

Standstill Monitor MOC3ZA



Motion Control



GB

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1 About the Standstill Monitor MOC3ZA

The Standstill Monitor MOC3ZA permits sensor-less monitoring of electric motors for safe standstill. It detects the standstill of three-phase motors, single-phase motors and DC motors that generate a voltage due to their remanence as they coast down. By adjusting the voltage threshold for the standstill detection and the standstill time, the function can be adapted to a large number of different motors and applications.

1.1 Product Features

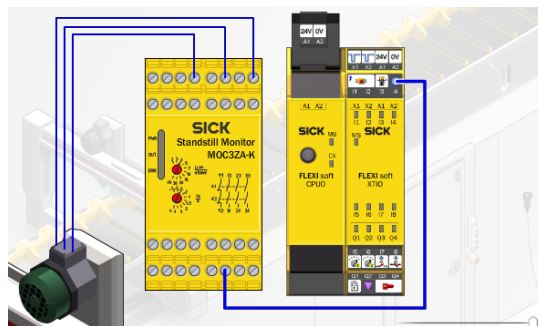
1.1.1 At a glance

- Standstill monitoring by means of residual voltage measurement
- 3 normally open and 1 normally closed positively guided safety contacts
- 2 application diagnostic outputs for semiconductors, 1 normally open contact as application diagnostic output
- PL e (EN ISO 13849-1), SIL3 (IEC61508), SILCL 3 (EN62061)
- Maximum motor supply voltage 690 V
- Adjustable voltage threshold (20 ... 400 mV)
- Adjustable standstill period (0.2 ... 6 s)

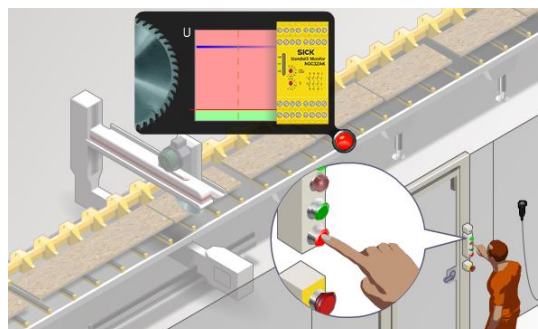
1.1.2 Your benefits

- Quick mounting and installation thanks to the lack of additional wiring requirements
- Simple commissioning with a screwdriver
- Easy to retrofit as the additional mounting of sensors is not necessary

1.2 Application Example: Standstill Monitoring at a Saw Line



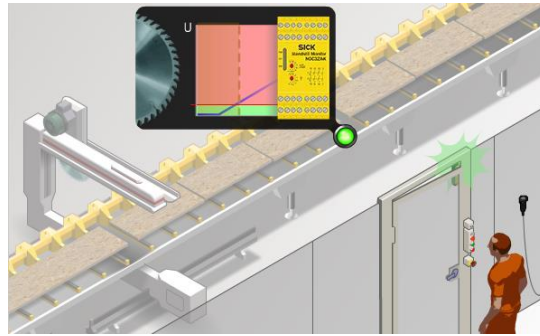
In this application, the Standstill Monitor MOC3ZA gets connected to the motor and the Safety Controller Flexi Soft.



The saw is in regular operating mode. Now the operator switches the saw off.

About the Standstill Monitor MOC3ZA

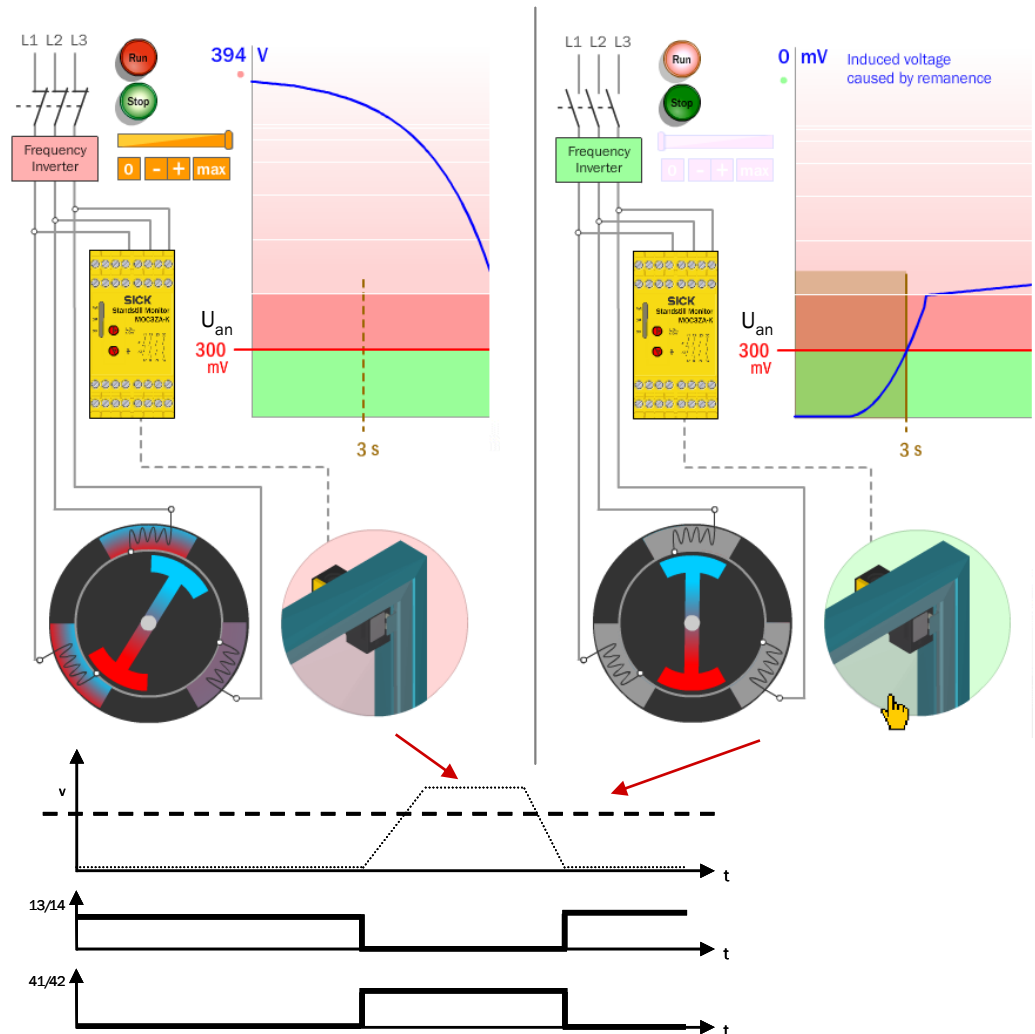
Standstill Monitor MOC3ZA



As soon as standstill is detected and the standstill time has elapsed, the Standstill Monitor MOC3ZA enables the release of the safety gate so the operator can access the hazardous area.

A restart of the saw is prevented by the safety controller that activates the drive's STO function. Therefore the operator is safe.

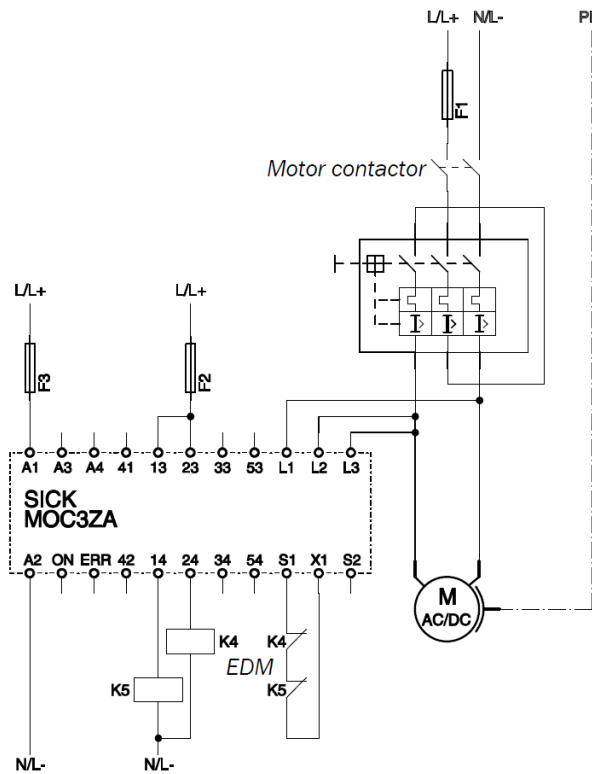
1.3 Functional Principle



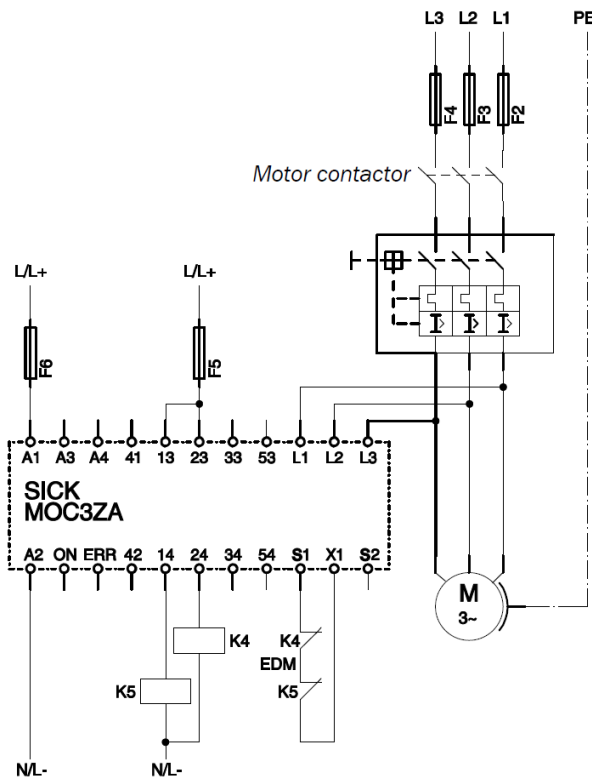
- The voltage is measured at L1/L2/L3
- U_{an} (voltage threshold) and t_s (standstill period) are adjustable
- Standstill is detected if the voltage is below the voltage threshold U_{an}
- The output relay switches on when the voltage drops below U_{an} , the external drive monitoring (EDM) is closed and t_s has elapsed
→ safety contacts 13/14 close, contact on 41/42 opens
- If the value for U_{an} gets exceeded, the output relay is switched off immediately
→ 13/14 opens, 41/42 closes

1.4 Connection Examples

1.4.1 Single-phase AC/DC motor



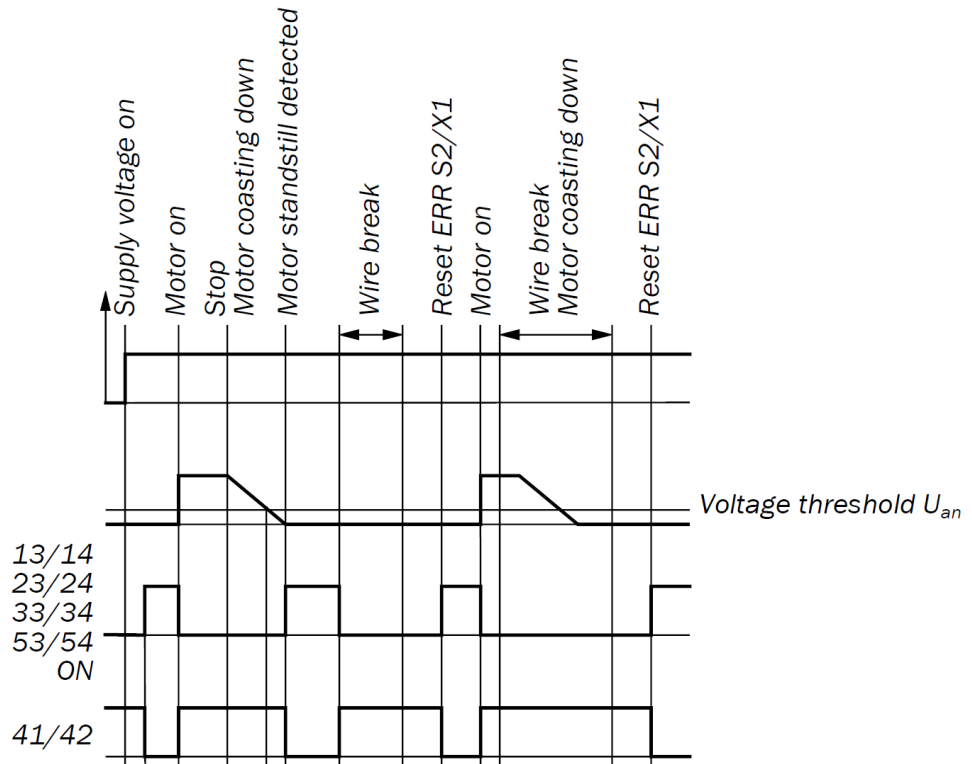
1.4.2 Three-phase motor



1.5 Function and Connection of S1 and S2

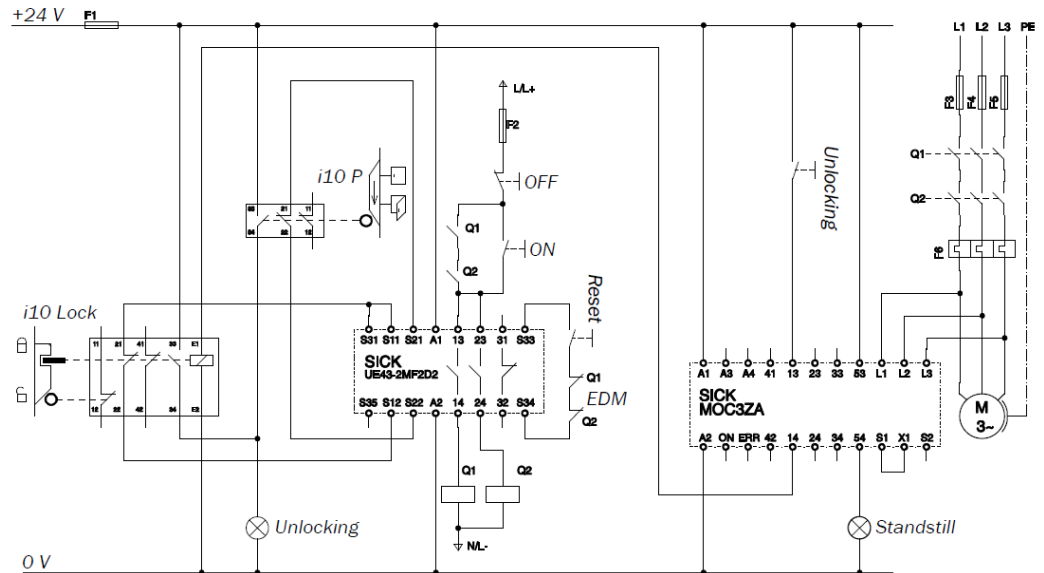
- S1:
 - EDM monitoring
 - Assures that external contactor contacts do not weld and that the switching of the output circuit works
 - The EDM circuit is open at standstill
 - To assure safe monitoring, the external contactors (see connection examples) can be connected to S1 and X1 for external device monitoring (EDM)

- S2:
 - Used to reset errors
 - Errors can be reset by a jumper between X1 and S2



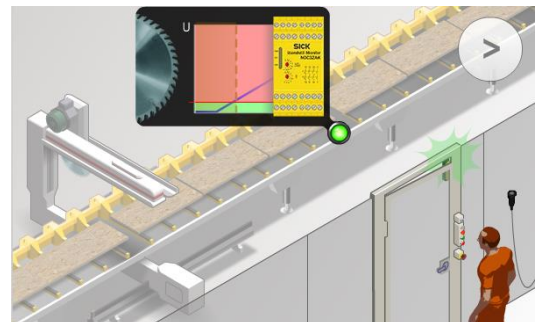
1.6 Function Diagram

1.7 Application Example Circuit



Circuit description:

- I10p and i10 Lock are mounted on the same door for monitoring
- When standstill is detected, the guard can be unlocked using pushbutton "Unlocking"
- When the guard is closed, the drive can be enabled by using pushbutton "Reset"



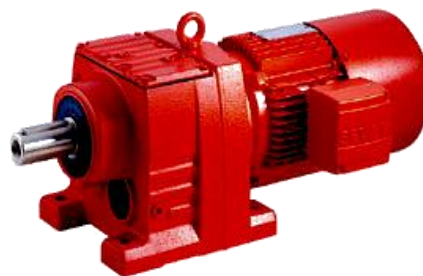
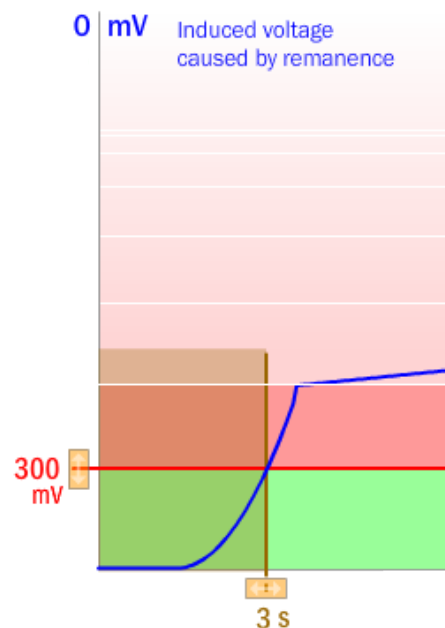
2 Commissioning

2.1 Overview

- Preparation for commissioning:
 1. Ensure that the motor is stationary/zero speed
 2. Connect measurement inputs L1/L2/L3
 3. Connect S1/X1/S2
 4. Set voltage threshold ($U_{an}=\text{min}$) and standstill period ($t_s=\text{min}$)
- Initial commissioning:
 5. Apply supply voltage to A1/A2
 6. Start the motor
 7. Shut down the motor and leave it to coast down

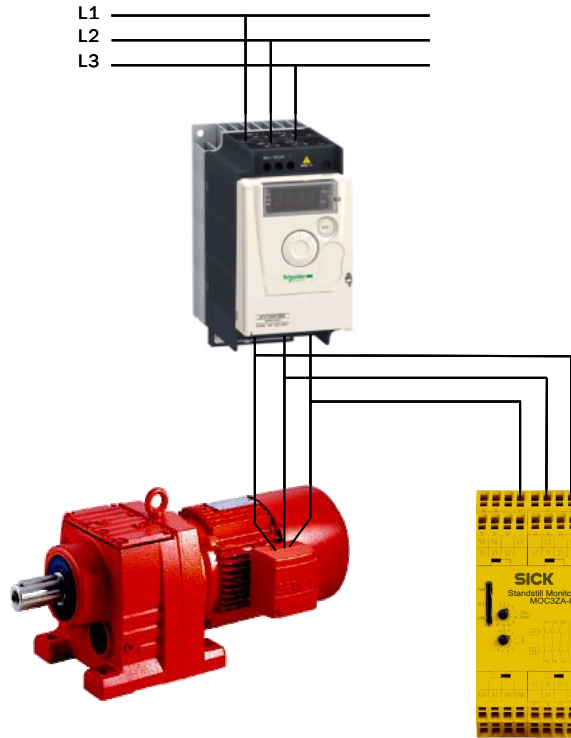
2.2 Preparation for Commissioning

2.2.1 Ensure that the motor is stationary



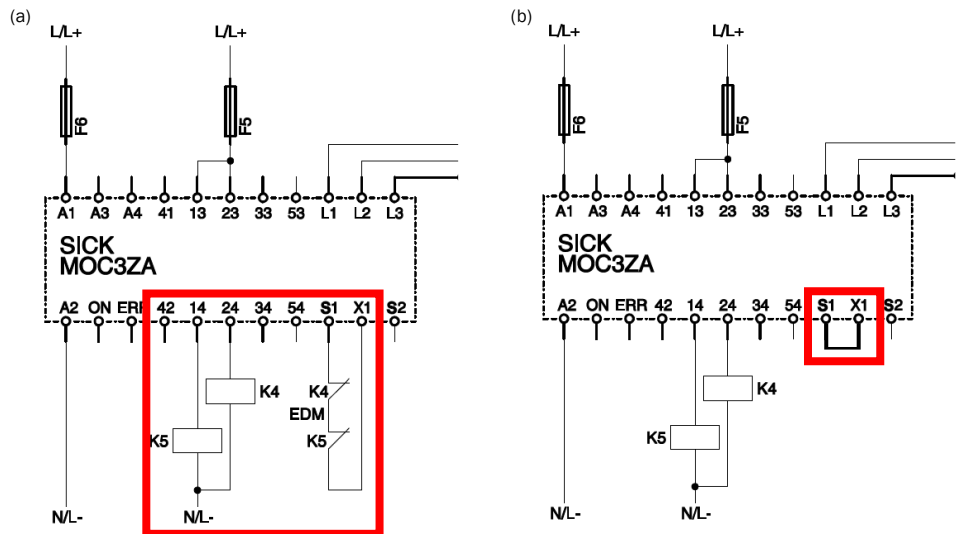
2.2.2 Connect measurement inputs L1/L2/L3

- Connect L1/L2/L3 to the motor windings



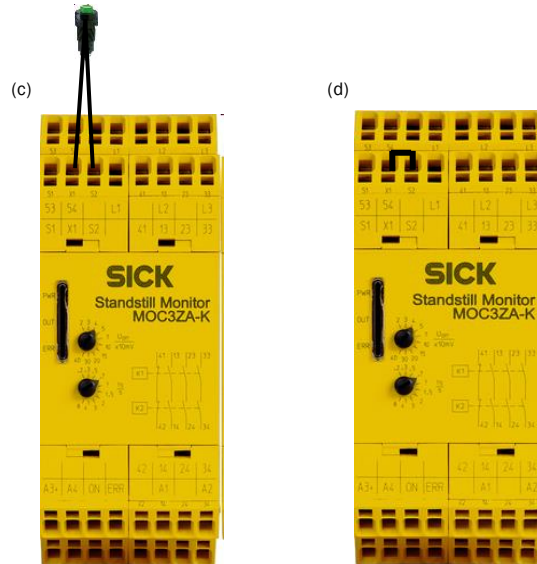
2.2.3 Connect S1/X1/S2

- S1/X1: EDM
 - External device monitoring: connect S1/X1 to the contractors that shall be monitored (EDM), the connection should be within the control cabinet (a)
 - If external device monitoring is not used: bypass S1/X1 (b)



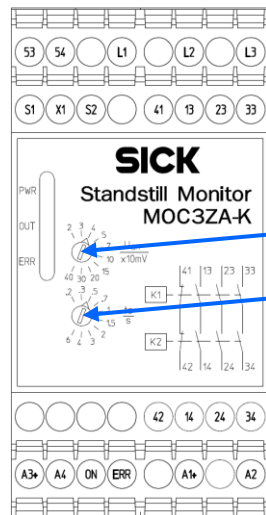
Standstill Monitor MOC3ZA

- S2/X1: error reset
 - For DC motors: bypass S2/X1 (d), (when the motor is running, there is a constant direct voltage offset error that is not saved)
 - Otherwise: switch/contact for manual reset (c), or bypassing, when error has to reset automatically (d)



2.2.4 Set voltage threshold and standstill period

- U_{an} : set to minimum value (20 mV)
- t_s : set to minimum value (0,2 s)

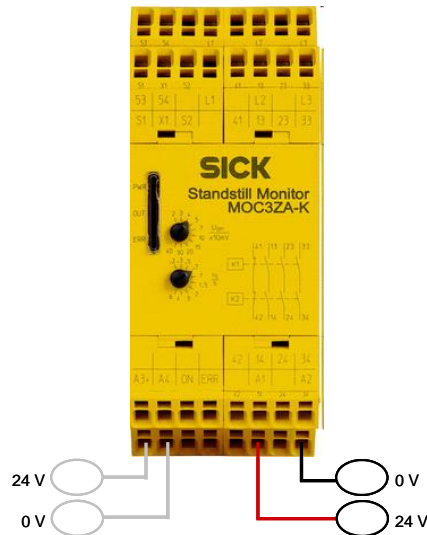


2.3 Initial Commissioning

2.3.1 Apply supply voltage to A1/A2

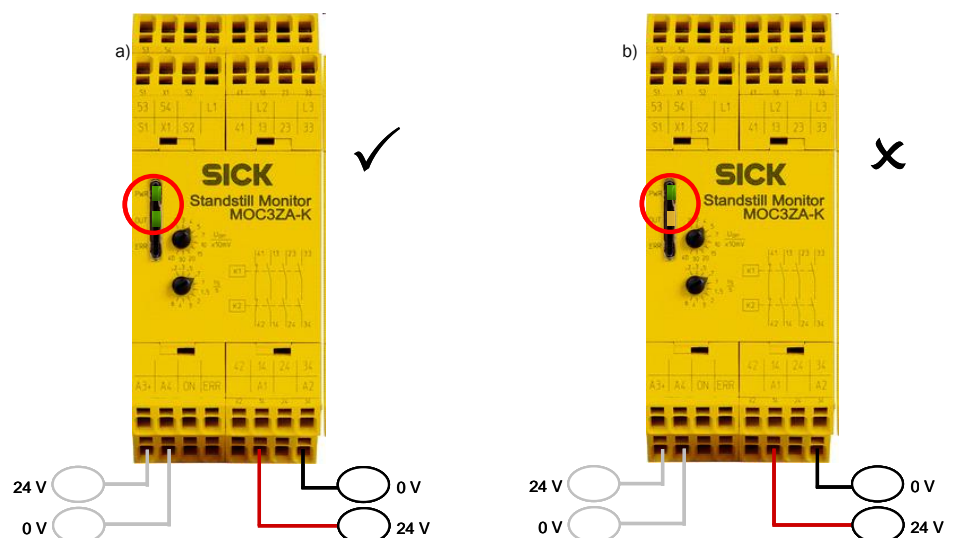
1.

- Connect supply voltage to A1 and A2
- When used with semiconductor application diagnostic output: an A3 und A4



2.

- After one second:
 - a) PWR and OUT LEDs are illuminated green and output circuit is enabled: standstill detected → device works properly
 - b) OUT LED is illuminated yellow: standstill not detected → adjustment required



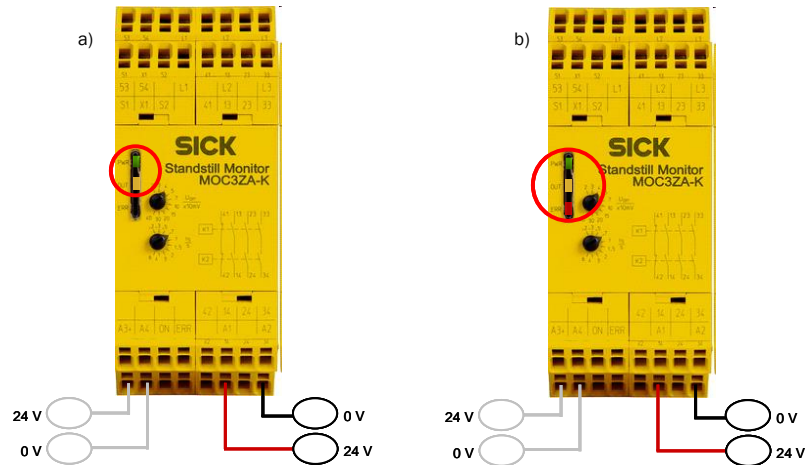
Measures:

Screen measurement input cables or increase voltage threshold U_{an} in steps until OUT LED illuminates green

2.3.2 Start the motor

➤ Start the motor

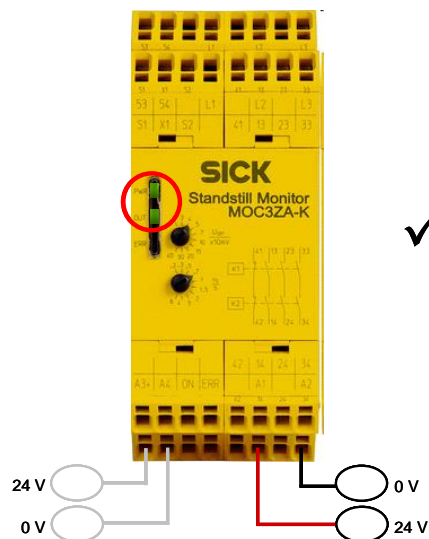
- OUT LED changes to yellow, output circuit switches off (a)
- DC motors: ERR LED flashes red after 2 s (with error code 2), semiconductor output ERR switches on, output circuit switches off (b)



2.3.3 Shut down the motor and leave it to coast down

➤ Shut down the motor and leave it to coast down

- At standstill: OUT LED is illuminated green, output circuit gets enabled
→ commissioning was successful

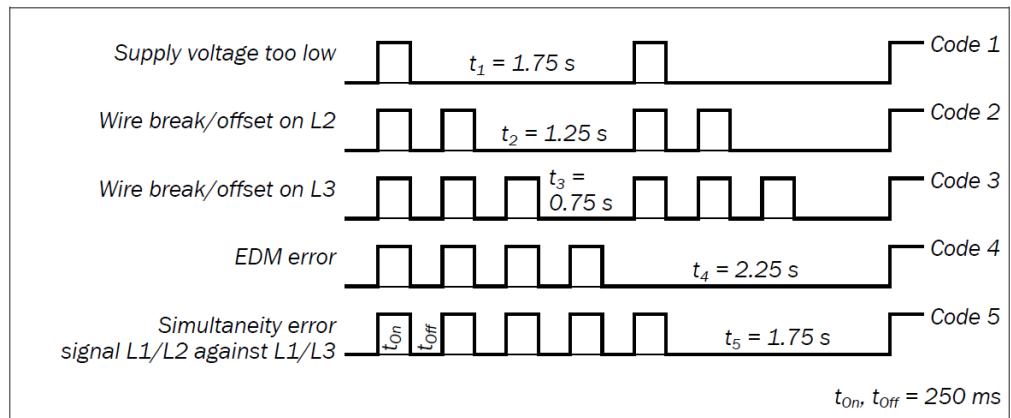


In case the switching of the output circuit should be delayed, the standstill time (t_s) can now be increased:

- Higher safety
- Time until access increased

Please document the values for U_{an} and t_s .

3 Error Diagnosis and Rectification



Error	Indication of the LEDs	Rectification of the error
The device enables the outputs even though the motor is running.	PWR ● Green OUT ● Green ERR ○ Off	<ul style="list-style-type: none"> ➤ Reduce the voltage threshold U_{an} if necessary to the minimum value. ➤ Check the wiring of the measurement inputs.
The device enables the outputs too early (motor is not yet fully at standstill).	PWR ● Green OUT ● Green ERR ○ Off	<ul style="list-style-type: none"> ➤ Reduce the voltage threshold U_{an}. ➤ If necessary increase the standstill time t_s (delay time to enable).
The device does not enable the outputs even though the motor is fully at a standstill.	PWR ○ Off	Undervoltage error or internal device error <ul style="list-style-type: none"> ➤ Disconnect the supply voltage to the MOC3ZA for at least 3 seconds. ➤ Replace the device if the problem persists.
The device does not enable the outputs even though the motor is fully at a standstill.	PWR ● Green ERR ● Red with code 1	Undervoltage error <ul style="list-style-type: none"> ➤ Check the supply voltage.
The device does not enable the outputs even though the motor is fully at a standstill.	PWR ● Green or OUT ● Green/yellow	Standstill has been detected, but the delay time t_s has not elapsed yet. <ul style="list-style-type: none"> ➤ Wait until t_s has elapsed. If the outputs are not enabled after 6 s at the latest, then the measurement inputs L1/L2/L3 are probably occasionally detecting voltage spikes greater than the U_{an} set. These voltage spikes can be detected by the OUT LED flashing ● Green/yellow (i.e. illuminated green and flashing yellow sporadically). <ul style="list-style-type: none"> ➤ In this case set U_{an} higher. ➤ Rectify the interference on the measurement inputs (possibly use screened cable).
The device does not enable the outputs even though the motor is fully at a standstill.	PWR ● Green OUT ○ Off ERR ● Red with code 2 or 3	A previous wire break or offset error on L2 or L3 is still saved (there is no jumper fitted to terminals S2/X1). <ul style="list-style-type: none"> ➤ Fit a jumper to terminals S2/X1 (disable error storage).
The device does not enable the outputs even though the motor is fully at a standstill.	PWR ● Green OUT ○ Off ERR ● Red with code 4	The external device monitoring (EDM, contacts S1/X1) is not closed or a previous EDM error is still saved (no jumper fitted to terminals S2/X1). <ul style="list-style-type: none"> ➤ Close the external device monitoring (EDM). ➤ Fit a jumper to terminals S2/X1 (disable error storage).

Error Diagnosis and Rectification

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Error	Indication of the LEDs	Rectification of the error
The device does not enable the outputs even though the motor is fully at a standstill.	PWR ● Green OUT ○ Off ERR ● Red with code 5	<p>Simultaneity error on measured signals on L2 and L3.</p> <p>How to reset the error:</p> <ul style="list-style-type: none"> ➤ Disconnect the supply voltage to the MOC3ZA for at least 3 seconds. ➤ The simultaneity error will be automatically reset when the motor starts again (both measurement inputs L2 and L3 simultaneously receive measured signals greater than U_{an}). <p>If the simultaneity error is still present:</p> <ul style="list-style-type: none"> ➤ Check the wiring of the measurement inputs L1/L2/L3.
The device does not enable the outputs even though the motor is fully at a standstill.	PWR ● Green OUT ● Yellow ERR ○ Off	<p>The voltage on the measurement inputs is greater than the voltage threshold U_{an} set. If the ERR LED continues to remain off after waiting 8 s, the problem is probably interference or residual voltage (coupled AC) on the measurement inputs.</p> <ul style="list-style-type: none"> ➤ Increase the voltage threshold U_{an}. <p>If the error is still present or if it is undesirable to increase U_{an}:</p> <ul style="list-style-type: none"> ➤ Reduce the coupling of interference onto the cables on the measurement inputs L1/L2/L3, e.g. using screening, by shortening the cables or laying them separately. ➤ For this purpose carry out the following test: If you short circuit the terminals L1/L2/L3 with no power applied to the motor, the OUT LED must extinguish.
The device does not enable the outputs even though the motor is fully at a standstill.	PWR ● Green OUT ● Yellow ERR ● Red with code 2 or 3	<p>Wire break between the measurement inputs L1 and L2 or L1 and L3 or DC offset between L1/L2 and L1/L3</p> <ul style="list-style-type: none"> ➤ Check the wiring from measurement inputs L1/L2/L3 to the motor windings for an open circuit. <p>Once errors due to open circuits on the measurement channels have been excluded, then the error may be caused by a DC offset $> U_{an}$. This problem may be due to incompletely shut down electronic controllers such as frequency inverters or brake modules that are still supplying a DC element to the measurement circuit (possibly check with a voltmeter).</p> <ul style="list-style-type: none"> ➤ Increase the voltage threshold U_{an} (OUT LED must extinguish). <p>Or:</p> <ul style="list-style-type: none"> ➤ Shut down the electronic motor controller such that the motor standstill is detected correctly.
An error message is displayed while the motor is running.	PWR ● Red OUT ○ Off	<p>An internal device error has occurred.</p> <ul style="list-style-type: none"> ➤ Disconnect the supply voltage to the MOC3ZA for at least 3 seconds. ➤ Replace the device if the problem persists.

4 Technical Specifications

4.1 Data Sheet

Minimum	Typical	Maximum
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Supply voltage (A1/A2)

Supply voltage U_B (A1/A2) ¹⁾	See type label		
24 V DC	21.6 V DC	24 V DC	28.8 V DC
230 V AC	184 V AC	230 V AC	253 V AC
400 V AC	320 V AC	400 V AC	440 V AC
Voltage range (for UL 508 applications only)			
24 V DC devices (a CLASS 2 power supply must be used)	21.6 V DC		26.4 V DC
230 V AC devices	196 V AC		253 V AC
400 V AC devices	340 V AC		440 V AC
Power consumption			
24 V DC			4 W
230 V AC			6 VA
400 V AC			10 VA
Recommended protection	To suit the maximum power consumption		
Frequency range (AC)	45 Hz	50/60 Hz	65 Hz
Max. ripple (DC)	10 %		
Output relay switch-on delay after application of the supply voltage (motor stationary)	0.4 s	0.6 s	0.8 s
	Value + standstill time $t_{s\text{ set}}$		

Supply voltage (A3/A4)

Supply voltage U_B (A3/A4)	11 V DC	24 V DC	30 V DC
Recommended protection	0.5 A		
Max. ripple (DC)	10 %		

¹⁾ To meet the requirements of the relevant product standards (e.g. IEC 61496-1), the external voltage supply for the devices must be able to bridge a brief mains failure of 20 ms. Suitable power supplies are available as accessories from SICK.

	Minimum	Typical	Maximum
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Measurement inputs (L1/L2/L3)

Measured/motor voltage For UL 508 applications only		400 V AC	690 V AC 600 V AC
Input resistances	500 kΩ		
Voltage threshold U_{an}	20 mV ... 400 mV, adjustable		
Standstill time t_s	0.2 ... 6 s, adjustable		
Hysteresis (for detection of running motor)	100 %		
Response time			100 ms
Standstill time t_s	0.2 ... 6 s, adjustable		

Response value dependent on frequency

Input frequency (Hz)	50	100	200	400	600	1k	1,5k	2k
Multiplication factor for U_{an}	1,0	1,1	1,2	1,5	2,0	2,8	5	8

Safety outputs: Normally open contact (13/14, 23/24, 33/34)

Positively guided N/C contacts: Normally closed contact (41/42)

Contact configuration (Safety contacts)	3 N/O contacts, 1 N/C contact		
Contact type	Relay, positively guided		
Nominal switching voltage	250 V AC		
Thermal current I_{th}	10 mA		5 A (up to 40 °C)
Switching capacity in accordance with AC 15 normally open contact normally closed contact	3 A/230 V AC (EN 60 947-5-1) 1 A/230 V AC (EN 60 947-5-1)		
Switching capacity in accordance with DC 13 normally open / normally closed contact	1 A/24 V DC (EN 60 947-5-1) 4 A/24 V at 0,1 Hz (EN 60 947-5-1)		
Contact rating (for UL 508 applications only) Ambient temperature 40 °C Ambient temperature 60 °C	Pilot duty B300 5 A 250 V AC G.P. 5 A 24 V DC Pilot duty B300 2 A 250 V AC G.P. 2 A 24 V DC		
Protection of the safety contacts	Max. fuse 5 A gL (up to 40 °C) Max. fuse 4 A gL Circuit breaker C6A		
Maximum switching frequency	1200/h		
Contact service life at 230 V/5 A (AC) $\cos \varphi = 1$	$\geq 2 \times 10^5$ switching operations		
Mechanical life	$\geq 50 \times 10^6$ switching operations		

Minimum	Typical	Maximum
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Application diagnostics outputs (not safe)

Semiconductor application diagnostics outputs (ON, ERR)	Electrically isolated supply via A3/A4 $I_{max} = 100 \text{ mA}$ (short-circuit protected) ON for Release, ERR for Error
Signal contacts 53/54 (normally open contact)	3 A/250 V AC G.P.

General data

Ambient operating temperature	-25 ... +60 °C
Storage temperature	-40 ... +75 °C
Enclosure rating	
Housing	IP 40 (EN 60529)
Terminals	IP 20 (EN 60529)
Climatic resistance	25/060/04 (EN 60068-1)
Net weight	Approx. 400 g
Dimensions (B × H × T)	45 × 90 × 121 mm

4.2 Dimensional Drawing

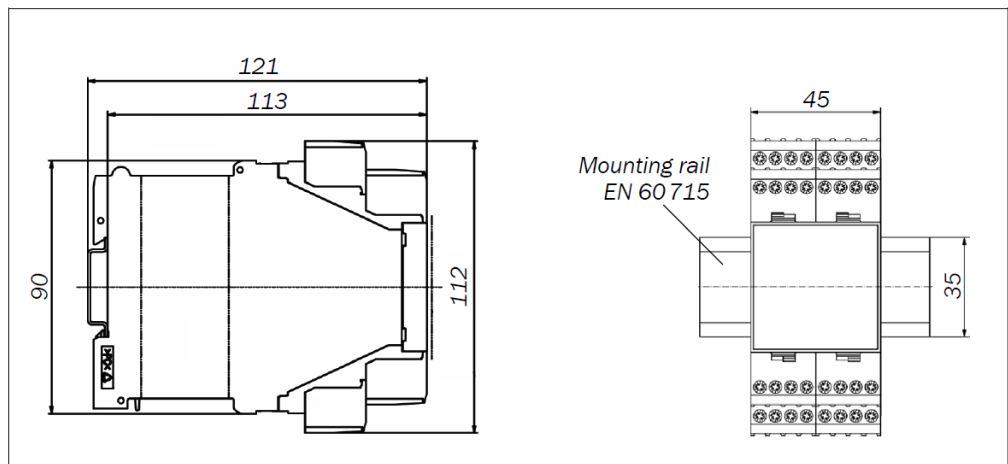


Fig. 12: Dimensional drawing
Standstill Monitor MOC3ZA
(mm)

5 Ordering Information

Type code	Description	Part number
MOC3ZA-KAZ33D3	Standstill Monitor MOC3ZA, supply voltage 24 V DC, with plug-in screw type terminals	6044981
MOC3ZA-KAZ33A3	Standstill Monitor MOC3ZA, supply voltage 230 V AC, with plug-in screw type terminals	6044982
MOC3ZA-KAZ33A6	Standstill Monitor MOC3ZA, supply voltage 400 V AC, with plug-in screw type terminals	6044983
MOC3ZA-KAZ34D3	Standstill Monitor MOC3ZA, supply voltage 24 V DC, with plug-in spring terminals	6047866
MOC3ZA-KAZ34A3	Standstill Monitor MOC3ZA, supply voltage 230 V AC, with plug-in spring terminals	6047865
MOC3ZA-KAZ34A6	Standstill Monitor MOC3ZA, supply voltage 400 V AC, with plug-in spring terminals	6047864