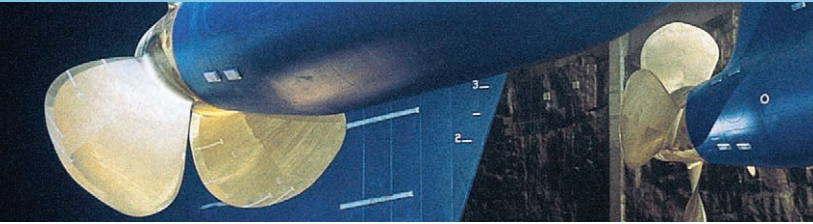


Measuring and monitoring relays for three-phase mains CM range



2CDC 255 085 F0004

Advantages and applications of three-phase mains



Three-phase mains are the ideal way to generate, transport and use electric energy. Today, three-phase AC is generally used because it allows 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 monitors of the CM range comprise a comprehensive program of capable and economic devices. All CM range monitors feature a 22.5 mm width. The range includes the multifunctional three-phase monitor CM-MPS and several single-function devices for the monitoring of individual parameters.

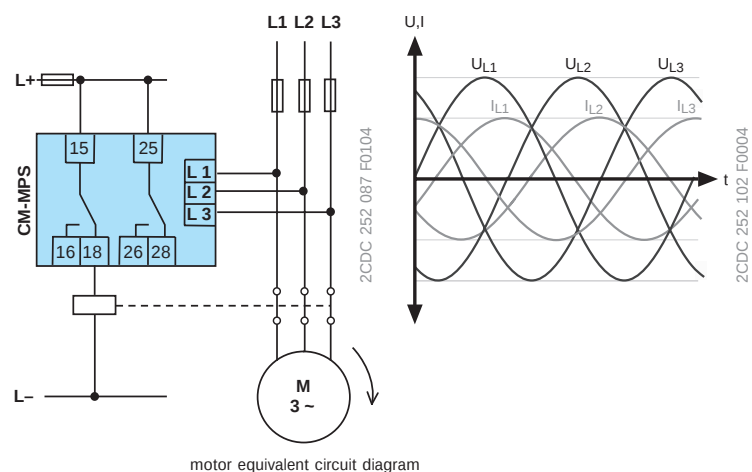
Example of application: CM-MPS

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:

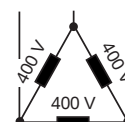
Nominal condition

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

Nominal condition



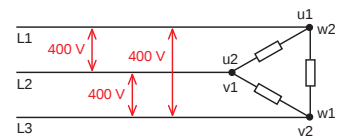
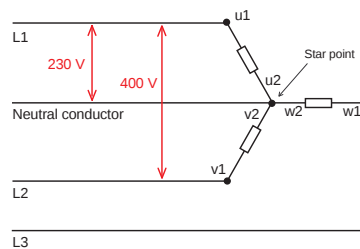
motor equivalent circuit diagram





Star connection

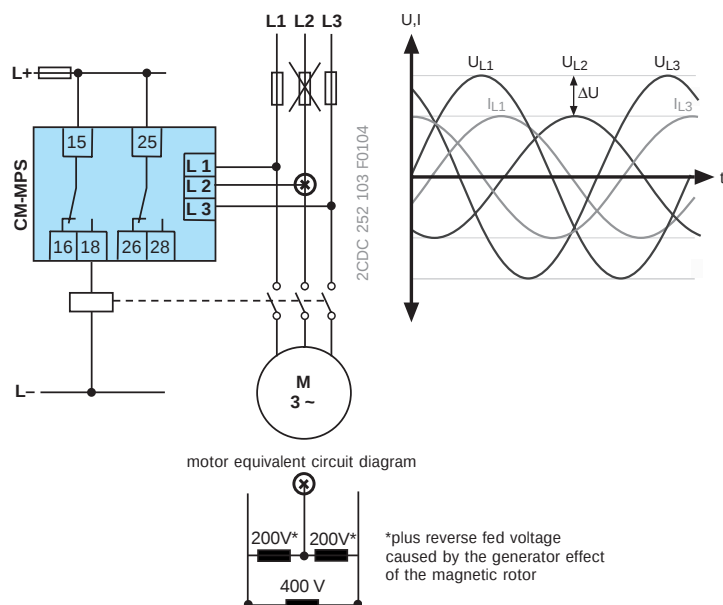
In star connection, the three phases of a three-phase network are interconnected at the star point, which is also connected to the neutral conductor. Star connection allows the collection of two different voltages: In central Europe, the voltage between one of the three phases and the neutral conductor is 230 V. Between two phases this value is multiplied by a factor of 1.73, e.g. resulting in a voltage of 400 V.



Delta connection

In delta connection, the three phases are connected in series. Between any two of the points u_1 , v_1 and w_1 , the voltage is 400 V. The neutral conductor is omitted. Delta connection is used in various industrial applications, e.g. in mining facilities.

Fault



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 $\otimes$ 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).

In operation, the CM-MPS 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.

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 monitors of the CM range, according to the individual requirements, monitor the phase voltages, phase sequence, phase unbalance and phase loss:

■ Voltage monitoring

All electric devices can be damaged when operated continuously in a network with out-of-range voltages. For example, safe starting is not ensured in case of undervoltage. Also, the switching state of a contactor is not clearly defined when operated in a “forbidden” voltage range. This can lead to undefined states of the installation and cause damage or destruction of valuable parts.

■ 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 monitors with phase unbalance monitoring can reliably detect this critical situation.

■ Phase sequence

Changing the phase sequence during operation or a wrong phase sequence prior to startup causes a change of the rotational direction of the connected device. Generators, pumps or fans rotate in the wrong direction, and the installation is no longer working properly. Especially for moveable equipment, such as construction machinery, phase sequence detection prior to the startup process is highly reasonable.

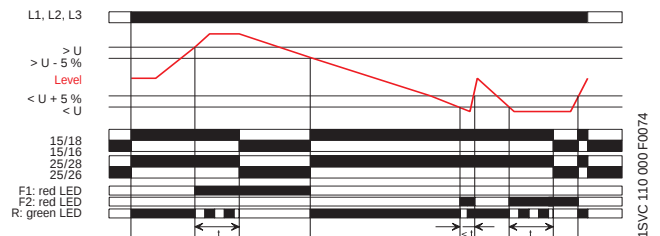
■ Phase loss

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 monitors of the ABB CM range detect a phase loss as soon as the voltage of one phase drops below 60% of its nominal value.

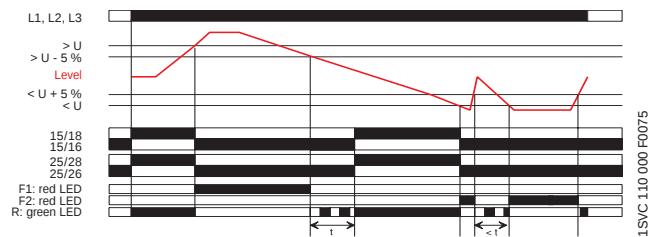


Function diagrams of three-phase monitoring

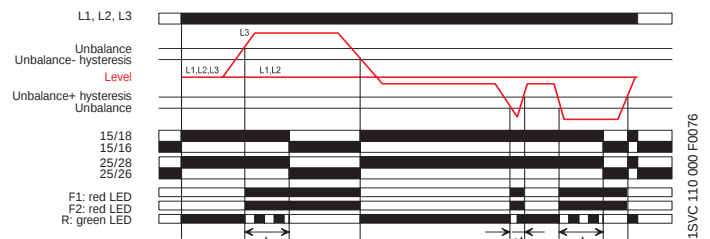
ON-delayed over- and undervoltage monitoring CM-MPS, CM-PVS, CM-PSS



OFF-delayed over- and undervoltage monitoring CM-MPS, CM-PVS, CM-PSS

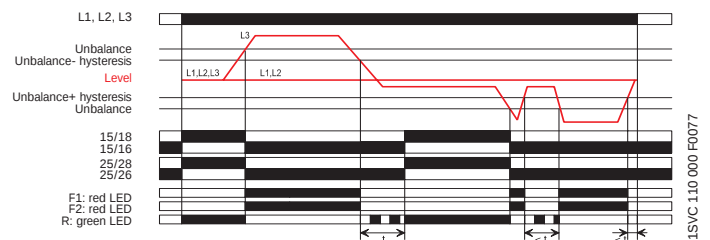


ON-delayed phase unbalance monitoring CM-MPS, CM-PAS

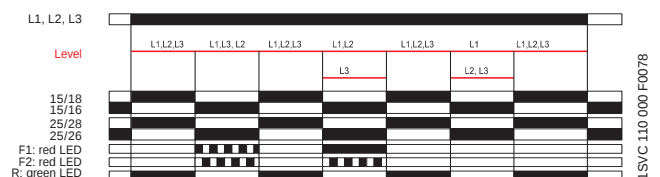


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OFF-delayed phase unbalance monitoring CM-MPS



Phase sequence and phase loss monitoring CM-MPS, CM-PVS, CM-PSS, CM-PAS, CM-PFS



Selection guides and order references for three-phase monitors



2CDC 253 089 F0004



2CDC 253 090 F0004



2CDC 255 088 F0004

Threshold value V_{min}/V_{max}

F2: red LED – failure:

- overvoltage: F1
- undervoltage: F2
- phase unbalance: F1 and F2 constant
- phase loss: F1 on, F2 flashing
- phase sequence: F1 and F2 alternately flashing

F1: red LED – failure

R: green LED – supply voltage, relay

Threshold value for phase unbalance 2-15 %

Time setting 0.1-10 s

Phase sequence and phase loss are indicated without time delay.

Sliding switch for setting the time function

 ON-delay

 OFF-delay

CM-MPS is a multifunctional monitoring relay for three-phase mains. It is available with or without neutral monitoring and provides monitoring of all phase parameters: Phase sequence, phase loss, over- and undervoltage and phase unbalance.

Characteristics of the CM range three-phase monitors

- Adjustable phase unbalance threshold value*
- Adjustable ON-delay/OFF-delay time*
- Dual frequency measuring 50/60 Hz
- Powered by the measuring circuit
- 1 n/o contact, 1 or 2 c/o contacts
- LED status indication
- Approvals*: 
- Marks: 
- Multifunctional and single-functional devices
- Phase loss monitoring
- Phase sequence monitoring*
- Over- and undervoltage monitoring (fixed or adjustable)*
- Wide-range operating voltage guarantees world-wide operation

*depending on device type

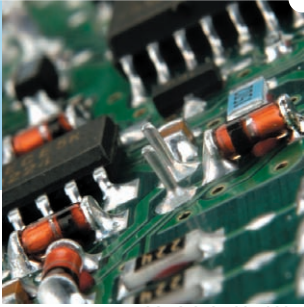
Accessories

Sealable transparent cover

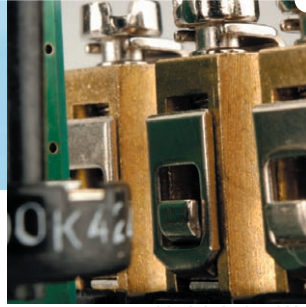
The products can be protected against unauthorized change of time and threshold values (available as an accessory).



2CDC 253 009 F0005



2CDC 252 100 F0004



2CDC 252 101 F0004

Monitoring functions

	Type	Phase sequence	Phase loss	Phase unbalance	Over/undervoltage	Threshold value V_{min}	Threshold value V_{max}	Comments	Output contacts	Measuring voltage = supply voltage	Order code
	CM-MPS	yes	yes	adjustable 2-15 %	adjustable	160-220 V	220-300 V	without neutral conductor monitoring	2 c/o	160-300 V AC, 50/60 Hz	1SVR 430 884 R1300
						300-380 V	420-500 V			300-500 V AC, 50/60 Hz	1SVR 430 884 R3300
						90-120 V*	120-170 V*	with neutral conductor monitoring*		90-170 V AC, 50/60 Hz	1SVR 430 885 R1300
						180-220 V*	240-280 V*			180-280 V AC, 50/60 Hz	1SVR 430 885 R3300
	CM-PVS	yes	yes	–	adjustable	160-220 V	220-300 V		2 c/o	160-300 V AC, 50/60 Hz	1SVR 430 794 R1300
						300-380 V	420-500 V			300-500 V AC, 50/60 Hz	1SVR 430 794 R3300
	CM-PSS	yes	yes	–	fixed	342 V	418 V		2 c/o	380 V AC, 50/60 Hz	1SVR 430 784 R2300
						360 V	440 V			400 V AC, 50/60 Hz	1SVR 430 784 R3300
	CM-PAS	yes	yes	adjustable 2-15 %	–	$0,6 \times V_N$	–	–	2 c/o	160-300 V AC, 50/60 Hz	1SVR 430 774 R1300
										300-500 V AC, 50/60 Hz	1SVR 430 774 R3300
	CM-PFS	yes	yes	–	–	$0,6 \times V_N$	–	–	2 c/o	200-500 V AC, 50/60 Hz	1SVR 430 824 R9300
	CM-PFE	yes	yes	–	–	$0,6 \times V_N$	–	–	1 n/c	208-440 V AC, 50/60 Hz	1SVR 550 824 R9100
	CM-PVE	–	yes	–	fixed	320 V	460 V	without neutral conductor monitoring	1 n/o	320-460 V AC, 50/60 Hz	1SVR 550 871 R9500
						185 V	265 V	with neutral conductor monitoring*		185-265 V AC, 50/60 Hz	1SVR 550 870 R9400
	CM-PBE	–	yes	–	–	$0,6 \times V_N$	–	without neutral conductor monitoring	1 n/o	380-440 V AC, 50/60 Hz	1SVR 550 882 R9500
								with neutral conductor monitoring*		220-240 V AC, 50/60 Hz	1SVR 550 881 R9400

*Measuring and selection of the threshold values between phase and neutral conductor.
Phase loss and phase sequence errors are indicated without delay.



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