MiCOM P111Enh

Numerical three phase and earth fault overcurrent relays

MiCOM P111Enh

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

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 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

To have good ratio: price to functionality used in the application, different models of P111Enh are available.
The newest enhancement models ensure more advanced features.

Differences between enhancement models for MiCOM P111Enh are shown in the Table 1.

Customer benefits:

- Flexible current relay
- Full set of measurement
- Good feature/price ratio
- Settings made easy
- Effortless installation

Schneider Electric

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.

The P111Enh protection relays are comprised of full suite of protection functions as well as automatic recloser and auxiliaries. Each function can be individually configured or disabled to suit every kind of application.

All available functions, including protection, automation, communication, LEDs, inputs and outputs, are easily programmable through the user-friendly human machine interface and/or the MiCOM S1 STUDIO software interface.

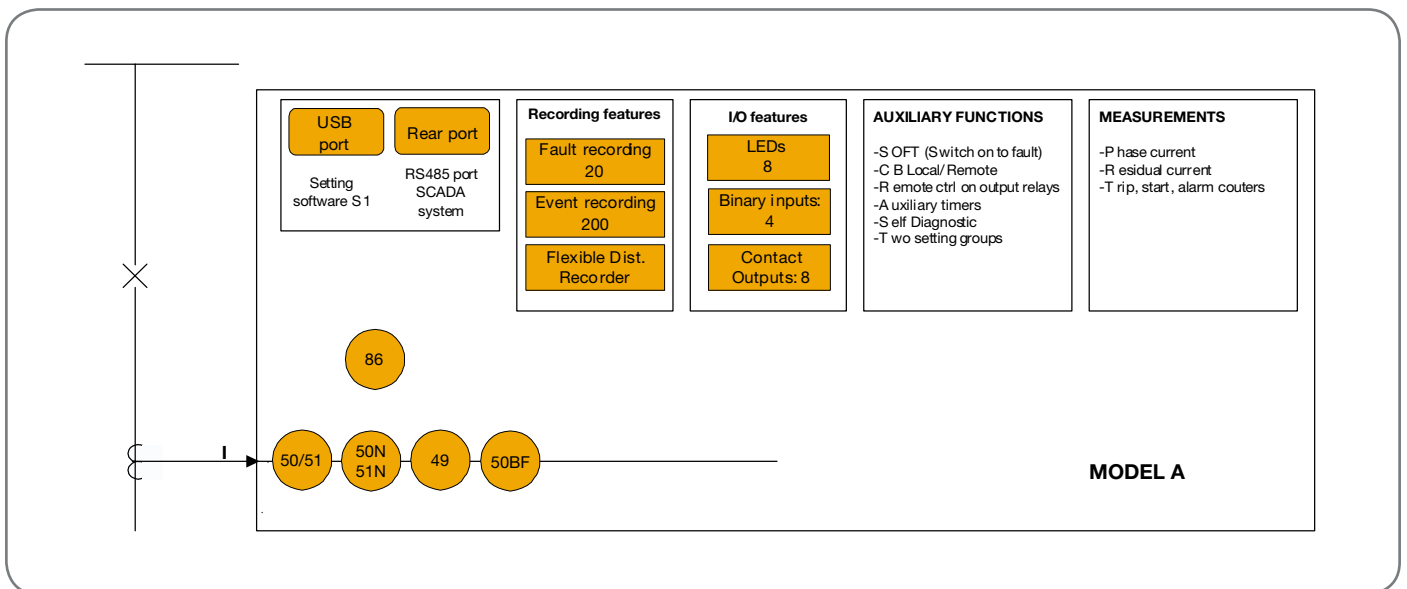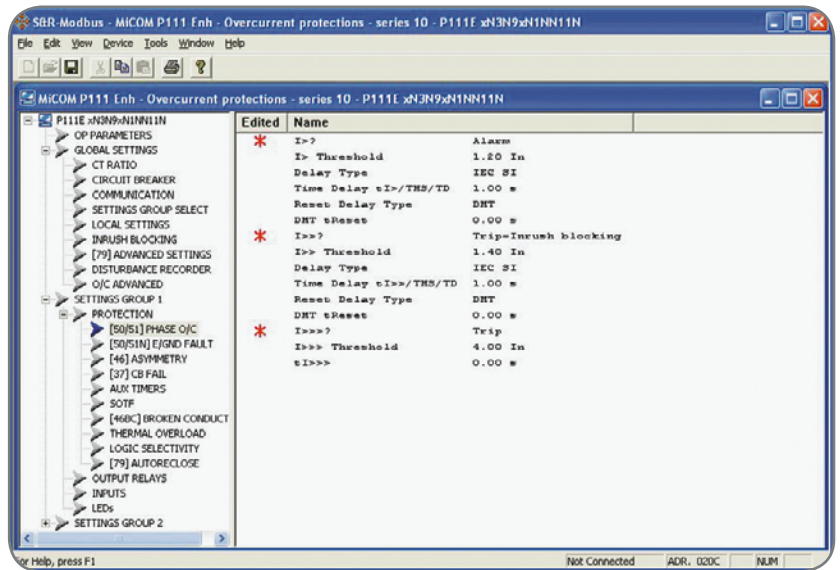| ANSI Code	Functions	Models		
		L	N	A
50/51	Three-phase non directional overcurrent: 3 independent thresholds (12 groups of IDMT curves)	•	•	•
50N/51N	Phase-earth non directional overcurrent: 2 independent thresholds (12 groups of IDMT curves)	•	•	•
49	Thermal overload (true RMS): 2 independent thresholds (Alarm, Trip)		•	•
50/51	Switch on to fault (SOTF)			•
	Inrush blocking			•
	Blocking logic			•
	Cold Load Pick-Up	•	•	•
50BF	Circuit breaker failure	•	•	•
	2 setting groups	•	•	•
	Self-monitoring feature with watchdog contact WD	•	•	•
	Freely configurable binary inputs / output relays	0/3 + WD	0/5 + WD	4/7 + WD
86	Output relay latching	•	•	•
	8 signalling LEDs ("Healthy" + "Trip" + "Alarm" + 5 freely configurable LEDs)	•	•	•
	Circuit breaker supervision and counters			•
	Trip circuit supervision			•
	Fault records for the 20 most recent trips	•	•	•
	Event records (up to 200 events)		•	•
	Disturbance records (up to 4 s)			•
	Front USB port for local downloading of settings, events and/or fault records		•	relay powering
	Rear port RS485 communications (Modbus RTU and IEC60870-5-103)		•	•
	LCD display	•	•	back-lit
	Measurements	•	•	•
	CB control: HMI, via binary input or RS485			•
	Setting software: MiCOM S1 and/or S1 Studio		•	•
	Optional cassette (adaptor) for: wall-mounted solution	•	•	•

Table 1. Functions of P111 Enhancement Models

Functional Overview (Description of ANSI code nos. see Functions Overview)

The 32 alphanumerical LCD (Enh) 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. User can switch HMI language directly through the front panel.

8 LEDs indicate the correct operation of the relay as well as other information regarding the protection of the electrical system.

The hardware architecture and software algorithms have been designed to operate on very short failure detection times. Tripping occurs typically within no more than 40 ms.

(Description of ANSI code nos. see Functions Overview)

PROTECTION FUNCTIONS

Three-Phase Overcurrent (50/51) & Earth Fault Overcurrent (50N/51N)

Three independent stages are available both for phase and earth fault protection. For the first and second (50/51 only) stages the user may independently select a definite time delay (DMT) or an inverse time delay (IDMT) with different types of curves (IEC, IEEE, RI, RECT, RXIDG, BNP EDF).

Each stage and related time-delay can be programmed to provide maximum selectivity.

The IDMT stages have a selectable reset feature: DMT (0 to 600 s) or an IDMT timer so as to reduce clearance times when intermittent faults occur.

The MiCOM P111Enh relays have separate instantaneous and delayed indications for each stage and output relays and LEDs can be configured to indicate the faulted phase(s).

Each protection stage can be disabled, configured to trip a circuit-breaker or to issue an ALARM signal only.

P111Enh -

Excellence in Balance

Switch-on-to-Fault (based on 50/51)

The closing of a circuit breaker might inadvertently lead to a short-circuit fault due to a maintenance ground clamp not yet removed. The P111Enh relays incorporate a settable switch-on–to-fault protection function. It provides an instantaneous trip over a settable time period after local or remote manual closure.

Inrush current in transformer applications can have an influence on the selectivity of instantaneous trips; the short time-delay (DMT) can therefore be set for this protection element in order to maintain selectivity and make it possible to have a current threshold below any inrush current peak.

One independent DMT current stage is available for phase fault protection.

Thermal Overload (49)

The protection of transformers and cables must take into account their particular thermal characteristics.

MiCOM P111Enh relays include a thermal replica element based on the true RMS value of the current, up to the 10th harmonic. Alarm and Trip overload thresholds and time constant are fully programmable to match each application requirement.

Tripping Characteristics
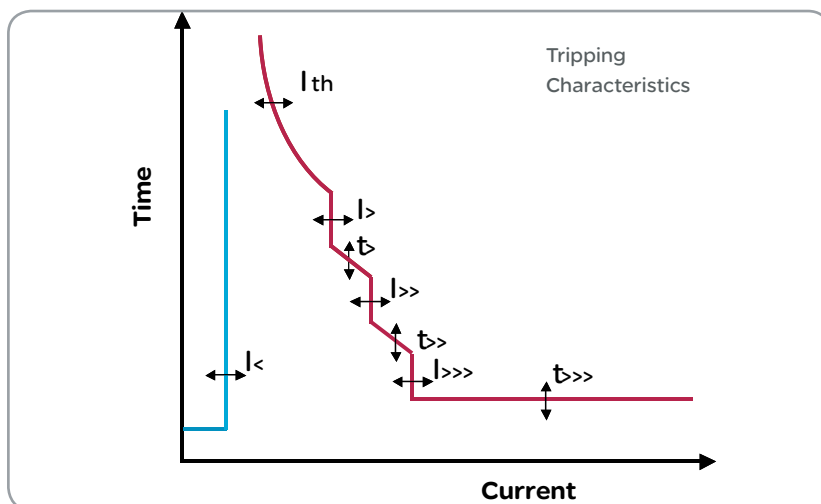
Circuit Breaker Failure (50BF)

The circuit breaker failure protection function verifies the effective opening of the CB using a dedicated undercurrent threshold.

The circuit breaker failure function can be activated by the trip of an internal protection function and/or an external command through the relevant digital input. The circuit breaker failure protection function can also be used to trip upstream circuit breakers.

Inrush Blocking

The 2nd Harmonic Blocking detects high inrush current inflows that occur upon connection of transformers or rotating machines. The function will block the phase overcurrent, earth fault and negative sequence overcurrent elements (freely selectable).

Timers AUX1, AUX2, AUX3, AUX4

Timers operate if the state of an input mapped to this function changes in such a way that the function will be triggered. Timers can be used for CB tripping or alarm signalling.

This function is available when inputs are energised via an auxiliary power supply.

Blocking Logic

When MiCOM P111Enh relays are used in critical networks, the management of protection relays must take surrounding devices into consideration. Any blocking digital inputs can be independently configured to lock any combination of selected elements (i.e. current stages, thermal replica, etc).

A typical application is to use a dedicated digital input to block the time-delayed settings of phase/earth fault protection in a relay in response to the phase/earth fault start condition of a downstream relay.

This function allows the MiCOM relays to clear the fault quickly and correctly when used in a cascading scheme.

Output Relay Latching (86)

The output contacts may be latched freely.

Latched outputs can be reset via the activation of a logic input through the front panel interface or by remote communication.

Instantaneous Information

Outputs and LEDs can be programmed with instantaneous information from freely selectable protection elements: with or without latching.

Additionally, every start of a protection element is recorded in the event recorder and the instantaneous recorder.

The instantaneous information is typically generated within 30 ms after the threshold has been exceeded.

Trip Via Binary Input

Opto-isolated binary inputs are freely configured to timers AUX1-AUX4. This function works if inputs are triggered via the auxiliary voltage.

Communication & Synchronization

The MiCOM P111Enh offers a wide range of communication protocols allowing its utilization in most network control and data acquisition systems (via Modbus, IEC 60870-5-103). The protocol can be selected in the P111Enh menu.

It has been designed for permanent multi-drop connection through the rear RS485 communication port.

The MiCOM P111Enh incorporates an internal clock to allow 1 ms accuracy time tagging of alarms, events, fault and disturbance records. To avoid any drifting of the time-tagging clock, it's necessary to periodically synchronize the relays. To do this the P111Enh offers synchronization from the substation control system via the rear communication port.

The back-up capacitor of the internal clock is charged from an auxiliary voltage supply and supports the internal clock typically up to three days.

Cold Load Pick-Up

Cold load pick-up temporarily raises the setting of selectable stages closer to the lad profile in order to avoid unwanted trips.

The setting value can be increased by 800% for example for a settable duration. To trigger this function, the CB closed position or current criteria are used.
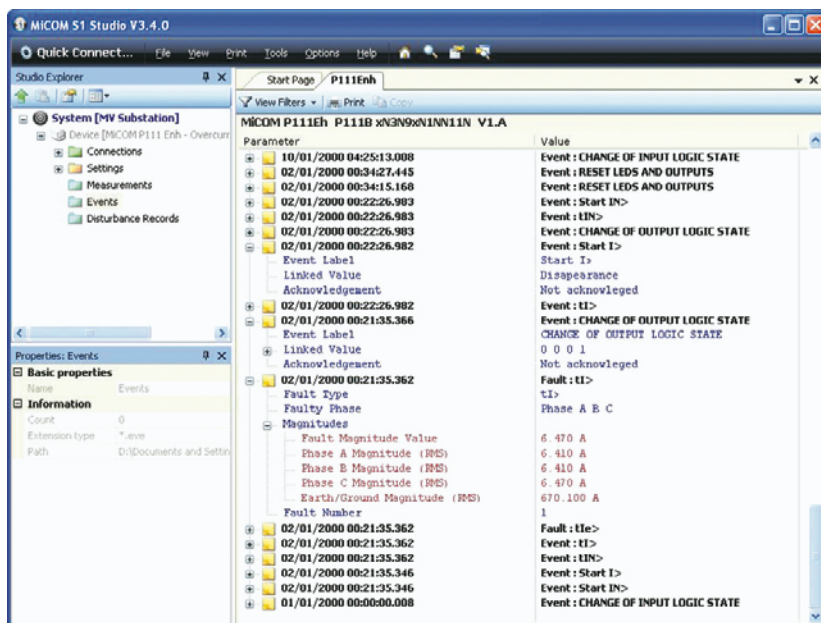
OPERATION & MAINTENANCE

Two Setting Groups

External conditions may require the need for different settings or I/O configuration. The MiCOM P111Enh provides two independent setting groups. The active setting group can be switched from the local HMI or due to external conditions (digital input change of state or DCS control).

The two setting groups include protection settings, binary input, output and LED configuration.

Local/Remote Mode of CB Commands

The goal of this feature is to make it possible to block commands sent remotely through communication networks (such as setting parameters, control commands, etc.) in order to prevent any accidents or maloperation during maintenance work performed on site.

The local mode can be set via the HMI, a digital input assigned to this feature or an RS485.The Local/Remote mode state can be indicated via the HMI.

### Circuit Breaker/Contactor Command

Circuit breaker control is available from the front panel user interface, optically-isolated inputs and remotely via substation communications. Circuit breaker control is also possible via the function keys (Close/Open).

For contactor application the output contact has to be configured with reverse logic&latching.

It is possible to send a local open/close command through the HMI upon operator confirmation.

MiCOM P111Enh, cost-effective over-current and earth-fault protection relay for essentials protection functions
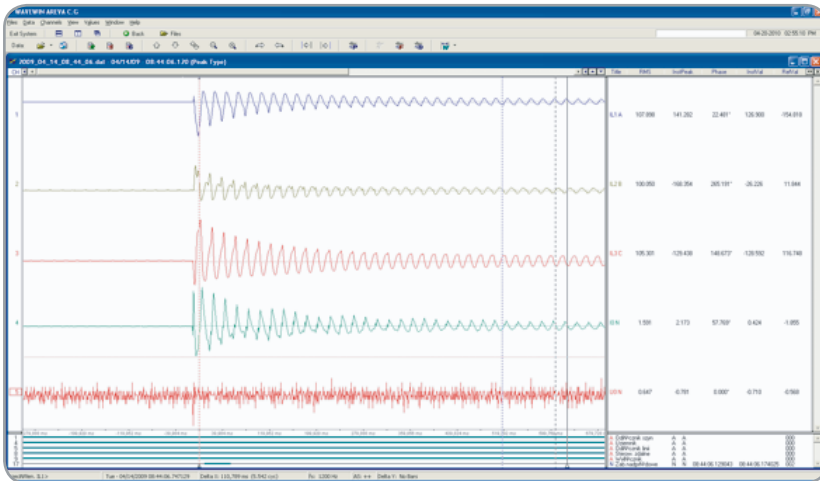
WaveWin – Data Analyzer Software

Circuit Breaker Condition Monitoring

The circuit breaker condition monitoring features include:

• Monitoring the number of breaker trip operations

• Recording the sum of the broken current quantity ΣI^X, (where x: 1 or 2)

• Monitoring the breaker operating time

An alarm signal is emitted if the above parameters exceed the settable threshold.

Event Recording

200 events are stored in the MiCOM P111Enh relays. Events include input/output state changes, alarms and contact operations.

To upload them, it is possible to use the front USB port (MiCOM S1) or the rear serial port (DCS). Event records are stored in a non volatile FRAM memory. All events are time-stamped to 1 ms.

Fault & Alarm Recording

The last 20 faults and 5 alarms records are stored inside the MiCOM P111Enh relays.

Each fault includes: Record number/ Fault time / Active setting group / Faulted phase / Protection operation / Magnitude of input quantities.

Fault indication helps the user to clearly identify the fault and monitor the relay's settings and operations as all information is available on the relay HMI.

Fault records are stored in a non-volatile FRAM memory.

Disturbance Recording

Up to 5 disturbance files are stored in the relay. Even if the total duration is set to 4 s, it is fully adjustable for easy adaptation to customer requirements. They are stored in COMTRADE format.

The disturbance recording function is triggered either by any of the programmed thresholds, by an external input, or through the communications. All digital and analog information is stored in non-volatile FRAM memory and can be transferred using the front communication port or the rear port to be used by an external data analyser. Disturbance records are stored in a non-volatile FRAM memory.

Trip Supervision

Trip circuit supervision in both circuit breaker open and closed states is possible using the optically isolated-inputs included in the P111Enh scheme logic.

I/O Configuration

Every input and output can be freely configured to available functions (blocking of protection element, reset LED or outputs, start, trip of every protection element, etc). Any input and output can be assigned to any predefined function.

Relay Maintenance Mode

The P111Enh incorporates direct control of the output relays (without the need to inject any current). This functionality allows the user to quickly check the external wiring of the relay's output contacts.

Support Software

MiCOM S1 Studio and MiCOM S1 (Windows™ compatible) support software is available for the entire MiCOM family, including the P111Enh relays.

This Support Software is used to set all parameters in the P111Enh or download setting parameters, fault and event records. Communication with a PC is managed by the front USB port of the P111Enh.

Self-Monitoring

Comprehensive self-monitoring procedures within the P111Enh ensure that internal hardware or software errors are detected and do not cause malfunctions of the device. When the auxiliary voltage is turned on, a functional test is carried out. Cyclic self-monitoring tests are run during operation. Any deviations are stored in non-volatile memory and determines whether protection is blocked or an alarm is raised. The result of the fault diagnostics determines whether the protection unit will be blocked or only an alarm will emitted.

HARDWARE & CASE

MiCOM P111Enh is based on advanced numerical technology.

All the models of P111Enh have a flush mounting plastic case (WxHxD :106.5x106.5x118).

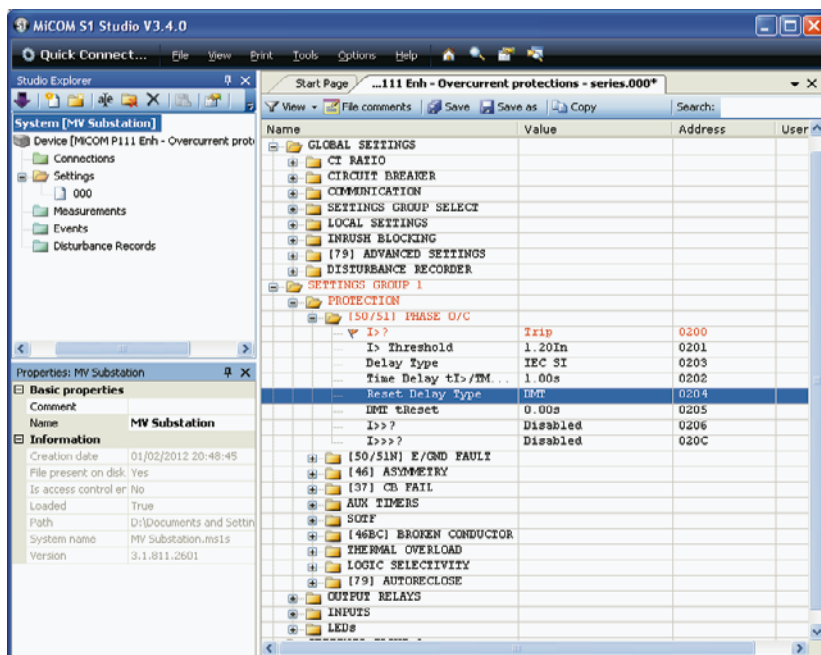Wall mounting solution is possible by using the wall mounting adapter (accessories).

WIRING

External connections are made via screw terminals.

The screw terminals allow connection of threaded wires of up to 2.5 mm2 or solid wires of 4 mm2 of conductor cross section.

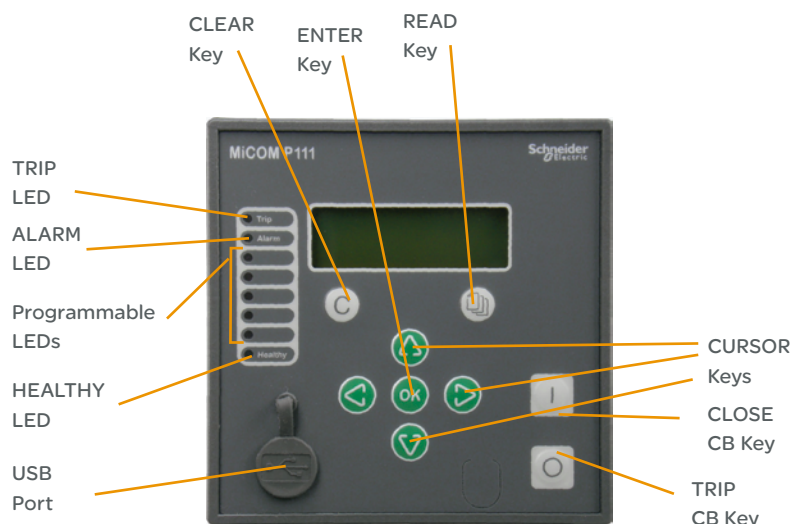## Multi-Language User Interface (HMI)

All functions, including protection, automation, communication, LEDs, inputs and outputs, can be programmed and modified using the front panel user interface (Human Machine Interface).

The LCD informs the user about settings, measurements & faults with a pull-down menu structure allowing easy and quick access to any data. The relay display language can be changed in the menu system: English / French / German / Spanish / Russian / Turkish / Regional.

MiCOM P111Enh:
Tailored to user's needs

MiCOM S1 Studio - Communication software

P111Enh Front Panel

The way of ordering:

Catalogue No. (for example: MiCOM P111Enh, REL10010)

Catalog No.	Description
REL10000	Model L; e/f setting range: 0.01-2Ien; auxiliary voltage: 24-240Vac/250Vdc;
REL10001	Model L; e/f setting range: 0.05-12Ien; auxiliary voltage: 24-240Vac/250Vdc;
REL10010	Model A; e/f setting range: 0.01-2Ien; auxiliary voltage: 24-60Vac/Vdc;
REL10011	Model A; e/f setting range: 0.01-2Ien; auxiliary voltage: 90-240Vac/250Vdc;
REL10012	Model A; e/f setting range: 0.05-12Ien; auxiliary voltage: 24-60Vac/Vdc;
REL10013	Model A; e/f setting range: 0.05-12Ien; auxiliary voltage: 90-240Vac/250Vdc;
REL10020	Model N; e/f setting range: 0.01-2Ien; auxiliary voltage: 24-240Vac/250Vdc;
REL10021	Model N; e/f setting range: 0.05-12Ien; auxiliary voltage: 24-240Vac/250Vdc;
Accessories for P111Enh	
REL10030	Adapter for standard case of P111Enh to allow mounting the relay on a wall

MiCOM SERIES RELAYS
TRACK RECORD

- P11x MiCOM series introduced in 2001.
  Worldwide application with approx.
  38 000 units delivered

- P12x MiCOM series introduced in 1999.
  Worldwide application with approx.
  243 000 units delivered (including
  approx. 21 000 Self/Dual powered
  devices)

- P13x MiCOM series introduced in 2001.
  Worldwide application with approx.
  18 000 units delivered

As standards, specifications and designs change from time to time, please ask for confirmation of the information given in this publication.

This document has been printed on recycled paper.