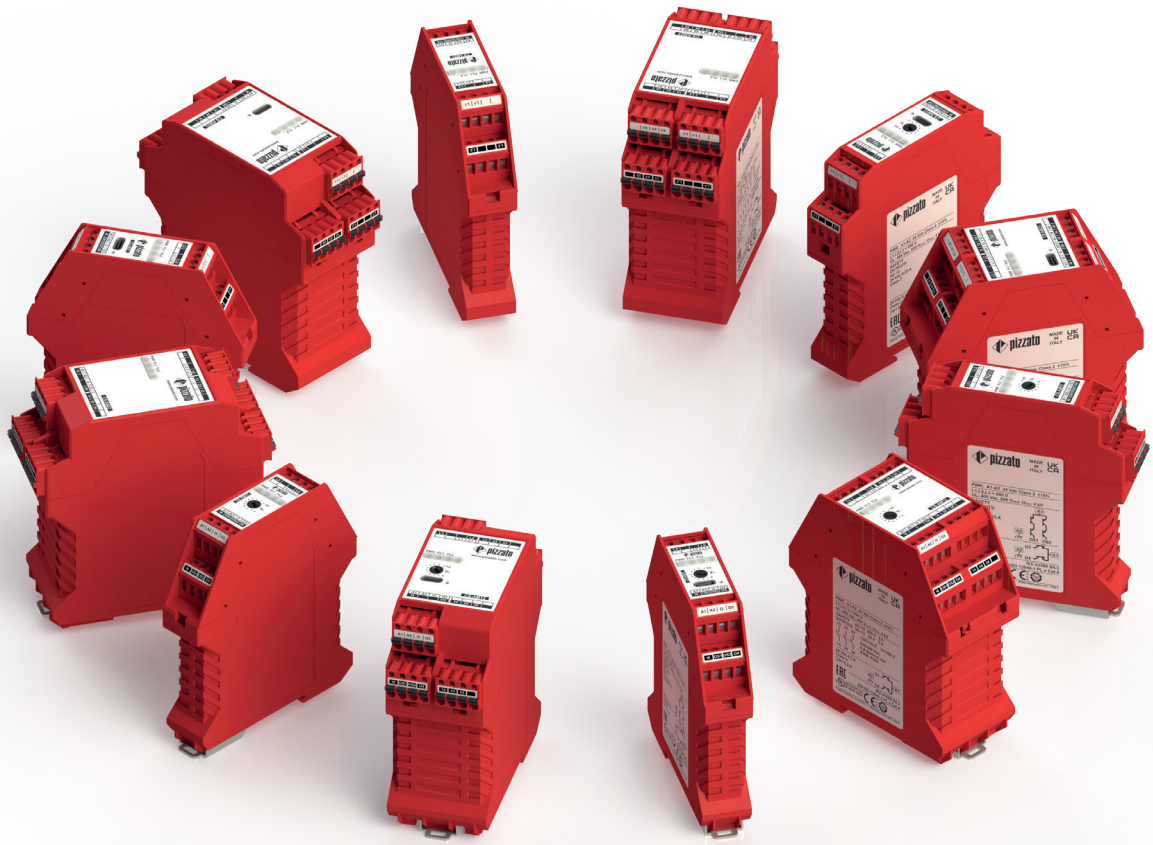
CS AM series safety modules

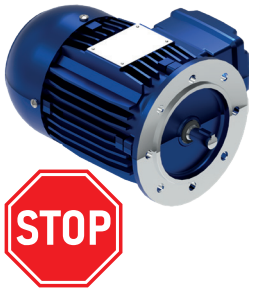


Introduction



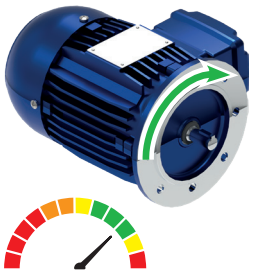
The CS AM series of safety modules is a family of Pizzato products designed for the monitoring of electric motors. They can be used for the following safety functions: motor-standstill detection, monitoring of motor speed of rotation and monitoring of motor direction of rotation.
These modules can be used with DC or AC electric motors. Speed of rotation can be detected on AC motors generally (mono-phase and three phase), while direction of rotation can be detected on three-phase AC motors.

CS AM1• - Detection of motor standstill



CS AM1• modules enable detection of movement in motor, with safety outputs deactivating when the residual voltage at the ends of the motor windings is above a selected threshold. This technology enables detection of motor rotation even when it is not powered and turning due to inertia.

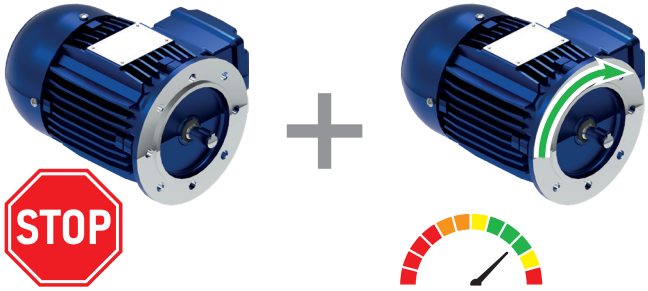
CS AM2• - Monitoring of motor speed and direction of rotation



CS AM2• modules enable monitoring of motor speed of rotation by measuring the frequency on its phases. The safety outputs deactivate when the frequency measured falls outside the set range.

With a three-phase motor, it is also possible to detect the direction of rotation of the motor: the safety outputs deactivate when the direction of rotation is not as expected.

CS AM3• - Monitoring of motor standstill, speed and direction of rotation

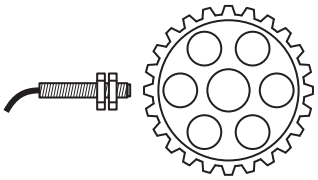


CS AM3• modules include all the safety functions of the new CS AM family: detection of motor standstill by measuring the residual voltage on motor phases, monitoring of motor speed via frequency measurement and identification of motor direction of rotation. CS AM3• modules provide the user with complete flexibility to configure safety functions according to the specific requirements of the application.

Sensorless monitoring

CS AM series modules use sensorless technology enabling various safety functions through direct connection of the CS AM module to the ends of the windings of the electric motor. The motor-standstill monitoring function is performed by monitoring the residual voltage generated by the rotating motor. The motor speed monitoring function is performed by measuring the frequency of the rotating magnetic field of the electric motor. By determining the phase shift between the voltages at the ends of two different windings, it is possible to identify the direction of rotation of the motor.

Additional diagnostics



With CS AM series modules, a proximity sensor can be connected to input I4, setting up safety functions with additional diagnostics functions on mechanical transmission components. The proximity sensor must be positioned to detect the teeth of a tone wheel that is integral with the shaft driven by the mechanical transmission components. This makes it possible to detect events such as breakage of transmission belts or chains, and to identify situations in which the motor is overloaded or the rotor is blocked.

Combined safety functions

CS AM2• and CS AM3• series modules can combine the safety functions for detection of motor speed and direction of rotation. More specifically, it is possible to configure the **Dual Speed** combined function, which enables the user to set different speed thresholds for the two different directions of rotation, and the **Speed & Rotation** combined function, which activates the safety outputs of the module if the speed detected is within the set threshold and the direction of rotation is as expected.

OSSD safety outputs

CS AM series modules are also available with OSSD solid-state safety outputs. Modules equipped with OSSD solid-state safety outputs have the benefit of occupying less space in the switching cabinet. The width of modules ranges from 45 mm for relay versions to 22.5 mm for OSSD versions.

Two independent safety functions

CS AM2• and CS AM3• series modules are also available with two independent OSSD solid-state safety outputs or with two independent pairs of safety relays. With these models, it is therefore possible to create two different safety functions simultaneously, associating each function with one of the two available inputs.

CS AM Configurator



CS AM••P series modules can be configured with the CS AM Configurator software. The device can be connected to a PC using the USB-C connection port on the front of the module, enabling transfer of the desired configuration. This makes CS AM modules extremely flexible, with numerous parameters that can be set from the software, enabling configuration of the modules behaviour to suit many different applications.

Selection diagram



SAFETY FUNCTION



1
For motor standstill detection



2
For speed and motor-direction-of-rotation monitoring



3
For motor standstill, speed and motor-direction-of-rotation monitoring

OUTPUT CONTACTS



1
2 OSSD outputs



2
3 NO



3
3 NO + 3NO



4
2 NO + 1 NC

COMMUNICATION PORT



P
Programmable with USB port



F
Not programmable

CONNECTION TYPE



V
Screw terminals



M
Connector with screw terminals



X
Connector with spring terminals

SUPPLY VOLTAGE



U

Code structure

Attention! The feasibility of a code number does not mean the effective availability of a product. Please contact our sales office.

CS AM11P1MU-P•••

Safety function	
1	For motor standstill detection
2	For speed and motor-direction-of-rotation monitoring
3	For motor standstill, speed and motor-direction-of-rotation monitoring

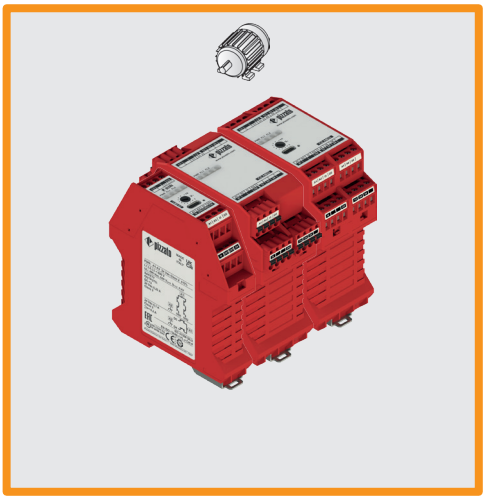
Output contacts	
1	2 OSSD outputs
2	3 NO safety contacts
3	6 NO safety contacts
4	2 NO safety contacts, 1 NC contact

Communication port	
F	Not programmable
P	Programmable with USB port

Connection type	
V	Screw terminals
M	Connector with screw terminals
X	Connector with spring terminals

Supply voltage	
U	24 Vdc

Program code	
P•••	Program code number



Safety modules for motor standstill, speed and motor direction of rotation monitoring

Main features

- For safety applications up to SIL 3/PL e
- Galvanic separation between control circuit and measurement circuit
- Possibility to connect single-phase or three-phase motors to measuring circuits
- OSSD electronic safety outputs (CS AM•1) or relay safety outputs (CS AM•2, CS AM•3 and CS AM•4)
- 24 Vdc power supply
- Choice of sensitivity ranges for motor stand-still threshold
- Programmable modules with USB-C port (CS AM••P)
- Detection of motor standstill (CS AM1•)
- Monitoring of motor speed and direction of rotation (CS AM2• and CS AM3•)
- Additional diagnostics with the option to detect the integrity of the kinematic chain (CS AM1• and CS AM3•), overload and rotor lock (CS AM2• and CS AM3•) by adding a single proximity sensor.
- Option to combine multiple safety functions in a single module (CS AM2• and CS AM3•)

Quality marks:

0123

EC type examination certificate:	M6A 075157 0039
UL approval:	E131787
EAC approval:	RU Д-IT.PA07.B.37848/24
TÜV SÜD approval:	Z10 075157 0038

Compliance with the requirements of:
Machinery Directive 2006/42/EC,
EMC Directive 2014/30/EU,
RoHS Directive 2011/65/EU.

In compliance with standards:
EN 60204-1, EN ISO 14118, EN ISO 12100, EN 60529, EN IEC 61000-6-2, EN IEC 61000-6-3, EN IEC 61326-1, EN IEC 60664-1, EN IEC 60947-1, EN 60947-5-1, EN IEC 63000, EN ISO 13849-1, EN ISO 13849-2, EN IEC 62061, UL 508, CSA C22.2 n°14, GB/T14048.5-2017

Technical data

Housing

Material:	Polyamide PA 66, self-extinguishing V0 acc. to UL 94
Protection degree:	IP40 (housing), IP20 (terminal strip)
Cable cross section:	0.2 … 2.5 mm² (24 … 12 AWG)
Terminal tightening torque:	0.5 … 0.6 Nm
Dimensions:	see General Catalogue - PLCs & Safety Modules 2025-2026 page 135, design C

General data

Safety Integrity Level (SIL)	Suitable for applications up to "Maximum SIL 3" in accordance with IEC 62061:2021 and SIL3 in accordance with EN 61508:2010
Performance Level (PL)	Up to PL e acc. to EN ISO 13849-1:2023
Safety category	Up to cat. 4 acc. to EN ISO 13849-1:2023
Safety parameters:	See General Catalogue - PLCs & Safety Modules 2025-2026 page 151
Mission time:	20 years
Ambient temperature:	-25°C … +55°C
Storage temperature:	-25°C … +70°C
Mechanical endurance (CS AM•2, CS AM•3):	10 million operating cycles
Pollution degree:	External 3, internal 2
Impulse withstand voltage U_{imp}:	6 kV (between motor inputs and 24 V / SELV signals) 4 kV (between phases of the motor input and between all relay contacts and 24 V / SELV signals) 2.5 kV (between the various relay contacts)
Rated insulation voltage U_i:	690 V (between motor inputs and 24 V signals, between motor phases) 250 V (between the relay contacts and between all relay contacts and the 24 V / SELV signals) 50 V (24 V / SELV connections)
Overvoltage category:	II
Air and surface distances:	Acc. to EN IEC 60947-1

Power supply electrical data

Rated operating voltage U_e:	24 Vdc
Supply voltage tolerance:	±15%
Maximum operating current at U_e voltage:	
CS AM•1	800 mA
CS AM•2 - CS AM•4	500 mA
CS AM•3	600 mA
External protection fuse:	2 A type gG or equivalent device

Electrical data of signalling inputs I3/I4

Rated operating voltage U_{e1}:	24 Vdc
Rated current consumption I_{e1}:	5 mA
Proximity sensor frequency (I4):	0.5 … 5000 Hz
Frequency detection accuracy (I4):	± 2%
Resolution (I4):	0.1 Hz
Duration of Start impulse t_i:	200 ms ÷ 10 s
Duration of Reset impulse t_{RESET}:	> 100 ms

Electrical data of O3/O4 signalling outputs

Rated operating voltage U_{e3}:	24 V_{dc}
Output type:	PNP
Maximum current per output I_{e3}:	0.1 A
Utilization category:	DC-13; U_{e3} = 24 V_{dc}, I_{e3} = 0.1 A
Short circuit detection:	No
Overvoltage protection:	Yes

Technical data

Electrical data of measurement outputs L1-L2-L3

Voltage between terminals L1-L2-L3:	0 … 690 Vac
Voltage between terminals L1-L2-L3 (CS AM2• and CS AM3•):	15 … 690 Vac
Frequency (CS AM1•):	0 … 3 kHz
Fundamental frequency (CS AM2• and CS AM3•):	0.5 … 1200 Hz
Inverter minimum PMW (CS AM2• and CS AM3•):	2 kHz
Hysteresis on frequency signal (CS AM2• and CS AM3•):	Adjustable from 2% to 10%
Started-motor threshold voltage V_H:	
• With trimmer enabled:	40 … 500 mV, adjustable in 10 increments 200 … 2000 mV, adjustable in 10 increments
• With trimmer disabled (via software):	40 … 2000 mV, adjustable
Motor-standstill threshold voltage V_L:	From 20 mV to 99% of V_H
Frequency measurement tolerance:	± 2%
Phase-shift threshold between f_{13} and f_{23} to establish the direction of rotation:	
• Clockwise rotation:	30° ÷ 90°
• Anti-clockwise rotation:	270° ÷ 330°
Input impedance:	> 1 MΩ

Electrical data of safety outputs OS1/OS2 (CS AM•1)

Rated operating voltage U_{e2}:	24 V_{dc}
Output type:	PNP type OSSD
Maximum current per output I_{e2}:	0.25 A
Minimum current per output I_{m2}:	0.5 mA
Thermal current I_{th2}:	0.25 A
Utilization category:	DC-13; U_{e2} = 24 V_{dc}, I_{e2} = 0.25 A
Short circuit detection:	Yes
Overcurrent protection:	Yes
Overvoltage protection:	Yes
Duration of the deactivation impulses at the safety outputs:	200 µs – 1 ms depending on capacitive load of the line
Permissible maximum capacitance between outputs:	< 1 µF
Permissible maximum capacitance between output and ground:	< 1 µF
Maximum EDM signal state change delay, t_{EDM}:	500 ms

Electrical data of safety relay outputs (CS AM•2, CS AM•3 and CS AM•4)

Output contacts (CS AM•2):	3NO
Output contacts (CS AM•3):	3NO + 3NO
Output contacts (CS AM•4):	2NO + 1NC
Contact type:	Forcibly guided acc. to EN 61810-3 (formerly EN 50205)
Material of the contacts:	Silver alloy
Maximum switching voltage:	230/240 Vac
Max. current per branch:	6 A
Conventional free air thermal current I_{th}:	6 A
Maximum sum of squared currents:	36 A^2
Minimum current:	10 mA
Contact resistance:	≤ 100 mΩ, at 1 A, 24 Vdc
External protection fuse:	4 A type gG
Maximum switching load per branch:	2000 VA
Electrical endurance:	> 100,000 operating cycles
Utilization categories acc. to EN 60947-5-1:	
– AC-15 (50 ... 60 Hz):	3 A, 250 Vac
– DC-13 (6 op. cycles/minute):	3 A, 24 Vdc
Utilization category acc. to UL 508:	R300, B300
Maximum EDM signal state change delay, t_{EDM}:	500 ms

Features approved by TÜV SÜD

Parameters: Safety Functions SF
- SF1 Standstill monitor
- SF2 Safe Speed Range Monitor
- SF3 Safe Direction Monitor

Tested according to: EN ISO 13849-1:2023
EN 61508-1:2010
EN 61508-2:2010
EN 61508-3:2010

Features approved by UL

Environmental ratings:

Open Type, maximum surrounding air 40°C.
Pollution degree 2.

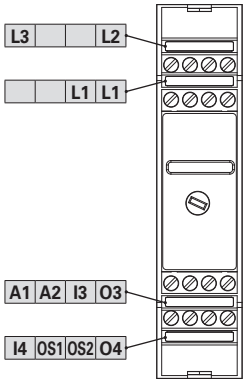
Electrical ratings:

Power supply:	24 Vdc, Class 2 Source or limited voltage/current
Power Consumption:	< 20 W (for CS AM•1•1•U only)
Power Consumption:	< 10 W (for CS AM•3•1•U only)
Relay outputs: (for CS AM•2•1•U 3NO contacts, CS AM•3•1•U 3NO+3NO contacts and CS AM•4•1•U 2NO+1NC contacts only)	230/240 V_{ac}, 6 A general use. B300, R300 Pilot Duty. U_{imp}: 2.5kV.
Semiconductor outputs: (for CS AM•1•1•U only)	2 outputs rated 24 Vdc, 0.25 A each, resistive load. Supplied by Class 2 Source or limited voltage/current.
Auxiliary outputs:	2 outputs rated 24 Vdc, 0.10 A each, resistive load. Supplied by Class 2 Source or limited voltage/current.
Motor Input:	Three phases, three lines, 400 Vac (rms), 600 Vpeak. U_{imp}: 4kV.

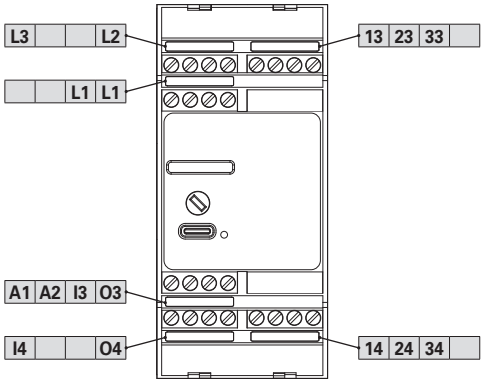
Notes:
- Use 60 or 75 °C copper (CU) conductor and wire size No. 30-12 AWG, stranded or solid.
- The terminal tightening torque of 5 – 7 Lb-In.
- Supply from Remote Class 2 Source or limited voltage limited current.
- For use in Pollution Degree 2 Environment.
- U_{imp} 4kV Motor Input.
- U_{imp} 2.5kV Relays circuit.

Safety modules CS AM11 - CS AM12

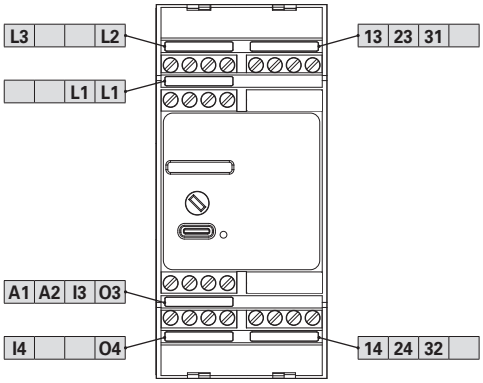
Terminal layout - CS AM11



Terminal layout - CS AM12

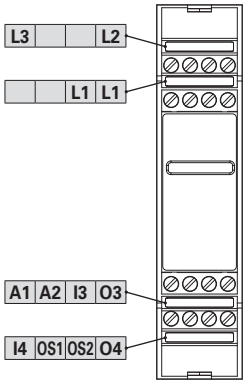


Terminal layout - CS AM14

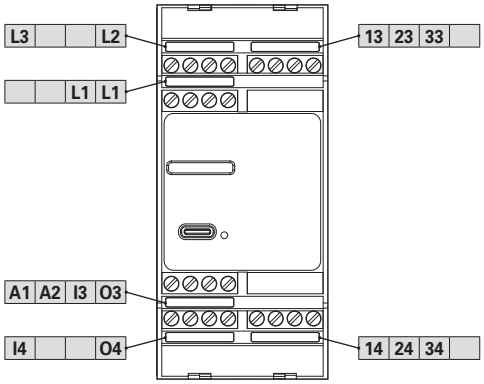


Safety modules CS AM21 - CS AM22 - CS AM23

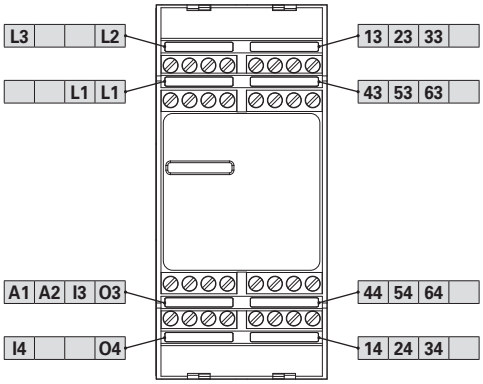
Terminal layout - CS AM21



Terminal layout - CS AM22

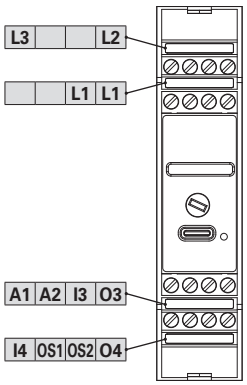


Terminal layout - CS AM23

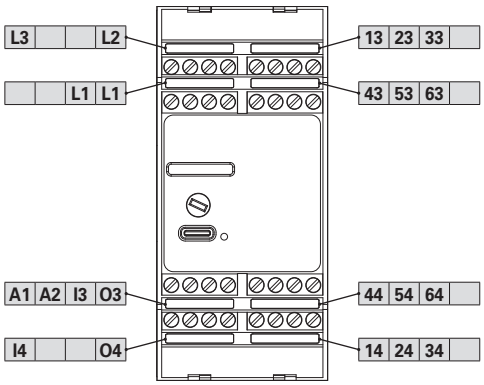


Safety modules CS AM31 - CS AM33

Terminal layout - CS AM31



Terminal layout - CS AM33



Backwards compatibility with model CS AM-01

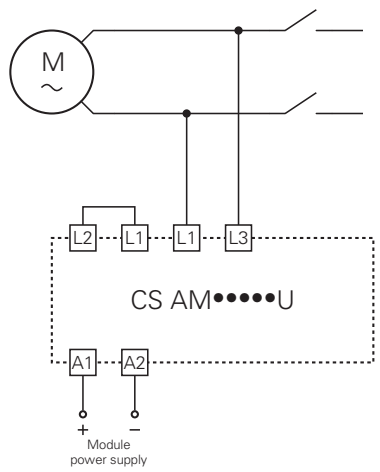
Models CS AM1• can be used in place of the various versions of the Pizzato CS AM-01 motor standstill monitoring module. The list of codes for compatible modules is available at www.pizzato.com. For further details, please contact Pizzato Elettrica Technical Assistance.

Electrical connections

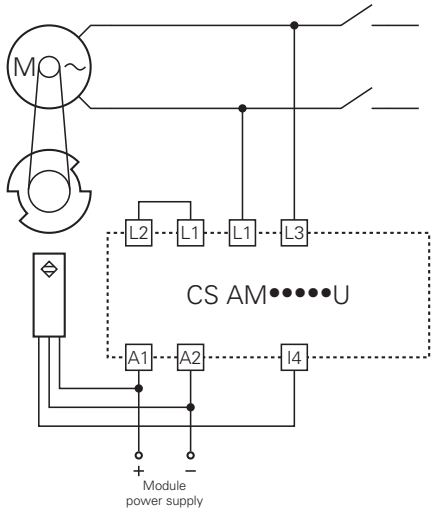
Connection		CS AM•1	CS AM•2	CS AM•3	CS AM•4
A1	Supply input +24 Vdc	■	■	■	■
A2	Supply input 0 V	■	■	■	■
I3	Configurable inputs	■	■	■	■
I4		■	■	■	■
O3	Configurable outputs	■	■	■	■
O4		■	■	■	■
L1	Motor phase 1	■	■	■	■
L2	Motor phase 2	■	■	■	■
L3	Motor phase 3	■	■	■	■
OS1	OSSD safety outputs	■			
OS2		■			
13-14	NO safety contacts		■	■	■
23-24			■	■	■
33-34			■	■	
43-44				■	
53-54				■	
63-64				■	
31-32	NC contact				■

Single-phase or DC motor

Without proximity sensor

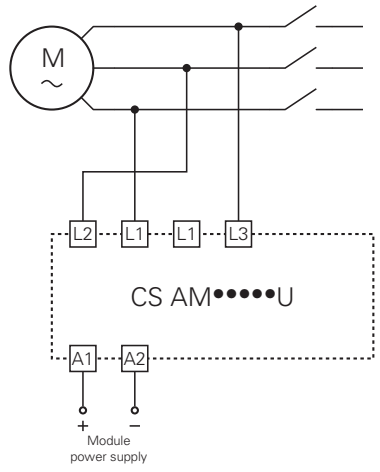


With proximity sensor

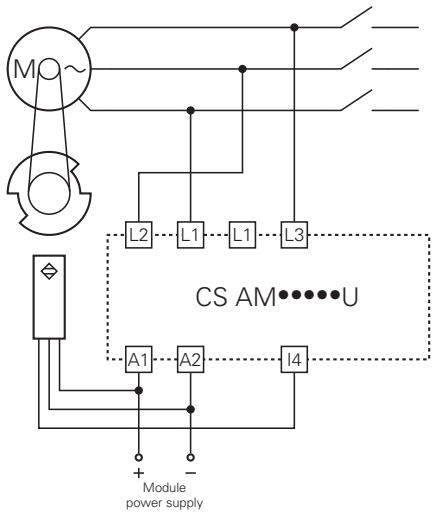


Three-phase motor

Without proximity sensor

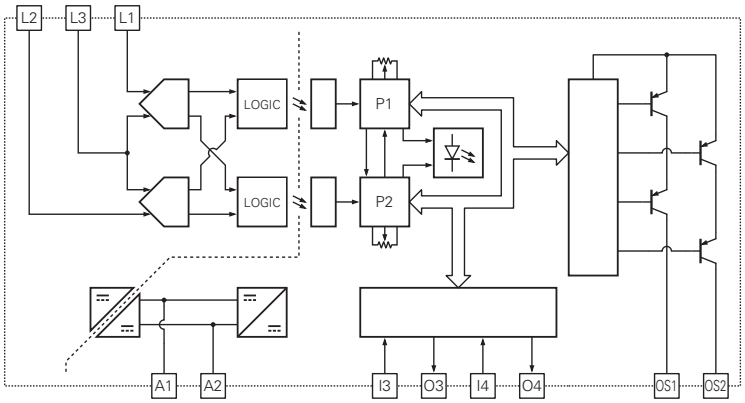


With proximity sensor

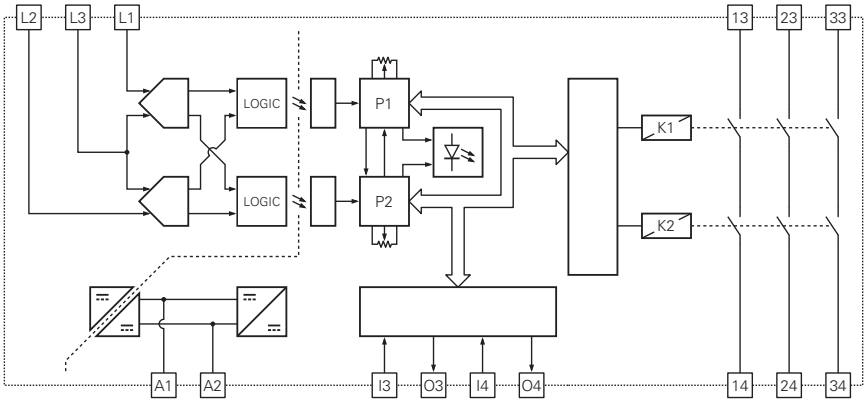


Internal wiring diagram

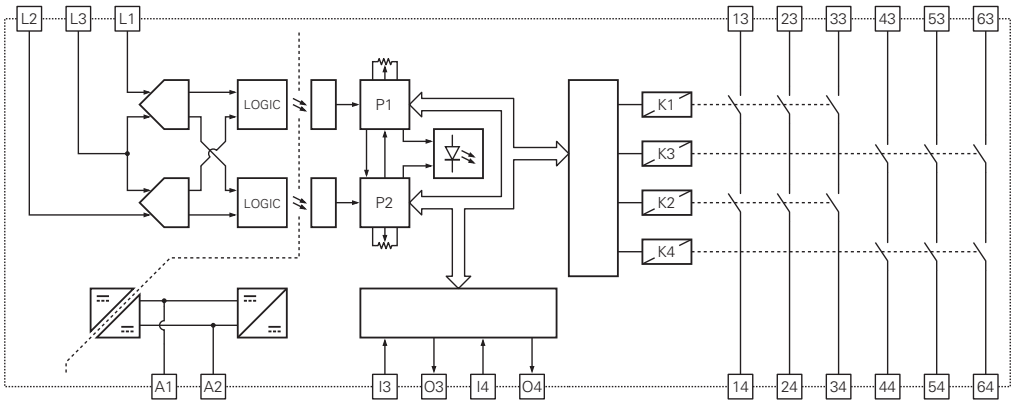
CS AM•1



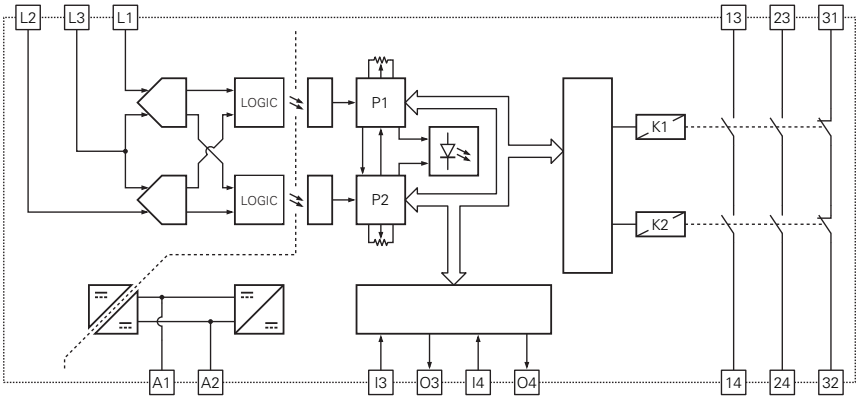
CS AM•2



CS AM•3



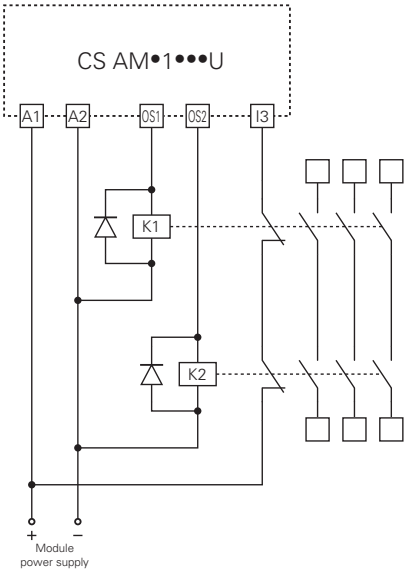
CS AM•4



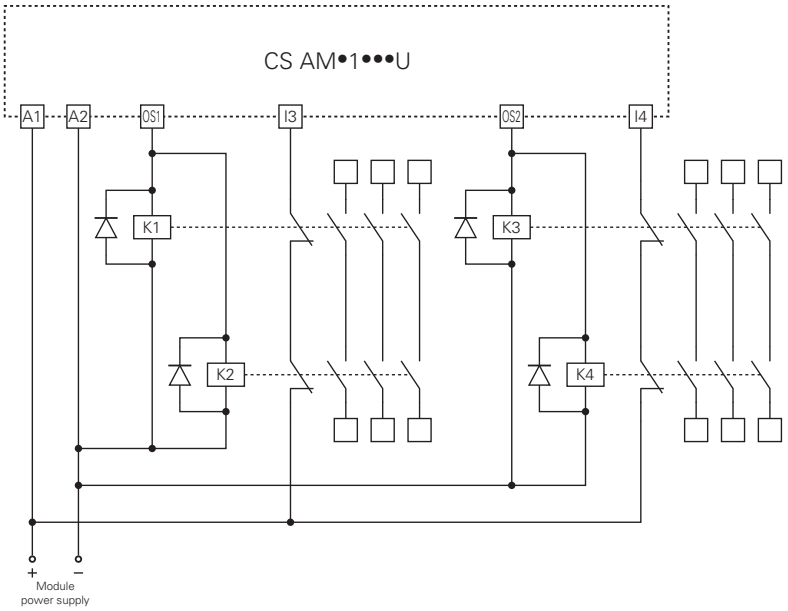
External device monitoring (EDM)

CS AM•1

EDM for CS AM with single safety function



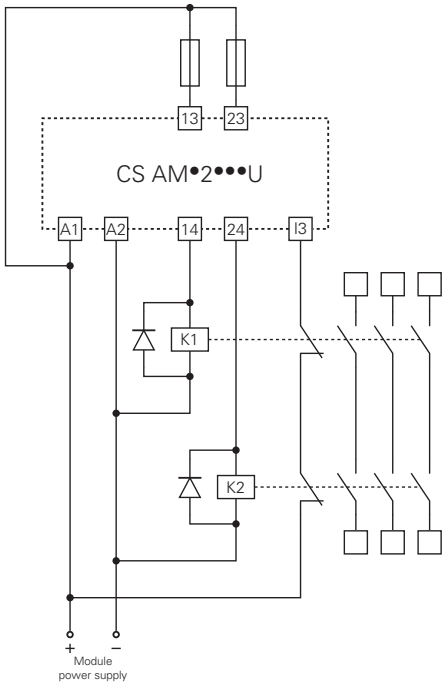
EDM for CS AM with dual safety function *



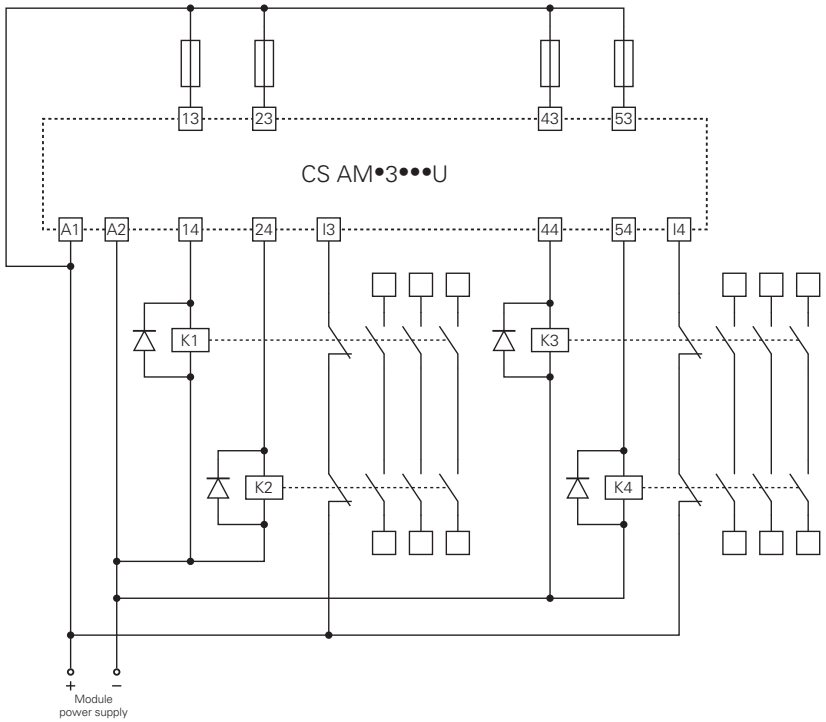
* Connection of the same OSSD of the CS AM module to the coils of two forcibly-guided contactors with contacts in series can be regarded as fault excluded since both are within the same housing. See table D.4, item D.2.4 of EN ISO 13849-2.

CS AM•2, CS AM•3 and CS AM•4

EDM for CS AM with single safety function

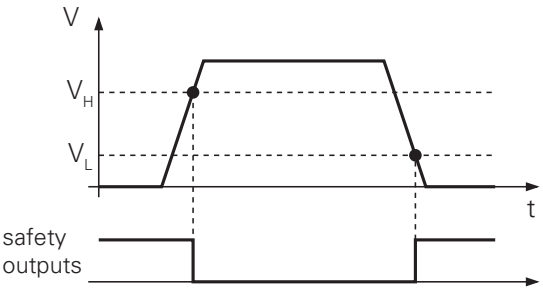


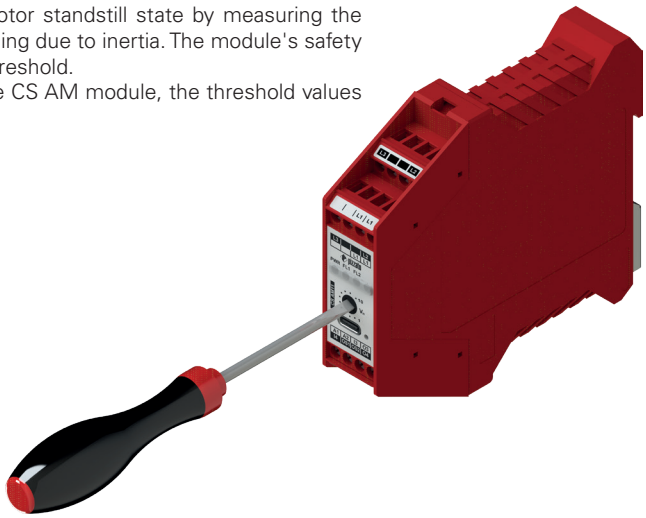
EDM for CS AM with dual safety function



Motor standstill detection function

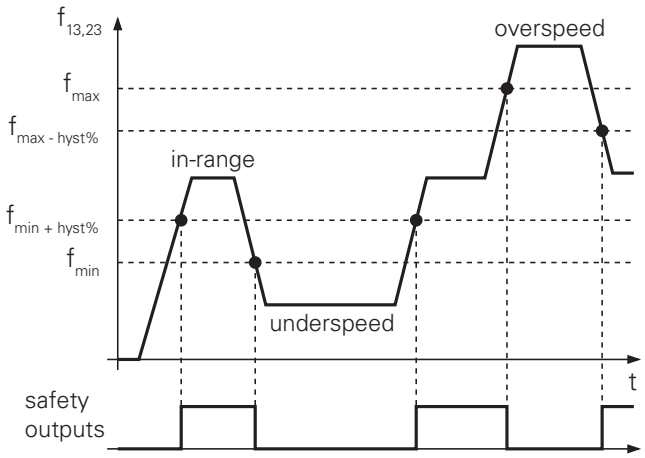
CS AM1• and CS AM3• series modules are capable of monitoring the motor standstill state by measuring the residual voltage generated by the rotating electric motor, e.g. when it is turning due to inertia. The module's safety outputs deactivate when the detected voltage is above the started-motor threshold.
Using the CS AM Configurator software and the trimmer on the front of the CS AM module, the threshold values for residual voltage can be set:
V_H: Started-motor threshold voltage
V_L: Motor-standstill threshold voltage





Speed monitoring function

By measuring the frequency of the phases of the electric motor, CS AM2• and CS AM3• series modules can monitor the speed of rotation of the motor. The module safety outputs deactivate when the speed detected is outside the frequency range set.

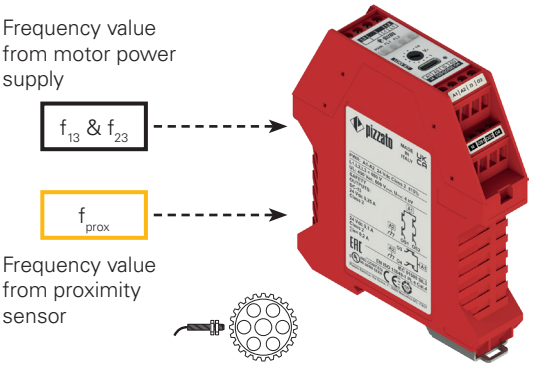


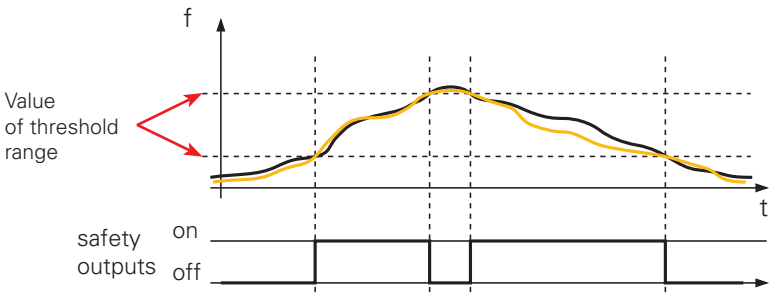
Direction-of-rotation detection function

By measuring the time difference between the pairs of phases at input, the modules of the CS AM2• and CS AM3• series are capable of detecting the direction of rotation of the motor.
This information enables various safety functions:
- **Rotation**: the safety outputs deactivate when the direction of rotation detected differs from that expected.
- **Speed & Rotation**: the safety outputs deactivate when the speed detected is outside the frequency range set or the direction of rotation is not as expected.
- **Dual Speed**: the safety outputs deactivate when the speed detected is outside the frequency range set for the specific direction of rotation. This makes it possible to set two permissible-speed ranges for the motor, one for clockwise rotation and one for anticlockwise rotation.

Optional transmission-component diagnostics function

By connecting a single proximity sensor, located so as to detect the speed of rotation directly on the shaft downstream of the transmission components to which the motor transfers motion, it is possible to check the coherence of the speed and the electrical measurements taken on the motor phases.
A discrepancy between the speed downstream of the transmission components (detected by the proximity sensor) and the speed detected upstream of the transmission components (measurement of voltage and frequency of motor phases) enables diagnosis of a fault or breakage of the transmission components themselves (e.g. gears, pulleys, belts or chains).
Combining this diagnostic function (optional) with the safety functions introduced above, enables the following combined functionality:
- **Motor standstill detection with proximity sensor:** the motor-standstill condition detected by measurement on the motor phases also requires that the proximity sensor detects that the shaft downstream of the transmission components stops before the safety outputs are activated.
- **Rotation-speed monitoring with proximity sensor:** comparing the rotation speed of the motor with the rotation speed of the shaft downstream of the transmission components enables detection of any motor block/overload or slippage/breakage of the transmission components.





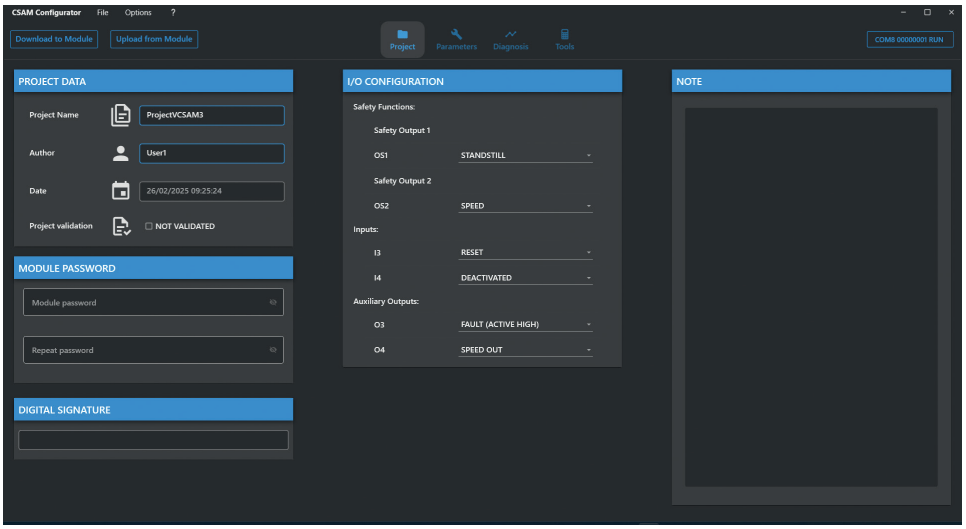
CS AM Configurator

CS AM••P safety modules are equipped with a USB Type-C port enabling their connection to a computer for configuration using the CS AM Configurator software, created by Pizzato Elettrica and available for free download by the user.



Configuration of parameters

Using the CS AM Configurator software, it is possible to configure the module outputs and inputs, set active functions and define the parameters according to the characteristics of the application and the motor. This makes the product highly flexible and adaptable for a great range of applications.



Real-time monitoring

Real-time monitoring of motor state and electrical measurements taken by the module.

This view allows real-time analysis of the behaviour of motor and module during use of the application, helping the user to check that the configuration of parameters effectively meets the requirements of their application.





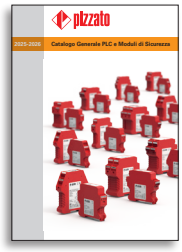
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