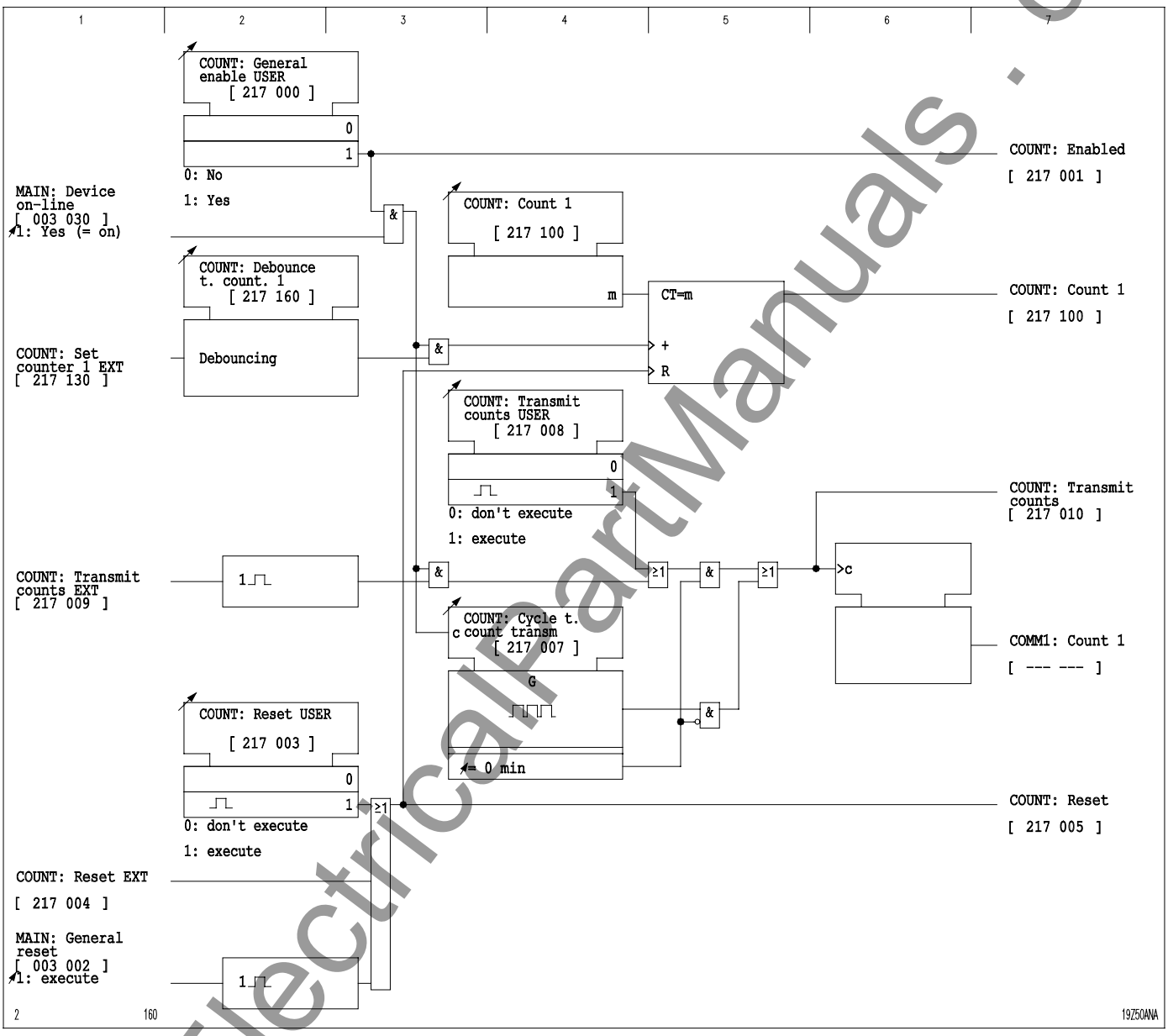
The debounced signal is counted by a 16 bit counter. Each counter can be set to a specific count from the local control panel and through the serial interfaces (preload function). The count (counter reading) can be displayed on the LCD display and output via the PC and communication interfaces.

Transmission of counts via the communication interface

The count is transmitted through the communication interface by triggering an appropriately configured binary signal input, or by giving a trigger command from the local control panel, or at cyclic intervals in accordance with the set cycle time. If the count is transmitted at cyclic intervals, transmission will be synchronized provided that the ratio (60/set cycle time) is an integer. In all other cases, the count is transmitted at intervals determined by a free running internal clock.

Resetting the counter

The counter can be reset from the local control panel, through an appropriately configured binary signal input, or by the general reset function.



3-117 Binary count

3.25 Tap Changer (Function Group TAPCH)

The transformer tap control function makes it possible to acquire data of one tap position and to output tap change commands for one tap changer. The functions and settings for the tap changer are described below.

Acquisition of tap positions

Data on tap positions are acquired in BCD code with 6 bits maximum and one sign bit for positions in the range of -64 to +63 maximum. The input signals must be connected to the binary signal inputs in BCD code. The sequence of assignment of binary signal inputs at TAPCH: Input assign. TapCh 1 defines value in the tap position signal. The assignment sequence proceeds from the low-value bit to the higher value bit. Signals are assigned to the sign of the tap position signal by way of configuration parameter INP: Funct. assignm. V xxx and 'TAPCH: TapChg 1, sign'. If the 'tap change operating' signal is to be made available for evaluation in order to suppress the tap position signal while a tap change is in progress, then a binary signal input must be configured for "TAPCH: TapCh 1 operating". Starting and ending signals will be issued for this input. If there is a logic value of '1' at the input, then a change in tap position will not be transmitted. The tap position signal is not transmitted until there is a logic value of '0'. If the unit is configured for suppression of the intermediate position, then the zero position is not transmitted while a tap change is in progress.

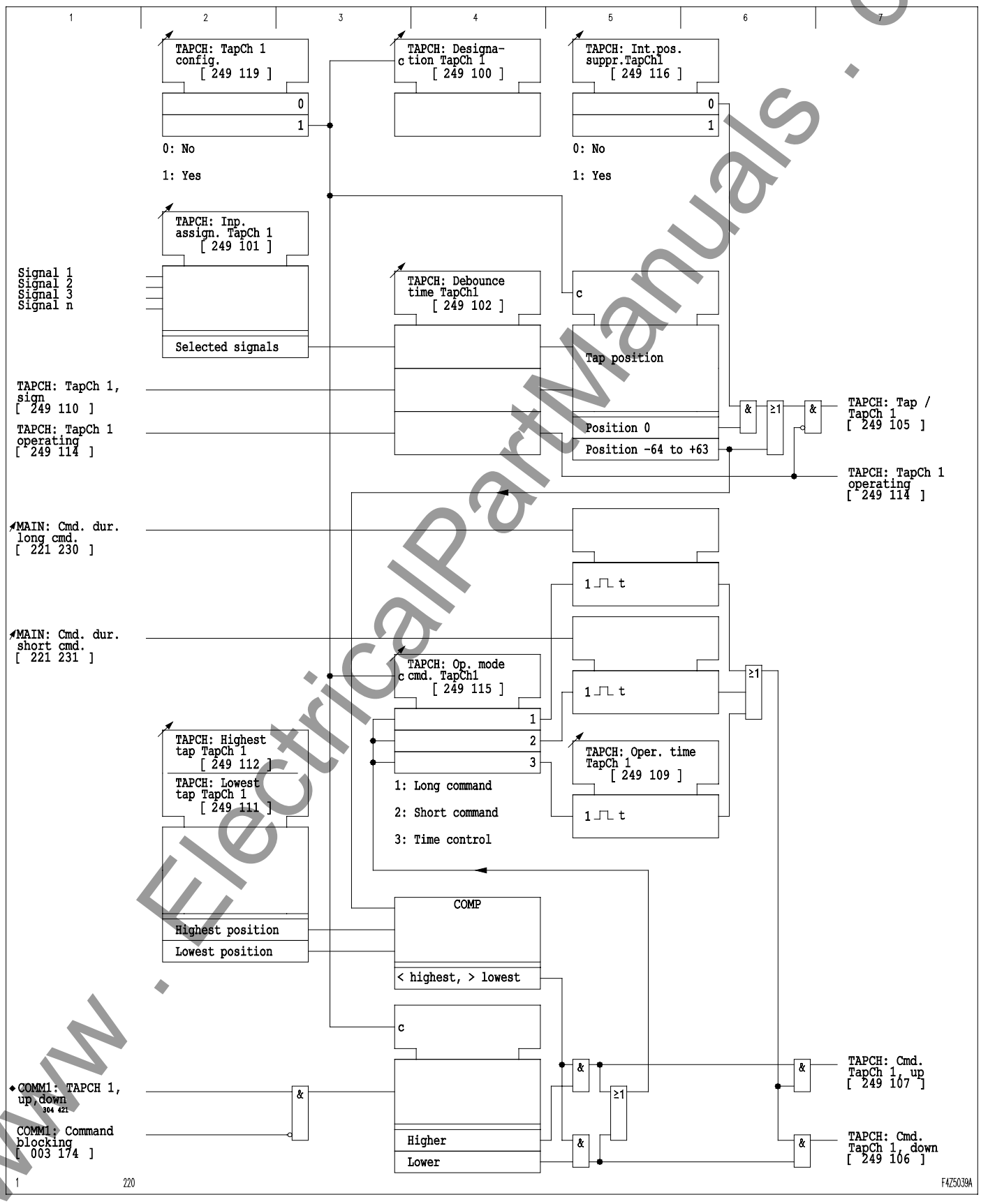
Control of the tap changer

The transformer tap changer is controlled solely by remote control through the communication interface via single tap change operations triggered by the tap change commands HIGHER or LOWER. The effective command range can be set between the lowest position and the highest position. When the range limits are reached (set value in lowest or highest tap position), no change commands are issued. If no sign is defined, then only the positive range is effective, even if the lowest position is set for a negative value. If only a positive range is set, then a configured sign will not be effective. The operating mode for the change command can be set for time control, long command, or short command. As soon as the tap change command is issued, the output relay configured for the tap changer is triggered 'higher' or 'lower' for the set time period.

When command blocking is activated, the tap change command will be rejected at the communication interface. Command initiation is possible in both the 'remote' and 'local' states.

Note

Once the operating time monitoring period has elapsed, the current tap position will not be transmitted. Tap changer operation cannot be triggered by programmable logic. Output relays can be directly triggered by the control system. In this case, however, sequence control is handled by the control system itself.



3-118 Tap Changer: TAPCH 1

4 Design

4 Design

The C232 is mounted in an aluminum case. Connection is via threaded terminal ends. The case is suitable for either wall-surface mounting or flush panel-mounting. The mounting brackets adjust for flush mounting.

Figures 4-1 and 4-2 show the case dimensions and mounting dimensions. A cover frame is supplied for flush mounting (see Installation and Connection).

Regardless of model, the C232 - like all other device types in the MiCOM Px30 system - is equipped with the standard local control panel. The local control panel is covered with a tough film so that the specified degree of protection will be maintained. In addition to the essential control and display elements, a parallel display consisting of a total of 13 LED indicators is also incorporated into the local control panel. The meaning of the various LED indications is shown in plain text on a label strip. The label strip is located in a pocket accessible from the rear of the front panel. It can be replaced by user-specific labels.

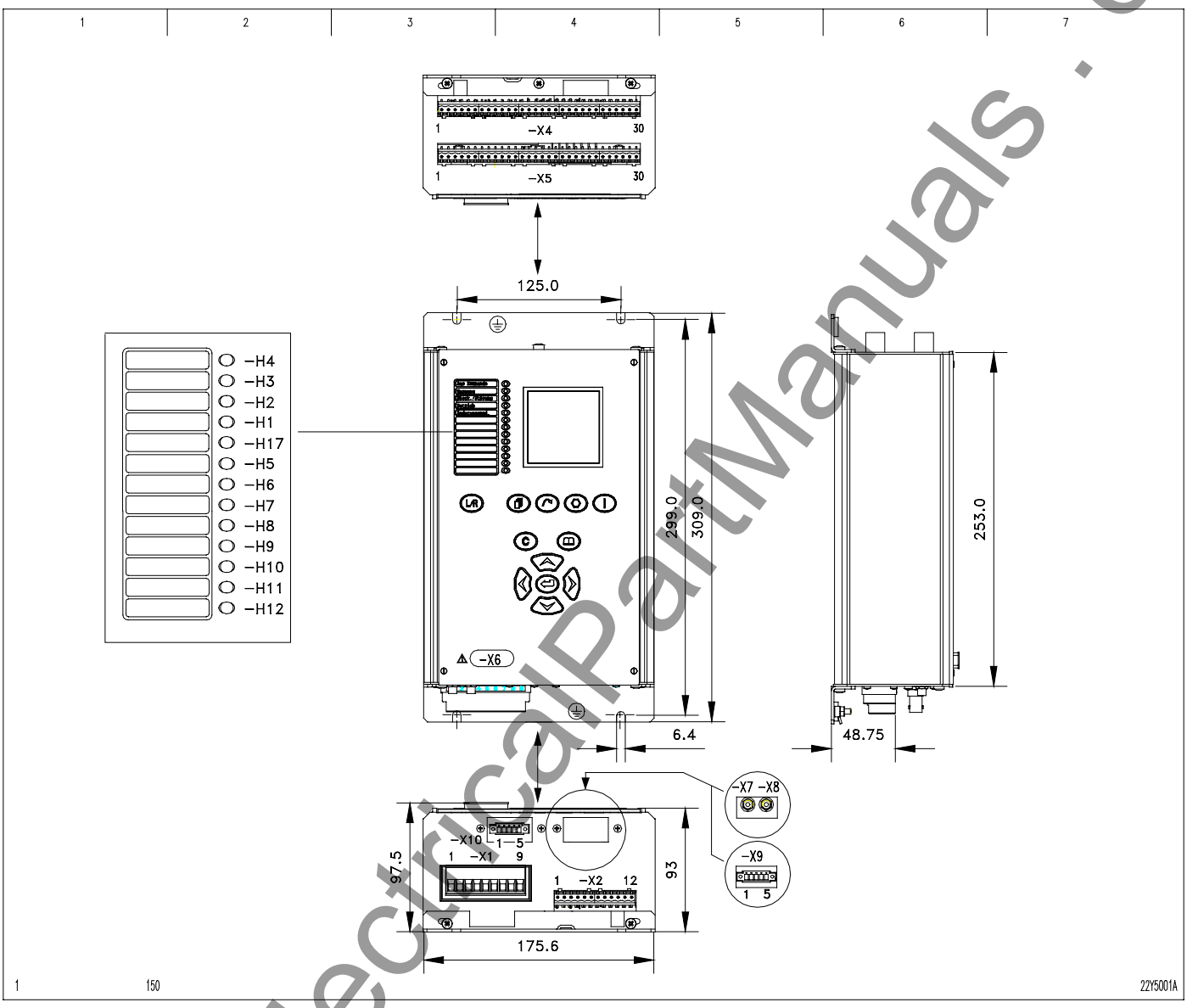
The components located behind the front panel are energized. Therefore always turn off the supply voltage before opening the device.

The processor module with the local control module is attached to the reverse side of the removable front plate and connected to the combined I/O module via a ribbon cable. The I/O module incorporates the power supply, the optional input transformers, the output relays and optical couplers for binary input signals.

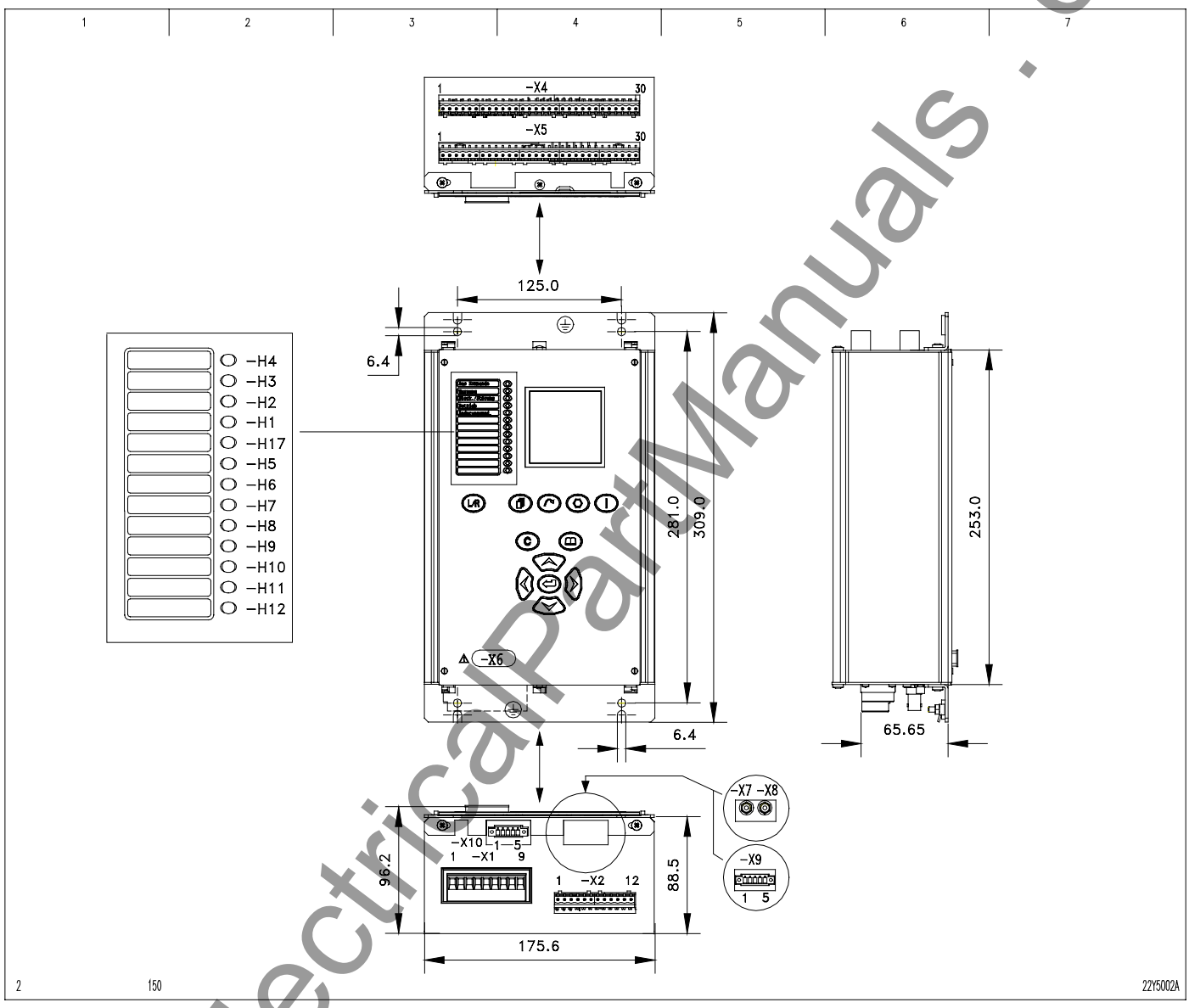
The secondary circuit of operating current transformers must not be opened. If the secondary circuit of an operating current transformer is opened, there is the danger that resulting voltages may injure personnel or damage the insulation.

The threaded terminal block for current transformer connection is not a shorting block. Therefore always short-circuit the current transformer before loosening the threaded terminals.

The front panel houses the -X6 serial interface for parameter setting by way of a PC. The optional communication interfaces (X7, X8 and X9 or X10) are located on the underside of the case.



4-1 Dimensional drawing of the wall-mounting case (-X7,-X8 and -X9 or –X10: communication interfaces, optional)



4-2 Dimensional drawing of the flush-mounting case (-X7,-X8 and -X9 or –X10: communication interfaces, optional)

5 Installation and Connection

5.1 Unpacking and Packing

All C232 units are packaged separately in their own cartons and shipped inside outer packaging. Use special care when opening cartons and unpacking units, and do not use force. In addition, make sure to remove from the inside carton the Supporting Documents and the type identification label supplied with each individual unit.

The design revision level of each module included in the unit when shipped can be determined from the list of components (assembly list). This list should be carefully saved.

After unpacking each unit, inspect it visually to make sure it is in proper mechanical condition.

If the C232 needs to be shipped, both inner and outer packaging must be used. If the original packaging is no longer available, make sure that packaging conforms to DIN ISO 2248 specifications for a drop height ≤ 0.8 m.

5.2 Checking the Nominal Data and the Design Type

The nominal data and design type of the C232 can be determined by consulting the type identification label (see Figure 5-1) One type identification label is located under the upper covering flap of the front panel and another is on the inside of the unit. Another copy of the type identification label is affixed to the outside of the C232 packaging.

C232	C232-99XXXXX0-302-40x-456-92x-603				Diagram C232-302	xx.yy
$U_{nom\ /NE,nom}$ = 50...130 V	I_{nom} = A	$I_{E,nom}$ = A	$I_{EP,nom}$ = A		f_{nom} = 50/60 Hz	
$U_{H,nom}$ = 48 - 250 VDC, 100 - 230 VAC		$U_{E,nom}$ = 24...250 V DC				
AREVA	Specification EN 60255-6 / IEC 255-6			F6.123456.0		CE

5-1 C232 type identification label

The type identification label shows the nominal voltage and current V_{nom} ('U_{nom}') and I_{nom}, the nominal residual current $I_{N,nom}$ ('$I_{E,nom}$'), the nominal auxiliary voltage $V_{A,nom}$ ('$U_{H,nom}$'), the nominal star-point current $I_{*,nom}$, the nominal input voltage $V_{in,nom}$ ('$U_{E,nom}$'), the nominal displacement voltage $V_{NG,nom}$ ('$U_{NE,nom}$') and the nominal frequency f_{nom}.

The C232 design version can be determined from the order number. A breakdown of the order number is given in Chapter 14 of this manual and in the Supporting Documents supplied with the unit.

5.3 Location Requirements

The C232 has been designed to conform to EN 60255-6. Therefore it is important when choosing the installation location to make sure that it provides the conditions specified in the chapter entitled 'Technical Data'. Several important conditions are listed below.

Environmental Conditions

Ambient temperature:	-5 °C to +55 °C [+23 °F to +131 °F]
Air pressure:	800 to 1100 hPa
Relative humidity:	The relative humidity must not result in the formation of either condensed water or ice in the C232.
Ambient air:	The ambient air must not be significantly polluted by dust, smoke, gases or vapors, or salt.
Solar radiation:	Direct solar radiation on the front of the device must be avoided to ensure the readability of the LCD display.

Mechanical conditions

Vibration stress:	10 to 60 Hz, 0.035 mm and 60 to 150 Hz, 0.5 g
Earthquake resistance:	5 to 8 Hz, 3.5 mm / 1.5 mm, 8 to 35 Hz, 5 m/s^2, 3 x 1 cycle

Electrical conditions for auxiliary voltage for the power supply

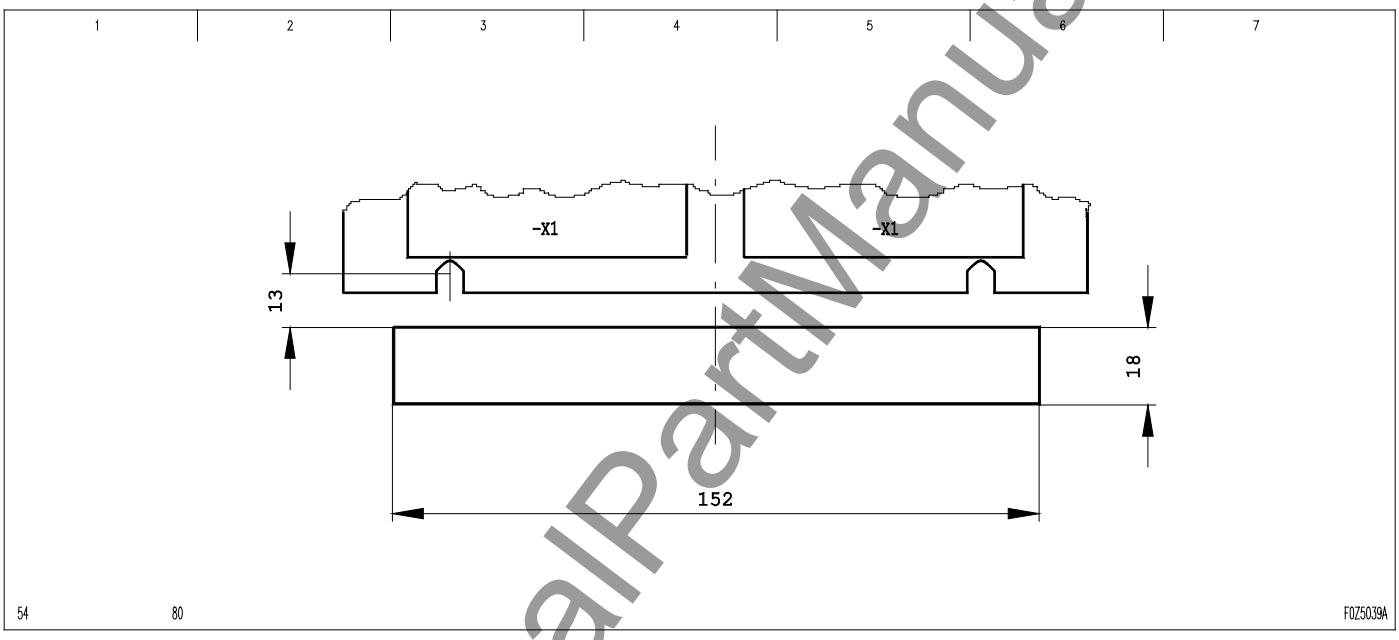
Operating range:	0.8 to 1.1 $V_{A,nom}$ with a residual ripple of up to 12 % $V_{A,nom}$

Electromagnetic conditions

Appropriate measures taken in substations must correspond to the state of the art (see, for example, the VDEW ring binder entitled "Schutztechnik" [Protective Systems], Section 8, June 1992 edition, which includes recommended measures for reducing transient overvoltage in secondary lines in high voltage substations).

5.4 Installation

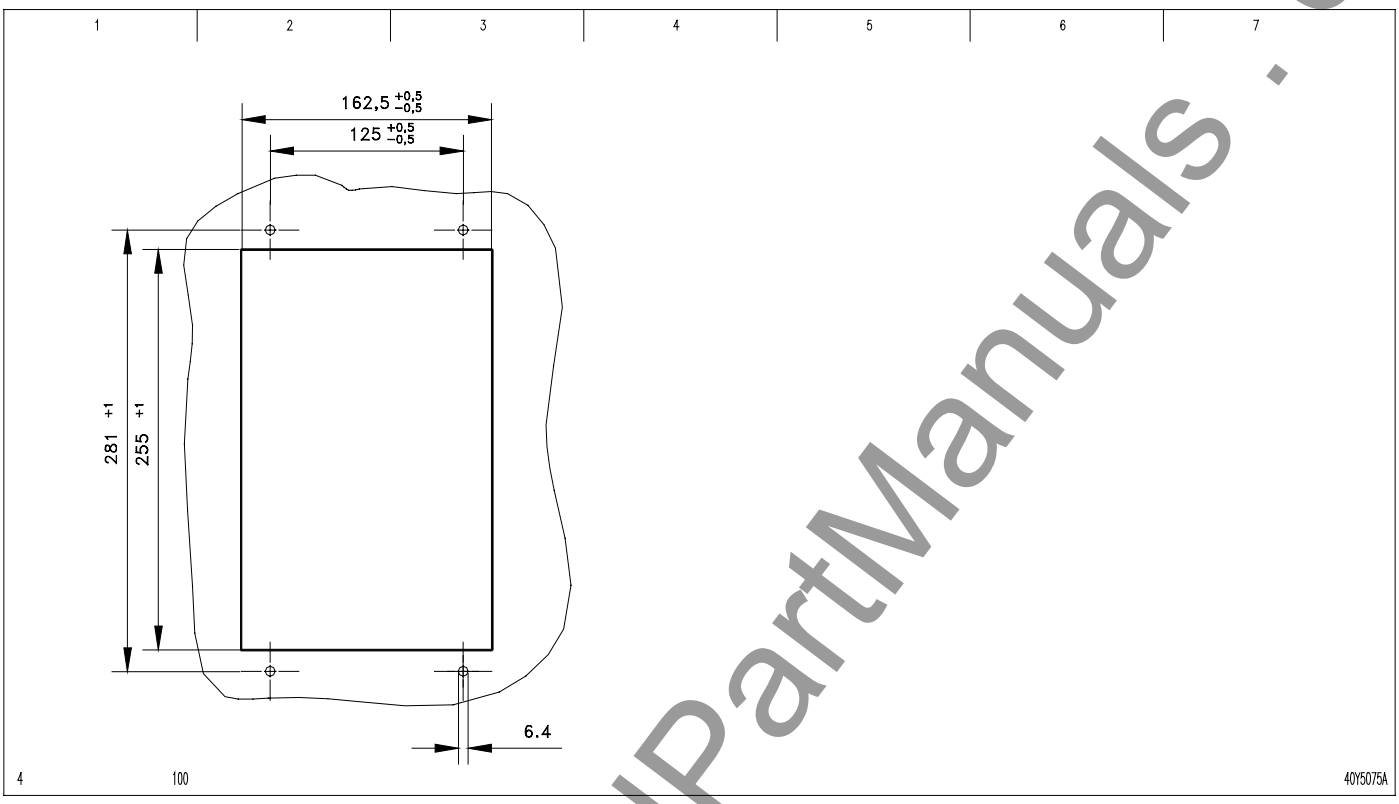
The dimensions and mounting dimensions for surface-mounted cases are given in Chapter 4. When the C232 is surface-mounted on a panel, the leads to the C232 are normally run along the front side of the mounting plane. If the wiring is to be in back, an opening can be provided below the surface-mounted case, as shown in Figure 5-2.



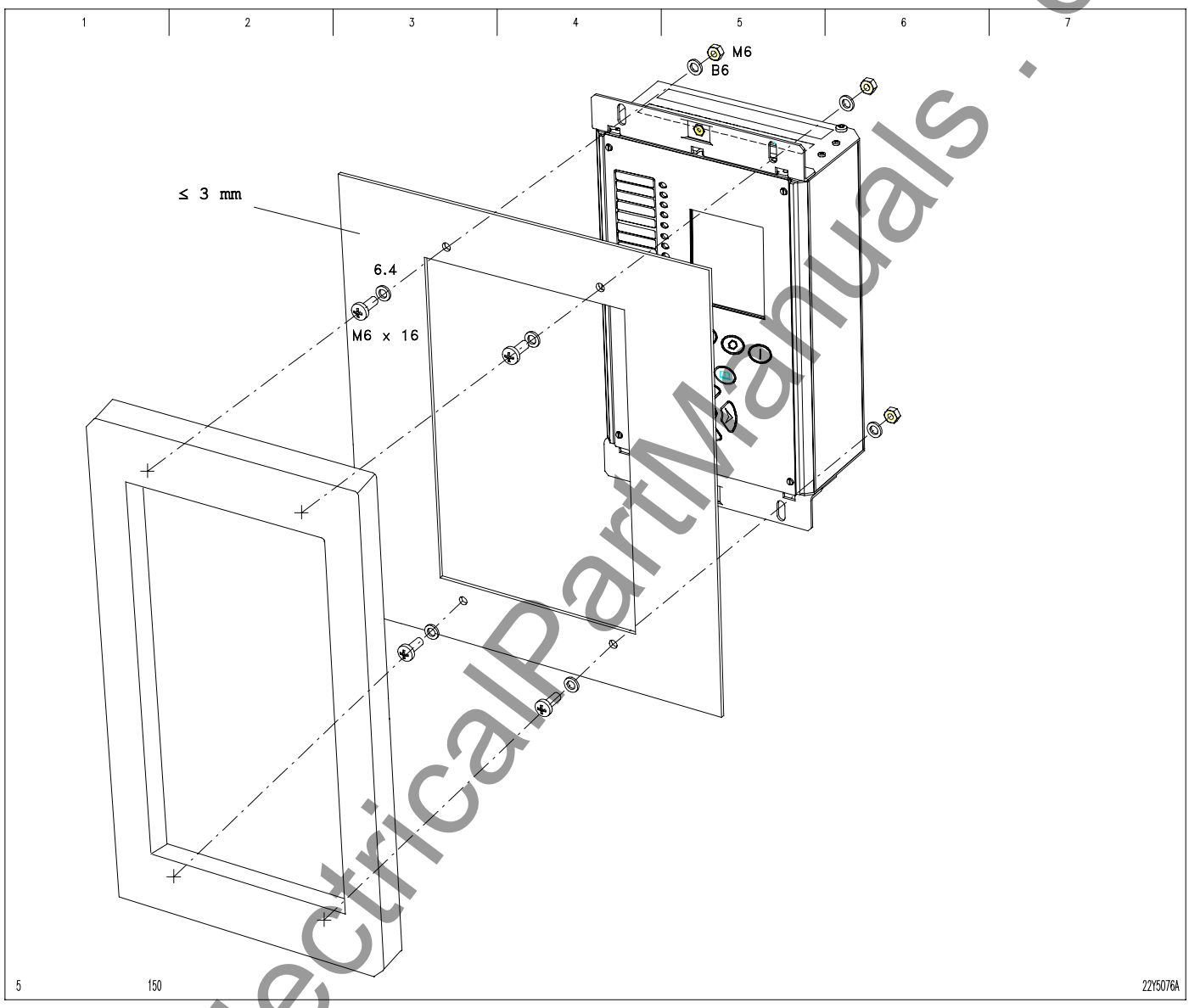
5-2 Opening for running the connecting leads to the surface-mounted case (dimensions in mm)

Flush-mounted cases are designed to be flush-mounted in control panels. The dimensions and mounting dimensions are given in Chapter 4. When the C232 is mounted in a cabinet door, special sealing measures are necessary to provide the degree of protection required for the cabinet (IP 51). Figure 5-3 shows the required panel cutout for the flush-mounted case.

5 Installation and Connection
(continued)



5-3 Panel cutout for the flush-mounted case (dimensions in mm)

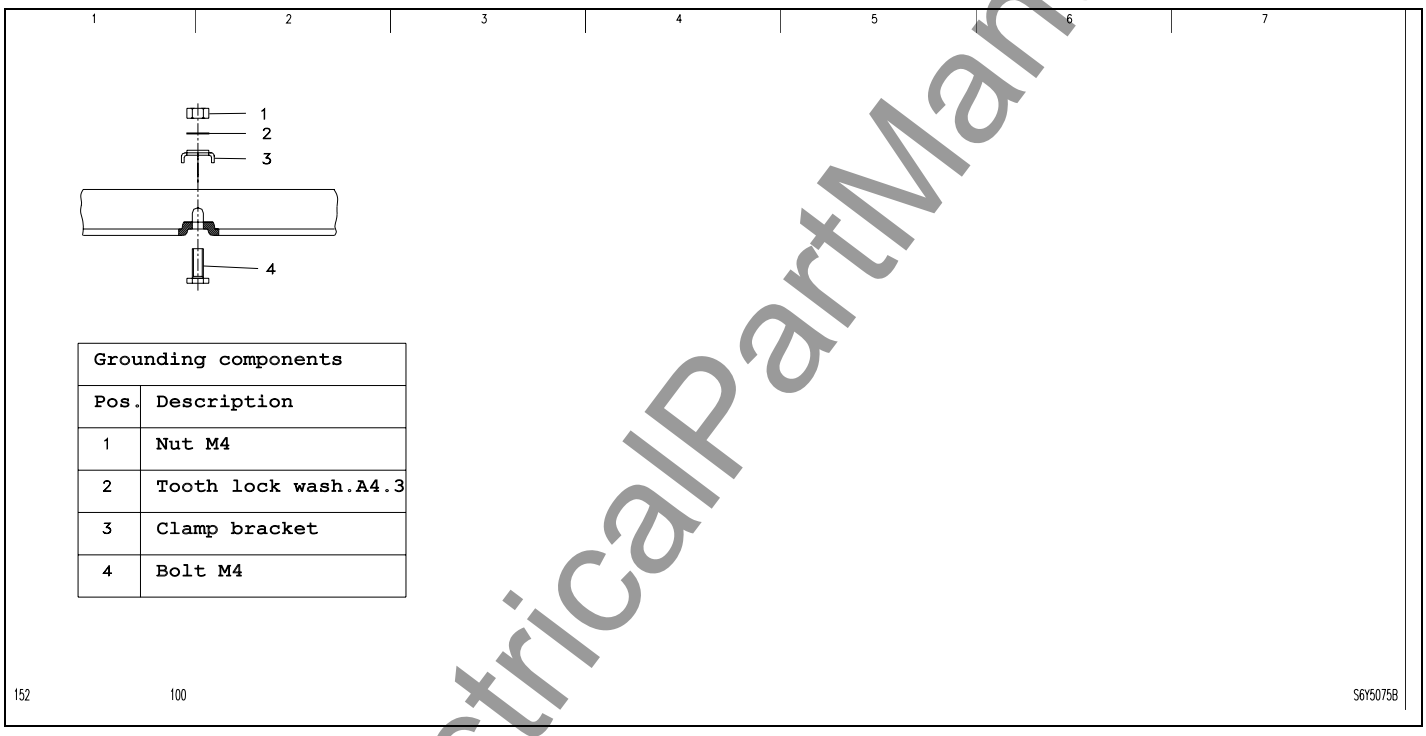


5-4 Installation of the 40 T case with cover frame)

5.5 Protective and Operational Grounding

The unit must be reliably grounded to meet protective equipment grounding requirements. The case is grounded using the appropriate bolt and nut as the ground connection. The cross-sectional area of this ground conductor must also conform to applicable national standards. A minimum conductor cross section of 2.5 mm^2 is required.

The grounding connection must be low-inductance, that is as short as possible.



Grounding components	
Pos.	Description
1	Nut M4
2	Tooth lock wash.A4.3
3	Clamp bracket
4	Bolt M4

5-5 Installing the PE terminal

5.6 Connection

The C232 must be connected in accordance with the terminal connection diagram indicated on the type identification label. The terminal connection diagram is included among the Supporting Documents supplied with the unit. The terminal connection diagrams that apply to the C232 are also found in the Appendix to this manual.

Copper leads having a 2.5 mm^2 cross-section are generally suitable as the connecting leads between the current transformers and the C232. Under certain conditions the connecting leads between the main current transformers and the C232 must be short and have a larger cross-section in order to handle the allowable burden on the main current transformers. Copper leads having a 1.5 mm^2 cross section are adequate for connecting the binary signal inputs, the output relays and the power supply input.

All connections run into the system must always have a defined potential. Connections that are pre-wired but not used should preferably be grounded when binary inputs and output relays are isolated. When binary inputs and output relays are connected to common potential, the pre-wired but unused connections should be connected to the common potential of the grouped connections.

5.6.1 Connecting the Measuring and Auxiliary Circuits

Power supply

Before connecting the auxiliary voltage V_A for the C232 power supply, make sure that the nominal value of the auxiliary device voltage agrees with the nominal value of the auxiliary system voltage.

Current-measuring inputs

When connecting the system transformers, check to make sure that the secondary nominal currents of the system and the unit agree.

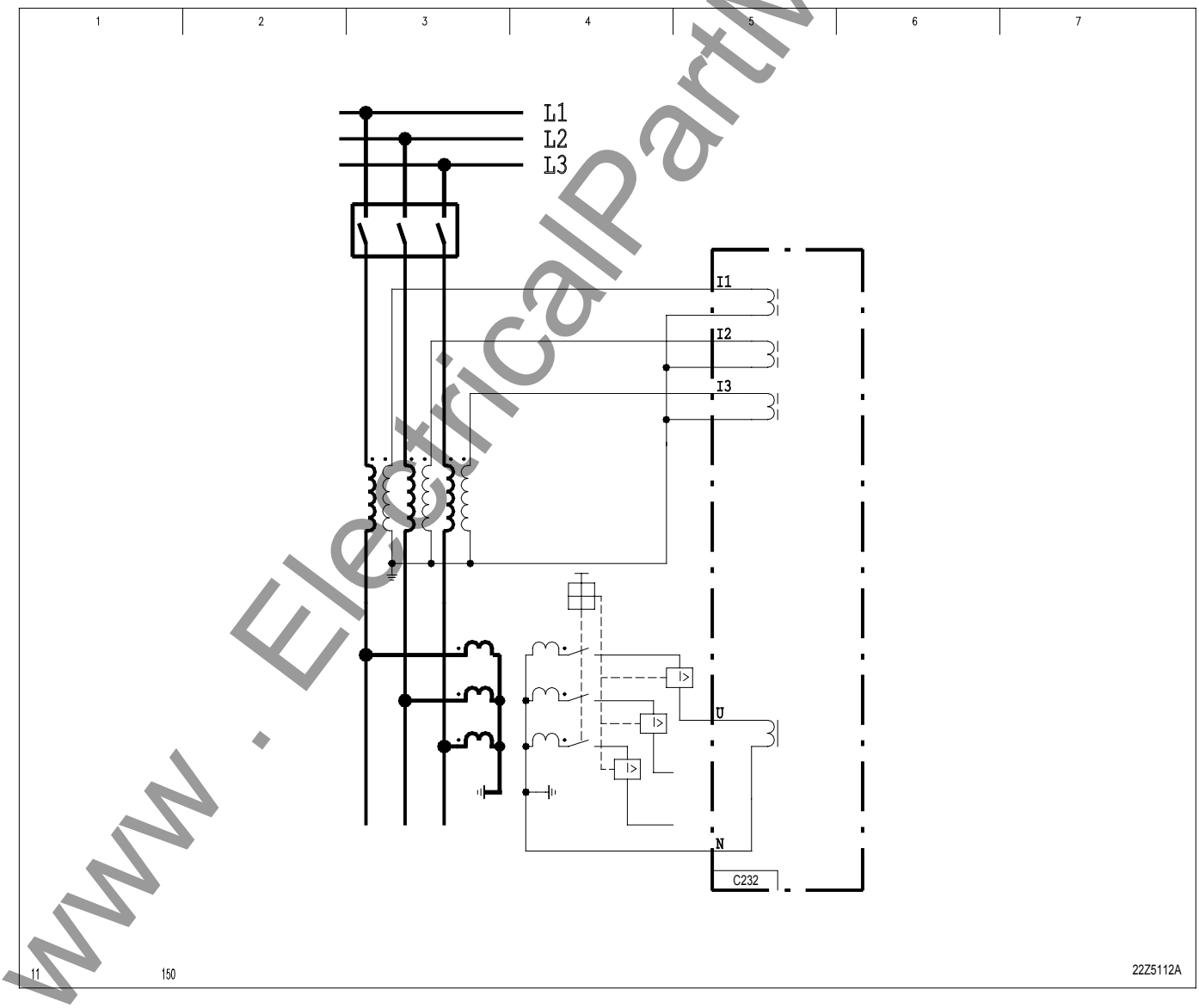
The secondary circuit of operating current transformers must not be opened. If the secondary circuit of an operating current transformer is opened, there is the danger that the resulting voltages will endanger people and damage the insulation.

The threaded terminal block for current transformer connection is not a shorting block. Therefore always short-circuit the current transformers before loosening the threaded terminals.

Connecting the time-overcurrent protection measuring circuits

C232 could be equipped with up to four current or voltage transformers. The applicable assignment of the terminal connections is described in the Appendix (E). The C232 model 4 (with time-overcurrent protection) is fitted with four current-measuring inputs as a standard.

The system current and voltage transformers must be connected in accordance with the standard schematic diagram shown in Figure 5-6. It is essential that the grounding configuration shown in the diagram be followed. If a connection is in opposition, this can be taken into account when making settings (see Chapter 7).



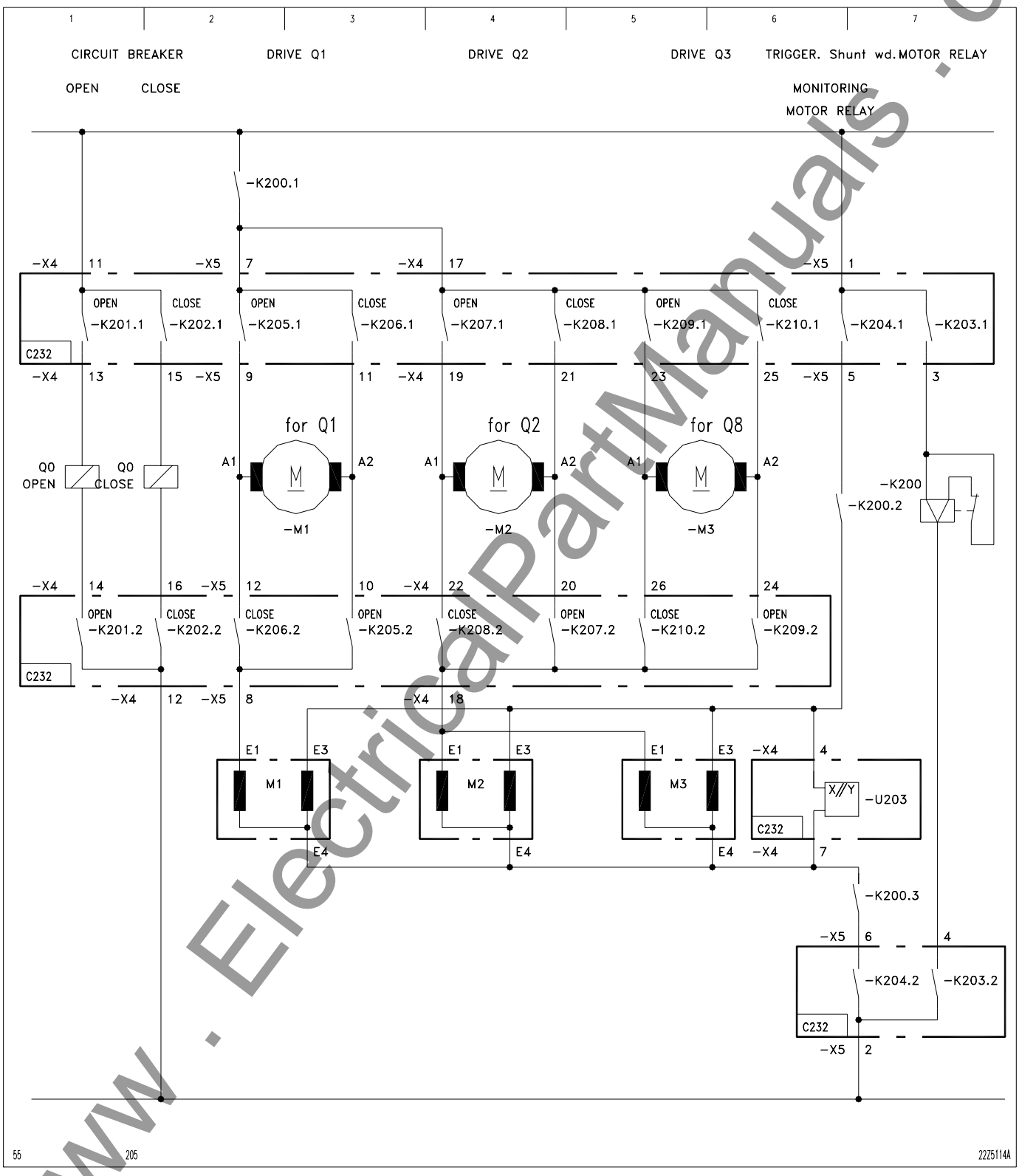
5-6 Standard schematic diagram for time-overcurrent protection

Connecting the binary inputs and output relays

The binary inputs and output relays are freely configurable. When configuring these components it is important to note that the contact rating of the binary I/O modules (X) varies (see the Chapter on “Technical Data”). Once the user has selected a bay type, the C232 can automatically configure the binary inputs and outputs with function assignments for the control of switchgear units. The standard configuration of binary inputs and output relays for each bay type is given in the list of bay types found in the Appendix to this operating manual. Terminal assignment is shown in the terminal connection diagrams found in the Supporting Documents supplied with the unit or in the Appendix to this manual.

Connection of switchgear units having direct motor control

In the case of bay types having direct motor control, one binary input is configured for the status signal and one output relay is configured for triggering and resetting the motor relay. Configuration of appropriate output relays for triggering the armature and shunt windings of motors for switch disconnectors, disconnectors or grounding switches is in accordance with the ‘List of Bay Types’ (see Appendix). A connection example for direct motor control is shown in Figure 5-7.



5-7 Connection example for direct motor control,
bay type No. 89 (A23.105.M04), feeder bay with circuit breaker, double busbar

5.6.2 Connecting the Serial Interfaces

PC interface

The PC interface is provided in order to operate the unit from a personal computer (PC).

The PC interface is not designed for permanent connection. Consequently, the female connector does not have the extra insulation from circuits connected to the system that is required per VDE 0106 Part 101.

Communication interface

The communication interface is provided for permanent connection of the unit to a control system for substations or to a central substation unit. The unit is connected either by a special fiber-optic connector or an RS 485 interface with twisted copper wires, depending on the type of communication interface.

The selection and assembly of a properly cut fiber-optic connecting cable requires special knowledge and expertise and is therefore not covered in this operating manual.

The fiber-optic interface may only be connected or disconnected when the supply voltage for the unit is shut off.

The RS 485 interface must be connected to other units is by a 2-pole twisted conductor cable. Additional instructions for connecting the communication interface can be found in the manual entitled ‘Bus Technology’.

A communication link consisting of a communication master and several slaves can be established via the RS 485 interface. The communication master can be a control station, for example. The devices connected to the communication master, such as the C232, are the communication slaves.

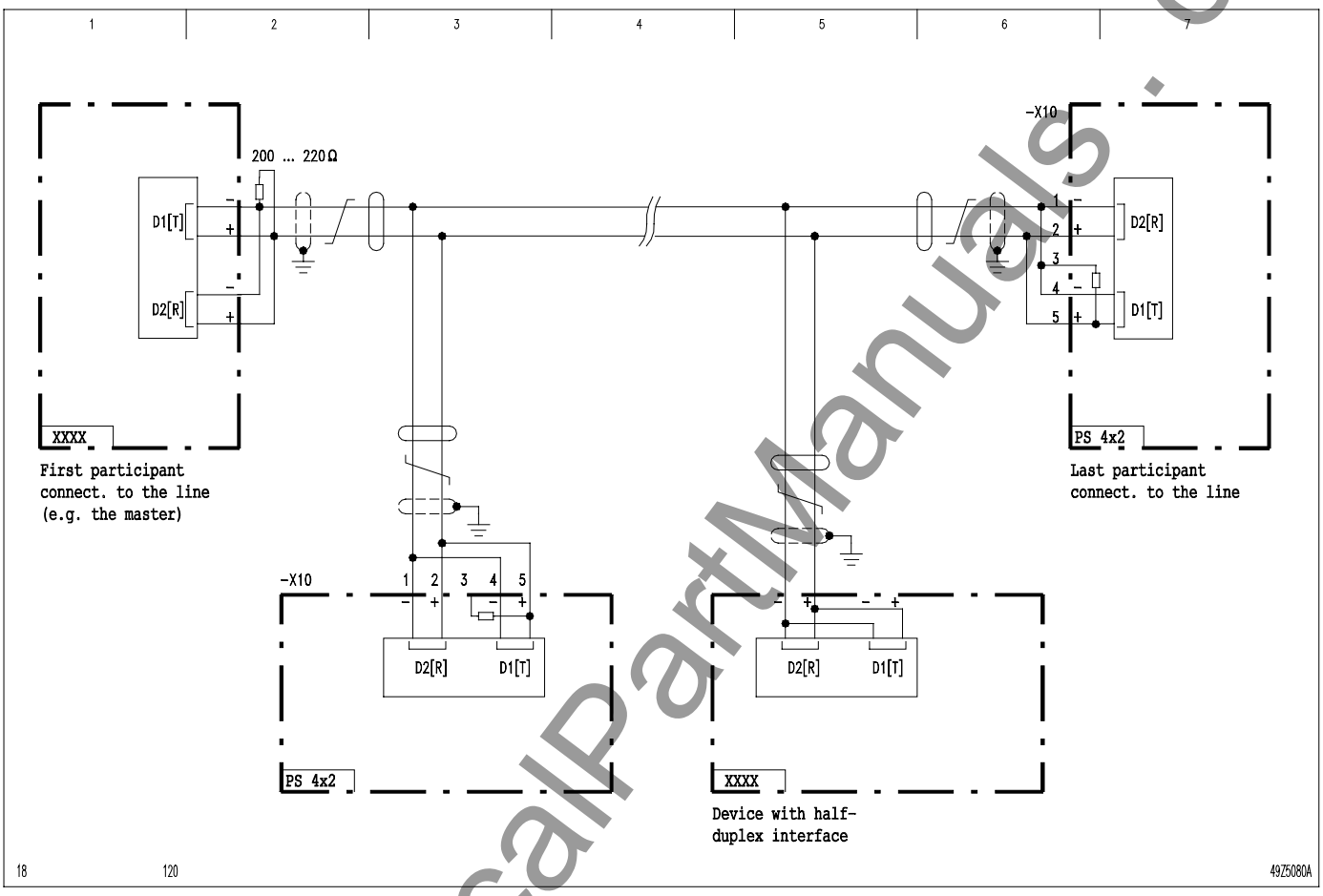
The RS 485 interface of the C232 is designed electrically to permit full-duplex operation through a 4-wire connection. However, communication through the RS 485 interface is always in the half-duplex mode of operation. The following connection instructions must always be followed:

- ☐ Always use twisted-pair shielded cables only, the kind used for telecommunications systems.
- ☐ At least one symmetrically twisted core pair will be required.
- ☐ Strip cable cores and cable shield right at the connection point and connect properly in accordance with specifications.
- ☐ Ground all shields at both ends (large-area grounding).
- ☐ Ground free (unshielded) cores at one end only.

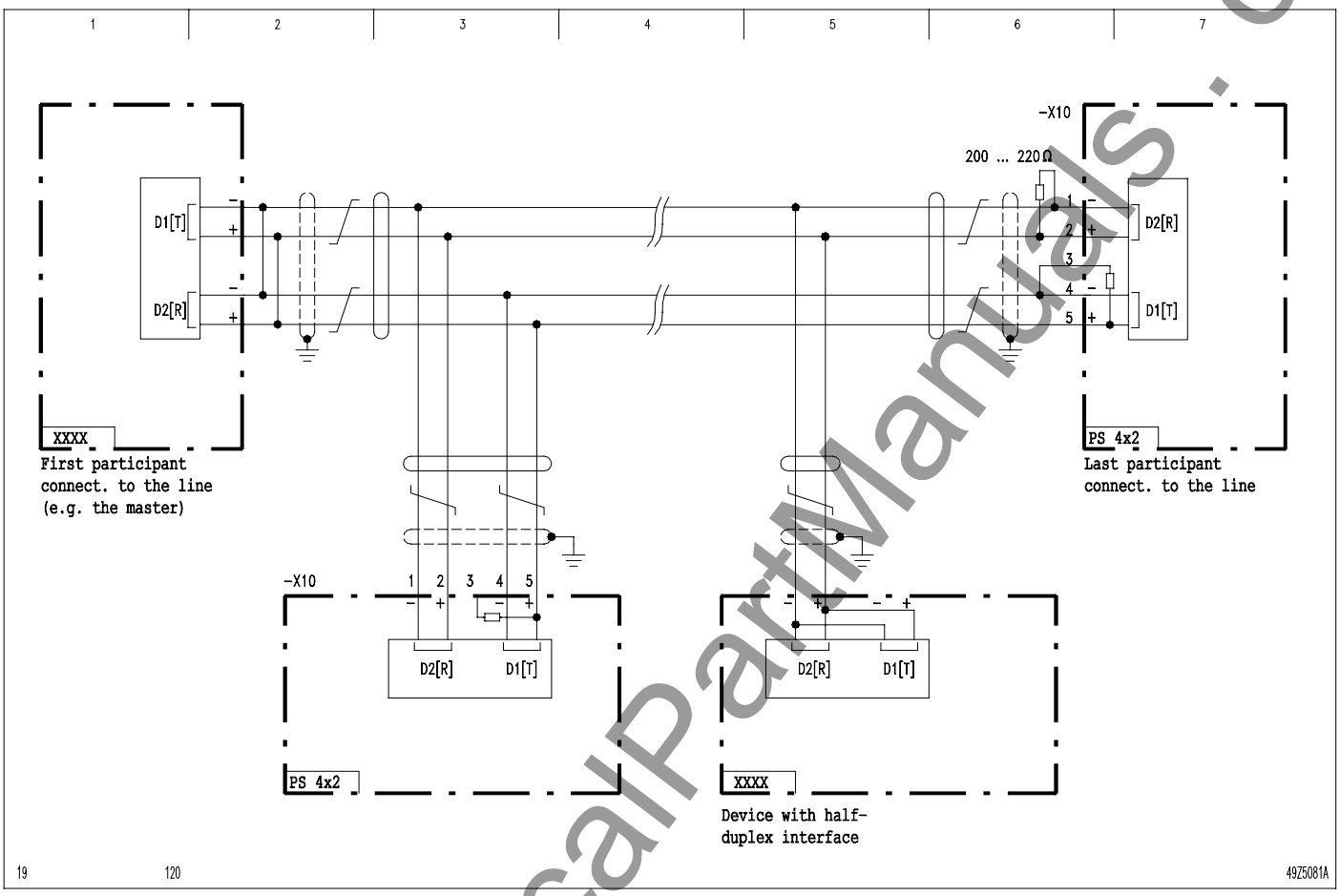
As another option, a 2-wire or 4-wire connection is also possible. For the 4-wire connection, a cable with two symmetrically twisted core pairs is required. Figure 5-8 shows the 2-wire connection and Figure 5-9 the 4-wire connection, as illustrated for channel 2 of the communication module. If channel 1 of the communication module is designed as an RS 485 interface, then the same arrangement would apply.

2-wire connection:
Transmitter and receiver must be bridged in all devices that have a full-duplex interface as part of their electrical system – like the C232, for example. In the two devices that form the physical ends of the line, the pair of leads must be terminated by a 200-to-220-Ω resistor. In most AREVA devices, and also in the C232, a 220-Ω resistor is integrated into the RS 485 interface and can be connected by means of a wire jumper. An external resistor is therefore not necessary.

4-wire connection:
Transmitter and receiver must be bridged in the device that forms one physical end of the line. The receivers of the slaves that have a full-duplex interface as part of their electrial system (like the C232, for example) are connected to the transmitter of the communication master, and the transmitters of the slaves are connected to the receiver of the master. Devices that only have a half-duplex interface are connected to the transmitter of the communication master. In the last physical participant (master or slave) of the communication link, the transmitter and receiver must each be terminated by a 200-to-220-Ω resistor. In most AREVA devices, and also in the C232, a 220-Ω resistor is integrated into the RS 485 interface and can be connected by means of a wire jumper. An external resistor is therefore not necessary. The second resistor must be connected to the device externally (see Chapter 13 for the resistor Order No.).



5-8 2-wire connection



5-9 4-wire connection

6 Local Control Panel

6 Local Control Panel

Local control panel

The switchgear units of the bay can be controlled from the local control panel. In addition, all data required for operation of the unit C232 are entered here, and the data important for system management are read out here as well. The following tasks can be handled from the local control panel:

- □ Controlling switchgear units
- □ Readout and modification of settings
- □ Readout of cyclically updated measured operating data and logic state signals
- □ Readout of operating data logs and of monitoring signal logs
- □ Readout of event logs after short circuits in the power system
- □ Device resetting and triggering of additional control functions used in testing and commissioning

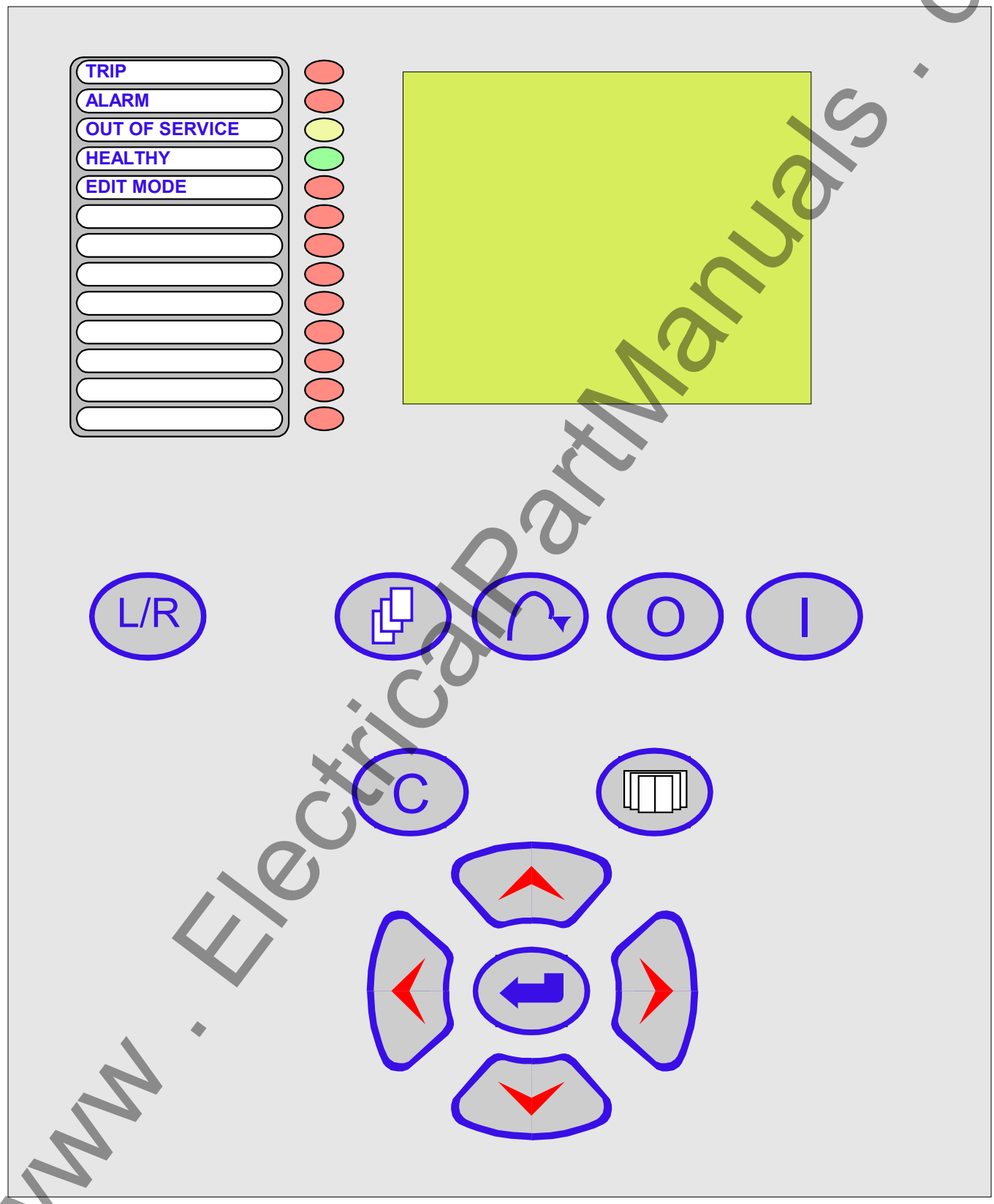
Control is also possible through the PC interface. This requires a suitable PC and the operating program S&R-103 for Windows.

6.1 Display and Keypad

Control and display elements

The local control panel includes an LCD display with a resolution of 128 x 128 pixels (divided semigraphically into 16 lines of 21 characters each), twelve function keys and 17 LED indicators.

6 Local Control Panel
(continued)

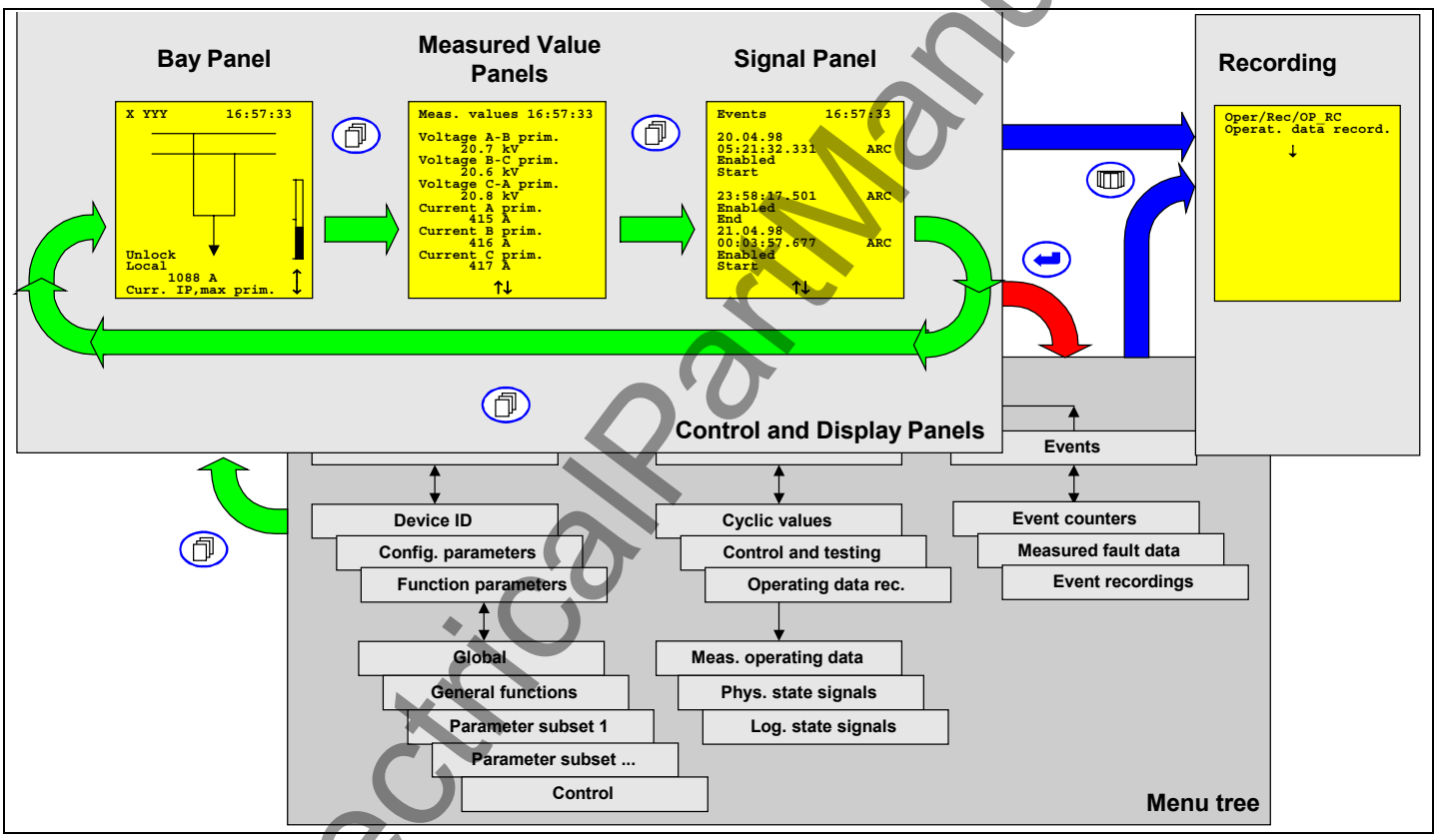


6-1 View of the local control panel

6 Local Control Panel
(continued)

Display levels

All data relevant for operation and all device settings are displayed on two levels. Data such as the switching status or the measured operating values are displayed at the Panel level and provide an up-to-date overview of the state of the bay. The menu tree level below the Panel level allows the user to select all *data points* (settings, signals, measured variables, etc.) and to change them, if appropriate. To access a selected event recording from either the Panel level or from any other point in the menu tree, press the READ key .



6-2 Display Panels and menu tree

Display Panels

The following display Panels are available with the C232:

- □ Bay Panel
- □ Measured Value Panels, which are called up according to system conditions
- □ Signal Panel

The Bay Panel displays the up-to-date switching state of the selected bay in single-pole representation. Selected measured values are displayed on the Measured Value Panels. The system condition determines which particular Panel is called up (examples are the Operation Panel and the Fault Panel). Only the Measured Value Panels relevant for the particular design version of the given unit and its associated range of functions are actually available. The Operation Panel is always available. The Signal Panel displays the most recent events such as the opening of a switchgear unit.

Menu tree and data points

All data points (setting values, signals, measured values, etc.) are selected using a *menu tree*. As the user navigates through the menu tree, the first two lines of the LCD display always show the branch of the menu tree that is active, as selected by the user. The data points are found at the lowest level of a menu tree branch. They are displayed either with their plain text description or in numerically coded form, as selected by the user. The value associated with the selected data point, its meaning, and its unit of measurement are displayed in the line below.

List data points

List data points are a special category. In contrast to other data points, list data points generally have more than one value element associated with them. This category includes tripping matrices, programmable logic functions, and event logs. When a list data point is selected, the symbol '↓' is displayed in the bottom line of the LCD display, indicating that there is another level below the displayed level. The individual value elements of a list data point are found at the lower level. In the case of a list *parameter*, the individual value elements are linked by operators such as 'OR'.

Keys

- **'Up' and 'Down' Keys** /

  Panel Level:
  The effect of using the 'up' and 'down' keys differs between the individual Panels.
  Bay Panel: The 'up' and 'down' keys switch between the measured values selected for this Panel.
  Measured Value Panel: The 'up' and 'down' keys switch between the pages of the Measured Value Panel.
  Signal Panel: The 'up' and 'down' keys switch between events.

  Menu Tree Level:
  By pressing the 'up' and 'down' keys, the user can navigate up and down through the menu tree in a vertical direction. If the unit is in input mode, the 'up' and 'down' keys have a different function.
  Input mode:
  Parameter values can only be changed in the input mode, which is signaled by the LED indicator labeled EDIT MODE. By pressing the 'up' and 'down' keys, the user can then change the parameter value.
  ('Up' key: the next higher value is selected.
  'Down' key: the next lower value is selected.)
  With list parameters, the user can change the logic operator of the value element by pressing the 'up' and 'down' keys.

- **'Left' and 'Right' Keys** /

  Panel Level:
  Pressing the 'right'/'left' keys switches between Bay Panel and Measured Value Panel, for example.

  Menu Tree Level:
  By pressing the 'left' and 'right' keys, the user can navigate through the menu tree in a horizontal direction. If the unit is in input mode, the 'left' and 'right' keys have a different function.
  Input mode:
  Parameter values can only be changed in the input mode, which is signaled by the LED indicator labeled EDIT MODE. When the 'left' and 'right' keys are pressed, the cursor positioned below one of the digits in the change-enabled value moves to the next digit to the right or left.
  ('Left' key: the cursor moves to the next digit on the left.
  'Right' key: the cursor moves to the next digit on the right.)
  In the case of a list parameter, the user can navigate through the list of items available for selection by pressing the 'left' and 'right' keys.

- **ENTER Key**

  Panel Level:
  By pressing the ENTER key at the Panel level, the user can go to the first menu tree level.

  Menu Tree Level:
  To enter the input mode, press the ENTER key. Press the ENTER key a second time to accept the changes as entered and leave the input mode. The LED indicator labeled EDIT MODE signals that the input mode is active.

- **CLEAR Key** (C)
  Press the CLEAR key to reset the LED indicators and clear all measured event data. The records in the recording memories are not affected by this action.
  Panel Level:
  Bay Panel:
  If the reset key is pressed while selecting a switchgear unit on the Bay Panel then the selection of the switchgear unit is canceled. The LED indicators are not reset in this procedure.
  Menu Tree Level:
  Input mode:
  Press the CLEAR key to reject the changes entered and leave the input mode.

- **READ Key**
  Press the READ key to access a selected event recording from either the Panel level or from any other point in the menu tree.

- **Local/Remote Key** (L/R)
  The local/remote key is effective in the Bay Panel only unless a binary signal input has been configured for this function.
  The local/remote key is the transfer switch between remote and local control (setting R↔L), or between remote&local and local control (setting R&L ↔ L). If the local/remote key is set to (R↔L), the transfer from remote to local control can only take place if the L/R password has been entered first. The transfer from local to remote control does not involve a password query.

- **Page Key**
  Panel Level:
  Pressing the page key shows the next Panel.
  Menu Tree Level:
  Pressing the page key results in leaving the menu tree and switching to the Bay Panel.

- **Selection Key**
  The selection key is effective only in the Bay Panel and only if local control is activated. If local control has been selected, pressing the selection key selects the switchgear unit to be controlled. The selected external device will be marked by an asterisk (*) – as long as no external device names are displayed. Otherwise the external device name will flash and will be displayed in the status line.

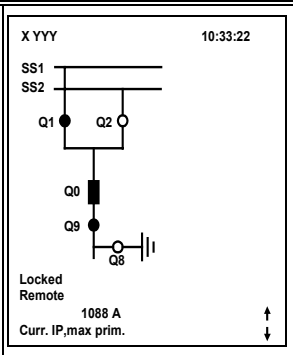
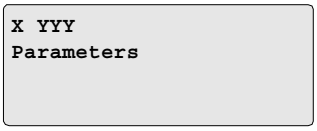
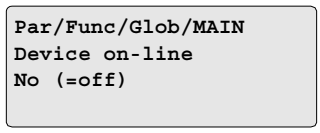
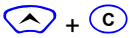
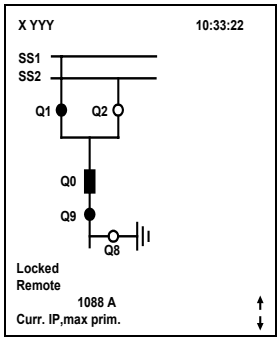
- **OPEN Key** (O)
  The OPEN key is effective in the Bay Panel only.
  Pressing the OPEN key controls the selected switchgear unit – taking into account the interlock equation – to assume the 'open' state.

- **CLOSE Key** (I)
  The CLOSE key is effective in the Bay Panel only.
  Pressing the CLOSE key controls the selected switchgear unit - taking into account the interlock equation – to assume the 'closed' state.

The following presentation of the individual control steps shows which displays can be changed in each case by pressing the keys. A small black square to the right of the enter key indicates that the “EDIT MODE” LED indicator is lit up. An underscored external device name in the Bay Panel indicates a selected switchgear unit. The examples used here are not necessarily valid for the unit type described in this manual; they merely serve to illustrate the control principles involved.

6.2 Changing between Display Levels

After start-up of the unit, the display is at the Panel level. The Bay Panel is displayed.

	Control Step / Description	Control Action	Display
Jumping from the Panel level to the menu tree level	**0** Example of a display after start-up of the unit. **Note:** When the unit is delivered, it is set for a dummy bay without switchgear units. Therefore only the name of the unit appears on the Bay Panel. The display shown in the example will not appear until a ‘real’ bay type has been selected.		
	1 Press the enter key to go from the Panel level to the menu tree level.		
Jumping from the menu tree level to the Panel level	**0** From the menu tree level, the user can go to the Panel level from any position within the menu tree.		
	1 Press the page key. Alternatively first press the ‘up’ key and hold it down while pressing the reset key. **Note:** It is important to press the ‘up’ key first and release it last in order to avoid unintentional resetting of stored data.	 or 	

After the set return time has elapsed (setting in menu tree: “Par/Conf/LOC”), the display will switch automatically to the Bay Panel.

6.3 Illumination of the Display

If none of the control keys is pressed, the display illumination will switch off once the set 'return time illumination' (set in the menu tree at 'Par/Conf/LOC') has elapsed. Press any one of the control keys to turn the display illumination on again. The control action that is normally triggered by that key will not be executed. Reactivation of display illumination is also possible by way of a binary input.

If continuous illumination is desired, set the 'return time illumination' function to *'blocked'*.

6.4 Control at the Panel Level

At the Panel level, the user can move from one Panel type to another by pressing the page key (in one direction only) or the 'left' and 'right' keys (in both directions).

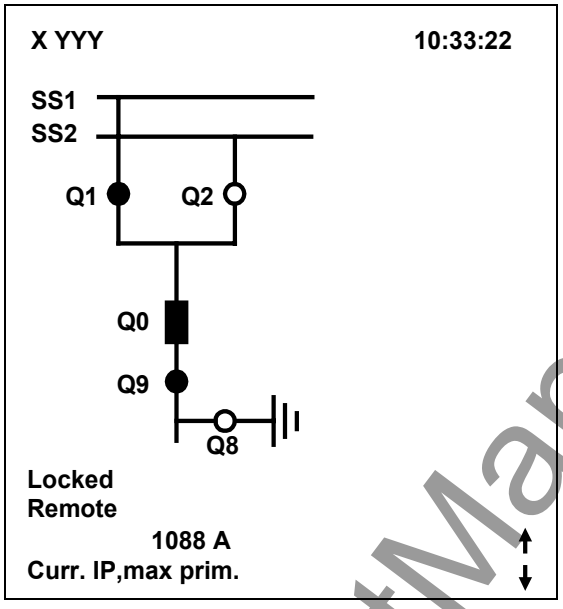
6.4.1 Bay Panel

Information displayed on the Bay Panel

Figure 6-3 shows an example of a Bay Panel. The top line shows the unit type on the left and the current time of day on the right.

The bay shown below in single-pole representation is a function of the set bay type. The symbols shown in the table on the next page are used to represent the switchgear units and other external devices as well as the state of the switchgear units. The user can switch between character sets 1, 2, and 3. Character set 3 is identical to character set 1 in as-delivered condition but can be replaced by a user-defined character set – by using a special ancillary tool. The symbols of character set 2 are used in the following description.

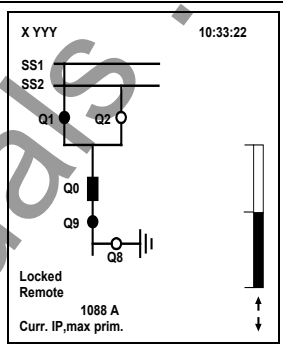
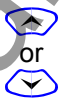
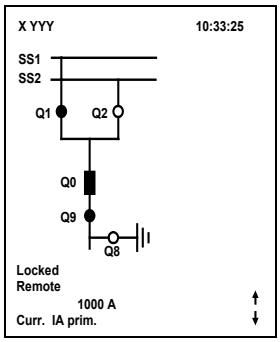
The fourth line from the bottom shows (in abbreviated form) whether a bay interlock is active. The third line from the bottom indicates whether remote or local control is permitted. In the example shown here, remote control is activated. The two lines at the bottom contain measured value data. The arrows to the right of the measured value data indicate that additional measured values can be called up by pressing the 'up' or 'down' keys.



6-3 Example for a Bay Panel

External device	State	Representation of the external devices with character set 1	character set 2
Circuit breaker	'Open'		
	'Closed'		
	'Off-end','Faulty'		
Switch disconnector	'Open'		
	'Closed'		
	'Off-end','Faulty'		
Disconnector	'Open'		
	'Closed'		
	'Off-end','Faulty'		
Switch truck	'Open'		
	'Closed'		
	'Off-end','Faulty'		
Fuse unit	'Open'		
	'Closed'		

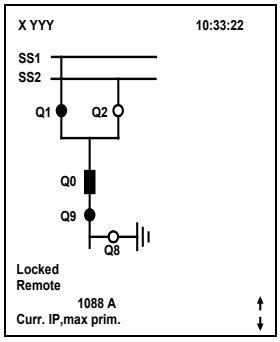
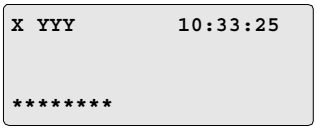
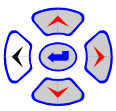
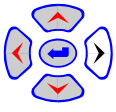
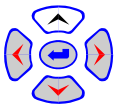
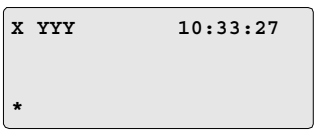
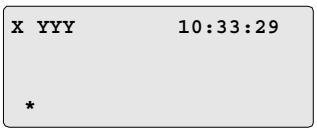
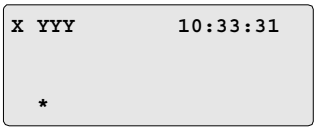
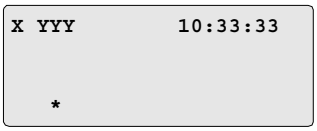
Measured value display in the Bay Panel

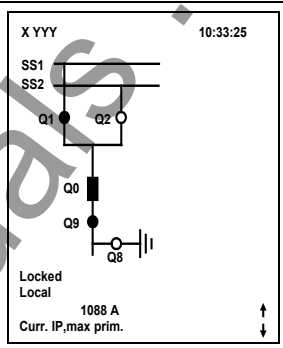
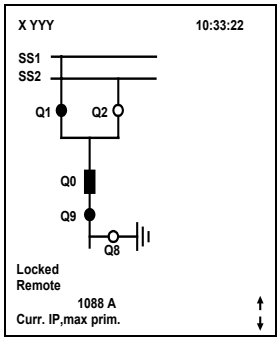
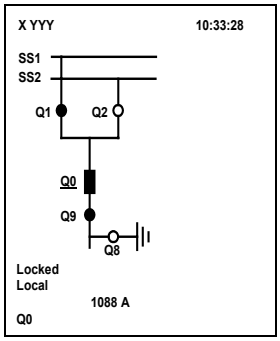
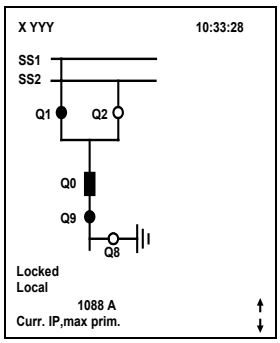
Control Step / Description	Control Action	Display
0 Measured values are shown one at a time. A configuration step determines whether the measured value will also be displayed in bar form. The position of the bar can also be set for horizontal or vertical (the setting applies to all measured values). The arrows under the bar indicate that additional measured values can also be displayed.		
1 Press the 'up' or 'down' key to display the next measured value. In the example shown, no bar display has been configured for the measured value.		

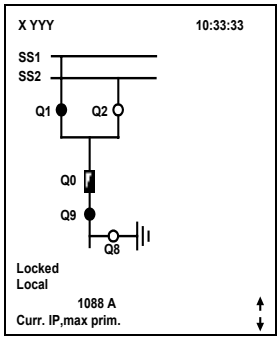
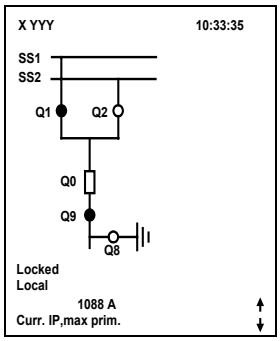
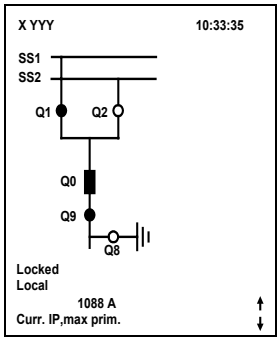
Controlling switchgear units

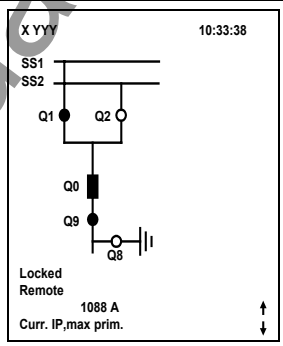
Switchgear units can be controlled from the local control panel, provided that the unit has been set for 'local control'. If the local/remote key is set to switch between remote and local control (R↔L), then the switch from 'remote' to 'local' operation requires a password.

The following example is based on the (R↔L) setting for the local/remote key and the factory-set L/R password. If the password has been changed by the user (see the section entitled 'Changing the Password'), the following description will apply analogously.

Control Step / Description	Control Action	Display
0 Select the Bay Panel.		
1 Press the 'local/remote' key (L/R) to switch the unit to local operation. The Bay Panel is no longer displayed. The unit type appears in the first line. Eight asterisks (*) appear in the fourth line as a prompt for entering the password.		
2a Press the following keys in sequence: 'Left' 'Down' 'Right' 'Up' The display will change as shown in the column on the right.	   	   

Control Step / Description	Control Action	Display
Now press the enter key. If the correct password has been entered, the Bay Panel will re-appear. The third line from the bottom will display 'Local'. If an invalid password has been entered, the display shown above in Step 1 will appear.		
2b This control step can be canceled at any time by pressing the reset key before the enter key is pressed.		
3a Press the selection key to select a switchgear unit. Only switchgear units that are electrically controllable can be selected. The device designation for the selected switchgear unit –'Q0', for example – is displayed in flashing characters (underlined in the example to the right) and also appears in the bottom line of the display. If the display of external device designations has been disabled, the selected switchgear unit will be marked by a flashing asterisk (*). The designation of the selected external device appears in the bottom line of the display.		
3b If you wish to cancel the selection of a switchgear unit, press the reset key. Press the selection key to select a new switchgear unit.		

Control Step / Description	Control Action	Display
4 After selecting a switchgear unit, press the keys "Open" or "Close" to control the switchgear unit. Before this switching action is executed, compliance with bay interlock conditions – if applicable – is checked.	O I	
4a If the check of bay interlock conditions determines that an operation can be carried out, then the switch command is executed. The 'off-end' (intermediate position) symbol is displayed while the switchgear unit is operating.		
Once the operating time of the switchgear unit has elapsed, the resulting switching state is displayed.		
4b If the check of interlock conditions determines that switching is not allowed, then the selected switchgear unit is no longer highlighted. If the LED indicators have been configured accordingly, the LED indicator for 'Interlock equations violated' will light up.		

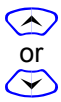
Control Step / Description	Control Action	Display
5 If a control action does not take place within a set time period after selection of a switchgear unit or if the return time for illumination has elapsed, then the selection is canceled.		
6 Press the local/remote key (L/R) to switch to remote control; this is accomplished without a password prompt.	L/R	

6.4.2 Measured Value Panels and Signal Panel

Measured Value Panels

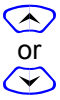
The measured values that will be displayed on the Measured Value Panels can first be selected in the menu tree under Par/Conf/LOC. The user can select different sets of measured values for the Operation Panel, the Overload Panel, the Ground Fault Panel, and the Fault Panel. Only the Measured Value Panels relevant for the particular design version of the given unit and its associated range of functions are actually available. The selected set of values for the Operation Panel is always available. Please see the section entitled 'Setting a List Parameter' for instructions regarding selection. The measured value display can be structured by inserting a dummy or placeholder in the list of selected measured values. If the MAIN: Without function setting has been selected for a given Panel, then that Panel is disabled.

The Measured Value Panels are called up according to system conditions. If, for example, the unit detects an overload or a ground fault, then the corresponding Measured Value Panel will be displayed as long as the overload or ground fault situation exists. If the unit detects a fault, then the Fault Panel is displayed and remains active until the measured fault values are reset – by pressing the reset key (C), for example.

Control Step / Description	Control Action	Display
0 The uppermost line of the display indicates the type of measured values being displayed. In this example, the display shows measured operating values (abbreviated as 'Meas. values'). The time of day is shown at the upper right of the display. Up to six selected measured values can be displayed on the Panel simultaneously.		Meas. values 16:57:33 Voltage A-B prim. 20.7 kV Voltage B-C prim. 20.6 kV Voltage C-A prim. 20.8 kV Current A prim. 415 A Current B prim. 416 A Current C prim. 417 A ↓↑
1 If more than 6 measured values have been selected, they can be viewed one page at a time by pressing the 'up' or 'down' keys.	 or	Meas. values 16:57:35 Voltage A-B norm. 0.7 Vnom Voltage B-C norm. 0.6 Vnom Voltage C-A norm. 0.8 Vnom Current A norm. 1.5 Inom Current B norm. 1.6 Inom Current C norm. 1.7 Inom ↓↑

Signal Panel

The Signal Panel shows the signals relevant for operation. Each signal is fully time-tagged (date and time of day). A maximum of three signals are displayed.

Control Step / Description	Control Action	Display
0 The top line of the display shows the Panel designation and the current time of day. Below this line, the signals are shown in chronological order. The arrows at the bottom of the display area indicate the presence of additional signals.		Events 16:57:33 20.04.98 05:21:32.331 MAIN Trip command Start 05:21:35.501 MAIN Trip command End 21.04.98 00:03:57.677 MAIN Blocked/faulty Start ↓↑
1 Press the 'up' or 'down' keys to display the signals one at a time.		Events 16:57:35 05:21:35.501 MAIN Trip command End 21.04.98 00:03:57.677 MAIN Blocked/faulty End 08:10:59.688 MAIN Blocked/faulty End ↓↑

6.5 Control at the Menu Tree Level

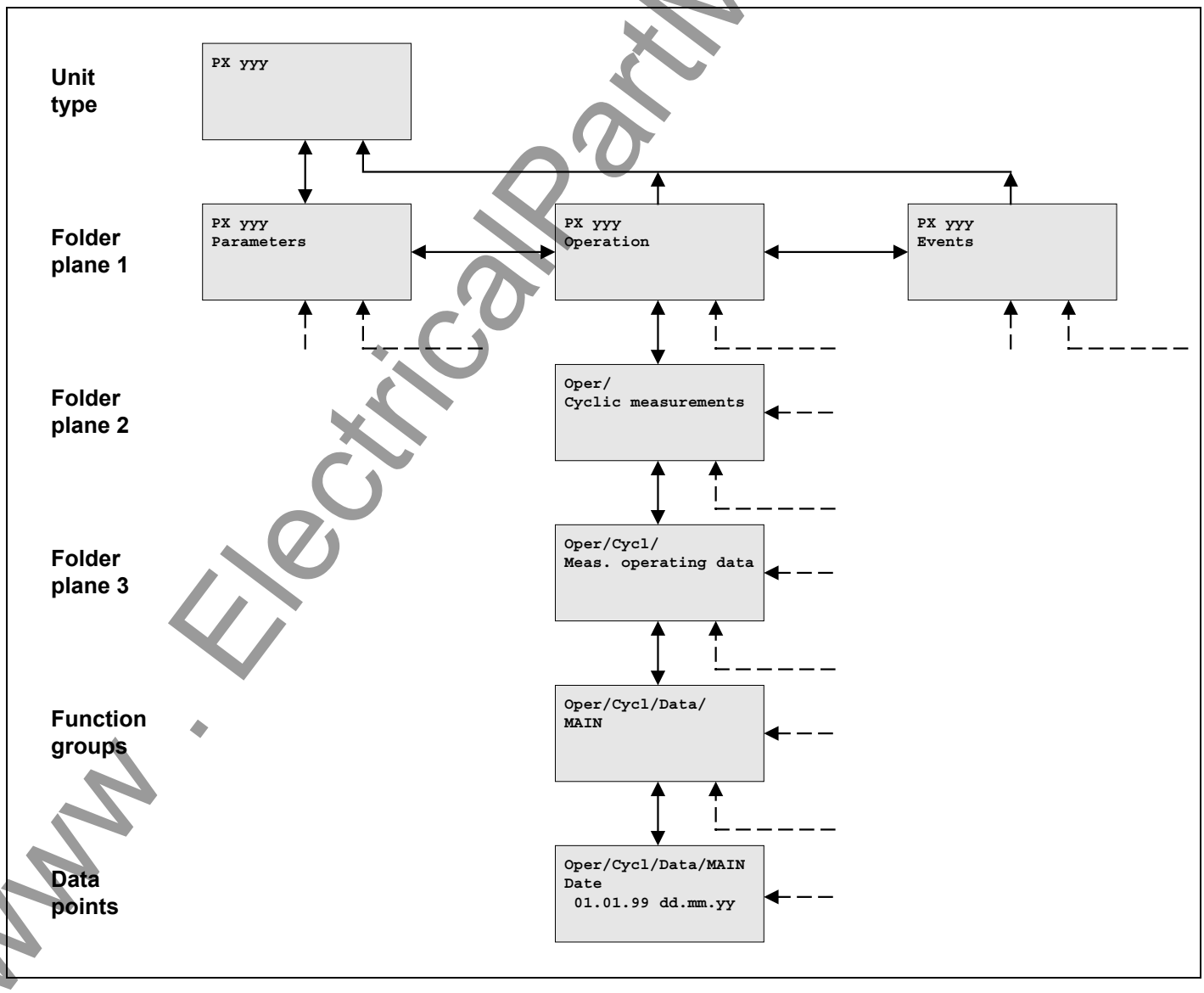
6.5.1 Navigation in the Menu Tree

Folders and function groups

All data points are grouped in function groups according to the function they are associated with and are also organized in different folders based on practical control requirements.

The menu tree begins with the device type at the top and then branches out below into the three main folders entitled Parameters, Operation, and Events, which form the first folder level. Below the first folder level are two more folder levels, so that the entire folder structure consists of three main branches and a maximum of three folder levels.

At the bottom of each branch of folders, below the folder levels, are the various function groups in which the individual data points are combined.



6-4 Basic menu tree structure

6.5.2 Switching Between Address Mode and Plain Text Mode

The display on the local control panel can be switched between address mode and plain text mode. In the address mode the display shows setting parameters, signals, and measured values in numerically coded form, that is, as addresses. In plain text mode the setting parameters, signals, and measured values are displayed in the form of plain text descriptions. In either case, control is guided by the menu tree. The active branch of the menu tree is displayed in plain text in both modes. In the following examples, the display is shown in only plain text mode.

Control Step / Description	Control Action	Display
0 In this example, the user switches from plain text mode to address mode.		Par/Func/Glob/MAIN Device on-line No (=off)
1 To switch from address mode to plain text mode or vice versa, press the CLEAR key (C) and either the 'left' key or the 'right' key simultaneously. This can be done at any point in the menu tree.	(C) + (‹) or (C) + (›)	Par/Func/Glob/MAIN 003.030 0

6.5.3 Change-Enabling Function

Although it is possible to select any data point in the menu tree and read the associated value by pressing the keys, it is not possible to switch directly to the input mode. This safeguard prevents unintended changes in the settings.

There are two ways to enter the input mode.

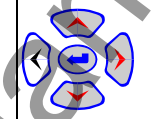
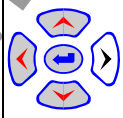
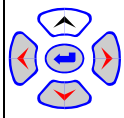
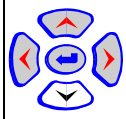
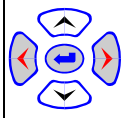
Global change-enabling function

- To activate the global change-enabling function, set the 'Param. change enabl.' parameter to 'Yes' (menu tree: 'Oper/CtrlTest/LOC').
  The change can only be made after the password has been entered. Thereafter, all further changes – with the exception of specially protected control actions (see the section entitled 'Password-Protected Control Actions') – are enabled without entering the password.

Selective change-enabling function

- Password input prior to any parameter change.

The password consists of a pre-defined sequential key combination entered within a specific time interval. The following example is based on the factory-set password. If the password has been changed by the user (see the section entitled 'Changing the Password'), the following description (next page) will apply analogously.

Control Step / Description	Control Action	Display
0 In the menu tree 'Oper/CtrlTest/LOC' select the 'Param. change enabl.' parameter.		Oper/CtrlTest/LOC Param. change enabl. No
1 Press the ENTER key. Eight asterisks (*) appear in the fourth line of the display.		Oper/CtrlTest/LOC Param. change enabl. No ********
2 Press the following keys in sequence: 'Left' 'Right' 'Up' 'Down' The display will change as shown in the column on the right. Now press the ENTER key. The LED indicator labeled EDIT MODE will light up. This indicates that the setting can now be changed by pressing the 'up' or 'down' keys. If an invalid password has been entered, the display shown in Step 1 appears.	    	Oper/CtrlTest/LOC Param. change enabl. No * Oper/CtrlTest/LOC Param. change enabl. No * Oper/CtrlTest/LOC Param. change enabl. No * Oper/CtrlTest/LOC Param. change enabl. No * Oper/CtrlTest/LOC Param. change enabl. No
3 Change the setting to '*Yes*'.		Oper/CtrlTest/LOC Param. change enabl. Yes
4 Press the ENTER key again. The LED indicator will go out. The unit is enabled for further parameter changes.		Oper/CtrlTest/LOC Param. change enabl. Yes

The same procedure applies to any parameter change unless the global change-enabling function has been activated. This method is recommended for a single parameter change only. If several settings are to be changed, then the global change-enabling function is preferable. In the following examples, the global change-enabling function has been activated.

Automatic return

The automatic return function prevents the change-enabling function from remaining activated after a change of settings has been completed. Once the set return time (menu tree 'Par/Conf/LOC') has elapsed, the change-enabling function is automatically deactivated, and the display switches to a Measured Value Panel corresponding to the current system condition. The return time is restarted when any of the control keys is pressed.

Forced return

The return described above can be forced from the local control panel by first pressing the 'up' key and then holding it down while pressing the CLEAR key.

Note: It is important to press the 'up' key first and release it last in order to avoid unintentional deletion of stored data.

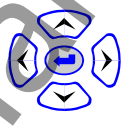
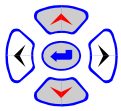
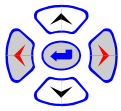
Even when the change-enabling function is activated, not all parameters can be changed. For some settings it is also necessary to disable the protective function (menu tree: Par/Func/Glob/MAIN, "Protection enabled"). Such settings include the configuration parameters, by means of which the device interfaces can be adapted to the system. The following entries in the "Change" column of the address list (see appendix) indicate whether values can be changed or not:

- **"on"**: The value can be changed even when the protective function is enabled.
- **"off"**: The value can only be changed when the protective function is disabled.
- **"-"**: The value can be read out but cannot be changed.

The device is factory-set so that the protective function is disabled.

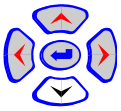
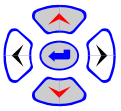
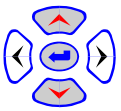
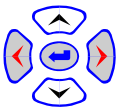
6.5.4 Changing Parameters

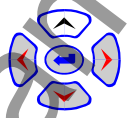
If all the conditions for a value change are satisfied (see above), the desired setting can be entered.

Control Step / Description	Control Action	Display
0 Example of a display. In this example the change-enabling function is activated and the protective function is disabled, if necessary.		Oper/CtrlTest/LOC Param. change enabl. Yes
1 Select the desired parameter by pressing the keys.		Par/Conf/LOC Autom. return time 50000 s
2 Press the ENTER key. The LED indicator labeled EDIT MODE will light up. The last digit of the value is highlighted by a cursor (underlined).		Par/Conf/LOC Autom. return time 50000 s
3 Press the 'left' or 'right' keys to move the cursor to the left or right.		Par/Conf/LOC Autom. return time 50000 s
4 Change the value highlighted by the cursor by pressing the 'up' and 'down' keys. In the meantime the device will continue to operate with the old value.		Par/Conf/LOC Autom. return time 50010 s
5 Press the ENTER key. The LED indicator labeled EDIT MODE will go out and the device will now operate with the new value. Press the keys to select another setting parameter for a value change.		Par/Conf/LOC Autom. return time 50010 s
6 If you wish to reject the new setting while you are still entering it (LED indicator labeled EDIT MODE is on), press the CLEAR key. The LED indicator will go out and the device will continue to operate with the old value. A further parameter can be selected for a value change by pressing the keys.		Par/Conf/LOC Autom. return time 50000 s

6.5.5 Setting a List Parameter

Using list parameters, the user is able to select several elements from a list in order to perform tasks such as defining a trip command or defining the measured values that will be displayed on Measured Value Panels. The maximum possible number 'm' that can be selected out of the total number 'n' of the set is given in the address list in the 'Remarks' column. As a rule, the selected elements are linked by an 'OR' operator. Other operators (NOT, OR, AND, NOT OR and NOT AND) are available in the LOGIC function group for linking the selected list items. In this way binary signals and binary input signals can be processed in a Boolean equation tailored to meet user requirements. For the DNP 3.0 communication protocol, the user defines the class of a parameter instead of assigning operators. The definition of a trip command shall be used here as an example to illustrate the setting of a list parameter.

Control Step / Description	Control Action	Display
0 Select a list parameter (in this example, the parameter 'Fct.assign.trip cmd.' at 'Par/Func/Glob/ MAIN' in the menu tree). The down arrow (↓) indicates that a list parameter has been selected.		Par/Func/Glob/MAIN Fct.assign.trip cmd. ↓
1 Press the 'down' key. The first function and the first selected signal will appear in the third and fourth lines, respectively. The symbol '#01' in the display indicates the first item of the selection. If 'MAIN: Without function' appears for the first item, then this means that no function assignment has been made yet.		Par/Func/Glob/MAIN Fct.assign.trip cmd. #01 DIST Trip zone 1
2 Scroll through the list of assigned functions by pressing the 'right' and 'left' keys. Once the end of the list is reached, the display shown on the right will appear.		Par/Func/Glob/MAIN Fct.assign.trip cmd. OR #02 DIST Trip zone 2 Par/Func/Glob/MAIN Fct.assign.trip cmd. #05 MAIN ?????
3 Press the ENTER key at any position in the list. The LED indicator labeled EDIT MODE will light up.		Par/Func/Glob/MAIN Fct.assign.trip cmd. #02 DIST Trip zone 2
4 Scroll through the assignable functions by pressing the 'right' and 'left' keys in the input mode.		Par/Func/Glob/MAIN Fct.assign.trip cmd. #02 DIST Trip zone 4
5 Select the operator or the class using the 'up' and 'down' keys. In this particular case, only the 'OR' operator can be selected. There is no limitation on the selection of classes.		Par/Func/Glob/MAIN Fct.assign.trip cmd. OR #02 DIST Trip zone 4

Control Step / Description	Control Action	Display
6 Press the ENTER key. The LED indicator will go out. The assignment has been made. The unit will now operate with the new settings. If no operator has been selected, the 'OR' operator is always assigned automatically when the ENTER key is pressed. There is no automatic assignment of classes.	C	Par/Func/Glob/MAIN Fct.assign.trip cmd. OR #02 DIST Trip zone 4
7 Press the 'up' key to exit the list at any point in the list.		Par/Func/Glob/MAIN Fct.assign.trip cmd. ↓
8 If you wish to reject the new setting while you are still entering it (LED indicator labeled EDIT MODE is on), press the CLEAR key. The LED indicator will go out.	C	Par/Func/Glob/MAIN Fct.assign.trip cmd. OR #02 DIST Trip zone 2

Deleting a List Parameter

If 'MAIN: Without function' is assigned to a given item, then all the following items are deleted. If this occurs for item #01, everything is deleted.

6.5.6 Memory Readout

After a memory is entered, the memory can be read out at the entry point. It is not necessary to activate the change-enabling function or even to disable the protective function. Inadvertent clearing of a memory at the entry point is not possible.

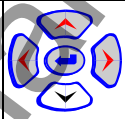
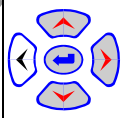
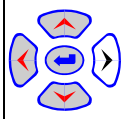
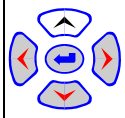
The following memories are available:

- In the menu tree ‘Oper/Rec/OP_RC’: Operating data memory
- In the menu tree ‘Oper/Rec/MT_RC’: Monitoring signal memory
- Event memories
  - In the menu tree ‘Events/Rec/FT_RC’: Fault memories 1 to 8
  - In the menu tree ‘Events/Rec/OL_RC’: Overload memories 1 to 8
  - In the menu tree ‘Events/Rec/GF_RC’: Ground fault memories 1 to 8

Not all of these event memories are present in each unit. A given unit may contain only some of them or even none at all, depending on the device type.

Readout of the operating data memory

The operating data memory contains stored signals of actions that occur during operation, such as the enabling or disabling of a device function. A maximum of 100 entries is possible, after which the oldest entry is overwritten.

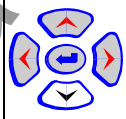
Control Step / Description	Control Action	Display
0 Select the entry point for the operating data memory.		Oper/Rec/OP_RC Operat. data record. ↓
1 Press the 'down' key to enter the operating data memory. The latest entry is displayed.		Oper/Rec/OP_RC 01.01.97 11:33 ARC Enabled USER No
2 Press the 'left' key repeatedly to display the entries one after the other in chronological order. Once the end of the operating data memory has been reached, pressing the 'left' key again will have no effect.		Oper/Rec/OP_RC 01.01.97 10:01 PSIG Enabled USER Yes
3 Press the 'right' key to display the previous entry.		Oper/Rec/OP_RC 01.01.97 11:33 ARC Enabled USER No
4 Press the 'up' key at any point within the operating data memory to return to the entry point.		Oper/Rec/OP_RC Operat. data record. ↓

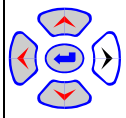
Readout of the monitoring signal memory

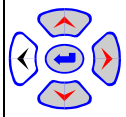
If the unit detects an internal fault in the course of internal self-monitoring routines or if it detects power system conditions that prevent flawless functioning of the unit, then an entry is made in the monitoring signal memory. A maximum of 30 entries is possible. After that an 'overflow' signal is issued.

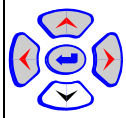
Control Step / Description	Control Action	Display

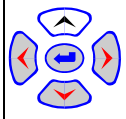
0 Select the entry point for the monitoring signal memory.		`Oper/Rec/MT_RC`
		`Mon. signal record.`
		↓

1 Press the 'down' key to enter the monitoring signal memory. The oldest entry is displayed.		`Mon. signal record.`
		`01.01.97 13:33 SFMON`
		`Checksum error param`

2 Press the 'right' key repeatedly to display the entries one after the other in chronological order. If more than 30 monitoring signals have been entered since the last reset, the 'overflow' signal is displayed as the last entry.		`Mon. signal record.`
		`01.01.97 10:01 SFMON`
		`Exception oper. syst.`

3 Press the 'left' key to display the previous entry.		`Mon. signal record.`
		`01.01.97 13:33 SFMON`
		`Checksum error param`

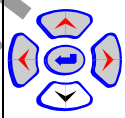
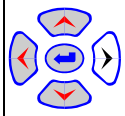
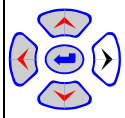
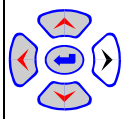
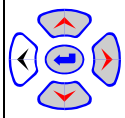
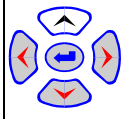
4 If the 'down' key is held down while a monitoring signal is being displayed, the following additional information will be displayed:
First: Time when the signal first occurred
Active: The fault is still being detected (Yes) or is no longer detected (No) by the self-monitoring function.
Reset: The fault was no longer detected by the self-monitoring function and has been reset (Yes).
Number: The signal occurred x times.
		`Mon. signal record.`
		`01.01.97 13:33 SFMON`
		`Checksum error param`
		
		`First: 13:33:59.744`
		`Active: Yes`
		`Reset: No`
		`Number: 5`

5 Press the 'up' key at any point within the monitoring signal memory to return to the entry point.		`Oper/Rec/MT_RC`
		`Mon. signal record.`
		↓

Readout of the event memories

There are eight event memories for each type of event. The latest event is stored in event memory 1, the previous one in event memory 2, and so forth.

Readout of event memories is illustrated using the fault memory as an example.

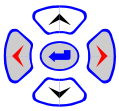
Control Step / Description	Control Action	Display
0 Select the entry point for the first fault memory, for example. If the memory contains entries, the third line of the display will show the date and time the fault began. If the third line is blank, then there are no entries in the fault memory.		Events/Rec/FT_RC Fault recording 1 01.01.99 10:00:33 ↓
1 Press the 'down' key to enter the fault memory. First, the fault number is shown. In this example it is the 22nd fault since the last reset.		Fault recording 1 FT_RC Event 22
2 Press the 'right' key repeatedly to see first the measured fault data and then the binary signals in chronological order. The time shown in the second line is the relative time, measured from the onset of the fault, at which the value was measured or the binary signal started or ended. Once the end of the fault has been reached (after the 'right' key has been pressed repeatedly), pressing the 'right' key again will have no effect.	  	Fault recording 1 200 ms FT_DA Running time 0.17 s Fault recording 1 0 ms FT_RC Record. in progress Start Fault recording 1 241 ms FT_RC Record. in progress End
3 Press the 'left' key to see the previous measured value or the previous signal.		Fault recording 1 0 ms FT_RC Record. in progress Start
4 Press the 'up' key at any point within the fault memory to return to the entry point.		Events/Rec/FT_RC Fault recording 1 01.01.99 10:00:33 ↓

6.5.7 Resetting

All information memories – including the event memories and the monitoring signal memory – and also the LED indicators can be reset manually. In addition, the LED indicators are automatically cleared and initialized at the onset of a new fault – provided that the appropriate operating mode has been selected – so that they always indicate the latest fault.

The LED indicators can also be reset manually by pressing the CLEAR key, which is always possible in the standard control mode. This action also triggers an LED indicator test and an LCD display test. The event memories are not affected by this action, so that inadvertent deletion of the records associated with the reset signal pattern is reliably prevented.

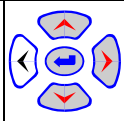
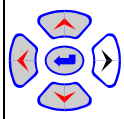
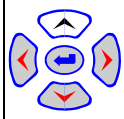
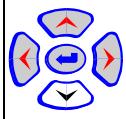
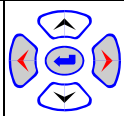
Because of the ring structure of the event memories, the data for eight consecutive events are updated automatically so that manual resetting should not be necessary, in principle. If the event memories need to be cleared completely, however, as would be the case after functional testing, this can be done after selecting the appropriate parameter. The resetting procedure will now be illustrated using the fault memory as an example. In this example the global change-enabling function has already been activated.

Control Step / Description	Control Action	Display
0 Select the reset parameter. Line 3 of the display shows the number of faults since the last reset, 10 in this example.		Oper/CtrlTest/FT_RC Reset recording 10
1 Press the ENTER key. The LED indicator labeled EDIT MODE will light up.		Oper/CtrlTest/FT_RC Reset recording 10 Don't execute
2 Press the ‘up’ or ’down’ keys to change the setting to *‘Execute’*.		Oper/CtrlTest/FT_RC Reset recording 10 Execute
3 Press the ENTER key. The LED indicator labeled EDIT MODE will go out. The value in line 3 is reset to ‘0’.		Oper/CtrlTest/FT_RC Reset recording 0
4 To cancel the intended clearing of the fault recordings after leaving the standard control mode (the LED indicator labeled EDIT MODE LED is on), press the CLEAR key. The LED indicator will go out, and the fault recordings remain stored in the device unchanged. Any parameter can be selected again for a value change by pressing the keys.		Oper/CtrlTest/FT_RC Reset recording 10

6.5.8 Password-Protected Control Actions

Certain actions from the local control panel (such as a manual trip command for testing purposes) can only be carried out by entering a password. This setup is designed to prevent accidental output and applies even when the global change-enabling function has been activated.

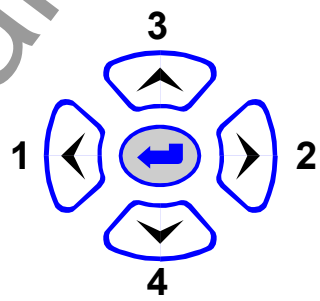
The password consists of a pre-defined sequential key combination entered within a specific time interval. The following example illustrates the password-protected output of a manual trip command using the factory-set password. If the password has been changed by the user (see the section entitled 'Changing the Password'), the following description will apply analogously.

Control Step / Description	Control Action	Display
0 In the menu tree 'Oper/CtrlTest/MAIN', select the parameter 'Man. trip cmd. USER'.		Oper/CtrlTest/MAIN Man. trip cmd. USER Don't execute
1 Press the ENTER key. Eight asterisks (*) appear in the fourth line of the display.		Oper/CtrlTest/MAIN Man. trip cmd. USER Don't execute ********
2 Press the following keys in sequence: 'left'		Oper/CtrlTest/MAIN Man. trip cmd. USER Don't execute *
'right'		Oper/CtrlTest/MAIN Man. trip cmd. USER Don't execute *
'up'		Oper/CtrlTest/MAIN Man. trip cmd. USER Don't execute *
'down'		Oper/CtrlTest/MAIN Man. trip cmd USER Don't execute *
The display will change as shown in the column on the right.		
Now press the ENTER key. The LED indicator labeled EDIT MODE will light up. This indicates that the setting can now be changed by pressing the 'up' or 'down' keys.		Oper/CtrlTest/MAIN Man. trip cmd. USER Don't execute
3 Change the setting to *'Execute'*.		Oper/CtrlTest/MAIN Man. trip cmd. USER Execute

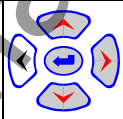
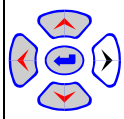
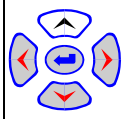
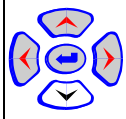
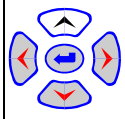
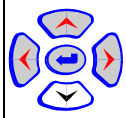
Control Step / Description	Control Action	Display
4 Press the ENTER key again. The LED indicator will go out. The unit will execute the command.	↵	Oper/CtrlTest/MAIN Man. trip cmd. USER Don't execute
5 As long as the LED indicator labeled EDIT MODE is on, the control action can be terminated by pressing the CLEAR key. The LED indicator will go out.	C	Oper/CtrlTest/MAIN Man. trip cmd. USER Don't execute

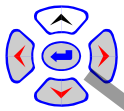
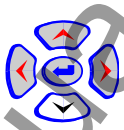
6.5.9 Changing the Password

The password consists of a combination of keys that must be entered sequentially within a specific time interval. The 'left', 'right', 'up' and 'down' keys may be used to define the password and represent the numbers 1, 2, 3 and 4, respectively:



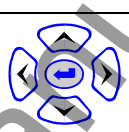
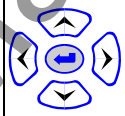
The password can be changed by the user at any time. The procedure for this change is described below. The starting point is the factory-set password.

Control Step / Description	Control Action	Display
0 In the menu tree 'Par/Conf/LOC' select the parameter 'Password'.		Par/Conf/LOC Password ********
1 Press the ENTER key. Eight asterisks appear in the fourth line of the display.		Par/Conf/LOC Password ******** ********
2 Press the 'left', 'right', 'up' and 'down' keys to enter the valid password. The display will change as shown in the column on the right.		Par/Conf/LOC Password ******** *
		Par/Conf/LOC Password ******** *
		Par/Conf/LOC Password ******** *
		Par/Conf/LOC Password ******** *
3 Now press the ENTER key. The LED indicator labeled EDIT MODE will light up. The third line shows an underscore character (_) as the prompt for entering a new password.		Par/Conf/LOC Password _
4 Enter the new password, which in this example is done by pressing the 'up' key followed by the 'down' key.		Par/Conf/LOC Password *
		Par/Conf/LOC Password **
5 Press the ENTER key again. Asterisks appear in the third line, and a cursor (underscore) in the fourth line prompts the user to enter the new password again.		Par/Conf/LOC Password ** _

Control Step / Description	Control Action	Display
6 Re-enter the password.	 	Par/Conf/LOC Password ** * Par/Conf/LOC Password ** **
7a Press the ENTER key again. If the password has been re-entered correctly, the LED indicator labeled EDIT MODE goes out and the display appears as shown on the right. The new password is now valid. **7b** If the password has been re-entered incorrectly, the LED indicator labeled EDIT MODE remains on and the display shown on the right appears. The password needs to be re-entered. It is also possible to cancel the change in password by pressing the CLEAR key (see Step 8).	 	Par/Conf/LOC Password ******** Par/Conf/LOC Password ** _
8 The change in password can be canceled at any time before Step 7 by pressing the CLEAR key. If this is done, the original password continues to be valid.		Par/Conf/LOC Password ********

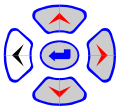
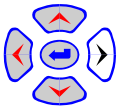
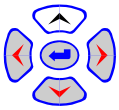
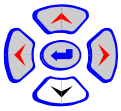
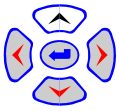
Operation from the local control panel without password protection is also possible. To select this option, immediately press the ENTER key a second time in steps 4 and 6 without entering anything else. This will configure the local control panel without password protection, and no control actions involving changes will be possible until the global change-enabling function has been activated (see the section entitled 'Change-Enabling Function').

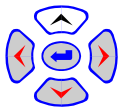
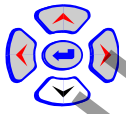
If the configured password has been forgotten, it can be called up on the LCD display as described below. The procedure involves turning the device off and then on again.

Control Step / Description	Control Action	Display
0 Turn off the device.		
1 Turn the device on again. At the very beginning of device startup, press the four directional keys (‘left’, ‘right’, ‘up’ and ‘down’) at the same time and hold them down.		TEST □□□□□□□□
2 When this condition is detected during startup, the password is displayed.		Password 1234 □□□□□□□□□□□□□□□□
3 After the four keys are released, startup will continue.		TEST □□□□□□□□□□□□□□□□□□□□

Changing and display of the L/R password

The L/R password must be entered to enable local control.

Control Step / Description	Control Action	Display
0 In the menu tree 'Par/Conf/LOC' select parameter 'Password L/R'.		Par/Conf/LOC Password L/R ********
1 Press enter key. Eight stars appear in the fourth line of the display.		Par/Conf/LOC Password L/R ******** ********
2 Press the 'left'/'right' and 'up'/'down' keys to enter the valid general password. The display changes as shown.		Par/Conf/LOC Password L/R ******** *
		Par/Conf/LOC Password L/R ******** *
		Par/Conf/LOC Password L/R ******** *
		Par/Conf/LOC Password L/R ******** *
3 Now press enter key. The "EDIT MODE" LED will light up. The third line shows the current L/R password.		Par/Conf/LOC Password L/R 1423
4 Enter the new password, using the 'up' key followed by the 'down' key for the shorter password in this example.		Par/Conf/LOC Password L/R *
		Par/Conf/LOC Password L/R **
5 Press enter key again. Stars appear in the third line; the enter prompt in the fourth line invites the user to enter the new L/R password once more.		Par/Conf/LOC Password L/R ** _

Control Step / Description	Control Action	Display
6 Re-enter the L/R password.	 	Par/Conf/LOC Password L/R ** * Par/Conf/LOC Password L/R ** **
7a Press enter key once more. If the password has been repeated correctly, the "EDIT MODE" LED goes out and the display changes as illustrated. The new password is now valid. **7b** If the L/R password has been repeated incorrectly, the "EDIT MODE" LED remains lit and the display to the right is shown. The L/R password needs to be re-entered. Alternatively, the password change can be aborted by pressing the reset key (see step 8).	 	Par/Conf/LOC Password L/R ******** Par/Conf/LOC Password L/R ** _
8 Up to step 7, the password change can be aborted at any time by pressing the reset key. The original password continues to be valid in this case.		Par/Conf/LOC Password L/R ********

7 Settings

7.1 Parameters

The C232 must be adjusted to the system and to the protected equipment by means of appropriate settings. This section gives instructions for determining the settings, which are located in the folder entitled ‘Parameters’ in the menu tree. The sequence in which the settings are listed and described in this chapter corresponds to their sequence in the menu tree. The 'Address List' in the Appendix lists all parameters, along with setting ranges and incrementation or selection tables.

The units are supplied with a factory-set configuration of default settings (underlined values in the 'Range of Values' column in the Address List). The default settings given in the Address List are activated after a cold restart. The C232 is blocked in that case. All settings must be re-entered after a cold restart.

All function groups and their parameters are contained in the Address List. All settings, signals, and control commands for controlling and monitoring a switchgear unit are included in one function group, DEVxx. The function group for the respective switchgear unit is given in the List of Bay Types (see Appendix).

7.1.1 Device Identification

The device identification settings are used to record the ordering information and the design version of the C232. They have no effect on the device functions. These settings should only be changed if the design version of the C232 is modified.

Device

DVICE: Device type	000 000
The device type is displayed. This display cannot be altered.	
DVICE: Software version	002 120
Software version for the device. This display cannot be altered.	
DVICE: SW date	002 122
Date the software was created. This display cannot be altered.	
DVICE: SW version communic.	002 103
DVICE: Language version	002 123
DVICE: Text vers.data model	002 121
Using the 'text replacement tool' provided by the operating program, the user can change the parameter descriptors (plain text designations) and load them into the device. These customized data models contain an identifier defined by the user while preparing the data model. This identifier is displayed at this point in the menu tree. Standard data models have the identifier '0' (factory-set default).	
DVICE: F number	002 124
The F number is the serial number of the device. This display cannot be altered.	
DVICE: Order No.	000 001
Order number of the device. This number cannot be altered by the user.	
DVICE: Order ext. No. 1	000 003
DVICE: Order ext. No. 2	000 004
DVICE: Order ext. No. 3	000 005
DVICE: Order ext. No. 4	000 006
DVICE: Order ext. No. 5	000 007
DVICE: Order ext. No. 6	000 008
DVICE: Order ext. No. 7	000 009
DVICE: Order ext. No. 8	000 010
DVICE: Order ext. No. 9	000 011
DVICE: Order ext. No. 10	000 012
DVICE: Order ext. No. 11	000 013
DVICE: Order ext. No. 12	000 014
DVICE: Order ext. No. 13	000 015
DVICE: Order ext. No. 14	000 016
DVICE: Order ext. No. 15	000 017
DVICE: Order ext. No. 16	000 018
DVICE: Order ext. No. 17	000 019
DVICE: Order ext. No. 18	000 020
DVICE: Order ext. No. 19	000 021
DVICE: Order ext. No. 20	000 022
DVICE: Order ext. No. 21	000 023
DVICE: Order ext. No. 22	000 024
DVICE: Order ext. No. 23	000 025
DVICE: Order ext. No. 24	000 026
DVICE: Order ext. No. 25	000 027

DVICE: Order ext. No. 26	000 028
DVICE: Order ext. No. 27	000 029
The order extension number for the device.	
DVICE: Module var. slot 1	086 050
DVICE: Module var. slot 2	086 051
DVICE: Module var. slot 3	086 052
Item number of the module inserted in the respective slot. The display always shows the actual component configuration at any given time.	
DVICE: Module vers. slot 1	086 193
DVICE: Module vers. slot 2	086 194
DVICE: Module vers. slot 3	086 195
Index letter specifying the version of the module inserted in the respective slot.	
DVICE: Variant of module B	086 049
Stock number of module B in this design version.	
DVICE: Version of module B	086 192
Index letter specifying the version of digital bus module B.	
DVICE: Customer ID data 1	000 040
DVICE: Customer ID data 2	000 041
DVICE: Customer ID data 3	000 042
DVICE: Customer ID data 4	000 043
DVICE: Customer ID data 5	000 044
DVICE: Customer ID data 6	000 045
DVICE: Customer ID data 7	000 046
DVICE: Customer ID data 8	000 047
Set your numerically coded user data here for your records.	
DVICE: Device ID	000 035
ID code used by operating program for identification purposes. See description of the respective operating program for more detailed setting instructions.	
DVICE: Substation ID	000 036
ID code used by operating program for identification purposes. See description of the respective operating program for more detailed setting instructions.	
DVICE: Feeder ID	000 037
ID code used by operating program for identification purposes. See description of the respective operating program for more detailed setting instructions.	
DVICE: Device password 1	000 048
DVICE: Device password 2	000 049
ID code used by operating program for identification purposes. See description of the respective operating program for more detailed setting instructions.	
DVICE: Comp. fitt. variant	031 050
Configuration of transformer modules.	

7.1.2 Configuration Parameters

Local control panel

LOC: Language	003 020	
Language in which texts will be displayed on the local control panel.		
LOC: Decimal delimiter	003 021	
Character to be used as decimal delimiter on the local control panel.		
LOC: Password	003 035	
The password to be used for changing settings from the local control panel can be defined here. Further information on changing the password is given in Chapter 6.		
LOC: Password L/R	221 040	
The password to be entered on the local control panel for switching from remote to local control can be defined here. Further information on changing the password is given in Chapter 6.		
LOC: Displ. ext.dev.desig	221 032	Fig. 3-2
This setting defines whether the external device designations shall be displayed on the Bay Panel.		
LOC: Display L/R	221 070	Fig. 3-2
This setting defines whether the control site – local or remote – shall be displayed on the Bay Panel.		
LOC: Displ. interl. stat.	221 071	Fig. 3-2
This setting defines whether the "Locked" or "Unlocked" status shall be displayed on the Bay Panel.		
LOC: Designation busbar 1	221 033	Fig. 3-2
LOC: Designation busbar 2	221 034	
LOC: Designation busbar 3	221 043	
Setting for the busbar designations to be displayed on the Bay Panel.		
LOC: Designat. bus sect.1	221 035	Fig. 3-2
LOC: Designat. bus sect.2	221 036	
Setting for the busbar section designations to be displayed on the Bay Panel.		
LOC: Character set	221 038	Fig. 3-2
The user can choose between several character sets for representing switchgear units and their switching states on the Bay Panel. The symbols assigned to the character sets are shown in Chapter 6: Local Control Panel. **Note:** Character set 3 is identical to character set 1 in the factory default setting, but can be replaced by a user-defined character set – by using a special S&R-103 accessory tool.		
LOC: Fct. assign. L/R key	225 208	Fig. 3-5
This setting determines whether the switching (using either the L/R key or the key switch) is between local and remote control (L↔R) or between local+remote and local control (R&L↔L).		
LOC: Assignment read key	080 110	
Selection of the event log that will be displayed when the read key (log key) is pressed.		

LOC: Fct. Operation Panel 053 007 Fig. 3-3

Definition of the values to be displayed on the Measured Value Panel referred to as the Operation Panel.

LOC: Fct. Fault Panel 053 003 Fig. 3-4

Definition of the values to be displayed on the Fault Panel.

LOC: Fct.asg. num. displ. 221 041 Fig. 3-2

Definition of the measured values to be displayed on the Bay Panel in numerical form.

LOC: Fct. asg. bar displ. 221 042 Fig. 3-2

Definition of the measured values to be displayed on the Bay Panel in bar form.

Note:
Measured values to be displayed in bar form must also be selected for display as numerical measured values.
However, not all measured values that can be displayed in numerical form can also be displayed in bar form! In such cases, a dummy or placeholder must be included in the selection list for the bar display at the same point at which a measured value that cannot be displayed in bar form appears in the selection list for numerical measured values.
Example:
Current I_B is to be displayed. In this case, either the primary current I_A or the per-unit current I_A shall be selected for the numerical display. The per-unit current I_B shall be entered at the same position in the selection list for the bar display.

LOC: Bar display type 221 039 Fig. 3-2

Deactivation of the bar display or definition of the orientation of the bar for display of measured values on the Bay Panel.

LOC: Scal. bar display I 221 044 Fig. 3-2

Selection of the current for the 100% display.

LOC: Scal. bar display V 221 045 Fig. 3-2

Selection of the voltage for the 100% display.

LOC: Display bar scale 221 046 Fig. 3-2

Enabling and disabling the scaling display.

LOC: Hold-time for Panels 031 075 Fig. 3-3

Setting for the time period for which a panel is displayed before the unit switches to the next panel. This setting is only relevant if more values are selected for display than can be shown on the LCD display.

LOC: Autom. return time 003 014 Fig. 3-3

If the user does not press a key on the local control panel during this set time period, the change-enabling function is deactivated and the Bay Panel is called up.

LOC: Return time select. 221 030 Fig. 3-3

If the user does not press a key on the local control panel during this set time period, then the selection of a switchgear unit is canceled.

LOC: Return time illumin. 003 023

If the user does not press a key on the local control panel during this set time period, then the backlighting of the LCD display is switched off, and any switchgear selection that might have been made is canceled.

PC link

PC: Name of manufacturer 003183 Fig. 3-6

Setting for the name of the manufacturer.

Note:
This setting can be changed to ensure compatibility.

PC: Bay address 003068 Fig. 3-6
PC: Device address 003069

Bay and device addresses are used to address the device in communication via the PC interface. An identical setting must be selected for both addresses.

PC: Baud rate 003081 Fig. 3-6

Baud rate of the PC interface.

PC: Parity bit 003181 Fig. 3-6

Set the same parity that is set at the interface of the PC connected to the C232.

PC: Spontan. sig. enable 003187 Fig. 3-6

Enable for the transmission of spontaneous signals via the PC interface.

PC: Select. spontan.sig. 003189 Fig. 3-6

Selection of signals transmitted via the communication interface, e.g. from private range of IEC 60870-5-103.

PC: Transm.enab.cycl.dat 003084 Fig. 3-6

Enable for the cyclic transmission of measured values via the PC interface.

PC: Cycl. data ILS tel. 003185 Fig. 3-6

Selection of the measured values that are transmitted in a user-defined telegram via the PC interface.

PC: Delta V 003055 Fig. 3-6

A measured voltage value is transmitted via the PC interface if it differs by the set delta quantity from the last measured value transmitted.

PC: Delta I 003056 Fig. 3-6

A measured current value is transmitted via the PC interface if it differs by the set delta quantity from the last measured value transmitted.

PC: Delta P 003059 Fig. 3-6

The active power value is transmitted via the PC interface if it differs by the set delta quantity from the last measured value transmitted.

PC: Delta f 003057 Fig. 3-6

The measured frequency value is transmitted via the PC interface if it differs by the set delta from the last measured value transmitted.

PC: Delta meas.v.ILS tel 003155 Fig. 3-6

The telegram is transmitted if a measured value differs by the set delta quantity from the last measured value transmitted.

PC: Delta t 003058 Fig. 3-6

All measured data are transmitted again through the PC interface after this time period has elapsed – provided that transmission has not been triggered by the other delta conditions.

PC: Time-out 003188 Fig. 3-6

Setting for the time between the last transmission via the PC interface and the activation of the second communication channel.

"Logical" communication interface 1

COMM1: Function group COMM1	056 026	
Canceling function group COMM1 or including it in the configuration. If the function group is cancelled from the configuration, then all associated settings and signals are hidden, with the exception of this setting.		
COMM1: General enable USER	003 170	Fig. 3-7
Disabling or enabling the communication interface.		
COMM1: Basic IEC870-5enable	003 215	Fig. 3-7
Common settings for enabling all protocols based on IEC 870-5-xxx.		
COMM1: Addit. -101 enable	003 216	Fig. 3-7
Enabling additional settings that are relevant for the protocol based on IEC 870-5-101.		
COMM1: Addit. ILS enable	003 217	Fig. 3-7
Enabling additional settings that are relevant for the ILS protocol.		
COMM1: MODBUS enable	003 220	Fig. 3-7
Enabling settings relevant for the MODBUS protocol.		
COMM1: DNP3 enable	003 231	Fig. 3-7
Enabling settings relevant for the DNP 3.0 protocol.		
COMM1: Communicat. protocol	003 167	Fig. 3-7
The setting defines the standard used as basis for the communication interface protocol.		
COMM1: -103 prot. variant	003 178	Fig. 3-8
The user may select either the AREVA D or the AREVA variant of the 103 protocol. **Note:** This setting is hidden unless the IEC 870-5-xxx protocol is enabled.		
COMM1: MODBUS prot. variant	003 214	Fig. 3-11
The user may select either the AREVA D or the AREVA variant of the MODBUS protocol. **Note:** This setting is hidden unless the MODBUS protocol is enabled.		
COMM1: Line idle state	003 165	Fig. 3-8, 3-9, 3-10, 3-11, 3-12
Setting for the line idle state indication.		
COMM1: Baud rate	003 071	Fig. 3-8, 3-9, 3-10, 3-11, 3-12
Baud rate of the communication interface.		
COMM1: Parity bit	003 171	Fig. 3-8, 3-9, 3-10, 3-11, 3-12
Set the same parity that is set at the interface of the control system connected to the C232.		
COMM1: Dead time monitoring	003 176	Fig. 3-8, 3-9, 3-10, 3-11, 3-12

The C232 monitors telegram transmission to make sure that no pause within a telegram exceeds 33 bits. This monitoring function can be disabled if it is not required.

Note:
This setting is only necessary for modem transmission.

COMM1: Mon. time polling 003202 Fig. 3-8, 3-9, 3-10, 3-11, 3-12

The time between two polling calls from the communication master must be less than the time set here.

COMM1: Octet comm. address 003072 Fig. 3-8, 3-9, 3-10, 3-11, 3-12

The communication address and the ASDU address are used to identify the device in communication via the interface. An identical setting must be selected for both addresses.

Note:
The former designation for 'COMM1: Octet comm. address' was ILSA: Bay address.

(ASDU: Application Service Data Unit).

COMM1: Oct.2 comm.addr.DNP3 003240 Fig. 3-12

In the DNP 3.0 protocol, a 16 bit address is used to identify devices. The address that can be set here is the higher-order octet, whereas the address set at COMM1: Octet comm. address is the lower-order octet of the DNP address.

Note:
This setting is hidden unless the DNP 3.0 protocol is enabled.

COMM1: Address mode 003168

Setting for the address mode.

COMM1: Test monitor on 003166 Fig. 3-8, 3-9, 3-10

Setting specifying whether data shall be recorded for service activities.

COMM1: Name of manufacturer 003161 Fig. 3-8, 3-9, 3-10

Setting for the name of the manufacturer.

Note:
This setting can be changed to ensure compatibility.
This setting is hidden unless an IEC 870-5 protocol is enabled.

COMM1: Octet address ASDU 003073 Fig. 3-8, 3-9, 3-10

The communication address and the ASDU address are used to identify the device in communication via the interface. An identical setting must be selected for both addresses.

Note:
The former designation for 'COMM1: Octet address ASDU' was 'ILSA: Device address'.
This setting is hidden unless an IEC 870-5 protocol is enabled.

(ASDU: Application Service Data Unit).

COMM1: Spontan. sig. enable 003177 Fig. 3-8, 3-9, 3-10

Enable for the transmission of spontaneous signals via the communication interface.

COMM1: Select. spontan.sig. 003179 Fig. 3-8, 3-9, 3-10

Selection of signals transmitted via the communication interface, e.g. from private range of IEC 60870-5-103.

COMM1: Transm.enab.cycl.dat 003074 Fig. 3-8, 3-9, 3-10

Enabling of cyclic transmission of measured values via the communication interface.

COMM1: Cycl. data ILS tel. 003175 Fig. 3-8, 3-9, 3-10

Selection of the measured values transmitted in a user-defined telegram via the communication interface.

COMM1: Delta V 003050 Fig. 3-8, 3-9, 3-10

A measured voltage value is transmitted via the communication interface if it differs by the set delta quantity from the last measured value transmitted.

COMM1: Delta I 003051 Fig. 3-8, 3-9, 3-10

A measured current value is transmitted via the communication interface if it differs by the set delta quantity from the last measured value transmitted.

COMM1: Delta P 003054 Fig. 3-8, 3-9, 3-10

The active power value is transmitted via the communication interface if it differs by the set delta quantity from the last measured value transmitted.

COMM1: Delta f 003052 Fig. 3-8, 3-9, 3-10

The measured frequency is transmitted via the communication interface if it differs by the set delta quantity from the last measured value transmitted.

COMM1: Delta meas.v.ILS tel 003150 Fig. 3-8, 3-9, 3-10

The telegram is transmitted if a measured value differs by the set delta quantity from the last measured value transmitted.

COMM1: Delta t 003053 Fig. 3-8, 3-9, 3-10

All measured data are transmitted again through the communication interface after this time period has elapsed – provided that transmission has not been triggered by the other delta conditions.

COMM1: Delta t (energy) 003151 Fig. 3-8, 3-9, 3-10

The measured data for active energy and reactive energy are transmitted through the communication interface after this time has elapsed.

COMM1: Contin. general scan 003077 Fig. 3-8, 3-9, 3-10

A continuous or background general scan means that the C232 transmits all settings, signals, and monitoring signals through the communication interface during slow periods when there is not much activity. This ensures that there will be data consistency with a connected control system. The time to be set defines the minimum time difference between two telegrams.

COMM1: Comm. address length 003201 Fig. 3-9

Setting for the communication address length.

Note:
This setting is hidden unless the IEC 870-5-101 protocol is enabled.

COMM1: Octet 2 comm. addr. 003200 Fig. 3-9

Setting for the length of the higher-order communication address.

Note:
This setting is hidden unless the IEC 870-5-101 protocol is enabled.

COMM1: Cause transm. length 003192 Fig. 3-9

Setting for the length of the cause of transmission.

Note:
This setting is hidden unless the IEC 870-5-101 protocol is enabled.

COMM1: Address length ASDU 003193 Fig. 3-9

Setting for the length of the common address for identification of telegram structures.

Note:
This setting is hidden unless the IEC 870-5-101 protocol is enabled.
(ASDU: Application Service Data Unit).

COMM1: Octet 2 addr. ASDU 003194 Fig. 3-9

Setting for the length of the common higher-order address for identification of telegram structures.

Note:
This setting is hidden unless the IEC 870-5-101 protocol is enabled.
(ASDU: Application Service Data Unit).

COMM1: Addr.length inf.obj. 003196 Fig. 3-9

Setting for the length of the address for information objects.

Note:
This setting is hidden unless the IEC 870-5-101 protocol is enabled.

COMM1: Oct.3 addr. inf.obj. 003197 Fig. 3-9

Setting for the length of the higher-order address for information objects.

Note:
This setting is hidden unless the IEC 870-5-101 protocol is enabled.

COMM1: Inf.No.<->funct.type 003195 Fig. 3-9

Setting specifying whether information numbers and function type shall be reversed in the object address.

Note:
This setting is hidden unless the IEC 870-5-101 protocol is enabled.

COMM1: Time tag length 003198 Fig. 3-9

Setting for the time tag length.

Note:
This setting is hidden unless the IEC 870-5-101 protocol is enabled.

COMM1: ASDU1 / ASDU20 conv. 003190 Fig. 3-9

Setting specifying whether telegram structure 1 or 20 shall be converted as a single signal or double signal.

Note:
This setting is hidden unless the IEC 870-5-101 protocol is enabled.
(ASDU: Application Service Data Unit).

COMM1: ASDU2 conversion 003191 Fig. 3-9

Setting specifying whether telegram structure 2 shall be converted as a single signal or double signal.

Note:
This setting is hidden unless the IEC 870-5-101 protocol is enabled.
(ASDU: Application Service Data Unit).

COMM1: Initializ. signal 003199 Fig. 3-9

Setting specifying whether an initialization signal shall be issued.

Note:
This setting is hidden unless the IEC 870-5-101 protocol is enabled.

COMM1: Balanced operation 003226 Fig. 3-9

Setting that determines whether communication takes place on a balanced basis (full duplex operation).

Note:
This setting is hidden unless the IEC 870-5-101 protocol is enabled.

COMM1: Direction bit 003227 Fig. 3-9

Setting for the transmission direction. Normally this value will be set at '1' at the control center and at '0' at the substation.

Note:
This setting is hidden unless the IEC 870-5-101 protocol is enabled.

COMM1: Time-out interval 003228 Fig. 3-9

Setting for the maximum time that will elapse until the status signal for the acknowledgment command is issued.

Note:
This setting is hidden unless the IEC 870-5-101 protocol is set.

COMM1: Reg.asg. selec. cmds 003210 Fig. 3-11

MODBUS registers in the range 00301 to 00400 are assigned to the selected commands. Assignment is made in the order of selection. This means that the first command is given the register no. 00301, the second the register no. 00302, etc.

Note:
This setting is hidden unless the MODBUS protocol is enabled.

COMM1: Reg.asg. selec. sig. 003211 Fig. 3-11

MODBUS registers in the range 10301 to 10400 are assigned to the selected signals. Assignment is made in the order of selection. This means that the first signal is given the register no. 10301, the second the register no. 10302, etc.

Note:
This setting is hidden unless the MODBUS protocol is enabled.

COMM1: Reg.asg. sel. m.val. 003212 Fig. 3-11

MODBUS registers in the range 30301 to 30400 are assigned to the selected measured values. Assignment is made in the order of selection. This means that the first measured value is given the register no. 30301, the second the register no. 30302, etc.

Note:
This setting is hidden unless the MODBUS protocol is enabled.

COMM1: Reg.asg. sel. param. 003213 Fig. 3-11

MODBUS registers in the range 40301 to 40400 are assigned to the selected parameters. Assignment is made in the order of selection. This means that the first parameter is given the register no. 40301, the second the register no. 40302, etc.

Note:
This setting is hidden unless the MODBUS protocol is enabled.

COMM1: Delta t (MODBUS) 003152 Fig. 3-11

All MODBUS registers are transmitted again through the communication interface after this time has elapsed.

Note:
This setting is hidden unless the MODBUS protocol is enabled.

COMM1: Autom.event confirm. 003249 Fig. 3-11

Setting specifying whether an event must be confirmed by the master in order for an event to be deleted from the 'event queue'.

Note:
This setting is hidden unless the MODBUS protocol is enabled.

COMM1: Phys. Charact. Delay 003241 Fig. 3-12

Number of bits that must pass between the receipt of the 'request' and the start of sending the 'response'.

Note:
This setting is hidden unless the DNP 3.0 protocol is enabled.

COMM1: Phys. Char. Timeout 003242 Fig. 3-12

Number of bits that may be missing from the telegram before receipt is terminated.

Note:
This setting is hidden unless the DNP 3.0 protocol is enabled.

COMM1: Link Confirm. Mode 003243 Fig. 3-12

Setting for the acknowledgment mode of the link layer.

Note:
This setting is hidden unless the DNP 3.0 protocol is enabled.

COMM1: Link Confirm.Timeout 003244 Fig. 3-12

Setting for the time period within which the master must acknowledge at the link layer.

Note:
This setting is hidden unless the DNP 3.0 protocol is enabled.

COMM1: Link Max. Retries 003245 Fig. 3-12

Number of repetitions that are carried out on the link layer if errors have occurred during transmission (such as failure to acknowledge).

Note:
This setting is hidden unless the DNP 3.0 protocol is enabled.

COMM1: Appl.Confirm.Timeout 003246 Fig. 3-12

Setting for the time period within which the master must acknowledge at the application layer.

Note:
This setting is hidden unless the DNP 3.0 protocol is enabled.

COMM1: Appl. Need Time Del. 003247 Fig. 3-12

Time interval within which the slave requests time synchronization cyclically from the master.

Note:
This setting is hidden unless the DNP 3.0 protocol is enabled.

COMM1: Ind./cl. bin. inputs 003232 Fig. 3-12

Selection of data points and data classes for object 1 – binary inputs. Assignment of indices is made in the order of selection, beginning with 0.

Note:
This setting is hidden unless the DNP 3.0 protocol is enabled.

COMM1: Ind./cl. bin.outputs 003233 Fig. 3-12

Selection of data points and data classes for object 10 – binary outputs. Assignment of indices is made in the order of selection, beginning with 0.

Note:
This setting is hidden unless the DNP 3.0 protocol is enabled.

COMM1: Ind./cl. bin. count. 003234 Fig. 3-12

Selection of data points and data classes for object 20 – binary counters. Assignment of indices is made in the order of selection, beginning with 0.

Note:
This setting is hidden unless the DNP 3.0 protocol is enabled.

COMM1: Ind./cl. analog inp. 003235 Fig. 3-12

Selection of data points and data classes for object 30 – analog inputs. Assignment of indices is made in the order of selection, beginning with 0.

Note:
This setting is hidden unless the DNP 3.0 protocol is enabled.

COMM1: Ind./cl. analog outp 003236 Fig. 3-12

Selection of data points and data classes for object 40 – analog outputs. Assignment of indices is made in the order of selection, beginning with 0.

Note:
This setting is hidden unless the DNP 3.0 protocol is enabled.

COMM1: Delta meas.v. (DNP3) 003250 Fig. 3-12

Initialization value of threshold values for transmission of measured values in object 30. The threshold values can be changed separately by the master for each measured value by writing to object 34, 'analog input reporting deadband'.

Note:
This setting is hidden unless the DNP 3.0 protocol is enabled.

COMM1: Delta t (DNP3) 003248 Fig. 3-12

Cycle time for updating DNP object 30 (analog inputs).

Note:
This setting is hidden unless the DNP 3.0 protocol is enabled.

"Logical" communication interface 2

COMM2: Function group COMM2 056057

Canceling function group COMM2 or including it in the configuration. If the function group is cancelled from the configuration, then all associated settings and signals are hidden, with the exception of this setting.

COMM2: General enable USER 103170 Fig. 3-14

Disabling or enabling "logical" communication interface 2.

COMM2: Line idle state 103165 Fig. 3-14

Setting for the line idle state indication.

COMM2: Baud rate 103071 Fig. 3-14

Baud rate of the communication interface.

COMM2: Parity bit 103171 Fig. 3-14

Set the same parity that is set at the interface of the control system connected to the C232.

COMM2: Dead time monitoring 103176 Fig. 3-14

The C232 monitors telegram transmission to make sure that no excessive pause occurs within a telegram. This monitoring function can be disabled if it is not required.

Note: This setting is only necessary for modem transmission.

COMM2: Mon. time polling 103202 Fig. 3-14

The time between two polling calls from the communication master must be less than the time set here.

COMM2: Octet comm. address 103072 Fig. 3-14

The communication address and the ASDU address are used to identify the device in communication via the interface. An identical setting must be selected for both addresses.
The abbreviation ASDU stands for 'Application Service Data Unit'.

COMM2: Name of manufacturer 103161 Fig. 3-14

Setting for the name of the manufacturer.

Note: This setting can be changed to ensure compatibility.

COMM2: Octet address ASDU 103073 Fig. 3-14

The communication address and the ASDU address are used to identify the device in communication via the interface. An identical setting must be selected for both addresses.
The abbreviation ASDU stands for 'Application Service Data Unit'.

COMM2: Spontan. sig. enable 103177 Fig. 3-14

Enable for the transmission of spontaneous signals via the communication interface.

Note: This setting is hidden unless an IEC 870-5 protocol is enabled.

COMM1: Select. spontan.sig. 003179 Fig. 3-14

Selection of signals transmitted via the communication interface, e.g. from private range of IEC 60870-5-103.

COMM2: Transm.enab.cycl.dat 103074 Fig. 3-14

Enabling of cyclic transmission of measured values via the communication interface.

COMM2: Cycl. data ILS tel. 103175 Fig. 3-14

Selection of the measured values transmitted in a user-defined telegram via the communication interface.

COMM2: Delta V 103050 Fig. 3-14

A measured voltage value is transmitted via the communication interface if it differs by the set delta quantity from the last measured value transmitted.

COMM2: Delta I 103051 Fig. 3-14

A measured current value is transmitted via the communication interface if it differs by the set delta quantity from the last measured value transmitted.

COMM2: Delta P 103054 Fig. 3-14

The active power value is transmitted via the communication interface if it differs by the set delta quantity from the last measured value transmitted.

COMM2: Delta f 103052 Fig. 3-14

The measured frequency is transmitted via the communication interface if it differs by the set delta quantity from the last measured value transmitted.

COMM2: Delta meas.v.ILS tel	103150	Fig. 3-14
The telegram is transmitted if a measured value differs by the set delta quantity from the last measured value transmitted.		
COMM2: Delta t	103053	Fig. 3-14
All measured data are transmitted again through the communication interface after this time period has elapsed – provided that transmission has not been triggered by the other delta conditions.		

Binary inputs

The C232 has optical coupler inputs for processing binary signals from the system. The number and connection schemes for the available binary inputs are shown in the terminal connection diagrams. The Address List gives information about the configuration options for all binary inputs.

The C232 identifies the installed modules during startup. If any binary signal inputs are not included, the configuration addresses of the missing binary signal inputs are automatically shielded so that they do not appear in the menu tree.

When configuring binary inputs one should keep in mind that the same function can be assigned to several signal inputs. Thus one function can be activated from several control points having different signal voltages.

The configuration of C232 will be changed with the selection of a new bay type!
For C232 the assignement of designators to the binary inputs is given in the following table:

Model 1	Model 2	Model 3	Model 4	Model 4 with additional I/O	Binary inputs
U 201	U 201	U 201	U 201	U 201	U 2A
U 202	U 202	U 202	U 202	U 202	U 2B
U 203	U 203	U 203	U 203	U 203	U 2C
U 204	U 204	U 204	U 204	U 204	U 2D
U 205	U 205	U 205	U 205	U 205	U 2E
U 206	U 206	U 206	U 206	U 206	U 2F
U 213	U 207	U 207	U 213	U 207	U 2G
U 214	U 208	U 208	U 214	U 208	U 2H
U 215	U 209	U 209	U 215	U 209	U 2I
U 216	U 210	U 210	U 216	U 210	U 2J
-	U 213	U 211	U 220	U 211	U 2K
-	U 214	U 212	-	U 212	U 2L
-	U 215	U 213	-	U 213	U 2M
-	U 216	U 214	-	U 214	U 2N
-	U 217	U 215	-	U 215	U 2O
-	U 218	U 216	-	U 216	U 2P
-	U 219	U 217	-	U 217	U 2Q
-	-	U 218	-	U 218	U 2R
-	-	U 219	-	U 219	U 2S
-	-	U 220	-	U 220	U 2T

The configuration of binary inputs for each bay type is given in the List of Bay Types in the Appendix.

Note: Before selecting a new bay type, make sure that only functions of function groups DEVxx are configured for the binary inputs. Otherwise there will be an error message, and the new bay type will not be activated.

Note: Before selecting a new bay type, make sure that all binary inputs specified in the List of Bay types for the selected bay type are actually available in the device. Otherwise there will be an error message, and the new bay type will not be activated.

The operating mode for each binary signal input can be defined. The user can specify whether the presence (*active 'high'* mode) or absence (*active 'low'* mode) of a voltage shall be interpreted as the logic '1' signal.

Note: The operating mode of the binary inputs is automatically set to *active 'high'* when a new bay type is selected.

INP: Fct. assignm. U 201	178 002	Fig. 3-16
INP: Fct. assignm. U 202	178 006	
INP: Fct. assignm. U 203	178 010	
INP: Fct. assignm. U 204	178 014	
INP: Fct. assignm. U 205	178 018	
INP: Fct. assignm. U 206	178 022	
INP: Fct. assignm. U 207	178 026	
INP: Fct. assignm. U 208	178 030	
INP: Fct. assignm. U 209	178 034	
INP: Fct. assignm. U 210	178 038	
INP: Fct. assignm. U 211	178 042	
INP: Fct. assignm. U 212	178 046	
INP: Fct. assignm. U 213	178 050	
INP: Fct. assignm. U 214	178 054	
INP: Fct. assignm. U 215	178 058	
INP: Fct. assignm. U 216	178 062	
INP: Fct. assignm. U 217	178 066	
INP: Fct. assignm. U 218	178 070	
INP: Fct. assignm. U 219	178 074	
INP: Fct. assignm. U 220	178 078	
Assignment of functions to binary signal inputs.		
INP: Oper. mode U 201	178 003	Fig. 3-16
INP: Oper. mode U 202	178 007	
INP: Oper. mode U 203	178 011	
INP: Oper. mode U 204	178 015	
INP: Oper. mode U 205	178 019	
INP: Oper. mode U 206	178 023	
INP: Oper. mode U 207	178 027	
INP: Oper. mode U 208	178 031	
INP: Oper. mode U 209	178 035	
INP: Oper. mode U 210	178 039	
INP: Oper. mode U 211	178 043	
INP: Oper. mode U 212	178 047	
INP: Oper. mode U 213	178 051	
INP: Oper. mode U 214	178 055	
INP: Oper. mode U 215	178 059	
INP: Oper. mode U 216	178 063	
INP: Oper. mode U 217	178 067	
INP: Oper. mode U 218	178 071	
INP: Oper. mode U 219	178 075	
INP: Oper. mode U 220	178 079	
Selection of operating mode for binary signal inputs.		

Measured data input

MEASI: Function group MEASI	056 030	
Canceling function group MEASI or including it in the configuration. If the function group is cancelled from the configuration, then all associated settings and signals are hidden, with the exception of this setting.		
MEASI: General enable USER	011 100	Fig. 3-17
Disabling or enabling analog measured data input.		
MEASI: Enable IDC p.u.	037 190	Fig. 3-20
Setting for the minimum current that must flow in order for the C232 to display a measured value > 0 (zero suppression).		
MEASI: IDC< open circuit	037 191	Fig. 3-20
If the input current falls below the set threshold, the C232 will issue an 'open circuit' signal.		
MEASI: IDC 1	037 150	Fig. 3-20
MEASI: IDC 2	037 152	Fig. 3-20
MEASI: IDC 3	037 154	Fig. 3-20
MEASI: IDC 4	037 156	Fig. 3-20
MEASI: IDC 5	037 158	Fig. 3-20
MEASI: IDC 6	037 160	Fig. 3-20
MEASI: IDC 7	037 162	Fig. 3-20
MEASI: IDC 8	037 164	Fig. 3-20
MEASI: IDC 9	037 166	Fig. 3-20
MEASI: IDC 10	037 168	Fig. 3-20
MEASI: IDC 11	037 170	Fig. 3-20
MEASI: IDC 12	037 172	Fig. 3-20
MEASI: IDC 13	037 174	Fig. 3-20
MEASI: IDC 14	037 176	Fig. 3-20
MEASI: IDC 15	037 178	Fig. 3-20
MEASI: IDC 16	037 180	Fig. 3-20
MEASI: IDC 17	037 182	Fig. 3-20
MEASI: IDC 18	037 184	Fig. 3-20
MEASI: IDC 19	037 186	Fig. 3-20
MEASI: IDC 20	037 188	Fig. 3-20
Setting for the input current that will correspond to a linearized value that has been set accordingly.		

MEASI: IDC,lin 1	037 151	Fig. 3-20
MEASI: IDC,lin 2	037 153	Fig. 3-20
MEASI: IDC,lin 3	037 155	Fig. 3-20
MEASI: IDC,lin 4	037 157	Fig. 3-20
MEASI: IDC,lin 5	037 159	Fig. 3-20
MEASI: IDC,lin 6	037 161	Fig. 3-20
MEASI: IDC,lin 7	037 163	Fig. 3-20
MEASI: IDC,lin 8	037 165	Fig. 3-20
MEASI: IDC,lin 9	037 167	Fig. 3-20
MEASI: IDC,lin 10	037 169	Fig. 3-20
MEASI: IDC,lin 11	037 171	Fig. 3-20
MEASI: IDC,lin 12	037 173	Fig. 3-20
MEASI: IDC,lin 13	037 175	Fig. 3-20
MEASI: IDC,lin 14	037 177	Fig. 3-20
MEASI: IDC,lin 15	037 179	Fig. 3-20
MEASI: IDC,lin 16	037 181	Fig. 3-20
MEASI: IDC,lin 17	037 183	Fig. 3-20
MEASI: IDC,lin 18	037 185	Fig. 3-20
MEASI: IDC,lin 19	037 187	Fig. 3-20
MEASI: IDC,lin 20	037 189	Fig. 3-20
Setting for the linearized current that will correspond to an input current that has been set accordingly.		
MEASI: Scaled val. IDC,lin1	037 192	Fig. 3-21
Setting for the scaled value of IDC,lin 1.		
MEASI: Scaled val.IDC,lin20	037 193	Fig. 3-21
Setting for the scaled value of IDC,lin 20.		

Binary outputs

The C232 has output relays for the output of binary signals. The number and connection schemes for the available output relays are shown in the terminal connection diagrams. The Address List gives information about the configuration options for all binary outputs.

The C232 identifies the fitted modules during startup. If a given binary output is not installed, the configuration addresses is automatically hidden in the menu tree.

The contact data for the all-or-nothing relays permits them to be used either as command relays or as signal relays. One signal can also be assigned to several output relays simultaneously for the purpose of contact multiplication.

Note that the configuration will be changed by the selection of a new bay type!

Leistungs-klasse 1	Leistungs-klasse 2	Leistungs-klasse 3	Leistungs-klasse 4	Leistungs-klasse 4 mit Erw.	Ausgangs-relais
K 201	K 201	K 201	K 201	K 201	K 2A
K 202	K 202	K 202	K 202	K 202	K 2B
-	K 203	K 203	K 207	K 203	K 2C
-	K 204	K 204	K 208	K 204	K 2D
-	K 205	K 205	K 209	K 205	K 2E
-	K 206	K 206	K 210	K 206	K 2F
-	-	K 207	K 211	K 207	K 2G
-	-	K 208	K 212	K 208	K 2H
-	-	K 209		K 209	K 2I
-	-	K 210		K 210	K 2J
-	-	K 211		K 211	K 2K
-	-	K 212		K 212	K 2L

The configuration of output relays for each bay type is given in the List of Bay Types in the Appendix.

Note: Before selecting a new bay type, make sure that only functions of function groups DEVxx are configured for the output relays. Otherwise there will be an error message, and the new bay type will not be activated.

Note: Before selecting a new bay type, make sure that all output relays specified in the List of Bay types for the selected bay type are actually available in the device. Otherwise there will be an error message, and the new bay type will not be activated.

An operating mode can be defined for each output relay. Depending on the selected operating mode, the output relay will operate in either an energize-on-signal mode ('open-circuit principle') or a normally-energized mode ('closed-circuit principle') and in either a latching or non-latching mode. For output relays operating in latching mode, the operating mode setting also determines when latching will be canceled.

Note: The operating mode for the output relays will automatically be set to *ES updating* (ES: energize-on-signal mode) when a new bay type is selected.

OUTP: Fct. assignm. K 201	157 002	Fig. 3-22
OUTP: Fct. assignm. K 202	157 006	
OUTP: Fct. assignm. K 203	157 010	
OUTP: Fct. assignm. K 204	157 014	
OUTP: Fct. assignm. K 205	157 018	
OUTP: Fct. assignm. K 206	157 022	
OUTP: Fct. assignm. K 207	157 026	
OUTP: Fct. assignm. K 208	157 030	
OUTP: Fct. assignm. K 209	157 034	
OUTP: Fct. assignm. K 210	157 038	
OUTP: Fct. assignm. K 211	157 042	
OUTP: Fct. assignm. K 212	157 046	
OUTP: Fct. assignm. K 213	157 050	
OUTP: Fct. assignm. K 214	157 054	
Assignment of functions to output relays.		
OUTP: Oper. mode K 201	157 003	Fig. 3-22
OUTP: Oper. mode K 202	157 007	
OUTP: Oper. mode K 20	157 011	
OUTP: Oper. mode K 204	157 015	
OUTP: Oper. mode K 205	157 019	
OUTP: Oper. mode K 206	157 023	
OUTP: Oper. mode K 207	157 027	
OUTP: Oper. mode K 208	157 031	
OUTP: Oper. mode K 209	157 035	
OUTP: Oper. mode K 210	157 039	
OUTP: Oper. mode K 211	157 043	
OUTP: Oper. mode K 212	157 047	
OUTP: Oper. mode K 213	157 051	
OUTP: Oper. mode K 214	157 055	
Selection of operating mode for output relays.		

LED indicators

The C232 has a total of 13 LED indicators for parallel display of binary signals. The Address List in the Appendix gives information about the configuration options for all LED indicators. The following table provides an overview.

LED indicator	Description on the label strip as supplied	Configuration
H 1	'HEALTHY'	Not configurable. H 1 signals the operational readiness of the device (supply voltage present).
H 17	'EDIT MODE'	Not configurable. H 17 signals the fact that the user is in the 'EDIT MODE'. In this mode, parameter values can be changed. (See the section entitled 'Display and Keypad' in Chapter 6.)
H 2	'OUT OF SERVICE'	Permanently assigned to the function MAIN: Blocked/faulty.
H 3	'ALARM'	Permanently assigned to the function SFMON: Warning (LED).
H 4	'TRIP'	The factory-set configuration is shown in the Terminal Connection Diagrams. These diagrams are found in the appendix to this manual or in the Supporting Documents shipped with the device.
H 5 to H 12	----	The user has the option of assigning functions to these LED indicators.

The arrangement of the LED indicators on the local control panel is illustrated in the dimensional drawings of Chapter 4.

An operating mode can be defined for each LED indicator. Depending on the selected operating mode, the output relay will operate in either energize-on-signal (ES) mode ('open-circuit principle') or normally-energized (NE) mode ('closed-circuit principle') and in either latching or non-latching mode. For LED indicators operating in latching mode, the operating mode setting also determines when latching will be canceled.

LED: Fct. assignm. H 2 085 001 Fig. 3-24

Display of the function assigned to LED indicator H 2 ('OUT OF SERVICE'). The MAIN: Blocked/faulty function is permanently assigned to this LED.

LED: Fct. assignm. H 3 085 004

Display of the function assigned to LED indicator H 3 ('ALARM'). The SFMON: Warning (LED) function is permanently assigned to this LED.

LED: Fct. assignm. H 4 085 007
LED: Fct. assignm. H 5 085 010
LED: Fct. assignm. H 6 085 013
LED: Fct. assignm. H 7 085 016
LED: Fct. assignm. H 8 085 019
LED: Fct. assignm. H 9 085 022
LED: Fct. assignm. H 10 085 025
LED: Fct. assignm. H 11 085 028
LED: Fct. assignm. H 12 085 031

Assignment of functions to LED indicators.

LED: Operating mode H 2	085 002	Fig. 3-24
LED: Operating mode H 3	085 005	
LED: Operating mode H 4	085 008	
LED: Operating mode H 5	085 011	
LED: Operating mode H 6	085 014	
LED: Operating mode H 7	085 017	
LED: Operating mode H 8	085 020	
LED: Operating mode H 9	085 023	
LED: Operating mode H 10	085 026	
LED: Operating mode H 11	085 029	
LED: Operating mode H 12	085 032	
Selection of operating mode for LED indicators.		

Main funcions

MAIN: Chann.assign.COMM1/2	003 169	Fig. 3-60
Assigment of the “logical” communication interface to the physical communication port..		
MAIN: Type of bay	220 000	Fig. 3-28
Configuration of a bay type.		
MAIN: Customized bay type	221 062	Fig. 3-28
If a user-specific (customized) bay type has been loaded, ist bay type No. will be displayed. If no customized bay type has been loaded, the number ‘0’ will be displayed.		

Fault recording

FT_RC: Rec. analog chann. 1	035 160
FT_RC: Rec. analog chann. 2	035 161
FT_RC: Rec. analog chann. 3	035 162
FT_RC: Rec. analog chann. 4	035 163
FT_RC: Rec. analog chann. 7	035 166
The user specifies the channel on which each physical variable is recorded.	

Canceling a function

The user can adapt the device to the requirements of a particular high- or medium-voltage system by including the relevant functions in the device configuration and canceling all others (removing them from the device configuration).

The following conditions must be met before canceling a function:

- ☐ The function in question must be disabled.
- ☐ None of the functions of the function to be canceled may be assigned to a binary input.
- ☐ None of the signals of the function may be assigned to a binary output or an LED indicator.
- ☐ None of the signals of the function may be linked to other signals by way of an ‘m out of n’ parameter.

The function to which a parameter, a signal, or a measured value belongs is defined by the function group descriptor (example: ‘LIMIT’).

Definite-time overcurrent protection

DTOC: Function group DTOC 056 008

Canceling function group DTOC or including it in the configuration. If the function group is cancelled from the configuration, then all associated settings and signals are hidden, with the exception of this setting.

Inverse-time overcurrent protection

IDMT: Function group IDMT 056 009

Canceling function group IDMT or including it in the configuration. If the function group is cancelled from the configuration, then all associated settings and signals are hidden, with the exception of this setting.

Limit value monitoring

LIMIT: Function group LIMIT 056 025

Canceling function group LIMIT or including it in the configuration. If the function group is cancelled from the configuration, then all associated settings and signals are hidden, with the exception of this setting.

Logic

LOGIC: Function group LOGIC 056 017

Canceling function group LOGIC or including it in the configuration. If the function group is cancelled from the configuration, then all associated settings and signals are hidden, with the exception of this setting.

External devices 01 to 10

DEV01: Function group DEV01	210 047
DEV02: Function group DEV02	210 097
DEV03: Function group DEV03	210 147
DEV04: Function group DEV04	210 197
DEV05: Function group DEV05	210 247
DEV06: Function group DEV06	211 047
DEV07: Function group DEV07	211 097
DEV08: Function group DEV08	211 147
DEV09: Function group DEV09	211 197
DEV10: Function group DEV10	211 247

Canceling function groups DEV01 to DEV10 or including them in the configuration. If the function group is cancelled from the configuration, then all associated settings and signals are hidden, with the exception of this setting.

DEV01: Funct. type, signal	210 034
DEV02: Funct. type, signal	210 084
DEV03: Funct. type, signal	210 134
DEV04: Funct. type, signal	210 184
DEV05: Funct. type, signal	210 234
DEV06: Funct. type, signal	211 034
DEV07: Funct. type, signal	211 084
DEV08: Funct. type, signal	211 134
DEV09: Funct. type, signal	211 184
DEV10: Funct. type, signal	211 234

Setting for the function type of the signal.

Note:
If the IEC 870-5-101 communication protocol has been set, then the 'low address' of the information object will be defined by this setting. If the ILS-C protocol has been set, then this setting will correspond to DN2.

DEV01: Inform. No., signal	210 035
DEV02: Inform. No., signal	210 085
DEV03: Inform. No., signal	210 135
DEV04: Inform. No., signal	210 185
DEV05: Inform. No., signal	210 235
DEV06: Inform. No., signal	211 035
DEV07: Inform. No., signal	211 085
DEV08: Inform. No., signal	211 135
DEV09: Inform. No., signal	211 185
DEV10: Inform. No., signal	211 235

Setting for the information number of the signal.

Note:
If the IEC 870-5-101 communication protocol has been set, then the 'high' address' of the information object will be defined by this setting. If the ILS-C protocol has been set, then this setting will correspond to DN3.

DEV01: Funct. type, command	210 032
DEV02: Funct. type, command	210 082
DEV03: Funct. type, command	210 132
DEV04: Funct. type, command	210 182
DEV05: Funct. type, command	210 232
DEV06: Funct. type, command	211 032
DEV07: Funct. type, command	211 082
DEV08: Funct. type, command	211 132
DEV09: Funct. type, command	211 182
DEV10: Funct. type, command	211 232

Setting for the function type of the command.

Note:
If the IEC 870-5-101 communication protocol has been set, then the 'low address' of the information object will be defined by this setting. If the ILS-C protocol has been set, then this setting will correspond to DN2.

DEV01: Inform. No., command	210 033
DEV02: Inform. No., command	210 083
DEV03: Inform. No., command	210 133
DEV04: Inform. No., command	210 183
DEV05: Inform. No., command	210 233
DEV06: Inform. No., command	211 033
DEV07: Inform. No., command	211 083
DEV08: Inform. No., command	211 133
DEV09: Inform. No., command	211 183
DEV10: Inform. No., command	211 233

Setting for the information number of the signal.

Note:
If the IEC 870-5-101 communication protocol has been set, then the 'high' address' of the information object will be defined by this setting. If the ILS-C protocol has been set, then this setting will correspond to DN3.

Single-pole commands

CMD_1: Function group CMD_1	249 252

Canceling function group CMD1 or including it in the configuration. If the function group is cancelled from the configuration, then all associated settings and signals are hidden, with the exception of this setting.

CMD_1: Command C001 config.	200 004
CMD_1: Command C002 config.	200 009
CMD_1: Command C003 config.	200 014
CMD_1: Command C004 config.	200 019
CMD_1: Command C005 config.	200 024
CMD_1: Command C006 config.	200 029
CMD_1: Command C007 config.	200 034
CMD_1: Command C008 config.	200 039
CMD_1: Command C009 config.	200 044
CMD_1: Command C010 config.	200 049
CMD_1: Command C011 config.	200 054
CMD_1: Command C012 config.	200 059

Canceling commands C001 to C026 or including them in the configuration. If a command is cancelled, then all associated settings and signals are hidden, with the exception of this setting.

Single-pole signals

SIG_1: Function group SIG_1	249 250	
Canceling function group SIG_1 or including it in the configuration. If the function group is cancelled from the configuration, then all associated settings and signals are hidden, with the exception of this setting.		
SIG_1: Signal S001 config.	226 007	Fig. 3-115
SIG_1: Signal S002 config.	226 015	
SIG_1: Signal S003 config.	226 023	
SIG_1: Signal S004 config.	226 031	
SIG_1: Signal S005 config.	226 039	
SIG_1: Signal S006 config.	226 047	
SIG_1: Signal S007 config.	226 055	
SIG_1: Signal S008 config.	226 063	
SIG_1: Signal S009 config.	226 071	
SIG_1: Signal S010 config.	226 079	
SIG_1: Signal S011 config.	226 087	
SIG_1: Signal S012 config.	226 095	
SIG_1: Signal S013 config.	226 103	
SIG_1: Signal S014 config.	226 111	
SIG_1: Signal S015 config.	226 119	
SIG_1: Signal S016 config.	226 127	
SIG_1: Signal S017 config.	226 135	
SIG_1: Signal S018 config.	226 143	
SIG_1: Signal S019 config.	226 151	
SIG_1: Signal S020 config.	226 159	
Canceling signals S001 to S040 or including them in the configuration. If a signal is cancelled, then all associated settings and signals are hidden, with the exception of this setting.		

Tap changers

TAPCH: Function group TAPCH	249 253	
Canceling function group TAPCH or including it in the configuration. If the function group is cancelled from the configuration, then all associated settings and signals are hidden, with the exception of this setting.		
TAPCH: TapCh 1 config.	249 119	Fig. 3-118
Canceling TAPCH functions or including them in the configuration. If the function is cancelled from the configuration, then all associated settings and signals are hidden, with the exception of this setting.		

Binary counters

COUNT: Function group COUNT	217 047
Canceling function group COUNT or including it in the configuration. If the function group is cancelled from the configuration, then all associated settings and signals are hidden, with the exception of this setting.	

7.1.3 Function Parameters

7.1.3.1 Global

PC link

PC: Command blocking	003182	Fig. 3-6
When command blocking is activated, commands are rejected at the PC interface.		
PC: Sig./meas.val.block.	003086	Fig. 3-6
When signal and measured value blocking is activated, no signals or measured data are transmitted through the PC interface.		

"Logical" communication interface 1

COMM1: Command block. USER	003172	Fig. 3-7
When command blocking is activated, commands are rejected at the communication interface.		
COMM1: Sig./meas.block.USER	003076	Fig. 3-8, 3-9, 3-10
When signal and measured value blocking is activated, no signals or measured data are transmitted through the communication interface.		

"Logical" communication interface 2

COMM2: Command block. USER	103172	Fig. 3-14
When command blocking is activated, commands are rejected at the communication interface.		
COMM2: Sig./meas.block.USER	103076	Fig. 3-14
When signal and measured value blocking is activated, no signals or measured data are transmitted through the communication interface.		

Binary outputs

OUTP: Outp.rel.block USER	021014	Fig. 3-22
When this blocking is activated, all output relays are blocked.		

Main functions

MAIN: Device on-line	003030	Fig. 3-37
Switching the device off-line or on-line. Parameters marked *'off'* in the Address List can only be changed when the device is off-line.		
MAIN: Test mode USER	003012	Fig. 3-61
When the test mode is activated, signals or measured data for PC and communication interfaces are labeled 'test mode'.		
MAIN: Nominal frequ. fnom	010030	
Setting for the nominal frequency of the protected system.		
MAIN: Rotary field	010049	Fig. 3-88
Setting for the rotary field direction, either clockwise or anti-clockwise.		
MAIN: Inom C.T. prim.	010001	Fig. 3-34, 3-68
Setting for the primary nominal current of the main current transformers for measurement of phase currents.		
MAIN: Vnom V.T. prim.	010002	Fig. 3-34
Setting for the primary nominal voltage of the system transformer for measurement of phase-to-ground and phase-to-phase voltages.		

MAIN: Inom device 010 003

Setting for the secondary nominal current of the system transformer for measurement of phase currents. This also corresponds to the nominal device current.

MAIN: Vnom V.T. sec. 010 009

Setting for the secondary nominal voltage of the system transformer for measurement of phase-to-ground and phase-to-phase voltages.

MAIN: M.v.asg. bay/station 010 110 Fig. 3-23
MAIN: M.v.asg. bay/station 010 111 Fig. 3-23
MAIN: M.v.asg. bay/station 010 112 Fig. 3-23

Indication the mode how C232 handles the measuered quantities connected.

Note:
Depending on the configuration of the transformer modules provided, only one of the three parameters above is visible. If no transformer modules are provided, the three parameters are invisible.

MAIN: Conn. meas. circ. IP 010 004 Fig. 3-23

Short-circuit direction determination is governed by the connection of the measuring circuits IP and VPG. If the connection is as shown in Chapter 5, then the setting must be '*Standard*' if the C232's 'Forward' decision is to be in the direction of the outgoing feeder. If the connection direction is reversed or – given a connection scheme according to Chapter 5 – if the 'forward' decision is to be in the busbar direction, then the setting must be *'Opposite'*.

MAIN: Meas. value rel. IP 011 030 Fig. 3-30

Setting for the minimum current that must be exceeded in order for the measured operating values of the phase currents – and the currents derived from them – to be displayed.

MAIN: Meas. value rel. V 011 032 Fig. 3-33

Setting for the minimum voltage that must be exceeded in order for the measured operating values of the phase-to-ground voltages, phase-to-phase voltages, and the voltages derived from them to be displayed.

MAIN: Settl. t. IP,max,del 010 113 Fig. 3-30

Setting for the time after which the delayed maximum current display shall reach 95% of the maximum current $I_{P,max}$.

MAIN: Fct.assign. block. 1 021 021 Fig. 3-42

Selection of the measuring stages to be blocked by a binary signal (MAIN: Blocking 1 EXT).

MAIN: Fct.assign. block. 2 021 022 Fig. 3-42

Selection of the measuring stages to be blocked by a binary signal (MAIN: Blocking 2 EXT).

MAIN: Trip cmd.block. USER 021 012 Fig. 3-50

Blocking of the trip commands from the local control panel.

MAIN: Fct.assig.trip cmd.1 021 001 Fig. 3-50

Assignment of the signals that trigger trip command 1.

MAIN: Fct.assig.trip cmd.2 021 002 Fig. 3-50

Assignment of the signals that trigger trip command 2.

MAIN: Min.dur. trip cmd. 1	021 003	Fig. 3-50
Setting for the minimum duration of trip command 1.		
MAIN: Min.dur. trip cmd. 2	021 004	Fig. 3-50
Setting for the minimum duration of trip command 2.		
MAIN: Latching trip cmd. 1	021 023	Fig. 3-50
Specification as to whether trip command 1 should latch.		
MAIN: Latching trip cmd. 2	021 024	Fig. 3-50
Specification as to whether trip command 2 should latch.		
MAIN: Fct. asg. close cmd.	021 019	
Assignment of the signal for the close command.		
MAIN: Close cmd.pulse time	015 067	Fig. 3-45, 3-47
Setting for the duration of the close command.		
MAIN: Inp.asg. ctrl.enabl.	221 057	Fig. 3-53
Definition of the binary signal used to issue a general command output enable.		
MAIN: Debounce time gr. 1	221 200	Fig. 3-25
MAIN: Debounce time gr. 2	221 203	
MAIN: Debounce time gr. 3	221 206	
MAIN: Debounce time gr. 4	221 209	
MAIN: Debounce time gr. 5	221 212	
MAIN: Debounce time gr. 6	221 215	
MAIN: Debounce time gr. 7	221 218	
MAIN: Debounce time gr. 8	221 221	
Setting for the debouncing time.		
MAIN: Chatt.mon. time gr.1	221 201	Fig. 3-25
MAIN: Chatt.mon. time gr.2	221 204	
MAIN: Chatt.mon. time gr.3	221 207	
MAIN: Chatt.mon. time gr.4	221 210	
MAIN: Chatt.mon. time gr.5	221 213	
MAIN: Chatt.mon. time gr.6	221 216	
MAIN: Chatt.mon. time gr.7	221 219	
MAIN: Chatt.mon. time gr.8	221 222	
Setting for the chatter monitoring time.		
MAIN: Change of state gr.1	221 202	Fig. 3-50
MAIN: Change of state gr.2	221 205	
MAIN: Change of state gr.3	221 208	
MAIN: Change of state gr.4	221 211	
MAIN: Change of state gr.5	221 214	
MAIN: Change of state gr.6	221 217	
MAIN: Change of state gr.7	221 220	
MAIN: Change of state gr.8	221 223	
Setting for the number of signal changes allowed during the chatter monitoring time before chatter suppression operates.		
MAIN: Cmd. dur.long cmd.	221 230	Fig. 3-110, 3-114
Setting for the command duration of a long command.		

MAIN: Cmd. dur. short cmd.	221 231	Fig. 3-110, 3-114
Setting for the command duration of a short command.		
MAIN: Inp.asg.interl.deact	221 007	Fig. 3-54
Definition of the binary signal used to deactivate interlocking of the control commands of the switchgear units.		
MAIN: Inp.asg. L/R key sw.	221 008	Fig. 3-5
Definition of the binary signal used to switch from remote control to local control.		
MAIN: Auto-assignment I/O	221 065	Fig. 3-28
Once the user has selected a bay type, the binary inputs and outputs are automatically configured with function assignments for the control of switchgear units.		
MAIN: Electrical control	221 061	Fig. 3-106
This setting determines whether the binary inputs that are configured to control the switchgear units will be active with remote control or local control.		
MAIN: W. ext. cmd. termin.	221 063	Fig. 3-112
This setting applies to bay types defined for direct motor control and determines whether intervention in the control sequence of motor-operated switchgear units will be by way of external terminating contacts.		
MAIN: Inp.assign. tripping	221 010	Fig. 3-53
Definition of the binary signal used to signal the tripping of an external protection device. This signal is used to form the CB trip signal.		
MAIN: Prot.trip>CB tripped	221 012	Fig. 3-53
Selection of the protection function trip command that will be used to form the CB trip signal.		
MAIN: Inp. asg. CB trip	221 013	Fig. 3-53
Definition of the binary signal used by the C232 to signal the 'CB open' position signal.		
MAIN: Sig. asg. CB closed	021 020	Fig. 3-44
Definition of the binary signal used by the C232 to evaluate the 'CB closed' position signal.		
MAIN: Inp.asg.CB tr.en.ext	221 050	Fig. 3-53
Definition of the binary signal used to enable the CB trip signal of an external device.		
MAIN: Inp.asg. CB trip ext	221 024	Fig. 3-53
Definition of the binary signal used to carry the CB trip signal of an external device.		
MAIN: Inp.asg. mult.sig. 1	221 051	Fig. 3-46
MAIN: Inp.asg. mult.sig. 2	221 052	Fig. 3-46
Definition of the function that will be interpreted as a multiple signal (group signal).		
MAIN: Fct. assign. fault	021 031	Fig. 3-43
Selection of the signals whose appearance shall result in a 'Blocked/faulty' signal and in the activation of the LED indicator labeled 'OUT OF SERVICE'. Signals that lead to blocking of the device are not configurable and always result in the above signal and indication.		

Parameter subset selection

PSS: Control via USER 003100 Fig. 3-62

If parameter subset selection is to be handled from the integrated local control panel rather than via the binary signal inputs, choose the '*Yes*' setting.

PSS: Param.subs.sel. USER 003060 Fig. 3-62

Selection of the parameter subset from the local control panel.

PSS: Keep time 003063 Fig. 3-62

The setting of this timer stage is relevant only if parameter subset selection is carried out via the binary signal inputs. Any voltage-free pause that may occur during selection is bridged. If, after this time period has elapsed, no binary signal input has yet been set, then the parameter subset selected from the local control panel shall apply.

Self-monitoring

SFMON: Fct. assign. warning 021030 Fig. 3-63

Selection of the signals whose appearance shall result in the signals 'Warning (LED)' and 'Warning (relay) and in the activation of the LED indicator labeled 'ALARM'. Signals caused by faulty hardware and leading to blocking of the device are not configurable. They always result in the above signals and indication.

Fault data acquisition

FT_DA: Start data acquisit. 010011 Fig. 3-67

This setting determines at what point during a fault the acquisition of fault data should take place.

Fault recording

FT_RC: Fct. assig. trigger 003085 Fig. 3-69

This setting defines the signals that will trigger fault recording and fault data acquisition.

FT_RC: I> 017065 Fig. 3-69

This setting defines the threshold value of the phase currents that will trigger fault recording and fault data acquisition.

FT_RC: Pre-fault time 003078 Fig. 3-70

Setting for the time during which data will be recorded before the onset of a fault (pre-fault recording time).

FT_RC: Post-fault time 003079 Fig. 3-70

Setting for the time during which data will be recorded after the end of a fault (post-fault recording time).

FT_RC: Max. recording time 003075 Fig. 3-71

Setting for the maximum recording time per fault. This includes pre-fault and post-fault recording times.

7.1.3.2 General Functions

Main function

MAIN: Hold time dyn.param.	018 009	Fig. 3-39
Setting for the hold time of the "dynamic parameters". After switching to the "dynamic" thresholds, the latter will remain active in place of the "normal" thresholds during this period.		
MAIN: Syst.IN enabled USER	018 008	Fig. 3-38
Enable/disable the DTOC or IDMT residual current stages.		
MAIN: Block tim.st. IN,neg	017 015	Fig. 3-47
This setting defines whether a blocking of the residual current stages should take place for single-pole or multi-pole phase current startings.		
MAIN: Gen. starting mode	017 027	Fig. 3-48
This setting defines whether the triggering of the residual current stages I_N>, $I_{ref,N}$>, I_N>> or I_{ref}>>> as well as the negative-sequence current stage $I_{ref,neg}$> should result in the formation of the general starting signal. If the setting is *W/o start. IN, Ineg* then the associated time delays $t_{IN>}$, $t_{Iref,N>}$, $t_{IN>>}$, $t_{IN>>>}$, $t_{Iref,neg>}$ are automatically excluded from the formation of the trip command.		
MAIN: Op. mode rush restr.	017 097	Fig. 3-40
Setting the operating mode of the inrush stabilization function.		
MAIN: Rush restr. active	017 093	Fig. 3-40
MAIN: Rush I(2*fn)/I(fn)	017 098	
Setting for the operate value of inrush stabilization.		
MAIN: I> lift rush restr.	017 095	Fig. 3-40
Setting the current threshold for inactivation of inrush stabilization.		
MAIN: Suppress start. sig.	017 054	
Setting of the timer stage for the suppression of the phase-selective startings and of the residual and negative-sequence system starting.		
MAIN: tGS	017 005	Fig. 3-48
Setting for the time delay of the general starting signal.		

Definite-time overcurrent protection

DTOC: General enable USER	022 075	Fig. 3-72
Disabling or enabling the definite-time overcurrent protection function.		

Inverse-time overcurrent protection

IDMT: General enable USER	017 096	Fig. 3-81
Disabling or enabling the inverse-time overcurrent protection function.		

Limit value monitoring

LIMIT: General enable USER	014 010	Fig. 3-93
Disabling or enabling limit value monitoring.		
LIMIT: I>	014 004	Fig. 3-93
Setting for the operate value of the first overcurrent stage of limit value monitoring.		
LIMIT: I>>	014 020	Fig. 3-93
Setting for the operate value of the second overcurrent stage of limit value monitoring.		

LIMIT: tI>	014031 Fig. 3-93
Setting for the operate delay of the first overcurrent stage of limit value monitoring.	
LIMIT: tI>>	014032 Fig. 3-93
Setting for the operate delay of the second overcurrent stage of limit value monitoring.	
LIMIT: I<	014021 Fig. 3-93
Setting for the operate value of the first undercurrent stage of limit value monitoring.	
LIMIT: I<<	014022 Fig. 3-93
Setting for the operate value of the second undercurrent stage of limit value monitoring.	
LIMIT: tI<	014033 Fig. 3-93
Setting for the operate delay of the first undercurrent stage of limit value monitoring.	
LIMIT: tI<<	014034 Fig. 3-93
Setting for the operate delay of the second undercurrent stage of limit value monitoring.	
LIMIT: VPG>	014023 Fig. 3-94
Setting for the operate value of overvoltage stage VPG> of limit value monitoring.	
LIMIT: VPG>>	014024 Fig. 3-94
Setting for the operate value of overvoltage stage VPG>> of limit value monitoring.	
LIMIT: tVPG>	014035 Fig. 3-94
Setting for the operate delay of overvoltage stage VPG> of limit value monitoring.	
LIMIT: tVPG>>	014036 Fig. 3-94
Setting for the operate delay of overvoltage stage VPG>> of limit value monitoring.	
LIMIT: VPG<	014025 Fig. 3-94
Setting for the operate value of undervoltage stage VPG< of limit value monitoring.	
LIMIT: VPG<<	014026 Fig. 3-94
Setting for the operate value of undervoltage stage VPG<< of limit value monitoring.	
LIMIT: tVPG<	014037 Fig. 3-94
Setting for the operate delay of undervoltage stage VPG< of limit value monitoring.	
LIMIT: tVPG<<	014038 Fig. 3-94
Setting for the operate delay of undervoltage stage VPG<< of limit value monitoring.	
LIMIT: VPP>	014027 Fig. 3-94
Setting for the operate value of overvoltage stage VPP> of limit value monitoring.	

LIMIT: VPP>> 014 028 Fig. 3-94

Setting for the operate value of overvoltage stage VPP>> of limit value monitoring.

LIMIT: tVPP> 014 039 Fig. 3-94

Setting for the operate delay of overvoltage stage VPP> of limit value monitoring.

LIMIT: tVPP>> 014 040 Fig. 3-94

Setting for the operate delay of overvoltage stage VPP>> of limit value monitoring.

LIMIT: VPP< 014 029 Fig. 3-94

Setting for the operate value of undervoltage stage VPP< of limit value monitoring.

LIMIT: VPP<< 014 030 Fig. 3-94

Setting for the operate value of undervoltage stage VPP<< of limit value monitoring.

LIMIT: tVPP< 014 041 Fig. 3-94

Setting for the operate delay of undervoltage stage VPP< of limit value monitoring.

LIMIT: tVPP<< 014 042 Fig. 3-94

Setting for the operate delay of undervoltage stage VPP<< of limit value monitoring.

LIMIT: VNG> 014 043 Fig. 3-95

Setting for the operate value of overvoltage stage VNG> of limit value monitoring.

LIMIT: VNG>> 014 044 Fig. 3-95

Setting for the operate value of overvoltage stage VNG>> of limit value monitoring.

LIMIT: tVNG> 014 045 Fig. 3-95

Setting for the operate delay of overvoltage stage VNG> of limit value monitoring.

LIMIT: tVNG>> 014 046 Fig. 3-95

Setting for the operate delay of overvoltage stage VNG>> of limit value monitoring.

LIMIT: IDC,lin> 014 110 Fig. 3-96

Setting for operate value IDC,lin> for monitoring the linearized direct current.

LIMIT: IDC,lin>> 014 111 Fig. 3-96

Setting for operate value IDC,lin>> for monitoring the linearized direct current.

LIMIT: tIDC,lin> 014 112 Fig. 3-96

Setting for the operate delay of overcurrent stage IDC,lin>.

LIMIT: tIDC,lin>> 014 113 Fig. 3-96

Setting for the operate delay of overcurrent stage IDC,lin>>.

LIMIT: IDC,lin< 014 114 Fig. 3-96

Setting for operate value IDC,lin< for monitoring the linearized direct current.

	LIMIT: IDC,lin<<	014 115	Fig. 3-96
	Setting for operate value IDC,lin<< for monitoring the linearized direct current.		
	LIMIT: tIDC,lin<	014 116	Fig. 3-96
	Setting for the operate delay of undercurrent stage IDC,lin<.		
	LIMIT: tIDC,lin<<	014 117	Fig. 3-96
	Setting for the operate delay of undercurrent stage IDC,lin<<.		

Logic	**LOGIC: General enable USER**	031 099	Fig. 3-98
	Disabling or enabling the logic function.		
	LOGIC: Set 1 USER	034 030	Fig. 3-97
	LOGIC: Set 2 USER	034 031	
	LOGIC: Set 3 USER	034 032	
	LOGIC: Set 4 USER	034 033	
	LOGIC: Set 5 USER	034 034	
	LOGIC: Set 6 USER	034 035	
	LOGIC: Set 7 USER	034 036	
	LOGIC: Set 8 USER	034 037	
	These settings define the static input conditions for the logic function.		
	LOGIC: Fct.assignm. outp. 1	030 000	Fig. 3-98
	LOGIC: Fct.assignm. outp. 2	030 004	
	LOGIC: Fct.assignm. outp. 3	030 008	
	LOGIC: Fct.assignm. outp. 4	030 012	
	LOGIC: Fct.assignm. outp. 5	030 016	
	LOGIC: Fct.assignm. outp. 6	030 020	
	LOGIC: Fct.assignm. outp. 7	030 024	
	LOGIC: Fct.assignm. outp. 8	030 028	
	LOGIC: Fct.assignm. outp. 9	030 032	
	LOGIC: Fct.assignm. outp.10	030 036	
	LOGIC: Fct.assignm. outp.11	030 040	
	LOGIC: Fct.assignm. outp.12	030 044	
	LOGIC: Fct.assignm. outp.13	030 048	
	LOGIC: Fct.assignm. outp.14	030 052	
	LOGIC: Fct.assignm. outp.15	030 056	
	LOGIC: Fct.assignm. outp.16	030 060	
	LOGIC: Fct.assignm. outp.17	030 064	
	LOGIC: Fct.assignm. outp.18	030 068	
	LOGIC: Fct.assignm. outp.19	030 072	
	LOGIC: Fct.assignm. outp.20	030 076	
	LOGIC: Fct.assignm. outp.21	030 080	
	LOGIC: Fct.assignm. outp.22	030 084	
	LOGIC: Fct.assignm. outp.23	030 088	
	LOGIC: Fct.assignm. outp.24	030 092	
	LOGIC: Fct.assignm. outp.25	030 096	
	LOGIC: Fct.assignm. outp.26	031 000	
	LOGIC: Fct.assignm. outp.27	031 004	
	LOGIC: Fct.assignm. outp.28	031 008	
	LOGIC: Fct.assignm. outp.29	031 012	

LOGIC: Fct.assignm. outp.30	031 016	
LOGIC: Fct.assignm. outp.31	031 020	
LOGIC: Fct.assignm. outp.32	031 024	
These settings assign functions to the outputs.		
LOGIC: Op. mode t output 1	030 001	Fig. 3-98
LOGIC: Op. mode t output 2	030 005	
LOGIC: Op. mode t output 3	030 009	
LOGIC: Op. mode t output 4	030 013	
LOGIC: Op. mode t output 5	030 017	
LOGIC: Op. mode t output 6	030 021	
LOGIC: Op. mode t output 7	030 025	
LOGIC: Op. mode t output 8	030 029	
LOGIC: Op. mode t output 9	030 033	
LOGIC: Op. mode t output 10	030 037	
LOGIC: Op. mode t output 11	030 041	
LOGIC: Op. mode t output 12	030 045	
LOGIC: Op. mode t output 13	030 049	
LOGIC: Op. mode t output 14	030 053	
LOGIC: Op. mode t output 15	030 057	
LOGIC: Op. mode t output 16	030 061	
LOGIC: Op. mode t output 17	030 065	
LOGIC: Op. mode t output 18	030 069	
LOGIC: Op. mode t output 19	030 073	
LOGIC: Op. mode t output 20	030 077	
LOGIC: Op. mode t output 21	030 081	
LOGIC: Op. mode t output 22	030 085	
LOGIC: Op. mode t output 23	030 089	
LOGIC: Op. mode t output 24	030 093	
LOGIC: Op. mode t output 25	030 097	
LOGIC: Op. mode t output 26	031 001	
LOGIC: Op. mode t output 27	031 005	
LOGIC: Op. mode t output 28	031 009	
LOGIC: Op. mode t output 29	031 013	
LOGIC: Op. mode t output 30	031 017	
LOGIC: Op. mode t output 31	031 021	
LOGIC: Op. mode t output 32	031 025	
These settings define the operating modes for the output timer stages.		
LOGIC: Time t1 output 1	030 002	Fig. 3-98
LOGIC: Time t1 output 2	030 006	
LOGIC: Time t1 output 3	030 010	
LOGIC: Time t1 output 4	030 014	
LOGIC: Time t1 output 5	030 018	
LOGIC: Time t1 output 6	030 022	
LOGIC: Time t1 output 7	030 026	
LOGIC: Time t1 output 8	030 030	
LOGIC: Time t1 output 9	030 034	
LOGIC: Time t1 output 10	030 038	
LOGIC: Time t1 output 11	030 042	
LOGIC: Time t1 output 12	030 046	
LOGIC: Time t1 output 13	030 050	
LOGIC: Time t1 output 14	030 054	
LOGIC: Time t1 output 15	030 058	

LOGIC: Time t1 output 16	030 062
LOGIC: Time t1 output 17	030 066
LOGIC: Time t1 output 18	030 070
LOGIC: Time t1 output 19	030 074
LOGIC: Time t1 output 20	030 078
LOGIC: Time t1 output 21	030 082
LOGIC: Time t1 output 22	030 086
LOGIC: Time t1 output 23	030 090
LOGIC: Time t1 output 24	030 094
LOGIC: Time t1 output 25	030 098
LOGIC: Time t1 output 26	031 002
LOGIC: Time t1 output 27	031 006
LOGIC: Time t1 output 28	031 010
LOGIC: Time t1 output 29	031 014
LOGIC: Time t1 output 30	031 018
LOGIC: Time t1 output 31	031 022
LOGIC: Time t1 output 32	031 026
Settings for timer stage t1 of the respective outputs.	
LOGIC: Time t2 output 1	030 003
LOGIC: Time t2 output 2	030 007
LOGIC: Time t2 output 3	030 011
LOGIC: Time t2 output 4	030 015
LOGIC: Time t2 output 5	030 019
LOGIC: Time t2 output 6	030 023
LOGIC: Time t2 output 7	030 027
LOGIC: Time t2 output 8	030 031
LOGIC: Time t2 output 9	030 035
LOGIC: Time t2 output 10	030 039
LOGIC: Time t2 output 11	030 043
LOGIC: Time t2 output 12	030 047
LOGIC: Time t2 output 13	030 051
LOGIC: Time t2 output 14	030 055
LOGIC: Time t2 output 15	030 059
LOGIC: Time t2 output 16	030 063
LOGIC: Time t2 output 17	030 067
LOGIC: Time t2 output 18	030 071
LOGIC: Time t2 output 19	030 075
LOGIC: Time t2 output 20	030 079
LOGIC: Time t2 output 21	030 083
LOGIC: Time t2 output 22	030 087
LOGIC: Time t2 output 23	030 091
LOGIC: Time t2 output 24	030 095
LOGIC: Time t2 output 25	030 099
LOGIC: Time t2 output 26	031 003
LOGIC: Time t2 output 27	031 007
LOGIC: Time t2 output 28	031 011
LOGIC: Time t2 output 29	031 015

Fig. 3-98

LOGIC: Time t2 output 30	031 019	
LOGIC: Time t2 output 31	031 023	
LOGIC: Time t2 output 32	031 027	
Settings for timer stage t2 of the respective outputs. **Note:** This setting has no effect in the 'minimum time' operating mode.		
LOGIC: Sig.assig. outp. 1	044 000	Fig. 3-104
LOGIC: Sig.assig. outp. 2	044 002	
LOGIC: Sig.assig. outp. 3	044 004	
LOGIC: Sig.assig. outp. 4	044 006	
LOGIC: Sig.assig. outp. 5	044 008	
LOGIC: Sig.assig. outp. 6	044 010	
LOGIC: Sig.assig. outp. 7	044 012	
LOGIC: Sig.assig. outp. 8	044 014	
LOGIC: Sig.assig. outp. 9	044 016	
LOGIC: Sig.assig. outp. 10	044 018	
LOGIC: Sig.assig. outp. 11	044 020	
LOGIC: Sig.assig. outp. 12	044 022	
LOGIC: Sig.assig. outp. 13	044 024	
LOGIC: Sig.assig. outp. 14	044 026	
LOGIC: Sig.assig. outp. 15	044 028	
LOGIC: Sig.assig. outp. 16	044 030	
LOGIC: Sig.assig. outp. 17	044 032	
LOGIC: Sig.assig. outp. 18	044 034	
LOGIC: Sig.assig. outp. 19	044 036	
LOGIC: Sig.assig. outp. 20	044 038	
LOGIC: Sig.assig. outp. 21	044 040	
LOGIC: Sig.assig. outp. 22	044 042	
LOGIC: Sig.assig. outp. 23	044 044	
LOGIC: Sig.assig. outp. 24	044 046	
LOGIC: Sig.assig. outp. 25	044 048	
LOGIC: Sig.assig. outp. 26	044 050	
LOGIC: Sig.assig. outp. 27	044 052	
LOGIC: Sig.assig. outp. 28	044 054	
LOGIC: Sig.assig. outp. 29	044 056	
LOGIC: Sig.assig. outp. 30	044 058	
LOGIC: Sig.assig. outp. 31	044 060	
LOGIC: Sig.assig. outp. 32	044 062	
These settings assign the function of a binary input signal to the output of the logic equation.		
LOGIC: Sig.assig.outp. 1(t)	044 001	Fig. 3-104
LOGIC: Sig.assig.outp. 2(t)	044 003	
LOGIC: Sig.assig.outp. 3(t)	044 005	
LOGIC: Sig.assig.outp. 4(t)	044 007	
LOGIC: Sig.assig.outp. 5(t)	044 009	
LOGIC: Sig.assig.outp. 6(t)	044 011	
LOGIC: Sig.assig.outp. 7(t)	044 013	
LOGIC: Sig.assig.outp. 8(t)	044 015	
LOGIC: Sig.assig.outp. 9(t)	044 017	
LOGIC: Sig.assig.outp.10(t)	044 019	
LOGIC: Sig.assig.outp.11(t)	044 021	

LOGIC: Sig.assig.outp.12(t)	044 023
LOGIC: Sig.assig.outp.13(t)	044 025
LOGIC: Sig.assig.outp.14(t)	044 027
LOGIC: Sig.assig.outp.15(t)	044 029
LOGIC: Sig.assig.outp.16(t)	044 031
LOGIC: Sig.assig.outp.17(t)	044 033
LOGIC: Sig.assig.outp.18(t)	044 035
LOGIC: Sig.assig.outp.19(t)	044 037
LOGIC: Sig.assig.outp.20(t)	044 039
LOGIC: Sig.assig.outp.21(t)	044 041
LOGIC: Sig.assig.outp.22(t)	044 043
LOGIC: Sig.assig.outp.23(t)	044 045
LOGIC: Sig.assig.outp.24(t)	044 047
LOGIC: Sig.assig.outp.25(t)	044 049
LOGIC: Sig.assig.outp.26(t)	044 051
LOGIC: Sig.assig.outp.27(t)	044 053
LOGIC: Sig.assig.outp.28(t)	044 055
LOGIC: Sig.assig.outp.29(t)	044 057
LOGIC: Sig.assig.outp.30(t)	044 059
LOGIC: Sig.assig.outp.31(t)	044 061
LOGIC: Sig.assig.outp.32(t)	044 063

These settings assign the function of a binary input signal to the output of the logic equation.

Single-pole commands

CMD_1: Design. command C001	200 000	
CMD_1: Design. command C002	200 005	
CMD_1: Design. command C003	200 010	
CMD_1: Design. command C004	200 015	
CMD_1: Design. command C005	200 020	
CMD_1: Design. command C006	200 025	
CMD_1: Design. command C007	200 030	
CMD_1: Design. command C008	200 035	
CMD_1: Design. command C009	200 040	
CMD_1: Design. command C010	200 045	
CMD_1: Design. command C011	200 050	
CMD_1: Design. command C012	200 055	
Selection of the command designation.		
CMD_1: Oper. mode cmd. C001	200 002	Fig. 3-114
CMD_1: Oper. mode cmd. C002	200 007	
CMD_1: Oper. mode cmd. C003	200 012	
CMD_1: Oper. mode cmd. C004	200 017	
CMD_1: Oper. mode cmd. C005	200 022	
CMD_1: Oper. mode cmd. C006	200 027	
CMD_1: Oper. mode cmd. C007	200 032	
CMD_1: Oper. mode cmd. C008	200 037	
CMD_1: Oper. mode cmd. C010	200 047	
CMD_1: Oper. mode cmd. C009	200 042	
CMD_1: Oper. mode cmd. C011	200 052	
CMD_1: Oper. mode cmd. C012	200 057	
Selection of the command operating mode.		

Single-pole signals

SIG_1: Designat. sig. S001	226 000	
SIG_1: Designat. sig. S002	226 008	
SIG_1: Designat. sig. S003	226 016	
SIG_1: Designat. sig. S004	226 024	
SIG_1: Designat. sig. S005	226 032	
SIG_1: Designat. sig. S006	226 040	
SIG_1: Designat. sig. S007	226 048	
SIG_1: Designat. sig. S008	226 056	
SIG_1: Designat. sig. S009	226 064	
SIG_1: Designat. sig. S010	226 072	
SIG_1: Designat. sig. S011	226 080	
SIG_1: Designat. sig. S012	226 088	
SIG_1: Designat. sig. S013	226 096	
SIG_1: Designat. sig. S014	226 104	
SIG_1: Designat. sig. S015	226 112	
SIG_1: Designat. sig. S016	226 120	
SIG_1: Designat. sig. S017	226 128	
SIG_1: Designat. sig. S018	226 136	
SIG_1: Designat. sig. S019	226 144	
SIG_1: Designat. sig. S020	226 152	
Selection of the signal designation.		
SIG_1: Oper. mode sig. S001	226 001	Fig. 3-115
SIG_1: Oper. mode sig. S002	226 009	
SIG_1: Oper. mode sig. S003	226 017	
SIG_1: Oper. mode sig. S004	226 025	
SIG_1: Oper. mode sig. S005	226 033	
SIG_1: Oper. mode sig. S006	226 041	
SIG_1: Oper. mode sig. S007	226 049	
SIG_1: Oper. mode sig. S008	226 057	
SIG_1: Oper. mode sig. S009	226 065	
SIG_1: Oper. mode sig. S010	226 073	
SIG_1: Oper. mode sig. S011	226 081	
SIG_1: Oper. mode sig. S012	226 089	
SIG_1: Oper. mode sig. S013	226 097	
SIG_1: Oper. mode sig. S014	226 105	
SIG_1: Oper. mode sig. S015	226 113	
SIG_1: Oper. mode sig. S016	226 121	
SIG_1: Oper. mode sig. S017	226 129	
SIG_1: Oper. mode sig. S018	226 137	
SIG_1: Oper. mode sig. S019	226 145	
SIG_1: Oper. mode sig. S020	226 153	
Selection of the signal operating mode.		
SIG_1: Gr.asg. debounc.S001	226 003	Fig. 3-115
SIG_1: Gr.asg. debounc.S002	226 011	
SIG_1: Gr.asg. debounc.S003	226 019	
SIG_1: Gr.asg. debounc.S004	226 027	
SIG_1: Gr.asg. debounc.S005	226 035	
SIG_1: Gr.asg. debounc.S006	226 043	
SIG_1: Gr.asg. debounc.S007	226 051	
SIG_1: Gr.asg. debounc.S008	226 059	
SIG_1: Gr.asg. debounc.S009	226 067	
SIG_1: Gr.asg. debounc.S010	226 075	

SIG_1: Gr.asg. debounc.S011	226 083
SIG_1: Gr.asg. debounc.S012	226 091
SIG_1: Gr.asg. debounc.S013	226 099
SIG_1: Gr.asg. debounc.S014	226 107
SIG_1: Gr.asg. debounc.S015	226 115
SIG_1: Gr.asg. debounc.S016	226 123
SIG_1: Gr.asg. debounc.S017	226 131
SIG_1: Gr.asg. debounc.S018	226 139
SIG_1: Gr.asg. debounc.S019	226 147
SIG_1: Gr.asg. debounc.S020	226 155

Group assignment for the debouncing time and the chatter suppression.

SIG_1: Min. sig. dur. S001	226 002
SIG_1: Min. sig. dur. S002	226 010
SIG_1: Min. sig. dur. S003	226 018
SIG_1: Min. sig. dur. S004	226 026
SIG_1: Min. sig. dur. S005	226 034
SIG_1: Min. sig. dur. S006	226 042
SIG_1: Min. sig. dur. S007	226 050
SIG_1: Min. sig. dur. S008	226 058
SIG_1: Min. sig. dur. S009	226 066
SIG_1: Min. sig. dur. S010	226 074
SIG_1: Min. sig. dur. S011	226 082
SIG_1: Min. sig. dur. S012	226 090
SIG_1: Min. sig. dur. S013	226 098
SIG_1: Min. sig. dur. S014	226 106
SIG_1: Min. sig. dur. S015	226 114
SIG_1: Min. sig. dur. S016	226 122
SIG_1: Min. sig. dur. S017	226 130
SIG_1: Min. sig. dur. S018	226 138
SIG_1: Min. sig. dur. S019	226 146
SIG_1: Min. sig. dur. S020	226 154

Fig. 3-115

The logic '1' signal must be available for this minimum time setting for a telegram to be sent in the *Start/end signal* mode.

Tap changers

TAPCH: Designation TapCh 1	249 100	Fig. 3-118
Assignment of a name to the tap changer.		
TAPCH: Inp.assign. TapCh 1	249 101	Fig. 3-118
Assignment of the tap changer position signal to the binary signal inputs in BCD code. The assignment sequence proceeds from the low-value bit to the higher value bit.		
TAPCH: Lowest tap TapCh 1	249 111	Fig. 3-118
Setting for the lowest tap position for which control commands will be operative.		
TAPCH: Highest tap TapCh 1	249 112	Fig. 3-118
Setting for the highest tap position for which control commands will be operative.		
TAPCH: Oper. time TapCh 1	249 109	Fig. 3-118
Setting for the operating time for control commands.		
TAPCH: Int.pos.suppr.TapCh1	249 116	Fig. 3-118
If suppression of the intermediate position is activated, then the zero position is not transmitted while a tap change is in progress.		
TAPCH: Debounce time TapCh1	249 102	Fig. 3-118
Setting for the debouncing time.		
TAPCH: TapCh 1, sign	249 110	Fig. 3-118
Consideration of the sign of the tap changer.		
TAPCH: Op. mode cmd. TapCh1	249 115	Fig. 3-118
The operating mode for the tap changer command can be set for long command, short command, or time control.		
TAPCH: I.asg.e.TapCh1.lower	249 117	Fig. 3-118
Assignment of the tap changing command lower to an output relay.		
TAPCH: I.asg.e.TapCh1.raise	249 118	Fig. 3-118
Assignment of the tap changing command upper to an output relay.		

Binary counters

COUNT: General enable USER	217 000	Fig. 3-117
Enabling or disabling the counting function.		
COUNT: Debounce t. count. 1	217 160	Fig. 3-117
Setting for the debounce time of the binary signal to be counted.		
COUNT: Cycle t.count transm	217 007	Fig. 3-117
Setting for the cycle time for the periodic transmission of the counts.		

7.1.3.3 Parameter Subsets

Definite-time overcurrent protection

DTOC: Enable PSx	072 098	073 098	074 098	075 098		Fig. 3-72
This setting defines the parameter subset in which definite-time overcurrent protection is enabled.						
DTOC: I> PSx	017 000	073 007	074 007	075 007		Fig. 3-73
Setting for the operate value of the first overcurrent stage (phase current stage). **Caution!** The range of setting values includes operate values that are not permitted as continuous current values (see 'Technical Data').						
DTOC: I> dynamic PSx	017 080	073 032	074 032	075 032		Fig. 3-73
Setting for the operate value of the first overcurrent stage in dynamic mode (phase current stage). This operate value is effective only while the timer stage MAIN: Hold-time dyn. param. is elapsing. **Caution!** The range of setting values includes operate values that are not permitted as continuous current values (see 'Technical Data').						
DTOC: I>> PSx	017 001	073 008	074 008	075 008		Fig. 3-73
Setting for the operate value of the second overcurrent stage (phase current stage). **Caution!** The range of setting values includes operate values that are not permitted as continuous current values (see 'Technical Data').						
DTOC: I>> dynamic PSx	017 084	073 033	074 033	075 033		Fig. 3-73
Setting for the operate value of the second overcurrent stage in dynamic mode (phase current stage). This operate value is effective only while the timer stage MAIN: Hold-time dyn. param. is elapsing. **Caution!** The range of setting values includes operate values that are not permitted as continuous current values (see 'Technical Data').						
DTOC: I>>> PSx	017 002	073 009	074 009	075 009		Fig. 3-73
Setting for the operate value of the third overcurrent stage (phase current stage). **Caution!** The range of setting values includes operate values that are not permitted as continuous current values (see 'Technical Data').						
DTOC: I>>> dynamic PSx	017 085	073 034	074 034	075 034		Fig. 3-73
Setting for the operate value of the third overcurrent stage in dynamic mode (phase current stage). This operate value is effective only while the timer stage MAIN: Hold-time dyn. param. is elapsing. **Caution!** The range of setting values includes operate values that are not permitted as continuous current values (see 'Technical Data').						
DTOC: tI> PSx	017 004	073 019	074 019	075 019		Fig. 3-73
Setting for the operate delay of the first overcurrent stage.						

DTOC: tI>> PSx	017 006 073 020 074 020 075 020	Fig. 3-73
Setting for the operate delay of the second overcurrent stage.		
DTOC: tI>>> PSx	017 007 073 021 074 021 075 021	Fig. 3-73
Setting for the operate delay of the third overcurrent stage.		
DTOC: IN> PSx	017 003 073 015 074 015 075 015	Fig. 3-76
Setting for the operate value of the first overcurrent stage (residual current stage). **Caution!** The range of setting values includes operate values that are not permitted as continuous current values (see 'Technical Data').		
DTOC: IN> dynamic PSx	017 081 073 035 074 035 075 035	Fig. 3-76
Setting for the operate value of the first overcurrent stage in dynamic mode (residual current stage). This operate value is effective only while the timer stage MAIN: Hold-time dyn. param. is elapsing. **Caution!** The range of setting values includes operate values that are not permitted as continuous current values (see 'Technical Data').		
DTOC: IN>> PSx	017 009 073 016 074 016 075 016	Fig. 3-76
Setting for the operate value of the second overcurrent stage (residual current stage). **Caution!** The range of setting values includes operate values that are not permitted as continuous current values (see 'Technical Data').		
DTOC: IN>> dynamic PSx	017 086 073 036 074 036 075 036	Fig. 3-76
Setting for the operate value of the second overcurrent stage in dynamic mode (residual current stage). This operate value is effective only while the timer stage MAIN: Hold-time dyn. param. is elapsing. **Caution!** The range of setting values includes operate values that are not permitted as continuous current values (see 'Technical Data').		
DTOC: IN>>> PSx	017 018 073 017 074 017 075 017	Fig. 3-76
Setting for the operate value of the third overcurrent stage (residual current stage). **Caution!** The range of setting values includes operate values that are not permitted as continuous current values (see 'Technical Data').		
DTOC: IN>>> dynamic PSx	017 087 073 037 074 037 075 037	Fig. 3-76
Setting for the operate value of the third overcurrent stage in dynamic mode (residual current stage). This operate value is effective only while the timer stage MAIN: Hold-time dyn. param. is elapsing. **Caution!** The range of setting values includes operate values that are not permitted as continuous current values (see 'Technical Data').		
DTOC: tIN> PSx	017 008 073 027 074 027 075 027	Fig. 3-76
Setting for the operate delay of the first overcurrent stage (residual current stage).		

DTOC: tIN>> PSx	017 010 073 028 074 028 075 028	Fig. 3-76
Setting for the operate delay of the second overcurrent stage (residual current stage).		
DTOC: tIN>>> PSx	017 019 073 029 074 029 075 029	Fig. 3-76
Setting for the operate delay of the third overcurrent stage (residual current stage).		
DTOC: Puls.prol.IN>,intPSx	017 055 073 042 074 042 075 042	Fig. 3-78
Setting for the pulse prolongation time of the hold-time logic for intermittent ground faults.		
DTOC: tIN,interm. PSx	017 056 073 038 074 038 075 038	Fig. 3-78
Setting for the tripping time of the hold-time logic for intermittent ground faults.		
DTOC: Hold-t. tIN>,intmPSx	017 057 073 039 074 039 075 039	Fig. 3-78
Setting for the hold-time for intermittent ground faults.		

Inverse-time overcurrent protection

IDMT: Enable PSx	072 070 073 070 074 070 075 070	Fig. 3-81
This setting defines the parameter subset in which IDMT protection is enabled.		
IDMT: Iref,P PSx	072 050 073 050 074 050 075 050	Fig. 3-86
Setting for the reference current (phase current system).		
IDMT: Iref,P dynamic PSx	072 003 073 003 074 003 075 003	Fig. 3-86
Setting for the reference current in dynamic mode (phase current system). This operate value is effective only while the timer stage MAIN: Hold-time dyn. param. is elapsing.		
IDMT: Characteristic P PSx	072 056 073 056 074 056 075 056	Fig. 3-86
Setting for the tripping characteristic (phase current system).		
IDMT: Factor kt,P PSx	072 053 073 053 074 053 075 053	Fig. 3-86
Setting for factor kt,P of the starting characteristic (phase current system).		
IDMT: Min. trip time P PSx	072 077 073 077 074 077 075 077	Fig. 3-86
Setting for the minimum trip time (phase current system). As a rule, this value should be set as for the first DTOC stage (I>).		
IDMT: Hold time P PSx	072 071 073 071 074 071 075 071	Fig. 3-86
Setting for the holding time for intermittent short circuits (phase current system).		
IDMT: Release P PSx	072 059 073 059 074 059 075 059	Fig. 3-86
Setting for the release or reset characteristic (phase current system).		
IDMT: Iref,neg PSx	072 051 073 051 074 051 075 051	Fig. 3-88
Setting for the reference current (negative-sequence current system).		
IDMT: Iref,neg dynamic PSx	072 004 073 004 074 004 075 004	Fig. 3-88
Setting for the reference current in dynamic mode (negative-sequence current system). This operate value is effective only while the timer stage MAIN: Hold-time dyn. param. is elapsing.		
IDMT: Character. neg. PSx	072 057 073 057 074 057 075 057	Fig. 3-88
Setting for the tripping characteristic (negative-sequence current system).		

IDMT: Factor kt,neg PSx	072 054 073 054 074 054 075 054	Fig. 3-88
Setting for factor kt,neg of the starting characteristic (negative-sequence current system).		
IDMT: Min.trip time negPSx	072 078 073 078 074 078 075 078	Fig. 3-88
Setting for the minimum trip time (negative-sequence current system). As a rule, this value should be set as for the first DTOC stage (I>).		
IDMT: Hold time neg PSx	072 072 073 072 074 072 075 072	Fig. 3-88
Setting for the holding time for intermittent short circuits (negative-sequence current system).		
IDMT: Release neg. PSx	072 060 073 060 074 060 075 060	Fig. 3-88
Setting for the release characteristic (negative-sequence current system).		
IDMT: Iref,N PSx	072 052 073 052 074 052 075 052	Fig. 3-90
Setting for the reference current (residual current system).		
IDMT: Iref,N dynamic PSx	072 005 073 005 074 005 075 005	Fig. 3-90
Setting for the reference current in dynamic mode (residual current system). This operate value is effective only while the timer stage MAIN: Hold-time dyn. param. is elapsing.		
IDMT: Characteristic N PSx	072 058 073 058 074 058 075 058	Fig. 3-90
Setting for the tripping characteristic (residual current system).		
IDMT: Factor kt,N PSx	072 055 073 055 074 055 075 055	Fig. 3-90
Setting for the tripping characteristic (residual current system).		
IDMT: Min. trip time N PSx	072 079 073 079 074 079 075 079	Fig. 3-90
Setting for the minimum trip time (residual current system). As a rule, this value should be set as for the first DTOC stage (IN>).		
IDMT: Hold time N PSx	072 073 073 073 074 073 075 073	Fig. 3-90
Setting for the holding time for intermittent short circuits (residual current system).		
IDMT: Release N PSx	072 061 073 061 074 061 075 061	Fig. 3-90
Setting for the release characteristic (residual current system).		

7.1.3.4 Control

Main functions

MAIN: BI active USER	221 003	Fig. 3-54
Enabling the bay interlocking function from the local control panel.		
MAIN: SI active USER	221 002	Fig. 3-54
Enabling the station interlocking function from the local control panel.		
MAIN: Inp.asg. fct.block.1 **MAIN: Inp.asg. fct.block.2**	221 014 221 022	Fig. 3-41
Definition of the binary signal that will act as function block 1 or 2.		
MAIN: Op. delay fct. block	221 029	Fig. 3-41
Setting for the operate delay of the function blocks.		
MAIN: Perm.No.mot.drive op	221 027	Fig. 3-56
Setting for the permissible motor drive operations within the time interval defined at MAIN: Mon.time mot.drives.		
MAIN: Mon.time mot.drives	221 026	Fig. 3-56
Setting for the monitoring time for monitoring the number of motor drives.		
MAIN: Cool.time mot.drives	221 028	Fig. 3-56
Setting for the cooling time of the motors of motor-operated switchgear units.		
MAIN: Mon.time motor relay	221 060	Fig. 3-112
Setting for the monitoring time for the motor relay.		

External devices 01 t o10

DEV01: Designat. ext. dev.	210 000	Fig. 3-2
DEV02: Designat. ext. dev.	210 050	
DEV03: Designat. ext. dev.	210 100	
DEV04: Designat. ext. dev.	210 150	
DEV05: Designat. ext. dev.	210 200	
DEV06: Designat. ext. dev.	211 000	
DEV07: Designat. ext. dev.	211 050	
DEV08: Designat. ext. dev.	211 100	
DEV09: Designat. ext. dev.	211 150	
DEV10: Designat. ext. dev.	211 200	

Setting for the designation of the respective external device.

Note:
This setting is only active if the external device designations are displayed on the Bay Panel.

DEV01: Op.time switch. dev.	210 004	Fig. 3-105, 3-111
DEV02: Op.time switch. dev.	210 054	
DEV03: Op.time switch. dev.	210 104	
DEV04: Op.time switch. dev.	210 154	
DEV05: Op.time switch. dev.	210 204	
DEV06: Op.time switch. dev.	211 004	
DEV07: Op.time switch. dev.	211 054	
DEV08: Op.time switch. dev.	211 104	
DEV09: Op.time switch. dev.	211 154	
DEV10: Op.time switch. dev.	211 204	

Setting for the operating time of the switchgear unit (switching device).

DEV01: Latching time	210 005	Fig. 3-106
DEV02: Latching time	210 055	
DEV03: Latching time	210 105	
DEV04: Latching time	210 155	
DEV05: Latching time	210 205	
DEV06: Latching time	211 005	
DEV07: Latching time	211 055	
DEV08: Latching time	211 105	
DEV09: Latching time	211 155	
DEV10: Latching time	211 205	

Setting for the time that a control command persists after a switchgear position signal – Open or Closed – has been received.

DEV01: Gr. assign. debounc.	210 011	Fig. 3-105, 3-111
DEV02: Gr. assign. debounc.	210 061	
DEV03: Gr. assign. debounc.	210 111	
DEV04: Gr. assign. debounc.	210 161	
DEV05: Gr. assign. debounc.	210 211	
DEV06: Gr. assign. debounc.	211 011	
DEV07: Gr. assign. debounc.	211 061	
DEV08: Gr. assign. debounc.	211 111	
DEV09: Gr. assign. debounc.	211 161	
DEV10: Gr. assign. debounc.	211 211	

Assign the external device to one of eight groups for debouncing and chatter suppression.

DEV01: Interm. pos. suppr.	210 012	Fig. 3-105, 3-111
DEV02: Interm. pos. suppr.	210 062	
DEV03: Interm. pos. suppr.	210 112	
DEV04: Interm. pos. suppr.	210 162	
DEV05: Interm. pos. suppr.	210 212	
DEV06: Interm. pos. suppr.	211 012	
DEV07: Interm. pos. suppr.	211 062	
DEV08: Interm. pos. suppr.	211 112	
DEV09: Interm. pos. suppr.	211 162	
DEV10: Interm. pos. suppr.	211 212	
This setting determines whether the 'intermediate position' signal will be suppressed or not while the switchgear unit is operating.		
DEV01: Stat.ind.interm.pos.	210 027	Fig. 3-105, 3-111
DEV02: Stat.ind.interm.pos.	210 077	
DEV03: Stat.ind.interm.pos.	210 127	
DEV04: Stat.ind.interm.pos.	210 177	
DEV05: Stat.ind.interm.pos.	210 227	
DEV06: Stat.ind.interm.pos.	211 027	
DEV07: Stat.ind.interm.pos.	211 077	
DEV08: Stat.ind.interm.pos.	211 127	
DEV09: Stat.ind.interm.pos.	211 177	
DEV10: Stat.ind.interm.pos.	211 227	
This setting determines whether the actual status will be signaled with a 5 s delay after the '*Faulty position*' signal is issued.		
DEV01: Oper. mode cmd.	210 024	Fig. 3-110
DEV02: Oper. mode cmd.	210 074	
DEV03: Oper. mode cmd.	210 124	
DEV04: Oper. mode cmd.	210 174	
DEV05: Oper. mode cmd.	210 224	
DEV06: Oper. mode cmd.	211 024	
DEV07: Oper. mode cmd.	211 074	
DEV08: Oper. mode cmd.	211 124	
DEV09: Oper. mode cmd.	211 174	
DEV10: Oper. mode cmd.	211 224	
Select from long command, short command or time control for the operating mode of the command.		
DEV01: Inp.asg. sw.tr. plug	210 014	Fig. 3-105, 3-111
DEV02: Inp.asg. sw.tr. plug	210 064	
DEV03: Inp.asg. sw.tr. plug	210 114	
DEV04: Inp.asg. sw.tr. plug	210 164	
DEV05: Inp.asg. sw.tr. plug	210 214	
DEV06: Inp.asg. sw.tr. plug	211 014	
DEV07: Inp.asg. sw.tr. plug	211 064	
DEV08: Inp.asg. sw.tr. plug	211 114	
DEV09: Inp.asg. sw.tr. plug	211 164	
DEV10: Inp.asg. sw.tr. plug	211 214	
Definition of the binary signal used to signal the position (*plugged-in* / *unplugged*) of the switch truck plug.		

DEV01: With gen. trip cmd.1	210021	Fig. 3-109
DEV02: With gen. trip cmd.1	210071	
DEV03: With gen. trip cmd.1	210121	
DEV04: With gen. trip cmd.1	210171	
DEV05: With gen. trip cmd.1	210221	
DEV06: With gen. trip cmd.1	211021	
DEV07: With gen. trip cmd.1	211071	
DEV08: With gen. trip cmd.1	211121	
DEV09: With gen. trip cmd.1	211171	
DEV10: With gen. trip cmd.1	211221	

This setting specifies whether the circuit breaker will be opened by “general trip command 1” of the protection function.

Note:
This setting is only visible (active) for external devices that are defined as ‘circuit breakers’. This definition is included in the bay type definitions.

DEV01: With gen. trip cmd.2	210022	Fig. 3-109
DEV02: With gen. trip cmd.2	210072	
DEV03: With gen. trip cmd.2	210122	
DEV04: With gen. trip cmd.2	210172	
DEV05: With gen. trip cmd.2	210222	
DEV06: With gen. trip cmd.2	211022	
DEV07: With gen. trip cmd.2	211072	
DEV08: With gen. trip cmd.2	211122	
DEV09: With gen. trip cmd.2	211172	
DEV10: With gen. trip cmd.2	211222	

This setting specifies whether the circuit breaker will be opened by “general trip command 2” of the protection function.

Note:
This setting is only visible (active) for external devices that are defined as ‘circuit breakers’. This definition is included in the bay type definitions.

DEV01: With close cmd./prot	210023	Fig. 3-109
DEV02: With close cmd./prot	210073	
DEV03: With close cmd./prot	210123	
DEV04: With close cmd./prot	210173	
DEV05: With close cmd./prot	210223	
DEV06: With close cmd./prot	211023	
DEV07: With close cmd./prot	211073	
DEV08: With close cmd./prot	211123	
DEV09: With close cmd./prot	211173	
DEV10: With close cmd./prot	211223	

This setting specifies whether the circuit breaker will be closed by the "close command" of the protection function.

Note:
This setting is only visible (active) for external devices that are defined as 'circuit breakers'. This definition is included in the bay type definitions.

DEV01: Inp.asg.el.ctrl.open	210 019	Fig. 3-106
DEV02: Inp.asg.el.ctrl.open	210 069	
DEV03: Inp.asg.el.ctrl.open	210 119	
DEV04: Inp.asg.el.ctrl.open	210 169	
DEV05: Inp.asg.el.ctrl.open	210 219	
DEV06: Inp.asg.el.ctrl.open	211 019	
DEV07: Inp.asg.el.ctrl.open	211 069	
DEV08: Inp.asg.el.ctrl.open	211 119	
DEV09: Inp.asg.el.ctrl.open	211 169	
DEV10: Inp.asg.el.ctrl.open	211 219	

This setting defines the binary signal that will be used as the control signal to move the switchgear unit to the open position.

Note:
Only signals that are defined in the DEVxx function groups can be selected.

DEV01: Inp.asg.el.ctr.close	210 020	Fig. 3-106
DEV02: Inp.asg.el.ctr.close	210 070	
DEV03: Inp.asg.el.ctr.close	210 120	
DEV04: Inp.asg.el.ctr.close	210 170	
DEV05: Inp.asg.el.ctr.close	210 220	
DEV06: Inp.asg.el.ctr.close	211 020	
DEV07: Inp.asg.el.ctr.close	211 070	
DEV08: Inp.asg.el.ctr.close	211 120	
DEV09: Inp.asg.el.ctr.close	211 170	
DEV10: Inp.asg.el.ctr.close	211 220	

This setting defines the binary signal that will be used as the control signal to move the switchgear unit to the closed position.

Note:
Only signals that are defined in the DEVxx function groups can be selected.

DEV01: Inp. asg. end Open	210 015	Fig. 3-112
DEV02: Inp. asg. end Open	210 065	
DEV03: Inp. asg. end Open	210 115	
DEV04: Inp. asg. end Open	210 165	
DEV05: Inp. asg. end Open	210 215	
DEV06: Inp. asg. end Open	211 015	
DEV07: Inp. asg. end Open	211 065	
DEV08: Inp. asg. end Open	211 115	
DEV09: Inp. asg. end Open	211 165	
DEV10: Inp. asg. end Open	211 215	

This setting defines the binary signal that will be used to terminate the 'Open' command.

Note:
This setting is only visible (active) for bay types that are defined for 'direct motor control'.

DEV01: Inp. asg. end Close	210 016	Fig. 3-112
DEV02: Inp. asg. end Close	210 066	
DEV03: Inp. asg. end Close	210 116	
DEV04: Inp. asg. end Close	210 166	
DEV05: Inp. asg. end Close	210 216	
DEV06: Inp. asg. end Close	211 016	
DEV07: Inp. asg. end Close	211 066	
DEV08: Inp. asg. end Close	211 116	
DEV09: Inp. asg. end Close	211 166	
DEV10: Inp. asg. end Close	211 216	

This setting defines the binary signal that will be used to terminate the 'Close' command.

Note:
This setting is only visible (active) for bay types that are defined for 'direct motor control'.

DEV01: Open w/o stat.interl	210 025	Fig. 3-108
DEV02: Open w/o stat.interl	210 075	
DEV03: Open w/o stat.interl	210 125	
DEV04: Open w/o stat.interl	210 175	
DEV05: Open w/o stat.interl	210 225	
DEV06: Open w/o stat.interl	211 025	
DEV07: Open w/o stat.interl	211 075	
DEV08: Open w/o stat.interl	211 125	
DEV09: Open w/o stat.interl	211 175	
DEV10: Open w/o stat.interl	211 225	

This setting specifies whether switching to open position is permitted without a check by the station interlock function.

DEV01: Close w/o stat. int.	210 026	Fig. 3-108
DEV02: Close w/o stat. int.	210 076	
DEV03: Close w/o stat. int.	210 126	
DEV04: Close w/o stat. int.	210 176	
DEV05: Close w/o stat. int.	210 226	
DEV06: Close w/o stat. int.	211 026	
DEV07: Close w/o stat. int.	211 076	
DEV08: Close w/o stat. int.	211 126	
DEV09: Close w/o stat. int.	211 176	
DEV10: Close w/o stat. int.	211 226	

This setting specifies whether switching to closed position is permitted without a check by the station interlock function.

DEV01: Fct.assig.BiwSI open	210 039	Fig. 3-107
DEV02: Fct.assig.BiwSI open	210 089	
DEV03: Fct.assig.BiwSI open	210 139	
DEV04: Fct.assig.BiwSI open	210 189	
DEV05: Fct.assig.BiwSI open	210 239	
DEV06: Fct.assig.BiwSI open	211 039	
DEV07: Fct.assig.BiwSI open	211 089	
DEV08: Fct.assig.BiwSI open	211 139	
DEV09: Fct.assig.BiwSI open	211 189	
DEV10: Fct.assig.BiwSI open	211 239	

This setting defines which output will issue the ‘Open’ enable to the interlocking logic when there is ‘bay interlock with substation interlock’.

Note:
The interlock conditions for bay interlock with station interlock are included in the bay type definitions (see List of Bay Types in the Appendix). If the interlock condition is to be modified, this is possible by modifying the corresponding Boolean equation in the interlocking logic or by defining a new interlocking logic equation. Only in the last case is it necessary to change the function assignment.

DEV01: Fct.assig.BIwSI clos	210 040	Fig. 3-107
DEV02: Fct.assig.BIwSI clos	210 090	
DEV03: Fct.assig.BIwSI clos	210 140	
DEV04: Fct.assig.BIwSI clos	210 190	
DEV05: Fct.assig.BIwSI clos	210 240	
DEV06: Fct.assig.BIwSI clos	211 040	
DEV07: Fct.assig.BIwSI clos	211 090	
DEV08: Fct.assig.BIwSI clos	211 140	
DEV09: Fct.assig.BIwSI clos	211 190	
DEV10: Fct.assig.BIwSI clos	211 240	

This setting defines which output will issue the 'Close' enable to the interlocking logic when there is 'bay interlock with substation interlock'.

Note:
The interlock conditions for bay interlock with station interlock are included in the bay type definitions (see List of Bay Types in the Appendix). If the interlock condition is to be modified, this is possible by modifying the corresponding Boolean equation in the interlocking logic or by defining a new interlocking logic equation. Only in the last case is it necessary to change the function assignment.

DEV01: Fct.asg.Bl w/o Sl op	210041	Fig. 3-107
DEV02: Fct.asg.Bl w/o Sl op	210091	
DEV03: Fct.asg.Bl w/o Sl op	210141	
DEV04: Fct.asg.Bl w/o Sl op	210191	
DEV05: Fct.asg.Bl w/o Sl op	210241	
DEV06: Fct.asg.Bl w/o Sl op	211041	
DEV07: Fct.asg.Bl w/o Sl op	211091	
DEV08: Fct.asg.Bl w/o Sl op	211141	
DEV09: Fct.asg.Bl w/o Sl op	211191	
DEV10: Fct.asg.Bl w/o Sl op	211241	

This setting defines which output will issue the 'Open' enable to the interlocking logic when there is 'bay interlock without substation interlock'.

Note:
The interlock conditions for bay interlock without station interlock are included in the bay type definitions (see List of Bay Types in the Appendix). If the interlock condition is to be modified, this is possible by modifying the corresponding Boolean equation in the interlocking logic or by defining a new interlocking logic equation. Only in the last case is it necessary to change the function assignment.

DEV01: Fct.asg.Bl w/o Sl cl	210042	Fig. 3-107
DEV02: Fct.asg.Bl w/o Sl cl	210092	
DEV03: Fct.asg.Bl w/o Sl cl	210142	
DEV04: Fct.asg.Bl w/o Sl cl	210192	
DEV05: Fct.asg.Bl w/o Sl cl	210242	
DEV06: Fct.asg.Bl w/o Sl cl	211042	
DEV07: Fct.asg.Bl w/o Sl cl	211092	
DEV08: Fct.asg.Bl w/o Sl cl	211142	
DEV09: Fct.asg.Bl w/o Sl cl	211192	
DEV10: Fct.asg.Bl w/o Sl cl	211242	

This setting defines which output will issue the 'Close' enable to the interlocking logic when there is 'bay interlock without substation interlock'.

Note:
The interlock conditions for bay interlock without station interlock are included in the bay type definitions (see List of Bay Types in the Appendix). If the interlock condition is to be modified, this is possible by modifying the corresponding Boolean equation in the interlocking logic or by defining a new interlocking logic equation. Only in the last case is it necessary to change the function assignment.

Interlocking logic

ILOCK: Fct.assignm. outp. 1	250 000
ILOCK: Fct.assignm. outp. 2	250 001
ILOCK: Fct.assignm. outp. 3	250 002
ILOCK: Fct.assignm. outp. 4	250 003
ILOCK: Fct.assignm. outp. 5	250 004
ILOCK: Fct.assignm. outp. 6	250 005
ILOCK: Fct.assignm. outp. 7	250 006
ILOCK: Fct.assignm. outp. 8	250 007
ILOCK: Fct.assignm. outp. 9	250 008
ILOCK: Fct.assignm. outp.10	250 009
ILOCK: Fct.assignm. outp.11	250 010
ILOCK: Fct.assignm. outp.12	250 011
ILOCK: Fct.assignm. outp.13	250 012
ILOCK: Fct.assignm. outp.14	250 013
ILOCK: Fct.assignm. outp.15	250 014
ILOCK: Fct.assignm. outp.16	250 015
ILOCK: Fct.assignm. outp.17	250 016
ILOCK: Fct.assignm. outp.18	250 017
ILOCK: Fct.assignm. outp.19	250 018
ILOCK: Fct.assignm. outp.20	250 019
ILOCK: Fct.assignm. outp.21	250 020
ILOCK: Fct.assignm. outp.22	250 021
ILOCK: Fct.assignm. outp.23	250 022
ILOCK: Fct.assignm. outp.24	250 023
ILOCK: Fct.assignm. outp.25	250 024
ILOCK: Fct.assignm. outp.26	250 025
ILOCK: Fct.assignm. outp.27	250 026
ILOCK: Fct.assignm. outp.28	250 027
ILOCK: Fct.assignm. outp.29	250 028
ILOCK: Fct.assignm. outp.30	250 029
ILOCK: Fct.assignm. outp.31	250 030
ILOCK: Fct.assignm. outp.32	250 031

Definition of the interlock conditions.

Fig. 3-113

8 Information and Control Functions

C232 generates a large number of signals, processes binary input signals, and acquires measured data during fault-free operation of the protected object as well as fault-related data. A number of counters are maintained for statistical purposes. This information can be read out from the integrated local control panel. All this information can be found in the 'Operation' and 'Events' folders in the menu tree.

8.1 Operation

8.1.1 Cyclic Values

8.1.1.1 Measured Operating Data

Measured data input

MEASI: Current IDC	004 134	Fig. 3-20
Display of the input current.		
MEASI: Current IDC p.u.	004 135	Fig. 3-20
Display of the input current referred to $I_{DC,nom}$.		
MEASI: Curr. IDC,lin. p.u.	004 136	Fig. 3-20, 3-21
Display of the linearized input current referred to $I_{DC,nom}$.		
MEASI: Scaled value IDC,lin	004 180	
Display of the scaled linearized value.		

Main function

MAIN: Date	003 090	Fig. 3-58
Date display. **Note:** The date can also be set here.		
MAIN: Time of day	003 091	Fig. 3-58
Display of the time of day. **Note:** The time can also be set here.		
MAIN: Time switching	003 095	Fig. 3-58
Setting for standard time or daylight saving time. This setting is necessary in order to avoid misinterpretation of the times assigned to signals and event data that can be read out through the PC or communication interfaces. **Note:** The time can be set here for standard time or daylight saving time. In the case of clock synchronization via the clock synchronization telegram from a central control system or a central device, this setting will be overwritten each time a new clock synchronization telegram is received. With a free-running clock or synchronization by minute pulse through a binary input, the time of day setting and the time switching setting in the device must be plausible. The two settings do not have a mutual effect on one another.		
MAIN: Frequency f	004 040	Fig. 3-35
Display of system frequency.		

MAIN: Curr. IP,max prim.	005 050	Fig. 3-30
Display of the maximum phase current as a primary quantity.		
MAIN: IP,max prim.,delay	005 036	Fig. 3-30
Display of the delayed maximum phase current as a primary quantity.		
MAIN: IP,max prim.,stored	005 034	Fig. 3-30
Display of the delayed stored maximum phase current as a primary quantity.		
MAIN: Curr. IP,min prim.	005 055	Fig. 3-30
Display of the minimum phase current as a primary quantity.		
MAIN: Current A prim.	005 040	Fig. 3-30
Display of phase current A as a primary quantity.		
MAIN: Current B prim.	006 040	Fig. 3-30
Display of phase current B as a primary quantity.		
MAIN: Current C prim.	007 040	Fig. 3-30
Display of phase current C as a primary quantity.		
MAIN: Current Σ(IP) prim.	005 010	Fig. 3-30
Display of the calculated resultant current as a primary quantity.		
MAIN: Volt. VPG,max prim.	008 042	Fig. 3-33
Display of the maximum phase-to-ground voltage as a primary quantity.		
MAIN: Volt. VPG,min prim.	009 042	Fig. 3-33
Display of the minimum phase-to-ground voltage as a primary quantity.		
MAIN: Voltage A-G prim.	005 042	Fig. 3-33
Display of the updated value for phase-to-ground voltage A-G as a primary quantity.		
MAIN: Voltage B-G prim.	006 042	Fig. 3-33
Display of the updated value for phase-to-ground voltage B-G as a primary quantity.		
MAIN: Voltage C-G prim.	007 042	Fig. 3-33
Display of the updated value for phase-to-ground voltage C-G as a primary quantity.		
MAIN: Volt. Σ(VPG)/3 prim.	005 012	Fig. 3-33
Display of the calculated neutral-displacement voltage as a primary quantity.		
MAIN: Volt. VPP,max prim.	008 044	Fig. 3-33
Display of the maximum phase-to-phase voltage as a primary quantity.		
MAIN: Voltage VPP,min prim	009 044	Fig. 3-33
Display of the minimum phase-to-phase voltage as a primary quantity.		
MAIN: Voltage A-B prim.	005 044	Fig. 3-33
Display of the updated value for phase-to-phase voltage A-B as a primary quantity.		
MAIN: Voltage B-C prim.	006 044	Fig. 3-33
Display of the updated value for the phase-to-phase voltage B-C as a primary quantity.		
MAIN: Voltage C-A prim.	007 044	Fig. 3-33
Display of the updated value for the phase-to-phase voltage C-A as a primary quantity.		

MAIN: Active power P prim.	004 050	Fig. 3-34
Display of the updated active power value as a primary quantity.		
MAIN: Reac. power Q prim.	004 052	Fig. 3-34
Display of the updated reactive power value as a primary quantity.		
MAIN: Act.energy outp.prim	005 061	Fig. 3-36
Display of the updated active energy output as a primary quantity.		
MAIN: Act.energy inp. prim	005 062	Fig. 3-36
Display of the updated active energy input as a primary quantity.		
MAIN: React.en. outp. prim	005 063	Fig. 3-36
Display of the updated reactive energy output as a primary quantity.		
MAIN: React. en. inp. prim	005 064	Fig. 3-36
Display of the updated reactive energy input as a primary quantity.		
MAIN: Current IP,max p.u.	005 051	Fig. 3-30
Display of the maximum phase current referred to I_{nom}.		
MAIN: IP,max p.u.,delay	005 037	Fig. 3-30
Display of the delayed maximum phase current referred to I_{nom}.		
MAIN: IP,max p.u.,stored	005 035	Fig. 3-30
Display of the delayed stored maximum phase current referred to I_{nom}.		
MAIN: Current IP,min p.u.	005 056	Fig. 3-30
Display of the minimum phase current referred to I_{nom}.		
MAIN: Current A p.u.	005 041	Fig. 3-30
Display of phase current A referred to I_{nom}.		
MAIN: Current B p.u.	006 041	Fig. 3-30
Display of phase current B referred to I_{nom}.		
MAIN: Current C p.u.	007 041	Fig. 3-30
Display of phase current C referred to I_{nom}.		
MAIN: Current Σ(IP) p.u.	005 011	Fig. 3-30
Display of the calculated resultant current referred to $I_{N,nom}$.		
MAIN: Voltage VPG,max p.u.	008 043	Fig. 3-33
Display of the maximum phase-to-ground voltage referred to V_{nom}.		
MAIN: Voltage VPG,min p.u.	009 043	Fig. 3-33
Display of the minimum phase-to-ground voltage referred to V_{nom}.		
MAIN: Voltage A-G p.u.	005 043	Fig. 3-33
Display of the updated value for phase-to-ground voltage A-G referred to V_{nom}.		
MAIN: Voltage B-G p.u.	006 043	Fig. 3-33
Display of the updated value for phase-to-ground voltage B-G referred to V_{nom}.		
MAIN: Voltage C-G p.u.	007 043	Fig. 3-33
Display of the updated value for phase-to-ground voltage C-G referred to V_{nom}.		
MAIN: Volt. Σ(VPG)/√3 p.u.	005 013	Fig. 3-33
Display of the calculated neutral-displacement voltage referred to V_{nom} .		

MAIN: Voltage VPP,max p.u.	008 045	Fig. 3-33
Display of the maximum phase-to-phase voltage referred to V_{nom}.		
MAIN: Voltage VPP,min p.u.	009 045	Fig. 3-33
Display of the minimum phase-to-phase voltage referred to V_{nom}.		
MAIN: Voltage A-B p.u.	005 045	Fig. 3-33
Display of the updated value for phase-to-phase voltage A-B referred to V_{nom}.		
MAIN: Voltage B-C p.u.	006 045	Fig. 3-33
Display of the updated value for phase-to-phase voltage B-C referred to V_{nom}.		
MAIN: Voltage C-A p.u.	007 045	Fig. 3-33
Display of the updated value for phase-to-phase voltage C-A referred to V_{nom}.		
MAIN: Active power P p.u.	004 051	Fig. 3-34
Display of the updated value for active power referred to nominal apparent power S_{nom}.		
MAIN: Reac. power Q p.u.	004 053	Fig. 3-34
Display of the updated value for reactive power referred to nominal apparent power S_{nom}.		
MAIN: Active power factor	004 054	Fig. 3-34
Display of the updated active power factor.		
MAIN: Load angle	004 115	Fig. 3-34
Display of the updated load angle value.		

Binary counts

COUNT: Count 1	217 100	Fig. 3-117
Display of the updated count.		

8.1.1.2 Physical State Signals

Binary inputs

INP: State U 201	178 001
INP: State U 202	178 005
INP: State U 203	178 009
INP: State U 204	178 013
INP: State U 205	178 017
INP: State U 206	178 021
INP: State U 207	178 025
INP: State U 208	178 029
INP: State U 209	178 033
INP: State U 210	178 037
INP: State U 211	178 041
INP: State U 212	178 045
INP: State U 213	178 049
INP: State U 214	178 053
INP: State U 215	178 057
INP: State U 216	178 061
INP: State U 217	178 065
INP: State U 218	178 069
INP: State U 219	178 073
INP: State U 220	178 077

The state of the binary signal inputs is displayed as follows:

- □ *Without function*: No functions are assigned to the binary signal input.
- □ *Low*: Not energized.
- □ *High*: Energized.

This display appears regardless of the setting for the binary signal input mode.

Binary outputs

OUTP: State K 201	157 001
OUTP: State K 202	157 005
OUTP: State K 203	157 009
OUTP: State K 204	157 013
OUTP: State K 205	157 017
OUTP: State K 206	157 021
OUTP: State K 207	157 025
OUTP: State K 208	157 029
OUTP: State K 209	157 033
OUTP: State K 210	157 037
OUTP: State K 211	157 041
OUTP: State K 212	157 045
OUTP: State K 213	157 049
OUTP: State K 214	157 053

The state of the output relays is displayed as follows:

- □ *Without function*: No functions are assigned to the output relay.
- □ *Low:* The output relay is not energized.
- □ *High*: The output relay is energized.

This display appears regardless of the operating mode set for the output relay.

LED indicators

LED: State H 2	085 000
LED: State H 3	085 003
LED: State H 4	085 006
LED: State H 5	085 009
LED: State H 6	085 012
LED: State H 7	085 015
LED: State H 8	085 018
LED: State H 9	085 021
LED: State H 10	085 024
LED: State H 11	085 027
LED: State H 12	085 030

The state of the LED indicators is displayed as follows:

- □ *Inactive:* The LED indicator is not energized.
- □ *Active:* The LED indicator is energized.

8.1.1.3 Logic State Signals

Local control panel	LOC: Illumination on EXT	037 101	
	LOC: Loc.acc.block.active	221 005	Fig. 3-5
	LOC: Rem.acc.block.active	221 004	Fig. 3-5
"Logical" communication interface 1	COMM1: Command block. EXT	003 173	Fig. 3-7, 3-8, 3-9, 3-10, 3-11
	COMM1: Sig./meas. block EXT	037 074	Fig. 3-8, 3-9, 3-10
	COMM1: Command blocking	003 174	Fig. 3-7, 3-8, 3-9, 3-10, 3-11, 3-12
	COMM1: Sig./meas.val.block.	037 075	Fig. 3-8, 3-9, 3-10
	COMM1: IEC 870-5-103	003 219	Fig. 3-8
	COMM1: IEC 870-5-101	003 218	Fig. 3-9
	COMM1: IEC 870-5,ILS	003 221	Fig. 3-10
	COMM1: MODBUS	003 223	Fig. 3-11
	COMM1: DNP3	003 230	Fig. 3-12
Measured data input	MEASI: Enabled	035 008	Fig. 3-17
	MEASI: Overload 20mA input	040 191	Fig. 3-20
	MEASI: Open circ. 20mA inp.	040 192	Fig. 3-30
Binary outputs	OUTP: Block outp.rel. EXT	040 014	Fig. 3-22
	OUTP: Reset latch. EXT	040 015	Fig. 3-22
	OUTP: Outp. relays blocked	021 015	Fig. 3-22
	OUTP: Latching reset	040 088	Fig. 3-22
Main function	MAIN: Enable protect. EXT	003 027	Fig. 3-37
	MAIN: Disable protect. EXT	003 026	Fig. 3-37
	MAIN: System IN enable EXT	040 130	Fig. 3-38
	MAIN: Syst. IN disable EXT	040 131	Fig. 3-38
	MAIN: Test mode EXT	037 070	Fig. 3-61
	MAIN: Blocking 1 EXT	040 060	Fig. 3-42
	MAIN: Blocking 2 EXT	040 061	Fig. 3-42
	MAIN: Reset latch.trip EXT	040 138	Fig. 3-50
	MAIN: Trip cmd. block. EXT	036 045	Fig. 3-50
	MAIN: Switch dyn.param.EXT	036 033	Fig. 3-39
	MAIN: CB closed sig. EXT	036 051	Fig. 3-45
	MAIN: Man.cl.cmd.enabl.EXT	041 023	Fig. 3-45
	MAIN: Manual close EXT	036 047	
	MAIN: Man. close cmd. EXT	041 022	Fig. 3-45
	MAIN: Man. trip cmd. EXT	037 018	Fig. 3-51
	MAIN: Reset indicat. EXT	065 001	Fig. 3-59
	MAIN: Min-pulse clock EXT	060 060	Fig. 3-58
	MAIN: Prot. ext. enabled	003 028	Fig. 3-37
	MAIN: Prot. ext. disabled	038 046	Fig. 3-37
	MAIN: Gen. trip signal	036 251	Fig. 3-50
	MAIN: Syst.IN ext/user en.	040 132	Fig. 3-38
	MAIN: System IN enabled	040 133	Fig. 3-38
	MAIN: System IN disabled	040 134	Fig. 3-38
	MAIN: Device not ready	004 060	Fig. 3-43

MAIN: Enable control	221 058	Fig. 3-54
MAIN: Test mode	037 071	Fig. 3-61
MAIN: Blocked/faulty	004 065	Fig. 3-43
MAIN: Trip cmd. blocked	021 013	Fig. 3-50
MAIN: Latch. trip c. reset	040 139	Fig. 3-50
MAIN: Manual trip signal	034 017	Fig. 3-51
MAIN: Man. close command	037 068	Fig. 3-45
MAIN: Gen. trip command	035 071	Fig. 3-50
MAIN: Gen. trip signal 1	036 005	Fig. 3-50
MAIN: Gen. trip signal 2	036 023	Fig. 3-50
MAIN: Gen. trip command 1	036 071	Fig. 3-50
MAIN: Gen. trip command 2	036 022	Fig. 3-50
MAIN: Close command	037 009	Fig. 3-45
MAIN: Close aft.man.cl.rqu	037 012	
MAIN: Dynam. param. active	040 090	Fig. 3-39
MAIN: General starting	040 000	Fig. 3-48
MAIN: tGS elapsed	040 009	Fig. 3-48
MAIN: Starting A	040 005	Fig. 3-47
MAIN: Starting B	040 006	Fig. 3-47
MAIN: Starting C	040 007	Fig. 3-47
MAIN: Starting GF	040 008	Fig. 3-47
MAIN: Starting Ineg	040 105	Fig. 3-47
MAIN: Rush restr. A trig.	041 027	Fig. 3-40
MAIN: Rush restr. B trig.	041 028	Fig. 3-40
MAIN: Rush restr. C trig.	041 029	Fig. 3-40
MAIN: TripSig. tI>/tIrefP>	040 042	Fig. 3-49
MAIN: TripSig tIN>/tIrefN>	040 043	Fig. 3-49
MAIN: Bay interlock. act.	221 001	Fig. 3-54
MAIN: Subst. interl. act.	221 000	Fig. 3-54
MAIN: Fct. block. 1 active	221 015	Fig. 3-41
MAIN: Fct. block. 2 active	221 023	Fig. 3-41
MAIN: Mon. mot. drives tr.	221 056	Fig. 3-56
MAIN: Interlock equ. viol.	221 018	Fig. 3-55
MAIN: CB trip internal	221 006	Fig. 3-53
MAIN: CB tripped	221 016	Fig. 3-53
MAIN: Mult. sig. 1 active	221 017	Fig. 3-46
MAIN: Mult. sig. 1 stored	221 054	Fig. 3-46
MAIN: Mult. sig. 2 active	221 053	Fig. 3-46
MAIN: Mult. sig. 2 stored	221 055	Fig. 3-46
MAIN: Communication error	221 019	Fig. 3-57
MAIN: Auxiliary address	038 005	
MAIN: Dummy entry	004 129	
MAIN: Without function	060 000	
MAIN: Without function	061 000	

Parameter subset selection

PSS: Control via user EXT	036 101	Fig. 3-62
PSS: Activate PS 1 EXT	065 002	Fig. 3-62
PSS: Activate PS 2 EXT	065 003	Fig. 3-62
PSS: Activate PS 3 EXT	065 004	Fig. 3-62
PSS: Activate PS 4 EXT	065 005	Fig. 3-62
PSS: Control via user	036 102	Fig. 3-62
PSS: Ext.sel.param.subset	003 061	Fig. 3-62
PSS: PS 1 activated ext.	036 094	Fig. 3-62
PSS: PS 2 activated ext.	036 095	Fig. 3-62
PSS: PS 3 activated ext.	036 096	Fig. 3-62
PSS: PS 4 activated ext.	036 097	Fig. 3-62
PSS: Actual param. subset	003 062	Fig. 3-62
PSS: PS 1 active	036 090	Fig. 3-62
PSS: PS 2 active	036 091	Fig. 3-62
PSS: PS 3 active	036 092	Fig. 3-62
PSS: PS 4 active	036 093	Fig. 3-62

Self-monitoring

SFMON: Warning (LED)	036 070	Fig. 3-63
SFMON: Warning (relay)	036 100	Fig. 3-63
SFMON: Warm restart exec.	041 202	
SFMON: Cold restart exec.	041 201	
SFMON: Cold restart	093 024	
SFMON: Cold rest./SW update	093 025	
SFMON: Blocking/ HW failure	090 019	
SFMON: Relay Kxx faulty	041 200	
SFMON: Hardware clock fail.	093 040	
SFMON: Invalid SW d.loaded	096 121	
SFMON: Invalid type of bay	096 122	
SFMON: +15V supply faulty	093 081	
SFMON: +24V supply faulty	093 082	
SFMON: -15V supply faulty	093 080	
SFMON: Wrong module slot 1	096 100	
SFMON: Wrong module slot 2	096 101	
SFMON: Wrong module slot 3	096 102	
SFMON: Defect.module slot 1	097 000	
SFMON: Defect.module slot 2	097 001	
SFMON: Defect.module slot 3	097 002	
SFMON: Error K 201	097 038	
SFMON: Error K 202	097 039	
SFMON: Error K 203	097 040	
SFMON: Error K 204	097 041	
SFMON: Error K 205	097 042	
SFMON: Error K 206	097 043	
SFMON: Error K 207	097 044	
SFMON: Error K 208	097 045	
SFMON: Error K 209	097 200	
SFMON: Error K 210	097 201	
SFMON: Error K 211	097 202	
SFMON: Error K 212	097 203	
SFMON: Error K 213	097 204	
SFMON: Error K 214	097 205	
SFMON: Undef. operat. code	093 010	

	SFMON: Invalid arithm. op.	093 011	
	SFMON: Undefined interrupt	093 012	
	SFMON: Exception oper.syst.	093 013	
	SFMON: Data acquis. failure	090 021	
	SFMON: Checksum error param	090 003	
	SFMON: Clock sync. error	093 041	
	SFMON: Overflow MT_RC	090 012	Fig. 3-65
	SFMON: Semaph. MT_RC block.	093 015	
	SFMON: Inval. SW vers.COMM1	093 075	
	SFMON: Invalid scaling IDC	093 116	Fig. 3-20
	SFMON: Overload 20 mA input	098 025	Fig. 3-20
	SFMON: Open circ. 20mA inp.	098 026	Fig. 3-20
	SFMON: Output 30	098 053	
	SFMON: Output 30 (t)	098 054	
	SFMON: Output 31 (t)	098 056	
	SFMON: Output 32 (t)	098 058	
	SFMON: Output 31	098 055	
	SFMON: Output 32	098 057	
Fault data acquisition	FT_DA: Trigger EXT	036 088	Fig. 3-67
Fault recording	FT_RC: Trigger EXT	036 089	Fig. 3-69
	FT_RC: Trigger	037 076	Fig. 3-69
	FT_RC: I> triggered	040 063	Fig. 3-69
	FT_RC: Record. in progress	035 000	Fig. 3-69
	FT_RC: System disturb. runn	035 004	Fig. 3-69
	FT_RC: Fault mem. overflow	035 001	Fig. 3-70
	FT_RC: Faulty time tag	035 002	
Definite-time overcurrent protection	DTOC: Blocking tI> EXT	041 060	Fig. 3-73
	DTOC: Blocking tI>> EXT	041 061	Fig. 3-73
	DTOC: Blocking tI>>> EXT	041 062	Fig. 3-73
	DTOC: Enabled	040 120	Fig. 3-72
	DTOC: Blocking tIN> EXT	041 063	Fig. 3-75
	DTOC: Starting I>	040 036	Fig. 3-79
	DTOC: Blocking tIN>> EXT	041 064	Fig. 3-76
	DTOC: Starting I>>	040 029	Fig. 3-79
	DTOC: Blocking tIN>>> EXT	041 065	Fig. 3-76
	DTOC: Starting I>>>	039 075	Fig. 3-79
	DTOC: Starting IN>	040 077	Fig. 3-76
	DTOC: Starting IN>>	040 041	Fig. 3-76
	DTOC: Starting IN>>>	039 078	Fig. 3-76
	DTOC: tI> elapsed	040 010	Fig. 3-79
	DTOC: tI>> elapsed	040 033	Fig. 3-79
	DTOC: tI>>> elapsed	040 012	Fig. 3-79
	DTOC: Trip signal tI>	041 020	Fig. 3-74
	DTOC: Trip signal tI>>	040 011	Fig. 3-74
	DTOC: Trip signal tI>>>	040 076	Fig. 3-74
	DTOC: I> rush. stab. enab.	041 136	
	DTOC: I>> rush.stab. enab.	041 137	
	DTOC: I>>> rush.stab. enab	041 138	
	DTOC: tIN> elapsed	040 013	Fig. 3-76

	DTOC: tIN>> elapsed	040 121	Fig. 3-76
	DTOC: tIN>>> elapsed	039 079	Fig. 3-76
	DTOC: Trip signal tIN>	041 021	Fig. 3-77
	DTOC: Trip signal tIN>>	040 028	Fig. 3-77
	DTOC: Trip signal tIN>>>	040 079	Fig. 3-77
	DTOC: H.-time tIN>,i. runn	040 086	Fig. 3-78
	DTOC: tIN>,interm. elapsed	040 099	Fig. 3-78
	DTOC: Trip sig. tIN>,intm.	039 073	Fig. 3-78
	DTOC: IN> rush.stab. enab.	041 139	
	DTOC: IN>> rush.stab. enab	041 140	
	DTOC: IN>>> rush.stab. en.	041 141	
Inverse-time overcurrent protection	IDMT: Block. tIref,P> EXT	040 101	Fig. 3-86
	IDMT: Block. tIref,neg>EXT	040 102	Fig. 3-88
	IDMT: Block. tIref,N> EXT	040 103	Fig. 3-90
	IDMT: Enabled	040 100	Fig. 3-81
	IDMT: Starting Iref,P>	040 080	Fig. 3-88
	IDMT: tIref,P> elapsed	040 082	Fig. 3-88
	IDMT: Trip signal tIref,P>	040 084	Fig. 3-87
	IDMT: Hold time P running	040 053	Fig. 3-86
	IDMT: Memory P clear	040 110	Fig. 3-86
	IDMT: Iref,P rush.stab.en.	041 145	
	IDMT: Starting Iref,neg>	040 107	Fig. 3-88
	IDMT: tIref,neg> elapsed	040 109	Fig. 3-88
	IDMT: Trip sig. tIref,neg>	040 108	Fig. 3-88
	IDMT: Hold time neg runn.	040 113	Fig. 3-88
	IDMT: Memory neg clear	040 111	Fig. 3-88
	IDMT: Starting Iref,N>	040 081	Fig. 3-96
	IDMT: tIref,N> elapsed	040 083	Fig. 3-96
	IDMT: Trip signal tIref,N>	040 085	Fig. 3-96
	IDMT: Hold time N running	040 054	Fig. 3-96
	IDMT: Memory N clear	040 112	Fig. 3-96
	IDMT: Iref,N rush.stab.en.	041 146	
Limit value monitoring	LIMIT: Enabled	040 074	Fig. 3-93
	LIMIT: tI> elapsed	040 220	Fig. 3-93
	LIMIT: tI>> elapsed	040 221	Fig. 3-93
	LIMIT: tI< elapsed	040 222	Fig. 3-93
	LIMIT: tI<< elapsed	040 223	Fig. 3-93
	LIMIT: tVPG> elapsed	040 224	Fig. 3-94
	LIMIT: tVPG>> elapsed	040 225	Fig. 3-94
	LIMIT: tVPG< elapsed	040 226	Fig. 3-94
	LIMIT: tVPG<< elapsed	040 227	Fig. 3-94
	LIMIT: tVPP> elapsed	040 228	Fig. 3-94
	LIMIT: tVPP>> elapsed	040 229	Fig. 3-94
	LIMIT: tVPP< elapsed	040 230	Fig. 3-94
	LIMIT: tVPP<< elapsed	040 231	Fig. 3-94
	LIMIT: tVNG> elapsed	040 168	Fig. 3-95
	LIMIT: tVNG>> elapsed	040 169	Fig. 3-95
	LIMIT: Starting IDC,lin>	040 180	Fig. 3-96
	LIMIT: Starting IDC,lin>>	040 181	Fig. 3-96

	LIMIT: tIDC,lin> elapsed	040 182	Fig. 3-96
	LIMIT: tIDC,lin>> elapsed	040 183	Fig. 3-96
	LIMIT: Starting IDC,lin<	040 184	Fig. 3-96
	LIMIT: Starting IDC,lin<<	040 185	Fig. 3-96
	LIMIT: tIDC,lin< elapsed	040 186	Fig. 3-96
	LIMIT: tIDC,lin<< elapsed	040 187	Fig. 3-96
Logic	LOGIC: Input 1 EXT	034 000	Fig. 3-98
	LOGIC: Input 2 EXT	034 001	
	LOGIC: Input 3 EXT	034 002	
	LOGIC: Input 4 EXT	034 003	
	LOGIC: Input 5 EXT	034 004	
	LOGIC: Input 6 EXT	034 005	
	LOGIC: Input 7 EXT	034 006	
	LOGIC: Input 8 EXT	034 007	
	LOGIC: Input 9 EXT	034 008	
	LOGIC: Input 10 EXT	034 009	
	LOGIC: Input 11 EXT	034 010	
	LOGIC: Input 12 EXT	034 011	
	LOGIC: Input 13 EXT	034 012	
	LOGIC: Input 14 EXT	034 013	
	LOGIC: Input 15 EXT	034 014	
	LOGIC: Input 16 EXT	034 015	
	LOGIC: Set 1 EXT	034 051	Fig. 3-97
	LOGIC: Set 2 EXT	034 052	
	LOGIC: Set 3 EXT	034 053	
	LOGIC: Set 4 EXT	034 054	
	LOGIC: Set 5 EXT	034 055	
	LOGIC: Set 6 EXT	034 056	
	LOGIC: Set 7 EXT	034 057	
	LOGIC: Set 8 EXT	034 058	
	LOGIC: Reset 1 EXT	034 059	Fig. 3-97
	LOGIC: Reset 2 EXT	034 060	
	LOGIC: Reset 3 EXT	034 061	
	LOGIC: Reset 4 EXT	034 062	
	LOGIC: Reset 5 EXT	034 063	
	LOGIC: Reset 6 EXT	034 064	
	LOGIC: Reset 7 EXT	034 065	
	LOGIC: Reset 8 EXT	034 066	
	LOGIC: 1 has been set	034 067	Fig. 3-97
	LOGIC: 2 has been set	034 068	
	LOGIC: 3 has been set	034 069	
	LOGIC: 4 has been set	034 070	
	LOGIC: 5 has been set	034 071	
	LOGIC: 6 has been set	034 072	
	LOGIC: 7 has been set	034 073	
	LOGIC: 8 has been set	034 074	
	LOGIC: 1 set externally	034 075	Fig. 3-97
	LOGIC: 2 set externally	034 076	
	LOGIC: 3 set externally	034 077	
	LOGIC: 4 set externally	034 078	
	LOGIC: 5 set externally	034 079	
	LOGIC: 6 set externally	034 080	

LOGIC: 7 set externally	034 081	
LOGIC: 8 set externally	034 082	
LOGIC: Enabled	034 046	Fig. 3-98
LOGIC: Output 1	042 032	Fig. 3-98
LOGIC: Output 2	042 034	
LOGIC: Output 3	042 036	
LOGIC: Output 4	042 038	
LOGIC: Output 5	042 040	
LOGIC: Output 6	042 042	
LOGIC: Output 7	042 044	
LOGIC: Output 8	042 046	
LOGIC: Output 9	042 048	
LOGIC: Output 10	042 050	
LOGIC: Output 11	042 052	
LOGIC: Output 12	042 054	
LOGIC: Output 13	042 056	
LOGIC: Output 14	042 058	
LOGIC: Output 15	042 060	
LOGIC: Output 16	042 062	
LOGIC: Output 17	042 064	
LOGIC: Output 18	042 066	
LOGIC: Output 19	042 068	
LOGIC: Output 20	042 070	
LOGIC: Output 21	042 072	
LOGIC: Output 22	042 074	
LOGIC: Output 23	042 076	
LOGIC: Output 24	042 078	
LOGIC: Output 25	042 080	
LOGIC: Output 26	042 082	
LOGIC: Output 27	042 084	
LOGIC: Output 28	042 086	
LOGIC: Output 29	042 088	
LOGIC: Output 30	042 090	
LOGIC: Output 31	042 092	
LOGIC: Output 32	042 094	
LOGIC: Output 1 (t)	042 033	Fig. 3-98
LOGIC: Output 2 (t)	042 035	
LOGIC: Output 3 (t)	042 037	
LOGIC: Output 4 (t)	042 039	
LOGIC: Output 5 (t)	042 041	
LOGIC: Output 6 (t)	042 043	
LOGIC: Output 7 (t)	042 045	
LOGIC: Output 8 (t)	042 047	
LOGIC: Output 9 (t)	042 049	
LOGIC: Output 10 (t)	042 051	
LOGIC: Output 11 (t)	042 053	
LOGIC: Output 12 (t)	042 055	
LOGIC: Output 13 (t)	042 057	
LOGIC: Output 14 (t)	042 059	
LOGIC: Output 15 (t)	042 061	
LOGIC: Output 16 (t)	042 063	
LOGIC: Output 17 (t)	042 065	
LOGIC: Output 18 (t)	042 067	

	LOGIC: Output 19 (t)	042 069	
	LOGIC: Output 20 (t)	042 071	
	LOGIC: Output 21 (t)	042 073	
	LOGIC: Output 22 (t)	042 075	
	LOGIC: Output 23 (t)	042 077	
	LOGIC: Output 24 (t)	042 079	
	LOGIC: Output 25 (t)	042 081	
	LOGIC: Output 26 (t)	042 083	
	LOGIC: Output 27 (t)	042 085	
	LOGIC: Output 28 (t)	042 087	
	LOGIC: Output 29 (t)	042 089	
	LOGIC: Output 30 (t)	042 091	
	LOGIC: Output 31 (t)	042 093	
	LOGIC: Output 32 (t)	042 095	
External devices 01 to 10	DEV01: Open signal EXT	210 030	Fig. 3-111
	DEV02: Open signal EXT	210 080	
	DEV03: Open signal EXT	210 130	
	DEV04: Open signal EXT	210 180	
	DEV05: Open signal EXT	210 230	
	DEV06: Open signal EXT	211 030	
	DEV07: Open signal EXT	211 080	
	DEV08: Open signal EXT	211 130	
	DEV09: Open signal EXT	211 180	
	DEV10: Open signal EXT	211 230	
	DEV01: Closed signal EXT	210 031	Fig. 3-111
	DEV02: Closed signal EXT	210 081	
	DEV03: Closed signal EXT	210 131	
	DEV04: Closed signal EXT	210 181	
	DEV05: Closed signal EXT	210 231	
	DEV06: Closed signal EXT	211 031	
	DEV07: Closed signal EXT	211 081	
	DEV08: Closed signal EXT	211 131	
	DEV09: Closed signal EXT	211 181	
	DEV10: Closed signal EXT	211 231	
	DEV01: Control state	210 018	Fig. 3-111
	DEV02: Control state	210 068	
	DEV03: Control state	210 118	
	DEV04: Control state	210 168	
	DEV05: Control state	210 218	
	DEV06: Control state	211 018	
	DEV07: Control state	211 068	
	DEV08: Control state	211 118	
	DEV09: Control state	211 168	
	DEV10: Control state	211 218	
	DEV01: Switch. device open	210 036	
	DEV02: Switch. device open	210 086	Fig. 3-111
	DEV03: Switch. device open	210 136	
	DEV04: Switch. device open	210 186	
	DEV05: Switch. device open	210 236	
	DEV06: Switch. device open	211 036	
	DEV07: Switch. device open	211 086	

DEV08: Switch. device open	211 136	
DEV09: Switch. device open	211 186	
DEV10: Switch. device open	211 236	
DEV01: Switch.device closed	210 037	Fig. 3-111
DEV02: Switch.device closed	210 087	
DEV03: Switch.device closed	210 137	
DEV04: Switch.device closed	210 187	
DEV05: Switch.device closed	210 237	
DEV06: Switch.device closed	211 037	
DEV07: Switch.device closed	211 087	
DEV08: Switch.device closed	211 137	
DEV09: Switch.device closed	211 187	
DEV10: Switch.device closed	211 237	
DEV01: Sw. dev. interm.pos.	210 038	Fig. 3-111
DEV02: Sw. dev. interm.pos.	210 088	
DEV03: Sw. dev. interm.pos	210 138	
DEV04: Sw. dev. interm.pos.	210 188	
DEV05: Sw. dev. interm.pos.	210 238	
DEV06: Sw. dev. interm.pos.	211 038	
DEV07: Sw. dev. interm.pos.	211 088	
DEV08: Sw. dev. interm.pos.	211 138	
DEV09: Sw. dev. interm.pos.	211 188	
DEV10: Sw. dev. interm.pos.	211 238	
DEV01: Open command	210 028	Fig. 3-110, 3-111
DEV02: Open command	210 078	
DEV03: Open command	210 128	
DEV04: Open command	210 178	
DEV05: Open command	210 228	
DEV06: Open command	211 028	
DEV07: Open command	211 078	
DEV08: Open command	211 128	
DEV09: Open command	211 178	
DEV10: Open command	211 228	
DEV01: Close command	210 029	Fig. 3-110, 3-111
DEV02: Close command	210 079	
DEV03: Close command	210 129	
DEV04: Close command	210 179	
DEV05: Close command	210 229	
DEV06: Close command	211 029	
DEV07: Close command	211 079	
DEV08: Close command	211 129	
DEV09: Close command	211 179	
DEV10: Close command	211 229	

Interlocking logic

ILOCK: Output 1	250 032	Fig. 3-113
ILOCK: Output 2	250 033	
ILOCK: Output 3	250 034	
ILOCK: Output 4	250 035	
ILOCK: Output 5	250 036	
ILOCK: Output 6	250 037	
ILOCK: Output 7	250 038	

	ILOCK: Output 8	250 039	
	ILOCK: Output 9	250 040	
	ILOCK: Output 10	250 041	
	ILOCK: Output 11	250 042	
	ILOCK: Output 12	250 043	
	ILOCK: Output 13	250 044	
	ILOCK: Output 14	250 045	
	ILOCK: Output 15	250 046	
	ILOCK: Output 16	250 047	
	ILOCK: Output 17	250 048	
	ILOCK: Output 18	250 049	
	ILOCK: Output 19	250 050	
	ILOCK: Output 20	250 051	
	ILOCK: Output 21	250 052	
	ILOCK: Output 22	250 053	
	ILOCK: Output 23	250 054	
	ILOCK: Output 24	250 055	
	ILOCK: Output 25	250 056	
	ILOCK: Output 26	250 057	
	ILOCK: Output 27	250 058	
	ILOCK: Output 28	250 059	
	ILOCK: Output 29	250 060	
	ILOCK: Output 30	250 061	
	ILOCK: Output 31	250 062	
	ILOCK: Output 32	250 063	
Single-pole commands	CMD_1: Command C001	200 001	Fig. 3-114
	CMD_1: Command C002	200 006	
	CMD_1: Command C003	200 011	
	CMD_1: Command C004	200 016	
	CMD_1: Command C005	200 021	
	CMD_1: Command C006	200 026	
	CMD_1: Command C007	200 031	
	CMD_1: Command C008	200 036	
	CMD_1: Command C009	200 041	
	CMD_1: Command C010	200 046	
	CMD_1: Command C011	200 051	
	CMD_1: Command C012	200 056	
Single-pole signals	SIG_1: Signal S001 EXT	226 004	Fig. 3-115
	SIG_1: Signal S002 EXT	226 012	
	SIG_1: Signal S003 EXT	226 020	
	SIG_1: Signal S004 EXT	226 028	
	SIG_1: Signal S005 EXT	226 036	
	SIG_1: Signal S006 EXT	226 044	
	SIG_1: Signal S007 EXT	226 052	
	SIG_1: Signal S008 EXT	226 060	
	SIG_1: Signal S009 EXT	226 068	
	SIG_1: Signal S010 EXT	226 076	
	SIG_1: Signal S011 EXT	226 084	
	SIG_1: Signal S012 EXT	226 092	
	SIG_1: Signal S013 EXT	226 100	

	SIG_1: Signal S014 EXT	226 108	
	SIG_1: Signal S015 EXT	226 116	
	SIG_1: Signal S016 EXT	226 124	
	SIG_1: Signal S017 EXT	226 132	
	SIG_1: Signal S018 EXT	226 140	
	SIG_1: Signal S019 EXT	226 148	
	SIG_1: Signal S020 EXT	226 156	
	SIG_1: Logic signal S001	226 005	
	SIG_1: Logic signal S002	226 013	
	SIG_1: Logic signal S003	226 021	
	SIG_1: Logic signal S004	226 029	
	SIG_1: Logic signal S005	226 037	
	SIG_1: Logic signal S006	226 045	
	SIG_1: Logic signal S007	226 053	
	SIG_1: Logic signal S008	226 061	
	SIG_1: Logic signal S009	226 069	
	SIG_1: Logic signal S010	226 077	
	SIG_1: Logic signal S011	226 085	
	SIG_1: Logic signal S012	226 093	
	SIG_1: Logic signal S013	226 101	
	SIG_1: Logic signal S014	226 109	
	SIG_1: Logic signal S015	226 117	
	SIG_1: Logic signal S016	226 125	
	SIG_1: Logic signal S017	226 133	
	SIG_1: Logic signal S018	226 141	
	SIG_1: Logic signal S019	226 149	
	SIG_1: Logic signal S020	226 157	

Tap changer	TAPCH: Tap / TapCh 1	249 105	Fig. 3-118
	TAPCH: TapCh 1 operating	249 114	Fig. 3-118
	TAPCH: Cmd. TapCh 1, down	249 106	Fig. 3-118
	TAPCH: Cmd. TapCh 1, up	249 107	Fig. 3-118

Binary counts	COUNT: Set counter 1 EXT	217 130	Fig. 3-117
	COUNT: Transmit counts EXT	217 009	Fig. 3-117
	COUNT: Reset EXT	217 004	Fig. 3-117
	COUNT: Enabled	217 001	Fig. 3-117
	COUNT: Transmit counts	217 010	Fig. 3-117
	COUNT: Reset	217 005	Fig. 3-117

8.1.2 Control and Testing

Device

DVICE: Service info 031 080	031 080	

Local control panel

LOC: Param. change enabl.	003 010	
Setting the enable for changing values from the local control panel.		

"Logical" communication interface 1

COMM1: Sel.spontan.sig.test	003 180	Fig. 3-13
COMM1: Test spont.sig.start	003 184	Fig. 3-13
COMM1: Test spont.sig. end	003 186	Fig. 3-13

"Logical" communication interface 2

COMM2: Sel.spontan.sig.test	103 180	Fig. 3-15
COMM2: Test spont.sig.start	103 184	Fig. 3-15
COMM2: Test spont.sig. end	103 186	Fig. 3-15

Binary outputs

OUTP: Reset latch. USER	021 009	Fig. 3-22
Reset of latched output relays from the local control panel.		
OUTP: Relay assign. f.test	003 042	Fig. 3-23
Selection of the relay to be tested.		
OUTP: Relay test	003 043	Fig. 3-23
The relay selected for testing is triggered for the set time (OUTP: Hold-time for test). This control action is password-protected (see section entitled 'Password-Protected Control Operations' in Chapter 6).		
OUTP: Hold-time for test	003 044	Fig. 3-23
Setting for the time period for which the selected output relay is triggered for functional testing.		

Main function

MAIN: Enable syst. IN USER	003 142	Fig. 3-38
Enabling the residual current stages of the DTOC/IDMT protection.		
MAIN: Disable syst.IN USER	003 141	Fig. 3-38
Disabling the residual current stages of the DTOC/IDMT protection.		
MAIN: General reset	003 002	Fig. 3-59

Reset of the following memories:

All counters

- □ LED indicators
- □ Operating data memory
- □ All event memories
- □ Event counters
- □ Fault data
- □ Measured overload data
- □ Recorded fault values

This control action is password-protected (see section entitled 'Password-Protected Control Operations' in Chapter 6).

MAIN: Reset indicat. USER 021 010 Fig. 3-59

Reset of the following displays:

- □ LED indicators
- □ Fault data

MAIN: Rset.latch.trip USER 021 005 Fig. 3-50

Reset of latched trip commands from the local control panel.

MAIN: Reset c. cl./trip c. 003 007 Fig. 3-52

The counters for counting the trip commands are reset.

MAIN: Reset IP,max,stored 003 033 Fig. 3-30

The display for the stored maximum phase current is reset.

MAIN: Reset meas.v. energy 003 032 Fig. 3-36

The display for active and reactive energy output and input is reset.

MAIN: Man. trip cmd. USER 003 040 Fig. 3-51

A trip command is issued from the local control panel for 100 ms. This setting is password-protected (see section entitled 'Password-Protected Control Operations' in Chapter 6).

Note:
The command is only executed if the manual trip command has been configured as trip command 1 or 2.

MAIN: Man. close cmd. USER 018 033 Fig. 3-45

A close command is issued from the local control panel for the set reclose command time. This setting is password-protected (see section entitled 'Password-Protected Control Operations' in Chapter 6).

MAIN: Warm restart 003 039

A warm restart is carried out. The device functions as it does when the power supply is turned on.

MAIN: Cold restart 000 085

A cold restart is executed. This setting is password-protected (see section entitled 'Password-Protected Control Operations' in Chapter 6). A cold restart means that all settings and recordings are cleared. The values with which the device operates after a cold restart are the underlined default settings given in the 'Range of Values' column in the Address List. They are selected so as to block the device after a cold restart.

Operating data recording

OP_RC: Reset recording	100 001	Fig. 3-64
The operating data memory and the counter for operation signals are reset.		

Monitoring signal recording

MT_RC: Reset recording	003 008	Fig. 3-65
Reset of the monitoring signal memory.		

Fault recording

FT_RC: Trigger USER	003 041	Fig. 3-69
Fault recording is enabled from the local control panel for 500 ms.		
FT_RC: Reset recording	003 006	Fig. 3-70
Reset of the following memories: □ LED indicators □ Fault memory □ Fault counter □ Fault data □ Recorded fault values		

Logic

LOGIC: Trigger 1	034 038	Fig. 3-98
LOGIC: Trigger 2	034 039	Fig. 3-98
LOGIC: Trigger 3	034 040	Fig. 3-98
LOGIC: Trigger 4	034 041	Fig. 3-98
LOGIC: Trigger 5	034 042	Fig. 3-98
LOGIC: Trigger 6	034 043	Fig. 3-98
LOGIC: Trigger 7	034 044	Fig. 3-98
LOGIC: Trigger 8	034 045	Fig. 3-98
Intervention in the logic at the appropriate point by a 100 ms pulse.		

Binary counts

COUNT: Transmit counts USER	217 008	Fig. 3-117
Count transmission.		
COUNT: Reset USER	217 003	Fig. 3-117
Count reset.		

8.1.3 Operating Data Recording

Operating data recording

OP_RC: Operat. data record.	003 024	Fig. 3-64
Point of entry into the operating data log.		

Monitoring signal recording

MT_RC: Mon. signal record.	003 001	Fig. 3-65
Point of entry into the monitoring signal log.		

8.2 Events

8.2.1 Event Counters

Main functions

MAIN: No. general start.	004 000	Fig. 3-48
Number of general starting signals.		
MAIN: No. gen.trip cmds. 1	004 006	Fig. 3-52
Number of general trip commands 1.		
MAIN: No. gen.trip cmds. 2	009 050	Fig. 3-52
Number of general trip commands 2.		
MAIN: No. close commands	009 055	Fig. 3-45
Number of close commands.		
MAIN: No. motor drive op.	221 025	Fig. 3-56
Number of times external devices with direct motor control are activated during the monitoring time.		

Operating data recording

OP_RC: No. oper. data sig.	100 002	Fig. 3-69
Number of signals stored in the operating data memory.		

Monitoring signal recording

MT_RC: No. monit. signals	004 019	Fig. 3-65
Number of signals stored in the monitoring signal memory.		

Fault recording

FT_RC: No. of faults	004 020	Fig. 3-69
Number of faults.		
FT_RC: No. system disturb.	004 010	Fig. 3-69
Number of system disturbances.		

8.2.2 Measured Fault Data

Fault data acquisition

FT_DA: Fault duration	008 010	Fig. 3-66
Display of the fault duration.		
FT_DA: Running time	004 021	Fig. 3-66
Display of the running time.		
FT_DA: Fault current P p.u.	004 025	Fig. 3-68
Display of the fault current referred to I_{nom}.		
FT_DA: Fault curr. N p.u.	004 049	Fig. 3-68
Display of the ground fault current referred to $I_{N,nom}$.		

8.2.3 Fault Data Acquisition

FT_RC: Fault recording 1	003 000	Fig. 3-70
FT_RC: Fault recording 2	033 001	Fig. 3-70
FT_RC: Fault recording 3	033 002	Fig. 3-70
FT_RC: Fault recording 4	033 003	Fig. 3-70
FT_RC: Fault recording 5	033 004	Fig. 3-70
FT_RC: Fault recording 6	033 005	Fig. 3-70
FT_RC: Fault recording 7	033 006	Fig. 3-70
FT_RC: Fault recording 8	033 007	Fig. 3-70
Point of entry into the fault log.		

9 Commissioning

9.1 Safety Instructions

The device must be reliably grounded before auxiliary voltage is turned on.

The surface-mounted case is grounded using the appropriate bolt and nut as the ground connection. The flush-mounted case must be grounded in the area of the rear sidepieces at the location provided. The cross-sectional area of this ground conductor must also conform to applicable national standards. A minimum conductor cross section of 2.5 mm^2 is required.

In addition, a protective ground connection at the terminal contact on the power supply module (identified by the letters “PE” on the terminal connection diagram) is also required for proper operation of the unit. The cross-sectional area of this ground conductor must also conform to applicable national standards. A minimum cross section of 1.5 mm^2 is required.

Before working on the device itself or in the space where the device is connected, always disconnect the device from the supply.

The secondary circuit of operating current transformers must not be opened. If the secondary circuit of an operating current transformer is opened, there is the danger that the resulting voltages will endanger people and damage the insulation.

The threaded terminal block for current transformer connection is not a shorting block. Therefore always short-circuit current transformers before loosening the threaded terminals.

The fiber-optic interface may only be connected or disconnected when the supply voltage for the unit is shut off.

The PC interface is not designed for permanent connection. Consequently the socket does not have the extra insulation from circuits connected to the system that is required per VDE 0106 Part 101. Therefore when connecting the connecting cable make sure that you do not touch the socket contacts.

Application of analog signals to the measuring inputs must be in compliance with the maximum permissible rating of the measuring inputs (see chapter entitled 'Technical Data').

9.2 Commissioning Tests

Preparation

After the C232 has been installed and connected as described in Chapter 5, the commissioning procedure can begin.

Before turning on the power supply voltage, the following items must be checked again:

- ☐ Is the device connected to the protective ground at the specified location?
- ☐ Does the nominal voltage of the battery agree with the nominal auxiliary voltage of the device?
- ☐ Are the current and voltage transformer connections, grounding, and phase sequences correct?

After the wiring work is completed, check the system to make sure it is properly isolated. The conditions given in VDE 0100 must be satisfied.

Once all checks have been made, the power supply voltage may be turned on. After voltage has been applied, the device starts up. During startup, various startup tests are carried out (see section entitled 'Self-Monitoring' in Chapter 3). The LED indicator labeled 'HEALTHY' (H1) and the LED indicator labeled 'OUT OF SERVICE' (H2) will light up. (The LED indicator H2 is coupled to the signal MAIN: Blocked/faulty.) After approximately 15 s, the C232 is ready for operation. In initial, factory-set condition or after a cold restart, the device type 'C232' and the time of day will be displayed in the first line of the LCD display. If a bay type has already been set, the bay will be displayed in single-pole representation.

Once the change-enabling command has been issued (see the Section Change-Enabling Function in Chapter 6), all settings can be entered. The procedure for entering settings from the integrated local control panel is described in Chapter 6.

Note: First set the desired bay type (MAIN: Type of bay in the "Par/Conf/" folder). When the bay type is set, the binary signal inputs and output relays are automatically configured to conform to the definitions specified for the bay type (see List of Bay Types) – provided that the automatic configuration is enabled at MAIN: Auto-assignment I/O.

After the enter key (E) is pressed to confirm the 'Type of bay' setting parameter, the 'Initializing bay' signal is displayed for 20 s. The "EDIT MODE" LED will light up. Local control actions are not possible during this time.

If either the PC interface or the communication interface will be used for setting the C232 and reading out event records, then the following settings must first be made from the integrated local control panel.

□ 'Par/DvID/' folder:

- DVICE: Device password 1
- DVICE: Device password 2

□ 'Par/Conf/' folder:

- PC: Name of manufacturer
- PC: Bay address
- PC: Device address
- PC: Baud rate
- PC: Parity bit
- COMM1: Function group COMM1
- COMM1: General enable USER
- COMM1: Name of manufacturer
- COMM1: Line idle state
- COMM1: Baud rate
- COMM1: Parity bit
- COMM1: Communicat. protocol
- COMM1: Octet comm. address
- COMM1: Octet address ASDU

□ 'Par/Func/Glob/' folder:

- PC: Command blocking
- PC: Sig./meas.val.block
- COMM1: Command block. USER
- COMM1: Sig./meas.block.USER

Instructions on these settings are given in Chapters 7 and 8.

Note: The settings given above apply to the IEC 60870-5-103 communication protocol. If another protocol is being used for the communication interface, additional settings may be necessary. See Chapter 7 for further details.

After the settings have been made, the following checks should be carried out again before blocking is canceled:

- ☐ Has the appropriate bay type been configured?
- ☐ Does the function assignment of the binary signal inputs agree with the terminal connection diagram?
- ☐ Has the correct operating mode been selected for the binary signal inputs?
- ☐ Does the function assignment of the output relays agree with the terminal connection diagram?
- ☐ Has the correct operating mode been selected for the output relays?
- ☐ Have the interlocking equations and the external interlocking inputs been configured correctly?
- ☐ Have all settings been made correctly?

Now the blocks can be cleared as follows ('Par/Func/Glob/' folder):

- ☐ OUTP: Outp.rel.block USER
- ☐ MAIN: Trip cmd.block USER
- ☐ MAIN: Device on-line *"Yes (on)"*
- ☐ MAIN: Syst.IN Enabeld USER *"Yes (on)"*

Tests

By using the signals and displays generated by the C232, it is possible to determine whether the C232 is correctly set and properly interconnected with the station. Signals are signaled by output relays and LED indicators and entered into the event memory. In addition, the signals can be checked by selecting the appropriate signal in the menu tree.

If the user does not wish to operate the circuit breaker during the protection functions test, the trip commands can be blocked through MAIN: Trip cmd. block. USER ('Par/Func/Glob/' folder) or an appropriately configured binary signal input. If circuit breaker testing is desired, it is possible to issue a trip command for 100 ms through MAIN: Man. trip cmd. USER ('Oper/CtrlTest' folder) or an appropriately configured binary signal input. Selection of the trip command from the integrated local control panel is password-protected (see Section Password-Protected Control Actions in Chapter 6).

Note: The manual trip command is only executed if it has been configured for trip command 1 or 2.

If the C232 is connected to substation control level, it is advisable to activate the test mode via MAIN: Test mode USER ('Par/Func/Glob/' folder) or an appropriately configured binary signal input. The telegrams are then identified accordingly (cause of transmission: test mode).

Checking the binary signal inputs

By selecting the corresponding state signal (‘Oper/Cycl/Phys’ folder), it is possible to determine whether the input signal that is present is recognized correctly by the C232. The values displayed have the following meanings:

- *Low*: Not energized.
- *High*: Energized.
- *Without function*: No functions are assigned to the binary signal input.

This display appears regardless of the binary signal input mode selected.

Checking the output relays

It is possible to trigger the output relays for a settable time period for test purposes (time setting at OUTP: Hold-time for test in 'Oper/CtrlTest/' folder). First select the output relay to be tested (OUTP: Relay assign. f.test, ‘Oper/CtrlTest/’ folder). Test triggering then occurs via OUTP: Relay test (Oper/CtrlTest/' folder). It is password-protected (see the section entitled ‘Password-Protected Control Operations’ in Chapter 6).

Before starting the test, open any triggering circuits for external devices so that no inadvertent switching operations will take place.

Checking the current-measuring inputs

By applying appropriate analog signals as ‘measuring variables’ to the measuring inputs, the user can check via the operating data displays (see Chapter ‘Information and Control Functions’) whether the protection and control unit detects the analog signals with the specified accuracy (folder ‘Oper/Cycl/Data/’).

- MAIN: Current A p.u.: Display of the updated phase current A referred to the nominal device current I_{nom}
- MAIN: Current B p.u.: Display of the updated phase current B referred to the nominal device current I_{nom}
- MAIN: Current C p.u.: Display of the updated phase current C referred to the nominal device current I_{nom}

Application of analog signals to the measuring inputs must be in compliance with the maximum permissible rating of the measuring inputs (see the Chapter on Technical Data).

Checking the protection function

Four parameter subsets are stored in the C232, one of which is activated. Before checking the protective function, the user should determine which parameter subset is activated. The activated parameter subset is displayed at PSS: Actual param. subset ('Oper/Cycl/Log/" folder).

Testing the definite-time overcurrent protection function

Testing of the definite-time overcurrent protection function can only be carried out if the following conditions are met:

- □ DTOC protection is enabled. This may be interrogated at the logic state signal DTOC: Enabled (‘Oper/Cycl/Log/’ folder).
- □ The function MAIN: Block tim.st. IN,neg is set to *No* (folder Par/Func/Gen).
- □ The function MAIN: Gen. starting mode is set to ‘*Starting IN, Ineg’* (folder Par/Func/Gen).

By applying appropriate measuring variables, the overcurrent stages and the associated timer stages can be tested.

Application of analog signals to the measuring inputs must be in compliance with the maximum permissible rating of the measuring inputs (see the Chapter on Technical Data).

Testing the inverse-time overcurrent protection function

Testing of the inverse-time overcurrent protection function can only be carried out if the following conditions are met:

- □ IDMT protection is enabled. This may be interrogated at the logic state signal IDMT: Enabled (folder ‘Oper/Cycl/Log/’).
- □ The function MAIN: Block tim.st. IN,neg is set to *No* (folder Par/Func/Gen).
- □ The function MAIN: Gen. starting mode is set to ‘*Starting IN, Ineg’* (folder Par/Func/Gen).

By applying appropriate measuring variables, the overcurrent stages and the associated time delays can be tested.

Application of analog signals to the measuring inputs must be in compliance with the maximum permissible rating of the measuring inputs (see the Chapter on Technical Data).

The trip times for the inverse-time overcurrent protection function as a function of the set tripping characteristics are shown in the following table:

No.	Tripping Characteristic	Formula for the Tripping Characteristic	Constants			Formula for the Release Characteristic	
	k = 0.01 to 10.00		a	b	c		R
0	Definite Time	$t = k$					
	Per IEC 255-3	$t = k \cdot \frac{a}{\left(\frac{I}{I_{ref}}\right)^{b} - 1}$					
1	Standard Inverse		0.14	0.02			
2	Very Inverse		13.50	1.00			
3	Extremely Inverse		80.00	2.00			
4	Long Time Inverse		120.00	1.00			
	Per IEEE C37.112	$t = k \cdot \left(\frac{a}{\left(\frac{I}{I_{ref}}\right)^{b} - 1} + c \right)$				$t_r = k \cdot \frac{R}{\left(\frac{I}{I_{ref}}\right)^{2} - 1}$	
5	Moderately Inverse		0.0515	0.0200	0.1140		4.85
6	Very Inverse		19.6100	2.0000	0.4910		21.60
7	Extremely Inverse		28.2000	2.0000	0.1217		29.10
	Per ANSI	$t = k \cdot \left(\frac{a}{\left(\frac{I}{I_{ref}}\right)^{b} - 1} + c \right)$				$t_r = k \cdot \frac{R}{\left(\frac{I}{I_{ref}}\right)^{2} - 1}$	
8	Normally Inverse		8.9341	2.0938	0.17966		9.00
9	Short Time Inverse		0.2663	1.2969	0.03393		0.50
10	Long Time Inverse		5.6143	1.0000	2.18592		15.75
11	RI-Type Inverse	$t = k \cdot \frac{1}{0.339 - \frac{0.236}{\left(\frac{I}{I_{ref}}\right)}}$					
12	RXIDG-Type Inverse	$t = k \cdot \left(5.8 - 1.35 \cdot \ln \frac{I}{I_{ref}} \right)$					

Testing the control functions

The selected bay type is displayed on the Bay Panel. The activation of the Bay Panel display is described in Chapter 6. If the position signals of the switchgear units are connected correctly to the C232, then the updated switching status of the switchgear units will be displayed on the bay panel. If the switching status is not displayed correctly, the user can check the physical state signals of the binary inputs to determine whether the status signals in the C232 are correct (this can be checked at INP: State U xxx, 'Oper/Cycl/Phys').

Switching from local to remote control

Switchgear units can be controlled locally using the keys on the local control panel, remotely through the communication interface, or through appropriately configured binary signal inputs. The control point – Local or Remote – is selected either by means of the L/R key on the local control panel or via an appropriately configured binary signal input. If a binary signal input has been configured, then the L/R key has no effect. Switching from Remote to Local using the L/R key on the local control panel is only possible if the L/R password has been entered first (see additional instructions in Chapter 6). The selected control point is displayed on the Bay Panel.

Local control

The switchgear unit to be controlled is selected by pressing the Selection key on the local control panel and then controlled by pressing the Open or Close key. If the switchgear units are to be controlled through binary signal inputs, then the appropriate signal input must be triggered.

Remote control

The switchgear units can be controlled via the communication interface or appropriately configured binary signal inputs.

Switchgear unit not responding

If a switchgear unit does not respond to a switching command, it could be due to the following factors:

- ☐ The general control enable – if configured – has not been set.
  (configuration at MAIN: Inp.asg. ctrl.enabl., 'Par/Func/Glob' folder)
- ☐ Interlocking has been triggered.
  (This can be checked at MAIN: Interlock equ. viol., 'Oper/Cycl/Log/'.)
- ☐ For bays with direct motor control only:
  Motor monitoring has been triggered.
  (This can be checked at MAIN: Mon. mot. drives tr., 'Oper/Cycl/Log/'.)

To determine which interlocks are activated, check as follows:

- ☐ For bay interlock (BI) check:
  MAIN: Bay interlock. act., 'Oper/Cycl/Log/' folder
- ☐ For substation interlock (SI) check:
  MAIN: Subst. interl. act., 'Oper/Cycl/Log/' folder
- ☐ For local control:
  It is possible to deactivate the interlock through an appropriately configured binary signal input.
  Configuration through MAIN: Inp.asg.interl.deact, 'Oper/Func/Glob' folder)

Note: Substation interlocking is only active when there is communication with the substation control level through the communication interface. In the event of a communication error, the unit will switch automatically to 'bay interlock without station interlock'. To determine if there is a communication error, check at MAIN: Communication error, 'Oper/Cycl/Log/' folder.

Substation interlocking can be deactivated selectively for each switchgear unit and each control direction – Open or Close.
(This can be checked at DEVxx: Open w/o stat.interl or DEVxx: Close w/o stat. int., 'Oper/Cycl/Log/' folder.)

Completion of commissioning

Before the C232 is released for operation, the user should make sure that the following steps have been taken:

- ☐ All memories have been reset.
  (Reset at MAIN: General reset (password-protected) and MT_RC: Reset recording, both in 'Oper/CtrlTest/ folder.)
- ☐ Blocking of output relays has been canceled.
  (OUTP: Outp.rel.block USER in 'Par/Func/Glob/' folder, setting '*No'*)
- ☐ Blocking of the trip command has been canceled.
  (MAIN: Trip cmd.block.USER, 'Par/Func/Glob/' folder, setting *'No'*)
- ☐ The C232device is on-line.
  (MAIN: Device on-line, 'Par/Func/Glob/' folder, setting *'Yes (on)'*)
- ☐ The residual current stages of the protection functions are enabled (on).
  (MAIN: Syst.IN enabled USER ,'Par/Func/Gen/' folder, setting *'Yes (on)'*)
- ☐ The correct control point – Local or Remote – is activated.
- ☐ The desired interlocking conditions are activated.

After completion of commissioning, only the green LED indicator signaling ‘Operation’ (H1) should be on.

10 Troubleshooting

This chapter describes problems that might be encountered, their causes, and possible methods for eliminating them. It is intended as a general orientation only, and in cases of doubt it is better to return the C232 to the manufacturer. Please follow the packaging instructions in the section entitled 'Unpacking and Packing' in Chapter 5 when returning equipment to the manufacturer.

Problem:

□ Lines of text are not displayed on the local control panel.

- Check to see whether there is supply voltage at the device connection points.
- Check to see whether the magnitude of the auxiliary voltage is correct. The C232 is protected against damage resulting from polarity reversal.

Before checking further, disconnect the C232 from the power supply.

The local control panel is connected to I/O module by a plug-in connecting cable. Make sure the connector position is correct. Do not bend the connecting cable.

□ The C232 issues a 'Warning' signal on LED H3. (H3 is labeled 'ALARM', it is coupled to the signal SFMON: Warning (LED).)

Identify the specific problem by reading out the monitoring signal memory (see the section entitled 'Monitoring Signal Memory Readout' in Chapter 6). The table below lists possible monitoring or warning indications (provided that a configuration setting has been entered at SFMON: Fct. assign. warning), the faulty area, the C232 response, and the mode of the output relay configured for 'Warning' and 'Blocked/faulty'.

SFMON: Warning (LED)	036 070
Warning configured for LED H3.	
SFMON: Warning (relay)	036 100
Warning configured for an output relay.	

Key

- :	No reaction and/or no output relay triggered.
Yes:	The corresponding output relay is triggered.
Updating:	The output relay configured for 'Warning' starts only if the monitoring signal is still present.
[1] :	The 'Blocked/faulty' output relay only operates if the signal has been configured at MAIN: Fct. assignm. fault.
[2] :	The 'Warning' output relay only operates if the signal has been configured at SFMON: Fct. assignm. warning.

SFMON: Cold restart	093 024
A cold restart has been carried out on account of a checksum error in the memory (NOVRAM).	
1st device reaction / 2nd device reaction:	Warm restart / Device blocking
'Warning' output relay:	Yes / Yes
'Blocked/faulty' output relay:	Yes / Yes

SFMON: Cold rest./SW update	093 025
A cold restart has been carried out following a software update.	
1st device reaction / 2nd device reaction:	Warm restart / Device blocking
'Warning' output relay:	Yes / Yes
'Blocked/faulty' output relay:	Yes / Yes

SFMON: Blocking HW failure	090 019
Supplementary warning that this device is blocked.	
'Warning' output relay:	Updating / Updating

SFMON: Relay Kxx faulty	041 200
Multiple signal: output relay defective.	
1st device reaction / 2nd device reaction:	– / –
'Warning' output relay:	Updating / Updating
'Blocked/faulty' output relay:	Yes / Yes [1)]

SFMON: Hardware clock fail.	093 040
The hardware clock has failed.	
1st device reaction / 2nd device reaction:	– / –
'Warning' output relay:	Yes / Yes
'Blocked/faulty' output relay:	– / –

SFMON: Invalid SW d.loaded	096 121
Wrong or invalid software has been downloaded.	
1st device reaction / 2nd device reaction:	Warm restart / Device blocking
'Warning' output relay:	Yes / Yes
'Blocked/faulty' output relay:	Yes / Yes

SFMON: Invalid type of bay	096 122
If the user has selected a bay type that requires a C232 hardware configuration that is not actually fitted, then this signal is generated.	
1st device reaction / 2nd device reaction:	- / -
'Warning' output relay:	- / -
'Blocked/faulty' output relay:	- / -

SFMON: +15V supply faulty	093 081
The +15 V internal supply voltage has dropped below a minimum value.	
1st device reaction / 2nd device reaction:	Warm restart / Device blocking
'Warning' output relay:	Yes / Yes
'Blocked/faulty' output relay:	Yes / Yes

SFMON: +24V supply faulty	093 082
The +24 V internal supply voltage has dropped below a minimum value.	
1st device reaction / 2nd device reaction:	Warm restart / Device blocking
'Warning' output relay:	Yes / Yes
'Blocked/faulty' output relay:	Yes / Yes
SFMON: -15V supply faulty	093 080
The -15 V internal supply voltage has dropped below a minimum value.	
1st device reaction / 2nd device reaction:	Warm restart / Device blocking
'Warning' output relay:	Yes / Yes
'Blocked/faulty' output relay:	Yes / Yes
SFMON: Wrong module slot 1	096 100
SFMON: Wrong module slot 2	096 101
SFMON: Wrong module slot 3	096 102
Module in wrong slot.	
1st device reaction / 2nd device reaction:	Warm restart / Device blocking
'Warning' output relay:	Yes / Yes
'Blocked/faulty' output relay:	Yes / Yes
SFMON: Defect.module slot 1	097 000
SFMON: Defect.module slot 2	097 001
SFMON: Defect.module slot 3	097 002
Defective module in slot x.	
1st device reaction / 2nd device reaction:	– / –
'Warning' output relay:	Updating / Updating
'Blocked/faulty' output relay:	Yes / Yes [1)]
SFMON: Error K 201	097 038
SFMON: Error K 202	097 039
SFMON: Error K 203	097 040
SFMON: Error K 204	097 041
SFMON: Error K 205	097 042
SFMON: Error K 206	097 043
SFMON: Error K 207	097 044
SFMON: Error K 208	097 045
SFMON: Error K 209	097 200
SFMON: Error K 210	097 201
SFMON: Error K 211	097 202
SFMON: Error K 212	097 203
SFMON: Error K 213	097 204
SFMON: Error K 214	097 205
Output relay K xxx defective.	
1st device reaction / 2nd device reaction:	– / –
'Warning' output relay:	Updating / Updating
'Blocked/faulty' output relay:	Yes / Yes [1)]

SFMON: Undef. operat. code	093 010
Undefined operation code, i.e. software error.	
1st device reaction / 2nd device reaction:	Warm restart / Device blocking
'Warning' output relay:	Yes / Yes
'Blocked/faulty' output relay:	Yes / Yes
SFMON: Invalid arithm. op.	093 011
Invalid arithmetic operation, i.e. software error.	
1st device reaction / 2nd device reaction:	Warm restart / Device blocking
'Warning' output relay:	Yes / Yes
'Blocked/faulty' output relay:	Yes / Yes
SFMON: Undefined interrupt	093 012
Undefined interrupt, i.e. software error.	
1st device reaction / 2nd device reaction:	Warm restart / Device blocking
'Warning' output relay:	Yes / Yes
'Blocked/faulty' output relay:	Yes / Yes
SFMON: Exception oper.syst.	093 013
Interrupt of the operating system.	
1st device reaction / 2nd device reaction:	Warm restart / Device blocking
'Warning' output relay:	Yes / Yes
'Blocked/faulty' output relay:	Yes / Yes
SFMON: Data acquis. failure	090 021
Watchdog is monitoring the periodic start of protection routines. It has detected an error.	
1st device reaction / 2nd device reaction:	Warm restart / Device blocking
'Warning' output relay:	Yes / Yes
'Blocked/faulty' output relay:	Yes / Yes
SFMON: Checksum error param	090 003
A checksum error involving the parameters in the memory (NOVRAM) has been detected.	
1st device reaction / 2nd device reaction:	Warm restart / Device blocking
'Warning' output relay:	Yes / Yes
'Blocked/faulty' output relay:	Yes / Yes
SFMON: Clock sync. error	093 041
In 10 consecutive clock synchronization telegrams, the difference between the time of day given in the telegram and that of the hardware clock is greater than 10 ms.	
1st device reaction / 2nd device reaction:	– / –
'Warning' output relay:	Yes / Yes
'Blocked/faulty' output relay:	– / –

SFMON: Overflow MT_RC	090 012
Last entry in the monitoring signal memory in the event of overflow.	
1st device reaction / 2nd device reaction:	– / –
'Warning' output relay:	Yes / Yes
'Blocked/faulty' output relay:	– / –
SFMON: Semaph. MT_RC block.	093 015
Software overloaded.	
1st device reaction / 2nd device reaction:	– / –
'Warning' output relay:	Yes / Yes
'Blocked/faulty' output relay:	– / –
SFMON: Inval. SW vers.COMM1	093 075
Incorrect or invalid communication software has been downloaded.	
1st device reaction / 2nd device reaction:	– / –
'Warning' output relay:	Yes / Yes
'Blocked/faulty' output relay:	– / –
SFMON: Invalid scaling IDC	093 116
An invalid characteristic has been set for the analog input channel of analog I/O module Y.	
1st device reaction / 2nd device reaction:	Depends on type of fault.
'Warning' output relay:	Yes / Yes [2)]
'Blocked/faulty' output relay:	– / –
SFMON: Overload 20 mA input	098 025
The 20 mA input of analog I/O module Y is overloaded.	
1st device reaction / 2nd device reaction:	Depends on type of fault.
'Warning' output relay:	Yes / Yes [2)]
'Blocked/faulty' output relay:	– / –
SFMON: Open circ. 20mA inp.	098 026
The C232 has detected an open circuit in the connection of the 20 mA input.	
1st device reaction / 2nd device reaction:	Depends on type of fault.
'Warning' output relay:	Yes / Yes [2)]
'Blocked/faulty' output relay:	– / –

11 Maintenance

11 Maintenance

The C232 is a low-maintenance device. The components used in the units are selected to meet exacting requirements. Recalibration is not necessary.

Maintenance procedures in the power supply area

Electrolytic capacitors are installed in the power supply area because of dimensioning requirements. The useful life of these capacitors is significant from a maintenance standpoint. When the equipment is operated continuously at the upper limit of the recommended temperature range (+55°C or 131°F), the useful life of these components is 80,000 hours, or more than 9 years. Under these conditions, replacement of the electrolytic capacitors is recommended after a period of 8 to 10 years. Component drift follows the '10-degree rule'. This means that the useful life is doubled for each 10 K reduction in temperature. When the operating temperatures inside the devices are lower, the required maintenance intervals are increased accordingly.

Replacement of the maintenance-related components named above is not possible without soldering. Maintenance work must be carried out by AREVA service personnel only.

Routine functional testing

The C232 is used as a safety device and must therefore be routinely checked for proper operation. The first functional tests should be carried out approximately 6 to 12 months after commissioning. Additional functional tests should performed at intervals of 2 to 3 years – 4 years at the maximum.

The C232 incorporates in its system a very extensive self-monitoring function for hardware and software. The internal structure guarantees, for example, that communication within the processor system will be checked on a continuing basis.

Nonetheless, there are a number of subfunctions that cannot be checked by the self-monitoring feature without running a test from the device terminals. The respective device-specific properties and setting parameters must be observed in such cases.

In particular, none of the control and signaling circuits that are run to the device from the outside are checked by the self-monitoring function.

Analog input circuits

The analog measured variables are fed through an analog preprocessing feature (anti-aliasing filtering) to a common analog-to-digital converter. In conjunction with the self-monitoring function, the measuring-circuit monitoring function that is available for the device's general functions can detect deviations in many cases, depending on the parameter settings for sensitivity. However, it is still necessary to test from the device terminals in order to make sure that the analog measuring circuits are functioning correctly.

The best way to carry out a static test of the analog input circuits is to check the primary measured operating data using the operating data measurement function or to use a suitable testing instrument. A "small" measured value (such as the nominal current in the current path) and a "large" measured value (such as the nominal voltage in the voltage path) should be used to check the measuring range of the A/D converter. This makes it possible to check the entire control range.

The accuracy of operating data measurement is <1 %. An important factor in evaluating device performance is long-term performance based on comparison with previous measurements.

In addition, a dynamic test can be used to check transmission performance and the phase relation of the current transformers and the anti-aliasing filter.
A dynamic test is not absolutely necessary, since it only checks the stability of a few less passive components. Based on reliability analysis, the statistical expectation is that only one component in 10 years in 1000 devices will be outside the tolerance range.

Additional analog testing is not necessary, in our opinion, since information processing is completely numerical and is based on the measured analog current and voltage values. Proper operation was checked in conjunction with type testing.

Binary inputs

The binary inputs are not checked by the self-monitoring function. However, a testing function is integrated into the software so that the trigger state of each input can be read out ('Oper/Cycl/Phys' folder). This check should be performed for each input being used and can be done, if necessary, without disconnecting any device wiring.

Binary outputs

With respect to binary outputs, the integrated self-monitoring function includes even two-phase triggering of the relay coils of all the relays. External contact circuits are not monitored. In this case, relays must be triggered by way of device functions or integrated test functions. For these testing purposes, triggering of the output circuits is integrated into the software through a special control function ('Oper/CtrlTest/' folder).

Before starting testing, open any triggering circuits for external devices so that no inadvertent switching operations will take place.

Serial interfaces

The integrated self-monitoring function for the PC or communication interface also includes the communication module. The complete communication system, including connecting link and fiber-optic module (if applicable), is always totally monitored as long as a link is established through the control program or the communication protocol.

12 Storage

Devices must be stored in a dry and clean environment. A temperature range of -25°C to +70°C (-13°F to +158°F) must be maintained during storage (see the Chapter on Technical Data). The relative humidity must be controlled so that neither condensation nor ice formation will result.

If the units are stored without being connected to auxiliary voltage, then the electrolytic capacitors in the power supply area need to be reformed every 4 years. Reform the capacitors by connecting auxiliary voltage to the C232 for approximately 10 minutes.

13 Accessories and Spare Parts

The C232 is supplied with standard labeling for the LED indicators. User-specific labeling for non-standard configurations of the LED's can be printed on the blank label strips packed with the device. The label strip can then be glued to the front panel area reserved for this purpose.

The label strip can be filled in using an overhead projector pen, waterproof type. Example: Stabilo brand pen, OH Pen 196 PS.

Description	Order No.
S&R-103 operating program (for Windows)	On request

14 Order Information

C232

Designs	Order No.																				
Compact Bay Unit for Control and Monitoring C232	C232-								0	**-302**							**-603**	-XXX			
Compact case		9																			
Wall-mounting and fush-mounting, local HMI with graphic LCD		9																			
Model 1 1 two-pole switching command with checkback signals 2 two-pole breaker position indications or 4 free inputs and 4 free inputs			1	0	0	0	0				-401										
Model 2 3 two-pole switching command with checkback signals 2 two-pole breaker position indications or 4 free inputs and 4 free inputs			2		0		0				-402										
Model 3 6 two-pole switching command with checkback signals and 8 free inputs			3				0				-403										
Model 4 with overcurrent protection 3 two-pole switching command with checkback signals 5 free inputs and 2 free outputs			4			0	0				-404										
with additional I/O extension 6 two-pole switching command with checkback signals 8 free inputs			4				1				-404										
Measured value acqusition (transformer connection)																					
without				0	0																
1 x 1A (Models 2 and 3 only)				1	0																
1 x 5A (Models 2 and 3 only)				2	0																
3 x 1A, 1 x 100V (Model 3 only)				0	1																
3 x 5A, 1 x 100V (Model 3 only)				0	2																
1 x 1A, 3 x 100V (Model 3 only)				0	3																
1 x 5A, 3 x 100V (Model 3 only)				0	4																
3 x 1A, 1 x 100V (Model 4 only)				0	6																
3 x 5A, 1 x 100V (Model 4 only)				0	8																
Measured value acquisition (0...20mA)																					
without							0														
with (Model 2,3 and 4 [404] only)							1														
with communication interface																		-456	9	2	
Protocol settable: IEC 60870-5-101/-103, Modbus, DNP 3.0																					
Channel 1 and 2: wire leads, RS485, isolated																					1
Channel 1: plastic fiber, FSMA; Channel 2: wire leads, RS485, isolated																					2
Channel 1: glass fiber, ST; Channel 2: wire leads, RS485, isolated																					4
Channel 1: wire leads, RS485, isolated																					5
Channel 1: plastic fiber, FSMA																					6
Channel 1: glass fiber, ST																					7
Language: English	(German)		without order code																		
Language: German	(English)		<1>															-801			
Language: French	(English)		<1>															-802			
Language: Spanish	(English)		<1>															-803			
Acceptance test certificate according to EN10204-2.1/DIN 50049-2.1																	to be ordered in plain text				

<1> Must be ordered prior to device production

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