AREVA

# P631 up to P634

## Transformer Differential Protection Devices

**Version P631 -304 -403/404 -606 ff**
**Version P632 -304 -403/404 -606 ff**
**Version P633 -304 -404/405/406 –606 ff**
**Version P634 -304 -403/404 –606 ff**

## Technical Data Sheet

**This document does not replace the Technical Manual**

## Application and scope

The differential protection devices of the MiCOM P63x series are intended for the fast and selective short-circuit protection of transformers, motors, generators and other installations with two, three or four windings, respectively.

The MiCOM P63x series provides high-speed three-system differential protection using a triple-slope characteristic and two high-set differential elements in combination with transformer inrush restraint, overfluxing restraint and through-stabilization. Amplitude and vector group matching is done just by entering the nominal values of transformer windings and associated CTs.

For ring bus and breaker-and-a-half applications a virtual winding can be defined for which the current measuring inputs are based on the vector sum of currents from two or three freely selectable windings.

In addition many supplementary protective functions are incorporated in the devices. Protective functions which are available several times are freely assignable to the windings.

The P63x provides four setting groups for easy adaptation to varying system operation conditions.

All main functions are individually configurable and can be disabled or enabled by the user as desired. By means of a straight-forward configuration procedure, the user can adapt the device flexibly to the scope of protection required in each particular application. Due to the powerful, freely configurable logic of the device, special applications can be accommodated.

| Functions overview | | | P631 | P632 | P633 | P634 |
|---|---|---|---|---|---|---|
| 87 | DIFF | Differential protection | 2 wind. | 2 wind. | 3 wind. | 4 wind. |
| 87G | REF_x | Restricted earth fault protection | - | 2 | 3 | 3 |
| 50 | DTOC_x | Definite-time O/C protection | 2 | 2 | 3 | 3 |
| 51 | IDMT_x | Inverse-time O/C protection | 2 | 2 | 3 | 3 |
| 49 | THRMx | Thermal overload protection | 1 | 1 | 2 | 2 |
| 27/ 59 | U<> | Over/undervoltage protection | - | 1 | 1 | 1 |
| 81 O/U | f<> | Over/underfrequency protection | - | 1 | 1 | 1 |
| 24 | V/f | Overexcitation protection | - | 1 | 1 | 1 |
| | CTS | Current transformer supervision | Option | Option | Option | Option |
| | MCM_x | Measuring circuit monitoring | 2 | 2 | 3 | 4 |
| | LIMIT / LIM_x | Limit value monitoring | 2 | 2 | 3 | 3 |
| | LOGIC | Programmable logic | 1 | 1 | 1 | 1 |
| | COMMx | 2 Communication interfaces, IRIG-B | Option | Option | Option | Option |
| | INP / OUTP | Binary inputs and outputs (max. number) | 4 / 14 | 34 / 22 | 40 / 30 | 34 / 22 |
| | MEASI / MEASO | Analogue inputs and outputs (2 x 20 mA outputs, 20 mA input and RDT input) | - | Option | Option | Option |
| | | Measuring inputs | | | | |
| | | Phase currents | 2 x 3 | 2 x 3 | 4 x 3 | 4 x 3 |
| | | Residual current or star-point current | - | 2 | 3 | 3 |
| | | Voltage | - | 1 | 1 | 1 |

*Figure 1: Functional Overview*

In addition to the features listed above, as well as comprehensive self-monitoring, the following global functions are available in the MiCOM P63x series differential protection devices:

- Parameter subset selection (4 independent parameter subsets)
- Measured operating data to support the user during commissioning, testing and operation
- Operating data recording (time-tagged signal logging)
- Overload data acquisiton
- Overload recording (time-tagged signal logging)
- Fault data acquisition
- Fault recording (time-tagged signal logging with fault value recording of the phase currents of each winding and, depending on the design version, of the neutral-point current of each winding and of the voltage).

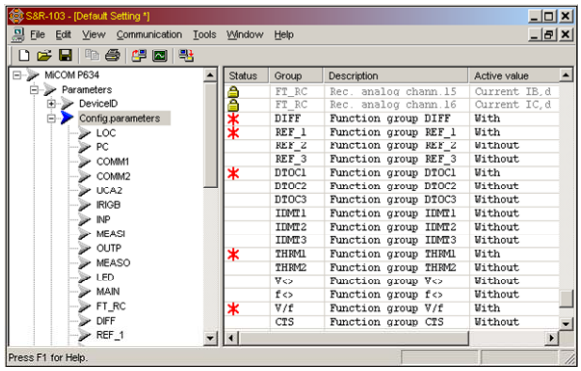



*Figure 2: Simple Function Selection by Mouseclick*

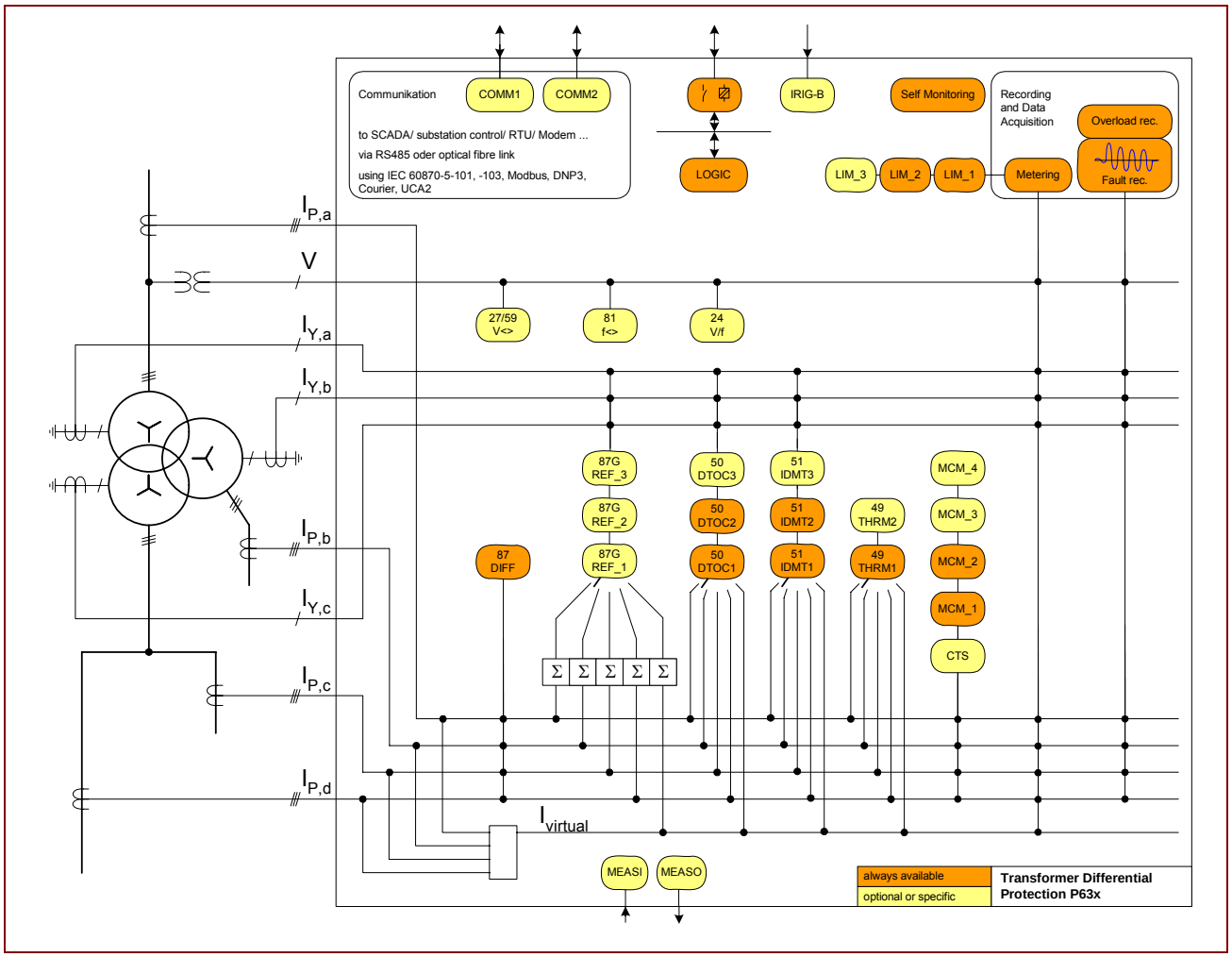



*Figure 3: Function Diagram*

The protection devices MiCOM P631, P632, P633 and P634 are of modular design. The plug-in modules are housed in a robust aluminum case and electrically connected via an analog and a digital bus printed circuit board.

The nominal currents or the nominal voltage, respectively, of the measuring inputs can be set with the help of function parameters.

The nominal voltage range of the optical coupler inputs is 24 to 250 V DC without internal switching. Optional there are also ranges with higher switching thresholds available.

The auxiliary voltage input for the power supply is a wide-range design with a nominal voltage range of 48 to 250 V DC and 100 to 230 V AC. An additional version is available for the lower nominal voltage range of 24 V DC.

All output relays are suitable for both signals and commands.

The optional PT 100 input is lead-compensated, balanced and linearized for PT-100 resistance thermometers per IEC 751.

The optional 0 to 20 mA input provides open-circuit and overload monitoring, zero suppression defined by a setting, plus the option of linearizing the input variable via 20 adjustable interpolation points.

Two freely selected measured variables (cyclically updated measured operating data and stored measured fault data) can be output as a load-independent direct current via the two optional 0 to 20 mA outputs. The characteristics are defined via 3 adjustable interpolation points allowing a minimum output current (4 mA, for example) for receiver-side open-circuit monitoring, knee-point definition for fine scaling and a limitation to lower nominal currents (10 mA, for example). Where sufficient output relays are available, a freely selected measured variable can be output in BCD-coded form via contacts.

## Control and Display

- Local control panel
- 17 LED indicators,12 of which allow freely configurable function assignment
- PC Interface
- Communication interface (optional)

## Information Interface

Information exchange is done via the local control panel, the PC interface and 2 optional communication interfaces.

One of the communication interfaces conforms to IEC 60870-5-103, IEC 60870-5-101, DNP 3.0 and Modbus and is intended for integration of MiCOM P63x with substation control systems.

The 2nd communication interface (COMM2) conforms to IEC 60870-5-103 and is intended for remote setting access only.

Clock synchronization can be achieved using one of the protocols or using the IRIG-B signal input.

## Main functions

Main functions are autonomous function groups and can be individually configured or disabled to suit a particular application. Function groups that are not required and have been disabled by the user are masked completely (except for the configuration parameter) and functional support is withdrawn from such groups. This concept permits an extensive scope of functions and universal application of the protection device in a single design version, while at the same time providing for a clear and straight-forward setting procedure and adaptation to the protection task under consideration.

### Differential Protection

#### Amplitude Matching

On the basis of the primary transformer currents, the MiCOM P63x differential protection devices can be flexibly adapted to the reference currents of the protected object. Amplitude matching is by means of a straight-forward input of the reference power common to all windings plus the nominal voltages and the nominal transformer currents for each winding. The resulting reference currents and matching factors are automatically deduced by the device and checked for compatibility with the internally allowed value ranges.

#### Vector Group Matching and Zero-Sequence Filtering

Matching of the MiCOM P63x series differential protection devices to the vector group of the protected object is via a straight-forward input of the relevant vector group identification number. The mathematical formula to be applied to the measured values is automatically selected internally according to the relevant vector group and zero-sequence filtering is taken into account simultaneously. For special applications, zero-sequence filtering may be deactivated separately for each winding.

#### Tripping Characteristics

The tripping characteristics of the differential protection device has two knees (see Figure 4). The first knee is dependent on the setting of the basic threshold value Id> and is on the load line for single-side feed. The second knee of the tripping characteristic is defined by a setting. Above the user-selected differential current level Id>>>, the restraining current is no longer taken into account.

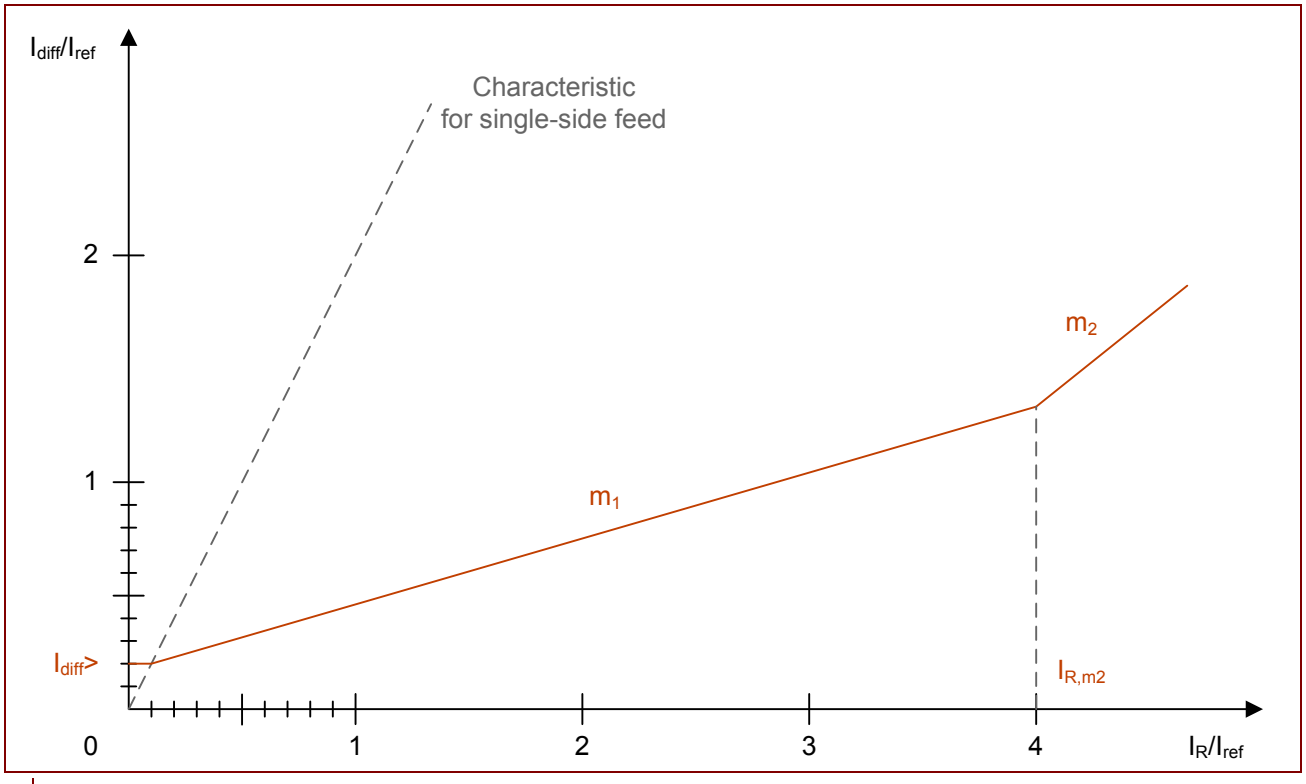



*Figure 4: Tripping Characteristic of the Differential Protection (Setting Parameters see „Address List“)*

### Harmonic Restraint

Stabilization under inrush conditions is based on the presence of second harmonic components in the differential currents. The ratio of the second harmonic component to the fundamental wave for the differential currents of the measuring system serves as the criterion. Optionally, tripping is blocked either across all three measuring systems or selectively for one measuring system. However, from a user-selected differential current level Id>>, the blocking criterion is no longer taken into account. For application as differential protection device for motors or generators, the harmonic restraint can be deactivated.

### Through Stabilization

Up to a certain limit, stability in the event of external faults is ensured by means of the bias. Due to the triple-slope tripping characteristic, the stabilization is particularly pronounced for high currents. However, as an additional safeguard for through-currents with transformer saturation, the MiCOM P63x series differential protection devices are provided with a saturation discriminator. Particularly the start-up of directly switched asynchronous motors represents a problem in differential protection due to transient transformer saturation caused by a displacement of the start-up current for relatively high primary time constants. Even under such unfavourable measurement conditions, the MiCOM P63x series differential protection devices perform with excellent stability.

### Overfluxing Restraint

For stabilization under overfluxing conditions, the ratio of the fifth harmonic to the fundamental wave for the differential currents of the measuring system serves as criterion. Tripping is blocked selectively for each measuring system. For differential currents of $4 \cdot I_{ref}$ or higher, the blocking criterion is no longer taken into account. The overfluxing restraint function may be deactivated.

## Restricted Earth Fault Protection

Restricted earth fault protection (REF) is applied on transformers in order to detect ground-faults on a given winding more sensitively than overall transformer differential protection is able to do. Two different measuring principles are available:

- Biased restricted earth fault protection
- High impedance restricted earth fault protection.

The biased restricted earth fault protection can be applied to transformer windings with grounded neutral point where the neutral point/ground connection is fitted with a current transformer. It is based on comparing the vector sum of the phase currents of the relevant transformer winding to the neutral point current. The vector sum of the phase currents can be generated, for example, by Holmgreen connection of the three main current transformers.

The advantage of restricted earth fault protection resides in the linear dependence of the sensitivity on the distance between the fault and the neutral point.

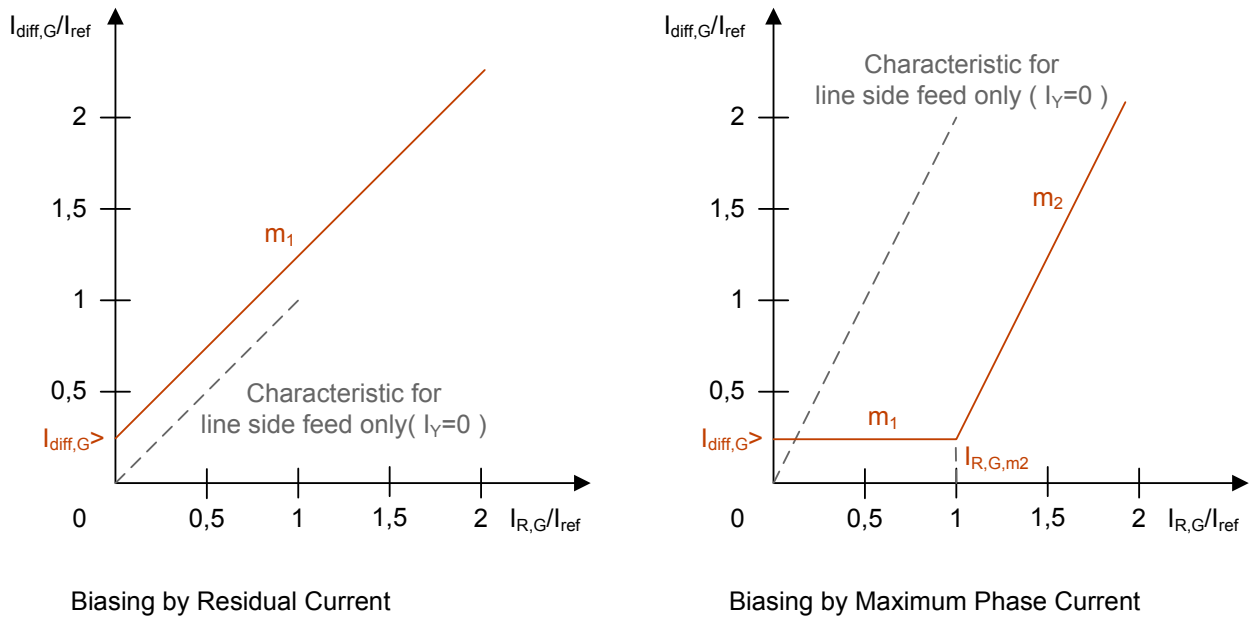



*Figure 5: Tripping Characteristic of the Restricted Earth Fault Protection (Setting Parameters see „Address List“)*

## Definite-Time Overcurrent Protection

The definite-time overcurrent protection function operates with separate measuring systems for the evaluation of the three phase currents, the negative-sequence current and the residual current. The negative-sequence current is determined from the filtered fundamental component of the three phase currents. The residual current is obtained either from the fourth current input or from the internal vector addition of the three phase currents, depending on the user's choice. Three stages each are provided for the three phase measuring systems. Each stage of the phase current-related measuring system operates with phase-selective starting. The effect on the general starting signal of the stages measuring in the negative-sequence system and in the residual path, respectively, can be suppressed if preferred.

For the optimum performance of the differential protection function under inrush conditions of the protected transformer, starting of the phase current stage I> and the negative-sequence current stage $I_{neg}$> can be stabilized, if desired.

The blocking signals of the inrush stabilization function of differential protection are selective to the measuring system. These signals are linked by OR operators to obtain the criterion for stabilization. As a consequence, stabilization is always effective across all three phases. Neither the phase current stages I>> and I>>> nor the negative-sequence current stages $I_{neg}$>> and $I_{neg}$>>> are affected by the stabilization.

Additionally, the operate values of all overcurrent stages can be set as dynamic parameters. For a settable hold time, switching to the dynamic operate values can be done via an external signal. Once the hold time has elapsed, the static operate values are reinstated.

## Inverse-Time Overcurrent Protection

The inverse-time overcurrent protection operates on the basis of one measuring system each for the three phase currents, the negative-sequence current and the residual current just as the definite-time overcurrent protection does. The three measuring systems operate with single-stage evaluation for this function, however. The timer stage of the phase-current-related measuring system operates with phase-selective starting. The effect on the general starting signal of the stages measuring in the residual path and in the negative-sequence system, respectively, can be suppressed if desired.

For the individual measuring systems, the user can select from a multitude of tripping characteristics (see figure 6).

Starting of the phase current stage can be stabilized under inrush conditions if desired. The blocking signals from the harmonic restraint function of differential protection - formed selectively for each measuring system - are linked by an OR operator to serve as the criterion. Consequently, this stabilization is always effective across all three phases.

Intermittent startings of the phase, negative sequence or residual current stage can be accumulated on the basis of the set tripping characteristic by means of a settable hold time. Tripping is also performed in accordance with the relevant tripping characteristic.

Additionally, the operate values of all overcurrent stages can be set as dynamic parameters. For a settable hold time, switching to the dynamic operate values can be done via an external signal. Once the hold time has elapsed, the static operate values are reinstated.

| No. | Tripping time characteristic (k = 0.01 to 10.00) | Constants and formulae ($t$ in s) a | b | c | R |
|---|---|---|---|---|---|
| 0 | Definite time | $t = k$ | | | |
| | Per IEC 255-3 | | | | |
| 1 | Normally inverse | 0.14 | 0.02 | $t = k \cdot \frac{a}{\left(\frac{I}{I_{ref}}\right)^b - 1}$ | |
| 2 | Very inverse | 13.5 | 1.00 | | |
| 3 | Extremely inverse | 80 | 2.00 | | |
| 4 | Long time inverse | 120 | 1.00 | | |
| | Per ANSI/IEEE C37.112 | Trip | | | Release |
| 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 | Trip | | | Release |
| 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 |
| | | $t = k \cdot \left[\frac{a}{\left(\frac{I}{I_{ref}}\right)^b - 1} + c\right]$ | | | $t_r = k \cdot \frac{R}{\left(\frac{I}{I_{ref}}\right)^2 - 1}$ |
| | Not per standard | | | | |
| 11 | RI-type inverse | $t = k \cdot \frac{1}{0.339 - \frac{0.236}{\left(\frac{I}{I_{ref}}\right)}}$ | | | |
| | Not per standard | | | | |
| 12 | RXIDG-type inverse | $t = k \cdot \left(5.8 - 1.35 \cdot \ln \frac{I}{I_{ref}}\right)$ | | | |

*Figure 6: Tripping time characteristics of inverse-time overcurrent protection*

## Thermal Overload Protection

Using this function, thermal overload protection can be realized. The highest of the three phase currents serves to track a first-order thermal replica according to IEC 255-8. The tripping time is determined by the set thermal time constant $\tau$ of the protected object and the set tripping level $\Delta\vartheta_{trip}$ and depends on the accumulated thermal load $\Delta\vartheta_0$ :

$$t = \tau \cdot \ln \frac{\left(\frac{I}{I_{ref}}\right)^2 - \Delta\vartheta_0}{\left(\frac{I}{I_{ref}}\right)^2 - \Delta\vartheta_{Trip}}$$

The temperature of the cooling medium can be taken into account in the thermal replica using the optional PT 100 input or the 0 to 20 mA input. The user has a choice of using a thermal replica on the basis of either absolute or relative temperature.

A warning signal can be issued in accordance with the set warning level $\Delta\vartheta_{warning}$.
As an alternative method of generating a warning, the cyclically updated measured operating value of the predicted time remaining before tripping is monitored to check whether it is falling below a set threshold

## Over-/Undervoltage Protection

The over-/undervoltage protection function evaluates the fundamental component of the voltage by way of two definite-time overvoltage and undervoltage stages each.

## Over-/Underfrequency Protection

Over-/underfrequency protection has four stages. Each of these can be operated in one of the following modes:

- Over-/underfrequency monitoring
- Over-/underfrequency monitoring combined with differential frequency gradient monitoring (df/dt) for system decoupling applications
- Over-/underfrequency monitoring combined with medium frequency gradient monitoring ($\Delta f/\Delta t$) for load shedding applications

## Overexcitation Protection

Overexcitation protection detects impermissible high magnetic flux densitiy in the iron core of power transformers which can occur in case of increase in voltage and/or decrease in frequency. Flux density above the rated value saturates the iron core which may result in power transformer overheating due to large iron losses.

Overexcitation protection processes the voltage to frequency ratio (V/f) in relation to their nominal values. The inverse-time characteristic may be set via 12 value pairs and therefore enables accurate adaptation to power transformer data. In addition a definite-time alarm stage and a definite-time tripping stage are available.

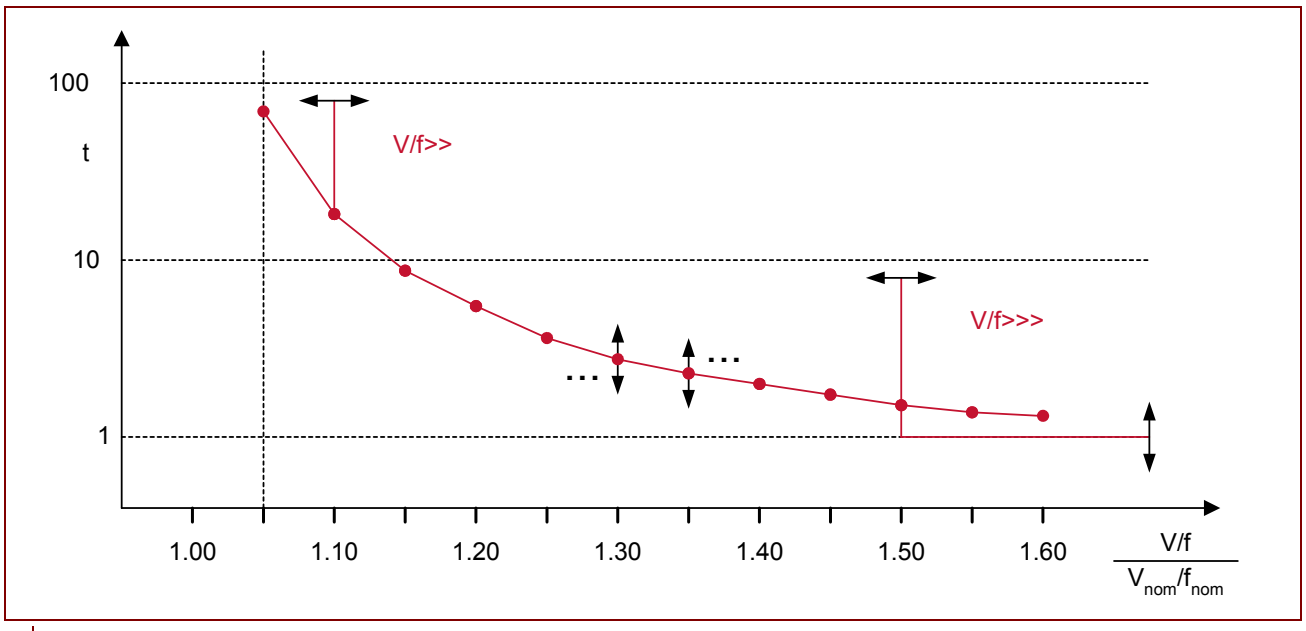



*Figure 7: Tripping Characteristic of the Overexcitation Protection (Setting Parameters see „Address List“)*

## Measuring Circuit Monitoring

The measuring circuit monitoring of the P63x detects and signals unsymmetrical phase-currents, related to each protected winding end. Each MCM_x is linked to one winding. It may be used as a back-up 'broken conductor' protection of the associated feeder.

The monitoring criterion is the ratio of the negative to the positive sequence current. The function operates if the set ratio Ineg/Ipos is exceeded and the positive or the negative sequence current value exceeds 0,02 Inom. After a set time delay a warning signal will be raised.

## Current Transformer Supervision

(Option)

The current transformer supervision (CTS) feature is used to detect failure of one or more of the AC phase current inputs to the relay. Failure of a phase CT or an open circuit of the secondary wiring can lead to incorrect operation of current based protection elements. Additionally, interruption of the CT secondary wiring can induce high voltages presenting a danger to life and insulation. The patent pending CTS scheme is designed on the measurement of the negative and positive sequence current levels at all line ends. The advantage of this scheme is that no additional CT or VT inputs are needed aside from those necessary for biased differential protection, therefore further secondary equipment and wiring is not required. Only for the increased computing power the protection device needs an additional coprocessor module.

The technique used allows application of CTS to any differential protection scheme. Operation is independent of the primary power system configuration, unaffected by transformer winding configuration, load levels, methods of earthing and the like.

CT failure is detected if

- Positive sequence current is above set threshold in at least two ends (current measured at one end only indicates a single-end fed internal fault or a low-load condition, in either case CTS must not operate), and
- High negative sequence current is measured at exactly one end with none or only low levels measured in all other ends.

As soon as a CT failure condition is detected, the function will raise the low set threshold of the differential protection, Idiff>, to the set Idiff>(CTS). This threshold should be set above maximum load current to ensure differential protection will not operate under load conditions, but remains active for higher short-circuit currents, which is predominantly the case for internal faults.

CT failure condition signaling can be delayed by a settable delay timer to prevent signaling under transient system conditions. The signals may be latched once the failure condition has been present for a set minimum time. Signals for each end can be used to selectively block the restricted earth fault (REF) protection associated to that end.

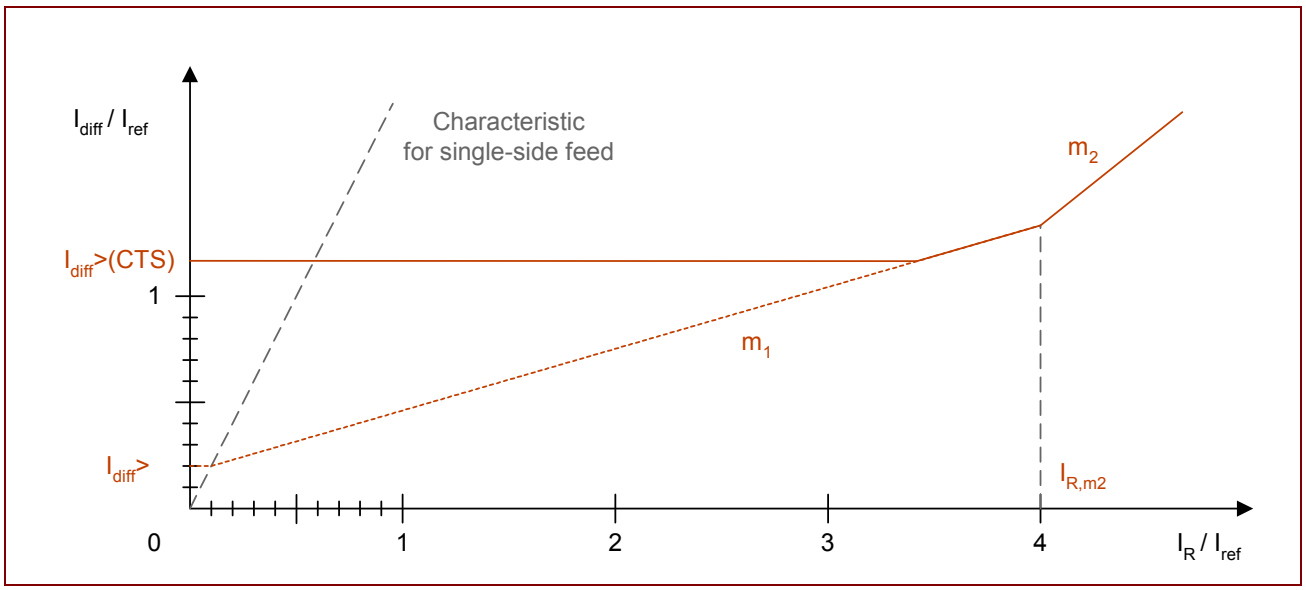



*Figure 8: CTS tripping characteristic (Setting Parameters see „Address List")*

### Limit Monitoring

A multitude of currents, the voltage and the measured temperature are monitored to aid operation of the protected line. This function is not intended to be used for protection purposes, as it has an inherent 1 second delay.

E.g. for the 3-phase currents and the voltage the highest and the lowest value is determined. These are evaluated using an operate value and time delay set by the user. Thereby, these currents and the voltage can be monitored for exceeding an upper limit or falling below a lower limit.

### Programmable Logic

User-configurable logic enables the user to set up logic operations on binary signals within a framework of Boolean equations. By means of a straightforward configuration procedure, any of the signals of the protection device can be linked by logic ‘OR’ or ‘AND’ operations with the possibility of additional negation operations.

The output signal of an equation can be fed into a further, higher-order equation as an input signal thus leading to a set of interlinked Boolean equations.

The output signal of each equation is fed to a separate timer stage with two timer elements each and a choice of operating modes. Thus the output signal of each equation can be assigned a freely configurable time characteristic.

The two output signals of each equation can be configured to each available input signal after logic OR linking. The user-configurable logic function is then able to influence the individual functions without external wiring (block, reset, trigger, for example).

Via non-storable continuous signals, monostable trigger signals and bistable setting/resetting signals, the Boolean equations can be controlled externally via any of the device’s interfaces.

### Measured Data Input

(optional)

The optional analog I/O module provides a 0 to 20 mA input fort he acquisition of externally measured variables such as transducer outputs. The external input characteristics can be linearized via adjustable interpolation points. This feature also provides for an adaption of the range to, for example, 4 to 20 mA or 0 to 10 mA.

The measured variables acquired by the analog measured data input function are monitored for exceeding or falling below set limits. Furthermore, they are used by thermal overload protection function for the acquisition of the coolant temperature

### Meassured Data Output

The protection device provides the options of operating data output a n fault data output. The user can select an output in BCD-coded form through relay contacts or an output in analog form as load-independent current (0 to 20 mA). For an output in BCD-coded form, an appropriate number of free output relays needed to be available. For the current output, a special analog I/O module is required.

## Global Functions

Functions operating globally allow the adaptation of the device’s interfaces to the protected power system, offer support during commissioning and testing and provide continuously updated information on the operation, as well as valuable analysis results following events in the protected system.

### Clock Synchronisation

The device incorporates an internal clock with a resolution of 1ms. All events are time-tagged based on this clock, entered in the recording memory appropriate to their significance and signaled via the communication interface. Alternatively two external synchronisation signals can be used according to the selected communication protocol: using one of the protocols Modbus, DNP3, IEC 60870-5-103, IEC 60870-5-101 the device will be synchronized by a time telegram from a higher-level substation control system or in any other case it will be synchronized using the IRIG-B signal input. The internal clock will then be adjusted accordingly and operate with an accuracy of ±10 ms if synchronized via protocol and ±1ms if synchronized via IRIG-B signal.

### Parameter Subset Selection

The function parameters for setting the protection functions are, to a large extent, stored in four independent parameter subsets. Switching between these alternative setting groups is readily achieved via any of the device´s interfaces.

### Operating Data Recording

For the continuous recording of processes in system operation or of events, a non-volatile ring memory entries is provided. The relevant signals, each fully tagged with date and time at signal start and signal end, are entered in chronological sequence. Included are control actions such as the enabling or disabling of functions as well as local control triggering for testing and resetting. The onset and end of events in the network, as far as these represent a deviation from normal operation (overload or short-circuit, for example) are recorded..

## Overload Data Acquisition

Overload situations in the network represent a deviation from normal system operation and can be permitted for a brief period only. The overload protection functions enabled in the protection and control units recognize overload situations in the system and provide for acquisition of overload data such as the magnitude of the overload current, the relative heating during the overload situation and its duration.

## Overload Recording

While an overload condition persists in the network, the relevant signals, each fully tagged with date and time at signal start and signal end, are entered into a non-volatile memory in chronological sequence. The measured overload data, fully tagged with the date and time of acquisition, are also entered. Up to eight overload situations can be recorded. If more than eight overload situations occur without interim memory clearance then the oldest overload recording is overwritten.

## Fault Data Acquisition

A short-circuit within the network is described as a fault. The acquisition of the measured fault data is determined by the triggering protection function. Beside neutral and phase currents also the differential and restraining currents of all 3 measuring systems of the differential and of restricted earth-fault protection are provided.

## Fault Recording

Fault recording comprises event and disturbance recording along with the stored fault measurands.

While a fault condition persists in the power system, the relevant signals, each fully tagged with date and time at signal start and signal end, are entered into a non-volatile memory in chronological sequence . The measured fault data, fully tagged with the date and time of acquisition, are also entered. Furthermore, the sampled values of all analog input variables such as phase currents and phase-to-ground voltages are recorded during a fault.

Up to eight faults can be recorded. If more than eight faults occur without interim memory clearance then the oldest fault recording is overwritten.

## Self-Monitoring

Comprehensive self-monitoring procedures within the devices ensure that internal hardware or software errors are detected and do not cause malfunctions of the protective devices.
As the auxiliary voltage is turned on, a functional test is carried out. Cyclic self-monitoring tests are run during operation. If test results deviate from the default value then the corresponding signal is entered into the non-volatile monitoring signal memory. The result of the fault diagnosis determines whether a blocking of the protection device will occur or whether a warning only is issued.

## Control

All data required for operation of the protection unit are entered from the integrated local control panel, and the data important for system management are read out there as well. The following tasks can be handled via the local control panel:

- Readout and modification of settings
- Readout of cyclically updated measured operating data and state signals
- Readout of operating data logs and of monitoring signal logs
- Readout of event logs (after overload situations, ground faults or short-circuits in the power system)
- Resetting of the unit and triggering of further control functions designed to support testing and commissioning tasks

The local control panel shown in Figure 9 comprises the local control elements and functions described below.

### Operation

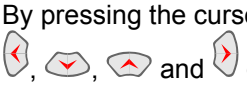
(1) The integrated local control panel has an LCD display with 4x20 alphanumeric characters.

17 LED indicators are provided for signal display.

(2) 5 LED indicators are permanently assigned to signals.

(3) The remaining 12 LED indicators are available for free assignment by the user. A separate adhesive label is provided for user-defined labeling of these LED indicators according to the chosen configuration.

### Menu Tree

(4) By pressing the cursor keys  , guided by the LCD display, the user moves within a plain text menu. All setting parameters and measured variables as well as all local control functions are arranged in this menu which is standardized for all devices of the system.

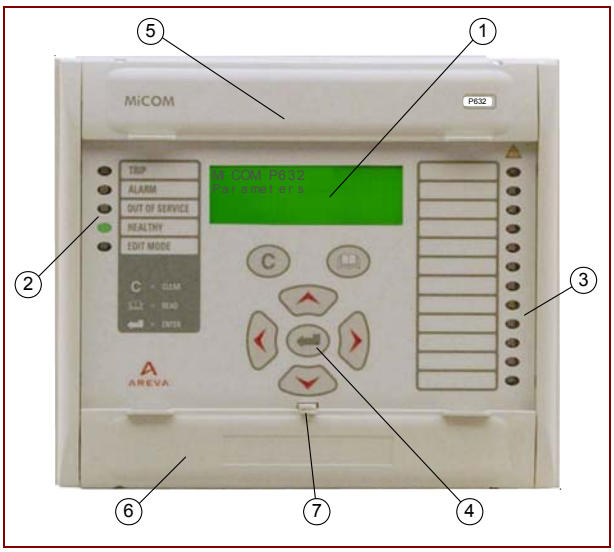



*Figure 9: Local Control Panel*

Changes to the settings can be prepared and confirmed by means of the ENTER key which also serves to trigger local control functions. In the event of erroneous entries, exit from the EDIT MODE with rejection of the entries is possible at any time by means of the CLEAR key C When the EDIT MODE is not activated, pressing the CLEAR key has the effect of resetting the indications. Pressing the READ key provides direct access to a preselected point in the menu

### Device Identification, Ports

(5) An upper cover identifying the product name. The cover may be raised to provide access to the product model number and ratings.

(6) A lower cover concealing the RS232 front port to connect a personal computer.

(7) To guard the lower cover against unauthorized opening it is provided a facility for fitting a security lead seal..

#### Measured Value Panels

The configuration of the local control panel allows the installation of measured value `Panels`on the LCD display. The Panels automatically for certain operation conditions of the system. Priority increases from normal operation to operation under overload conditions and finally operation following a short-circuit in the system. The protection device thus provides the measured value data relevant for the prevailing conditions.

#### Password Protection

Access barriers protect the enter mode in order to guard against inadvertent or unauthorized changing of parameter settings or triggering of control functions.

## Mechanical Design

The devices are supplied in two case designs.

> Surface-mounted case

> Flush-mounted case

With both case designs, connection is via threaded terminal ends with the option of either pin-terminal or ring-terminal connection.
Two 40TE flush-mounted cases can be combined to form a complete 19" mounting rack.

Figure 10 shows the modular hardware structure of the devices. The plug-in modules can be combined to suit individual requirements. The device itself can identify the fitted modules. During each startup, the number and type of fitted modules are identified and checked for compliance with the permissible configurations. As as function of the components actually fitted, the corresponding configuration parameters are then enabled for application.

### Transformer Module T

The transformer modules convert the measured current and voltage variables to the internal processing levels and provide for electrical isolation.

### Processor Module P

The processor module performs the analog/digital conversion of the measured variables as well as all digital processing tasks.

### Local Control Module L

The local control module encompasses all control and display elements as well as a PC interface. The local control module is located behind the front panel and connected to the processor module via a ribbon cable.

### Bus Modules B

Bus modules are printed circuit boards (PCBs). They provide the electrical connection between the other modules. Two types of bus modules are used, namely the analog- and the digital-bus PCB.

### Communication Module A

The optional communication module provides one or two serial information interfaces for the integration of the protection device into a substation control system and for remote access. The communication module with serial communication interface(s) is plugged into the processor module.

### Binary I/O Modules X

The binary I/O modules are equipped with optical couplers for binary signal input as well as output relays for the output of signals and commands or combinations of these.

### Analog Module Y

The analog module is fitted with a PT 100 input, a 20 mA input and two 20 mA outputs. One output relay each is assigned to two 20 mA outputs. One output relay each is assigned to the two 20 mA outputs. Additionally, four optical coupler inputs are available.

### Power Supply Module V

The power supply module ensures the electrical isolation of the device as well as providing the power supply. Depending on the chosen design version, optical coupler inputs and output relays are provided in addition.

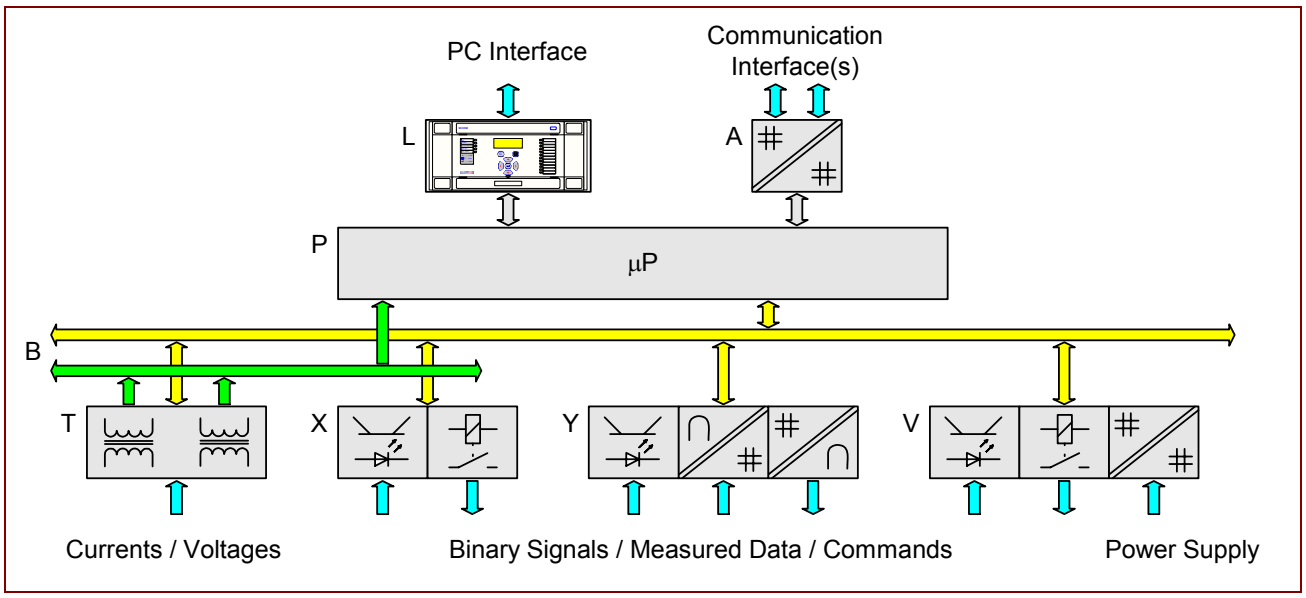



*Figure 10: System Structure*

# Technical Data

## General Data

### Design

Surface-mounted case suitable for wall installation or flush-mounted case for 19" cabinets and for control panels

### Installation position

Vertical ±30°

### Degree of Protection

Per DIN VDE 0470 and EN 60529 or IEC 529.
IP 52; IP 20 for the rear connection area of the flush-mounted case

### Weight

Case 40 TE: ca. 7 kg
Case 84 TE: ca. 11 kg

**Dimensions**
See “Dimensions”

**Terminal Connection Diagrams**
See “Connections”

### Terminals

**PC Interface (X6)**
DIN 41652 connector ,
type D-Sub, 9-pin

**Communication Interface**
Optical fibers (X7, X8):
F-SMA-interface per DIN 47258
or IEC 874-2 per plastic fibers
or
BFOC-(ST®)-interface 2.5 per DIN 47254-1
or IEC 874-10 per glass fiber
or
Leads (X9, X10, X33):
Threaded terminal ends M2
for wire cross-sections up to 1.5 mm².

**IRIG-B Interface** (X11)
BNC plug

**Current-Measuring Inputs (conventioal)**
Threaded terminals for pin-terminal connection:
Threaded terminal ends M5,
self-centering with wire protection for
conductor cross sections of ≤ 4 mm²
or
Threaded terminals M4 for ring-terminal connection

**Other Inputs and Outputs**
Threaded terminals for pin-terminal connection:
Threaded terminal ends M3,
self-centering with wire protection for
conductor cross sections of 0,2 to 2,5 mm²
or
Threaded terminals M4 for ring-terminal connection

### Creepage Distance and Clearance

Per EN 61010-1 and IEC 664-1,
pollution degree 3,
working voltage 250 V,
overvoltage category III,
impulse test voltage 5 kV

## Tests

### Type Test

Tests according to EN 60255-6 or IEC 255-6

### EMC

**Interference Suppression**
Per EN 55022 or IEC CISPR 22, Class A

**1-MHz-Burst Disturbance Test**
Per IEC 255 Part 22-1 bzw. IEC 60255-22-1, Class III,
Common-mode test voltage: 2,5 kV,
Differential test voltage: 1,0 kV,
Test duration: > 2 s, Source impedance: 200 Ω

**Immunity to Electrostatic Discharge**
Per EN 60255-22-2 or IEC 60255-22-2, Level 3,
Contact discharge, single discharges : > 10,
Holding time: > 5 s, Test voltage: 6 kV,
Test generator: 50...100 MΩ, 150 pF / 330 Ω

**Immunity to Radiated Electromagnetic Energy**
Per EN 61000-4-3 and ENV 50204, Level 3,
Antenna distance to tested device: > 1 m on all sides,
Test field strength, frequ. band 80...1000 MHz: 10 V / m,
Test using AM: 1 kHz / 80 %,
Single test at 900 MHz: AM 200 Hz / 100 %

**Electrical Fast Transient or Burst Requirements**
Per IEC 60255-22-4 Test severity Level 4,
Rise time of one pulse t: 5 ns,
Impulse duration (50% value): 50 ns,
Amplitude: 4 kV / 2 kV, resp.,
Burst duration: 15 ms, Burst period: 300 ms ,
Burst frequency: 2,5 kHz, Source impedance: 50 Ω

**Surge immunity Test**
Per EN 61000-4-5 or IEC 61000-4-5, Level 4,
Testing of power supply circuits,,
unsymmetrically / symmetrically operated lines,
Open-circuit voltage front time/time to half-value: 1,2 / 50 µs,
Short-circuit current front time/time to half-value: 8 / 20 µs,
Amplitude: 4 / 2 kV, Pulse frequency: > 5 / min,
Source impedance: 12 / 42 Ω

**Immunity to Conducted Disturbances Induced by Radio Frequency Fields**
Per EN 61000-4-6 or IEC 61000-4-6, Level 3,
Disturbing test voltage: 10 V

**Power Frequency Magnetic Field Immunity**
Per EN 61000-4-8 or IEC 61000-4-8, Level 4,
Frequency: 50 Hz, Test field strength: 30 A / m

**Alternating Component (Ripple) in DC Auxilliary Energizing Quantity**
Per IEC 255-11, 12 %

### Insulation

**Voltage Test**
Per IEC 255-5 or DIN EN 61010, 2 kV~, 60 s
For the voltage test of the power supply inputs,
direct voltage (2,8 kV DC) must be used.
The PC Interface must not be subjected to the voltage test.

**Impulse Voltage Withstand Test**
Per IEC 255-5,
Front time: 1,2 µs, Time to half-value: 50 µs,
Peak value: 5 kV, Source impedance: 500 Ω

### Mechanical Robustness

**Vibration Test**
Per EN 60255-21-1 or IEC 255-21-1, Test severity class 1,
Frequency range in operation:
10..60 Hz, 0,035 mm,
60..150 Hz, 0,5 g,
Frequency range during transport:
10...150 Hz, 1 g

**Shock Response and Withstand Test, Bump Test**
Per EN 60255-21-2 or IEC 255-21-2, Test severity class 1,
Acceleration: 5 g/15 g, Pulse duration 11 ms

**Seismic Test**
Per EN 60255-21-3 or IEC 255-21-3,
Test procedure A, Class 1,
Frequency range:
5...8 Hz, 3,5 mm / 1,5 mm,
8...35 Hz, 10 / 5 m/s²
3 × 1 cycle

### Routine Test

Test per EN 60255-6 or IEC 255-6

**Voltage Test**
Per IEC 255-5, 2,2 kV AC, 1 s
For the voltage test of the power supply inputs,
direct voltage (2,8 kV DC) must be used.
The PC Interface must not be subjected to the voltage test.

**Additional Thermal Test**
100 % controlled thermal endurance test, inputs loaded.

## Environmental Conditions

### Ambient Temperature Range

Recommended temperature range:
–5 °C...+55 °C, or +23 °F...+131 °F
Limit temperature range:
–25 °C...+70 °C ,or -13 °F...+158 °F

### Ambient Humidity Range

≤ 75 % relative humidity (annual mean),
up to 56 days at ≤ 95 % relative humidity and 40 °C,
condensation not permissible

### Solar Radiation

Avoid exposure of the front panel to direct solar radiation.

## Ratings

### Measurement Inputs

Nominal frequency $f_{nom}$: 50 Hz and 60 Hz (settable)
Operating range: 0,95...1,05 $f_{nom}$
Over-/Underfrequency Protection: 40…70 Hz
Overexcitation Protection: 0,5…1,5 $f_{nom}$

**Current**
Nominal current $I_{nom}$: 1 A and 5 A (settable)
Nominal consumption per phase: < 0,1 VA at $I_{nom}$
Load ratingel:
continuous: 4 $I_{nom}$
for 10 s: 30 $I_{nom}$
for 1 s: 100 $I_{nom}$
Nominal surge current: 250 $I_{nom}$

**Voltage**
Nominal voltage $V_{nom}$: 50...130 V AC (settable)
Nominal consumption per phase: < 0,3 VA at $V_{nom}$=130 V AC
Load rating: continuous 150 V AC

### Binary Signal Inputs

Max. permissible voltage: 300 V DC

**Switching threshold (as per order option)**
Standard variant: 18V ($V_{A,nom}$: 24 ... 250 V DC):
Switching threshold range 14 V ... 19 V DC

Special variant with switching thresholds from
58 ... 72 % of the nominal supply voltage ($V_{A,nom}$)
(definitively "low" at $V_A$ < 58 % of the nominal supply voltage,
definitively "high" at $V_A$ > 72 % of the nominal supply voltage):
"Special variant 73 V": nominal supply voltage 110 V DC
"Special variant 90 V": nominal supply voltage 127 V DC
"Special variant 146 V": nominal supply voltage 220 V DC
"Special variant 155 V": nominal supply voltage 250 V DC

**Power Consumption (as per order option)**:
Standard variant:
$V_A$ = 19...110V DC : 0,5 W +/-30%
$V_A$ > 110V DC : $V_A$ * 5 mA +/- 30 %

Special variants:
$V_A$ > switching threshold: $V_A$ * 5mA +/-30 %

### Analog Inputs and Outputs

**Direct Current Input**
Input current: 0...26 mA
Value range 0,00...1,20 $I_{DC,nom}$ ($I_{DC,nom}$ = 20 mA)
Maximum permissible continuous current: 50 mA
Maximum permissible input voltage: 17 V
Input load: 100 Ω
Open-circiut monitoring: 0...10 mA (adjustable)
Overload monitoring: > 24.8 mA
Zero suppression:
0,000...0,200 $I_{DC,nom}$ (adjustable)

**Resistance Temperature Detector**
For analog module only PT 100 permitted,
Value range: -40...+215 °C
3-wire configuration: max. 20 Ω per conductor
open and short-circuit input permitted
Open circuit monitoring:
Θ > +215 °C (or Θ > +419 °F) and
Θ < -40 °C (or Θ > -40 °F)

**Direct Current Output**
Output current: 0 … 20 mA
Maximum permissible load: 500 Ω
Maximum output voltage: 15 V

## IRIG-B Interface

Min./max. input voltage level (peak-peak): 100 mVpp / 20 Vpp
Input impedance: 33 kΩ at 1 kHz
Galvanic isolation: 2 kV

**Output Relays**
Rated voltage: 250 V DC, 250 V AC
Continuous current: 5 A
Short-duration current: 30 A for 0,5 s
Making capacity: 1000 W (VA) at L/R = 40 ms
Breaking capacity:
0,2 A at 220 V DC and L/R = 40 ms,
4 A at 230 V AC and cos φ = 0,4

## Power Supply

**Nominal Auxiliary Voltage**
$V_{A,nom}$: 48…250 V DC and 100...230 V AC or
$V_{A,nom}$: 24 V DC (depends on ordering)

**Operating Range**
for direct voltage: 0,8…1,1 $V_{A,nom}$
with a residual of up to 12 % of $V_{A,nom}$
for alternating current: 0,9…1,1 $V_{A,nom}$

**Nominal Consumption**
at $V_A$ = 220 V DC and maximum number of modules fitted
in case 40TE:
Inital position approx.: 13 W
Active position approx.: 29 W
in case 84TE:
Inital position approx.: 13 W
Active position approx.: 37 W

**Start-Up Peak Current**
< 3 A, duration 0,25 ms

**Stored-Energy Time**
≥ 50 ms for interruption of $V_A$ ≥ 220 V DC

## PC-Interface

Transmission rate: 300...115200 Baud (settable)

## Communication Interface

**Communication Interface COMM1:**
Protocol per order either IEC 60870-5-103
or can be switched between
IEC 60870-5-103, IEC 870-5-101,
Modbus, DNP 3.0 (Option)
Transmission speed: 300...64000 bit/s (settable)

**Communication Interface COMM2:**
Protokcol per IEC 60870-5-103
Transmission speed: 300...57600 bit/s (settable)

**Wire Leads**
Per RS 485 or RS 422, 2 kV-isolation
Distance to be bridged:
peer to peer link: max. 1200 m
multi-endpoint link: max. 100 m

**Plastic Fiber Connection**
Optical wavelength : typ. 660 nm
Optical output: min. – 7,5 dBm
Optical sensivity: min. – 20 dBm
Optical input: max. – 5 dBm
Distance to be bridged: max. 45 m [1)]

**Class Fiber Connection G 50/125**
Optical wavelength : typ. 820 nm
Optical output: min. – 19,8 dBm
Optical sensivity: min. – 24 dBm
Optical input: max. – 10 dBm
Distance to be bridged: max. 400 m [1)]

**Class Fiber Connection G 62,5/125**
Optical wavelength : typ. 820 nm
Optical output: min. – 16 dBm
Optical sensivity: min. – 24 dBm
Optical input: max. – 10 dBm
Distance to be bridged: max. 1400 m [1)]

**IRIG-B-Interface**
Format B122, Amplitude modulated
1 kHz carrier signal, BCD time-of-year code

[1)] Distance to be bridged for optical outputs and inputs that are equal on both ends, taking into account a system reserve of 3 dB and typical fiber attenuation.

## Typical Characteristic Data

**Main Function**
Minimum output pulse for a trip command:
0,1 … 10 s (settable)

**Differential Protection**
Tripping time:
≤ 16 ms without inrush stabilisation or Idiff > Idiff>>
≤ 32 ms with inrush stabilisation

**Definite Time and Inverse Time Overcurrent Protection**
Operate time inclusive of output relay (measured variable from 0 to 2-fold operate value):
≤ 40 ms, approx. 30 ms
Reset time (measured variable from 0 to 2-fold operate value):
≤ 40 ms, approx. 30 ms
Starting resetting ratio: approx. 0,95

**Over-/Undervoltage Protection**
Operate time inclusive of output relay (measured variable from nominal value to 1,2-fold operate value or measured variable from nominal value to 0,8-fold operate value):
≤ 40 ms, approx. 30 ms
Reset time (measured variable from nominal value to 1,2-fold operate value or measured variable from nominal value to 0,8-fold operate value):
≤ 45 ms, approx. 30 ms
Starting resetting ratio: settable hysteresis 1...10 %

**Overexcitation Protection**
Starting resetting ratio: approx. 0,95

## Deviations of the Operate Values

´Reference Conditions`
Sinusoidal signals with nominal frequency $f_{nom}$,
total harmonic distortion ≤ 2 %,
ambient temperature 20°C and
nominal auxiliary voltage $V_{A,nom}$.

´Deviation`
Deviation relative to the set value under reference conditions

**Differential Protection**
Measuring system
at Id ≥ 0,2 Iref: ± 5 %
Harmonic restraint: ± 10 %

**Restricted Earthfault Protection**
Measuring system
at Id ≥ 0,2 Iref: ± 5 %

**Overcurrent-Time Protection**
Operate Values: ± 5 %

**Thermal Overload Protection**
Operate Value Θ: ± 5 %

**Over-/Underfrequency Protection**
Operate Values f<>: +/- 30mHz (fnom = 50 Hz)
+/- 40mHz (fnom = 60 Hz)
Operate Values df/dt: +/- 0,1Hz/s (fnom = 50 or 60 Hz)

**Over-/Undervoltage Protection**
Operate Values V<>: ± 1 % (setting 0,6…1.4 Vnom)

**Overexcitation Protection**
Operate Values: ± 3 %

## Deviations of the Timer Stages

´Reference Conditions`
Sinusoidal signals with nominal frequency $f_{nom}$,
total harmonic distortion ≤ 2 %,
ambient temperature 20°C and
nominal auxiliary voltage $V_{A,nom}$.

´Deviation`
Deviation relative to the set value under reference conditions

**Definite-Time Stages**
± 1% + 20...40 ms

**Inverse-Time Stages**
± 5 % + 10...25 ms (measured variable greater than 2 Iref)

for IEC characteristic, extremely inverse‘ and for thermal overload protection and V/f characteristic:
± 7,5 % + 10...20 ms

for frequency protection:
± 1% + up to 80 ms (depending on evaluation time setting)

## Deviations in Measured Data Aquisiton

´Reference Conditions`
Sinusoidal signals with nominal frequency $f_{nom}$,
total harmonic distortion ≤ 2 %,
ambient temperature 20°C and
nominal auxiliary voltage $V_{A,nom}$.

´Deviation`
Deviation relative to the relevant nominal value under reference conditions

**Operating Data**
Currents / measuring inputs: ±1%
Voltages / measuring inputs: ± 0,5 %
Currents / internally calculated: ± 2 %
Voltages / internally calculated: ± 2 %
Frequency: ± 10 mHz

**Fault Data**
Phase and neutral/starpoint currents: ± 3 %
Restraining and differential currents: ± 5 %

**Internal Clock**
With free running internal clock: < 1 min. / month
With external synchronization
via protocol, synch. interval ≤ 1 min: < 10 ms
via IRIG-B signal input: ± 1 ms

## Resolution in Fault Data Aquisition

**Time Resolution**
20 sampled values per period

**Currents**
Dynamic range: 33 $I_{nom}$
Amplitude resolution
at $I_{nom}$ = 1 A: 2.0 $mA_{r.m.s.}$
at $I_{nom}$ = 5 A: 10.1 $mA_{r.m.s.}$

**Voltage**
Dynamic range: 150 V
Amplitude resolution: 9,2 $mV_{r.m.s.}$

# Adress List

## Function Parameters

### Global Functions

**PC Link (PC):**
Command blocking: No/Yes
Sig./meas.val.block.: No/Yes

**Communication Link 1 (COMM1):**
Command block. USER: No/Yes
Sig./meas.val.block.USER: No/Yes

**Communication Link 2 (COMM2):**
Command block. USER: No/Yes
Sig./meas.val.block.USER: No/Yes

**Binary and Analog Output (OUTP):**
Outp.rel.block USER: No/Yes

**Main Function (MAIN):**
Protection enabled: No (= off) / Yes (= on)
Test mode USER: No/Yes
Nominal frequ. fnom: 50 Hz / 60 Hz
Phase sequence: A - B - C / A - C - B
Inom C.T. prim.,end a: 1...50000 A
Inom C.T. prim.,end b: 1...50000 A
Inom C.T. prim.,end c: 1...50000 A
Inom C.T. prim.,end d: 1...50000 A
Inom C.T. Yprim.,end a: 1...50000 A
Inom C.T. Yprim.,end b: 1...50000 A
Inom C.T. Yprim.,end c: 1...50000 A
Vnom V.T. prim.: 0,1...1500,.0 kV
Inom device, end a: 1,0 A/5,0 A
Inom device, end b: 1,0 A/5,0 A
Inom device, end c: 1,0 A/5,0 A
Inom device, end d: 1,0 A/5,0 A
IY,nom device, end a: 1,0 A/5,0 A
IY,nom device, end b: 1,0 A/5,0 A
IY,nom device, end c: 1,0 A/5,0 A
Vnom V.T. sec.: 50...130 V
Conn. Meas.circ. IP,a: Standard / Opposite
Conn. Meas.circ. IP,b: Standard / Opposite
Conn. Meas.circ. IP,c: Standard / Opposite
Conn. Meas.circ. IP,d: Standard / Opposite
Conn. Meas.circ. IY,a: Standard / Opposite
Conn. Meas.circ. Iy,b: Standard / Opposite
Conn. Meas.circ. IY,c: Standard / Opposite
Meas. Value rel. IP: 0,00...0,20 Inom
Meas. Value rel. Ineg: 0,000…0,200 Inom
Meas. Value rel. Ipos: 0,000…0,200 Inom
Meas. Value rel. IN: 0,000...0,200 Inom
Meas. Value rel. IY: 0,000...0,200 IN,nom
Meas. Value rel. V: 0,00...0,20 Vnom
Settl. T. IP,max,del: 0,1...60,0 min
Fct. assign. block. 1: see selection table
Fct. assign. block. 2: see selection table
Fct. assign. block. 3: see selection table
Fct. assign. block. 4: see selection table
Trip cmd.block. USER: No/Yes
Fct. assign. trip cmd. 1: see selection table
Fct. assign. trip cmd. 2: see selection table
Fct. assign. trip cmd. 3: see selection table
Fct. assign. trip cmd. 4: see selection table
Min.dur. trip cmd. 1: 0,10...10,00 s
Min.dur. trip cmd. 2: 0,10...10,00 s
Min.dur. trip cmd. 3: 0,10...10,00 s
Min.dur. trip cmd. 4: 0,10...10,00 s
Latching trip cmd. 1: No/Yes
Latching trip cmd. 2: No/Yes
Latching trip cmd. 3: No/Yes
Latching trip cmd. 4: No/Yes
Fct. assign. fault: see function table

**Parameter Subset Selection (PSS)**:
Control via USER: No/Yes
Param.subs.sel. USER:
- Parameter subset 1
- Parameter subset 2
- Parameter subset 3
- Parameter subset 4

Keep time: 0.000...65.000 s / Blocked

**Self-Monitoring (SFMON):**
Fct. assign. warning: see selection table
Mon.sig. retention: 0...240 h / Blocked

**Fault Recording (FT_RC):**
Fct. assign. trigger: see selection table
Id>: 0,01...30,00 Iref / Blocked
IR>: 0,01...30,00 Iref / Blocked
Pre-fault time: 1...50 Periods
Post-fault time: 1...50 Periods
Max. recording time: 5...300 Periods

### General Functions

**Main Function (MAIN):**
Vnom prim., end a: 0,1...1500,0 kV
Vnom prim., end b: 0,1...1500,0 kV
Vnom prim., end c: 0,1...1500,0 kV
Vnom prim., end d: 0,1...1500,0 kV
Evaluatiom IN, end a: Calculated / Measured
Evaluatiom IN, end b: Calculated / Measured
Evaluatiom IN, end c: Calculated / Measured
Current summation:
- Without
- End (a) + end (b)
- End (a) + end (c)
- End (a) + end (d)
- End (b) + end (c)
- End (b) + end (d)
- End (c) + end (d)
- End (a) + end (b) + end (c)
- End (a) + end (b) + end (d)
- End (a) + end (c) + end (d)
- End (b) + end (c) + end ( d)
- End (a) – end (b)
- End (a) – end (c)
- End (a) – end (d)
- End (b) – end (c)
- End (b) – end (d)
- End (c) – end (d)

Hold time dyn.param.: 0,00...100,00 s / Blocked

**Differential Protection (DIFF):**
General enable USER: No/Yes
Reference power Sref: 0,1...5000,0 MVA
Ref. curr. Iref,a: 0,000...50,000 kA
Ref. curr. Iref,b: 0,000...50,000 kA
Ref. curr. Iref,c: 0,000...50,000 kA
Ref. curr. Iref,d: 0,000...50,000 kA
Matching fact. kam,a: 0,000...5,000
Matching fact. kam,b: 0,000...5,000
Matching fact. kam,c: 0,000...5,000
Matching fact. kam,d: 0,000...5,000
Vector grp. ends a-b: 0...11
Vector grp. ends a-c: 0...11
Vector grp. ends a-d: 0...11
Meas. value rel. Id: 0,000...0,200 Iref
Meas. value rel. IR: 0,000...0,200 Iref

**Restricted Earth-Fault Protection (REF_1,REF_2,REF_3):**
General enable USER: No/Yes
Select. meas. input : End a/ End b/ End c
Reference power Sref: 0,1...5000,0 MVA
Ref. curr. Iref: 0,000...50,000 kA
Matching fact. kam,N: 0,000...50,000
Matching fact. kam,Y: 0,000...50,000
Meas. value rel. Id: 0,00...0,20 Iref
Meas. value rel. IR: 0,00...0,20 Iref

**Definite-Time Overcurrent Protection (DTOC1, DTOC2, DTOC3):**
General enable USER: No/Yes
Select. meas. input:
End a/ End b/ End c/ End d/ Current summation

**Inverse-Time Overcurrent Protection (IDMT1, IDMT2, IDMT3):**
General enable USER: No/Yes
Select. meas. input:
End a/ End b/ End c/ End d/ Current summation

**Thermal Overload Protection (THRM1, THRM2):**
General enable USER: No/Yes
Select. meas. input:
End a/ End b/ End c/ End d/ Current summation
Operating mode: Absolute replice / Relative replice
O/T f.Iref persist x: -40…300 °C

**Over-/Undervoltage Protection (V<>):**
General enable USER: No/Yes

**Over-/Underffrequency Protection (f<>):**
General enable USER: No/Yes
Evaluation time : 3...6 Periods
Undervolt.block.V<: 0,20...1,00 Vnom

**Overfluxing Protection (V/f):**
General enable USER: No/Yes

**Current Transformer Supervision (CTS):**
General enable USER: No/Yes

**Measuring-Circuit Monitoring (MCM_1, MCM_2, MCM_3, MCM_4):**
General enable USER: No/Yes
Select. meas. input:
End a/ End b/ End c/ End d/ Current summation

**Limit Value Monitoring (LIMIT):**
General enable USER: No/Yes
IDC,lin>: 0,100...1,100 IDC,nom / Blocked
IDC,lin>>: 0,100...1,100 IDC,nom / Blocked
tIDC,lin>: 0,00...20,00 s / Blocked
tIDC,lin>>: 0,00...20,00 s / Blocked
IDC,lin<: 0,100...1,100 IDC,nom / Blocked
IDC,lin<<: 0,100...1,100 IDC,nom / Blocked
tIDC,lin<: 0,00...20,00 s / Blocked
tIDC,lin<<: 0,00...20,00 s / Blocked
T>: -20...200 °C
T>>: -20...200 °C
tT>: 0...1000 s / Blocked
tT>>: 0...1000 s / Blocked
T<: -20...200 °C
T<<: -20...200 °C
tT<: 0...1000 s / Blocked
tT<<: 0...1000 s / Blocked

**Limit Value Monitoring (LIM_1, LIM_2, LIM_3):**
General enable USER: No/Yes
Select. meas. input:
End a/ End b/ End c/ End d/ Current summation
I>: 0,20...4,00 Inom / Blocked
I>>: 0,20...4,00 Inom / Blocked
tI>: 0...100 s / Blocked
tI>>: 0...100 s / Blocked
I<: 0,00…4,00 Inom
I<<: 0,00…4,00 Inom
tI<: 0...100 s / Blocked
tI<<: 0...100 s / Blocked

**Programmable Logic (LOGIC):**
General enable USER: No/Yes
*Valid for für y = ‚1' to ‚8':* Set y USER: No/Yes
Valid for *y = ‚1' to ‚32':*
Fct.assignm. outp. y: see selection table
Op. mode t output y:
Without timer stage
Oper./release.delay.
Oper.del./puls.dur
Op./rel.delay,retrig
Op.del./puls.dur.,rt
Minimum time
Time t1 output y: 0,00...600,00 s
Time t2 output y: 0,00...600,00 s
Sig.assig. outp. y: see selection table
Sig.assig. outp. y(t): see selection table

## Parameter Subset

(valid for parameter subsets x = = ‚1' to ‚4':

**Differential Protection (DIFF):**
Enable PSx: No/Yes
Idiff> PSx: 0,10...2,50 Iref
Idiff>> PSx: 2,5...30 Iref
Idiff>>> PSx: 2,5...30 Iref
Idiff>(CTS) PSx: 0,10...30,00 Iref
m1 PSx: 0,10...1,50
m2 PSx: 0,10...1,50
IR,m2 PSx: 1,5...10,0 Iref
Op. Mode rush rst.PSx:
Without
Not phase-selective
Phase selective
RushI(2f0)/I(f0) PSx: 10...50 %
0-seq. filt.a en.PSx: No/Yes
0-seq. filt.b en.PSx: No/Yes
0-seq. filt.c en.PSx: No/Yes
0-seq. filt.d en.PSx: No/Yes
Overflux.bl. en.PSx: No/Yes
Ov. I(5f0)/I(f0) PSx: 10...80 %
Op.del.,trip sig.PSx: 0,00…100 s
Hyst. effective PSx: No/Yes

**Restricted Earth-Fault Protection (REF_1,REF_2,REF_3):**
Enable PSx: No/Yes
Operating mode PSx:
Low imped. / sum (IP)
Low imped. / IP,max
High impedance
CTS effective PSx: No/Yes
Idiff> PSx: 0,10...1,00 Iref
Idiff>>> PSx: 2,5...30,0 Iref
m1 PSx: 0,00…1,00
m2 PSx: 0,15…1,50
IR,m2 PSx: 0,10…1,50 Iref

**Definite-Time Overcurrent Protection (DTOC1, DTOC2, DTOC3):**
Enable PSx: No/Yes
Block tim.st. IN PSx:
  Without
  For single-ph. start
  For multi-ph. start
Gen.starting mode PSx:
  W/o start IN/Ineg
  With start IN/Ineg
tGS PSx: 0,00...100,00 s / Blocked
Rush restr.enabl. PSx: No/Yes
*Valid for y = ‚>' to ‚>>>':*
  Iy PSx: 0,10...30,00 Inom / Blocked
  Iy dynamic PSx: 0,10...30,00 Inom / Blocked
  tIy PSx: 0,00...100,00 s / Blocked
  Ineg y PSx: 0,10...8,00 Inom / Blocked
  Ineg y dynamic PSx: 0,10...8,00 Inom / Blocked
  tIneg y: 0,00...100,00 s / Blocked
  INy: 0,10...8,00 Inom / Blocked
  INy dynamic: 0,10...8,00 Inom / Blocked
  tINy: 0,00...100,00 s / Blocked

**Inverse-Time Overcurrent Protection (IDMT1, IDMT2, IDMT3):**
Enable PSx: No/Yes
Block tim.st. IN PSx:
  Without
  For single-ph. start
  For multi-ph. start
Gen.starting mode PSx:
  W/o start IN/Ineg
  With start IN/Ineg
tGS PSx: 0,00...100,00 s / Blocked
Rush restr.enabl PSx: No/Yes

*Valid for y = ‚P', ‚neg' or ‚N':*
  Iref,y PSx: 0,10...4,00 Inom / Blocked
  Iref,y dynamic PSx: 0,10...4,00 Inom / Blocked
  Characteristic y PSx:
    Definite Time /
    IEC Standard Inverse / IEC Very Inverse /
    IEC Extr. Inverse / IEC Long Time Inv. /
    IEEE Moderately Inv. / IEEE Very Inverse /
    IEEE Extremely Inv. / ANSI Normally Inv. /
    ANSI Short Time Inv. / ANSI Long Time Inv. /
    RI-Type Inverse / RXIDG-Type Inverse
  Factor kt,y PSx: 0,05...10,00
  Min. trip t. y PSx: 0,00…10 s
  Holdtime y PSx: 0,00...600,00 s
  Release y PSx: Without delay / delayed as per char.

**Thermal Overload Protection (THRM1, THRM2):**
Enable PSx: No/Yes
Iref PSx: 0,10...4,00 Inom
Start.fact.OL_RC PSx: 1,05...1,50
Tim.const. 1 >Ibl PSx: 1,0...1000,0 min
Tim.const. 2<Ibl PSx: 1,0...1000,0 min
Max.perm.obj.tmp. PSx: 0...300 °C
Max.perm.cool.tmp PSx: 0...70 °C
Select CTA PSx:
  Default temp. value / from PT100 / from 20 mA input
Default CTA PSx: -40...70 °C
Bl. f. CTA fault PSx: No/Yes
Rel. O/T warning PSx: 50…200 %
Rel. O/T trip PSx: 50…200 %
Hysteresis trip PSx: 2…30 %
Warning pre-trip PSx: 0,0...1000,0 min / Blocked

**Over-/Undervoltage Protection (U<>):**
Enable PSx: No/Yes
V> PSx: 0,20…1,50 Vnom / Blocked
V>> PSx: 0,20...1,50 Vnom / Blocked
tV> PSx: 0,00...100,00 s / Blocked
tV>> PSx: 0,00...100,00 s / Blocked
V< PSx: 0,20…1,50 Vnom / Blocked
V<< PSx: 0,20...1,50 Vnom / Blocked
Vmin> PSx: 0,00…0,60 Vnom / Blocked
tV< PSx: 0,00...100,00 s / Blocked
tV<< PSx: 0,00...100,00 s / Blocked
tTransient PSx: 0,00...100,00 s / Blocked
Hyst. V<> meas. PSx: 1...10 %

**Over-/Underfrequency Protection (f<>):**
Enable PSx: No/Yes
*Valid for y = ‚1' to ‚4':*
  Oper. mode fy PSx: f / f with df/dt / f w. Delta f/Delta t
  fy PSx: 40,00...70,00 Hz / Blocked
  tfy PSx: 0,00...10,00 s / Blocked
  dfy/dt PSx: 0,1...10,0 Hz/s / Blocked
  Delta fy PSx: 0,01...5,00 Hz / Blocked
  Delta ty PSx: 0,04...3,00 s

**Overfluxing Protection (V/f):**
Enable PSx: No/Yes
V/f> (alarm) PSx: 1,00...1,20 Vnom/fnom / Blocked
V/f(t)> PSx: 1,05...1,50 Vnom/fnom / Blocked
V/f>> PSx: 1,05...1,60 Vnom/fnom / Blocked
tV/f> PSx: 0...10000 s / Blocked
t at V/f=1,05 PSx: 1,0…1000,0 s
t at V/f=1,10 PSx: 1,0…1000,0 s
t at V/f=1,15 PSx: 1,0…1000,0 s
t at V/f=1,20 PSx: 1,0…1000,0 s
t at V/f=1,25 PSx: 1,0…1000,0 s
t at V/f=1,30 PSx: 1,0…1000,0 s
t at V/f=1,35 PSx: 1,0…1000,0 s
t at V/f=1,40 PSx: 1,0…1000,0 s
t at V/f=1,45 PSx: 1,0…1000,0 s
t at V/f=1,50 PSx: 1,0…1000,0 s
t at V/f=1,55 PSx: 1,0…1000,0 s
t at V/f=1,60 PSx: 1,0…1000,0 s
Reset time PSx: 0…10000 s
tV/f>> PSx: 0…10000 s / Blocked

**Current Transformer Supervision (CTS):**
Enable PSx: No/Yes
Ipos> PSx: 0,05…4,00 Iref
Ineg/Ipos> PSx: 0,05…1,00
Ineg/Ipos>> PSx: 0,05…1,00
t(alarm) PSx: 0,00…10,00 s
t(latch) PSx: 0,00…10,00 s

**Measuring-circuit monitoring (MCM_1, MCM_2, MCM_3, MCM_4):**
Enable PSx: No/Yes
Ineg/Ipos> PSx: 0,20…1,00
Operate delay. PSx: 0,10…100,00 s

## Measured Operating Data

**Measured Data Input (MEASI):**
Current IDC: 0,00...24,00 mA
Current IDC p.u..: 0,00...1,20 IDC,nom
Curr. IDC, lin. p.u..: 0,00...1,20 IDC,nom
Scaled value IDC, lin: -32000...32000
Temperature: -40,0...215,0 °C
Temperature p.u.: -0,40...2,15 (100 °C)

**Meassured Data Output (MEASO):**
Current A-1: 0,00...20,00 mA
Current A-2: 0,00...20,00 mA

**Main Function (MAIN)):**
Date: 01.01.1997...31.12.2096 dd.mm.yy
Time of day: 00:00:00...23:59:59 hh:mm:ss
Time switching: Standard time / Daylight saving time
Frequency f: 40,00...70,00 Hz
*Valid for y = ‚a' to ‚d':*
Curr. IPmax,y prim.: 0...25000 A
IP,max, prim. delay y.: 0...25000 A
IP,max, prim. stored y: 0...25000 A
Curr. IP,min, y prim.: 0...25000 A
Current IA,y prim.: 0...25000 A
Current IB,y prim.: 0...25000 A
Current IC y prim.: 0...25000 A
Current Ineg y prim.: 0…25000 A
Current Ipos y prim.: 0…25000 A
Current IN,y prim.: 0...25000 A
Current IY, a prim.:0…25000 A
Current IY, b prim.:0…25000 A
Current IY, c prim.:0…25000 A
Voltage V prim.: 0,0...2500,0 kV
*Valid for y = ‚a' to ‚d':*
Curr. IP,max,y p.u..: 0,00...25,00 Inom
IP, max p.u. delay y.: 0,00...25,00 Inom
IP max. p.u.,stored y.: 0,00...25,00 Inom
Curr. IP,min,y p.u.: 0,00...25,00 Inom
Current IA,y p.u.: 0,00...25,00 Inom
Current IB,y p.u.: 0,00...25,00 Inom
Current IC,y p.u.: 0,00...25,00 Inom
Current Ineg y p.u.: 0,00…25,00 Inom
Current Ipos y p.u.: 0,00...25,00 Inom
Current IN,y p.u.: 0,000...25,000 Inom
Current IY,a p.u.: 0,000...25,000 Inom
Current IY,b p.u.: 0,000...25,000 Inom
Current IY,c p.u.: 0,000...25,000 Inom
IP,max,add p.u.: 0,00…25,00 Inom
IP,min,add p.u.: 0,00…25,00 Inom
Current IA,add p.u.: 0,00…25,00 Inom
Current IB,add p.u.: 0,00…25,00 Inom
Current IC,add p.u.: 0,00…25,00 Inom
Curr. Ineg, add p.u.: 0,00…25,00 Inom
Curr. Ipos, add p.u.: 0,00…25,00 Inom
Current IN,add p.u.: 0,000…25,000 Inom
Voltage V p.u.: 0,00...25,00 Vnom
*Valid for y = ‚a' to ‚d':*
Angle phi AB, end y: -180...180°
Angle phi BC, end y: -180...180°
Angle phi CA, end y: -180...180°
Angle phi A, end a-b: -180...180 °
Angle phi B, end a-b: -180...180 °
Angle phi C, end a-b: -180...180 °
Angle phi A, end a-c: -180...180 °
Angle phi B, end a-c: -180...180 °
Angle phi C, end a-c: -180...180 °
Angle phi A, end a-d: -180...180 °
Angle phi B, end a-d: -180...180 °
Angle phi C, end a-d: -180...180 °
Angle phi NY, end a: -180...180 °
Angle phi NY, end b: -180...180 °
Angle phi NY, end c: -180...180 °

**Differential Protection (DIFF)**
Diff. current 1: 0,000...40,000 Iref
Restrain. current 1: 0,000...40,000 Iref
Diff. current 2: 0,000...40,000 Iref
Restrain. current 2: 0,000...40,000 Iref
Diff. current 3: 0,000...40,000 Iref
Restrain. current 3: 0,000...40,000 Iref

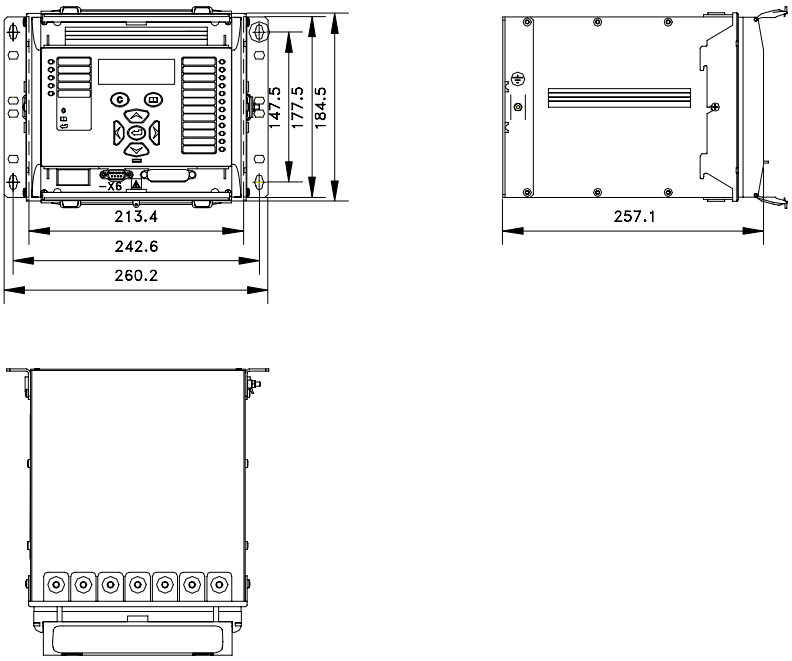
**Restricted Earth-Fault Protection (REF_1,REF_2,REF_3):**
*Valid for x = ‚1' to ‚3':*
Diff. current,REF_x: 0,00...20,00 Iref
Restrain.curr.,REF_x: 0,00...20,00 Iref

**Thermal Overload Protection (THRM1, THRM2)**
*Valid for x = ‚1' to ‚2':*
Status replica, THx: -25000...25000 %
Object temperat., THx: -40...300 °C
Coolant temp. THx: -40...200 °C
Pre-trip t. left, THx: 0,0...1000,0 min
Status repl., p.u.THx: -25,00...25,00
Object temp. p.u. x .: -0,04...0,30 100 °C
Coolant temp. p.u. x: -0,04...0,20 100 °C
Temp. offset repl. x: -25000...25000 %

**Overfluxing Protection (V/f)**
Excitation V/f p.u.: 0,00…10,00
Status replica in %: 0…100 %
Status replica p.u.: 0,00…1,00

## Dimensional Drawings

### Surface-mounted case 40 TE




### Flush-mounted case 40 TE with panel cutout

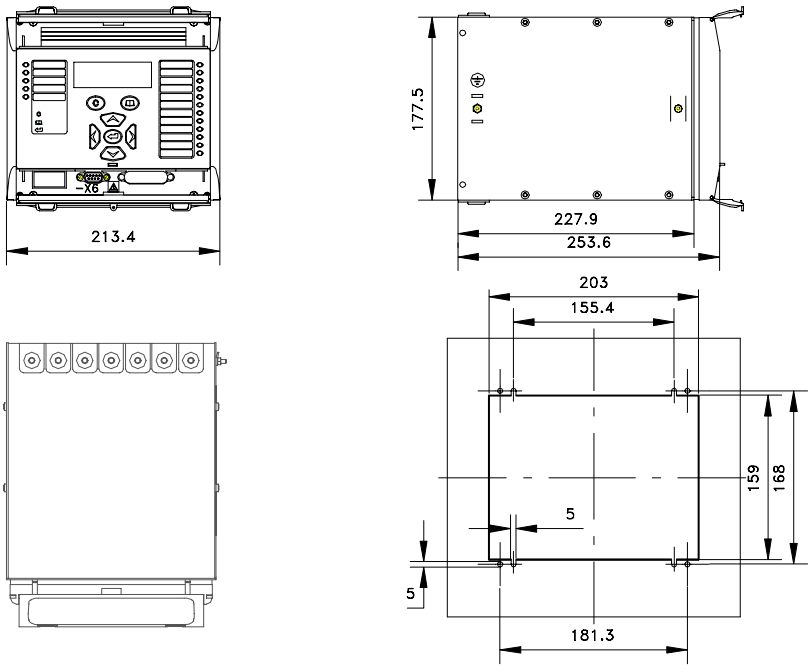
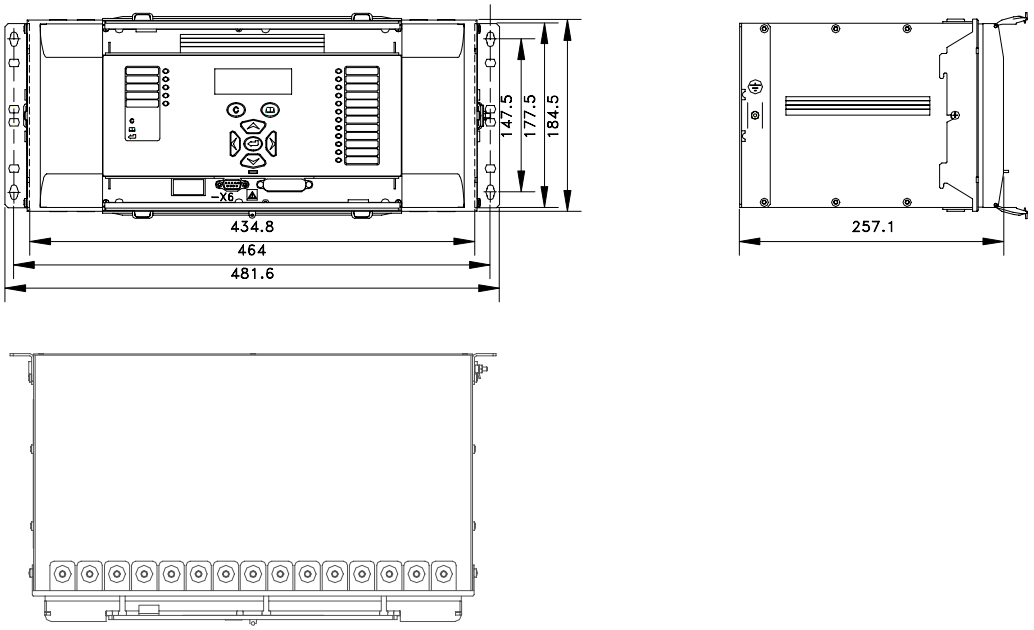



*Figure 11: Dimensional Drawings for Case 40 TE*

## Surface-mounted case 84 TE




## Flush-mounted case 84 TE with panel cutout

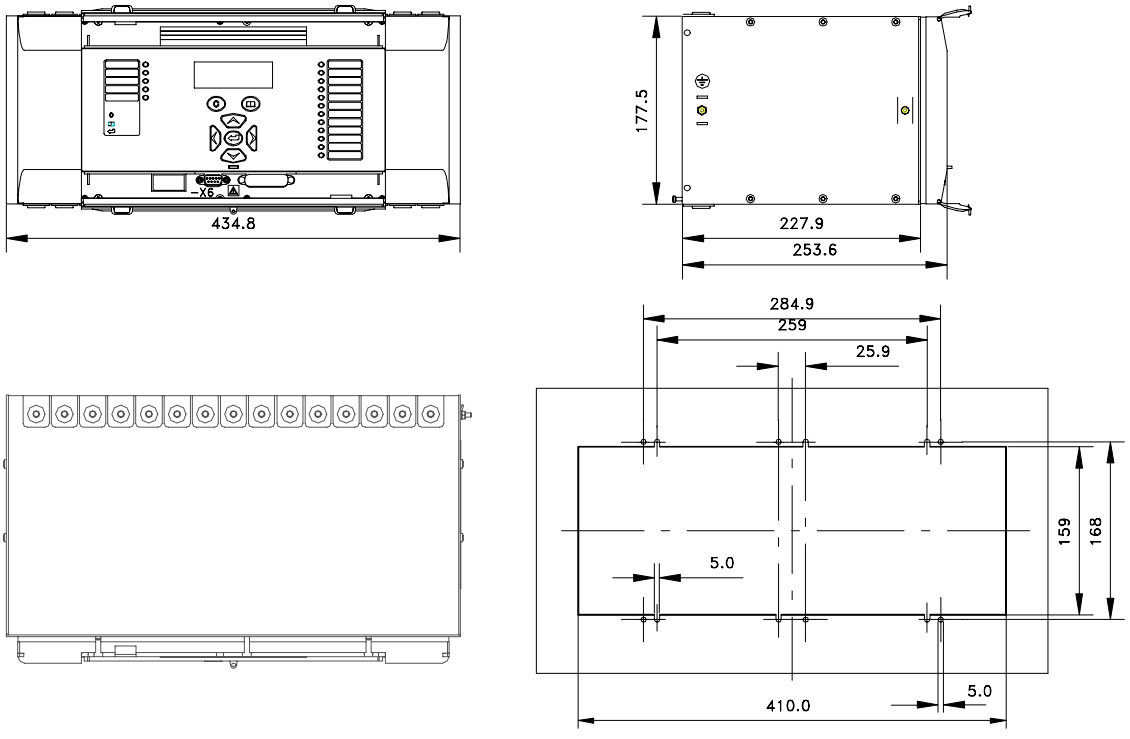
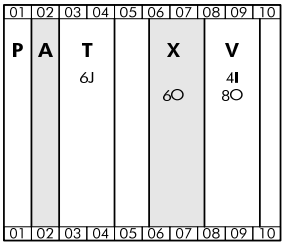


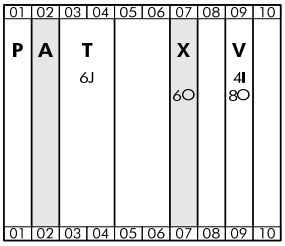

*Figure 12: Dimensional Drawings for Case 84 TE*

## Location and Connection

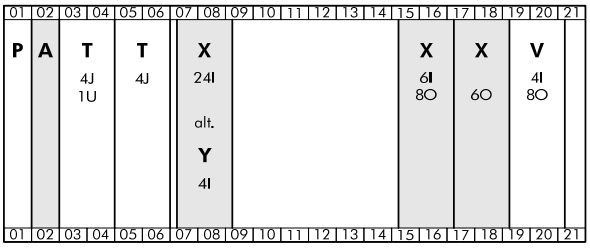
**P631 in case 40 TE for ring-terminal connection**



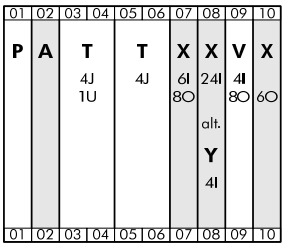

**P631 in case 40 TE for pin-terminal connection**



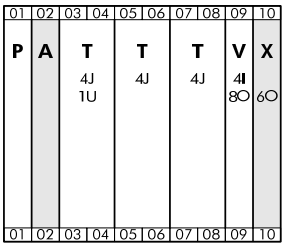

**P632 in case 84 TE for ring-terminal connection**



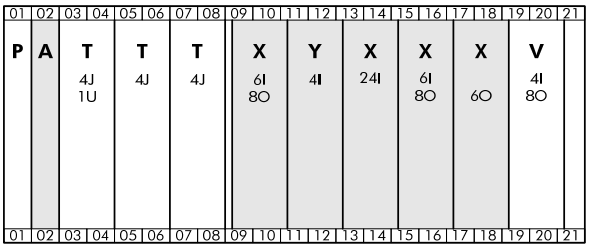

**P632 in case 40 TE for pin-terminal connection**



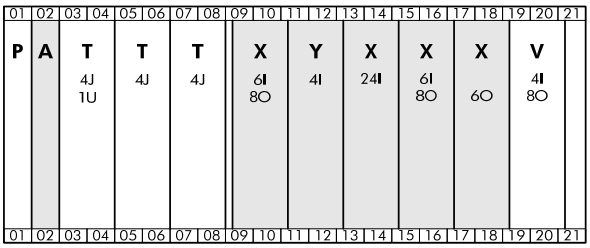

**P633 in case 40 TE for pin-terminal connection**



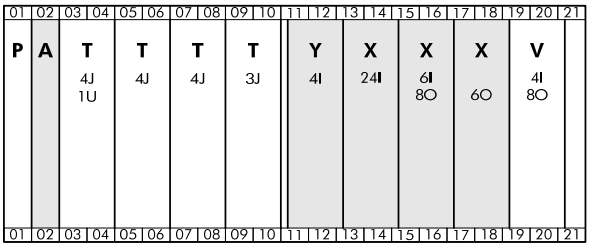

**P633 in case 84 TE for ring-terminal connection**




**P633 in case 84 TE for pin-terminal connection**




**P634 in case 84 TE for ring-terminal connection**




**P634 in case 84 TE for pin-terminal connection**

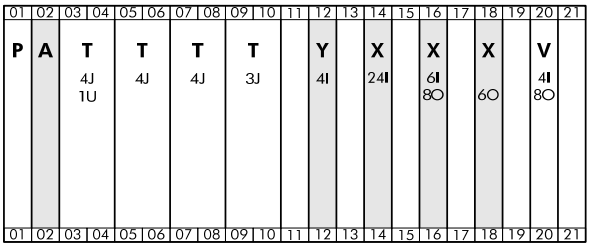
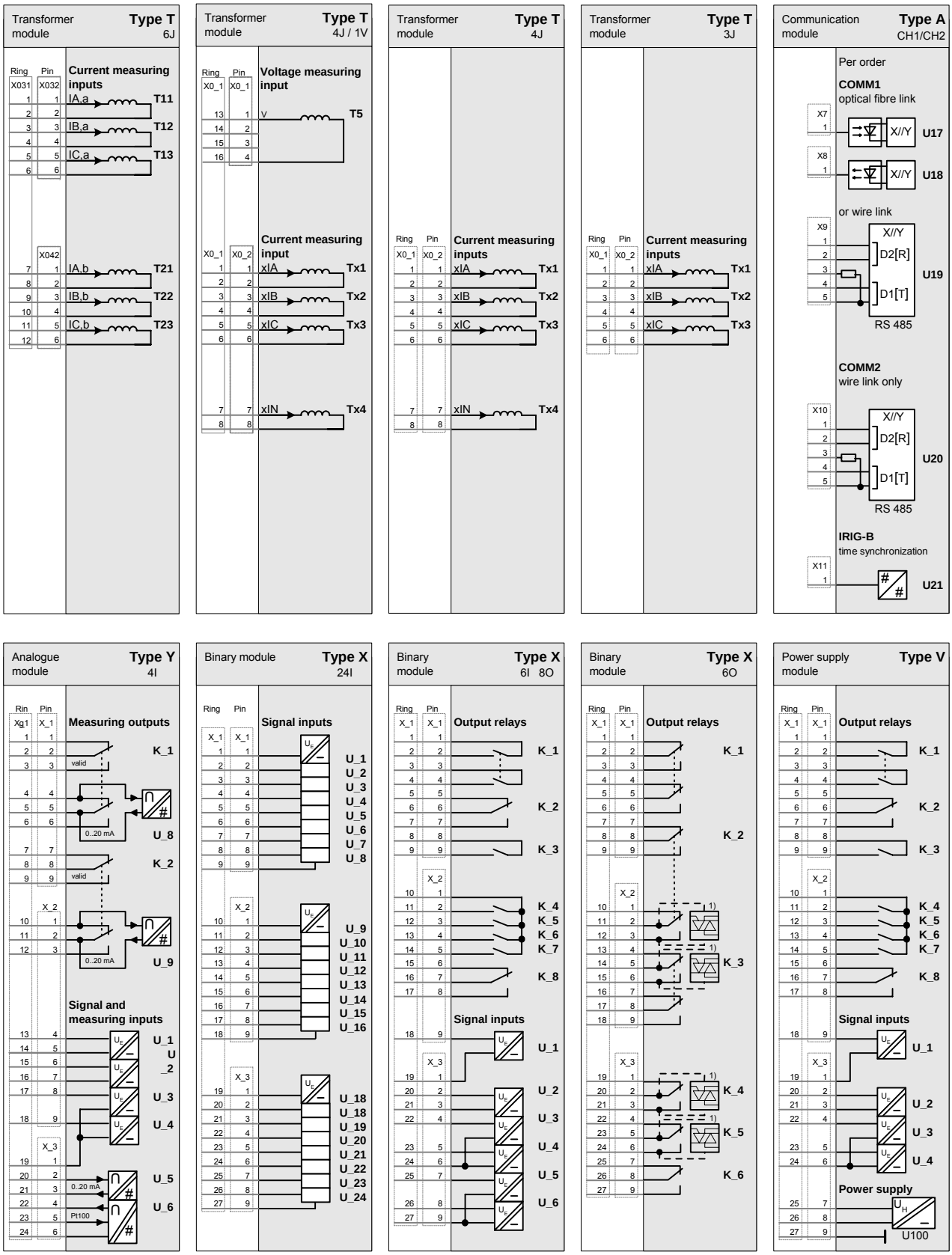



*Figure 13: Location Diagrams*




'_' is used as a wildcard fort he location

[1] Binary module X (6O) optional with 4 static outputs, in parallel with closer contact K_2.2, K_3.1, K_4, K_5

*Figure 14: Terminal Connection Diagrams of the Modules*

## Connection Examples

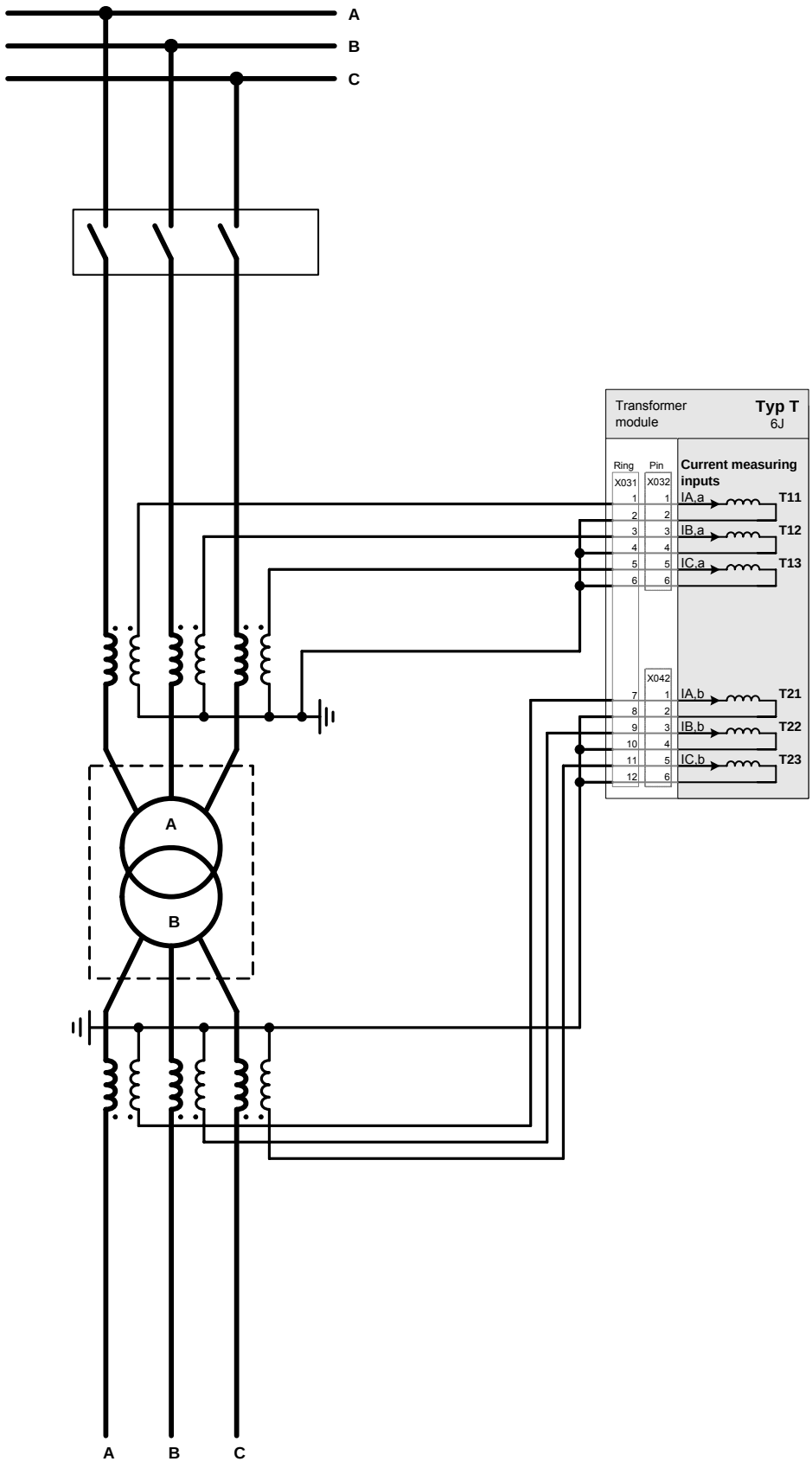



*Figure 15: Connection Example P631*

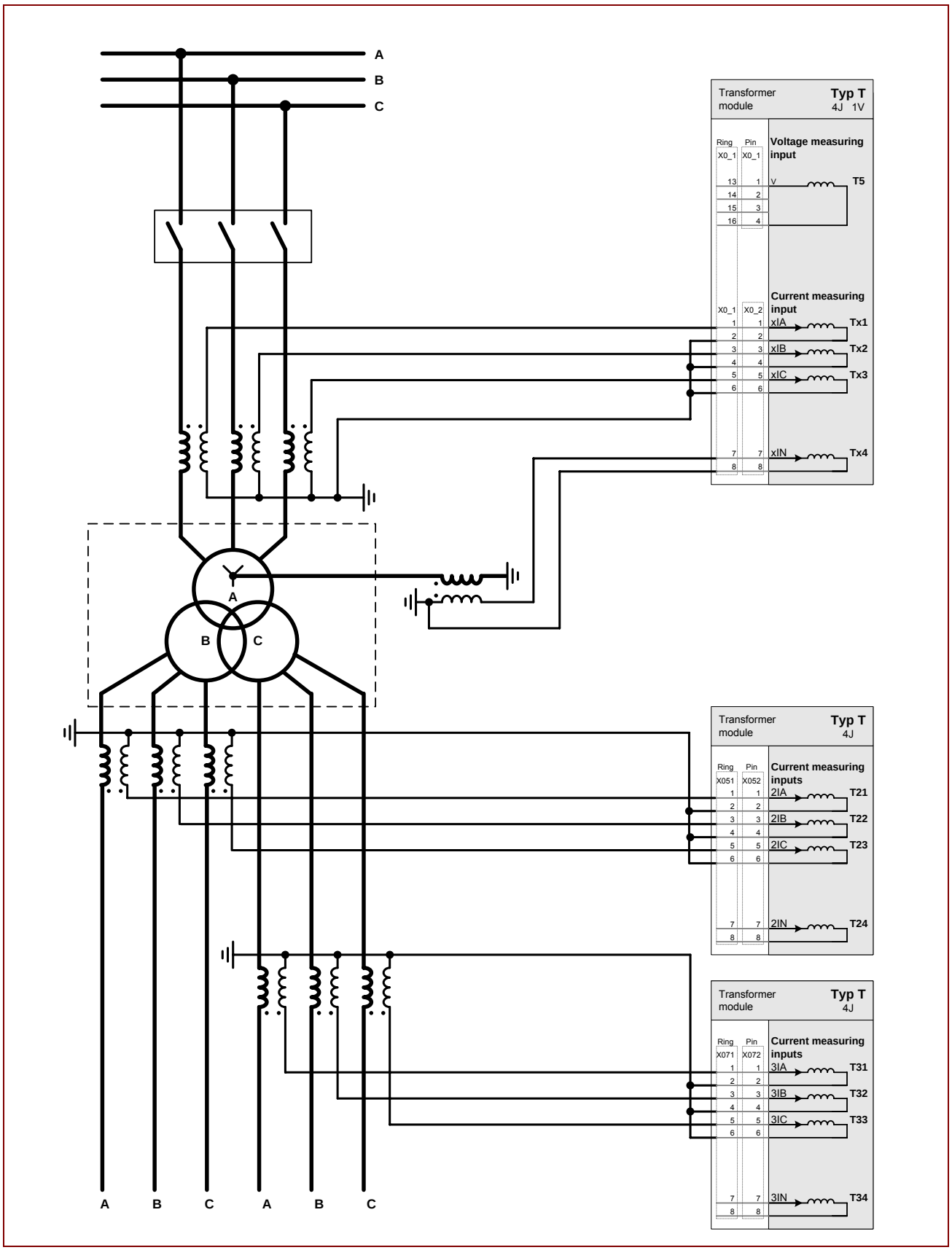



*Figure 16: Connection Example P633*

# Ordering Information

## MiCOM P631

| Name | Order number | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Two Winding Transformer Diff. Prot.** | **P 6 3 1 -** | | | **9** | **0** | **0** | **0** | | **0** | **-304** | **-4xx** | **-606** | | | **-46x** | **-9x x** | **-95 x** | **-8xx** |
| **Basic device:** | | | | | | | | | | | | | | | | | | |
| Basic device 40TE, pin-terminal connection, | | 3 | | | | | | | | | -403 | | | | | | | |
| Basic device 40TE, ring-terminal connection, | | 4 | | | | | | | | | -404 | | | | | | | |
| basic complement with 4 binary inputs and 8 output relays | | | | | | | | | | | | | | | | | | |
| **Mounting option and display:** | | | | | | | | | | | | | | | | | | |
| Surface-mounted, local control panel with text display | | | 3 | | | | | | | | | | | | | | | |
| Flush-mounted, local control panel with text display | | | 4 | | | | | | | | | | | | | | | |
| **Processor extension and Current transformer:** | | | | | | | | | | | | | | | | | | |
| With DSP-Coprocessor, Inom = 1 A / 5 A (T11...T13 / T21...23) [2] | | | | 8 | | | | | | | | | | | | | | |
| Inom = 1 A / 5 A (T11...T13 / T21...23) [2] | | | | 9 | | | | | | | | | | | | | | |
| **Power supply and additional outputs:** | | | | | | | | | | | | | | | | | | |
| VA,nom = 24 VDC | | | | | | | 3 | | | | | | | | | | | |
| VA,nom = 48 ... 250 VDC / 100 ... 230 VAC | | | | | | | 4 | | | | | | | | | | | |
| VA,nom = 24 VDC and 6 output relays, 4 with thyristor | | | | | | | 6 | | | | | | | | | | | |
| VA,nom = 48 ... 250 VDC / 100 ... 230 VAC | | | | | | | 7 | | | | | | | | | | | |
| and 6 output relays, 4 with thyristor | | | | | | | | | | | | | | | | | | |
| VA,nom = 24 VDC and 6 output relays | | | | | | | 8 | | | | | | | | | | | |
| VA,nom = 48 ... 250 VDC / 100 ... 230 VAC and 6 output relays | | | | | | | 9 | | | | | | | | | | | |
| **Switching threshold on binary inputs:** | | | | | | | | | | | | | | | | | | |
| >18 V (standard variant) | | (without order extension no.) | | | | | | | | | | | | | | | | |
| >90 V (60...70% of VA,nom = 125...150 V) [8] | | | | | | | | | | | | | | | -461 | | | |
| >155 V (60...70% of VA,nom = 220...250 V) [8] | | | | | | | | | | | | | | | -462 | | | |
| >73 V (67% of VA,nom = 110 V) [8] | | | | | | | | | | | | | | | -463 | | | |
| >146 V (67% of VA,nom = 220 V) [8] | | | | | | | | | | | | | | | -464 | | | |
| **With communication / information interface:** | | | | | | | | | | | | | | | | | | |
| Only IRIG-B input for clock synchronization | | | | | | | | | | | | | | | | -90 0 | | |
| Protocol IEC 60870-5-103 | | | | | | | | | | | | | | | | -91 ☐ | | |
| Protocol can be switched between: | | | | | | | | | | | | | | | | -92 ☐ | | |
| IEC 60870-5-101/-103, Modbus, DNP3, Courier | | | | | | | | | | | | | | | | | | |
| and IRIG-B input for clock synchronization | | | | | | | | | | | | | | | | | | |
| and 2nd interface (RS485, IEC 60870-5-103) | | | | | | | | | | | | | | | | | | |
| For connection to wire, RS485, isolated | | | | | | | | | | | | | | | | 1 | | |
| For connection to plastic fibre, FSMA connector | | | | | | | | | | | | | | | | 2 | | |
| For connection to glass fibre, ST connector | | | | | | | | | | | | | | | | 4 | | |
| Protocol UCA2 | | | | | | | | | | | | | | | | -93 ☐ | | |
| For connection to 10 MHz Ethernet, glass fibre ST and wire RJ45 | | | | | | | | | | | | | | | | 5 | | |
| and 2nd interface (RS485, IEC 60870-5-103) | | | | | | | | | | | | | | | | | | |
| For connection to 100 MHz Ethernet, glass fibre SC and wire RJ45 | | | | | | | | | | | | | | | | 6 | | |
| and 2nd interface (RS485, IEC 60870-5-103) | | | | | | | | | | | | | | | | | | |
| **Language:** | | | | | | | | | | | | | | | | | | |
| English (German) [4] | | (without order extension no.) | | | | | | | | | | | | | | | | |
| Px40 English (English) [4] | | | | | | | | | | | | | | | | | | -800 |
| German (English) [4] | | | | | | | | | | | | | | | | | | -801 |
| French (English) [4] | | (on request) | | | | | | | | | | | | | | | | -802 |
| Spanish (English) [4] | | (on request) | | | | | | | | | | | | | | | | -803 |
| Polish (English) [4] | | (on request) | | | | | | | | | | | | | | | | -804 |
| Russian (English) [4] [7] | | (on request) | | | | | | | | | | | | | | | | -805 |

2) Switching via parameter, default setting is underlined!

4) Second included language in brackets

7) Hardware option, supports cyrillic letters instead of special West. Europe characters

8) Standard variant recommended, if higher pickup threshold not explicitly required by the application

## MiCOM P632

| Name | Order number | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Two Winding Transformer Diff. Prot.** | **P 6 3 2 -** | | | **9** | **0** | **1** | | | | **-304** | **-4xx** | **-606** | | | **-46x** | **-9x x** | **-95 x** | **-8xx** |
| **Basic device:** | | | | | | | | | | | | | | | | | | |
| Basic device 40TE, pin-terminal connection, | | 3 | | | | | | | | | -403 | | | | | | | |
| Basic device 84TE, ring-terminal connection, | | 8 | | | | | | | | | -404 | | | | | | | |
| basic complement with 4 binary inputs and 8 output relays | | | | | | | | | | | | | | | | | | |
| **Mounting option and display:** | | | | | | | | | | | | | | | | | | |
| Surface-mounted, local control panel with text display | | | 3 | | | | | | | | | | | | | | | |
| Flush-mounted, local control panel with text display | | | 4 | | | | | | | | | | | | | | | |
| **Processor extension and Current transformer:** | | | | | | | | | | | | | | | | | | |
| With DSP-Coprocessor, Inom = 1 A / 5 A (T11...T13 / T21...23) [2] | | | | 8 | | | | | | | | | | | | | | |
| Inom = 1 A / 5 A (T11...T14 / T21...24) [2] | | | | 9 | | | | | | | | | | | | | | |
| **Voltage transformer:** | | | | | | | | | | | | | | | | | | |
| Vnom = 50 ... 130 V (1-pole) | | | | | | 1 | | | | | | | | | | | | |
| **Additional binary I/O options:** | | | | | | | | | | | | | | | | | | |
| Without | | | | | | | 0 | | | | | | | | | | | |
| With 1 binary module (add. 6 binary inputs and 8 output relays) | | | | | | | 1 | | | | | | | | | | | |
| **Power supply and additional outputs:** | | | | | | | | | | | | | | | | | | |
| VA,nom = 24 VDC | | | | | | | | 3 | | | | | | | | | | |
| VA,nom = 48 ... 250 VDC / 100 ... 230 VAC | | | | | | | | 4 | | | | | | | | | | |
| VA,nom = 24 VDC and 6 output relays, 4 with thyristor | | | | | | | | 6 | | | | | | | | | | |
| VA,nom = 48 ... 250 VDC / 100 ... 230 VAC | | | | | | | | 7 | | | | | | | | | | |
| and 6 output relays, 4 with thyristor | | | | | | | | | | | | | | | | | | |
| VA,nom = 24 VDC and 6 output relays | | | | | | | | 8 | | | | | | | | | | |
| VA,nom = 48 ... 250 VDC / 100 ... 230 VAC and 6 output relays | | | | | | | | 9 | | | | | | | | | | |
| **Further add. options:** | | | | | | | | | | | | | | | | | | |
| Without | | | | | | | | | 0 | | | | | | | | | |
| With analogue module | | | | | | | | | 2 | | | | | | | | | |
| With binary module (add. 24 binary inputs) | | | | | | | | | 4 | | | | | | | | | |
| **Switching threshold on binary inputs:** | | | | | | | | | | | | | | | | | | |
| >18 V (standard variant) | (without order extension no.) | | | | | | | | | | | | | | | | | |
| >90 V (60...70% of VA,nom = 125...150 V) [8] | | | | | | | | | | | | | | | -461 | | | |
| >155 V (60...70% of VA,nom = 220...250 V) [8] | | | | | | | | | | | | | | | -462 | | | |
| >73 V (67% of VA,nom = 110 V) [8] | | | | | | | | | | | | | | | -463 | | | |
| >146 V (67% of VA,nom = 220 V) [8] | | | | | | | | | | | | | | | -464 | | | |
| **With communication / information interface:** | | | | | | | | | | | | | | | | | | |
| Only IRIG-B input for clock synchronization | | | | | | | | | | | | | | | | -90 0 | | |
| Protocol IEC 60870-5-103 | | | | | | | | | | | | | | | | -91 | | |
| Protocol can be switched between: | | | | | | | | | | | | | | | | -92 | | |
| IEC 60870-5-101/-103, Modbus, DNP3, Courier | | | | | | | | | | | | | | | | | | |
| and IRIG-B input for clock synchronization | | | | | | | | | | | | | | | | | | |
| and 2nd interface (RS485, IEC 60870-5-103) | | | | | | | | | | | | | | | | | | |
| For connection to wire, RS485, isolated | | | | | | | | | | | | | | | | 1 | | |
| For connection to plastic fibre, FSMA connector | | | | | | | | | | | | | | | | 2 | | |
| For connection to glass fibre, ST connector | | | | | | | | | | | | | | | | 4 | | |
| Protocol UCA2 | | | | | | | | | | | | | | | | -93 | | |
| For connection to 10 MHz Ethernet, glass fibre ST and wire RJ45 | | | | | | | | | | | | | | | | 5 | | |
| and 2nd interface (RS485, IEC 60870-5-103) | | | | | | | | | | | | | | | | | | |
| For connection to 100 MHz Ethernet, glass fibre SC and wire RJ45 | | | | | | | | | | | | | | | | 6 | | |
| and 2nd interface (RS485, IEC 60870-5-103) | | | | | | | | | | | | | | | | | | |
| **Language:** | | | | | | | | | | | | | | | | | | |
| English (German) [4] | (without order extension no.) | | | | | | | | | | | | | | | | | |
| Px40 English (English) [4] | | | | | | | | | | | | | | | | | | -800 |
| German (English) [4] | | | | | | | | | | | | | | | | | | -801 |
| French (English) [4] | (on request) | | | | | | | | | | | | | | | | | -802 |
| Spanish (English) [4] | (on request) | | | | | | | | | | | | | | | | | -803 |
| Polish (English) [4] | (on request) | | | | | | | | | | | | | | | | | -804 |
| Russian (English) [4] [7] | (on request) | | | | | | | | | | | | | | | | | -805 |

2) Switching via parameter, default setting is underlined!

4) Second included language in brackets

7) Hardware option, supports cyrillic letters instead of special West. Europe characters

8) Standard variant recommended, if higher pickup threshold not explicitly required by the application

## MiCOM P633

| Name | Order number | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Three Winding Transformer Diff. Prot.** | **P 6 3 3 -** | | | **9** | **9** | **1** | | | | **-304** | **-4xx** | **-606** | | | **-46x** | **-9x x** | **-95 x** | **-8xx** |
| **Basic device:** | | | | | | | | | | | | | | | | | | |
| Basic device 40TE, pin-terminal connection, | | 3 | | | | | 0 | 0 | | | -404 | | | | | | | |
| Basic device 84TE, pin-terminal connection, | | 7 | | | | | | | | | -405 | | | | | | | |
| Basic device 84TE, ring-terminal connection, | | 8 | | | | | | | | | -406 | | | | | | | |
| basic complement with 4 binary inputs and 8 output relays | | | | | | | | | | | | | | | | | | |
| **Mounting option and display:** | | | | | | | | | | | | | | | | | | |
| Surface-mounted, local control panel with text display | | | 3 | | | | | | | | | | | | | | | |
| Flush-mounted, local control panel with text display | | | 4 | | | | | | | | | | | | | | | |
| **Processor extension and Current transformer:** | | | | | | | | | | | | | | | | | | |
| With DSP-Coprocessor, Inom = 1 A / 5 A (T11...T13 / T21...23) [2] | | | | 8 | | | | | | | | | | | | | | |
| Inom = 1 A / 5 A (T11...T14 / T21...24) [2] | | | | 9 | | | | | | | | | | | | | | |
| Inom = 1 A / 5 A (T31...T34) [2] | | | | | 9 | | | | | | | | | | | | | |
| **Voltage transformer:** | | | | | | | | | | | | | | | | | | |
| Vnom = 50 ... 130 V (1-pole) | | | | | | 1 | | | | | | | | | | | | |
| **Additional binary I/O options:** | | | | | | | | | | | | | | | | | | |
| Without | | | | | | | 0 | | | | | | | | | | | |
| With 1 binary module (add. 6 binary inputs and 8 output relays) | | | | | | | 1 | | | | | | | | | | | |
| With 2 binary modules (add. 12 binary inputs and 16 output relays) | | | | | | | 2 | | | | | | | | | | | |
| **Power supply and additional outputs:** | | | | | | | | | | | | | | | | | | |
| VA,nom = 24 VDC | | | | | | | | 3 | | | | | | | | | | |
| VA,nom = 48 ... 250 VDC / 100 ... 230 VAC | | | | | | | | 4 | | | | | | | | | | |
| VA,nom = 24 VDC and 6 output relays, 4 with thyristor | | | | | | | | 6 | | | | | | | | | | |
| VA,nom = 48 ... 250 VDC / 100 ... 230 VAC | | | | | | | | 7 | | | | | | | | | | |
| and 6 output relays, 4 with thyristor | | | | | | | | | | | | | | | | | | |
| VA,nom = 24 VDC and 6 output relays | | | | | | | | 8 | | | | | | | | | | |
| VA,nom = 48 ... 250 VDC / 100 ... 230 VAC and 6 output relays | | | | | | | | 9 | | | | | | | | | | |
| **Further add. options:** | | | | | | | | | | | | | | | | | | |
| Without | | | | | | | | | 0 | | | | | | | | | |
| With analogue module | | | | | | | | | 2 | | | | | | | | | |
| With binary module (add. 24 binary inputs) | | | | | | | | | 4 | | | | | | | | | |
| With analogue and binary module (add. 24 binary inputs) | | | | | | | | | 6 | | | | | | | | | |
| **Switching threshold on binary inputs:** | | | | | | | | | | | | | | | | | | |
| >18 V (standard variant) | (without order extension no.) | | | | | | | | | | | | | | | | | |
| >90 V (60...70% of VA,nom = 125...150 V) [8] | | | | | | | | | | | | | | | -461 | | | |
| >155 V (60...70% of VA,nom = 220...250 V) [8] | | | | | | | | | | | | | | | -462 | | | |
| >73 V (67% of VA,nom = 110 V) [8] | | | | | | | | | | | | | | | -463 | | | |
| >146 V (67% of VA,nom = 220 V) [8] | | | | | | | | | | | | | | | -464 | | | |
| **With communication / information interface:** | | | | | | | | | | | | | | | | | | |
| Only IRIG-B input for clock synchronization | | | | | | | | | | | | | | | | -90 0 | | |
| Protocol IEC 60870-5-103 | | | | | | | | | | | | | | | | -91 ☐ | | |
| Protocol can be switched between: | | | | | | | | | | | | | | | | -92 ☐ | | |
| IEC 60870-5-101/-103, Modbus, DNP3, Courier | | | | | | | | | | | | | | | | | | |
| and IRIG-B input for clock synchronization | | | | | | | | | | | | | | | | | | |
| and 2nd interface (RS485, IEC 60870-5-103) | | | | | | | | | | | | | | | | | | |
| For connection to wire, RS485, isolated | | | | | | | | | | | | | | | | 1 | | |
| For connection to plastic fibre, FSMA connector | | | | | | | | | | | | | | | | 2 | | |
| For connection to glass fibre, ST connector | | | | | | | | | | | | | | | | 4 | | |
| Protocol UCA2: | | | | | | | | | | | | | | | | -93 ☐ | | |
| For connection to 10 MHz Ethernet, glass fibre ST and wire RJ45 | | | | | | | | | | | | | | | | 5 | | |
| and 2nd interface (RS485, IEC 60870-5-103) | | | | | | | | | | | | | | | | | | |
| For connection to 100 MHz Ethernet, glass fibre SC and wire RJ45 | | | | | | | | | | | | | | | | 6 | | |
| and 2nd interface (RS485, IEC 60870-5-103) | | | | | | | | | | | | | | | | | | |
| **Language:** | | | | | | | | | | | | | | | | | | |
| English (German) [4] | (without order extension no.) | | | | | | | | | | | | | | | | | |
| Px40 English (English) [4] | | | | | | | | | | | | | | | | | | -800 |
| German (English) [4] | | | | | | | | | | | | | | | | | | -801 |
| French (English) [4] | (on request) | | | | | | | | | | | | | | | | | -802 |
| Spanish (English) [4] | (on request) | | | | | | | | | | | | | | | | | -803 |
| Polish (English) [4] | (on request) | | | | | | | | | | | | | | | | | -804 |
| Russian (English) [4] [7] | (on request) | | | | | | | | | | | | | | | | | -805 |

2) Switching via parameter, default setting is underlined!

4) Second included language in brackets

7) Hardware option, supports cyrillic letters instead of special West. Europe characters

8) Standard variant recommended, if higher pickup threshold not explicitly required by the application

## MiCOM P634

| Name | Order number | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Four Winding Transformer Diff. Prot.** | **P 6 3 4 -** | | | **9** | **9** | **1** | | | | **-304** | **-4xx** | **-606** | | | **-46x** | **-9x x** | **-95 x** | **-8xx** |
| **Basic device:** | | | | | | | | | | | | | | | | | | |
| Basic device 84TE, pin-terminal connection, | | 7 | | | | | | | | | -403 | | | | | | | |
| Basic device 84TE, ring-terminal connection, | | 8 | | | | | | | | | -404 | | | | | | | |
| basic complement with 4 binary inputs and 8 output relays | | | | | | | | | | | | | | | | | | |
| **Mounting option and display:** | | | | | | | | | | | | | | | | | | |
| Surface-mounted, local control panel with text display | | | 3 | | | | | | | | | | | | | | | |
| Flush-mounted, local control panel with text display | | | 4 | | | | | | | | | | | | | | | |
| **Processor extension and Current transformer:** | | | | | | | | | | | | | | | | | | |
| With DSP-Coprocessor, Inom = 1 A / 5 A (T11...T13 / T21...23) [2] | | | | 8 | | | | | | | | | | | | | | |
| Inom = 1 A / 5 A (T11...T14 / T21...24) [2] | | | | 9 | | | | | | | | | | | | | | |
| Inom = 1 A / 5 A (T31...T34 / T41...43) [2] | | | | | 9 | | | | | | | | | | | | | |
| **Voltage transformer:** | | | | | | | | | | | | | | | | | | |
| Vnom = 50 ... 130 V (1-pole) | | | | | | 1 | | | | | | | | | | | | |
| **Additional binary I/O options:** | | | | | | | | | | | | | | | | | | |
| Without | | | | | | | 0 | | | | | | | | | | | |
| With 1 binary module (add. 6 binary inputs and 8 output relays) | | | | | | | 1 | | | | | | | | | | | |
| **Power supply and additional outputs:** | | | | | | | | | | | | | | | | | | |
| VA,nom = 24 VDC | | | | | | | | 3 | | | | | | | | | | |
| VA,nom = 48 ... 250 VDC / 100 ... 230 VAC | | | | | | | | 4 | | | | | | | | | | |
| VA,nom = 24 VDC and 6 output relays, 4 with thyristor | | | | | | | | 6 | | | | | | | | | | |
| VA,nom = 48 ... 250 VDC / 100 ... 230 VAC | | | | | | | | 7 | | | | | | | | | | |
| and 6 output relays, 4 with thyristor | | | | | | | | | | | | | | | | | | |
| VA,nom = 24 VDC and 6 output relays | | | | | | | | 8 | | | | | | | | | | |
| VA,nom = 48 ... 250 VDC / 100 ... 230 VAC and 6 output relays | | | | | | | | 9 | | | | | | | | | | |
| **Further add. options:** | | | | | | | | | | | | | | | | | | |
| Without | | | | | | | | | 0 | | | | | | | | | |
| With analogue module | | | | | | | | | 2 | | | | | | | | | |
| With binary module (add. 24 binary inputs) | | | | | | | | | 4 | | | | | | | | | |
| With analogue and binary module (add. 24 binary inputs) | | | | | | | | | 6 | | | | | | | | | |
| **Switching threshold on binary inputs:** | | | | | | | | | | | | | | | | | | |
| >18 V (standard variant) | (without order extension no.) | | | | | | | | | | | | | | | | | |
| >90 V (60...70% of VA,nom = 125...150 V) [8] | | | | | | | | | | | | | | | -461 | | | |
| >155 V (60...70% of VA,nom = 220...250 V) [8] | | | | | | | | | | | | | | | -462 | | | |
| >73 V (67% of VA,nom = 110 V) [8] | | | | | | | | | | | | | | | -463 | | | |
| >146 V (67% of VA,nom = 220 V) [8] | | | | | | | | | | | | | | | -464 | | | |
| **With communication / information interface:** | | | | | | | | | | | | | | | | | | |
| Only IRIG-B input for clock synchronization | | | | | | | | | | | | | | | | -90 0 | | |
| Protocol IEC 60870-5-103 | | | | | | | | | | | | | | | | -91 ☐ | | |
| Protocol can be switched between: | | | | | | | | | | | | | | | | -92 ☐ | | |
| IEC 60870-5-101/-103, Modbus, DNP3, Courier | | | | | | | | | | | | | | | | | | |
| and IRIG-B input for clock synchronization | | | | | | | | | | | | | | | | | | |
| and 2nd interface (RS485, IEC 60870-5-103) | | | | | | | | | | | | | | | | | | |
| For connection to wire, RS485, isolated | | | | | | | | | | | | | | | | 1 | | |
| For connection to plastic fibre, FSMA connector | | | | | | | | | | | | | | | | 2 | | |
| For connection to glass fibre, ST connector | | | | | | | | | | | | | | | | 4 | | |
| Protocol UCA2: | | | | | | | | | | | | | | | | -93 ☐ | | |
| For connection to 10 MHz Ethernet, glass fibre ST and wire RJ45 | | | | | | | | | | | | | | | | 5 | | |
| and 2nd interface (RS485, IEC 60870-5-103) | | | | | | | | | | | | | | | | | | |
| For connection to 100 MHz Ethernet, glass fibre SC and wire RJ45 | | | | | | | | | | | | | | | | 6 | | |
| and 2nd interface (RS485, IEC 60870-5-103) | | | | | | | | | | | | | | | | | | |
| **Language:** | | | | | | | | | | | | | | | | | | |
| English (German) [4] | (without order extension no.) | | | | | | | | | | | | | | | | | |
| Px40 English (English) [4] | | | | | | | | | | | | | | | | | | -800 |
| German (English) [4] | | | | | | | | | | | | | | | | | | -801 |
| French (English) [4] | (on request) | | | | | | | | | | | | | | | | | -802 |
| Spanish (English) [4] | (on request) | | | | | | | | | | | | | | | | | -803 |
| Polish (English) [4] | (on request) | | | | | | | | | | | | | | | | | -804 |
| Russian (English) [4] [7] | (on request) | | | | | | | | | | | | | | | | | -805 |

2) Switching via parameter, default setting is underlined!

4) Second included language in brackets

7) Hardware option, supports cyrillic letters instead of special West. Europe characters

8) Standard variant recommended, if higher pickup threshold not explicitly required by the application

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