MiCOM P120, P121, P122 and P123
Universal Overcurrent Relays
MiCOM P120, P121, P122 and P123
A whole range for a global answer

Description

The MiCOM P12x series are the universal overcurrent relay range for ALSTOM. Starting with the single phase P120 up to the multifunction three phases and earth P123, MiCOM relays are fully designed to protect and control industrial plants, utilities substations and networks at any voltage level.

Protection features of the MiCOM P12x range include 3 independent phase overcurrent stages, 3 independent earth overcurrent stages, 12 selectable curve characteristics, thermal overload protection, undercurrent and negative-sequence overcurrent protection.

Flexible automation functions enable accurate co-ordination with other devices.

Circuit-breaker monitoring is performed through closing and opening time measurements, breaker failure protection and trip circuit supervision.

Two setting groups accommodate complex protection and control schemes. Setting commutation is available locally or remotely.

The MiCOM P12x relays are fully compatible with a wide range of standard communication protocols (MODBUS™, IEC 60870-5-103, etc.).

All the information in memory such as settings, measurements, events, fault or disturbance records are easily transmitted for better network management. Remote system requests are immediately executed and transmitted to the adjacent switchgear.

MiCOM P12x relays provide simple and powerful operator interface. The LEDs and LCD display on the front panel are fully programmable to user requirements.

True RMS current and frequency values are measured by all the MiCOM P12x relays. Measurements are displayed on the front panel and are available for local viewing and remote transmission.

For each MiCOM P12x relay, inputs and outputs are freely assignable and combinations of any thresholds are independently programmable for each output.

Setting software MiCOM S1 combined with the front and rear communication ports allow the user easy access to all stored information and output of operating curves or parameter trends.

The MiCOM P120, P121, P122, P123 relays are housed in the same drawout 4U metal case for panel or rack mounting.

The use of MIDOS connectors allows full compatibility with existing ALSTOM devices.

CT inputs of any relay of the MiCOM P12x series are 1 and 5 Amp dual rated.
### Models available

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### Protection and control

#### Time-delayed phase overcurrent (51)

The MiCOM P12x relays provide three phase current inputs (except for the single phase P120 relay).

Three independent stages relay are available. For the first stage, the user may select between 12 different shapes of curves (IEEE/ANSI, IEC, RI, RC).

For each curve model, a wide selection of 60 different TMS values can be set to optimise detection and shorten tripping time for co-ordination with fuses, motors, feeders, transformers and other devices.

The second and third stages have independent settings with an adjustable definite time tripping. The time delays are programmable from 0 to 150 s thus providing maximum selectivity.

The phase current range is adjustable independently for each stage from 0.1 to 40 times the rated phase current (0.002 to 40 In for the MiCOM P120 model).

All the phase overcurrent settings are fully programmable using the front panel HMI, the Setting Software front connection or a remote communication control system (e.g. MiCOM S10).
**Instantaneous phase overcurrent (50)**
The MiCOM P12x relays have separate phase instantaneous overcurrent information for each selected stage.

Phase instantaneous trips (with no time delay programmed) are available in less than 30 ms.

Each instantaneous trip is fully assignable to any dedicated output of the MiCOM relays and/or on the front panel LEDs.

**High impedance restricted earth-fault (64N)**
MiCOM P12x range offer the REF feature applied to enhanced ground fault detection on each transformer winding.

The relays ensure a high degree of stability against external fault conditions and a reliable performance against internal faults.

All the stages can be used for this application.

**Time-delayed earth-fault overcurrent (51N)**
Earth fault detection in the MiCOM P12x range is identical to the time-delayed phase overcurrent.

Three independent earth-fault stages are selectable. The user can select any of the 14 families of curves and TMS values for the first stage.

Earth current range is adjustable for each stage from 0.002 to 40 times the rated earth current to allow maximum sensitivity for earth fault detection.

The earth current input is usually generated by a dedicated earth CT but may also be derived from the residual connection of the 3 line CTs.

**Broken conductor**
One type of unbalanced fault which can occur on the system is an open circuit fault. This can arise from broken conductors, maloperation of single phase switchgear, or the blowing of fuses.

MiCOM P122 and P123 relays incorporate an element which measures the ratio of negative to positive sequence current ($I_2/I_1$). This fully programmable function allows more sensitivity than negative sequence overcurrent detection.

**Thermal overload (49)**
Transformers and cables must be protected to account for their particular thermal characteristics.

MiCOM P122 and P123 relays include a thermal overload element based on the true RMS value of the current. Alarm and overload thresholds are fully programmable to match each device requirement.

**Broken conductor**
One type of unbalanced fault which can occur on the system is an open circuit fault. This can arise from broken conductors, maloperation of single phase switchgear, or the blowing of fuses.

MiCOM P122 and P123 relays incorporate an element which measures the ratio of negative to positive sequence current ($I_2/I_1$). This fully programmable function allows more sensitivity than negative sequence overcurrent detection.

**Cold load pickup**
When a feeder is loaded after a long outage, all connected devices such as transformers will call for an over energisation current, over the nominal setting, during a short time.

To prevent unwanted tripping, MiCOM P122 and P123 have a cold load pickup function which automatically increases the standard settings during a dedicated adjustable time. After a successful close, all settings are returned to their nominal values.
**Setting groups**

External conditions may call the need for several setting groups. The MiCOM P122 and P123 relays have two selectable setting groups including all the protection, automation features and monitoring functions.

Commutation between groups 1 and 2 can be achieved locally, remotely or via a dedicated logic input.

Transition from one setting group to the other is achieved only if no protection or automation function is running to prevent unwanted tripping.

**Programmable inputs and outputs**

MiCOM P12x relays include up to 5 logic inputs and 9 logic outputs including a watch-dog. All inputs and outputs are freely configurable.

Two of the outputs are change-over type typically used for tripping commands.

All programmed thresholds (time-delayed or instantaneous) can easily be combined onto any of the outputs.

**Output relay latching (86)**

Any of the outputs, including trip, can be latched.

Reset of the outputs is possible from a logic input, the front panel operator interface or through the remote communications.

**Circuit breaker failure protection (50BF)**

The circuit breaker failure protection verifies the effective opening of the CB by a dedicated undercurrent threshold during a t_BF timer.

The circuit breaker failure function is activated by the trip of a generic protection.

Circuit breaker failure protection may be used for tripping upstream circuit breakers.

**Autorecloser (79)**

MiCOM P123 relays include a 4-shot autorecloser with one instantaneous and three time-delayed reclose shots. All the programmed protection functions may start any of the shots independently and the user can program which functions are allowed to trip after any of the shots. Dead and reclaim times are freely adjustable. Associated LEDs can be programmed on the front LCD display of the MiCOM relay.

A counter stores the number of reclose commands, incremented with each reclose order. This information can be displayed locally or remotely.

**Selective relay scheme logic**

Reduction of supply outages is a primary objective in any electrical network. To help the user reduce these non-quality factors, MiCOM P122 and P123 relays include selective relay scheme logic.

A dedicated input can temporarily alter the time-delay settings in response to a downstream relay phase/earth fault start condition. This function allows the MiCOM relays to discriminate correctly when used in a cascade scheme.

The selective relay scheme logic function can be enabled or disabled by the user as required.

**Monitoring functions and measurements**

**Circuit-breaker maintenance**

Circuit-breaker preventive maintenance is the advanced function provided by the MiCOM P122 and P123 relays with adjustable closing and opening time measurements and breaker failure protection.

All phase currents I and I2 during faults are memorised and summed.

The MiCOM P122 & P123 relays allow trip circuit supervision via a specific input. The result of this monitoring can be viewed locally or remotely.

**Measurements**

The MiCOM P12x relays monitor permanently all the current inputs, calculate the frequency and the line currents, display the values on the LCD display and store the measurements into memory.

The calculation of the average value for each phase during a selectable rolling sub-period is also available.

The measured values are true RMS up to the 10th harmonic with a 0.1% accuracy (nominal conditions). Peak demands with a 15-minute window are also memorised.

All the measured and derived values can be displayed on the front panel LCD or transferred locally or remotely upon user request.

**Instantaneous recording**

Five instantaneous logs are stored in the MiCOM P122 & P123 relays.

Each instantaneous record includes:

- instantaneous time (date & duration)
- origin (phase & earth threshold)

Instantaneous records give the user useful information for preventive maintenance of the electrical system.

**Event recording**

75 logic events are stored in the MiCOM P122 and P123 relays.

Events include inputs/outputs, state changes, alarms and contact operations.

All events are time-tagged to 1ms.
**Disturbance recording**
Current waveforms are captured by the MiCOM P122 and P123 relays at a sampling frequency of 1600Hz. Up to 3 seconds of records are stored inside the relays. The disturbance recording function is triggered either by any of the programmed thresholds or by an external input, or through the communications.
All logic and analogue information is stored in memory and can be transferred using the front communication port or the rear LAN to an external data analyser.

**User interface**

**Front display and menus**
All functions including protection automation, communication, LEDs, inputs and outputs can be programmed and modified using the front panel user interface.
The 32 alphanumerical backlit LCD display (available in a range of languages) provides the user with key information (faults, measurements, settings, etc.).
The menus have a pull-down structure for easy use and quick access to any data.

**Dedicated LEDs**
4 LEDs indicate the state of the MiCOM relays (Trip, Alarm, Warning, Healthy).
Acknowledgement of alarm and trip LEDs can be easily performed locally or remotely.

**Programmable LEDs**
4 freely programmable LEDs are provided on all models of the MiCOM P12x series.
The user can assign independently each LED to any program function or combination of thresholds.

**Keypad**
A seven-button tactile keypad on the front panel allows the user easy access to any data in the MiCOM P12x relays.

**Communication EIA RS485**
All models of MiCOM P12x series have an EIA RS485 communications rear port. This port is available for MODBUS™, Courier, IEC 60870-5-103, or DNP3 protocols. MiCOM relays can transmit to the local monitoring system (e.g. MiCOM S10), or remotely to the SCADA, settings, measurements and alarms, as well as fault, event and disturbance records.
The communications settings (relay address, data rate, parity, etc.) can be programmed using the Human Machine Interface of the relay.

**Communication EIA RS232**
An EIA RS232 front port is available in the MiCOM P12x series.
It allows the user to download a new firmware (update, language changing,...) and the link with the setting software MiCOM S1 (P122 & P123 only).

**MiCOM S1 support software**
A dedicated ALSTOM Support Software MiCOM S1 is available for the MiCOM P12x relays to allow easy use.
Fully Windows™ compatible (98 and NT4.0), the Support Software allows easy setting of any MiCOM P12x model, in addition to uploading of event, fault and disturbance records, settings and measurements.

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Figure 5: P123
Disturbance record analysis

Figure 6: MiCOM P12x front panel

Fault records
Five faults are stored inside the MiCOM relays. Each record includes:
- Fault indicators
- Current values
- Tripping time
Fault indications help the user identify clearly the fault and monitor the MiCOM P122 and P123 relays’ settings.
Hardware

MiCOM P12x models are numerical protection and control relays.

Case

For all models of the MiCOM P12x series (P120, P121, P122 and P123), the unit has a drawout metal 4U case. All the CT inputs are short-circuited if the active unit is withdrawn from its case. All MiCOM relays can be panel or rack-mounted.

Wiring

External connections are made via MIDOS type terminal blocks. Each connection includes two 6.35mm Faston and one M4 screw fixing. The wiring for all the MiCOM P120, P121, P122 and P123 relays is standard so as to provide maximum compatibility.
Alternative : The earth current input is connected to the summation of the three phase CTs.

Alternative (P121 only): Connection to 2 phases CTs + a core balanced CT.

Scheme representing MiCOM relay off
Auxiliary
Programmable input
Phase rotation

Alternative: The earth current input is connected to the summation of the three phase CTs.

Alternative: Connection to 2 phases CTs + a core balanced CT.

MiCOM P122/P123

The current inputs are connected to 3 phase CTs + a core balanced CT.

Notas:
1. CT shorting links make before (b) and (c) disconnect
2. Short terminals break before (c)
3. Long terminals
4. First terminals (pcb type)

Alternative: The earth current input is connected to the summation of the three phase CTs.

Alternative: Connection to 2 phases CTs + a core balanced CT.

Scheme representing MiCOM relay off

Figure 9: Typical application diagram MiCOM P122/123.
**Technical specifications**

**Inputs**
- AC phase current: 1A and 5A
- AC earth current: 1A and 5A
- Frequency: 50/60Hz
- Auxiliary voltage (Vaux): 3 ranges 24-60Vdc, 48-150Vdc, 130-250Vdc/100-250Vac
- Digital input
  - Range: Identical to Vaux range

**Burden**
- AC current
  - Phase: < 0.025VA (1A) < 0.3VA (5A)
  - Earth: < 0.008VA at 0.1
- Auxiliary voltage
  - DC: 3 W standby + 0.25 per energised relay
  - AC: 6VA + 0.4VA per energised relay
- Optical isolated input
  - Auxiliary voltage: 130-250Vdc/100-250Vac

**Thermal withstand**
- AC current inputs
  - 1s at 100 x I^2
  - 2s at 40 x I^2
  - Continuous at 4 x I^2

**Accuracy**
- Protection thresholds: ±2%
- Time delay (for DT): ±2% with a minimum of 10ms
- For IDMT conform to BS 14-class5
- Measurements: ±1% @ I^2

**CT requirements**
- 1A: 2.5 VA 10P10
- 5A: 7.5 VA 10P20

**Overcurrent settings**
- Phase current
  - 0.1 to 40 x I^2
- Earth current
  - 0.002 to 1 x I^2
  - 0.01 to 8 x I^2
  - 0.1 to 40 x I^2
  - Range
    - I^2 > 0.01 to 1 x I^2 (see note)
    - I^2 >> 0.01 to 8 x I^2 (see note)
  - Range
    - I^2 > 0.1 to 25 x I^2 (see note)
    - I^2 >> 0.5 to 40 x I^2 (see note)
    - I^2 >>> > 0.5 to 40 x I^2 (see note)
  - Sensitive range
    - 0.002 to 1 x I^2
    - 0.0002 to 1 x I^2 (see note)
    - 0.0002 to 1 x I^2 (see note)
    - 0.0002 to 1 x I^2 (see note)

**Overcurrent time settings**
- Phase time
  - (I^2, I^2, I^2>>)
  - 0 to 150s, step size 10ms
- Earth time
  - (I^2, I^2, I^2>>)
  - 0 to 150s, step size 10ms
- IDMT curves (IEC and special type):
  - Short time inverse (A)
  - Standard inverse (IEC)
  - Very inverse (IEC)
  - Extremely inverse (IEC)
  - Long time inverse (A)
  - Rectifier (RC)
- IEEE/ANSI type:
  - Short time inverse (CO2)
  - Moderately inverse (ANSI)
  - Inverse (CO8)
  - Very inverse (ANSI)
  - Extremely inverse (ANSI)
- Electromechanical type (RI)
  - LABORELEC 1, 2 & 3
  - on earth current range
  - 0.01 to 8 x I^2 only
  - Time multiplier setting (TMS): 0.025 to 1.5, step 0.025
  - Reset time
  - IDMT curves:
    - Short time inverse (CO2)
    - Moderately inverse (ANSI)
    - Inverse (CO8)
    - Very inverse (ANSI)
    - Extremely inverse (ANSI)
  - DT: 0 to 60s, step size 0.01s

**Thermal overload**
- Ranges: 0.1 to 3.2 x I^2
- Alarm and Trip: 50 to 200% x θ
- Time constant
  - 1 to 200mn, step size 1mn

**Cold load pickup**
- Range
  - 20 to 500%
- Time delay
  - 0.1 to 3600s, step size 0.1s

**Undercurrent**
- Range
  - 0.02 I^2 to 1 I^2
- Hysteresis: 105%
- Time delay
  - 0 to 150s, step size 10ms

**CB fail detection**
- Undercurrent threshold
  - 0.02 I^2 to 1 I^2
- Time delay (BF): 10ms to 10s, step size 10ms
- Detection: < 15ms

**Negative sequence overcurrent**
- 2 Phase current
  - thresholds (I^2, I^2)
  - Range
    - 0.1 to 40 x I^2
  - Hysteresis: 95%
  - Time delay
    - 0 to 150s, step size 10ms
  - IDMT curves: (I^2>>)
    - Identical to phase overcurrent

**Broken conductor**
- I^2/I^1 threshold
  - 20 to 100%, step size 1%
- Time delay
  - 0 to 14400s, step size 1s

**Recloser**
- Dead time: 1 & 2
  - 0.01 to 300s, step size 0.01s
- Dead time: 3 & 4
  - 0.01 to 600s, step size 0.01
- Reclaim time
  - 0.02 to 600s, step size 0.01s

**Circuit breaker control**
- Trip time: 0.1 to 5s, step size 0.1s
- Closing time: 0.1 to 5s, step size 0.1s

**Contacts**
- Contacts ratings
  - Make: 30A and carry for 3s
  - Carry: 5A continuous
- Break:
  - dc 50W resistive
  - 25 W inductive
  - (L/R=40ms)
  - ac 1250VA resistive
  - 1250VA inductive
  - (P= 0.5)
  - Subject to maxima of 5A and 300V.
- Durability:
  - Loaded contact
    - 10,000 operations minimum
  - Unloaded contact
    - 100,000 operations minimum

**Housing**
- MiCOM 20TE, rack or flush mounting
- Size: 4U (177mm) x 103mm W x 226mm D
- Drawout with automatic CT shorting
- Weight: 2.1 Kg
- MIDOS connectors:
  - each terminal has two blades
  - 4.8mm x 0.8mm + one M4 screw

**High voltage withstand**
- Dielectric withstand
  - IEC 60255-5
    - 2kV common mode
    - 1kV differential mode
- Impulse voltage
  - IEC 60255-5
    - 5kV common mode
    - 1kV differential mode
- Insulation resistance
  - IEC 60255-5 > 1000 MΩ
**Electrical environment**
- High frequency disturbance
  - IEC 61000-4-12
    - 2.5kV common mode, class 3
    - 1kV differential mode, class 3
- Fast transient disturbance
  - IEC 61000-4-4
    - 4kV auxiliary voltage, class 4
    - ANSI C37.90.1
      - 2kV others, class 4
- Electrostatic discharge
  - IEC 61000-4-2
    - 8kV, class 4
- Radio Frequency Impulse
  - ANSI C37.90.2
  - IEC 61000-4-3
    - 35V/m
    - 10V/m

**Atmospheric environment**
- Temperature
  - Storage
    - –25°C to +70°C
  - Operation
    - –25°C to +55°C
- Humidity
  - IEC 60068-2-3
    - 56 days at 93% RH and 40°C
- Enclosure protection
  - IEC 60529
    - IP 52, IK 07
- Vibrations
  - IEC 60255-21-1
    - Response and endurance, class 2

**Outline description**
Phase and earth numerical overcurrent relay in drawout 4U metal case.

The following functions are available:
- 3 independent phase stages (instantaneous and time-delayed) 50/51
- 3 independent earth stages (instantaneous and time-delayed) 50N/51N
- Tripping curves type IEC (short time inverse, standard inverse, very inverse, extremely inverse, long time inverse) and IEEE/ANSI (short time inverse, moderately inverse, inverse, very inverse, extremely inverse)
- LABORELEC curves
- Rectifier curve

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<td>4</td>
<td>130-250 Vdc</td>
<td></td>
<td></td>
<td>Czech</td>
</tr>
<tr>
<td>MiCOM P</td>
<td>2</td>
<td>95-150 Vdc (special EA)</td>
<td></td>
<td></td>
<td>Hungarian</td>
</tr>
<tr>
<td>MiCOM P</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td>Greek</td>
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</tbody>
</table>

**User interface includes:**
- A 32-character backlit display
- Programmable LEDs
- A front panel EIA RS232 for local settings
- A EIA RS485 rear port compatible with MODBUS, Courier, IEC 60870-5-103, or DNP3
- An easy to use PC setting software

**HMI languages (see Note 1)**
- French
- English/American
- Spanish
- German
- Italian
- Russian
- Polish
- Portuguese
- Dutch
- Czech
- Hungarian
- Greek

Note 1: Please consult us for language availability.