

Protection Relays Guide



List of ANSI codes applied in the Guide

ANSI Code	Main Protection Function
50/51	Non-directional phase overcurrent
50N/51N	Non-directional earth fault
67	Directional phase overcurrent
67N	Directional earth fault
67YN	Admittance earth fault
37	Phase undercurrent / Loss of load
49/51	Thermal overload
46	Negative phase sequence thermal_I2 / Unbalance load
46BC	Broken conductor detection
50BF	Circuit breaker failure
79	Multi-shot autoreclose
32N/67W	Wattmetric earth fault
27	Phase undervoltage
59	Phase overvoltage
47	Negative sequence overvoltage _ U2
27D	Positive sequence undervoltage _ U1
59N	Residual overvoltage / Neutral displacement _ Uo
27TN // 59TN	100% stator earth fault (3 harm.)_neutral // terminal
87	Differential
32R // 32F	Reverse power_R // Directional power _ F (3 ph measure)
32O	Overpower
32L	Low forward power
81O	Overfrequency
81U	Underfrequency
81R	Rate of change of frequency _ df/dt / ROCOF /
81AB	Turbine abnormal frequency
VVS*	Voltage vector shift _ dU >
40	Loss of field
24	Overfluxing_U/Hz
51V	Voltage dependent overcurrent
21	Underimpedance / Impedance / Distance
64N // 87N	Restricted earth fault (differential)
50DT	Interturn (Split Phase)
64R	Rotor earth fault
50 / 27	Unintentional energisation at standstill // Dead machine
78 / 68	Pole slipping_Power swings
26 / 38	Temperature detectors
48	Excess long start
51LR // 50S	Locked rotor at start // Saturated rotor
66	Start number
ABS*	Anti Back Spin
55	Out of step
25	Check synchronising
74TCS	Trip Circuit Supervision
FL*	Fault locator
50HS	Switch On To Fault
VTS/CTS	Measure circuit supervision

Function symbols in accordance with ANSI / IEEE Std C37.2 - 1996 Standards

* - the symbol does not appear in the Standard

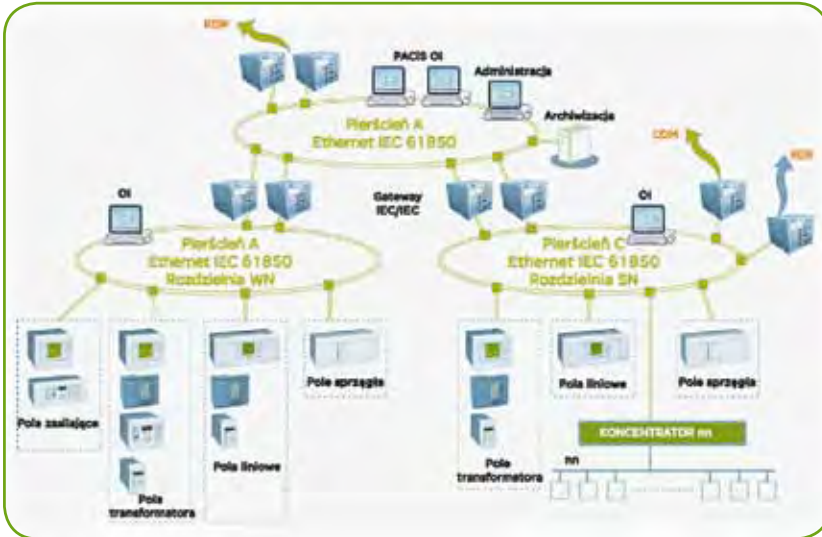
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PACiS

Protection, Automation & Control integrated Solution

CONTROL AND SUPERVISION SYSTEM FOR ELECTRICAL POWER SUBSTATIONS



- Signalling and remote control
- Execution of substation schemes
- Measurement processing
- Distributed Architecture
- Flexible topology
- IEC61850 100MBit/s STP6 system bus or optical fibre, Client-Server relation, GOOSE events, integration of equipment produced by various manufacturers
- Conversion of data format between a digital device and SCADA
- Possibility to test equipment operations by means of software simulators
- Diverse interfaces of data transmissions
- Control and supervision over all types of substations

MiCOM C264 C / MiCOM C264 P

MODULAR SUBSTATION COMPUTER AND SYSTEM BAY MODULE, COMMUNICATION CONCENTRATOR, PROTOCOL CONVERTER



Control and signalling circuits

- Possibility to count impulses on inputs
- Direct inputs for CTs and VTs
- Transducer measurements 0 - 20 mA
- Configurable schemes in accordance with IEC 61131-3 standard, switchgear interlocking
- Integrated schemes of synchro-check and transformer voltage regulator
- Record of up to 2000 events
- Routing of: Modbus, IEC 60870-5-101, IEC 60870-5-103, IEC 60870-5-104, DNP 3.0, UCA-2, IEC 61850 protocols
- Electrical and optical interfaces
- Used as a stand-alone device or as a part of PACiS system
- Co-operation with external SCADA systems (WindEX, SYNDIS, DYSTER, PRINCE etc.)
- Capacity to perform basic protection functions
- Analogue outputs

Application

- Bay unit with synchro-check
- Transformer voltage regulator
- Protocol concentrator (gateway)
- Back-up protection
- Modular substation computer - execution of control sequences, regulator schemes, interbay interlocks
- Mini HMI - visualisation of a substation layout on a LCD display
- Various combinations of the above

Documents

- Catalogue card

PACiS Gateway

ACCESS GATEWAY

Application

- Interface between PACiS system bus and a dispatching centre

Protection and Logic Control

- Data acquisition, processing and transmission
- Self-diagnosis and monitoring of data transfers
- Communication in V.24 and 802.3 standards: Slave DNP3, Modbus RTU, IEC 60870-5-101, IEC 60870-5-104, G174, OPC, Server/Client IEC61850

- 4 doubled communication ports
- Time synchronisation
- Possibility of parallel operations (redundancy)
- Supervision of modes: remote/local, „maintenance“
- Computer without rotating components, power supply within thresholds of safe voltage
- Windows Embedded software



SUI (System User Interface)

HUMAN-MACHINE INTERFACE

Application & Functions

- Used in HV and SV substations and in other areas of commercial power industry as a local or remote OI
- Possibility to create multiple Operator Interfaces in systems of distributed architecture
- Cyber-security compatible with NERC CIP standard, certified by US-CERT (authorised login, antivirus system, management of access rights, 4 levels of password-based protections)
- Compatible with many platforms, e.g.: XP/Server/Seven/32bits
- Designed from scratch using OPC architecture
- Report processing
- Configurable filtering of alarms and events
- Configurable on-line graphic interface
- Multilingual, with variety of licenses
- Web Server interface

Advanced Graphic Features

- Graphic libraries in compliance with power engineering standards
- Real-time charts (bar graphs, XY)
- Adjustable level of details - zooming / cluttering, result scaling
- Multilayer images and applications
- Simulation tools
- Possibility to create individual software scripts

Other Functionalities

- Data automatic processing (Access/Excel/SQL)
- Calculation of measurements
- Complexity of characteristics (real-time mode - X/Y - bar graphs / log-log plots / pie charts)
- SNMP configurator, integrated schedule

Enhanced Efficiency

- Object including more than 50,000 pieces of data
- „Hot Redundancy“ mode - takeover of supervision functions (without data loss) by a backup computer
- Acquisition and archiving of 5,000 pieces of data per second in real-time
- Acquisition and archiving of 1,000 measurements per second in real-time
- Up to 12 data servers (redundant)
- Up to 64 graphic interfaces on the data servers



MiCOM P 120 / MiCOM P 121

OVERCURRENT PROTECTION RELAY

Functions: 50/51, 50N/51N



Application

- Phase and earth fault overcurrent protections applicable in HV and MV substations and to protect MV and LV transformers

Protections

- P120:
 - Single-phase or earth fault overcurrent, 3-stage DT or IDMT, co-operation with core balanced CT or in Holmgreen arrangement
- P121:
 - 3-phase overcurrent, phase-to-phase, 3-stage, DT or IDMT
 - Earth fault, 3-stage DT or IDMT, co-operation with core balanced CT or in Holmgreen arrangement

Measurements

- Phase currents
- Earth current

Other Functions

- 2 setting group
- Circuit breaker control
- CB status monitoring
- Protection blocking logic
- Output contact latching
- Programmable binary inputs, outputs relays and LEDs, 2 inputs / 4 outputs
- Communication in RS485/RS232 standard
- Transmission protocols: Courier, Modbus, IEC60870-5-103 and DNP 3.0
- Recording of:
 - Events - 250
 - Faults - 25 (1600 Hz, 3s window)
 - Triggers - 25
 - Trips - 5 (display)

Documents

- Catalogue card
- User manual

MiCOM P 122 / MiCOM P 123

OVERCURRENT PROTECTION RELAY (3-phase)

Functions: 50/51, 50N/51N, 37, 49, 46, 46BC, 50BF, 79, 74TCS, 50HS



Application

- Phase and earth fault overcurrent protections applicable in HV and MV substations and to protect MV and LV transformers

Protections

- 3-phase overcurrent, phase-to-phase, 3-stage, DT or IDMT
- Earth fault, 3-stage, DT or IDMT
- Thermal overload with 1 thermal time constant
- Undercurrent, single stage
- Negative phase sequence overcurrent, IDMT and DT

Measurements

- Phase currents
- Earth current
- Thermal state

Other Functions

- 2 setting group
- Circuit breaker control
- CB status monitoring
- Protection blocking logic
- Output contact latching
- Programmable binary inputs, outputs relays and LEDs:
 - P122 3 inputs / 6 outputs
 - P123 5 inputs / 8 outputs
- Communication in RS485/RS232 standard
- Transmission protocols: Courier, Modbus, IEC60870-5-103 and DNP 3.0
- Recording of:
 - Events - 250
 - Faults - 25 (1600 Hz, 3s window)
 - Triggers - 25
 - Trips - 5 (display)

Documents

- Catalogue card
- User manual

MiCOM P122C

COMPACT OVERCURRENT PROTECTION RELAY

Functions: 50/51, 50N/51N, 37, 49, 46, 46BC, 50BF, 79, 74TCS, 50HS, CTS

Application

- Utilities
- Industrial electrical networks
- HV and MV substations
- MV and LV transformers

Protection and Logic Control

- 3 independent non-directional phase and earth overcurrent thresholds
- DT and IDMT curves
- Thermal overload
- Unbalance / Loss of phase
- Loss of load
- Output contacts latching
- Broken conductor detection

- Circuit breaker failure detection
- Blocking logic for reverse interlocking
- Circuit breaker status monitoring
- Trip circuit supervision
- Switch on to fault
- Cold load pick-up
- Output contacts testing mode

Measurements & Recording

- IA, IB, IC, IN, Is1, Is2, Is2/Is1, f, Θ
- Rolling and peak phase current values
- Recording of events, disturbances and fault parameters



Documents

- Catalogue card
- User manual

MiCOM P116

OVERCURRENT PROTECTION RELAY DUAL-POWERED WITH CTs / AUXILIARY SUPPLY VOLTAGE

Functions: 50/51, 50N/51N, 37, 49, 46, 46BC, 50BF, 79, 74TCS

Application

- Phase and earth fault dual-powered overcurrent protection applicable in HV and MV substations and to protect MV and LV transformers
- Applicable in systems where auxiliary supply voltage may be interrupted or lost

Protections

- Overcurrent, against phase-to-phase faults, 3-stage, DT or IDMT
- Earth fault, 3-stage, DT or IDMT
- Thermal overload with 1 thermal time constant
- Undercurrent, single stage
- Negative phase sequence overcurrent, IDMT and DT

Measurements

- Phase currents
- Earth current

Other Functions

- Autonomous operation: dual-powered supply from current circuits or/and auxiliary voltage
- 4-pole multishot autoreclose
- 2 setting groups
- Circuit breaker diagnosing
- Circuit breaker control
- Circuit breaker state monitoring
- Circuit breaker failure detection with undercurrent criterion
- Broken conductor detection
- Cold load pick-up logic
- Protection blocking logic
- Auxiliary output latching
- 5 x electromagnetic flag indicator
- Tripping the circuit breaker at a loss of auxiliary supply voltage by means of:
 - an internal energy tripping output, cooperating with the sensitive voltage coil of the circuit breaker (CB ordering option): 24VDC or 12VDC
- MiCOM E124 - an external microprocessor capacitor unit designed for cooperation with traditional CB trip coils
- Programmable digital inputs, output relays and LEDs, 6 inputs / 7 outputs
- Communication standards: USB, RS485
- Transmission protocols: Modbus, IEC60870-5-103
- Recording of:
 - Events - 200
 - Faults - 20
 - Disturbance - dynamic (1600 Hz, 7 s)



Documents

- Catalogue card
- User manual

MiCOM P115

AUTONOMOUS OVERCURRENT PROTECTION RELAY

Functions: 50/51, 50N/51N, 37, 49, 46, 46BC, 50BF, 79, 74TCS



Application

- Phase and earth fault dual-powered overcurrent protection applicable in MV substations
- Applicable in systems where auxiliary supply voltage may be interrupted or lost
- Auxiliary protection of HV/MV transformers

Interaction with Circuit Breaker

- Tripping a CB when powered by current transformers only, achieved by:
 - cooperation with a current coil of the circuit breaker, an optional piece of equipment for modern CB's,
 - an energy output in P115 (24VDC 0,1J) to trigger a highly sensitive trip coil, an optional piece of equipment for modern CB's,
 - cooperation with E124 capacitor trip unit, being a separate product by Schneider Electric (an application for CB's of older types),
- an energy output in P115 (12VDC 0,02mJ) to trigger an external striker coil (Striker K1 type - mechanical coupling with the CB), being a separate product by Schneider Electric (an application for CB's of older types).



E124 capacitor trip unit

Protections

- Overcurrent, against phase-to-phase faults, 2-stage, DT or IDMT
- Earth fault, 2-stage, DT or IDMT
- Overcurrent, against asymmetry, IDMT
- Auxiliary (AUX1 and AUX2), IDMT

Measurements

- Measurements accessible via communication link (no display):
- Phase currents
- Earth current

Other Functions

- Autonomous operation: dual-powered supply from current circuits or/and Vx auxiliary voltage
- 2 setting groups
- Circuit breaker failure detection (undercurrent criterion)
- Circuit breaker control from P115 front panel or/and via RS485
- Circuit breaker state monitoring
- Protection blocking logic from binary inputs (decentralised bus bar protection)
- Programmable digital inputs (2 inputs), output relays (up to 4 outputs) and LEDs (6 LCD's)
- Communication standards: USB (local), RS 485 (remote)
- Transmission protocols: Modbus, IEC60870-5-103
- Special current output for CB tripping coil
- Recording of:
 - Events - 200 with time stamping
 - Faults - 20

Documents

- Catalogue card
- User manual

MiCOM P114D

AUTONOMOUS OVERCURRENT PROTECTION RELAY

Functions: 50/51, 50N/51N

Application

- Phase and earth fault dual-powered overcurrent protection applicable in MV substations
- Applicable in systems where auxiliary supply voltage may be interrupted or lost
- Auxiliary protection of HV/MV transformers

Interaction with Circuit Breaker

- Tripping a CB when powered by current transformers only, achieved by:
 - cooperation with a current coil of the circuit breaker, an optional piece of equipment for modern CB's,
 - an energy output in P114D (24VDC 0,1J) to trigger a highly sensitive trip coil, an optional piece of equipment for modern CB's,
 - cooperation with E124 capacitor trip unit, being a separate product by Schneider Electric (an application for CB's of older types),
 - an energy output in P114D (12VDC 0,02mJ) to trigger an external striker coil (Striker K1 type - mechanical coupling with the CB), being a separate product by Schneider Electric (an application for CB's of older types).

Protections

- Overcurrent, against phase-to-phase faults, 2-stage, DT or IDMT
- Earth fault, 2-stage, DT or IDMT

Measurements

- Measurements accessible via communication link (no display):
- Phase currents
- Earth current

Other Functions

- Autonomous operation: dual-powered supply from current circuits or/and Vx auxiliary voltage
- Protection criteria set with DIP-switches
- I/O configuration with DIP-switch or MiCOM S1 software
- Circuit breaker control via RS485
- Circuit breaker state monitoring
- Protection blocking logic from binary inputs (decentralised bus bar protection)
- Programmable digital inputs (2 inputs) and output relays (up to 4 outputs)
- Communication standards: USB (local), RS 485 (remote)
- Transmission protocols: Modbus, IEC60870-5-103
- Special current output to the CB tripping coil
- Recording of:
 - Events - 200 with time stamping via USB
 - Faults - 20 via USB



E124 capacitor trip unit

Documents

- Catalogue card
- User manual

MiCOM P125

DIRECTIONAL EARTH FAULT PROTECTION RELAY

Functions: 50N/51N, 67N, 32N, 59N



Application

- Phase and earth overcurrent protection applicable in MV and HV stations and to protect LV and MV transformers

Protections

- Earth fault, 3-stage, DT or IDMT
- Earth fault, 2-stage (for Petersen coil earthed system)
- Residual overvoltage

Measurements

- Earth current
- Residual voltage

Other Functions

- Circuit breaker control
- Protection blocking logic
- Auxiliary output latching
- Programmable digital inputs, output relays and LEDs, 4 inputs, 6 outputs
- Communication standards: RS232, RS485
- Transmission protocols: Modbus, Courier, IEC60870-5-103, DNP 3.0

Documents

- Catalogue card
- User manual

MiCOM P126 / MiCOM P127

MULTIFUNCTION DIRECTIONAL LINE PROTECTION RELAY

Functions: 50/51, 50N/51N, 67, 67N, 37, 49, 46, 46BC, 50BF, 79, 32N, 27, 59, 59N, 74TCS, 81, 81R, 32F, 51V, VTS



Application

- Universal 3-phase directional overcurrent protection, applicable in MV substations for both incoming and outgoing feeders, as well as auxiliary protection for HV

Protections

- **Overcurrent, against phase-to-phase faults, 3-stage, DT or IDMT (P127 - directional)**
- Earth fault, directional, 5-stage, DT or IDMT (3 measured and 2 derived)
- Wattmetric earth fault, 2-stage (for Petersen coil earthed system)
- Undercurrent - single stage
- Residual overvoltage (P127)
- Negative phase sequence overcurrent, IDMT and DT
- Thermal overload with 1 thermal time constant
- Undervoltage, 2 thresholds (P127)
- Overvoltage, 2 thresholds (P127)
- Under- and overfrequency (P127)
- Power directional (P127)
- Frequency rate of change (P127)

Measurements

- Currents and voltages
- Current and voltage sequences
- Peak, average and rolling demand
- Thermal state in %
- THD i TDD for measure CTs

Other Functions

- Four-shot autoreclose
- 8 setting groups
- Switchgear monitoring
- Remote and local CB control
- CB state monitoring
- CB failure protection
- Broken conductor detection
- Cold load pick-up logic
- **Second harmonic blocking**
- Protection blocking logic
- Selective logic
- Output relay testing
- Output contacts latching
- Programmable binary inputs and outputs:
 - 7 x I / 8 x O
 - extra 5 opto-insulated inputs - option
- Extensive logic equations: 8 equations with 16 operators each, of AND, OR, AN NOT, OR NOT types
- Measuring transformers, 0.5 class - option
- Another RS485 port with Modbus protocol - option
- Time synchronisation via IRIG-B - option
- Communication standards RS232 (local) and RS485 (system)
- Transmission protocols: Modbus, IEC60870-5-103 and DNP3.0
- Recording of:
 - Events - 250
 - Faults - 25 (1600 Hz, window 3 s)
 - Triggers - 25

Documents

- Catalogue card
- User manual
- **PC simulator!**

MiCOM P111

UNIVERSAL OVERCURRENT PROTECTION RELAY

Functions: 50N/51N, 50/51, 67N/67YN, 26/38, 79

Application

- Thanks to its favourable „price vs technical features” ratio, P111 may be used both in medium voltage and in low voltage applications (specifically where communication facilities are required). Detailed technical specifications and setting procedures for P111 are included in the product’s user manual. The P111 series includes the following models: A, B, E, D, G, H, R. Their features are enumerated in the Table below.

Features

- Operation in 1, 2, or 3-phase arrangement in various types of networks
- True RMS phase current value measurement within a frequency range from 10Hz to 250Hz
- Protections (see the Table below)
- Possibility to configure protections: trip or signal
- RS485 communication facility via Modbus RTU protocol (option)**
- Local or remote control of a contactor or circuit breaker
- Independent programmable output relays (2 in basic version + optionally 2 extra)
- Programmable NO output relays (P2, P3)
- Programmable binary inputs (S1-S2 and T1-T2 in basic version + optionally V1-C, V2-C, V3-C, V4-C)
- LEDs to indicate protection triggering or tripping
- 4-digit LED display
- 5-button keypad to input settings and to configure protections
- 2 types of case: flush or 35 mm DIN rail mounted (R model is available in the flush version only)



Flush mounted version



35 mm DIN rail version

Documents

- Catalogue card
- User manual

MiCOM P111 Universal Overcurrent Protection Relay

Functions	Model							
	A	B	R	D	E	G	H	
Overcurrent I _{>>} (DT)	X	X	X	X	X			
Overcurrent I _{>} (DT or IDMT)	X	X	X	X	X			
Overcurrent I _{p>} (DT or IDMT) (Overload)	X	X	X	X	X			
Earth fault I _{o>} (DT or IDMT)		X	X	X	X	X	X	
Earth fault I _{o>>} (DT lub IDMT)		X	X	X	X	X	X	
Earth fault directional I _{fi} (0-90)				X			X	
Earth fault admittance G _{o>}				X			X	
Earth fault admittance B _{o>}				X			X	
Earth fault admittance Y _{o>}				X			X	
CB failure scheme			X					
External protection (opto-insulated binary input)	X	X	X	X	X		X	

Functions	Model							
	A	B	R	D	E	G	H	
Time counters AUX1 and AUX2 (external protection)			X					
Output relays P1 (no) and P2 (no)	X	X	X	X	X	X	X	
Output relays P3 (no) and P4 (c/o)			X	X	X	X	X	
2 binary inputs: S1-S2 and T1-T2	X	X	X	X	X	X	X	
2 binary inputs: V1-C and V2-C	X	X	X	X	X		X	
2 binary inputs: V3-C and V4-C			X					
2 setting groups	X	X	X	X	X	X	X	
RS485 communication port		X	X	X	X	X	X	
CB/contactor control (opto-insulated binary input and/or RS485)		X	X	X				
Recording of last 3 fault trips	X	X	X	X	X	X	X	
Recording of 25 events with time stamping feature (available via RS485)				X	X		X	

MiCOM P111Enh

Numerical three phase and earth fault overcurrent relays



MiCOM P111Enh

MiCOM P111Enh relays provide features for easy adaptation to different applications and operation conditions.

The P111Enh can be fully configured manually, without using setting software.

Alternatively, MiCOM S1 Studio setting software allows configuration parameters to be modified for a specific application via the USB port.

IEC 60870-5-103 and Modbus RTU integrated communication protocols are available for flexible integration into most substation control or DCS systems.

Close and Trip commands can be executed via functional key on the front panel, default menu window, DCS/SCADA system (RS485) or configured binary input.

Three level password gives proper rights for secure maintenance of the relay.

As a device housed in a small sized flush-mountable case, the P111Enh can be easily installed in all modern, dimension-focused switchgear panels.

The relay can be also considered as a cost-effective answer to retrofit demands of older substations.

Selectable measuring criteria: True RMS and/or fundamental frequency (Fourier) current measurements allow to increase selectivity and adapt to the application.

Application

The MiCOM P111Enh (Enhancement) relays are suitable for all the application where overcurrent and/or earth-fault protection are required.

P111Enh can be applied to medium and low vol-

tage electrical systems as an optimized and cost efficient solution tailored to user's needs.

The MiCOM P111Enh numerical overcurrent protection relays provide an optimized and cost efficient solution.

Typical applications are:

- Utility and industrial substation fitted with cost-optimized MV switchboards
- Retrofit relays of old technology, particularly during installation of DCS systems
- Transformers, incomers, bus couplers, capacitor banks, overhead lines and underground cables on MV systems
- Neutral system protection (insulated, solid and resistance earthed)
- LV substations

Main features

The following functions are generally available in all devices (refer to Table 1 below):

- Operate in 1, 2, or 3-phase arrangement.
- Two setting groups, selected from the relay menu, binary input or SCADA/DCS.
- Flush mounted case.
- Fundamental (fn) and True RMS (within a frequency range from 10Hz to 1kHz) phase current value measurement.
- Earth current fundamental (fn) frequency measurement.
- 9 button keypad to input settings, configure the relay and close and trip command and display (2x16 LCD).
- Fault record for most recent trips.

Documents

- Catalogue card
- User manual

MiCOM P132

TIME-OVERCURRENT PROTECTION RELAY

Functions: 50/51, 50N/51N, 67, 67N, ADMIT, 37, 49, 46, 50BF, 79 (3), 32N, 27, 59, 47, 27D, 59N, 32R/32(F), 81O, 81U, 81R, 51V, 26/38 (R), 48, 50S/51LR, 66, 74TCS

Application

- Phase and earth overcurrent protections applicable in MV and HV substations for both incoming and outgoing feeders and transformer applications
- Auxiliary earth fault directional protection for HV lines

Protections

- Overcurrent protection:
 - DT, three-stage, separate circuits for phase and residual currents,
 - IDMT, separate circuits for phase and residual currents
- Thermal overload protection (thermal image)
- Motor protection
- Unbalance protection (negative sequence current)
- Under- and overvoltage
- Short-circuit direction determination
- Ground fault direction determination - wattmetric and admittance
- Frequency: f , df/dt , $\Delta f/\Delta t$

Control Functions

- Control and supervision of 3 switches
- 6 configurable buttons
- Monitoring of extra signals and measurements
- Interlocking logic
- Over 80 pre-defined bay types

Measurements

- Phase currents
- Earth current
- Phase and phase-to-phase voltages
- Power P, Q
- Energy: active, reactive

Other Functions

- Auto-reclosing control
- Circuit breaker failure detection
- Switch on to fault protection
- Limit values monitoring
- Interlocking
- 4 setting groups
- Measuring circuit monitoring (voltage and current)
- Cold load pick-up logic
- Programmable scheme logic
- Freely configurable inputs / outputs / LEDs
 - max 16 x I / 30 x O
- 3 communication ports (optional)
- Communication protocols: IEC60870-103 / -101 / Modbus / DNP 3.0 / **IEC61850 (KEMA certified)**
- Recording of:
 - Faults – 8x200 events
 - Overload loads – 8x200 events
 - Ground faults – 8x200 events
 - Disturbances – 8 waveforms (1kHz)
- Circuit breaker monitoring



Case 40TE



Case 24TE

REMARK:

Voltage -dependent functions (U>, U<, f<, f>, directionality for I> and IN> ...) are available for a version with measuring voltage inputs

Documents

- Catalogue card

MiCOM P139

FEEDER MANAGEMENT AND BAY CONTROL

Functions: 50/51, 50N/51N, 50BF, 67, 67N, ADMIT, 37, 49, 79 (3), 32N, 27, 59, 47, 27D, 59N, 32R/32F (F), 81O, 81U, 81R, 51V, 26/38 (R), 48, 50S/51LR, 66, 25, 74TCS



Application

- One-box solution in MV and HV systems - a main element of dissipated change-over automatics

Protections

- Short-circuit directional against phase-to-phase faults, overcurrent, 3-stage DT and 1-stage IDMT
- Earth fault, directional
- Under- and overfrequency f , df/dt , $\Delta f/\Delta t$
- Directional power motor protection with true RMS value measurement
- Unbalance, checking of negative sequence current
- Thermal overload with 1 thermal time constant
- Motor protection features (excessive start time, limitation of number of starts etc.)
- Admittance earth fault
- Under- and overvoltage
- Switch onto fault protection
- Synchro-check (option)

Control Functions

- Control of 6 switches
- Monitoring of 10 switches
- Monitoring of extra signals and measurements
- Mimic diagram
- Interlocking logic
- More than 290 pre-defined bay types

Measurements

- Phase currents
- Earth current
- Voltages
- Power P, Q, S
- Energy: active, reactive
- Thermal load

Other Functions

- Autoreclose scheme
- 4 setting groups
- CB failure scheme
- Programmable inputs/outputs /LEDs
 - max. 70 x I / 23 x O or
- 3 communication ports (option)
- Communication protocols: IEC 60870-103 / -101 / Modbus / DNP 3.0 / **IEC 61850 (KEMA certified)**
- Recording of:
 - Faults – 8 x 200 events
 - Overload faults – 8 x 200 events
 - Ground faults – 8 x 200 events
 - Disturbances – 8 waveforms (1kHz)
- Circuit breaker monitoring

REMARK:

Voltage -dependent functions (U>, U<, f<, f>, directionality for I> and IN> ...) are available for a version with measuring voltage inputs

Documents

- Catalogue card
- User manual

MiCOM P141 / MiCOM P142 / MiCOM P143

FEEDER MANAGEMENT RELAY

Functions: 50/51, 50N/51N, 67, 67N, ADMIT, 49, 46, 46BC, 50BF, 79, 32N, 27, 59, 47, 81O, 81U, 81R, 51V, 64N/87N, 25, 60/VTS

Application

- Phase and earth overcurrent protections applicable in MV and HV substations for both incoming and outgoing feeders and transformer applications

Protections

- Overcurrent, directional against phase-to-phase faults, 4-stage, DT or IDMT
- Earth fault, two directional overcurrent characteristics, DT or IDMT
- Admittance earth fault
- Restricted earth fault (co-operation with transformer)
- Wattmetric earth fault (for Petersen Coil earthed system)
- Residual overvoltage
- Negative sequence overvoltage
- Unbalance, directional; check of negative sequence current
- Thermal overload with 1 or 2 thermal time constants
- Two stage under- and overvoltage
- Two stage under- and overfrequency

Measurements

- Phase currents
- Earth current
- Voltages
- Power P, Q, S
- Energy: active, reactive
- Thermal load

Other Functions

- **Three-shot autoreclose – P142 i P143**
- **Synchro-check – P143**
- 4 setting groups
- Switchgear monitoring
- Trip statistics
- CB control
- CB failure protection
- Broken conductor detection
- Current and voltage circuits supervision
- Cold load pick-up logic
- Programmable inputs (256 AND/OR gates and timers), outputs and LEDs
- P141 and P142 – 8 x I / 7 x O
- P143 – 16 x I / 14 x O
- Communication standards: RS232, RS485
- Transmission protocols: Courier, Modbus, IEC60870-5-103, DNP 3.0, **IEC 61850 (KEMA certified)**
- Recording of:
 - Events – 512
 - Faults – 20 (window 10.5 s)
- Quick access HOTKEY key



MiCOM P145

FEEDER MANAGEMENT RELAY WITH CONTROL FUNCTIONS

Functions: 50/51/67, 50N/51N/67N, YN/ADMIT, 49, 46, 46BC, 50BF, 32N, 27, 59, 59N, 74CTS, 81U/O, 81R, 32F, 51V, 64N/87N, VTS/CTS, 79, 25



Application

- MV overhead or cable lines
- Auxiliary earth fault directional protection for HV lines
- HV / MV transformer overcurrent protection

Protections

- Overcurrent, directional against phase-to-phase faults, 4-stage, DT or IDMT
- Earth fault, directional, 4-stages, DT or IDMT
- Sensitive earth fault in co-operation with core balanced CT, 4-stage
- Restricted earth fault (differential characteristic)
- Wattmetric earth fault (for Petersen coil earthed system)
- Residual overvoltage
- Negative sequence overvoltage
- Directional negative sequence overcurrent, 4-stage (Is²)
- Thermal overload
- Under- and overvoltage
- Under- and overfrequency
- Rate of change of frequency df/dt
- **Admittance Yo/Go/Bo**

Other Functions

- Autoreclose scheme
- Two measuring inputs for Io
- Synchro-check, 2 stages
- 4 setting groups
- Switchgear monitoring
- CB control
- CB failure protection
- Broken conductor detection
- Cold load pick-up logic
- Testing functions (DDB signals)
- Measurement circuits supervision
- **Quick access HOTKEY keys**
- **Tricolour LEDs**
- Communication standards: RS232 and RS485 (standard), F/O (option)
- Second port for remote communication
- Optional protocols: Courier, Modbus, IEC60870-5-103, DNP3.0, **IEC61850 (KEMA certified)**
- Programmable operating scheme logic through PSL Editor:
- P145 - max 24 x I / 32 x O
- Recording of:
 - Fault locator
 - Events - 512
 - Faults - 15
 - Disturbances – 20 (max window 10.5 s, COM-TRADE format)

Documents

- Catalogue card
- User manual

MiCOM P211

THREE-PHASE LV MOTOR PROTECTION RELAY

Functions: 50/51, 50N/51N, 37, 49, 46, 26/38 (P), 48, 50S/51LR

Application

- Comprehensive protection of LV motors.
- Replacement for RIz, RIzc, RIzx relays.
- Available models: A, B, C, U - see details in the catalogue card

Protections

- Overload - thermal image:
 - measurement of true RMS from 10 to 250Hz
 - nominal motor current setting from 0.37 to 80A (direct wiring)
 - time constants specified through tripping time setting at 6xIn current value
- Unbalance, loss of supply and loss-of-phase condition
- Excessive starting time
- Locked rotor
- Over temperature (with PTC sensors)
- Underload with time delay setting
- Short circuit
- Earth fault protection
- Self motor restart after a voltage loss on a substation busbar
- Limitation of the number of start-ups

Measurements

- Phase currents
- Thermal load
- Earth current

Other Functions

- Easy connection of motor feeders
- Pre-fault indication of overload
- Up to 4 programmable output relays
- Up to 4 programmable binary inputs
- RS 485 with Modbus RTU protocol



Flush mounted version



35 mm DIN rail version

Documents

- Catalogue card
- User manual

MiCOM P220

INTEGRATED PROTECTION & CONTROL SOLUTION FOR MOTOR MANAGEMENT

Functions: 50/51, 50N/51N, 37, 49, 46, 26/38 (RP), 48, 50S/51LR, 66



Application

- Comprehensive protection of LV/MV motors

Protections

- Thermal overload with thermal image (logarithmic characteristic). Configuration of 3 thermal time constants (starting, overload, cooling), 3 stages of thermal loading: alarm, trip and inhibition of CB closing.
- Three-phase overcurrent against phase-to-phase faults; 1-stage
- Earth fault, 2-stage. Co-operation with core balanced CT or three-phase CTs (Holmgreen arrangement).
- Excessive starting time. Overcurrent criteria. Detection of the motor's starting on the basis of the starting current value or of a change in CB status
- Locked rotor while running or starting. Overcurrent criteria
- Unbalance, loss of phase and single phasing. 2-stage protection based on the negative sequence component of the current
- Loss of load. 1-stage. Undercurrent criteria. Deactivated during start-up
- Temperature supervision. Co-operation with 6 RTD sensors (Pt, Ni, Cu) or 2 thermistors. 2-stage settings for each channel.
- Limitation of the number of successive start-ups. Inhibition of CB closing after last unsuccessful start-up. Separate settings for cold and hot start-ups.

Measurements

- Phase currents (up to 10th harmonic)
- Earth current
- Thermal load
- Temperature

Other Functions

- 2 setting groups
- Switchgear monitoring
- Trip statistics
- Analogue output
- Emergency start-up
- CB control
- Programmable binary inputs, output relays and LEDs
- Communication standards: RS232, RS485
- Transmission protocols: Courier, Modbus, IEC60870-5-103
- Recording of:
 - Events – 75
 - Faults – 5 (1600 Hz, window 3s)
 - Starting current (40s)

Documents

- Catalogue card
- User manual

MiCOM 225

INTEGRATED PROTECTION & CONTROL SOLUTION FOR MOTOR MANAGEMENT

Functions: 50/51, 50N/51N, 37, 49, 46, 50BF, 27, 59, 26/38 (P), 48, 50S/51LR, 66, ABS, 74TCS

Application

- Comprehensive MV motors protection with power and energy measurement

Protections

- Thermal overload with thermal image. Configuration of 3 thermal time constants (starting, overload, cooling), 3 stages of thermal loading: alarm, trip and inhibition of CB closing
- Three-phase overcurrent against phase-to-phase faults, 1-stage
- Earth fault, 2-stage
- Excessive starting time. Overcurrent criteria
- Locked rotor while running or starting. Overcurrent criteria
- Unbalance, loss of phase and single phasing. 2-stage protection based on negative sequence component of the current
- Loss of load. 1-stage. Undercurrent criteria
- Temperature supervision. Co-operation with 10 RTD sensors (Pt, Ni, Cu) or 3 thermistors.
- 2-stage setting for each channel.
- Limitation of the number of successive start-ups. Separate settings for cold and hot start-ups. Inhibition of CB closing after last unsuccessful start-up. Separate settings for cold and hot start-ups
- Undervoltage
- Anti-backspin protection

Measurements

- Phase currents (up to 10th harmonic)
- **Earth current**
- **Voltages**
- **Power P, Q, S**
- **Energy: active, reactive**
- Thermal load
- Temperature

Other Functions

- CB failure
- 2 setting groups
- Switchgear monitoring
- Trip statistics
- 2 analogue output
- Emergency starting
- CB control
- Programmable inputs, outputs and LEDs
- Communication standards: RS232, RS485
- Transmission protocols: Courier, Modbus, IEC60870-5-103
- Recording of:
 - Events – 250
 - Fault – 25
 - Disturbance – 5 (1600 Hz, window 2.5s)
 - Starting current (200s)
 - Starting voltage (200s)



Documents

- Catalogue card
- User manual

MiCOM P241 / MiCOM P242 / MiCOM P243 (with differential motor protection)

ASYNCHRONOUS & SYNCHRONOUS MOTOR MANAGEMENT RELAY

Functions: 50/51, 50N/51N, 67N, 37, 49, 46, 50BF, 32N, 27 59, 59N, 32R/32F, 81U, 26/38, 48, 50S/51LR, 66, 55, 60/VTS, 87M, 40



Protections

- **Motor differential (P243)**
- Thermal overload with thermal image. 3 thermal time constants (starting, overload, cooling)
- Three-phase overcurrent against phase-to-phase faults, 2-stage
- Earth fault, directional, 2-stage, overcurrent, DT or IDMT
- Residual overvoltage
- Wattmetric earth fault (for Petersen coil earthed system)
- Excessive starting time. Overcurrent criteria
- Locked rotor while running or starting. Overcurrent criteria
- Unbalance, loss of phase and single phasing, 2-stage protection based on negative sequence component of the current
- Loss of load; 2-stage, underload criteria
- Temperature supervision. Co-operation with 10 RTD sensors (Pt, Ni, Cu); 2-stage setting for each channel
- Limitation of the number of successive start-ups. Separate settings for cold and hot start-ups. Inhibition of CB closing after last unsuccessful start-up. Separate settings for cold and hot start-ups
- Under- / overvoltage
- Anti-Backspin protection
- Out of step (monitoring of $\cos \phi$)
- Reverse power
- Underfrequency
- Loss of field

Measurements

- Phase currents (up to 10th harmonic)
- Earth current, voltages
- Power P, Q, S
- Energy: active, reactive
- Thermal load
- Temperature

Other Functions

- 2 setting groups
- Switchgear monitoring
- Trip statistics
- Emergency starting
- CB control
- Programmable inputs (256 AND/OR gates and timers), output relays and LEDs
 - 8 x I / 7 x O (P241)
 - 16 x I / 14 x O (P242, P243)
- Communication standards: RS232/RS485
- Transmission protocols: Courier, Modbus, IEC 60870-5-103, DNP3.0, **IEC61850 (KEMA certified)**
- Dual redundant Ethernet: RSTP, DHP, SHP
- Recording of:
 - Events – 512
 - Faults – 20 (1200Hz, window 10.5s)

Documents

- Catalogue card
- User manual

MiCOM P341

INTERCONNECTION PROTECTION FOR EMBEDDED GENERATOR

Functions: 50/51, 50N/51N, 67, 67N, 49, 46, 50BF, 27, 59, 59N, 32R/32F, 32O, 32L, 81O, 81U, 81R, VVS, 64N/87N, 60/VTS, 25, DLR

Application

- Small generators for LV and MV systems. Back-up protection for bigger units
- Interconnection line

Protections

- Rate of frequency change (df/dt) ROCOF
- Voltage vector shift monitoring
- Directional / non-directional phase overcurrent
- Directional / non-directional earth fault
- Sensitive directional / non-directional earth fault
- Neutral displacement / residual overvoltage
- Restricted earth fault
- Under- / overvoltage
- Under- / overfrequency
- Reverse load, overload, low forward load
- **Check synchronism**
- **DLR – Dynamic Line Rating**

Measurements

- Phase currents
- Phase and line voltage
- Sequence current and voltage, neutral current and voltage
- Power P, Q, S; energy Ec, Eb
- Peak, mean and rolling demand
- Single and three-phase power factor

Other Functions

- 4 alternative setting groups
- Supervision of voltage and current transformer circuits
- Optional IRIG-B input for time stamp synchronisation
- Diagnostics and continuous self-monitoring
- CB status and condition monitoring
- Communication standards: RS232, RS485
- Optional transmission protocols: Courier, Modbus, IEC60870-5-103, DNP3.0
- **IEC61850 (KEMA certified)**
- Optional dual redundant Ethernet: RSTP, DHP, SHP
- Programmable scheme logic through PSL Editor (MiCOM S1)
- Programmable inputs (logic 256 AND/OR gates and timers, output relays and LEDs),
- 8 inputs / 7 outputs (standard)
- CLIO module
- Extra I/O cards – option
- Recording of:
 - Events – 250
 - Faults – 5
 - Disturbance waveforms – 20 (window 10.5s each)



Documents

- Catalogue card
- User manual

MiCOM P342 / MiCOM P343 / MiCOM P344 / MiCOM P345

INTEGRATED NUMERICAL GENERATOR PROTECTION

Functions: 50/51, 50N/51N, 67N, 49, 46, 50BF, 27, 59, 59N, 27TN/59TN, 87 (G/T), 32R/32F, 32O, 32L, 81O, 81U, 40, 24, 51V, 21, 64N/87N, 50/27, 78, 26/38, 60/VTS, 47, 81AB, 64S (100% - Gen), CLIO, 64R, 81R, 25



Application

- Medium and high power generators
- Unit protections for high-power turbine generators
- Protections for pumped-storage water power plants

Protections

- Generator/Transformer differential - only P343/4/5 models
- Rotor earth fault protection (P391 auxiliary unit)
- Interturn protection
- 100% stator earth fault, 3 harmonic analysis - only P343/4/5 models and 20Hz generator (P345)
- Non-directional phase overcurrent
- Non-directional earth fault
- Neutral displacement
- Sensitive directional earth fault
- Restricted earth fault
- Voltage dependent overcurrent or under-impedance
- Under- / overvoltage
- Under- / overfrequency
- Reverse power, low forward load and overload
- Loss of field
- Unbalance load
- Overfluxing
- Accidental energisation at standstill - only P343/4/5 models
- Resistance temperature devices 10 RTDs - option
- CLIO analogue measurements
- **Frequency rate of change**
- **Check synchronism**

Measurements

- Phase currents and voltages
- Sequence current and voltage, neutral current and voltage
- Differential and bias currents
- 3rd harmonic neutral voltage
- Power: P, Q, S; energies: Ec, Eb
- Temperature in °C

Other Functions

- Frequency tracking: from 5 Hz to 70 Hz
- Supervision of voltage and current transformer circuits
- Diagnostics and continuous self-monitoring
- Communication standards: RS232, RS485
- Optional transmission protocols: Courier, Modbus, IEC60870-5-103, DNP 3.0, **IEC61850 (KEMA certified)**
- Dual redundant Ethernet: RSTP, DHP, SHP
- Programmable inputs (logic - 256 AND/OR gates and timers), output relays and LEDs
- P342 - 8 x I / 7 x O
- P343 - 16 x I / 14 x O
- P344 - 16 x I / 14 x O
- P345 - 24 x I / 24 x O
- Extra I/O card - option
- Recording of:
 - Events – 512
 - Faults – 5
 - Disturbance waveforms – 20 (max. window 10.5 s)

Documents

- Catalogue card
- User manual

MX3EG1A

NUMERICAL MODULE FOR AUTOMATIC GENERATOR SYNCHRONISING

Functions: 25

Application

- Frequency and voltage regulation of a generator, permit for execution of automatic paralleling with a live or dead busbar
- Transmitting control signal on turbine and generator operation (monitoring of paralleling conditions)
- CB circuit monitoring
- Configuring binary inputs to operate on receiving: synchronisation signals, paralleling requests (with live-bus Start_LB or Dead-bus Start_DB), pause control, circuit breaker status, or other discrepancies
- Application of generator and busbar phase-to-phase voltage to 2 inputs

Measurements

- Voltage and frequency on busbar side
- Voltage and frequency on generator side
- Phase displacement
- Primary voltage values

Other Functions

- 2 setting groups
- Testing functions: LEDs, output relays
- 5 binary inputs, 6 output relays (5 freely configurable to the device functions, 1 for relay diagnostics)
- 12 LEDs (8 freely configurable to perform protection functions)
- Counters for each tripping threshold
- Local communication via PC to the front serial port (with a EOC12 fibre-optic cable)
- Enclosure protection: IP52 for front panel (optional IP66)
- Remote communication to network: via rear serial port, with Lonwork™ (1.25 Mb/s) or MODBUS (RS485)
- Recording of:
 - Events – 32 status changes
 - Faults – 8
 - Disturbance waveforms: 1 (600 Hz, window 2.5s)



MX3PG2A

INTEGRATED NUMERICAL GENERATOR PROTECTION (ROTOR PROTECTION)

Functions: 64R, 27DC, 59DC, 50/51



Application

- Rotor earth fault protection

Protections

- Rotor earth fault detection based on injection of AC low voltage (50Hz) between rotor windings of the protected synchronous machine and ground
- Monitoring of the injected voltage
- 2 independent time thresholds to monitor the resistance of the earth fault
- Independent time overcurrent protections
- 2 independent time delayed DC undervoltage protections
- 2 independent time delayed DC overvoltage protections

Measurements

- „Injected” voltage
- Circulating current
- Earth fault resistance
- DC voltage

Other Functions

- Dedicated input for a wide range of DC voltage measurements
- Instantaneous or delayed signalling output (alarm)
- 2 setting groups to be selected from HMI, via digital input or communication port
- 3 binary inputs, 6 output relays
- 12 LEDs (8 freely configurable to perform protection functions)
- Remote communication to network: via rear serial port, with Lonwork™ (1.25 Mb/s)
- Alternative MODBUS protocol (RS485)
- Recording of:
 - Events – 32 status changes
 - Faults – 8
 - Disturbance waveforms - 1
 - Counters and LEDs

MiCOM P433 / MiCOM P435

UNIVERSAL DISTANCE PROTECTION AND CONTROL UNIT (110 KV)

Functions: 50/51, 50N/51N, 67N, 49, 50BF, 79, 27, 59, 59N, 32R/32F (F), 81O, 81U, 81R, 21, 78, 26/38 (R), 25, 74TCS

Application

- HV line protection

Protections

- Distance protection:
 - circular or polygonal curve
 - 6 distance stages
 - 7 direction stages
 - 8 timer stages
 - start-ups: overcurrent, undervoltage and underimpedance
 - directional voltage memory
- Time-overcurrent protection:
 - backup (active when measuring circuit failure is detected)
 - DT, 4-stage, separate for phase and residual currents
 - IDMT, separate for phase and residual currents
- Under- / overvoltage protection
- Earth fault, wattmetric protections
- Frequency protection: $f / df/dt / \Delta f / \Delta t$
- Power-directional protection
- Thermal overload protection
- Directional earth fault
- PSB Power Swing Blocking

Control Functions

- 6 configurable buttons

Measurements

- Phase currents
- Earth current
- Phase and phase-to-phase voltages
- Power: P, Q
- Energy: active, reactive

Other Functions

- **Auto-reclosing control:**
 - **(3-phase) – P433**
 - **(1/3-phase) – P435**
- Circuit breaker failure protection
- Switch on to fault protection
- Limit values monitoring
- Interlocking
- 4 setting groups
- Measuring circuit monitoring (voltage and current)
- Programmable scheme logic
- Programmable inputs / outputs / LEDs
- max 16 x I / 30 x O (P433/P435-40TE)
- max 28 x I / 46 x O (P435-84TE)
- Analogue I/O module (option)
- 3 communication ports (option)
- Communication protocols: IEC 60870-103 / -101 / Modbus / DNP3.0 / **IEC61850 (KEMA certified)**
- Recording of:
 - Faults – 8x200 signals
 - Overload faults – 8x200 signals
 - Earth faults – 8x200 signals
 - Disturbances – 8 waveforms (1kHz)
- Circuit breaker monitoring
- Synchro-check (option)
- Power swing blocking



Documents

- Catalogue card
- User manual

MiCOM P437

NUMERICAL DISTANCE PROTECTION

Functions: 50/51, 50N/51N, 67N, 49, 50BF, 79, 27, 59, 59N, 32R/32F (F), 81O, 81U, 81R, 21, 78, 26/38 (R), 25, 74TCS



Application

- Line protection for HV systems

Protections

- Distance protection:
 - circular or polygonal curve
 - 6 distance stages
 - 7 direction stages
 - 8 timer stages
 - start-ups: overcurrent, undervoltage and underimpedance
 - directional voltage memory
- Time-overcurrent protections:
 - backup (active when measuring circuit failure is detected)
 - DT, 4-stage, separate for phase and residual currents
 - IDMT, separate for phase and residual currents
- Under- / overvoltage
- Frequency protection: f , df/dt , $\Delta f/\Delta t$
- Thermal overload protection
- Earth fault protection

Control Functions

- 6 configurable buttons

Measurements

- Phase currents
- Earth current
- Phase and phase-to-phase voltages

- Power: P, Q

Other Functions

- Auto-reclosing control (1/3-phase)
- Synchro-check (option)
- Power swing blocking
- Mutual compensation (option)
- Circuit breaker failure
- Switch on to fault protection
- Limit values monitoring
- Intertripping for distance protection
- Intertripping for earth fault protection
- 4 setting groups
- Measuring circuit monitoring (voltage and current)
- Programmable scheme logic
- Programmable inputs / outputs / LEDs
- max 28 x I / 46 x O
- Analogue I/O module (option)
- 3 communication ports (option)
- Communication protocols: IEC60870-103 / -101 / Modbus / DNP 3.0 / **IEC61850 (KEMA certified)**
- Recording of:
 - Faults – 8x200 signals
 - Overload faults – 8x200 signals
 - Earth faults – 8x200 signals
 - Disturbances – 8 waveforms (1kHz)
- CB monitoring

Documents

- Catalogue card
- User manual

MiCOM P432

DISTANCE PROTECTION AND BAY CONTROL

Functions: 21P, 50/51, 50N/51N, 67, 67N, 46, 46BC, 50BF, 79 (3) (1), 27, 59, 51V, 78, 25, 60/VTS

Application

- HV line protection

Protections

- Distance protection:
 - circular or polygonal curve
 - 6 distance stages
 - 7 direction stages
 - 8 timer stages
 - start-ups: overcurrent, undervoltage and underimpedance
 - directional voltage memory
- Time-overcurrent protections:
 - backup (active when measuring circuit failure is detected)
 - DT, 4-stage, separate for phase and residual currents
 - IDMT, separate for phase and residual currents
- Under- / overvoltage
- Frequency protection: f , df/dt , $\Delta f/\Delta t$
- Thermal overload protection
- Earth fault protection

Control Functions

- Control of 6 switches
- Monitoring of 10 switches
- Monitoring of extra signals and measurements
- Mimic diagram
- Interlocking logic
- More than 290 configurable bay types

Measurements

- Phase currents
- Earth current
- Phase and phase-to-phase voltages
- Power P, Q

Other Functions

- Auto-reclosing control (1/3-phase)
- Synchro-check (option)
- Power swing blocking
- Mutual compensation (option)
- Circuit breaker failure
- Switch on to fault protection
- Limit values monitoring
- Intertripping for distance protection
- Intertripping for earth fault protection
- 4 setting groups
- Measuring circuit monitoring (voltage and current)
- Programmable scheme logic
- Programmable inputs / outputs / LEDs
- max 28 x I / 46 x O
- Analogue I/O module (option)
- 3 communication ports (option)
- Communication protocols: IEC60870-103 / -101 / Modbus / DNP 3.0
- Recording of:
 - Faults – 8x200 signals (1 kHz)
 - Overload faults – 8x200 signals
 - Earth faults – 8x200 signals
 - Disturbances – 8 waveforms (1kHz)
- Circuit breaker monitoring



Documents

- Catalogue card

MiCOMho P443 With sub-cycle technology !!!

FAST MULTIFUNCTION DISTANCE PROTECTION

Functions: 21P/21N, 50/27, eI/eV, 68, 78, 85, 50/51/67, 79, 25, 46, 46BC, 50N/51N/67N, 67SEF, 49, 27, 59, 59N, 50BF, CTS/VTS, 81U/O/R, FL



Application

- Fast distance protection for HV / LV overhead or cable lines

Protections

- Single- (P443) and/or 3-phase tripping logic
- Single- and/or 3-phase autorecloser with optional synchro-check
- 5 zones of protection
- **Delta directional comparison $\Delta I/\Delta U$**
- Mho or quadrilateral (polygon) characteristics
- Loss of load protection
- Power swing alarm or blocking
- Directional / non-directional phase overcurrent
- Directional / non-directional earth fault
- Directional / non-directional negative sequence overcurrent
- Residual voltage protection
- Under- / overvoltage
- Switch on to fault and zone-selectable trip on reclose protection
- Out of step

Measurements

- Comprehensive measurements
- Instantaneous, I, U, P, Q, ...
- Time integrated, demands
- Diagnostics of connections for teleprotections

Other Functions

- Broken conductor detection
- Measuring circuit monitoring (voltage and current)
- Parallel line compensation
- Zone 1 extension
- Load blinder characteristics
- Stub bus protection
- Thermal overload
- Circuit breaker failure
- Breaker condition monitoring
- 4 setting groups
- **High break contacts (10A/220V DC) as option (max 8)**
- InterMiCOM64 teleprotection - option
 - Direct transmission of binary signals (max 8 per channel)
 - Support for 3-terminal applications
 - **1 or 2 FO channels (ST standard)**
- Quick access HOTKEY keys
- Optional transmission protocols: Courier, IEC60870-5-103, DNP 3.0, **IEC61850 + RS485 (Courier / IEC-103)**
- Dual redundant Ethernet: RSTP, DHP, SHP
- 2nd port for remote communication
- Programmable scheme logic through PSL Editor (MiCOM S1)
 - P443 A: 16 x I / 24 x O - A
 - P443 B: 24 x I / 32 x O - B
 - Extra I/O cards - option
- Recording of:
 - Fault location
 - Events - 512
 - Faults - 15
- Disturbance waveforms - 20 (max window 10.5 s)

Documents

- Catalogue card
- User manual

MiCOMho P446 Interoperates with 2 circuit breakers

HIGH PERFORMANCE DISTANCE PROTECTION

Functions: 21P/21N, 50/27, eI/eV, 68, 78, 85, 50/51/67, 79, 25, 46, 46BC, 50N/51N/67N, 67SEF, 49, 27, 59, 59N, 50BF, CTS/VTS, 81U/O/R, FL

Application

- Fast distance protection for HV / LV overhead or cable lines interacting with 2 circuit breakers
- 1.5- and 2-CB systems

Protections

- Single- (P443) and/or 3-phase tripping logic
- Single- and/or 3-phase autorecloser
- 5 zones of protection
- **Delta directional comparison $\Delta I/\Delta U$**
- Mho or quadrilateral (polygon) characteristics
- Loss of load protection
- Power swing alarm or blocking
- Directional / non-directional phase overcurrent
- Directional / non-directional earth fault
- Directional / non-directional negative sequence overcurrent
- Residual voltage protection
- Under- / overvoltage
- Switch on to fault and zone-selectable trip on reclose protection
- Out of step

Measurements

- Comprehensive measurements
- Instantaneous, I, U, P, Q, ...
- Time integrated, demands
- Diagnostics of connections for teleprotections

Other Functions

- Broken conductor detection
- Measuring circuit monitoring (voltage and current)
- Parallel line compensation
- Zone 1 extension
- Load blinder characteristics
- Stub bus protection
- Thermal overload
- Circuit breaker failure
- Breaker condition monitoring
- 4 setting groups
- **High break contacts (10A/220V DC) as option (max 8)**
- InterMiCOM64 teleprotection - option
 - Direct transmission of binary signals (max 8 per channel)
 - Support for 3-terminal applications
 - **1 or 2 FO channels (ST standard)**
- Quick access HOTKEY keys
- Optional transmission protocols: Courier, IEC60870-5-103, DNP 3.0, **IEC61850 + RS485 (Courier / IEC-103)**
- Dual redundant Ethernet: RSTP, DHP, SHP
- 2nd port for remote communication
- Programmable scheme logic through PSL Editor (MiCOM S1)
 - P446 - 32 x I / 32 x O
- Recording of:
 - Fault location
 - Events - 512
 - Faults - 15
- Disturbance waveforms - 20 (max window 10.5 s)



MiCOM P521

CURRENT DIFFERENTIAL PROTECTION

Functions: 87L, 87T, 50/51, 50N/51N, 46, 46BC, 50BF, 37, 74TCS



Application

- Current differential protection for MV/HV overhead or cable lines
- Line - transformer application

Protections

- Biased Differential Protection
- Low impedance
- 3-phase tripping
- Intertripping both Direct and Permissive
- Immune to line charging inrush currents
- Selectable inrush restrain
- Time delayed overcurrent protection
- 4-stage phase overcurrent
- 4-stage earth fault
- Thermal overload
- Broken conductor detection
- Negative sequence overcurrent
- Undercurrent

Measurements

- True RMS measured values
- Phase currents
- Neutral currents
- Sequence currents
- Bias and differential currents
- Remote currents
- Peak and rolling demand values
- Communication statistics

Other Functions

- Direct optical fibre links
 - 850nm – Multi-mode
 - 1300nm – Multi-mode
 - 1300nm – Multi-mode
- Suitable for interface to multiplexed systems
- Adjustment to electrical standard with P590 modules
- EAI232 modems
- Standard telephone lines
- EAI485 / EAI422 / EAI 530 modems
- TD32 type - leased lines
- mDSL type
- Wire connection with fast Campus Baseband modems (56/64kbit/s max up to 18 km)
- CB failure
- Trip circuit supervision
- CB condition monitoring
- Optional remote transmission protocols: Modbus, IEC60870-5-103
- Local communication: RS232
- Commissioning tests
- Recording of:
 - Events – 250
 - Faults – 25
 - Disturbance waveforms – 5 (1600Hz, window 3s, COMTRADE record format)

Documents

- Catalogue card
- User manual

MiCOM P541 / MiCOM P542

HIGH-SPEED CURRENT DIFFERENTIAL UNIT PROTECTION

Functions: 87L, 50, 51, 50N, 51N, 46, 46BC, 49, 50BF

Application

- Differential protection of HV / LV overhead or cable lines
- Protection of 2- or 3-terminal overhead or cable lines
- Line - transformer application
- Binary signal transfers for intertripping of distance protections

Protections

- Current differential: phase current compensation, CT ratio correction, vector compensation, transformer inrush restraint (2nd harmonic)
- Directional / non-directional phase and earth fault overcurrent
- Thermal overload
- Broken conductor detection

Measurements

- Local and remote currents
- Sequence currents
- Bias and differential currents
- Thermal state
- Propagation delay

Other Functions

- Dual redundant communications
- Propagation delay compensation
- Setting of a transformer connection group
- Direct and permissive intertripping via a communication channel
- Circuit breaker failure
- Autoreclose function for P542
- 4 setting groups
- Communication with optical fibre (point - point) or with multiplexed systems
- InterMiCOM64 teleprotections
- Binary signal transfers - max 8 signals per channel (max 16 signals per 2 channels)
- Optional transmission protocols: Courier, Modbus, IEC60870-5-103, DNP 3.0
- Programmable scheme logic through PSL Editor (MiCOM S1)
- P541 - 8 x I / 7 x O
- P542 - 16 x I / 14 x O
- Recording of:
 - Fault location
 - CB diagnostics
 - Error statistics for active channels
 - Events – 512
 - Trips – 5
- Disturbance waveforms – 20 max window 10.5s, COMTRADE record format



MiCOM P541_J



MiCOM P542_J

Documents

- Catalogue card
- User manual

MiCOM P543 / MiCOM P544 / MiCOM P545 / MiCOM P546

HIGH-SPEED CURRENT DIFFERENTIAL UNIT PROTECTION

Functions: 50/51, 50N/51N, 67, 67N, 49, 46BC, 50BF, 79, 87L, 21P/21N, 27, 68, 78, 85, 59, 59N, CTS/VTS, 25, 81O/U, 81R, FL



MiCOM P543/4/5/6_K

Application

- Differential protection of HV / LV overhead or cable lines with optional distance protection functions
- Protection of 2- or 3-terminal overhead or cable lines
- Line - transformer application
- Applicable in SDH/SONET synchronous networks

Protections

- Two CB's configuration (P544, P546)
- Current differential: phase current compensation, CT ratio correction, vector compensation, transformer inrush restraint (2nd harmonic)
- Directional / non-directional phase and earth fault overcurrent
- Directional wattmetric earth fault
- Thermal overload
- Sensitive earth fault
- 5-zone distance protection - option
- Power swing blocking
- Out of step protection
- Broken conductor detection

Measurements

- Local and remote currents
- Sequence currents
- Power and energy
- Bias and differential currents
- Thermal state
- Propagation delay

Other Functions

- Dual redundant communications
- Propagation delay compensation
- Capacitive current compensation
- Setting of a transformer connection group
- Direct and permissive intertripping via a communication channel
- Circuit breaker failure
- Autoreclose with synchro-check
- Teleprotection functions - 2 groups
- Supervision of current and voltage measuring circuits
- 4 setting groups
- **High break outputs (10A / 220V DC) as option (max 8 outputs) - P543/4/5/6**
- Communication with optical fibre (point - point) or with multiplexed systems
- InterMiCOM64 teleprotections
- Binary signal transfers - max 8 signals per channel (max 16 signals per 2 channels)
- Optional transmission protocols: Courier, Modbus, IEC60870-5-103, DNP 3.0, **IEC 61850 + RS485 (KEMA certified)**
- Dual redundant Ethernet: RSTP, DHP, SHP
- Programmable scheme logic through PSL Editor (MiCOM S1)
 - P543/4/5/6 - min. 16 x I / 14 x O
 - Extra I/O modules
- Recording of:
 - Fault location
 - Error statistics for active channels
 - Events – 512
 - Faults – 15
 - Disturbance waveforms – 20 max window 10.5s, COMTRADE record format

Documents

- Catalogue card
- User manual

MiCOM P532

LINE DIFFERENTIAL PROTECTION AND CONTROL DEVICE

Functions: 87L, 50/51, 50N/51N, 50BF, 67, 67N, ADMIT, 49, 79 (3), 32N, 27, 59, 47, 27D, 59N, 32R/32F (F), 51V, 26/38 (R), 46, 25, 74TCS, CTS/VTS, FL

Application

- Selective and sensitive protection of overhead and cable lines
- One-box solution with optional bay controller in MV systems

Protections

- Line current differential
- Directional phase-phase overcurrent, 3-stage IDMT and 1-stage DT
- Directional earth fault
- Directional, active and reactive power
- Unbalance, check of the negative sequence current
- Thermal overload with 1 thermal time constant
- Admittance earth fault
- Under- / overvoltage
- Switch onto fault protection
- Synchro-check (option)

Control Functions (IED with graphic HMI)

- Control of 6 switches (IED with graphic HMI)
- Monitoring of 10 switches (IED with graphic HMI)
- Control and monitoring of 3 switches (IED with text HMI – 6I6O module required)
- More than 290 pre-defined bay types
- Check of extra signals and measurements
- Mimic diagram
- Interlocking logic

Measurements

- Differential and restraining current
- Angles between local and remote currents (separate for each of the 3 phases)
- Local and remote phase currents
- Earth current
- Voltages
- Power P, Q, S
- Energy: active, reactive
- Thermal state

Other Functions

- Autoreclose function
- 4 setting groups
- CB failure scheme
- Circuit breaker monitoring
- Programmable inputs / outputs / LEDs
- Max of 46 x I / 30 x O
- 3 communication ports (option)
- Communication ports: IEC 60870-103 / -101 / Modbus / DNP 3.0 / **IEC 61850 (KEMA certified)**
- Recording of:
 - Faults – 8x200 events
 - Overload faults – 8x200 events
 - Ground faults – 8x200 events
 - Disturbances – 8 waveforms (1kHz)



Option with graphic HMI



Option with text HMI

MiCOM P631 / MiCOM P632 / MiCOM P633 / MiCOM P634

UNIVERSAL DIFFERENTIAL RELAY

Functions: 50/51, 50N/51N, 49, 87 (T), 81O, 81U, 81R, 24, 64N/87N, 26/38 (R), 74TCS, 50BF



Application

- Differential protection with supplementary functions for transformers, motors and generators

Protections

- Differential:
 - amplitude and vector group matching
 - zero-sequence current filtering for user-selected winding(s)
 - inrush restraint (2nd harmonic)
 - overfluxing restraint (5th harmonic)
 - saturation discriminator
- MiCOM P631: 2 ends
- MiCOM P632: 2 ends
- MiCOM P633: 3 ends
- MiCOM P634: 4 ends
- Restricted earth-fault, separate for each end of the protected unit (P632/3/4)
- Overcurrent: DT or IDMT, 3-stage, separate for phase and residual currents
- I_o calculated or measured (P632/3/4)
- Thermal overload (for 2 ends)
- Frequency: f, df/dt, Δf/Δt (P632/3/4)
- Overfluxing U/f

Control Functions

- Control and monitoring of 3 switches
- 6 configurable function keys
- Check of extra signals and measurements
- Interlocking logic
- More than 80 pre-defined bay types
-

Measurements

- Differential and restraining currents
- Phase currents (separate for each phase and each end of the protected unit)
- Earth current (separate for each end of the protected unit)
- Phase shifts between phases
- Phase shifts between the same phases of different ends in the protected unit
- Voltages (P632/3/4)

Other Functions

- Limit values monitoring
- 4 setting groups
- Programmable scheme logic
- Programmable inputs / outputs / LEDs
- Analogue I/O module (option)
- 3 communication ports
- Communication protocols: IEC60870-103 / -101 / Modbus / Courier / DNP 3.0 / **IEC61850 (KEMA certified)**
- Recording of:
 - Disturbances – 8 waveforms (1kHz)
 - Overload faults – 8x200 signals
 - Faults – 8 x 200 signals

Documents

- Catalogue card
- User manual

MiCOM P132

VOLTAGE PROTECTION WITH LOAD SHEDDING SCHEME

Functions: 27, 59, 47, 27D, 59, 59N, 81O, 81U, 81R

Application

- Voltage and frequency protection for applications in voltage measurement bays of a MV substation

Protections

- Phase under- / overvoltage
- Under- / overvoltage for positive sequence (U1)
- Under- / overvoltage for negative sequence voltage (U2)
- Overvoltage for zero-sequence (Uo)
- Monitoring of phase-to-phase and/or phase voltages
- Frequency (4-stage)
- with change of frequency rate df/dt
- with supervision of mean rate of frequency change ($\Delta f/\Delta t$)

Measurements

- Phase voltages
- Phase-to-phase voltages
- Positive, negative and zero-sequence voltages

Other Functions

- Limit values monitoring
- 4 setting groups
- Measuring circuit supervision
- Programmable scheme logic
- Programmable inputs / outputs / LEDs
- (4 x I / 8 x O) or (4 x I / 14 x O) or (10 x I / 11 x O)
- 3 communication ports (option)
- Communication protocols: IEC 60870-5-103 / -101 / Modbus / DNP 3.0 / **IEC 61850 (KEMA certified)**
- Recording of:
 - Disturbances - 8 waveforms (1kHz)



Documents

- Catalogue card
- User manual

MiCOM P921

VOLTAGE PROTECTION RELAY

Functions: 27, 59, 59N

Application

- Comprehensive voltage protection

Protections

- Undervoltage, 3-stage, IDMT and DT
- Overvoltage, 3-stage, IDMT and DT
- Residual overvoltage, 3-stage, IDMT and DT

Measurements

- Voltages
- Frequencies

Other Functions

- Available configurations:
 - 3 (phase-neutral)
 - 2 (phase-phase + residual)
 - 2 (phase-neutral + residual)
 - 1 (phase-phase + residual)
- 1 setting group
- CB state monitoring
- Blocking logic
- Programmable 2 binary inputs, 4 output relays and LED diodes
- Output contact latching
- Communication standards: RS232, RS485
- Transmission protocols: Courier, Modbus, IEC60870-5-103



Documents

- Catalogue card
- User manual

MiCOM P922 / MiCOM P923

VOLTAGE PROTECTION WITH LOAD SHEDDING SCHEME

Functions: 27, 59, 47, 27D, 59, 59N, 81O, 81U, 81R, eU/et



Application

- Comprehensive voltage protection with Load Shedding Scheme

Protections

- Undervoltage, 3-stage, DT and IDMT
- Overvoltage, 3-stage, DT and IDMT
- Zero-sequence overvoltage, 3-stage, DT and IDMT
- Negative sequence overvoltage, 2-stage, DT and IDMT
- Positive sequence undervoltage, 2-stage, DT and IDMT
- Under- / overfrequency, 6-stage
- 6-stage df/dt (P923 only)
- $\Delta U/\Delta t$ (P923 only)

Measurements

- Voltages
 - basic harmonic
 - average values
 - peak values
- Frequencies

Other Functions

- Available configurations:
 - 3 (phase-neutral)
 - 2 (phase-phase + residual)
 - 2 (phase-neutral + residual)
 - 1 (phase-phase + residual)
- 2 setting groups
- CB state monitoring
- CB supervision
- Blocking logic
- Programmable 5 binary inputs, 8 output relays and LED diodes
- Output contact latching
- Communication standards: RS232, RS485
- Transmission protocols: Courier, Modbus, IEC60870-5-103
- Recording of:
 - Events – 250
 - Faults – 250 (1600 Hz, window 2.5s)

Documents

- Catalogue card
- User manual

MiCOM P941 / MiCOM P943

VOLTAGE & FREQUENCY PROTECTION RELAY

Functions: 27, 59, 81O, 81U, 81R, 60/VTS, 81AB



Application

- All application where accurate frequency monitoring is required for system stability
- Load shedding scheme and autoreclose functionality afterwards

Protections

- Under- / overfrequency
- 6-stage, 4 measuring criteria:
 - check of frequency, time-delayed
 - change of frequency rate df/dt, time-delayed
 - frequency supervision vs. change of frequency rate f+df/dt, instantaneous
 - frequency supervision vs. mean rate of frequency change f+ $\Delta f/\Delta t$, instantaneous
- Abnormal operation of a generator; check of frequency changes within a timeframe, in 4 bands
- Under- / overvoltage, 2-stage. IDMT and DT.

Measurements

- Voltages
- Frequencies

Other Functions

- 4 setting groups
- Load shedding scheme, 6-stage
- Trip statistics
- Programmable inputs (logic 250 AND/OR gates and timers), output relays and LED diodes
 - P941: 8 x I / 7 x O
 - P943: 16 x I / 14 x O
- Communication standards: RS232, RS485
- Another RS232/RS485 port as an option
- Transmission protocols: Courier, Modbus, IEC60870-5-103, DNP 3.0
- Recording of:
 - Events – 512
 - Faults – 20 (1200Hz, window 10.5s)
- Extra I/O modules
- 6-stage autoreclose after load shedding scheme

Documents

- Catalogue card
- User manual

MiCOM P741 (CU) / MiCOM P742 (PU) / MiCOM P743 (PU)

NUMERICAL BUSBAR PROTECTION RELAYS WITH CB FAILURE PROTECTION - DISSIPATED

Functions: 87BB/P, 87BB/N, 87CZ, 50/51, 50N/51N, CTS, 50BF

Application

- Busbar and CB failure protections applicable in 110/220/400 kV power transmission and distribution network substations
- Suitable for industrial network and power plant substations (including reversible generators)
- Substation topologies: 1 ½ and 2 CBs, mesh corner

Protections

- Busbar bias differential - P741 (CU)
- Check zone protection - P741 (CZ)
- Circuit breaker failure protection (general 3-pole trip) - P741 (CU)
- Dead zone protection (a short zone between CB and CT)
- Non-directional overcurrent protection:
- P742/P743
 - phase fault (2-stage)
 - earth fault (2-stage)
- Circuit breaker failure protection (single- and 3-pole retrip) - P742/3

Measurements

- Central Unit (P741)
 - differential current: Idiff/phase/zone
 - bias current: Ibias/phase/zone
 - zone check: Idiff/zone
- Peripheral Units (P742/P743)
 - phase currents: IL1, IL2, IL3
 - earth current: Io
 - frequency

Other Functions

- Possibility to configure up to 8 zones and 28 Peripheral Units per a single Central Unit (P741)
- Distributed and centralised architecture in cubicles
- Fast fault clearance (a typical tripping time of 13 ms)
- Dynamic adjustments to changes in substation topology
- Innovative algorithms for CT saturation detection
- Possibility to accommodate different CT classes, with CT differentiating up to 40 times
- Available testing functions
- Optional transmission protocols: Courier, IEC 60870-5-103, IEC 61850 (P741, P743)
- Dual redundant Ethernet: RSTP, DHP, SHP
- Another RS232/RS485 port (Courier only) for P741, P743
- Programmable scheme logic through PSL Editor (MiCOM S1)
- P741 - 8 x I / 8 x O
- P742 - 16 x I / 8 x O
- P743 - 24 x I / 21 x O
- Recording of:
 - Events – 512
 - Faults – 5
 - Disturbance waveforms – 20
 - 10.5s for P742/P743
 - 1.2s for P741



MiCOM P741
Central Unit



MiCOM P742
Peripheral Unit



MiCOM P743
Peripheral Unit

Documents

- Catalogue card
- User manual

MiCOM P746

NUMERICAL BUSBAR PROTECTION RELAYS WITH CB FAILURE PROTECTION - CENTRALISED

Functions: 87BB/P, 87BB/N, 87CZ, 50/51, 50N/51N, CTS, VTS, 50BF



1-box mode



3-box mode
(one per phase)

Application

- Busbar and CB failure protections applicable in 110/220/400 kV power transmission and distribution network substations
- Suitable for industrial and railway networks as well as for power stations
- H3 - H5 substations (110kV)

Protections

- Busbar bias differential
- Check zone protection (CZ)
- Circuit breaker failure protection (general 3-pole trip)
- Dead zone protection (a short zone between CB and CT)
- Non-directional overcurrent protection: phase fault (2-stage) and earth fault (2-stage)
- Unbalance load (2-stage)
- Supervision of voltage and current circuits

Measurements

- Differential and bias current per phase and per zone/system
- Differential current per phase for check zone
- Phase currents: L1, L2, L3
- Sequence current
- Voltages
- Frequency

Other Functions

- Possibility to configure up to 2 systems
- P746 in 1-box mode solution can accommodate up to 6 CTs, 6 breakers, 12 isolators
- P746 in 3-box mode solution can accommodate up to 18 CTs, 18 breakers, 36 isolators
- Fast fault clearance (a typical tripping time of 12 ms HBC or 17 ms SC)
- Dynamic adjustments to changes in substation topology
- Innovative algorithms for CT saturation detection
- **Optional voltage criteria**
- Tricolour LED diodes, function keys x 10 and HOT KEY x 2
- Available testing functions
- Software for switch status monitoring and real-time measurements (Remote HMI)
- Optional transmission protocols: Courier, IEC60870-5-103, DNP 3.0, **IEC 61850 (KEMA certified)**
- Dual redundant Ethernet: RSTP, DHP, SHP
- Cyber Security on the NERC norm
- Another independent RS232/RS485 port (Courier only)
- Programmable scheme logic through PSL Editor (MiCOM S1)
- P746 - max 40 x I / 32 x O
- Recording of:
 - Events - 512
 - Faults - 5
 - Disturbance waveforms - max 10.5s, single disturbance (min. 50 records, 1.5s - memory of 75s)

Documents

- Catalogue card

MiCOM P132 / MiCOM P139

MV CHANGEOVER DEVICES

Hardware

- Changeover scheme utilises programmable logic of MiCOM P132 (or MiCOM P139) relay. For the relays description see page 12 and 13 of this Guide.

Principles of Operation

Two scheme configurations are possible:

- Information on primary voltage interruption is sent from voltage relays (e.g. MiCOM P921) located in measuring bays to binary inputs of a P13x relay, which initiates the course of the changeover scheme. During the course of the scheme the P13x performs several control operations (opening and closing CBs), using its auxiliary output relays and binary inputs. A manner to initiate the scheme can be selected by a user out of the following options:
 - on energising of a binary input of the device, assigned to an output relay of undervoltage facility in the measuring bay
 - on tripping of a protection relay in a transformer bay, having confirmed a change of CB state in the primary supply bay
 - remotely, on sending a system command.

On the basis of the state of a bus coupler CB, the P13x selects a type of back-up supply configuration. Accordingly, a changeover scheme mode and a sequence of control operations are chosen automatically. The device may be programmed to operate both in 1-shot changeover scheme and in return changeover scheme.

The scheme can be blocked by:

- external signals, sent to binary inputs from other controllers or functional relays, located in other bays
- internal signals, sent from an integrated facility which monitors the switching state, or after a successfully completed scheme
- a system of higher level.
- If no protection relay is required in a bus coupler bay, the P13x utilises its binary inputs and output relays only, whereas its protection facilities are disabled.
- There are 2 MiCOM P13x devices installed in parallel in 2 feeder bays. In such a case the relays perform several protection functions for feeder lines, apart from the changeover scheme features described above.



Documents

- Catalogue card
- User manual

MiCOM P841 Interoperates with 1 or 2 circuit breakers

MULTIFUNCTION LV LINE TERMINAL PROTECTION AND CONTROL IED

Functions: 79, 25, 50/51/67, 50N/51N/67N, 51N/67N/SEF, 67/46, 46BC, 49, 27, 59, 59N, 50BF, CTS/VTS, 81U/O/R, FL

Application

- Back-up protection for HV / LV overhead and cable lines
- Independent single- / 3-pole auto-reclosing unit dedicated to single breaker applications (P841A) or to 2 breaker applications (P841B)

Protections

- Single- / 3-pole auto-reclosing scheme
- Directional earth fault
- Sensitive directional earth fault SEF
- Loss of load
- Directional / non-directional overcurrent
- Directional / non-directional negative sequence overcurrent
- Residual voltage protection
- Under- / overvoltage
- Switch-on-to-fault and trip-on-reclose protection
- Out of step

Measurements

- Comprehensive measurements
- Instantaneous, I, U, P, Q ...
- Time integrated, demands
- Energy

Other Functions

- Broken phase conductor detection
- Voltage and current transformer supervision
- Thermal overload
- Circuit breaker failure protection
- Breaker condition monitoring
- 4 setting groups
- **High speed, high break contacts (10A/220V DC) available as an option (max 8)**
- InterMiCOM64 teleprotection - option
 - Direct transmission of binary signals
 - Support for 3-terminal applications
 - **1 or 2 FO channels (ST standard)**
- Quick access HOTKEY keys
- Optional transmission protocols: Courier, IEC60870-5-103, DNP 3.0, **IEC61850 + RS485 (Courier / IEC-103)**
- Dual redundant Ethernet: RSTP, DHP, SHP
- 2nd port for remote communication
- Programmable scheme logic through PSL Editor (MiCOM S1)
 - P841 - 24 x I / 32 x O
- Recording of:
 - Fault location
 - Events - 512
 - Faults - 15
 - Disturbance waveforms - 20 (max window 10.5s)



Documents

- Catalogue card
- User manual

MiCOM E124

CAPACITOR TRIP UNIT



Application

- Suitable for interaction with automatic relays of P115 and P124 types
- Back-up for auxiliary supply voltage for digital protection relays in case of a short-term loss of voltage supply
- Applicable for trip coils in 110kV bays (e.g. 110/MV transformer bays)

Key Features

- The cumulated energy (max 300V / 118J) remains over 8 days without recharge
- Possibility to energize 2 different tripping circuits (max 2 x 59 J)
- Load status indicators

Other Features

- Internal monitoring of current
- Possibility to operate with trip coils at 24V, 110V and 230V levels
- Test button switches allow discharge of each of capacitor banks
- Case of 10TE Midos type
- Flush mounting, available adapters for wall mounting
- Operating temperature range: -25°C to +55°C

Documents

- Catalogue card

MiCOM P891

CIRCUIT BREAKER TRIP / CLOSE MODULE



Application

- Direct control of CB tripping and closing
- Co-operation with MiCOM relays and P991 test blocks

Key Features

- Pushbutton switches
- LED indicators for device open and close indication
- Universal power supply for LED indication circuit
- Dedicated output contacts per pushbutton, direct wiring with tripping, controlling and indicating circuits

Other Features

- Suitable for synchro-check modules and auto-reclosing facility
- Available for ring- and pin-terminals
- Pushbutton covers are provided to prevent inadvertent operation of pushbutton switches
- Case of 10TE Midos type

Documents

- Catalogue card

MiCOM P991 / MiCOM P992 / MiCOM P993

TEST BLOCKS

Application

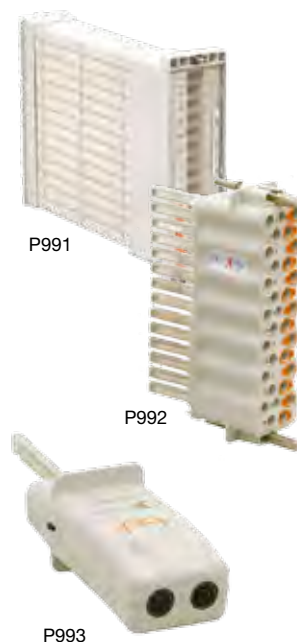
- Direct access to protective automation equipment and measuring relays
- Breaking of measuring and tripping circuits

Key Features

- Factory configurable to the customer's requirements (available 14 circuits)
- Sequential shorting / breaking of circuits
- Automatic shorting of current circuits
- One test plug applicable for all possible configurations of the socket
- Available single-finger (P993) or multi-finger (P992) test plugs

Other Features

- Customer's configuration defined at the ordering stage
- Screw terminals (pod M4)
- Mechanical polarisation of the plug
- Case of 10TE Midos type
- Flush mounting, available adapters for wall mounting
- Operating temperature range: -25°C to +55°C



Documents

- Catalogue card

MiCOM P591 / MiCOM P592 / MiCOM P593

COMMUNICATION INTERFACE UNITS FOR MULTIPLEXERS

Applications

- Conversion of fibre-optic to electrical standard for multiplex devices (MUX)
- Communication interface for current differential line protections (MiCOM P54x and P52x)

Key Features

- **MiCOM P591** - converts fibre-optic 850 nm MM standard to electrical standard of **G.703.1** type (64kbit/s)
- **MiCOM P592** - converts fibre-optic 850 nm MM standard to electrical standard of **V.35** type
- **MiCOM P593** - converts fibre-optic 850 nm MM standard to electrical standard of **X.21** type
- Zero-sequence overvoltage

Other Features

- Diagnostic and testing functions configurable with microswitches
- Maximum distance between a protection relay and the P59x communication interface up to 1km with the use of 850nm MM fibre-optic cable
- P59x interfaces should be installed as close to PCM multiplexers as possible
- Fibre-optic links through BFOC 2.5 (ST) connectors
- MiCOM 10TE case suitable for flush mounting



MiCOM P594

GPS SYNCHRONIZING UNIT



Application

- Real time synchronisation in IRIG-B standard (in modulated or un-modulated mode) for protections, recorders or RTUs within a whole substation / switchyard
- Real time synchronisation for protections, recorders or RTUs within a whole substation / switchyard through opto input (e.g. Px20 Phase2 V11, Px30, Px40 series)
- Sampling synchronisation for current-differential protection relays of P543/4/5/6 type installed in synchronous optical networks **SDH/SONET** (fibre-optic link)
- Sampling synchronisation for **CVCOM** Merging Units linked with non-conventional instrument transformers (NCITs) via **IEC61850-9-2** protocol.
- Sampling synchronisation for **Phasor Measurement Units**

Measurement Units

Other Functions

- Parameter settings input by means of LCD front panel
- Available 8 LED indicator diodes
- Available 2 „watchdog” contacts
- 4 fibre-optic outputs (for P543/4/5/6)
- 1 IRIG-B input (modulated), BNC type
- 1 IRIG-B input (non-modulated), RS422 type
- 4 output relays (configurable)
- Pulse-per-minute (PPM) or Pulse-per-hour (PPH) functionality
- Module supplied with antenna and cable (25m or 50m)
- Universal auxiliary voltage supply Vx AC/DC
- Flush unit casing in MiCOM 20TE standard

Documents

- Catalogue card

Services



- The services offered constitute a substantial part of business activities run by Schneider Electric Energy Poland Sp. z o.o. in the area of Protections and Systems. Being a global player in the sectors of energy generation, transmission and distribution for power industry and industrial power plants, we are offering a servicing scheme customised to meet individual customers' requirements.

Consulting and Expertise

- Technical support
- Application counselling
- Assistance in selection, input and modification of settings

Installation and Commissioning

- A team of professionals trained in handling our products installed on sites

Repairs

- Equipment reparations
- Lending of replacement products for the repair period
- Efficient troubleshooting
- Modernisation of legacy solutions

Installation Retrofit

- Maximum efficiency at minimum costs
- Maintenance and Technical Support
- Technical aid and assistance on a customer's site
- Spare parts stock
- Maintenance of equipment

Spare Parts

- Offer of supplies of necessary parts and components

Training Sessions

- Related to products
- Related to commissioning operations
- As per customer's requests

Easergy T2001

MV AND MV/LV SUBSTATION CONTROL UNIT WITH TELECONTROL INTERFACE TO SCADA SYSTEMS

Application

- 4 to 36kV cable networks
- MV network management
- Collaboration with standard MV switchgears (e.g. RM6 etc.)
- Remote monitoring of network parameters
- Monitoring of external IEDs via Modbus protocol
- Cooperation with external, directional fault passage indicators
- Supervision and control over the equipment installed in a substation
- Power supply switchover automation (internal logic schemes)

Functions & Measurements

- Measurements of work currents on cable lines
- Measurements and indication of fault currents on cable lines
- Measurements and control of voltages on MV or LV side

Communication

- Available 3 communication ports: 2 remote as per options and 1 of Ethernet type
- Remote network: radio, PSTN, GSM/GPRS, Ethernet
- Local network: RS485 Modbus. Communication protocols: IEC870-5-101 and IEC870-5-104, DNP3. The angles between local and remote currents (separately for each of the 3 phases)
- Local and remote phase currents
- Earth current
- Voltages
- Power P, Q, S
- Energy: active, reactive
- Thermal load

Other Functions

- Remote control and parameter setting with a built-in Web server
- Remote access to data in parallel to the control system by means of GSM, GPRS, Ethernet, PSTN transmission links
- Cooperation with L500 system for Easergy equipment
- Monitoring of battery availability
- Power supply self-check
- Transmission of alarms to SCADA system
- Selection of local and remote mode of operation
- 6 binary inputs for general utilisation
- 1 binary input for internal FPI reset
- 1 output relay for external FPI reset
- 1 output relay for launching an external flashing indicator (visibility 50m, a flash every 1s)
- Automatic selectioniser
- Automatic changeover switch with generator start-up function
- Paralleling
- Archives of events and measurements
- 5 types of counters
- In-built fault current detector
- Control of 4, 8 or 16 switches at a substation
- Dedicated CTs
- Unified connector for measuring circuit connections



Flair200C

DIRECTIONAL INDICATOR OF FAULT PASSAGE WITH RTU FUNCTIONALITY AND REMOTE COMMUNICATION FOR CABLE NETWORKS



Application

- Detection of earth fault current passages in networks with resistor-earthed, directly earthed or isolated neutral and compensated system
- Remote monitoring of MV substation status
- Remote monitoring of network parameters: load, current, power
- Recordings
- Monitoring of external IEDs via Modbus protocol
- Monitoring of substation conditions: temperature, smokiness, door opening, fuse tripping etc.

Functions

- Directional functionality to detect earth faults selectively in a standard and emergency mode of substation operations (optional ICC algorithm to detect faults, with „Insensitive to Capacitive Currents”, a patented solution)
- Possibility to monitor external IEDs via Modbus protocol (substation RTU)

Communication

- IP standards:
 - IEC870-5-101 and -103
 - DNP3 level 3, serial and TCP/IP
 - Modbus , serial and TCP/IP
- Interfaces:
 - GSM/GPRS, radio (FSK/FFSK), PSTN V32, Ethernet
 - RS232/RS485 (external modem)
 - Ethernet (extra port)

Other Functions

- Resetting of fault indications in MV networks: automatic after time delay, automatic upon voltage return and manual by a push button
- Suitable for connection to power supply wiring from LV switchgear
- Suitable for connection with external indicator terminals, wall-mounted on a transformer station
- 1 or 2 measuring channels
- Inrush filtering function
- Time synchronisation through SCADA, local PC, Ethernet
- Available 6 binary inputs and 3 output relays
- Memory capacity to store:
 - - 10000 events
 - - 2000 alarms
 - - 6000 system
 - - 30000 measurements
- Variable recording and time-stamping
- Local and remote operations and maintenance performed via a built-in Web server
- Password-protected access to data
- 3 access levels can be defined: Administrator, Operator, Monitoring.
- Cooperation with L500 supervision and control system for Easergy range



Power Logic ION7550 / ION7650

HIGH PERFORMANCE METER OF NETWORK PARAMETERS - A Class Accuracy

Application

- Analysis of electrical energy quality and efficiency
- Supervision over reliability of power supply
- Cooperation with ION Enterprise - power management system

Measurements

- Accurate and fast measurements of true RMS values ($\frac{1}{2}$ cycle) for 3-phase and individual phases (voltages, currents, active and reactive power, power factor, frequency and voltage and current asymmetry)
- Setting of mean, minimal and peak values (power, current and voltage)

Technical Parameters

- 16 binary inputs
- 4 output relays
- 8 analogue outputs - option

Communication

- Ethernet 10/100Base-T/TX/FX, Modbus TCP, ION, IEC61850 protocols
- RS232/RS485 with support for Modbus RTU master/slave, ION, DNP3 protocol
- Optical port on front panel
- Web Server/e-mail/SNMP/XML
- 1 binary input for internal FPI reset
- 1 output relay for external FPI reset
- 1 output relay for launching an external flashing indicator (visibility 50m, a flash every 1s)
- Automatic selectioniser
- Automatic changeover switch with generator start-up function
- Paralleling

- Archives of events and measurements
- 5 types of counters
- In-built fault current detector
- Control of 4, 8 or 16 switches at a substation
- Dedicated CTs
- Unified connector for measuring circuit connections

Other Parameters

- Power and energy metering in accordance with PN-EN 62053-22 Class 0.2S
- Parameters of electrical energy quality - recording compliant with PN-EN 61000-4-30 Class A (confirmed by KEMA and PSL laboratories)
- Metering of voltage and current harmonics and interharmonics in accordance with PN-EN 61000-4-7
- Individual analysis of voltage and current harmonics (ION7650 for H511 and ION8800A for H63)
- Assessment of quality of supply voltage in accordance with PN-EN 50160
- Voltage sagging and swelling detection, accuracy of $\frac{1}{2}$ cycle (10ms)
- Capture of ultra-fast transients (up to 20 μ s)
- Oscillograph recorder function - resolution of 1024 samples per a cycle (51 kHz)
- GPS time synchronisation
- Internal memory of up to 10MB for data and alarms
- Built-in LCD display - access to real-time measurements, spectral analysis of harmonics, vector diagram of voltages and currents and user-defined screens



Power Logic Seria PM800

NETWORK PARAMETER ANALYSER WITH FAULT DETECTION AND OSCILLOGRAPH RECORDING



Application

- Sub-billing, cost allocation, and utility bill verification
- Remote monitoring of electrical installations
- Mid-range power quality and energy management analysis
- Utility contract optimisation and load preservation

Features

- Measurement of parameters up to 63rd harmonic (PM850/870)
- Binary inputs: 1/8 - option
- Binary outputs: 1/4 - option
- Analogue inputs: 0/4 - option
- Analogue outputs: 0/4 - option

Communication

- 16 binary inputs
- 4 output relays
- 8 analogue outputs - option

Communication

- Modbus RTU / RS485
- Optional Ethernet communication port provides communication via Modbus TCP/IP protocol, -mail on alarm, web server and Ethernet-to-serial gateway. Transparent Ready - compliant with Level 1

Other Functions

- Direct connect voltage inputs. No need for potential transformers (PTs) up to 600 VAC
- Intuitive navigation with self-guided, language-selectable menus
- Large, anti-glare display with white back-light provides summary screens with multiple values
- Custom alarming with time-stamping
- Individual harmonic magnitudes and angles and waveform capture (PM850 and PM870)
- Voltage and current disturbance (sag and swells) detection and configurable waveform capture (PM870)
- ANSI C12.20 and IEC 62053-22 Class 0.5S for active energy. Accurate energy measurements for sub-billing and cost allocation
- Trend curves and short-term forecasting (PM850 i PM870)
- 5 channels to calculate the consumption of water, air, gas, electricity and steam in all models. Each channel can gather impulses from several inputs.
- Optional remote display unit (distance of up to 10m from the analyser)



SEPAM

SEPAM Range of Protections

Series 10: Simple applications for MV lines and distribution transformers

- Series 10 incorporates 3 types of SEPAM relays:
- series 10 N with phase or earth fault overcurrent protection
- series 10 B with overload, 3f short-circuit and earth fault protection
- series 10 A has the same functions as SEPAM series 10 B, with opto-insulated inputs and extra output relays i



Series 10

Series 20: Overcurrent or voltage protections for typical configurations

- Series 20 incorporates 7 types of SEPAM relays.
- Features:
- 3 types of UMI display types
- 4 current inputs OR 4 voltage inputs
- 10 opto-insulated binary inputs
- 8 output relays
- 1 Modbus communication port
- 1 analogue output (MST module)
- 8 RTD temperature measurement inputs (MSA module)



Series 20

Series 40: Overcurrent or voltage protections for complex configurations

- Series 40 incorporates 13 types of SEPAM protections dedicated for various types of MV bays.
- Features:
- 3 types of UMI display types
- 4 current inputs
- 3 voltage inputs
- 10 binary inputs
- 8 output relays
- Connection to Ethernet TCP/IP network with Web Server
- Logical equation editor
- 1 Modbus communication port
- 16 RTD temperature measurement inputs (MET module)



Series 40

SEPAM

SEPAM Range of Protections



Series 60

Series 60: Advanced overcurrent and voltage protections

- Series 60 incorporates 8 types of SEPAM protections dedicated for various types of MV bays.
- Features:
 - 3 types of UMI display types
 - 4 current inputs
 - 3 voltage inputs
 - 28 opto-insulated binary inputs
 - 16 output relays
 - Logical equation editor
 - Integrated IEC 61850 and Modbus TCP/IP via RSTP
 - Available protocols: Modbus, Modbus TCP/IP, IEC60870-5-103, DNP3 (RS485 or FO)
 - 4 communication ports plus 1 local
 - 16 RTD temperature measurement inputs (MET module)
 - 1 analogue output (MSA module)
 - External cartridge memory to save settings and configuration



Series 80

Series 80: Multifunctional overcurrent and voltage protections

- Series 80 incorporates 16 types of SEPAM protections dedicated for various types of MV bays.
- Features:
 - 3 types of UMI display types
 - 12 analogue inputs:
 - 8 current inputs and 4 voltage inputs
 - 4 current inputs and 8 voltage inputs
 - 42 opto-insulated binary inputs
 - 23 output relays
 - 4 communication ports plus 2 local Modbus
 - Integrated IEC 61850 and Modbus TCP/IP via RSTP
 - Available protocols: Modbus, Modbus TCP/IP, IEC60870-5-103, DNP3 (RS485 or FO)
 - 16 RTD temperature measurement inputs (MET module)
 - External cartridge memory to save settings and configuration
 - Logipam - software to program specific logical functions

Product Catalogue - DVD Version

Content

- The CD Catalogue covers information regarding products made by Schneider Electric Energy Poland Sp. z o.o. and offered in Poland by the Automation & Information Systems Unit in Swiebodzice.
- A complete offer of MiCOM protection relays, as well as of time, measuring and insulation monitoring relays.
- Possibility to search by product or by a range of operating voltage
- Special publications for designers present potential uses of the relays, application models and possibilities of replacement of legacy products with modern solutions.

Documentation

- The CD contains digital documents related to the protections. Those can be a catalogue card and/or user manual, depending on a selected device.

MiCOM S1 Studio Software Suite

Application

- MiCOM S1 Studio is a universal protection relay support software which enables global access to all data stored in the relays. The program provides easy access to MiCOM protections of Px20, Px30 and Px40 series, as well as to other types of devices.

Main Functions

- One, common program for MiCOM Px20, Px30 and Px40 relays to configure devices and record data
- The devices and files can be arranged in accordance with a topology system - Substation / Voltage Level / Bay. A graphical representation of the system is displayed in the Explorer's separate window and helps a user to navigate the system.
- Configuration files upload and download
- Acquisition of events and disturbances and analysis of the recorded data
- Real-time visualisation of measurements
- PSL Editor to edit programmable scheme logics
- Menu text editor
- Bay type configurator
- Configurator of IEC 61850 transmission in the relays
- Possibility to export configuration files in CSV format (comma-separated values) to a spreadsheet or an application such as CAPE





NOTES

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NOTES

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NOTES

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New factory in **STONE!**



Manufacturing of
MiCOM Px30, Px40 series.



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Electric

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