Three-phase monitoring relays
CM range

Three-phase monitoring
NEW GENERATION
2008.10.01

2CDC 255 057 F0008

The new generation of three-phase mains

Today, three-phase mains are generally used because they allow the most economic transport of high currents as well as simply designed, robust and efficiently working electric motors.
For the monitoring of three-phase mains, ABB's three-phase monitoring relays of the CM range comprise a comprehensive program of capable and economic devices. All devices feature a width of 22.5 or 45 mm. The range includes multifunctional three-phase monitoring relays as well as single-function devices for the monitoring of individual parameters.

Features of three-phase monitoring relays[1)]

- Multifunctional and single-functional devices
- Wide range operating voltage enables world-wide operation
- Monitoring functions [1)]:
  - Phase failure
  - Phase sequence
  - Automatic phase sequence correction
  - Overvoltage
  - Undervoltage
  - Phase unbalance
  - Neutral
- Fixed or adjustable thresholds for over- and undervoltage
- Adjustable threshold for phase unbalance
- Powered by the measuring circuit
- Monitoring of mains with and without neutral conductor
- Devices with 1 n/o contact, 1 or 2 c/o (SPDT) contacts
- LED(s) for status indication
- Energy saving of more than 80 % through innovative switch mode power supply technology

[1)] dependig on device

Approvals / Marks
(depending on devices)

UL 508, CAN/CSA C22.2 No.14; Germanischer Lloyd; GOST; CB scheme; CCC; RMRS / CE; C-Tick

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Highlights of the new generation [1)]

- All new devices are working with a modern TRMS-measuring principle (True root means square)
- Interpretation of any wave forms
- Devices for mains voltages of up to 690 V
- Signals can be measured within a frequency range of 45-65 Hz as well as within a range of 45-440 Hz [1)]
- Interrupted neutral monitoring [1)]
- Monitoring of single- and three-phase mains with the same device [1)]
- Applicable in grounded and ungrounded mains
- Operating principle of the output contacts configurable as 2x1 or 1x2 c/o (SPDT) contacts [1)]
- Configurable phase sequence monitoring
- Configurable automatic phase sequence correction [1)]
- Adjustable ON- or OFF-delayed tripping delay
- Time delay can be adjusted via a logarithmic scale [1)]
- Front-face rotary or DIP switch for function selection

[1)] depending on device

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Front-face adjustment

All setting and operating elements are on the front. This enables quick and easy adjustment

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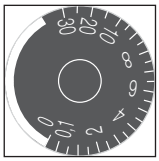
Direct reading scales

Direct setting of the threshold values and time delay without any additional calculation provides accurate time delay adjustment.



Logarithmic time scale

The new potentiometer allows a very exact time adjustment in the lower time range. By turning to the left stop the time delay can be switched off

2CDC 253 010 F0003

Double-chamber cage connecting terminals

Double-chamber cage connecting terminals provide connection of wires up to 2 x 2.5 mm² (2 x 14 AWG), rigid or fine-strand, with or without wire end ferrules. Potential distribution does not require additional terminals.

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Sealable transparent cover

The products can be protected against unauthorized change of time and threshold values (available as an accessory).

Monitoring the parameters of a three-phase network

Only reliable and continuous monitoring of a three-phase network guarantees the trouble-free and economic operation of machines and installations. Thus, the three-phase monitoring relays of the CM range, according to the individual requirements, monitor the phase voltages, phase sequence, phase unbalance, phase failure and the neutral:

- **Monitoring for over- and undervoltage**
  All electric devices can be damaged when operated continuously at voltages over or under their rated values. An overvoltage could potentially cause heating within the device. If the temperature is unduly high, component parts and thus whole devices or installations may fail or may be destroyed. Undervoltages involve the risk that the switching elements reach an undefined region. In this case, parts of the installation still function, but not others. This misoperation can result in damage of the product or installation. In the worst case, wrong voltages may even cause harm to the operating personnel.

- **Phase unbalance monitoring**
  If the supply by the three-phase system is unbalanced due to uneven distribution of the load, the motor will convert a part of the energy into reactive power. This energy gets lost unexploited; also the motor is exposed to higher thermal strain. Other thermal protection devices fail to detect continuing unbalances which can lead to damage or destruction of the motor. The CM range three-phase monitoring relays with phase unbalance monitoring can reliably detect this critical situation.

- **Phase failure detection**
  In case of a phase loss, undefined states of the installation are likely to occur. E.g. the startup process of motors is disturbed. All three-phase monitoring relays of the ABB CM range detect a phase loss as soon as the voltage of one phase drops below 60 % of its nominal value.

- **Phase sequence monitoring**
  An incorrect phase sequence applied at start-up or a change of the phase sequence during operation will cause a 3-phase motor to run with reverse rotation. Certain motors when operated in the reverse direction will cause severe damage to connected loads such as pumps, screw compressors and fans. Especially for non-fixed or portable equipment, such as construction machinery, phase sequence detection prior to the start-up process is highly recommended. ABB offers three-phase monitors with selectable phase sequence monitoring. This provides the capability of ignoring phase sequence conditions for applications, such as motors with forward and reverse rotation, where the phase sequence is unimportant.

- **Interrupted neutral**
  Under normal conditions, individual phase voltages are equal and the load causes the individual phase currents to vary. Systems that have neutral conductors accommodate this variation by a compensating current flow through the neutral conductor. If the neutral conductor breaks, the compensating current can no longer flow. As a result, the voltage is divided asymmetrically on the individual phases. This means that over- and undervoltages are produced in the individual phases and these can damage or even destroy the connected consumers. ABB offers three-phase monitoring relays that monitor the neutral conductor for interrupted neutral. The interruption of the neutral is detected by means of phase unbalance monitoring.

Adjustment possibilities on the front of the unit in the example of CM-MPS.43

- Adjustment of the threshold for overvoltage
- Adjustment of the threshold for undervoltage
- Adjustment of the threshold for phase unbalance
- Status LEDs

Function	R/T: yellow LED	F1: red LED	F2: red LED
Control supply voltage applied, output relay energized	⎍	-	-
Tripping delay t_V active	⎍⎍	-	-
Phase failure	-	⎍	⎍⎍
Phase sequence	-	⎍⎍ alternating	
Overvoltage	-	⎍	-
Undervoltage	-	-	⎍
Phase unbalance	-	⎍	⎍
Interruption of the neutral	-	⎍	⎍⎍
Adjustment error [1]	⎍⎍	⎍⎍	⎍⎍

[1] Misadjustments of the front-face operating controls

- Adjustment of the tripping delay t_V
- DIP switches for function selection:
  - (1) Timing function
    - ON = ⊠ ON-delay
    - OFF= ■ OFF-delay
  - (2) Phase sequence monitoring
    - ON = deactivated
    - OFF= activated

    NEW
  - (3) Operating principle of the output contacts
    - ON = 2x1 c/o (SPDT) contact [1]
    - OFF= 1x2 c/o (SPDT) contacts

    NEW
  - (4) Automatic phase sequence correction
    - ON = activated
    - OFF= deactivated

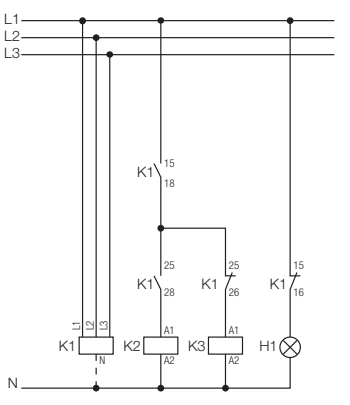
    NEW

[1] for separate signalling of over- and undervoltage

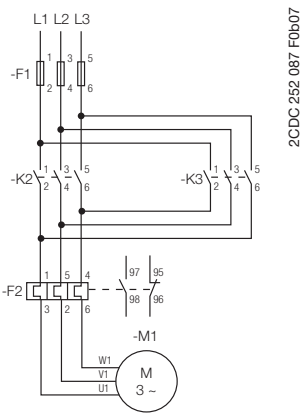
Automatic phase sequence correction

The new generation of ABB three-phase monitoring relays offers devices with automatic phase sequence correction. If phase sequence monitoring and phase sequence correction are activated, and in conjunction with a reversing contactor combination, it is ensured that for any non-fixed or portable equipment, e.g. construction machinery, the correct phase sequence is applied to the input terminals of the load.

NEW



Control circuit diagram (K1 = CM-MPS.x3 or CM-MPN.x2)



Power circuit diagram

Selection guide and order references

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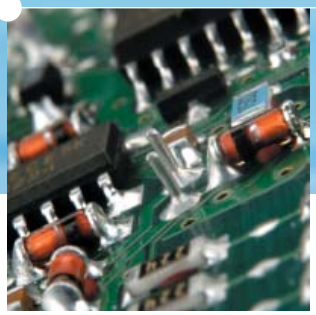
2CDC 253 100 F0004

CM-E - Economy

CM-S

	CM-PBE	CM-PBE	CM-PVE	CM-PVE	CM-PFE	CM-PFS	CM-PSS.31
							
Order code	1SVR 550 881 R9400	1SVR 550 882 R9500	1SVR 550 870 R9400	1SVR 550 871 R9500	1SVR 550 824 R9100	1SVR 430 824 R9300	1SVR 630 784 R
Input/measuring circuit							
Rated control supply voltage = Measuring voltage	3x220-240 V AC	3x380-440 V AC	3x185-265 V AC	3x320-460 V AC	3x208-440 V AC	3x200-500 V AC	3x380 V AC
Nominal voltages of the mains to be monitored	(L1/L2/L3-N) 220, 230, 240 V mains	(L1-L2-L3) 380, 400, 415 V mains	(L1/L2/L3-N) 220, 230, 240 V mains	(L1-L2-L3) 380, 400, 415 V mains	(L1-L2-L3) 230, 240, 257, 260, 380, 400, 415 V mains	(L1-L2-L3) 200, 208, 220, 230, 240, 257, 260, 380, 400, 415 V mains	(L1-L2-L3) 200, 208, 22 230, 240, 25 260 V mains
Rated frequency	50/60 Hz	50/60 Hz	50/60 Hz	50/60 Hz	50/60 Hz	50/60 Hz	50/60 Hz
Monitoring of three-phase mains	■	■	■	■	■	■	■
Monitoring of single-phase mains	■		■				
Monitoring functions, devices settings							
Phase failures	■	■	■	■	■	■	■
Phase sequence	-	-	-	-	■	■	can be switched
Automatic phase sequence correction	-	-	-	-	-	-	-
Undervoltage	-	-	185 / 320 V AC	320 V AC	-	-	3x342 V AC
Overvoltage	-	-	265 / 460 V AC	460 V AC	-	-	3x418 V AC
Phase unbalance	-	-	-		-	-	-
Neutral	■	-	■	-	-	-	-
Interruption of the neutral	-	-	-	-	-	-	-
Type of delay time	-	-	-	-	-	-	⌧ / ■
Start-up delay t_s	500 ms	500 ms	500 ms	500 ms	500 ms	500 ms	200 ms
Tripping delay t_v	150 ms	150 ms	500 ms	500 ms	500 ms	-	0; 0.1-30 s
Further data							
Output contacts	1 n/o contact	1 n/o contact	1 n/o contact	1 n/o contact	1 c/o (SPDT) contact	2 c/o (SPDT) contacts	2 c/o (SPDT) con
Indication of operational states	1 LED	1 LED	1 LED	1 LED	1 LED	1 LED	3 LEDs

⌧ ON-delay, ■ OFF-delay


2CDC 253 260 F0005

2CDC 253 089 F0004

Three-phase monitoring
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2008.10.01

- Single-functional

CM-S - Multifunctional

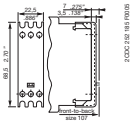
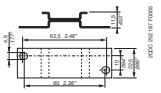
	CM-PSS.41	CM-PVS.31	CM-PVS.41	CM-PAS.31	CM-PAS.41	CM-MPS.11	CM-MPS.21	CM-MPS.31	CM-MPS.41
									
R2300	1SVR 630 784 R3300	1SVR 630 794 R1300	1SVR 630 794 R3300	1SVR 630 774 R1300	1SVR 630 774 R3300	1SVR 630 885 R1300	1SVR 630 885 R3300	1SVR 630 884 R1300	1SVR 630 884 R330
	3x400 V AC	3x160-300 V AC	3x300-500 V AC	3x160-300 V AC	3x300-500 V AC	3x90-170 V AC	3x180-280 V AC	3x160-300 V AC	3x300-500 V AC
0, 7, s	(L1-L2-L3) 380, 400, 415 V mains	(L1-L2-L3) 200, 208, 220, 230, 240, 257, 260 V mains	(L1-L2-L3) 380, 400, 415 V mains	(L1-L2-L3) 200, 208, 220, 230, 240, 257, 260 V mains	(L1-L2-L3) 380, 400, 415 V mains	(L1/L2/L3-N) 110, 115, 120, 127 V mains	(L1/L2/L3-N) 220, 230, 240 V mains	(L1-L2-L3) 200, 208, 220, 230, 240, 257, 260 V mains	(L1-L2-L3) 380, 400, 415 V mains
	50/60 Hz	50/60 Hz	50/60 Hz	50/60 Hz	50/60 Hz	50/60 Hz	50/60 Hz	50/60 Hz	50/60 Hz
	■	■	■	■	■	■	■	■	■
						■	■		
	■	■	■	■	■	■	■	■	■
d off	can be switched off	can be switched off	can be switched off	■	■	can be switched off	can be switched off	can be switched off	can be switched of
	-	-	-	-	-	-	-	-	-
	3x360 V AC	3x160-230 V AC	3x300-380 V AC	-	-	3x90-130 V AC	3x180-220 V AC	3x160-230 V AC	3x300-380 V AC
	3x440 V AC	3x220-300 V AC	3x420-500 V AC	-	-	3x120-170 V AC	3x240-280 V AC	3x220-300 V AC	3x420-500 V AC
	-	-	-	2-25 %	2-25 %	2-25 %	2-25 %	2-25 %	2-25 %
	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	■	■	-	-
	⊠ / ▬	⊠ / ▬	⊠ / ▬	⊠	⊠	⊠ / ▬	⊠ / ▬	⊠ / ▬	⊠ / ▬
	200 ms	200 ms	200 ms	200 ms	200 ms	200 ms	200 ms	200 ms	200 ms
	0; 0.1-30 s	0; 0.1-30 s	0; 0.1-30 s	0; 0.1-30 s	0; 0.1-30 s	0; 0.1-30 s	0; 0.1-30 s	0; 0.1-30 s	0; 0.1-30 s
tacts	2 c/o (SPDT) contacts	2 c/o (SPDT) contacts	2 c/o (SPDT) contacts	2 c/o (SPDT) contacts	2 c/o (SPDT) contacts	2 c/o (SPDT) contacts	2 c/o (SPDT) contacts	2 c/o (SPDT) contacts	2 c/o (SPDT) contact
	3 LEDs	3 LEDs	3 LEDs	3 LEDs	3 LEDs	3 LEDs	3 LEDs	3 LEDs	3 LEDs

CM-N - Multifunctional

CM-MPS.23	CM-MPS.43	CM-MPN.52	CM-MPN.62	CM-MPN.72
				
1SVR 630 885 R4300	1SVR 630 884 R4300	1SVR 650 487 R8300	1SVR 650 488 R8300	1SVR 650 489 R8300
3x180-280 V AC	3x300-500 V AC	3x350-580 V AC	3x450-720 V AC	3x530-820 V AC
(L1/L2/L3-N) 220, 230, 240 V mains	(L1-L2-L3) 380, 400, 415 V mains	(L1-L2-L3) 440, 460, 480, 500 V mains	(L1-L2-L3) 575, 600 V mains	(L1-L2-L3) 660, 690 V mains
50/60/400 Hz	50/60/400 Hz	50/60 Hz	50/60 Hz	50/60 Hz
■	■	■	■	■
■				
■	■	■	■	■
can be switched off	can be switched off	can be switched off	can be switched off	can be switched off
configurable	configurable	configurable	configurable	configurable
3x180-220 V AC	3x300-380 V AC	3x350-460 V AC	3x450-570 V AC	3x530-660 V AC
3x240-280 V AC	3x420-500 V AC	3x480-580 V AC	3x600-720 V AC	3x690-820 V AC
2-25 %	2-25 %	2-25 %	2-25 %	2-25 %
-	-	-	-	-
■	-	-	-	-
⊠ / ■	⊠ / ■	⊠ / ■	⊠ / ■	⊠ / ■
200 / 250 ms	200 / 250 ms	200 / 250 ms	200 / 250 ms	200 / 250 ms
0; 0.1-30 s	0; 0.1-30 s	0; 0.1-30 s	0; 0.1-30 s	0; 0.1-30 s
2 c/o (SPDT) contacts [1]	2 c/o (SPDT) contacts [1]	2 c/o (SPDT) contacts [1]	2 c/o (SPDT) contacts [1]	2 c/o (SPDT) contacts [1]
3 LEDs	3 LEDs	3 LEDs	3 LEDs	3 LEDs

[1] Operating mode 1x2 or 2x1 c/o (SPDT) contact can be selected. 2x1 c/o (SPDT) contact for separate signalling of over- and undervoltage.

Accessories for CM-S devices

COV.01	ADP.01
	
1SVR 430 005 R0100	1SVR 430 029 R0100
Description	
Sealable transparent cover	Adapter for screw mounting

MAR.01	MAR.02
	
1SVR 366 017 R0100	1SVR 430 043 R0000
Description	
Marker label for devices without DIP switches	Marker label for devices with DIP switches

Kr-Saege

2CDC 606 039 F0004

Phase failure detection

Indication of a phase loss on a running three-phase motor (with reverse feeding) by the phase unbalance monitoring of the three-phase monitor CM-MPS.xx:

Nominal condition

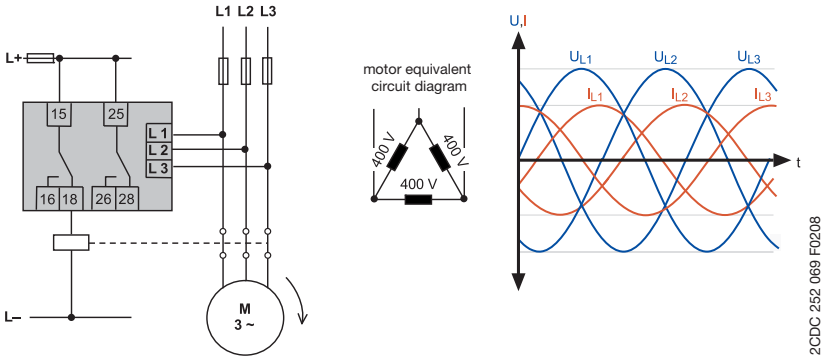
The motor is only turned-on, when the CM-MPS.xx detects the correct phase sequence L1-L2-L3 and when all voltages are within the preset voltage range U_{min}/U_{max}: I.e. no over-/undervoltage, no phase failure, and no phase unbalance is indicated.

Fault

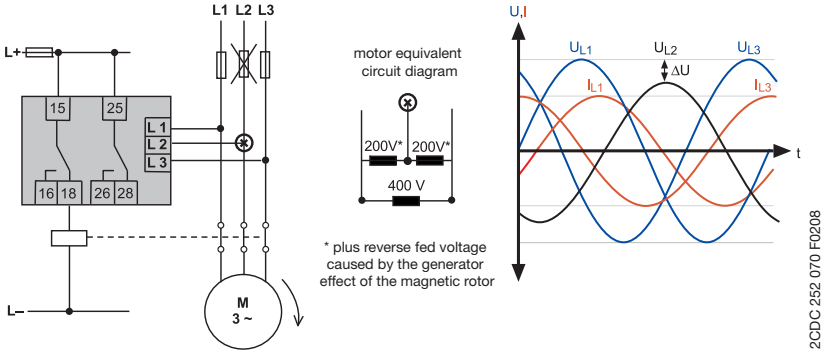
Phase loss (in this example phase L2) caused by a blown fuse and voltage loss caused by generator effect of the motor.

- Voltage at the point ⊗ can reach up to 95% of the original voltage, depending on the motor type used, the motor load and other parameters.
- The phase loss on a running motor can only be reliably detected by phase unbalance monitoring (e.g. with the CM-MPS.xx).

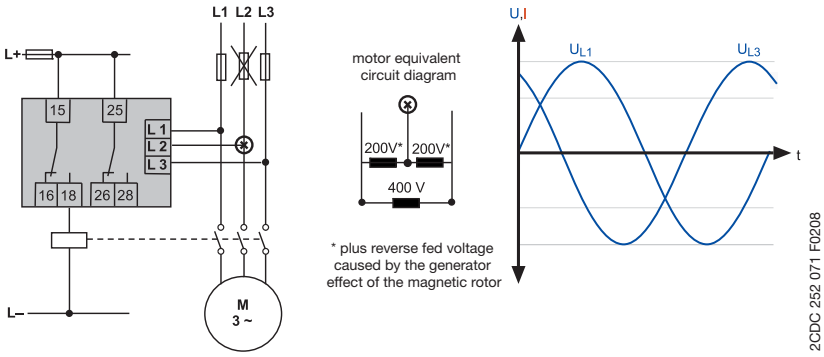
In operation, the CM-MPS.xx switches off the running motor, when the difference between one phase and the nominal voltage exceeds the preselected value ΔU. Thus, any damage of the motor and the installation will be safely avoided.



Nominal condition: Three-phase motor with monitoring relay CM-MPS.xx in full operation



Fault: Three-phase motor with line regeneration and a monitoring relay CM-MPS.xx prior to tripping due to a phase failure



Switch-off in case of failure: Three-phase motor with phase loss in L2 after monitoring relay CM-MPS.xx has tripped

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