7.2 PM-E F pm DC24V PROFIsafe Power Module

7.2.1 Properties of the PM-E F pm DC24V PROFIsafe Power Module

Order Number

6ES7 138-4CF02-0AB0

Properties

The PM-E F pm DC24V PROFIsafe power module has the following properties:

- Two relays for switching voltage buses P1 and P2, 10 A output current
- 2 fail-safe digital outputs, P/M-switching, output current 2 A
- 24 VDC rated load voltage
- Suitable for solenoid valves, DC contactors, and indicator lights
- Group fault display (SF; red LED)
- Status display for each output (green LED)
- Status display for load current power supply (PWR; green LED)
- Assignable diagnostics
- For achievable safety classes (safety integrity level), see following table

Table 7-1 Overview of Achievable Safety Classes (Safety Integrity Levels) with PM-E F pm DC24V PROFIsafe

PM-E F pm DC24V PROFIsafe			Maximum Safety Level That Can Be Achieved
Relay outputs P1 and P2	Without standard DO modules	Signal switches daily or more often	AK6/ SIL3/Category 4
		Signal switches less than once a day	AK4/ SIL2/ Category 3
	with standard DO modules		AK4/ SIL2/ Category 3
DO 0 and DO 1 electronic outputs	without standard DO modules on P1 and P2		AK6/ SIL3/Category 4
	with standard DO modules on P1 and P2		AK4/ SIL2/ Category 3

Switching of Voltage Buses P1 and P2

The power module can be used for fail-safe connection of voltage buses P1 and P2 by means of relay contacts in accordance with AK4/SIL2/Category 3.

Two fail-safe digital outputs

In addition to the P1 and P2 voltage buses the power module has two fail-safe digital outputs, DO 0 and DO 1. AK6/SIL3/Category 4 can be achieved with these outputs if standard DO modules are not connected to P1 and P2.

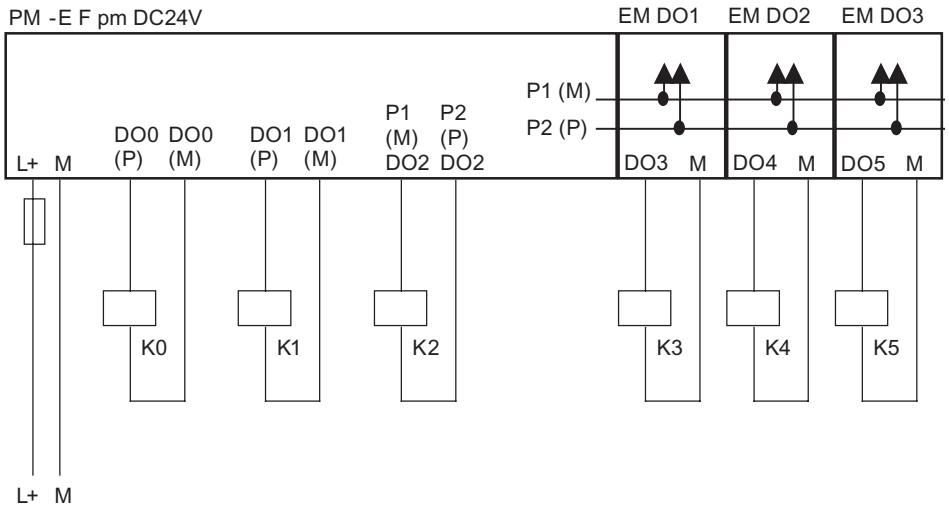

Figure 7-1 Wiring diagram of the PM-E F pm DC24V PROFIsafe

Conditions for Achieving Safety Class

The conditions for achieving the respective safety classes are summarized in the following table.

Table 7-2 PM-E F pm DC24V PROFIsafe: Conditions for AK/SIL/Category

Condition	Achievable AK/SIL/Category
ET 200S standard modules supplied by means of P1 and P2	AK4/SIL2/Category 3 on P1 and P2 and at DO 0 and DO 1
DO 0 and DO 1 used, modules not supplied by means of P1 and P2	AK6/SIL3/Category 4 on DO 0 and DO 1

Power Module Supplies for Standard ET 200S Modules

Warning

Always connect the 24 VDC supply for the standard ET 200S modules on the PM-E F pm DC24V PROFIsafe. Otherwise, the outputs of DO modules may exhibit safety critical behavior.

Warning

When supplying standard DO modules, always use the terminal modules to supply the sensors or actuators (actuator feedback on the DO module). Otherwise, the power module signals a short circuit and the load voltage of this voltage group is interrupted.

Safety-Related Shutdown of Standard DO Modules

Warning

The following ET 200S standard modules are approved for safety-related shutdown in accordance with SIL2:

- 2DO DC24V/0.5A (order number 6ES7 132-4BB01-0AA0 or higher)
- 2DO DC24V/2A (order number 6ES7 132-4BB31-0AA0 or higher)
- 2DO DC24V/0.5A HIGH FEATURE (order number 6ES7 132-4BB01-0AB0 or higher)
- 2DO DC24V/2A HIGH FEATURE (order number 6ES7 132-4BB31-0AB0 or higher)
- 4DO DC24V/0.5A (order number 6ES7 132-4BD00-0AA0 or higher)
- 4DO DC24V/2A (order number 6ES7 132-4BD31-0AA0 or higher)

Warning

Safety-related activation of outputs of standard DO modules is not possible; rather, only safety-related **shutdown** is possible. You must therefore take the following effects into account:

In the worst case you must consider all possible faults of the standard DO modules and the programs controlling them for which the faults cannot be found directly. For example, the PM-E F pm DC24V PROFIsafe does not detect external short-circuits as per L+ at the standard DO module outputs. All faults of the standard DO modules influence the process via final controlling elements. The process must be made known to the F-CPU via sensors and a suitable safety program.

The safety program must react in a safety-related and logically suitable fashion to unwanted or potentially dangerous states in the process via the PM-E F pm DC24V PROFIsafe and fail-safe output modules.

If you want to avoid the problems described above completely, we recommend that you use P/M switching fail-safe electronic modules 4 F-DO DC24V/2A PROFIsafe with standard ET 200S power modules (see *"4 F-DO DC24V/2A PROFIsafe Digital Electronic Module "*and *Table "Assignment of Power Modules to Electronic Modules/Motor Starters and Safety Class"*) instead of standard DO modules.

Property of the safety-related shutdown of standard DO modules by the PM-E F pm DC24V PROFIsafe:

With this cost-effective solution, when a fault is discovered in the process or on the PM-E F pm DC24V PROFIsafe, there is a comprehensive and simultaneous shutdown of all outputs involved.

Property of individual shutdown of F-modules with fail-safe outputs:

If a fault is discovered, the extent of the shutdown is kept to a minimum. It is also possible to react to critical process states staggered over time or to perform safety-related shutdown of individual outputs. This solution is expensive compared with the safety-related shutdown by the PM-E F pm DC24V PROFIsafe.

Switching grounded loads

If the PM-E F pm DC24V PROFIsafe switches loads that have a connection between chassis and ground (for example to improve the EMC properties) **and** if chassis and ground are connected in the power supply being used, a "short circuit" will be detected.

From the perspective of the F-module, the M switch is bridged by the chassis-ground connection (refer to the following figure as an example of a PM-E F pm DC24V PROFIsafe).

Remedy:

- Use the PM-E F pp DC24V PROFIsafe
- The value of the resistance between chassis and ground at the load end must be greater than 100 kΩ

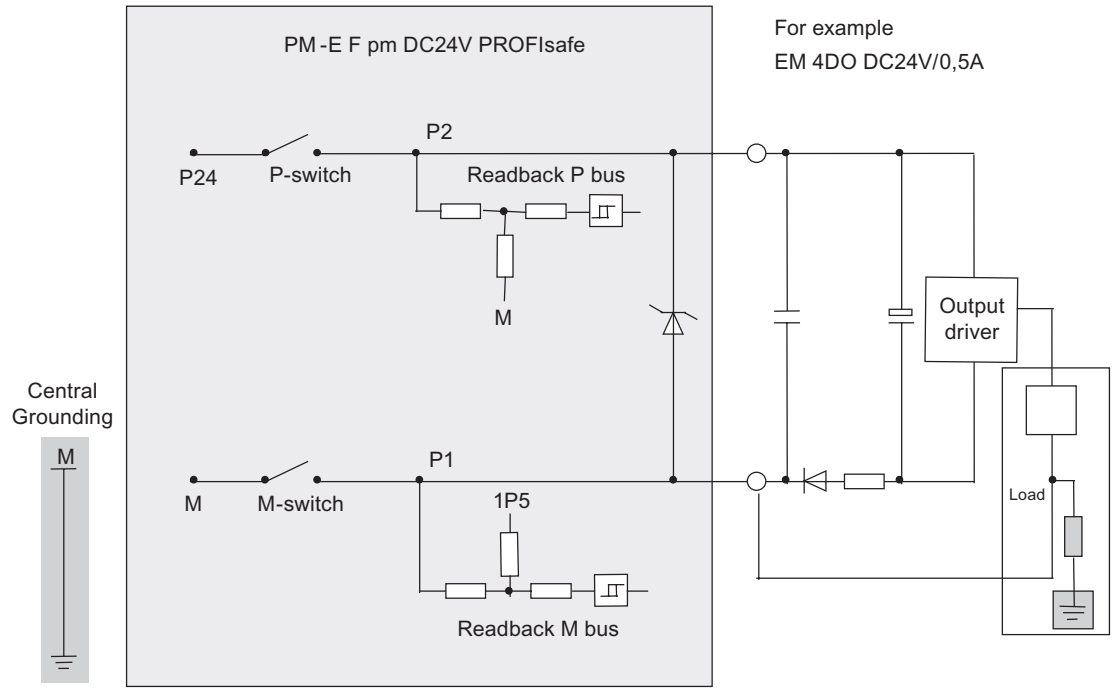

Figure 7-2 Connecting Grounded Loads (resistance exists between chassis and ground)

Capacitive Crosstalk of Digital Input/Output Signals

When fail-safe digital output signals and fail-safe digital input signals are routed through one cable, readback errors can occur on the PM E-F pm DC24V PROFIsafe power module or the F-DO modules. The module then signals a short-circuit.

Cause

During the sensor supply tests of the 4/8 F-DI DC24V PROFIsafe module, the steep switching edge of the output driver can cause crosstalk with other inactive output channels due to the coupling capacitance of the wire, for example on the PM E F pm DC24V PROFIsafe power module. In these channels, this can lead to a response in the readback circuit. A short is detected leading to a safety-related shutdown.

Remedy

- Use separate cables for F-DI modules and F-DO modules or standard DO modules driven by a PM-E F pm DC24V PROFIsafe
- Coupling relay or diodes in the outputs
- Turn off the sensor supply test if this is permitted by the required safety class (safety integrity level).

See also

Assigning Modules of an ET 200S (Page 2-4)

Properties of the 4 F-DO DC24V/2A PROFIsafe digital electronic module (Page 7-80)

7.2.2 Terminal assignment of the PM-E F pm DC24V PROFIsafe

Incoming Supply of the 24 VDC Supply for Electronic Modules with Process-Related Functions

Depending on whether the electronic and load current supplies are electrically isolated in the electronic modules with process-related functions (positioning, counting), you must adhere to the following wiring instructions:

- If electrically isolated, provide an external 24 VDC feed for the electronic module.
- If electrical isolation is not implemented, you must supply the electronic module from the voltage bus P1 of the PM-E F pm 24 VDC PROFIsafe power module.

AK4/SIL2/Category 3 is attainable in both cases.

Front View

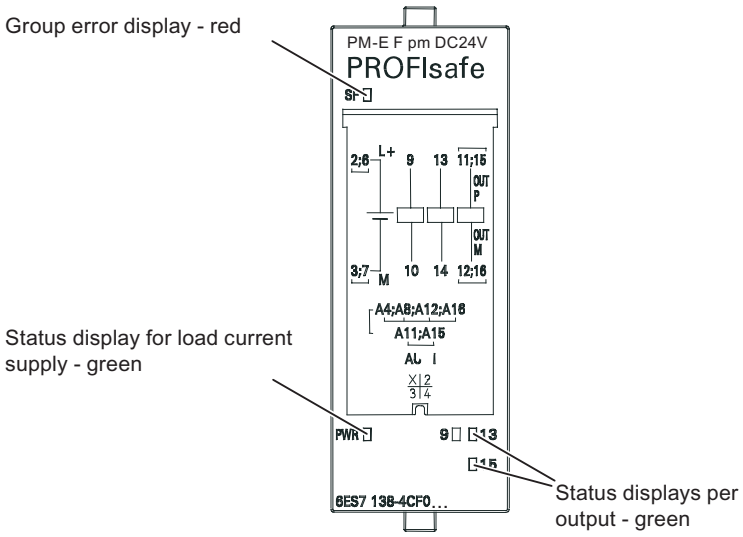

Figure 7-3 Front view of the PM-E F pm DC24V PROFIsafe

Warning

The SF LED and the status displays of the outputs must not be evaluated for safety-related activities.

Terminal assignment

The terminal assignment of the PM-E F pm DC 24 V PROFIsafe power module for the usable terminal modules TM-P30S44-A0 and TM-P30C44-A0 is shown in the following figure and table.

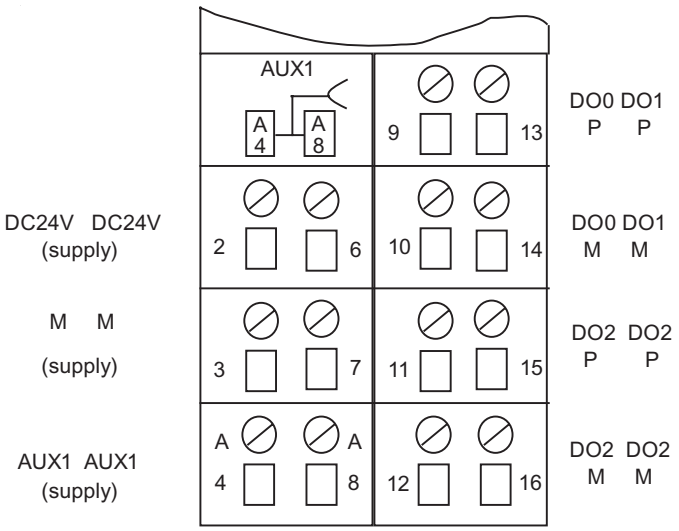

Figure 7-4 Terminal Assignment of the TM-P30S44-A0 or TM-P30C44-A0 for PM-E F pm DC 24V PROFIsafe

Table 7-3 Table-Terminal Assignment of the TM-P30S44-A0 or TM-P30C44-A0

Terminal		Designation
2	24 VDC	24 VDC rated load voltage for: • Inserted power module, • Corresponding voltage group, • DO 0 and DO 1 and • Voltage buses P1 and P2
3	M	Ground
A 4	AUX 1	Any terminal for PE or voltage bus up to the maximum rated load voltage of the module
6	24 VDC	24 VDC rated load voltage for: • Inserted power module, • Corresponding voltage group, • DO 0 and DO 1 • and voltage buses P1 and P2
7	M	Ground
A 8	AUX 1	Any terminal for PE or voltage bus up to the maximum rated load voltage of the module
9	DO 0 P	Terminals for fail-safe digital output 0 (P/M switching)
10	DO 0 M	
11	DO 2 P	Terminals (relay contacts) for fail-safe switching of voltage buses P1 and P2 P1 and P2 can also be used as DO 2 M and DO 2 P
12	DO 2 M	
13	DO 1 P	Terminals for fail-safe digital output 1 (P/M switching)
14	DO 1 M	
15	DO 2 P	Terminals (relay contacts) for fail-safe switching of voltage buses P1 and P2 P1 and P2 can also be used as DO 2 M and DO 2 P
16	DO 2 M	

Caution

If strong currents can occur on DO 2 P and DO 2 M, both terminals 11 and 15 (DO 2 P) and terminals 12 and 16 (DO 2 M) must be wired in parallel.

Otherwise, the current loading could cause the terminals to heat up.

7.2.3 Wiring of the PM-E F pm DC24V PROFIsafe

Block Diagram

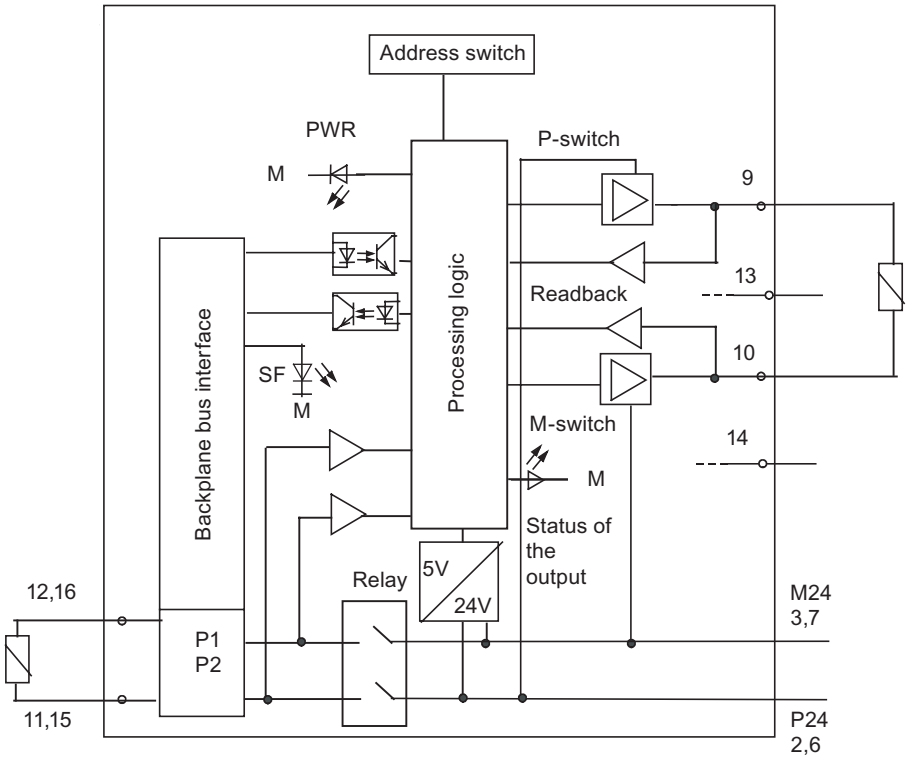

Figure 7-5 Block Diagram of the PM-E F pm DC24V PROFIsafe

Wiring Diagram

Each of the three digital outputs consists of a DOx P P-switch and a DOx M M-switch. They connect the load between P and M-switches. The two switches are always controlled so that voltage is applied to the load.

The wiring for the power module is carried out on the special terminal module.

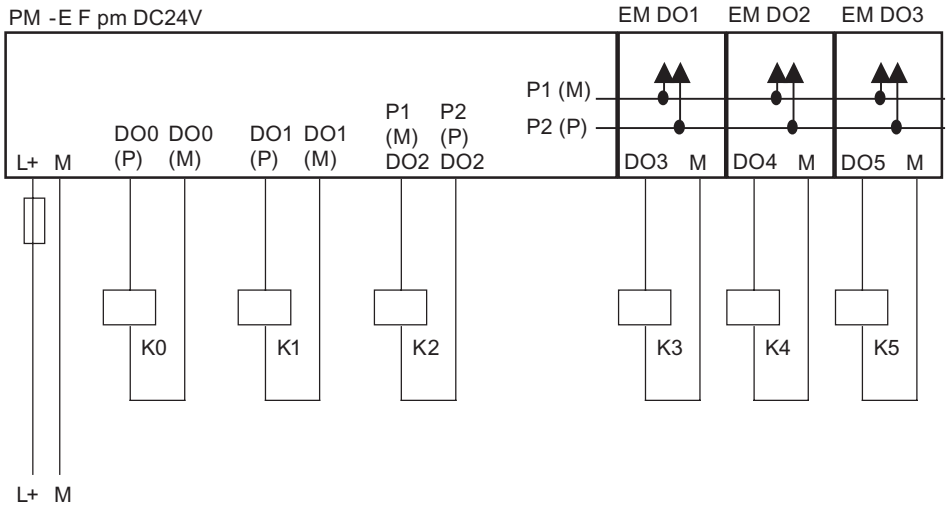

Figure 7-6 Wiring diagram of the PM-E F pm DC24V PROFIsafe

Warning

Please use an external fuse for L+ at the PM-E F pm with the following properties to protect the relay contact from overload: circuit-breaker of B characteristic as per IEC 947-5-1, 10 A.

Relay Output DO 2

The relay output DO 2 connects the voltage L+ and M using one relay contact for each. The voltage is fed outwards to the terminal module and to the internal voltage buses P1 and P2. This results in two connection options that can be used at the same time:

- A load can be connected directly to the terminal module (K2 in the figure above).
- Electronic modules can be supplied by means of the internal voltage buses P1 and P2. Loads can be connected to these modules in turn (K3, K4, K5 in the figure above).