Combined overvoltage and undervoltage relay

REU 513

1MRS 751122-MBG

Issued: 15.06.1999
Status: 15.06.1999
Version: B/09.11.2001
Data subject to change without notice

Features

- Overvoltage and undervoltage protection
- Single- or three-phase operation
- High-set overvoltage stage with definite-time or inverse definite minimum time (IDMT) characteristic
- Low-set overvoltage stage with definite-time or IDMT characteristic
- High-set undervoltage stage with definite-time or IDMT characteristic
- Low-set undervoltage stage with definite-time or IDMT characteristic
- Positive-phase-sequence protection
- Settable drop-off/pick-up ratio for low-set overvoltage and low-set undervoltage stages
- Circuit-breaker failure protection unit (CBFP)
- Disturbance recorder
- All settings are modified with a personal computer
- Settings are stored into non-volatile memory and remain even in case of power supply failure
- Two normally open power output contacts
- Two change-over type signal output contacts
- Output contact functions freely configurable for desired operation
- Three accurate voltage inputs
- Galvanically isolated binary input with a wide input voltage range
- Optical PC-connector for two-way SPA-bus data communication
- Continuous self-supervision of hardware and software. At a permanent fault all stages and outputs are blocked
- Rated frequency user-selectable 50/60 Hz
- Nominal voltage user-selectable 100/110/115/120 V

Application

The overvoltage and undervoltage relay REU 523 is a secondary relay that is connected to the voltage transformers of an object to be protected. It is designed for overvoltage and undervoltage protection and supervision in distribution substations. Other application areas are overvoltage and undervoltage protection of generators, motors and transformers.

The three-phase overvoltage and undervoltage stages continuously measure the phase-to-phase voltages of the system. On detection of a fault the relay starts, trips the circuit breaker, provides alarms, records fault data etc., in accordance with the application and the configured relay functions.

Both the overvoltage and the undervoltage units include two protection stages: low-set stages U> and U<, and high-set stages U>> and U<<. Each protection stage can be given a definite-time or an inverse definite minimum time (IDMT) characteristic.

The start and operation of the high-set and low-set undervoltage stages can be blocked when the measured voltages are under 0.2 x U_n. Further, the operation of all protection stages can be blocked separately by means of an external binary input signal.

The high-set undervoltage stage can be set to operate either based on conventional undervoltage measurement or on the calculated positive-phase-sequence voltage U1s. Selecting the positive-phase-sequence operation automatically deselects the conventional high-set undervoltage stage operation, and vice versa.

The operation of the stage U< can be blocked by the start of the stage U<<. The high-set stages of the overvoltage and undervoltage units can be deselected from operation separately.

The protection functions are independent of each other unless configured to be dependent, and they have their own setting groups as well as data recording. The over- and undervoltage functions use conventional voltage transformer measurement.

Output contact matrix allows any start or trip signal from the protection stages to be routed to the desired output contact.

Design

The relay consists of three protection units: a high-set and a low-set overvoltage unit, a high-set and a low-set undervoltage unit and a circuit-breaker failure protection unit. Further, the relay includes a self-supervision system and a disturbance recorder unit.

Overvoltage unit

When one or several of the measured voltages exceed the set start value of the low-set stage U> and the preset start time of ~ 60 ms elapses, the overvoltage unit begins delivering a start signal. Further, when the set operate time for the low-set stage at definite-time operation or the calculated operate time at inverse-time operation passes, the overvoltage unit operates.

In the same way as the low-set stage, the high-set stage U>> of the overvoltage unit begins delivering a start signal after a preset ~ 50 ms start time when the set start value is exceeded. When the set operate time for the high-set stage at definite-time operation or the calculated operate time at inverse-time operation elapses, the overvoltage unit operates.

The low-set and high-set stages of the overvoltage unit may be given a definite-time or an inverse definite minimum time (IDMT) characteristic. When the IDMT characteristic is chosen, two time/current curve groups called A and B are available.

The high-set stage can be deselected from operation by setting a bit in one of the software switchgroups. The deselection of the protection stage is indicated by “999” in communication via the SPA bus.

Undervoltage unit

When one or several of the measured voltages fall below the set start value of the low-set stage U< and the preset start time of ~ 80 ms elapses, the undervoltage unit begins delivering a start signal. Further, when the set operate time for the low-set stage at definite-time operation or the calculated operate time at inverse-time operation passes, the undervoltage unit operates.

When the conventional operation mode is selected for the high-set undervoltage stage and one or all of the measured voltages, depending on the set operation criteria, fall below the set start value of the high-set stage U<<, the undervoltage unit begins delivering a start signal after a preset ~ 50 ms start time.

When the positive-phase-sequence protection mode is selected for the high-set undervoltage stage and the calculated positive-phase-sequence voltage U1s falls below the set start value of the high-set stage U<<, the undervoltage unit begins delivering a start signal after a preset ~ 50 ms start time. When the set operate time at definite-time operation or the calculated operate time at inverse-time operation for the high-set stage elapses, the undervoltage unit operates.

The low-set and high-set stages of the undervoltage unit may be given a definite-time or an inverse definite minimum time (IDMT) characteristic. When the IDMT characteristic is chosen, one time/current curve group called C is available.

Starting and operation of the low-set and high-set undervoltage stages can be internally blocked when the measured value falls below 0.2 x U_n. This function is selected in one of the software switchgroups.

The high-set stage can be deselected from operation by setting a bit in one of the software switchgroups. The deselection of the protection stage is indicated by “999” in communication via the SPA bus.

The operation of stage U< can be blocked by the start of the stage U<<. The selection is made with a switch in one of the software switchgroups.

CBFP unit

The relay incorporates a circuit-breaker failure protection (CBFP) unit. The CBFP unit generates a trip signal via output PO2 after the set operate time of 0.1…1 s, provided the fault has not been cleared by that time. The CBFP unit can be used for tripping via redundant trip circuits of the same circuit breaker, if the circuit breaker is provided with two trip coils. The circuit-breaker failure protection unit is activated via a software switch.

Disturbance recorder unit

The relay includes an internal disturbance recorder, which records momentary measured values, external BI signal and states of the internal protection stages. The disturbance recorder can be set to be triggered on operation of stages or on an external BI signal, either on the falling or rising trigger edge.

Self-supervision unit

The relay is provided with an extensive self-supervision system. The self-supervision system handles run-time fault situations and informs the user about an existing fault via a LED on the front panel.

When the self-supervision system detects a permanent internal relay fault, the ready indication LED starts blinking. At the same time, the normally operated self-supervision alarm relay drops off and a fault code can be read via the serial communication. This fault code identifies the fault.

Communication capabilities

Relay data, such as events, input data, setting values and recorded information can be read via the optical PC interface. The relay communicates over the SPA bus protocol, data transfer rate 4.8 or 9.6 kbps. For the connection of a PC, an optical connection cable type 1MKC950001-1 is needed.

Auxiliary supply

For its operation the relay requires a secured auxiliary voltage supply. The internal power supply of the relay forms the voltages required by the relay electronics. The power supply is galvanically isolated. A green LED indicator “READY” on the front panel is lit when the power supply module is operating.

Rated voltage ranges:

- AC range 80…265 V ac, rated 110/120/220/240 V
- DC range 38…265V dc, rated 48/60/110/125/220 V

The primary side of the power supply is protected with a fuse located on the printed circuit board of the relay. The fuse size is 2.5 A (slow).

Technical data

Table 1: Energizing inputs

Rated voltage U_n		100/110/115/120 V
Maximum input voltage	continuously	2 x U_n
	for 10 s	3 x U_n
Power consuption		<0.5 VA
Rated frequency f_n		50 Hz or 60 Hz ±5 Hz

Table 2: Measuring range

Voltages measured on phases U_{12}, U_{23} and U_{31} as multiples of the rated voltages of the energizing inputs	0…2 x U_n
Measuring accuracy (f_n ±5 Hz) at 0.20...2.00 x U_n	±1.5%

Table 3: Output contact ratings for power outputs (PO1 and PO2)

Terminals	X2.1/3-4, X2.1/5-6
Rated voltage	250 V dc/ac
Continuous carry	5 A
Make and carry for 0.5 s	30 A
Make and carry for 3.0 s	15 A
Breaking capacity for dc, when the trip circuit time constant L/R ≤ 40 ms, at 48/110/220 V dc	5 A / 3 A / 1 A
Contact material	$AgCdO_2$

Table 4: Output contact ratings for signal outputs and self-supervision output (SO1, SO2 and IRF)

Terminals	X2.1/7-8-9, X2.1/10-11-12, X2.1/13-14-15
Rated voltage	250 V dc/ac
Continuous carry	5 A
Make and carry for 0.5 s	10 A
Make and carry for 3.0 s	8 A
Breaking capacity for dc, when the trip circuit time constant L/R ≤ 40 ms, at 48/110/220 V dc	1 A / 0.25 A / 0.15 A
Contact material	$AgCdO_2$

Table 5: External binary input

External control rated voltage level	U_n = 24/48/60/110/220 V dc
Operative range	18…265 V dc
Typical control current of input circuit	2…25 mA

Table 6: Auxiliary voltage

Rated voltage	U_n = 110/120/220/240 V ac U_n = 48/60/110/125/220 V dc
Operative range	80…265 V ac 38…265 V dc
Power consumption	4…10 W

Table 7: Data transmission

Transmission mode	Optical PC interface
Protocol	SPA bus
Selectable data transfer rates	4.8 or 9.6 kbps
Optical connection cable	1MKC 950001-1

Table 8: Dielectric tests

Insulation test according to IEC 60255-5	2 kV, 50 Hz, 1 min
Impulse test according to IEC 60255-5	5 kV, 1.2/50 µs, 0.5 J
Insulation resistance test according to IEC 60255-5	> 100 MΩ, 500 V dc

Table 9: Electromagnetic compatibility tests

The EMC immunity test level fulfills the requirements specified in the generic standard EN 50082-2		
1 MHz burst disturbance test, class III (IEC 60255-22-1)	common mode	2.5 kV
	differential mode	1.0 kV
Electrostatic discharge test, class III (IEC 61000-4-2)	for contact discharge	6 kV
	for air discharge	8 kV
Radio frequency interference test	conducted, common mode (IEC 61000-4-6)	10 V (rms), f = 150 kHz…80 MHz
	radiated, amplitude-modulated (IEC 61000-4-3)	10 V/m (rms), f = 80…1000 MHz
	radiated, pulse-modulated (ENV 50204)	10 V/m, f = 900 MHz
	radiated, test with a portable transmitter (IEC 60255-22-3, method C)	f = 77.2 MHz, P = 6 W; f = 172.25 MHz, P = 5 W
Fast transient disturbance test (IEC 60255-22-4 and IEC 61000-4-4)	ac/dc ports	4 kV
	binary inputs	2 kV
Surge immunity test (IEC 61000-4-5)	power supply, ac/dc ports	4 kV, common mode 2 kV, differential mode
	I/O ports	2 kV, common mode 1 kV, differential mode
Electromagnetic immunity tests (IEC 61000-4-8)	power frequency magnetic field	100 A/m
Voltage dips and short interruptions	IEC 61000-4-11	30% / 10 ms 60% / 100 ms >95% / 5 000 ms
Electromagnetic emission tests (EN 55011 and EN 50081-2)	conducted, RF emission (mains terminal)	EN 55011, class A
	radiated, RF emission	EN 55011, class A
CE approval	complies with the EMC directive 89/336/EEC and the LV directive 73/23/EEC	

Table 10: Mechanical tests

Vibration test, sinusoidal (IEC 60255-21-1)	class I
Shock and bump test (IEC 60255-21-2)	class I

Table 11: Environmental conditions

Climatic environmental tests	dry cold test	according to IEC 60068-2-1
	dry heat test	according to IEC 60068-2-2
	damp heat test, cyclic	according to IEC 60068-2-30
Enclosure class	front side	IP54 (flush-mounted)
	rear side, connection terminals	IP 20
Weight of the relay		~3.1 kg

Block diagram

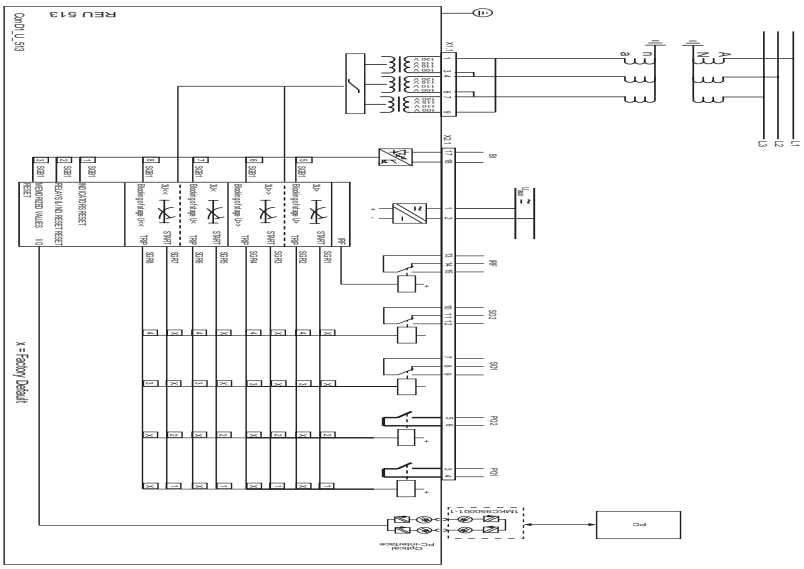
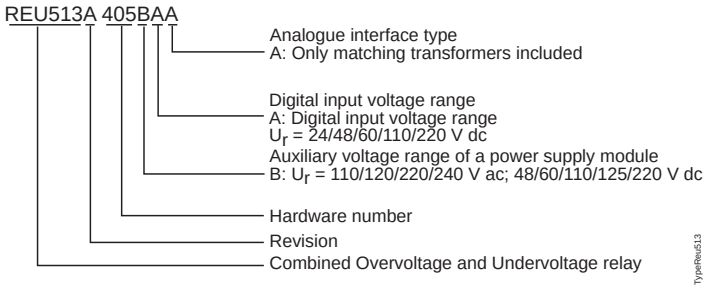


Fig. 1 Block diagram of the combined overvoltage and undervoltage relay

Ordering

The order number identifies the hardware as described below.

This number is labelled on the marking strip on the front panel.



When ordering, please specify:

Ordering information:	Ordering example:
1. Type designation and quantity	REU 513, 5 pieces
2. Order number	REU513A 405-BAA
3. Optical connection cable	1 piece (1MKC 950001-1)

Order numbers

Optical connection cable	1MKC 950001-1
Protective cover for rear connectors	1MRS060132
Flush mounting kit	1MRS050209
Semi-flush mounting kit	1MRS050253
Wall mounting kit	1MRS050240
Side-by-side mounting kit	1MRS050241
19” Rack mounting kit	1MRS050257

References

Additional information

User’s Guide	1MRS 750886-MUM

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