MiCOM P13x

Feeder Management Relays

compact P130C

modular P132

The time-overcurrent protection devices of the MiCOM P13x range are designed for selective short-circuit protection, ground fault protection and overload protection. They can be applied in all types of medium- and high-voltage systems.

The broad spectrum of protection functions enables the user to cover a wide range of applications in the protection of cables and overhead lines, transformers and motors. In addition, numerous control functions are available. Thanks to the provision of four setting groups, the P13x devices are readily adapted to varying conditions in system operation.

The intuitive user interface as well as the various communication interfaces allow simple and comprehensive setting as well as access to readings from extensive recordings. Numerous integrated communication protocols provide interfacing to almost any kind of substation control or SCADA system.

Furthermore the integrated InterMiCOM protection interface provides direct end-to-end communication between two protection devices. The particularly flat compact case of the P130C as well as the standard 19'' modular case of the P132 with a user-selected number of plug-in modules provide a flexible solution for easy integration of the devices into the substation. Both case variants are available for flush mounting and wall-surface mounting.

Customer Benefits

- 1A/5A software setting
- Two communication interfaces (for SCADA/RTU and remote access)
- Function keys
- Optional Bay control

Schneider Electric

Application

Overcurrent protection devices MiCOM P13x provide a wide range of protection functions. For the different requirements in system protection the integrated functions follow the availability of CT and VT inputs (order options). As a result the preferred applications are as follows:

- P130C with VT:
  Voltage and Frequency Protection
- P130C with CT and VT:
  Directional Time-Overcurrent Protection
- P132 with VT:
  Voltage and Frequency Protection
- P132 with CT:
  Non-Directional Time-Overcurrent Protection
- P132 with CT and VT:
  Directional Time-Overcurrent Protection

Global functions

The following global functions are generally available in all devices:

- Parameter subset selection
  (4 alternative setting groups)
- Metering
- Operating data recording
- Overload recording incl. overload data acquisition
- Ground fault recording incl. ground fault data acquisition
- Fault recording of all CT/VT inputs and binary events incl. fault measurands (e.g. fault location).

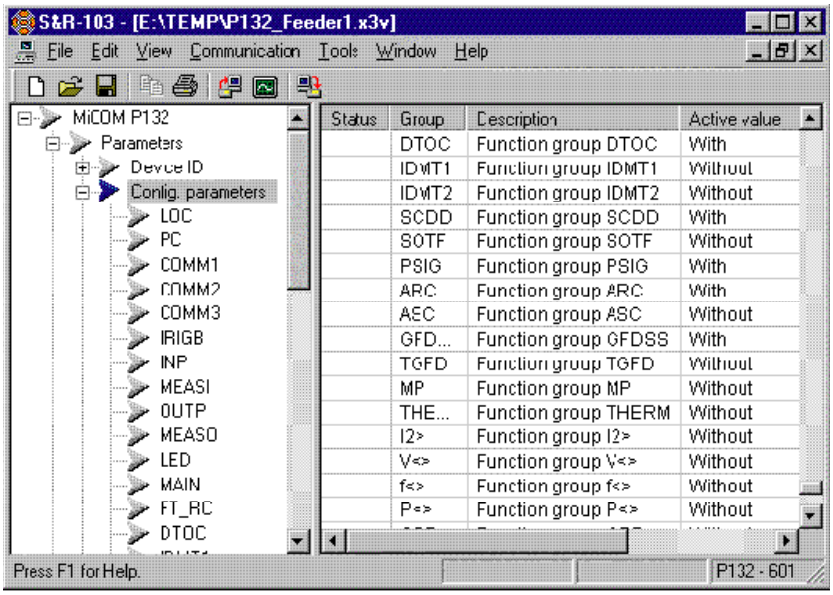
Functions overview			P130C with VT	P130C with CT/VT	P132 with VT	P132 with CT	P132 with CT/VT
50/51 P,Q,N	DTOC	Definite-time o/c protection, three stages, phase-selective	-	•	-	•	•
51 P,Q,N	IDMT1	Inverse-time o/c protection, single-stage, phase-selective	-	•	-	•	•
51 P,Q,N	IDMT2	Inverse-time o/c protection, single-stage, phase-selective	-	-	-	•	•
67 P,N	SCDD	Short-circuit direction determination	-	•	-	-	•
50	SOTF	Switch on to fault protection	-	•	-	•	•
85	PSIG	Protective signaling	-	•	-	•	•
79	ARC	Auto-reclosure control (3-pole)	-	•	-	•	•
25	ASC	Automatic synchronism check	-	-	-	-	option
67W/YN	GFDSS	Ground fault direction determination	-	•	-	-	•
	TGFD	Transient ground fault direction determination	-	-	-	-	option(1)
37/48/49/ 49LR/50S/66	MP	Motor protection	-	•	-	•	•
49	THERM	Thermal overload protection	-	•	-	•	•
46	I2>	Unbalance protection	-	•	-	•	•
27/59/47	V<>	Over-/Undervoltage protection	•	•	•	-	•
81	f<>	Over-/Underfrequency protection	•	•	•	-	•
32	P<>	Directional power protection	-	•	-	-	•
50BF	CBF	Circuit breaker failure protection	-	•	-	•	•
	CBM	Circuit breaker monitoring	-	-	-	•	•
	MCMOM	Measuring-circuit monitoring	•	•	•	•	•
	LIMIT	Limit value monitoring	-	•	-	•	•
	LOGIC	Programmable logic	•	•	•	•	•
	DEV	Control and monitoring of up to 3 switchgear units	-	-	option(1)	option(1)	option(1)
	SIG_1	Single-pole signals	-	-	option(1)	option(1)	option(1)
	CMD_1	Single-pole commands	-	-	option(1)	option(1)	option(1)
	ILOCK	Interlocking logic	-	-	option(1)	option(1)	option(1)
	COMMx	2 comm. interfaces, IRIG-B, protection comm. interface InterMiCOM	option	option	option	option	option
	IEC	IEC-61850-interface	-	-	option	option	option
	F_KEY	Function keys	4	4	6(1)	6(1)	6(1)
	INP/ OUTP	Binary inputs and output relays (max.)	2/8	2/8	40/30(1)	40/30(1)	40/30(1)
	MEASI/ MEASO	2x 20 mA outputs, 20 mA input, 1 RTD input	-	-	option(1)	option(1)	option(1)
	MEASI	9 RTD inputs	-	-	-	option(1)	option(1)

(1) Not available for P132 in 24TE case

Main functions

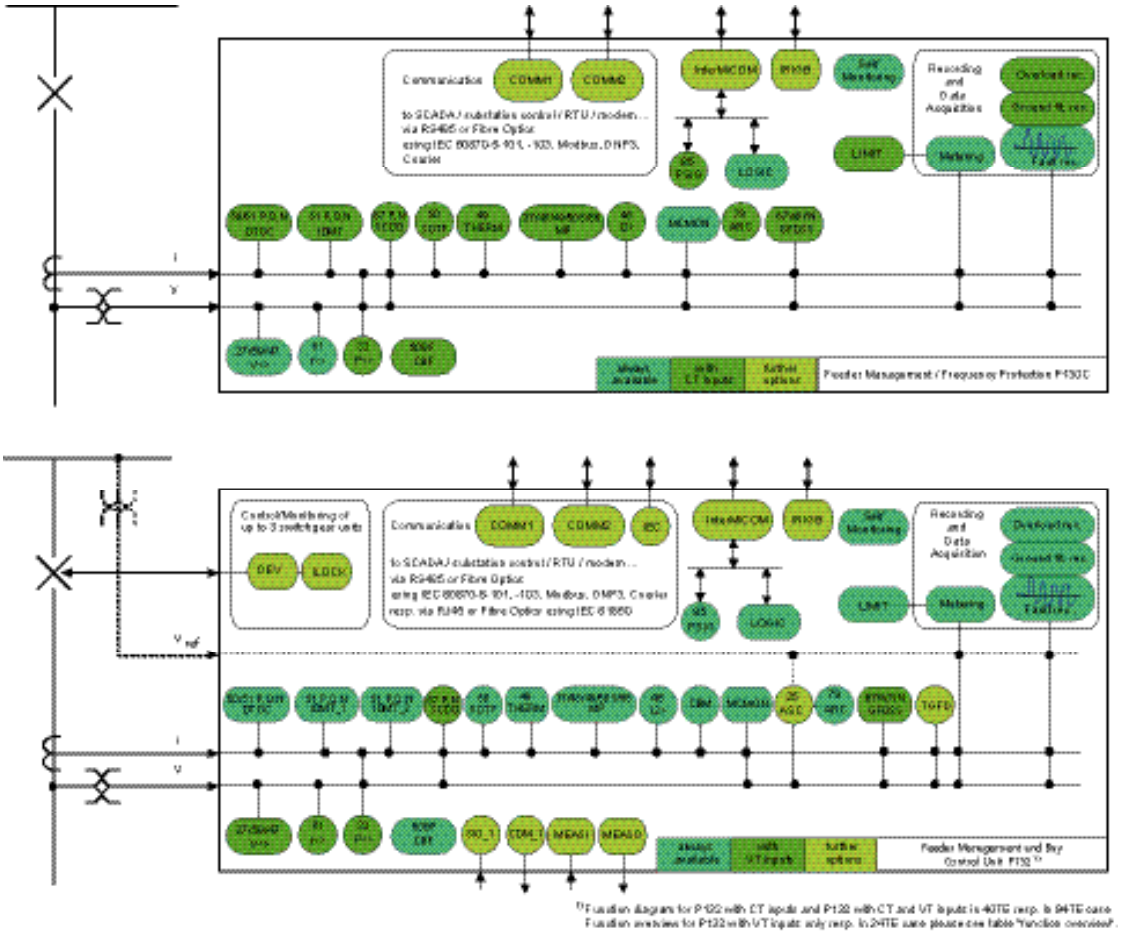
Main functions are autonomous function groups and can be individually configured or disabled to suit a particular application. Function groups that are not required and have been disabled by the user are masked completely (except for the configuration parameter) and functional support is withdrawn from such groups.

This concept permits an extensive scope of functions and universal application of the device in a single design version, while at the same time providing for a clear and straight-forward setting procedure and adaptation to the protection and control task under consideration.



Simple Function Selection by Mouseclick

Function diagrams



MiCOM P13x provide a wide range of protection functions

Time-overcurrent protection

For the overcurrent protection of the three phase currents, the residual current and the negativesequence current the P13x provide definite time overcurrent protection and inverse time overcurrent protection with a multitude of tripping characteristics.
The operate values of all overcurrent stages can dynamically changed (e.g. under cold load pickup conditions). Additionally, some of the phase and negative-sequence current stages can be stabilized under inrush conditions if desired.
The residual and negative-sequence current stages affect the general starting signal. This effect can be suppressed if desired.

Short-circuit direction determination

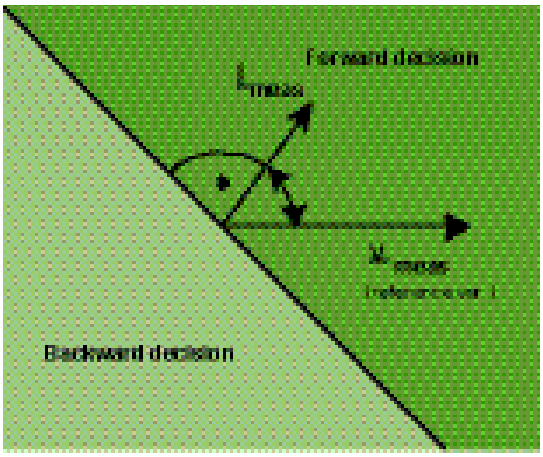
Due to the short-circuit direction determination function, the P13x can be used as directional time-overcurrent protection devices. For the individual overcurrent stages the user can select whether the stage shall be forwarddirectional, backward-directional or non-directional.
Direction determination is performed in separate measuring systems for the phase current and residual current elements, respectively.

Tripping time characteristics

No.	Tripping time characteristic	Constants and formulae (t in s)			
	(k = 0.01...10.00)	a	b	c	R
0	Definite Time			t = k	
	Per IEC 255-3				
1	Normally inverse	0.14	0.02	$t = k \cdot \frac{a}{\left(\frac{I}{I_{reg}}\right)^{b} - 1}$	
2	Very inverse	13.50	1.00		
3	Extremely inverse	80.00	2.00		
4	Long time inverse	120.00	1.00		
	Per ANSI/IEEE C37.112	Trip			Release
5	Moderately inverse	0.0515	0.0200	0.1140	4.85
6	Very inverse	19.6100	2.0000	0.4910	21.60
7	Extremely inverse	28.2000	2.0000	0.1217	29.10
	Per ANSI	Trip			Release
8	Normally inverse	8.9341	2.0938	0.17966	9.00
9	Short time inverse	0.2663	1.2969	0.03393	0.50
10	Long time inverse	5.6143	1.0000	2.18592	15.75
		$t = k \cdot \left[\frac{a}{\left(\frac{I}{I_{reg}}\right)^{b} - 1} + c\right]$		$t = k \cdot \frac{R}{\left(\frac{I}{I_{reg}}\right)^{2} - 1}$	
11	Not per standard RI-type inverse	$t = k \cdot \frac{1}{0.339 - \frac{0.236}{\left(\frac{I}{I_{reg}}\right)}}$			
12	Not per standard RXIDG-type inverse	$t = k \cdot \left(5.8 - 1.35 \cdot \ln \frac{I}{I_{reg}}\right)$			

Directional characteristics in short circuit direction determination

Meas. system	Starting	Variables selected for measurement		Characteristic angle αP or αN
		I_{meas}	V_{meas}	
P	A	I_A	$V_{BC} = V_{BN} - V_{CN}$	+45°
	B	I_B	$V_{CA} = V_{CN} - V_{AN}$	+45°
	C	I_C	$V_{AB} = V_{AN} - V_{BN}$	+45°
	A-B	I_A	$V_{BC} = V_{BN} - V_{CN}$	+60°
	B-C	I_C	$V_{AB} = V_{AN} - V_{BN}$	+30°
	C-A	I_C	$V_{AB} = V_{AN} - V_{BN}$	+60°
	A-B-C	I_C	$V_{AB} = V_{AN} - V_{BN}$	+45°
G	GF	I_N	$V_{NG} = 1/3 .(V_{AN}V_{BN}+V_{CN})$	-90°...+90° (adjustable)



Switch on to fault protection

Closing of a circuit breaker might inadvertently lead to a short-circuit fault due to a maintenance ground clamp not yet removed, for example. The function 'switch on to fault protection' provides for an undelayed protective tripping during a settable time after a manual close command has been issued.

Motor protection

For the protection of directly switched h.v. induction motors with thermally critical rotor, the following specially matched protection functions are provided:

- Recognition of operating mode
- Rotor overload protection using a thermal motor replica
- Choice of reciprocally quadratic or logarithmic tripping characteristic
- Inclusion of heat dispersion processes in the rotor after several startups
- Separate cooling periods for rotating and stopped motors
- Startup repetition monitoring with reclosure blocking
- Control logic for heavy starting and protection of locked rotor

Using the optional RTD inputs, direct monitoring of the temperature of the stator windings and the bearings can be set up with the P132.

Thermal overload protection

P13x provide thermal overload protection for lines, transformers and stator windings of h.v. motors. The highest of the three phase currents serves to track a first-order thermal replica according to IEC 255-8. For the P132 the temperature of the cooling medium can be taken into account in the thermal replica using the optional RTD inputs or the optional 20 mA input. The user has a choice of using a thermal replica on the basis of either relative or absolute temperature.

MiCOM P13x for rapid and selective fault clearance in your power system

Over-/Undervoltage protection

the over- and undervoltage protection allows the multistage evaluation of directly measured and internally calculated voltages.

Over-/Underfrequency protection

The four-stage frequency protection can be operated as pure over- and underfrequency monitoring as well as combined with differential frequency gradient monitoring (df/dt) for system decoupling applications or with
medium frequency gradient monitoring (Δf/Δt) for load
shedding applications.

Directional power protection

The directional power protection monitors the active and reactive power limits and detects power drop and reversal of direction.

Ground-fault direction determination

For the determination of the ground-fault direction in isolated or Peterson-coil compensated power systems two proven methods are provided:

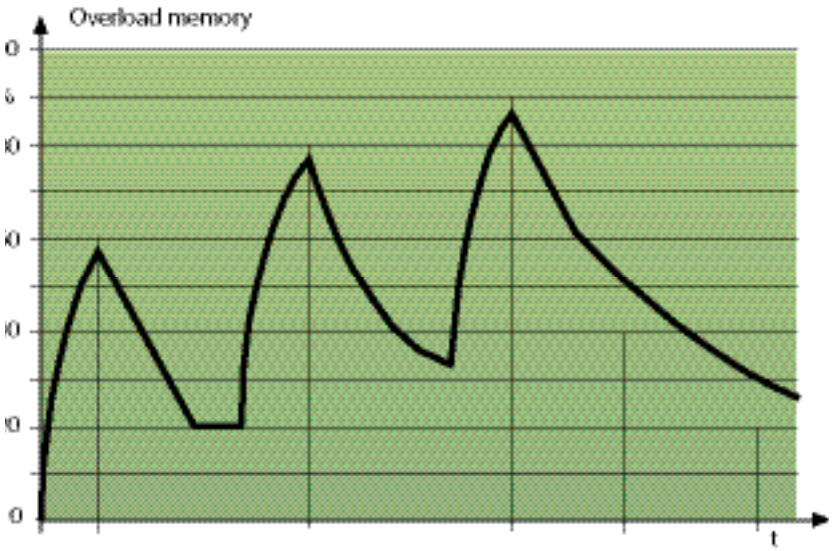
- Wattmetric or Admittance method

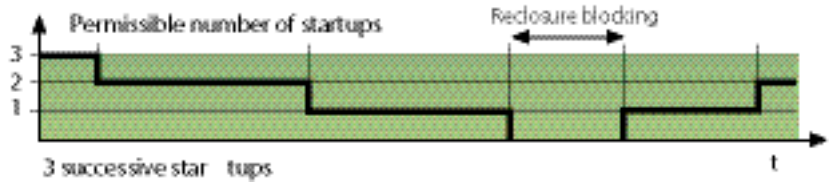
(analysis of steady-state signals)

- Transient method

(analysis of transient signals) (optional).

Overload memory and startup counter





Circuit breaker monitoring

This function provides the user with several criteria for the assessment of circuit breaker wear:

- Calculated number of remaining operations based on the CB wear curve
- Mechanical operations count
- Interrupted currents sum (linear and squared)

For each of these criteria, a signaling threshold can be set by the user.

Auto-reclosing control

The auto-reclosing control (ARC) operates in threephase mode. ARC cycles with one high-speed reclosing (HSR) and multiple (up to nine) subsequent time-delay reclosings (TDR) may be configured by the user.

Automatic synchronism check

This option for the P132 can be used in conjunction with automatic or manual (re)closure and the close command of the optional control function. In non-radial networks this ensures that reclosure will proceed only if the synchronism conditions are met.

Protective signaling

Protective signaling can be used in conjunction with short-circuit direction determination. For this purpose the protection devices must be suitably connected by pilot wires or the optional protection interface InterMiCOM on both ends of the line section to be protected.
For protection devices on the infeed side of radial networks, teleprotection can also be controlled without the short-circuit direction determination function.

Measured data inputs and outputs

For the acquisition of an externally measured variable or the output of measured datas P139 provides optionally a 0 to 20 mA input and two 0 to 20 mA outputs.
A settable scaling allows a simple adaption of the input resp. outputs ranges (e.g. 0 to 10 mA, 4 to 20 mA).
Up to 10 optional resistance temperature detectors are provided for direct temperature acquisition.
Depending on the set operating mode, the RTD's operate in parallel or the RTD's can be subdivided into regular inputs and reserve inputs.

Protection interface interMiCOM

Optional InterMiCOM allows high performance permissive and blocking type unit protection to be configured, plus transfer of any digital status information between line ends. Intertripping is supported too, with channel health monitoring and cyclic redundancy checks (CRC) on the received data for maximum message security.
InterMiCOM provides eight end-to-end signal bits, assignable to any function within a MiCOM relay's programmable logic.
Default failsafe states can be set in case of channel outage.

Information interfaces

Information exchange is done via the local control panel, the PC interface and two optional communication interfaces.

The first communication interface has settable protocols conforming to IEC 60870-5-103, IEC 60870-5-101,

DNP 3.0, Modbus and Courier or provides alternatively protocol conforming to IEC 61850 and is intended for integration with substation control systems.

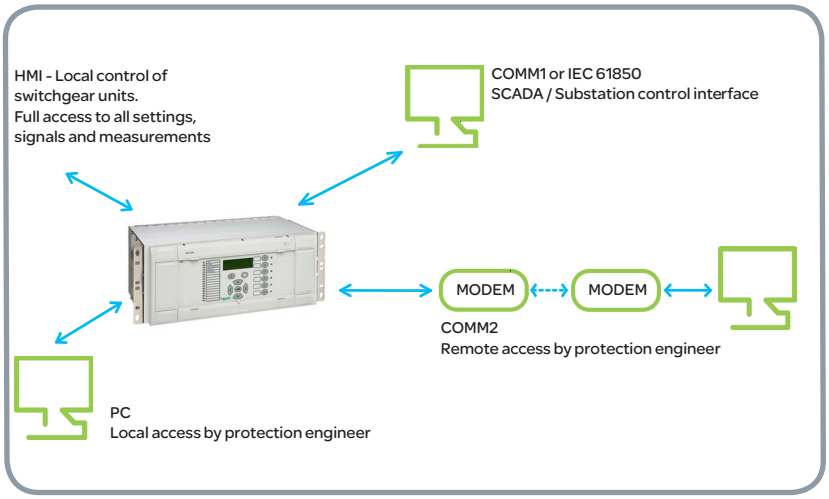
The 2nd communication interface (COMM2) conforms to IEC 60870-5-103 and is intended for central settings or remote access.
Clock synchronization can be achieved using one of the protocols or using the IRIG-B signal input.

Function keys

The function keys provide an easy local control of processes or functions by the user.

A single function can be assigned to each function key that allows manually opening and closing of the CB, enabling and disabling of functions, a quick navigation wi-th the selected menu jump list or a reset of stored information.

For each function key, the user can define an operating mode suitable to the assigned functionality. To guard against inadvertent or unauthorized use each function key is protected with a password.



Information Interfaces

Control

The optional control functions of the P132 are designed for the control of up to three electrically operated switchgear units equipped with electrical check-back signalling located in the bay of a medium-voltage substation or a non-complex high-voltage substation.

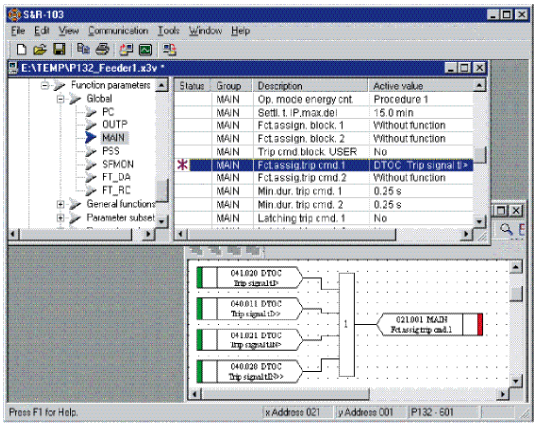
For the selection of the bay type the P132 is provided with a number of predefined bay types. These include the assignment of binary inputs and outputs for the switchgear unit control and monitoring and the interlocking logic. The settings of the predefined bay types can be adapted to the individual needs.

The P132 issues switching command outputs with the integration of switching readiness and permissibility tests; subsequently the P132 monitors the intermediate position times of the switchgear units. If a switchgear malfunction is detected, this fact will be indicated (e.g. by an appropriately configured LED indicator).

The switchgear units can be controlled via binary inputs, the optional communication interface or the function keys of the HMI.

Proven protection with advanced communication and comfortable data handling.

P132 version with detachable HMI



Just one Setting File

Device Track Record

- PS 451 / PM 481: first multi-functional, numerical time-overcurrent devices launched in 1991, more than 14000 devices installed.
- PS 441: first directional time-overcurrent device in compact case design, more than 9000 devices installed since 1994.
- PS 4x2: numerical time-overcurrent devices with extended functionality, more than 4000 devices installed since 1998.
- MiCOM P13x: Complete integration of the PS 4x2 into the MiCOM range, extended functionality and realization of a ‘compact-solution’ in the MiCOM family

Schneider Electric
35, rue Joseph Monier
CS 30323
92506 Rueil-Malmaison Cedex, France
Tel: +33 (0) 1 41 29 70 00

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