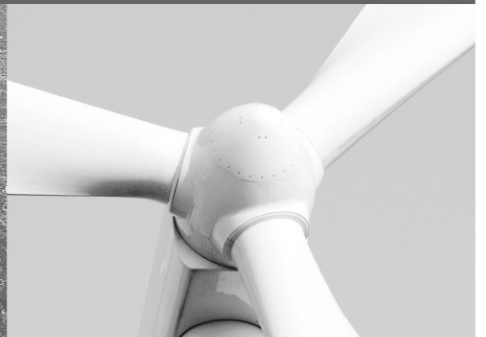




-power in control



DATA SHEET



Multi-functional Protection Relay, MTR-4P

- 13 protection functions
- Marine approval from GL/DNV
- Power accuracy class 0.5
- Fast and simple commissioning from M-Set
- Two-stage trip setting
- Start-up delay
- Typical response time below 50 ms
- Modbus RS-485 communication
- Password protection



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General information

Application and overview

The MTR-4P is a traditional protection relay, which can be configured to work in single-phase or three-phase electrical power networks. The MTR-4P series measures RMS value by means of fast sampling of voltage and current signals, which makes the instrument suitable for acquisition of transient events. A built-in microcontroller calculates measurements (voltage, current, frequency, energy, power, power factor, THD, phase angles, and so on) from the measured signals.

Features

- 13 multi-function protection functions
- Measurement of more than 50 instantaneous values (V, A, kW, kVA, kvar, kWh, kvarh, PF, Hz, MD thermal, THD, and so on)
- Accuracy class 0.5 (0.4)
- Serial communication, RS-485 up to 115,200 bit/s optional
- Modbus communication protocol
- Up to four relays
- Single wide auxiliary power supply range 24 to 250 ±20 % V DC, 48 to 230 ±20 % V AC
- Automatic range of nominal current and voltage (max. 20 A (12.5 to 20 A for 60 s) and 600 V L-N)
- Housing for DIN rail mounting
- Start-up delay
- Password protection (two levels)
- User-friendly configuration software

The range of I/O modules makes the MTR-4P series a perfect choice for numerous applications. The MTR-4P series supports standard serial communication RS-485 with speed up to 115,200 Baud, which is perfect for simple applications and serial bus interfacing.

Additionally, USB 2.0 interface can be used for a fast set-up without need for auxiliary power supply. This interface is **not** galvanically separated from the power input and can **only** be used when disconnected from all power inputs.

Programming

The MTR-4P protection relay is completely programmable by means of the M-Set utility software. Primary/secondary ratio (U, I), energy counter, input and output values are all programmed by setting software on the USB or the RS-485 communication.

Standard compliance

Standard	Description
EN 61010-1	Safety requirements for electrical equipment for measurement, control and laboratory use
EN 60688	Electrical measuring transducers for converting AC electrical variables into analogue and digital signals
EN 61000-6-2	Electromagnetic compatibility (EMC) – Immunity for industrial environments
EN 61000-6-4	Electromagnetic compatibility (EMC) – Emission standard for industrial environments
EN 60529	Degrees of protection provided by enclosures (IP code)
EN 60068-2-1/-2/-6/-27/-30	Environmental testing (-1 Cold, -2 Dry heat, -6 Vibration, -27 Shock, -30 Damp heat)
IEC 60255-1/-127	Type tests (partly) in accordance with IEC 60255-1 (2009) and -127 (2010). Environmental tests in accordance with DNV/GL -CG-0339 ed. November 2015: Temperature, Humidity, Cold, Vibration and EMC
UL 94	Tests for flammability of plastic materials for parts in devices and appliances

Protection functions

MTR-4P supports 13 different protection functions in six different logical categories: **Voltage** (over-/under-voltage), **Current** (over-current), **Frequency** (over-/under-frequency), **Asymmetry** (voltage unbalances and phase imbalances), **Load** (directional power, power underrun) and **LoM** (phase shift, ROCOF df/dt).

ANSI code	Protection function	Symbol
50	Over-current	(>I, >>I)
50N/G	Over-current – earth	(>I _E , >>I _E)
87N	Over-current – differential	(>I _{diff} , >>I _{diff})
59	Over-voltage	<U, <<U
27	Under-voltage	>U, >>U
81O	Over-frequency	(>f, >>f)
81U	Under-frequency	(<f, <<f)
32	Directional power	(>P, >>P)
32R/U	Power underrun	(<P, <<P)
46	Phase imbalance	(>I _{im} , >>I _{im})
47	Voltage unbalance	(>U _{Un})
78	Phase shift	(> dPhi/dt)
81R	ROCOF	(df/dt)

Under each particular protection category, an alarm triggering limit can be set for each function, based on a particular **parameter limit** in %.

Compare time delay (0 to 300 s) is then set to define time limit before the protection takes effect.

When the protection function is switched off a **hysteresis (0 to 10 %)** is set, which prevents premature triggering.

For each of the protection functions, an **assigned output** can be selected.

See a more detailed description of all available protection functions below:

It is possible to set up each individual relay output with different **output signals** such as, normal, normal inverse, latched, latched inverse, pulsed, pulsed inverse, always ON or always OFF.

MTR-4P has a **start-up delay (0 to 300 s)**, inhibiting the output relays when the auxiliary supply is powered on. The protection functions start simultaneously with the start-up delay, but the relay outputs stay in OFF state until expiration of the start-up delay time. After expiration of the start-up delay time, modules are set according to present network conditions. If a fault is detected and the compare time delay has run out during the start-up delay, it will change into fault condition when the start-up timer has run out.

The start-up delay and the latched output function are often used as a manually reset function of fault condition, by which a normally closed switch (external) resets the auxiliary supplies.

Current protection functions:

Over-current (>I, >>I) ANSI 50

It is possible to define up to two over-current limits with up to 2000 % of nominal current.

Over-current (>I_E, >>I_E) ANSI 50 N/G

It is possible to define up to two over-current limits within the range of 0.4 to 550 % of nominal current.

Over-current (>I_{diff}, >>I_{diff}) ANSI 87N

It is possible to define up to two over-current limits within the range of 0.8 to 200 % of nominal current.

Voltage protection functions:

Over-voltage (>U, >>U) ANSI 59

It is possible to define up to two over-voltage limits with up to 150 % of nominal voltage.

Under-voltage (<U, <<U) ANSI 27

It is possible to define up to two under-voltage limits with down to 50 % of nominal voltage.

Frequency protection functions:

Over-frequency (>f, >>f) ANSI 81O

It is possible to define up to two over-frequency limits with up to 150 % of nominal frequency.

Under-frequency (<f, <<f) ANSI 81U

It is possible to define up to two under-frequency limits with down to 50 % of nominal frequency.

Asymmetry protection functions:

Voltage unbalances (>UU_n)

Protection over phase unbalance resulting from phase inversion, unbalanced supply or distant fault, detected by the measurement of negative sequence voltage component of a three-phase system. This parameter has a range of 0 to 100 % of the rated nominal voltage.

Phase imbalance (>lim, >>lim) ANSI 46

Protection over phase imbalance resulting from phase inversion, unbalanced supply or distant fault, detected by the measurement of negative sequence voltage. This threshold is defined relative to the rated current and has a range of 0 to 100 %.

Load protection functions:

Directional power (>P, >>P) ANSI 32

Protection based on calculated active power. Active over-power monitoring is used to detect overloads and allow load shedding. It is possible to define up to two alarm limits within the range of -300 % to 300 % of the rated active power.

Power underrun (<P, <<P) ANSI 32R/U

Protection based on calculated active power. This user-defined limit defines the permissible deviation of the load from defined thresholds. The alarm is triggered if the measured value drops below the rated active power limit and can be set between -300 % and 300 %.

LoM (Loss of Mains) protection functions:

Phase shift (> dPhi/dt)

Protection based on exceeding the phase angle deviation rate for any of the three phases. This limit for single-phase and three-phase shifts respectively can be set in the range of 0 to 90 °.

ROCOF protection (> df/dt)

Protection based on exceeding the Rate Of Change Of Frequency within the system. This parameter has a permissible limit range of 0 to 10 Hz/s.

Technical information

Technical data

Accuracy		
Measured values	Range	Accuracy class *
Rms current (I1, I2, I3, Iavg, In)	-1/-5 A	0.4 (0.2) **
Maximum current	20.0 A (12.5 to 20 A for 60 s)	0.4 (0.2) **
Rms phase voltage (U1, U2, U3, Uavg)	62.5, 125, 250, 500 V L-N	0.4 (0.2) **
Maximum voltage	600 V L-N (1000 V L-L)	0.4 (0.2) **
Rms phase-to-phase voltage (U12, U23, U31, Uavg)	866 V L-L	0.4 (0.2) **
Frequency (f)	16 to 400 Hz	0.02 or 10 mHz
Power angle (φ)	-180 to 0 to 180 °	0.2 °
Power factor (PF)	-1 to 0 to +1 U = 50 % to 120 % Un I = 20 % to 200 % In	0.2
	-1 to 0 to +1 U = 50 % to 120 % Un I = 2 % to 20 % In	0.5
THD (U), THD (I)	5 to 500 V 0 to 400 %	0.5
Active power	75	0.5 (0.3) **
Reactive power	120	
Apparent power	250	
	500	
	[W/var/VA] In = 1 A	[W/var/VA] In = 5 A
Active energy		Class 1
Reactive energy		Class 2

* All measurements are calculated with high harmonic signals.

** Accuracy on RS-485 Modbus values.

Inputs		
Voltage inputs	Number of channels	4 *
	Nominal range values	62.5, 125, 250, 500 V _{LN} - auto range
	Nominal voltage (U _n)	500 V _{LN} , 866 V _{LL}
	Measuring range (cont.)	2 to 600 V _{LN} (1000 V _{LL}) sinusoidal
	Max. allowed value acc. to IEC/EN 60688	1.2 × U _n permanently
		2 × U _n ; 1 s, 10 times and 10 s interval
	Consumption	< U ² /3.3 MΩ per phase
Input impedance	3.3 MΩ per phase	
Current inputs	Nominal range values	0.01 to 10 A - auto range
	Nominal current (I _n)	1 A or 5 A (defined by software settings)
	Measuring range	1 mA to 20.0 A sinusoidal for MTR-4P (12.5 to 20 A for 60 s)
	Min. measurement (noise reduction)	Settings from "starting current for all powers" **
	Max. measurement	20 × I _n (I _n = 1 A), 4 × I _n (I _n = 5 A)
	Max. allowed value (thermal)	15 A continuously
	Acc. to IEC/EN 60688	20 × I _n ; 5 × 1 s; 300 s
	Acc. to IEC/EN 60255	20 A for 60 s
	Consumption	< I ² × 0.01 Ω per phase
Frequency	Nominal frequency (f _n)	50 or 60 Hz
	Measuring range	16 to 400 Hz ***
Power supply universal	Nominal voltage AC	48 to 230 V ±20 %
	Nominal frequency	45 to 65 Hz
	Nominal voltage DC	24 to 250 V ±20 %
	Consumption	< 8 VA
	Power-on transient	< 20 A; 1 ms

* 4th channel is used to measure U_{EARTH-NEUTRAL}.

** Starting current is set in the setting software M-Set > Settings > General.

*** For frequency measurement only.

Relay outputs		
Electromechanical relay output	Purpose	Alarm, pulse, general purpose digital output
	Type	Electromechanical relay switch
	Rated voltage	48 V AC/DC (+40 % max.)
	Max. switching current	1000 mA
	Contact resistance	≤ 100 mΩ (100 mA, 24 V)
	Pulse	Max. 4000 imp/hour
	(If used as pulse output)	Min. length 100 ms
	Insulation voltage:	
	Between coil and contact	4000 V DC
	Between contacts	1000 V DC
	Response time	≤ 50ms

Connection

Permitted conductor cross sections

Terminals	Max. conductor cross sections
Voltage inputs (4)	2.5 mm ² with pin terminal
	4 mm ² solid wire
Current inputs (6)	2.5 mm ² with pin terminal
	4 mm ² solid wire
Power supply (2)	2.5 mm ² with pin terminal
	4 mm ² solid wire
Relay outputs (0/4/6/8)	2.5 mm ² with pin terminal
	4 mm ² solid wire

Communication		
Type	RS-485	USB
Type of connection	Network	Direct
Max. connection length	1000 m	3 m
Number of bus stations	≤ 32	–
Terminals	Screw terminals	USB mini
Insulation	Protection class I, 3.3 kV AC RMS 1 min	NO INSULATION!
Transfer mode	Asynchronous	
Protocol	Modbus RTU	
Transfer rate	2,400 to 115,200 bit/s	USB 2.0

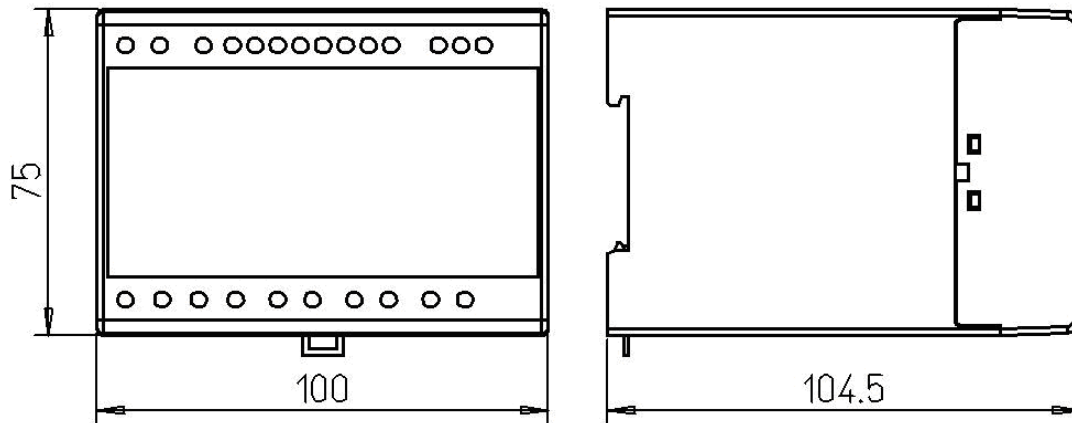
Electronic features	
Response time input→ communication	All calculations are averaged over an interval of 8 to 256 periods. Preset interval is 64 periods, which is 1.28 s at 50 Hz Modbus table refresh time: 50 ms
Status LEDs PWR	Red = instrument is powered ON

Safety features	
Protection	IP20 acc. to IEC/EN 60529
	Protection class II
Pollution degree	2
Installation category	CAT III; 600 V meas. inputs acc. to EN 61010-1
	CAT III; 300 V aux. supply acc. to EN 61010-1
Galvanic isolation acc. to EN 61010-1	UAUX↔AO, COM: 3310 V AC, 50 Hz, 60 s
	UAUX↔U, I inputs: 3310 V AC, 50 Hz, 60 s
	U in↔AO,COM: 3310 V AC, 50 Hz, 60 s
	I in↔AO,COM: 2210 V AC, 50 Hz, 60 s
	U in↔I in: 3310 V AC, 50 Hz, 60 s

Mechanical	
Dimensions	W100 x H75 x D105 mm
Max. conductor cross section for terminals	2.5 mm ² stranded wire
	4 mm ² solid wire
Vibration	IEC 60068-2-6, 3 to 13.2 Hz: 2mm _{pp} . 13.2 to 100 Hz: 0.7 g. To IEC 60068-2-6 & IACS UR E10
Shock	IEC 60068-2-27, 50 g, 11 ms, half sine. To IEC 60068-2-27
EMC	Acc. to EN 61000-6-2 and EN 61000-6-4
Mounting	Rail mounting 35 x 15 mm
	Acc. to DIN EN 50022
Enclosure material	PC/ABS
Flammability	Acc. to UL 94 V-0
Weight	370 g

Ambient conditions	
Ambient temperature	Usage group I
	-5 to 0 to 45 to 55 °C (Accuracy outside reference temperature range is not more than 2x class)
	Acc. to IEC/EN 60688
Operating temperature	-30 to +70 °C
Storage temperature	-40 to +70 °C
Average annual humidity	≤ 93 % r.h.

Unit dimensions



Dimensions are given in mm.

Order specifications

Variant	Output				RS-485	DEIF no.	EAN no.
	1	2	3	4			
MTR-4P105	RO					1200510030	5703727116287
MTR-4P205	RO	RO				1200510031	5703727116294
MTR-4P415	RO	RO	RO	RO	X	1200510032	5703727116300

Disclaimer

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Due to our continuous development we reserve the right to supply equipment which may vary from the described.



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