

MiCOM P92x

Voltage and Frequency Protection Relays



MiCOM P92x range of relays provide reliable and high performance voltage and frequency protection.

Versatile application and integration of protection functions with automation, control and measurement functions, combined with reduced maintenance, makes P92x relays an optimal and innovative choice.

A friendly, multi-lingual user interface with programmable LEDs and logic equations, allows for simple and flexible applications on any type of network.

Connecting the relay to virtually any kind of Digital Control System or SCADA is made possible by the wide range of updated communication protocols provided in P92x.



CUSTOMER BENEFITS

- Frequency measurement accuracy better than 0.01Hz
- Wide input voltage range
- Option of multiple communication protocol
- Configurable logic equations
- Housed in a compact case

APPLICATION

The MiCOM P92x relays provide fast and accurate protection for use in numerous applications requiring voltage and frequency based protection elements. To suit different application needs and provide optimum solution, following models are available:

P921:

Voltage protection, 2 logic inputs, 4 outputs.

P922:

Voltage and frequency protection, event and fault records, disturbance recorder, 5 logic inputs, and 8 output contacts.

P923:

Voltage and frequency protection (plus the rate of change of frequency element df/dt , and rate of change of voltage $\Delta U/\Delta T$), event and fault records, disturbance recorder, 5 logic inputs, 8 output contacts.

The relays can be ordered with one of the two voltage input range, to suit the application:

- 57V to 130V
- 220V to 480V

Integrated with 3 independent phase over voltage and phase under voltage thresholds, MiCOM P921, P922 and P923 relays provide effective voltage protection for typical applications like protection of motors, generators, etc. The configurable detection logic (AND, OR) can also indicate the absence of voltage, when the under voltage protection is used.

The 3 zero-sequence over voltage thresholds available in P921, P22 & P923 relays can be applied:

- to detect earth faults at the neutral point of generators, as the relays are insensitive to the 3rd harmonics
- to detect earth faults in high impedance earthed or isolated electrical systems .

The negative sequence over voltage protection provided by the P922 and P923 relays is designed to detect unbalanced conditions it could therefore be used for motor, in which any unbalance will lead to overheating and damage.

The P922 and P923 relays integrate 6 frequency thresholds programmable as under or over frequency, which can be used for automated load shedding/load restoration.

In addition, the P923 relays provide:

- 6 thresholds of instantaneous Rate of Change of Frequency (df/dt) or average measurements over a settable time interval.
- 4 thresholds of $\Delta U/\Delta T$ function to be used for automated load shedding/load restoration.

MANAGEMENT FUNCTIONS

The protection functions in P92x are complemented with a wide range of control, measurement, monitoring, post fault analysis and self-diagnostic features to assist efficient management of the primary system. These include:

- Programmable logic equation
- Programmable logic inputs and outputs
- Fail safe operation
- Circuit breaker control
- Output contact latching
- Circuit breaker status
- Circuit breaker condition monitoring (in P922 & P923)
- 2 setting groups (in P922 & P923)
- True rms phase to phase, phase to neutral and residual voltage measurement.

3

Zero-sequence over voltage thresholds

4

Thresholds of $\Delta U/\Delta T$ function

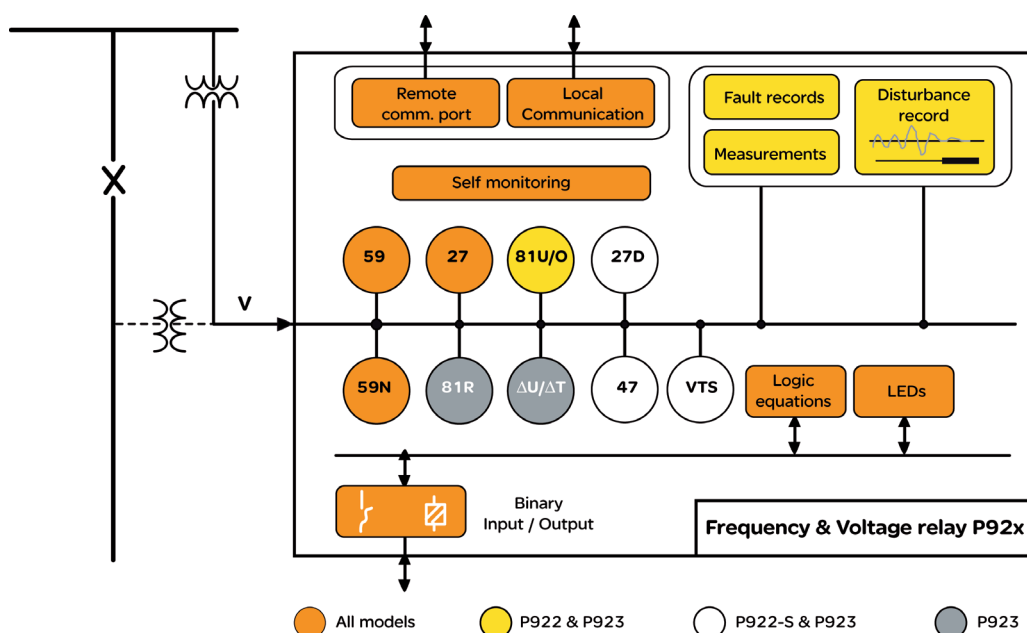
6

Thresholds of instantaneous Rate of Change of Frequency

Protection Functions Overview		P921	P922	P923
	Configuration depending on the number and type of voltage transformers	■	■	■
	Phase-to-neutral or phase-to-phase voltage protection	■	■	■
27	Phase under voltage (AND/OR logic)	■	■	■
59	Phase over voltage (AND/OR logic)	■	■	■
	Settable hysteresis	■	■	■
59N	Zero-sequence over voltage	■	■	■
59N	Derived V0 sequence over voltage		■	■
47	Negative sequence over voltage		■	■
27D	Positive sequence under voltage		■	■
81U/81O	Under/over frequency		■	■
81R	Rate of change of Frequency			■
	Delta U / Delta T			■
	Blocking logic	■	■	■
	Under voltage Blocking (settable for P923)			■
General Functions				
	Digital inputs	2	5	5
	Output relays	4	8	8
	Remote communication (RS485 port)	■	■	■
	Local communication (RS232 port)	■	■	■
	Event recording		250	250
	Fault recording		25	25
	Disturbance recording		5	5
	Setting group	1	2	2
	Time synchronisation (via digital input)		■	■
	Logic equation (AND / OR and NOT gates)	■	■	■
	Frequency change of rate of frequency (F + df/dt)			■
	VT Supervision		■	■
	CB Supervision	■	■	■

Functional Overview

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



ZERO-SEQUENCE OVERVOLTAGE

Three thresholds are available: each one can be independently activated or deactivated. Depending on the VT configuration, MiCOM P921, P922 and P923 relays will operate from the zero sequence voltage, which is calculated internally, or from the residual voltage, which is measured directly.

Available from firmware version V11, a software band-pass filter with an attenuation of 60 dB / decade and centered on the fundamental frequency (50 or 60 Hz) is provided. The filter can be enabled or disabled according to the setting.

CONFIGURATION DEPENDING ON THE VT

MiCOM P921, P922 and P923 relays can be used in the following configurations:

- “3 phase-neutral VTs” or “3 phase-neutral VTs and 1 residual VT”:
The voltage protection element can therefore operate either from measured phase-to-neutral voltages, or from phase-to-phase voltages which have been internally calculated by the relay. Zero-sequence over voltage protection will always be available; the presence of the residual VT is designed to display the true RMS value of the residual voltage,
- “3 phase-phase VTs and 1 residual VT” or “2 phase-phase VTs and 1 residual VT”:
The voltage protection element can only operate from measured phase-to-phase voltages. If the residual VT is not connected, the zero-sequence over voltage protection will not be available.
- The MiCOM P922-G is only designed to operate with the “3 phase-neutral VTs” or “3 phase-phase VTs” configuration.

VOLTAGE PROTECTION

For each of the voltage protection function listed below, an instantaneous signal and a time delayed signal is available for each threshold.

For time-delayed signals, the first threshold of each function (“low threshold”) offers the choice between a definite timer and an inverse timer, to which a reset timer can be assigned. The other thresholds only have one definite timer.

In the case of the MiCOM P922-G, all thresholds have definite time delays and the only detection logic is the “OR” logic.

Under / Overvoltage

Three thresholds are available for each function: each one can be independently activated or deactivated. If a threshold is activated, it can be configured to detect:

- an over voltage on the 3 simultaneous phases (logic “AND”) or on at least one of the phases (logic “OR”) for the “Over voltage” function
- an under voltage on the 3 simultaneous phases (absence of voltage with the “AND” logic) or on at least one of the phases (logic “OR”) for the “Under voltage” function
- The MiCOM P921, P922 and P923 relays provide a programmable hysteresis (drop- out / pick-up ratio) as a percentage of the under voltage and over voltage pick-up values.
- The P923 provides a settable under voltage block of all the protection and control elements based on the frequency.

Negative Sequence Overvoltage

Two thresholds are available: each one can be independently activated or deactivated. This function is based on the negative-sequence component of the voltage, which is calculated internally and displayed on the screen of the front panel: It is designed to detect any voltage unbalance condition.

Positive Sequence Undervoltage

Two thresholds are available: each one can be independently activated or deactivated. This function is based on the positive phase sequence component of the voltage, which is calculated internally.



Negative sequence overvoltage protection

FREQUENCY PROTECTIONS

Frequency protection functions are inhibited below a certain level of the measured secondary voltage (adjustable level on G version).

The following frequency based protection functions are available.

Under / Overfrequency

Six thresholds are available: each one can be configured to detect an under or over frequency within the range $[f_n - 10\text{Hz}, f_n + 10\text{Hz}]$, where f_n is the nominal frequency selected (50Hz or 60Hz). A definite timer is assigned to each threshold.

Rate of Change of Frequency

Six thresholds are available: each can be configured independently within the range $[-10\text{ Hz/s}, +10\text{ Hz/s}]$.

These functions are based on the calculation of the instantaneous rate of change of frequency over a settable integration time (number of cycles).

$\Delta U/\Delta T$ Function

Four thresholds are available: each can be configured independently within the range $[\pm 1\text{V}, \pm 200\text{V}]$ or $[\pm 4\text{V}, \pm 720\text{V}]$ for V and $[0, 1\text{s}, 10\text{s}]$ for T.

PROGRAMMABLE LOGIC EQUATIONS

The MiCOM P921/P922 & P923 relays integrate complete logic equations to allow customization of the product based on customer application. Up to 8 independent Boolean equations can be used. Each equation offers the possibility to use AND, OR & NOT logical gates. Up to 16 parameters can be used for each equation including any threshold and opto-input status. Every result of equation can be time delayed, reused in another equation and assigned to any output relays, trip, trip latching and/ or HMI LEDs. Each boolean equation result can be alarmed or not.

INPUTS / OUTPUTS / PROGRAMMABLE LEDs

All logic inputs, output contacts (excluding the RLO changeover output contact, dedicated to the "relay failed" function) and the 4 LEDs of the MiCOM P921, P922 and P923 relays can be programmed. This affects in particular all logic signals (instantaneous, time delayed) in the relays which can be combined with the different output contacts and LEDs. The output contacts can also be programmed to be latched.



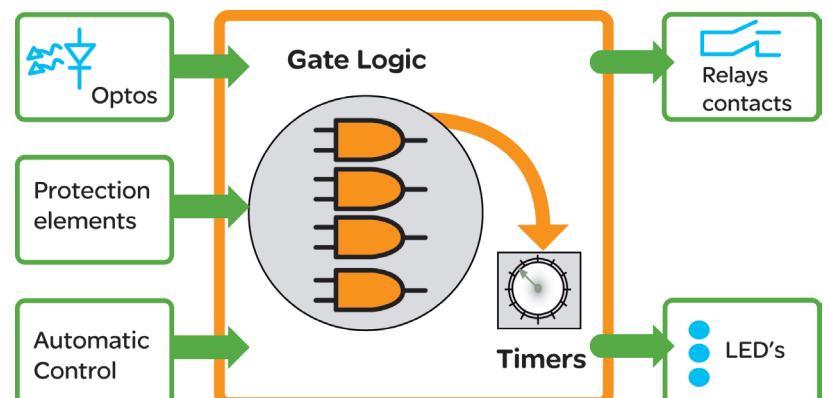
Optimized solution to provide efficient protection

BLOCKING LOGIC

Operation of the different protection elements of P92x can be coordinated with other devices in the system. Two blocking inputs are independently configurable. When active, they freeze the associated protection timers and when they drop-off, they re-impose the initial value if the fault conditions are still present.

SETTING GROUPS FOR PROTECTION FUNCTIONS

The MiCOM P922 and P923 relays have two independent setting groups, which can be used to adapt the protection functions to different operating conditions. The two groups can be switched by activating a dedicated logic input, or by the operator via the front panel, or locally (RS232 port) or remotely (RS485 port). The switch from one setting group to another will only take effect if no protection or automation functions are running, to prevent unwanted tripping.



MEASUREMENTS

Depending on the configuration of the VTs connected to MiCOM P921, P922 and P923 relays, the following values will be measured and displayed as true RMS values on the back-lit screen:

- phase-to-neutral voltages U_a , U_b , U_c
- phase-to-phase voltages U_{ab} , U_{bc} , U_{ca}
- residual voltage V_0
- frequency.

In addition, the MiCOM P922 (S version) and P923 relays calculate the following values internally:

- positive sequence voltage
- negative sequence voltage
- peak values of phase-to-neutral or phase-to-phase voltages
- rolling values of phase-to-neutral or phase-to-phase voltages

All measurements are available locally or remotely.

LOGS AND RECORDS

All event, fault and disturbance records are time-stamped to 1ms by the internal real time clock. In the event of a loss of auxiliary power, a lithium battery is used to save the records, the date and the time. Monitored at regular intervals, the battery can be easily accessed from the front panel if it has to be replaced.

All records can be retrieved locally, using the MiCOM S1 setting software (RS232 port), or remotely (RS485 port).

Event Records

Any change of state of logic inputs, output contacts or protection functions will be recorded in the non-volatile memory of the MiCOM P922 and P923 relays, with a maximum of 250 events. When the memory is full, the oldest events will be deleted, which will increase the storage capacity for more recent events. Each event can be retrieved locally to a PC using the MiCOM S1 support software through front RS232 port or remotely using the rear RS485 port.

Fault Records

The MiCOM P922 and P923 relays can store the last 25 faults that have occurred in non-volatile memory. Each record provides the following information:

- date and time of fault
- origin of fault (under voltage, etc.)
- faulted phase(s)
- magnitude of the quantity which lead to the fault
- magnitude of phase-to-neutral or phase-to-phase voltages
- magnitude of the zero-sequence voltage (if available)

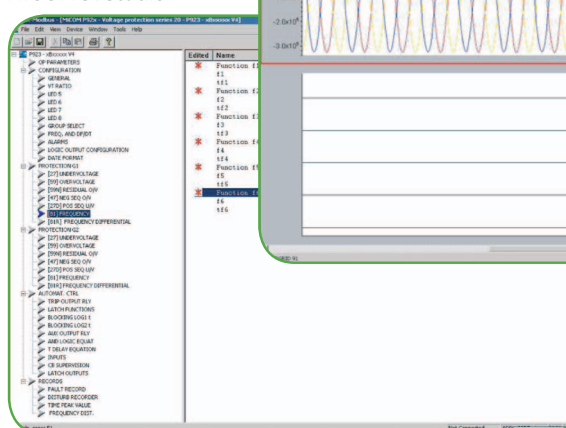
Disturbance Records

Up to 5 disturbance files are stored in the relays. Even if the total duration is fixed to 15s, it can be fully adjustable for easy adaptation to customer requirements (1s / 3s / 5s / 7s / 9s). They are stored in COMTRADE format. The disturbance recording function is triggered either by any of the programmed thresholds or by an external input, or through the communications. All digital and analogical information are stored in a flash 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 on a non volatile flash memory.

Frequency Disturbance Records

One frequency disturbance record, lasting 20 secs can be stored in non-volatile memory by the MiCOM P923 relay. The sampling frequency is fixed at 1 sample per cycle. The mechanism that triggers the recording can be configured: instantaneous or time delayed tripping, activation of a dedicated logic input or time delayed logic equation signal.

Relay setting using
MiCOM S1 Studio



25

Last faults stored

up to 5

Disturbance files stored

**lasting
20 s**

Can be stored in non-volatile memory, in 1 frequency disturbance record

Disturbance record analysis

CIRCUIT BREAKER STATUS & CONTROL

With MiCOM P921, P922 and P923 relays, the circuit breaker can be controlled manually via logic inputs (AUX1 and AUX2), with local or remote communication: the opening and closing commands will therefore activate the programmed output contacts. The LEDs can be programmed to indicate the status of the circuit breaker.

CIRCUIT BREAKER MAINTENANCE

In addition to protecting and controlling the electrical network, the P922 and P923 relays provides preventive and curative maintenance of the circuit breakers. The MiCOM P922 and P923 relays monitor the opening / closing time of the circuit breaker and monitor the number of operations carried out. An alarm is triggered as soon as the maximum opening or closing time, or the maximum permitted number of operations is exceeded.

COMMUNICATIONS

Two communication ports are available on MiCOM P921, P922 and P923 relays: A rear RS485 port for remote communication and a local front RS232 port for local communication.

A MiCOM S1 Studio software provided for relay setting, record retrieving and analysis is fully Windows™ compatible. This support Software allows easy setting of any MiCOM relay model including P92x.



Flexible communication and powerful post fault analysis tools.

Remote Communication

The P921, P922 and P923 relays can be ordered with any one of the following communication protocols.

- MODBUS™
- IEC 60870-5-103
- Courier (K bus)
- DNP 3.0

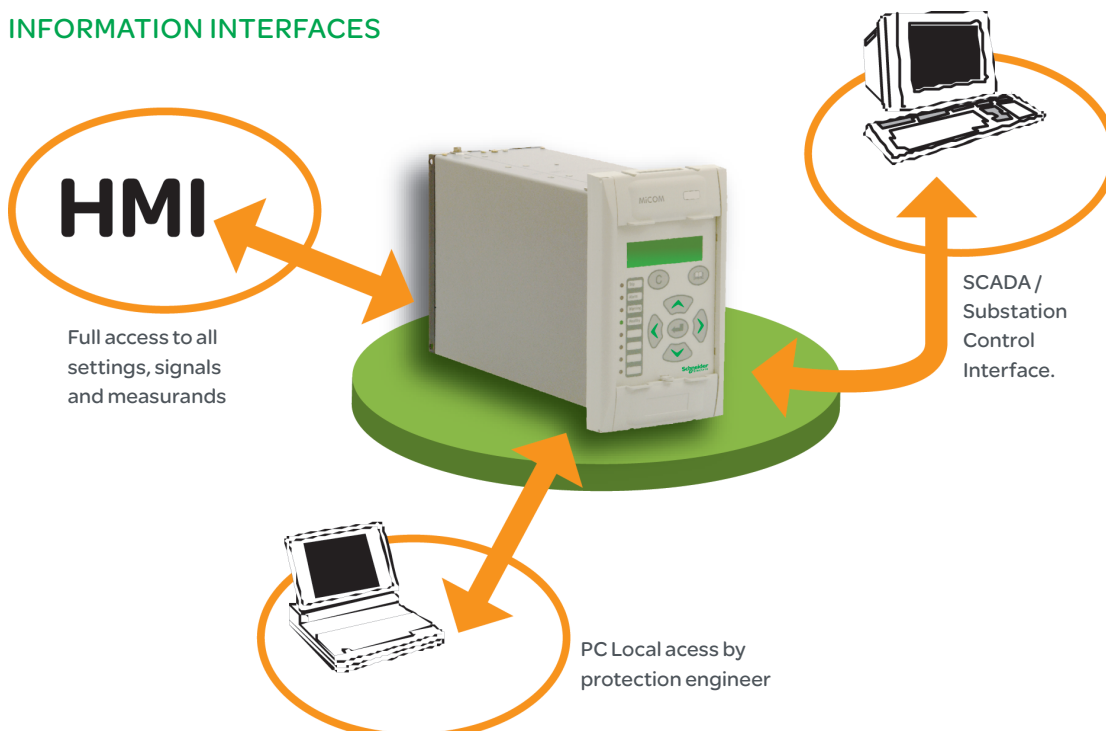
The remote RS485 port can be connected to any SCADA or digital control system to access settings, measurements and alarms as well as all records.

Local Communication

The RS232 port on the front panel of MiCOM P921, P922 and P923 relays has two functions:

- to download a software version to the relay (upgrade, change the language setting, modify the remote communication protocol, etc.)
- to connect a PC which has the setting software

INFORMATION INTERFACES



USER INTERFACE

The user interface for MiCOM P921, P922 and P923 relays comprises:

- back-lit, 2 x 16 characters LCD display,
- four dedicated LEDs to provide information such as “Trip”, “Alarm”, “Warning” and “Relay Healthy”
- four programmable LEDs: Each one lights up when protection information is displayed, or if a logic input state changes
- five tactile keys for scrolling through the menus and entering settings the pull-down structure of the menus enables quick and easy access to required information
- 1 key for reading and one for acknowledging alarms

HARDWARE & CASE

All the models of the MiCOM P92x range have a 4U draw out metal case, and can be flush-mounted in switchboard or panel or rack-mounted. External connections are made via MIDOS type terminal blocks. Each connection includes two 4.8 mm Faston and one M4 screw fixing.

USB/RS232 CABLE (to power the relay)

The USB/RS232 cable allows the user to be able to read and change the settings or retrieve records and disturbance files of the relay when it is not powered by its auxiliary source.



VOLTAGE AND FREQUENCY PROTECTION RELAYS TRACK RECORD

- **RFS3000:** First relay produced with rate of change of frequency elements, Over 400 devices installed since 1997.
- **MiCOM P94x:** Designed for all frequency based load applications. Over 1,100 units installed since 1999.
- **MiCOM P92x:** Combined numerical voltage and frequency relay. More than 4,000 devices installed since 2000.

Schneider Electric Industries SAS

35, rue Joseph Monier
CS 30323
F - 92506 Rueil Malmaison Cedex (France)
Tel.: +33 (0) 1 41 29 70 00
RCS Nanterre 954 503 439
Capital social 896 313 776 €
www.schneider-electric.com

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

Design: Schneider Electric Industries SAS - Sonovision
Photos: Schneider Electric Industries SAS
Printed: Altavia Connexion - Made in France



This document has been
printed on recycled paper.