MiCOM P220 and P225

Motor Protection Relays

The MiCOM P22x protection relay range is designed for motor protection applications. A complete set of protection functions is performed on the measurement of current, voltage* and temperature. In addition to these basic functions, the relay carries out a large number of other functions that enable it to protect and run the motor more effectively.

The reliability of the system is further enhanced via checks on bus voltage prior to start-up* during reacceleration, supervision of trip-circuit wiring continuity and protection against circuit-breaker failure.

The MiCOM P22x protection relay range is particularly adapted to oil refinery, chemical plant, metallurgy, glass and cement manufacturing, paper mills, electrical and mechanical engineering, food production, mining etc. It is also suitable for water treatment and in pumping stations as well as in steam power plants.

On top of that high inertia loads and anti-backspin protection ensures that the rotor stops before the motor can be re-started.

For motors whose current supply contains a considerable degree of distortion, the relay provides a true RMS base thermal image allowing efficient protection against overload phenomena due to the presence of harmonic components.

The addition of power measurement* and energy metering*, and the presence of analogue outputs (current loop) make the MiCOM P22x protection relay range a highly competitive and effective equipment in terms of protection.

* P225 only

CUSTOMER BENEFITS

- Provide comprehensive protection functions for a wide range of applications
- Optimize the installation cost
- Improve monitoring conditions
- Reduce the need of documents and trainings
- Save time on day-to-day use

Schneider Electric

Protection Functions		P220	P225
50/51	Three-Phase Overcurrent	•	•
50N/51N	Earth fault	•	•
50BF	Breaker Failure		•
66	Number of Starts Limitation	•	•
37	Loss of load/Underpower	•	•
46	Negative Sequence Overcurrent	•	•
49	Thermal Overload	•	•
27/27LV/59	Undervoltage / Overvoltage		•
86	Latching of Output Relay	•	•
48/ 51LR	Start / Stalled Protection / Motor Re-Acceleration	•	•
	Undervoltage Auto-Restart / Load Restoration Sequence	•	•
51S	Locked Rotor during Start-up	•	•
14	Speed Switch Input	•	•
26	Optional RTD / Thermistor Inputs	6/2	10/3
Control and Monitoring		**P220**	**P225**
	Emergency Restart		•
	Programmable Scheme Logic (4 basic equations)	•	•
	CB Control & Monitoring	•	•
	Trip Circuit Supervision		•
	Setting Groups	2	2
Measurements and Records		**P220**	**P225**
	Measurements	•	•
	Power and Energy Measurements		•
	Hours Run	•	•
	CB Operations	•	•
	Disturbance Records up to number x 2.5 sec (backed-up)	5	5
	Fault Records (backed-up)	25	25
	Event Logging (backed-up)	250	250
Communication		**P220**	**P225**
	Front port (RS232)	•	•
	Rear port (RS485) (*option)	•	•
Rear Port Communication Protocol		**P220**	**P225**
	Modbus RTU	•	•
	IEC 60870-5-103	•	•
	Kbus-Courier	•	•
Hardware		**P220**	**P225**
	Logic inputs (*option)	6	6
	Outputs relays	6	6
	1/5 dual rated AC Current inputs(*settable)	4	4
	57....130 or 220...480 V AC Voltage inputs (optional)		1

APPLICATION

The MiCOM P22x protection relay range performs and offers numerous functions in a compact design:

- Protection
- Monitoring
- Diagnosis
- Fault analysis tools
- Aid to maintenance

Compact and “Plug and play”, the P22x protection relay range supplies essential functions for industry applications, where the following requirements must be achieved:

- Small and medium motors
- High inertia
- Easy to use
- Universal auxiliary supply
- Low cost

MAIN FUNCTIONS

Protection functions are autonomous and can be individually configured or disabled to suit a particular application.

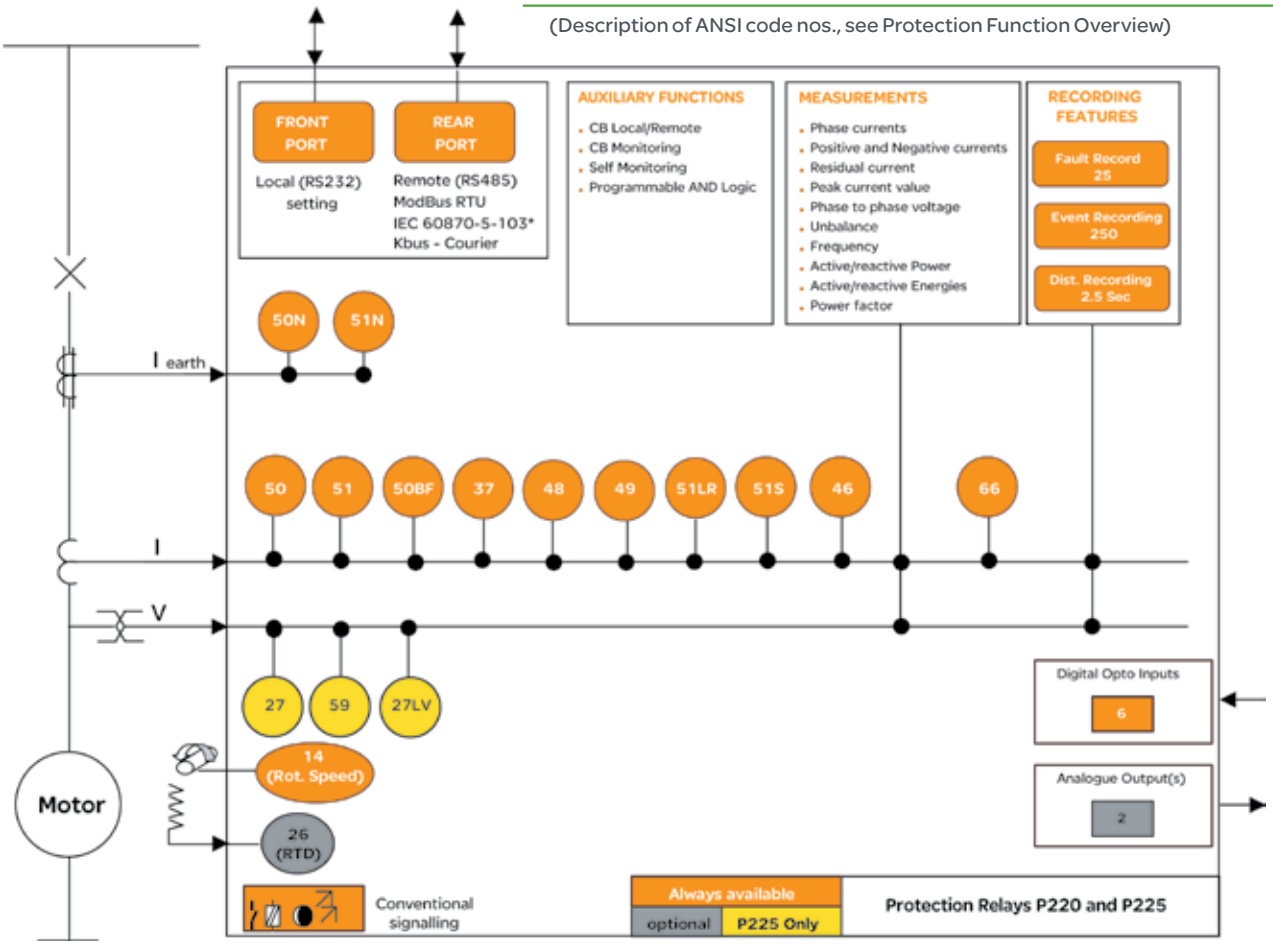
PROTECTION FUNCTIONS

Three-Phase Overcurrent (50/51)

Three independent stages are available in P220/P225 for phase fault protection. For the first and second stage the user may independently select definite time delay (DTOC) or inverse time delay (IDMT) with different type of curves (IEC, IEEE/ANSI, RI). The third stage is definite time only. Each stage and related time delay can be programmed to provide maximum selectivity. The IDMT stages have reset definite or IDMT timer to reduce clearance times when intermittent faults occur.

Functional Overview

(Description of ANSI code nos., see Protection Function Overview)



Earth Fault (50N/51N)

Two elements are available. Each threshold has instantaneous and delayed signal at its disposal. The adjustment range for earth current threshold varies from 0.002 to 1 Ien, allowing maximum sensitivity for earth fault detection. The relay's earth current input can be wired to a core balanced CT or to the summation of the three-phase CTs.

CB Failure (50BF)

The CB failure on fault will be detected very quickly by the P220/P225 relays, which will then either send a new local tripping signal or act directly on the immediately upstream CB.
By speeding up the time taken to clear the fault in the case of CB failure, the P220/P225 relays help maintain the stability of the network and the reliability of the protection system.

Limitation of the Number of Starts, Time between Starts (66)

The number of motor start-ups can be limited. The P22x relay can discriminate between a warm and a cold motor, making it possible to optimise the number of start-ups allocated to a particular motor over a given period of time. Setting a minimum delay between two start-ups avoids exposing the motor and its start-up system to over-large resultant stresses.

Loss of Load (37)

Loss of load, caused by shaft rupture or the unpriming of a pump, is detected by a timed minimum phase under current threshold. This function can be deactivated during the start-up phase so that the motor can gradually increase its load.

Unbalance, Loss of Phase and Single Phasing (46)

Two overcurrent elements based on the negative sequence component of current are available. One is associated with an IDMT characteristic, while the other has a definite time characteristic. The two elements make it possible to differentiate between a short or low amplitude unbalance and a more marked phenomenon such as loss of phase or single phasing.

Thermal Overload (49) - True RMS Base

The thermal image of the MiCOM P22x relay allows for simultaneous protection of the rotor and stator windings of the motor, whatever the operating conditions of the machine, under and overload operating conditions, during start-up, with rotor locked or with the motor off.
Classic I^2t thermal images afford protection to stator windings but do not take account of overheating in the rotor during a current unbalance. Similarly, the presence of harmonic current components causes additional overheating of the stator windings. In order to take this overheating properly into account, the P22x relay separates the negative sequence current and reconstitutes it with the true RMS value of the stator currents absorbed by the motor. The result is better protection against overloads and hence a marked decrease in the risk of motor damage. An alarm threshold, tripping threshold and thermal threshold, beyond which the motor cannot be re-started, are available.

As an option, RTDs can be connected to the MiCOM P220/P225 relays to monitor the motor's temperature. For each of the RTD channels, two temperature thresholds with individual time-delay settings are available. It is therefore possible to monitor stator windings separately, as well as the spin bearings of the motor and the load involved. If the motor is equipped with thermistors, the P220/P225 relays monitor temperature via its two/three thermistor inputs.

Undervoltage (27) / Overvoltage (59) / Re-acceleration Authorisation (27 LV)) / Auto Re-start

If supply voltage drops or the supply is lost completely, a phase-to-phase under voltage threshold causes the motor to stop. This function on P225 relays can be selectively put into or out of operation during the motor start-up phase. An over-voltage threshold (P225 only) protects against over-voltage and also give warning of ageing insulators.

The relays can detect voltage sag via the voltage input (P225 only) or by using an external U/V device and a logical input of the relay (P220/P225). Depending on the duration of the voltage sag, the P220/P225 relays can authorise a re-acceleration of the motor when voltage is restored or, on the other hand, stop the motor to allow the motors most critical to the process to re-accelerate. P225 relay can also auto re-start the motor if the voltage is restored within a set time after it has been stopped due to voltage sag condition or a sequential re-start to be programmed to allow load restoration in a

controlled manner.

Latching of Output Relays (86)
The trip order can be maintained to avoid the risk of re-starting on an electrical, mechanical or thermal fault.

Excessive Start Time (48) / Locked Rotor while Running or at Start-up (51LR)
Whether the motor is unloaded or coupled to a heavy load, this function monitors the duration of the motor start-up phase. The choice of the motor's start-up detection criteria makes it possible to use this function, whatever the motor's start-up mode: eg, direct-on-line, star-delta, auto-transformer, resistor insertion, etc. During normal motor operation, an overcurrent threshold detects rotor stalling.

Locked Rotor while Running or at Start-up (51S)
During motor start-up, a locked rotor is detected with the help of a speed switch input on P220/ P225 relays.

Anti-backspin
If a motor with a high inertia load, for example a fan, is stopped, the shaft continues to rotate for some time before the rotor stops completely. If the motor is switched back on while the rotor is still turning, a condition akin to a false coupling may occur, causing mechanical damage such as broken fan blades. The risk of such problems can be eliminated by setting a minimum time-lapse between stopping the motor and re-starting it.

Presence of Bus Voltage Prior to Start-up
Prior to starting the motor, the P225 relay check that voltage levels are sufficiently high before authorising the start-up sequence.

Emergency Start-up
When required by safety conditions or by the process, a logical input of the P22x relay can be used to allow motor start-up. All start-up restrictions will then be inhibited and the thermal image function will be disabled.

CONTROL FUNCTIONS

Independent Protection Setting Groups
By virtue of its two setting groups, the MiCOM P22x relay allows for the protection of dual-speed motors as well as motors operating under environmental or operational conditions, which are not constant over time. A change of setting group can be useful following a change in source impedance. The result is improved selectivity.

Programmable Scheme Logic (4 Basic Equations)
MiCOM P22x can achieve up to 4 AND logical gates linked to time delays, by combining internal and external information with the protection relay. The user can also create OR gates by individually programming each output relay. The logical gates help make economies on external relaying and make the relay interactive with the process.

Trip Circuit Supervision
Supervision of wiring continuity in the trip circuit makes the system more reliable. The relay can detect a break in the circuit, whether the CB is on or off.

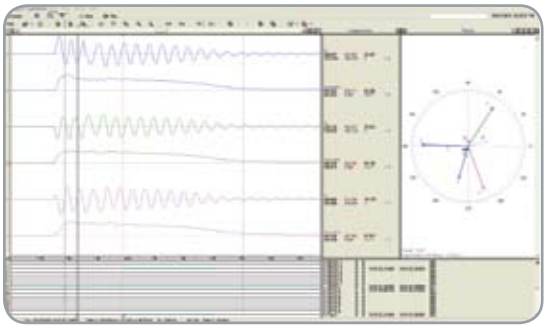
CB Monitoring
Preventive CB maintenance is provided by monitoring summated contact breaking duty, the number of switching operations and the opening time. If a pre-set threshold is exceeded, the P220/P225 relay will generate an alarm signal.

External Trips
The P22x relay accepts external binary signals, which can be used to give a trip or alarm signal, or which may simply be treated as binary information to be passed on through the relay to a remote control system.

Shape of Start-up Current and Voltage
The MiCOM P22x relay records the envelope of both start-up current and voltage signals with a resolution of one sample for every 5 periods. This recording can be uploaded to a PC via the communication network or via the RS232 port on the front plate. It is very helpful to be able to visualise these curves during commissioning and this function of the MiCOM P22x avoids the need for a plotter.

Analogue Outputs
Two optional analogue outputs are available (P220/P225). Some information and measurements such as power (P225), energy (P225) and temperature values, etc., can be fed through a current loop to a PLC.

Trip Cause Statistics
The MiCOM P22x relay provides the user with trip statistics for every protection function. The user can thus keep track of the number of trips, which have taken place as well as their origin.



Motor Start Curves

MEASUREMENTS AND RECORDING FACILITIES

Measurements
The MiCOM P22x relay constantly measures a large amount of electrical data, such as:
- Phase current magnitude in true RMS value: IA, IB, IC
- Neutral current magnitude in true RMS value: IN
- Positive sequence current I1
- Negative sequence current I2
- Zero sequence current Io
- Unbalance ratio I1/I2
- Frequency
- Peak current value
- Phase-to-phase voltage in true RMS value*
- Active and reactive power W and VAR*
- Active and reactive energies Wh and VARh*
- Power factor*

To provide the user with more accurate information on the motor's status and availability, the P22x relay keeps track of:
- Thermal status of the motor
- Load value as a % of full load current
- Time to thermal trip
- Temperature of each RTD (optional)
- Hottest RTD (optional)
- Authorised start number
- Time before another start-up authorisation
- Last start current magnitude
- Last start time value
- Number of starts and emergency starts
- Total motor running hours

Event Records
The last 250 status changes are recorded in a non-volatile memory. This covers all status changes to logic inputs and outputs, modifications to one or more parameters, alarm signals or the operation of one of the output contacts. Events are logged every 1 ms.

*P225 only

5
Disturbance records, of 2.5 s each

lasting
25
Fault records

lasting
250

Wide Range of Features to Provide Complete Protection for All Types of Application

Fault Records

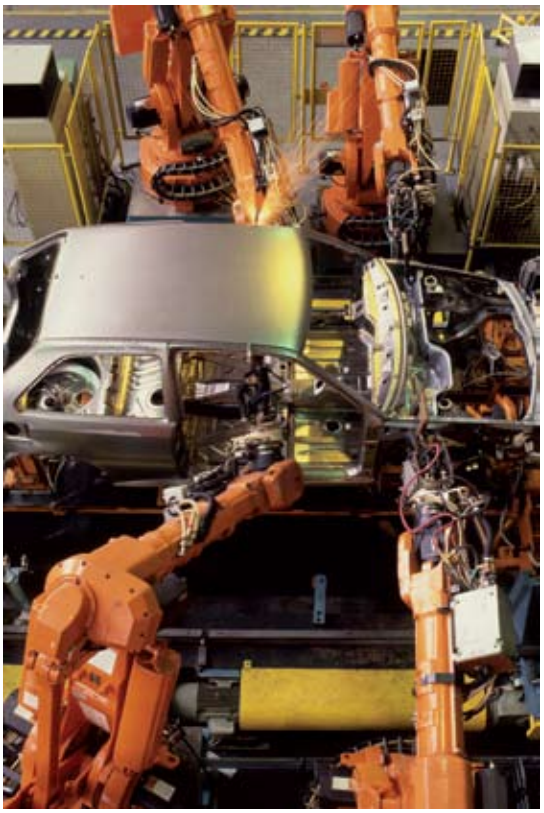
The P22x relay records the last 25 faults. The information provided in the fault record includes:

- Fault number
- Date and time
- Active setting group
- Faulty phase or phases
- Function that gave the trip
- Magnitude of the value that gave rise to the trip command
- Values of the phases and earth currents and voltage*.

Disturbance Records

5 disturbance records, of 2.5 seconds each, can be stored. Disturbance record can be uploaded via the communication network (RS485) or locally (RS232)

*P225 only



USER INTERFACE

Front Plate and Menus

All the relay's parameters, ie., protection functions, logic controls, communication, LEDs, inputs and outputs, can be programmed and modified by push-buttons located on the front panel. An alphanumeric, backlit, 32-character LCD screen displays all the relay's data (settings, measurements, etc.).

The menus are designed so that the user can move around them easily, without confusion. The user will soon be at ease with the Human-Machine Interface.

Dedicated and Programmable LEDs

4 LEDs show the relay's status (Trip, Alarm, Warning and Healthy). MiCOM P22x relay offers free programming of 4 LEDs. Each LED can be assigned to one or more functions or logic states and then limit the need for external signal lights. Each LED can also be assigned to to any one of the 6 logical inputs as well as the internal Auto Re-start signal.

Local and Remote Communication

The MiCOM P220/P225 relays are equipped with a RS485 port on its rear plate, which enables them to communicate via MODBUS™, Courier or IEC 60870-5-103. It is thus possible to transmit adjustment values, measurement data, alarm signals and all other recordings to the Substation Control System or to a SCADA. Communication parameters can be adjusted by the operator via the user interface. Communication failure does not affect MiCOM relays' protective functions.

SOFTWARE SUPPORT

MiCOM S1 Studio software makes it possible to pre-set all MiCOM P22x relay parameters from a PC. The relay is then accessed via the RS232 port on the front panel.

MiCOM S1 Studio software is fully compatible with Windows™ (95, 98, NT, 2000, XP), and can download relay settings, pull up current relay settings and upload measurement values, diagnostic data, fault records, disturbance records, start-up current and voltage shapes and event logging data.

HARDWARE DESCRIPTION

Case

The MiCOM P220/P225 relays are housed in a 4U case and suitable for either rack or flush-mounted. The relay can be withdrawn from its case with the supply voltage connected due to the presence of internal shorting links protecting the current circuits.

Weight

- P220 /P225: 3.7kg

TRACK RECORD - MOTOR PROTECTION RELAYS

- **Over 30 years experience** in motor protection
- **MiCOM range introduced in 1999** derived from previous successful range and user feedback
- Employ latest technology to enhance relay efficiency and reliability. World-wide application with **over 14,000 units delivered**

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