

AMIKON TECHNICAL DOCUMENTATION

Installation Instructions

Siemens 6ES7326-2BF10-0AB0

Ten-Channel Fail-Safe Output Module

OUTPUTS	RATED LOAD	GROUPS	CONNECTOR
10 fail-safe PP	24 V DC /2 A	2 ×5 outputs	40 pins

For qualified personnel only. Isolate the equipment and follow the complete manufacturer and site safety procedures. This reference does not replace the approved project design or the full installation manual.

01

PREPARATION AND WIRING CHECKS

- Match the hardware destination address to the unique configured PROFIsafe address.
- Use SELV/PELV supplies and prevent additive fault voltage above the documented limit.
- Connect 1L+,2L+ and 3L+ using the exact diagram and proper references.
- Route actuator leads to prevent cross circuits between L+ and outputs.
- Check light/dark-test compatibility and the daily-change requirement for the configured safety use.
- Apply orientation and temperature derating to each five-channel group.
- Assess Keep last valid value separately; never describe it as unconditional shutdown.

02

ORIGINAL WIRING REFERENCE

Original source PDF pages 173, 41, 42, 43, 46, 47, 57, 175, 176, 177, 178, 179, 180, 181, 182, 183, 184, 190, 191, 192, 170, 171, 172, 174, 185, 186, 187, 188, 189. The following pages retain the original Siemens drawings and printed page numbers.

[Siemens original documentation and product reference](#)

Wiring and block diagram

The following figure shows the wiring and block diagram of SM 326; F-DO 10 x DC 24V/2A PP.

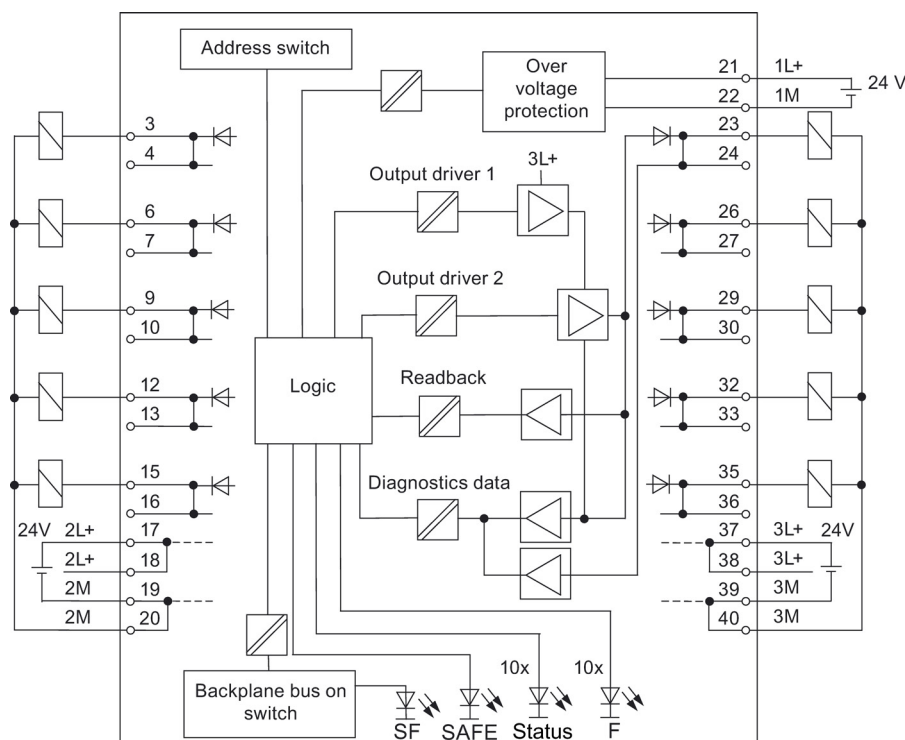


Figure 8-52 Wiring and block diagram of SM 326; F-DO 10 x DC 24V/2A PP

The potential groups 1L+, 2L+ and 3L+ can be supplied by separated power supply units but also by one common power supply unit.

Channel numbers

The channel numbers are used to identify the outputs and to assign channel-specific diagnostic messages.

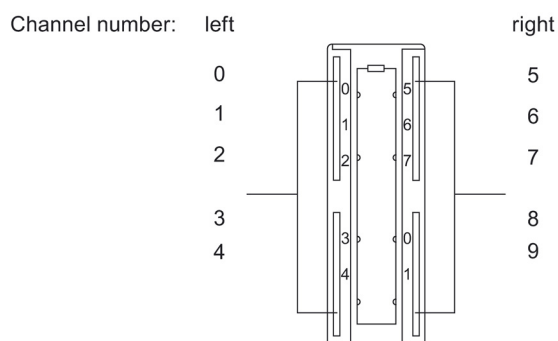


Figure 8-53 Channel numbers for SM 326; F-DO 10 x DC 24V/2A PP

4.3.3 Assigning PROFIsafe Address (F_destination_address) [ID: 431547659]

Introduction

In order to use

- SM 326; DI 24 x DC 24V (as of order no. 6ES7326-1BK01-0AB0),
- SM 326; DO 8 x DC 24V/2A PM,
- SM 326; F-DO 10 x DC 24V/2A PP and the
- SM 336; F-AI 6 x 0/4 ... 20 mA HART

in safety mode, you must perform the following steps:

1. setting the operating mode "Safety mode" for the SM 326; DI 24 x DC 24V
2. Set the PROFIsafe address = F_destination_address using the address switch before you install the fail-safe signal module.

By contrast to the PROFIsafe address setting, which is based on the start address, there is no correlation between the module start address and the PROFIsafe address for the modules mentioned earlier. You set the module start address in the object properties of the module similar to the addressing of S7-300 standard I/O modules in *STEP 7 HW Config*.

Setting safety mode

Set "Safety mode" in the object properties of the module in SM 326; DI 24 x DC 24V (as of order no. 6ES7326-1BK01-0AB0) in *HW Config*.

The SM 326; DO 8 x DC 24V/2A PM, SM 326; F-DO 10 x DC 24V/2A PP and SM 336; F-AI 6 x 0/4 ... 20 mA HART operate in safety mode only. This module is set up permanently for operation in "safety mode".

Assigning PROFIsafe addresses

The PROFIsafe addresses (F_source_address, F_destination_address) are assigned automatically to the two F-SMs mentioned earlier when you configure these modules in *STEP 7*. The F_destination_addresses of the FMs are shown in their object properties in *HW Config* and are returned in binary format at the "DIP switch setting" parameters.

You can edit the configured F_destination_address in *HW Config*. It is advisable, however, to use the F_destination_address which is assigned automatically.

Address switch

The 10-bit DIP switch for addressing is installed in the rear panel of the fail-safe signal modules. This switch is used to determine:

- whether to operate the module in safety mode or in standard mode
- In safety mode: the PROFIsafe address = F_destination_address.

The SM 326; DI 24 x DC 24V is set by default for operation in "standard mode" (all switches are in up position, but you can set all switches to down position, see figure below).

The SM 336; F-AI 6 x 0/4 ... 20 mA HART, SM 326; F-DO 10 x DC 24V/2A PP and SM 326; DO 8 x DC 24V/2A PM will be supplied with a PROFIsafe address of 1 to 1022, which means "safety mode". You can change this, as shown in the figure below.

Setting the address switch

Verify the correct setting of the address switch *before you start installation*.

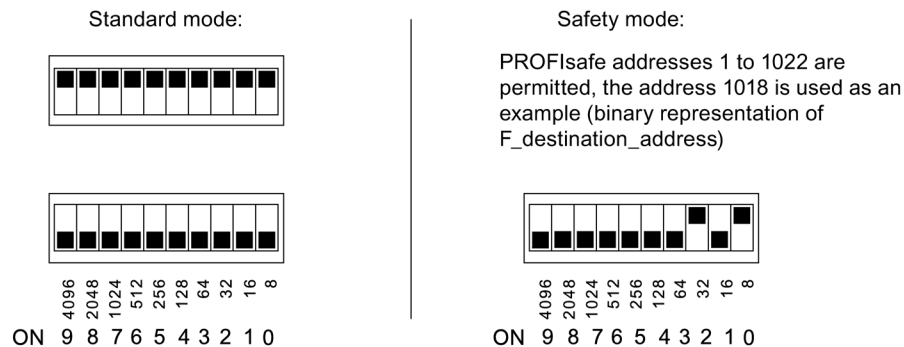


Figure 4-3 Example of address switch (DIP switch) settings

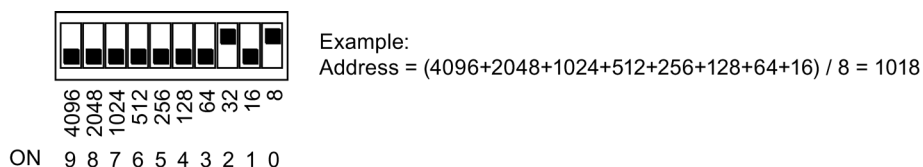


Figure 4-4 Example for calculation of the F_destination_address

Note

An address switch of the smallest possible dimensions is installed for reasons of space saving. This makes it sensitive to pressure and objects with sharp edges. Always use a suitable tool to manipulate the address switch.

A variety of tools suitable for activating the address switch are available on the market, for example, the Grayhill DIPSTICK. A ballpoint pen may be employed if used carefully. It is imperative to avoid any burring that would prevent the switch from reaching its home position. Do not use screwdrivers or knives to manipulate the address switch.

Addressing rules

WARNING

Rule for PROFIBUS subnets:

The PROFIsafe destination address and, thus, the switch setting on the address switch of the F-I/O must be unique network-wide* and station-wide** (system-wide). For S7-300 F-SMs and ET 200S, ET 200eco and ET 200pro F-modules, you can assign a maximum of 1022 different PROFIsafe destination addresses.

Exception: The F-I/O in different I-slaves may be assigned the same PROFIsafe destination address, as they are only addressed within the station, that is, by the F-CPU in the I-slave.

Rules for Ethernet subnets and hybrid configurations of PROFIBUS and Ethernet subnets:

The PROFIsafe destination address and, thus, the address switch setting on the F-I/O have to be unique only*** within the Ethernet subnet, including all lower-level PROFIBUS subnets, and station-wide** (system-wide). For S7-300 F-SMs and ET 200S, ET 200eco and ET 200pro F-modules, you can assign a maximum of 1022 different PROFIsafe destination addresses.

Exception: The F-I/O in different I-slaves may be assigned the same PROFIsafe destination address, as they are only addressed within the station, that is, by the F-CPU in the I-slave.

The networked nodes of an Ethernet subnet are characterized by having IP addresses with the same subnet address, which means the IP addresses match in those digits that have the value "1" in the subnet mask.

Example:

IP address: 140.80.0.2

Subnet mask: 255.255.0.0 = 11111111.11111111.00000000.00000000

Meaning: Bytes 1 and 2 of the IP address define the subnet; subnet address = 140.80

* A network consists of one or several subnets. "Network-wide" means beyond the boundaries of the subnet.

** "Station-wide" means for one station in *HW Config* (for example, an S7-300 station or I-slave)

*** Across Ethernet subnets, excluding cyclic PROFINET IO communication (RT communication)

Address inconsistency

A parameter assignment error is generated if addressing is inconsistent, for example, if the module address differs from the address set in *HW Config*. The module does not enter safety mode.

See also

Assigning PROFIsafe Address (Starting Address of F-SM) (Page 38)

5.1 Safe Functional Extra-Low Voltage for Fail-Safe Signal Modules [ID: 431563275]

PELV

WARNING

Fail-safe signal modules must be operated with safe functional extra low voltage (SELV, PELV). That is, the fail-safe modules may only be exposed to a maximum fault voltage of V_m . Rule for all fail-safe signal modules:

$$V_m < 60.0 \text{ V}$$

Additional information about PELV is available in the data sheets of the power supply modules to be installed, for example.

All system components which supply electrical power in any form must meet this condition.

Each additional power circuit (24 V DC) installed in the system must be operated with safe functional extra low voltage (SELV, PELV). Refer to the data sheets or contact the manufacturer for information.

You should also note that the sensors and actuators connected to the I/O modules may be connected to an auxiliary power supply. Make sure that such auxiliary power supplies conform to PELV requirements. The process signal of a 24 V digital module may not develop a fault voltage in excess of V_m .

WARNING

All power sources such as the internal and external 24 V DC load voltage supplies, and the 5 VDC bus voltage must be galvanically interconnected so that any development of cumulative voltage at the individual voltage sources which may lead to a fault voltage higher than V_m is safely ruled, irrespective of any potential differences.

Make sure that the conductor cross-sections used for the galvanic interconnections are compliant with S7-300 installation guidelines (see the *S7-300 Automation System: CPU 31xC and CPU 31x: installation* Operating Instructions).

The fail-safe signal modules and all their standard components can be operated in standard and safety mode on a single or on several shared power supply modules.

Power supply requirements for compliance with the NAMUR recommendation

Note

Always use power supply modules/units (230 V AC → 24 V DC) with integrated function for power failure backup for the duration of at least 20 ms in accordance with NAMUR recommendation NE 21, IEC 61131-2, and EN 298. Power supply components available (examples):

S7-400

- 6ES7407-0KA01-0AA0 for 10 A
- 6ES7407-0KR00-0AA0 for 10 A

S7-300

- 6ES7307-1BA00-0AA0 for 2 A
- 6ES7307-1EA00-0AA0 for 5 A
- 6ES7307-1KA00-0AA0 for 10 A

These requirements, of course, also apply to power supply modules/units which are not produced according to S7-300/400 installation technology.

6.1.3 Fault reactions in safety mode with parameter setting "Keep last valid value" [ID: 16215132811]

Applications

Typical applications for safety mode with parameter setting "Keep last valid value" are:

- Ventilation systems
- Smoke flaps

Fault reactions

Note

Consult the respective standards for installation.

Note

Only standards EN54-2 /-4 or NFPA72 will be met with parameter setting "Keep last valid value".

The last valid value will be retained in case of the following communication errors/interruptions:

- STOP of F-CPU (interruption of PROFIsafe communication)
- Interruption of PROFIsafe communication
 - in case of CRC errors
 - Interruption of PROFIBUS/PROFINET connection
 - Timeout of data frame monitoring
- Error in safety program of the F-CPU
- Error in PROFIsafe protocol

The current process value will be issued again once PROFIsafe communication resumes.

The safe status "0" will be assumed at the digital output module in case of the following errors:

- Channel errors (independent of parameter "Behavior after channel faults")
- Module faults

With a pending channel fault in connection with *S7 Distributed Safety*, the last valid value of all error-free channels will be retained after a STOP-RUN transition of the F-CPU until reintegration. You will have to correct the channel fault before reintegration if the parameter "Behavior after channel fault" is set to "Passivate the entire module".

To increase availability use application 6 of the SM 326; F-DO 10 x DC 24V/2A PP.

The typical break between two test pulses is 0.5 seconds. There can be another test pulse ① in between. The gap between the first test pulse and the additional test pulse is one module cycle.

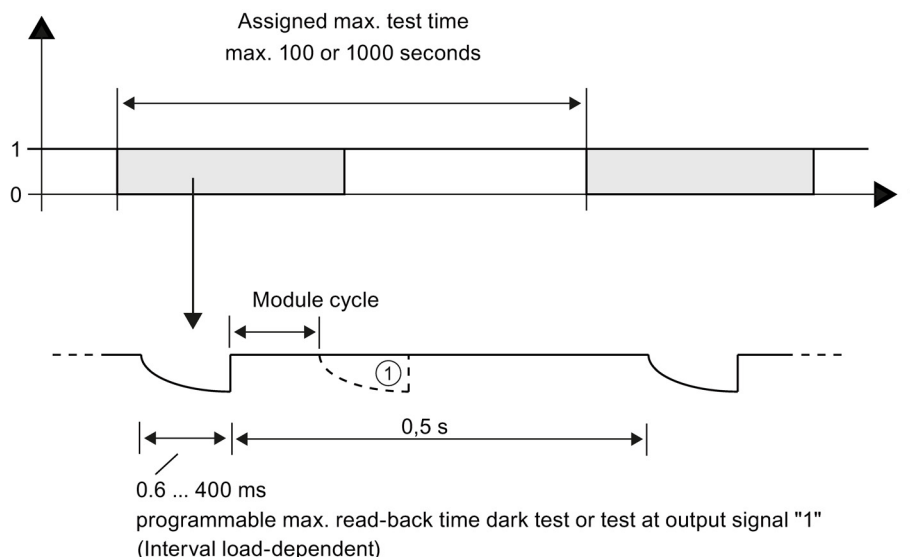


Figure 8-56 Dark test

The typical break between two test pulses is 0.5 seconds. There can be another test pulse ① in between. The gap between the first test pulse and the additional test pulse is one module cycle.

With redundant interconnection, both modules conduct the light and dark test in an asynchronous manner. This can result in an overlap of the test pulses.

Avoiding dark periods when operating in safety mode

Note

If you are using actuators that respond too fast (i.e. < 1 ms) to "dark period" test signals, you can nonetheless use the internal test coordination by wiring two opposite outputs (with assigned redundancy) in parallel using a series diode. Parallel wiring suppresses the dark periods. For more information, refer to the chapter "Application 5.1: Wiring two outputs in parallel for dark period suppression (Page 179)".

8.7.3 Applications 1 to 4 [ID: 15039296779]

Applications 1 and 2 are omitted because the module supports only safety mode.

Applications 3 and 4 are omitted because the module supports SIL3/Cat.4/PLe.

8.7.4 Application 5: Safety mode SIL3/Cat.4/PLe [ID: 14338159627]

Introduction

Below are the wiring scheme and the parameter assignment of SM 326; F-DO 10 x DC 24V/2A PP for

- Application 5: Safety mode SIL3/Cat.4/PLe.

Diagnostic messages, possible causes of the problem and their corrective measures are found in tables in the chapter "Diagnostic messages SM 326; F-DO 10 x DC 24V/2A PP (Page 185)".

Note

In case of parameter setting with SIL3

The signal at the output has to change daily or even more frequently. If this is not the case with the "0" signal, you will have to activate the light test that meets this condition.

Wiring scheme of application 5

Single-channel connection of one sensor for each process signal. The load voltage supply is wired to terminals 2L+/2M, 3L+/3M of the digital module.

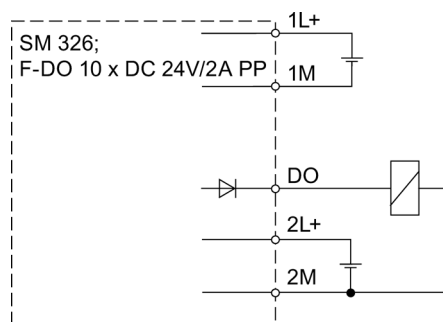


Figure 8-57 Wiring scheme of the SM 326; F-DO 10 x DC 24V/2A PP for application 5

! WARNING

It is no longer possible to shut down an actuator if a cross circuit has developed between 2L+ and DO. To prevent cross circuits between 2L+ and DO, you must route the cables used to connect the actuators in a cross-circuit-proof manner (for example, as separate, sheathed cables or in separate cable ducts).

Connecting two actuators to one digital output

The fail-safe digital output is capable of switching two actuators. The following conditions have to be met:

- Wire L+ and M of the actuators to 2L+ and 2M of the module (same reference potential required).

The actuators can be wired to any one of the 10 digital outputs. The figure below shows an example of an output wiring. This circuit is compliant with SIL 3/Cat. 4/PLe.

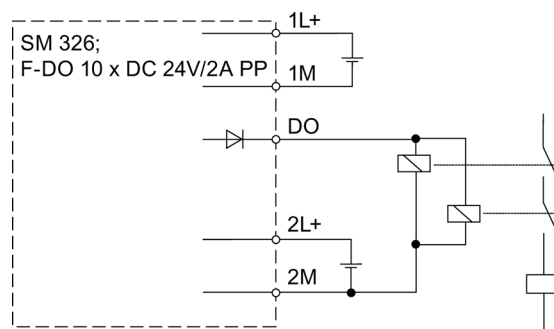


Figure 8-58 Wiring scheme 2 actuators at digital output of SM 326; F-DO 10 x DC 24V/2A PP

! WARNING

It is no longer possible to shut down an actuator if a cross circuit has developed between 2L+ and DO. To prevent cross circuits between 2L+ and DO, you must route the cables used to connect the actuators in a cross-circuit-proof manner (for example, as separate, sheathed cables or in separate cable ducts).

Assignable parameters for application 5

Table 8- 23 Parameters for application 5 of SM 326; F-DO 10 x DC 24V/2A PP

Parameters	Range of values	Type	Effective range
"Parameters" tab			
Mode of operation	Safety mode	Static	Module
F_Monitoring_Time (ms)	10 ms to 10000 ms	Static	Module
Diagnostic interrupt	Activated/deactivated	Static	Module
Fail-safe value	Switch to fail-safe value "0" Keep last valid value	Static	Module
Maximum test period	100 / 1000 s	Static	Module
Load voltage failure diagnostics	Activated/deactivated	Static	Channel group
Activated	Activated	Static	Channel
Diagnostics: Wire break	Activated/deactivated	Static	Channel
Activated light test	Activated/deactivated	Static	Channel
Max. time for light test (ms)	0.6 ms to 5 ms	Static	Channel
Max. read-back time for dark test (ms)	0.6 ms to 400 ms	Static	Channel
Redundant switched	Deactivated	Static	Channel

8.7.5 Application 5.1: Wiring two outputs in parallel for dark period suppression [ID: 14338161163]

Applications

Parallel operation of two outputs for dark period suppression is possible for all applications in safety mode (application 5).

Note

In case of parameter setting with SIL3

The signal at the output has to change daily or even more frequently. If this is not the case with the "0" signal, you will have to activate the light test that meets this condition.

WARNING

Note for "Keep last valid value" parameter setting:

If a module output is 0 due to a channel/module fault and the redundant module output is 1 due to a communication fault/interruption, the process value 1 will be created.

Also note the table "Reaction of the SM 326; F-DO x DC 24V/2A PP to CPU Stop" in the chapter "Fault reactions in safety mode (Page 54)".

WARNING

Prevent short circuits to L+ at the SM 326; F-DO 10 x DC 24V/2A PP with protected routing of the signal lines, because the actuator will remain activated otherwise.

In case of a short circuit to L+ it may happen in case of redundant wiring at the output with configured redundancy operation that the associated output will not be switched off.

Wiring scheme

Interconnect two *opposite outputs* with assigned redundancy to form a single output. The parallel circuit in combination with an internal test coordination between the outputs 0 to 4 and 5 to 9 suppresses the "0" test pulse (dark period).

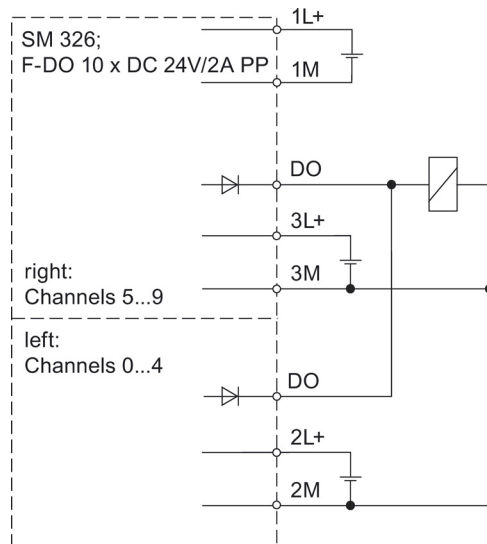


Figure 8-59 Wiring two outputs in parallel for dark period suppression of the SM 326; F-DO 10 x DC 24V/2A PP

Note

Use the same reference potential for 2M and 3M.

Note

If you are using actuators that respond too fast (< 1 ms) to "dark period" test signals, you can nonetheless use the internal test coordination by wiring two opposite outputs in parallel (with assigned redundancy). Parallel wiring suppresses the dark periods.

Parameters	Range of values	Type	Effective range
"Parameters" tab			
Mode of operation	Safety mode	static	module
F_Monitoring_Time (ms)	10 ms to 10000 ms	Static	Module
Diagnostic interrupt	Activated/deactivated	Static	Module
Fail-safe value	<i>Switch to fail-safe value</i> Keep last valid value	Static	Module
Maximum test period	100 / 1000 s	Static	Module
Load voltage failure diagnostics	Activated/deactivated	Static	Channel group
Activated	Activated/deactivated	Static	channel
Diagnostics: Wire break	Activated/deactivated	Static	Channel
Activated light test	Activated/deactivated	Static	Channel
Max. time for light test (ms)	0.6 ms to 5 ms	Static	Channel
Max. read-back time for dark test (ms)	0.6 ms to 400 ms	Static	Channel
Redundant switched	<i>Activated</i>	Static	Channel

Always set the interconnected outputs in parallel instead of setting only one output. Process signals of a redundant I/O system require four outputs with assigned redundancy.

8.7.6 Application 6: Safety mode SIL3/Cat.4/PLe with high availability (in S7 F/FH Systems only) [ID: 14338160395]

Introduction

Below are the wiring scheme and the parameter assignment of SM 326; F-DO 10 x DC 24V/2A PP for

- Application 6: Safety mode SIL3/Cat.4/PLe with high availability

Diagnostic messages, possible causes of the problem and their corrective measures are found in tables in the chapter "Diagnostic messages SM 326; F-DO 10 x DC 24V/2A PP (Page 185)".

Note

In case of parameter setting with SIL3

The signal at the output has to change daily or even more frequently. If this is not the case with the "0" signal, you will have to activate the light test that meets this condition.

WARNING

Note for "Keep last valid value" parameter setting:

If a module output is 0 due to a channel/module fault and the redundant module output is 1 due to a communication fault/interruption, the process value 1 will be created.

Also note the table "Reaction of the SM 326; F-DO x DC 24V/2A PP to CPU Stop" in the chapter "Fault reactions in safety mode (Page 54)".

WARNING

Prevent short circuits to L+ at the SM 326; F-DO 10 x DC 24V/2A PP with protected routing of the signal lines, because the actuator will remain activated otherwise.

In case of a short circuit to L+ it may happen in case of redundant wiring at the output with configured redundancy operation that the associated output will not be switched off.

Wiring scheme of application 6

Each process signal requires one actuator which is controlled redundantly by the two digital modules. The load voltage supply is wired to terminals 2L+/2M, 3L+/3M of the digital module.

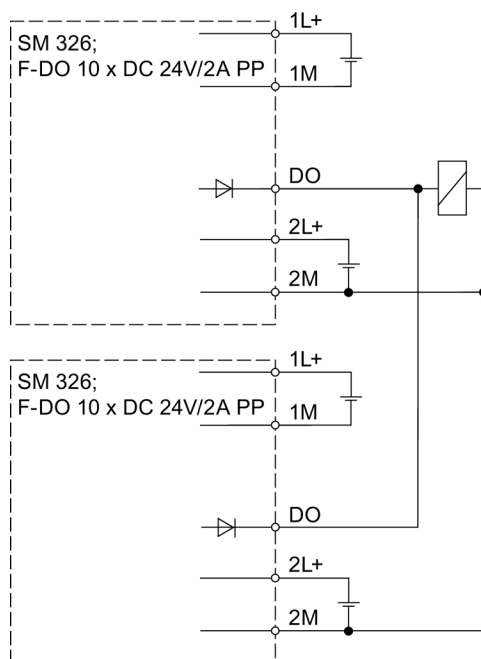


Figure 8-60 Wiring scheme of the SM 326; F-DO 10 x DC 24V/2A PP for application 6

Note

Use the same reference potential for both modules.

Assignable parameters for application 6

Table 8- 24 Parameters for application 6 of SM 326; F-DO 10 x 24V/2A PP

Parameters	Range of values	Type	Effective range
"Parameters" tab			
Mode of operation	Safety mode	Static	Module
F_Monitoring_Time (ms)	10 ms to 10000 ms	Static	Module
Diagnostic interrupt	Activated/deactivated	Static	Module
Fail-safe value	<i>Switch to fail-safe value</i> Keep last valid value	Static	Module
Maximum test period	100 / 1000 s	Static	Module
Load voltage failure diagnostics	Activated/deactivated	Static	Channel group
Activated	Activated/deactivated	Static	Channel
Diagnostics: Wire break	Activated/deactivated	Static	Channel
Activated light test	Activated/deactivated	Static	Channel
Max. time for light test (ms)	0.6 ms to 5 ms	Static	Channel
Max. read-back time for dark test (ms)	0.6 ms to 400 ms	Static	Channel
Redundant switched	<i>Activated</i>	Static	Channel

8.7.8 Technical data - SM 326; F-DO 10 x DC 24V/2A PP [ID: 14338161931]

Overview

Technical specifications	
Dimensions and weight	
Dimensions W x H x D (mm)	40 x 125 x 120
Weight	ca. 330 g
Module-specific specifications	
Number of outputs	10
Assigned address area	
• In the I/O input area	6 bytes
• In the I/O output area	8 bytes
Cable length	
• Unshielded	Max. 600 m
• Shielded	Max. 1000 m (see note at end of table)
Front connectors	40-pin
Maximum achievable Safety Integrity Level in safety mode	
• According to IEC 61508:2000	SIL 3
• According to ISO 13849-1:2006 or EN ISO 13849-1:2008	Cat. 4/PLe
Fail-safe performance characteristics	
• low demand mode (average probability of failure on demand)	< 1.00E-05
• high demand / continuous mode (probability of a dangerous failure per hour)	< 1.00E-09
Proof-test interval	20 years
Voltages, Currents, Potentials	
Rated supply voltage of the electronics 1L+	24 V DC
• Reverse polarity protection	Yes
Rated load voltage 2L+/3L+	24 V DC
• Reverse polarity protection	No
Aggregate current of outputs (per group)	
• Horizontal installation Up to 40 °C Up to 50 °C Up to 60 °C	Max. 10 A Max. 7 A Max. 6 A
• Vertical installation Up to 40 °C	Max. 5 A

Technical specifications	
Electrical isolation	
• Between channels and backplane bus	Yes
• Between channels and the power supply of the electronics	Yes
• Between channels In groups of	Yes 5
Permitted potential difference Between different circuits	75 V DC 60 V AC
Insulation test voltage	370 V AC for 1 min.
Current consumption	
• From backplane bus	Max. 100 mA
• From supply voltage 1L+	Max. 100 mA
• From load voltage 2L+ / 3L+ (no-load)	Max. 100 mA
Power loss of the module	6 W, typical
Status, Interrupts, Diagnostics	
Status display	1 green LED 1 red LED
Interrupts	
Diagnostic interrupt	Configurable
Diagnostics functions	Configurable
Group fault display	Red LED (SF)
Fail-safe mode display	Green LED (SAFE)
Diagnostic information can be read out	Possible
Fail-safe values	Switch to / Keep last valid value
Actuator selection data	
Output voltage	
• For "1" signal	Minimum L+ (-1.0 V)
Output current	
• For "1" signal – Rated value – Approved range	2 A 7 mA to 2.4 A
• For "0" signal (residual current)	Max. 0.5 mA
Load resistance range	
• Up to 40 °C	12 Ω to 3.4 kΩ
• Up to 60 °C	12 Ω to 3.4 kΩ
Lamp load	Max. 5 W
Parallel switching of 2 outputs	
• For redundant load control	With assigned redundancy
• For power increase	Not possible

Technical specifications	
Control of a digital input	Possible
Switching frequency	
• With resistive load	Max. 25 Hz symmetrical
• with inductive load (see section "Switching capacitive and inductive loads (Page 349)")	Max. 25 Hz symmetrical
• With inductive load in accordance with IEC 60947-5-1, DC 13	Max. 0.5 Hz symmetrical
• With lamp load	Max. 10 Hz symmetrical
Internal limit of the inductive shutdown voltage	type L+ (-33 V)
Short-circuit protection of output	Yes, electronic
• Response threshold	2.6 to 4.5 A
• Response threshold of redundant interconnection	2.6 to 9 A
Actuator timing requirements	Actuator must not respond if: • Dark period < 0.6 ms • Light period < 0.6 ms (refer to section "Sensor and Actuator Requirements for F-SMs in Safety Mode (Page 50)")
Time, Frequency	
Internal preparation time for	
• Safety mode	Max. 8 ms
• Redundant safety mode	Max. 8 ms
Acknowledgment time	
• In safety mode	Max. 10 ms

Note

To reach the maximum cable length, it may be necessary to increase the settings for maximum light test time or maximum read-back time dark test.

We also recommend a more detailed consideration of the boundary conditions, such as EMC, cables used, cable guide, etc.

8.7 SM 326; F-DO 10 x DC 24V/2A PP (6ES7326-2BF10-0AB0)

8.7.1 Properties, front view, wiring diagram and block diagram [ID: 14338158091]

Order number

6ES7326-2BF10-0AB0

Properties

SM 326; F-DO 10 x DC 24V/2A PP has the following properties:

- 10 outputs, two electrically isolated groups of 5
- Output current 2 A
- Rated load voltage 24 V DC
- Protection against short circuit and overload
- Suitable for solenoid valves, DC relay contactors, and signal lamps
- Assignable redundant operation
- Operation in safety mode
- SIL3/Cat.4/PLe can be achieved without safety protector
- Group fault display (SF)
- Safety mode display (SAFE)
- Status display for each channel (green LED)
- Display of channel-specific errors (red LED)
- Programmable diagnostics functions
- Programmable diagnostic interrupt
- Firmware update via *HW Config*
- I&M identification data
- can be used with PROFINET IO
- "Keep last valid value" parameter
- Simplified redundant circuit
- Channel-selective passivation

Note

The fail-safe performance characteristics in the technical data apply to a proof-test interval of 20 years and a mean time to repair of 100 hours.

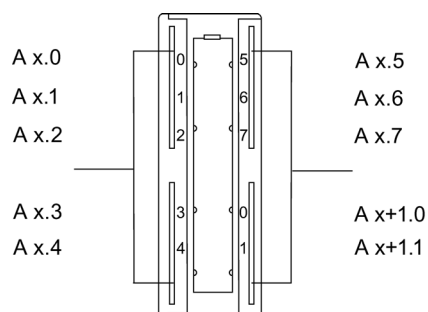
"Keep last valid value" parameter setting**⚠ WARNING**

If "Keep last valid value" has been assigned, the last valid process value 0 *or* 1 will be retained with events such as abort of PROFIsafe communication or F-CPU stop.

For more information, refer to the section entitled "Fault reactions in safety mode with parameter setting "Keep last valid value" (Page 57)".

Address assignment

Check the output address in the user program:



x = Module start address

Figure 8-50 Address assignment for SM 326; F-DO 10 x DC24V/2A PP

Front view

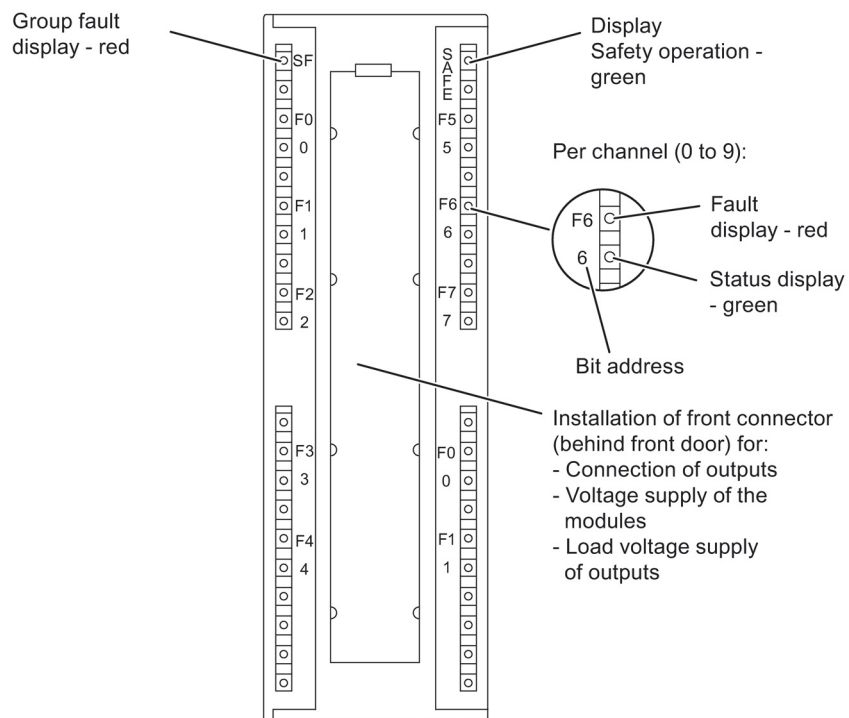


Figure 8-51 Front view of SM 326; F-DO 10 x DC 24V/2A PP

8.7.2 SM 326; F-DO 10 x DC 24V/2A PP applications [ID: 14338158859]

Selecting the application

The figure below helps you to select an application based on availability and fail-safe operation requirements. The next pages provide information on the module wiring for a specific application, and on the parameters to set in *STEP 7* using the *S7 Distributed Safety* or *S7 F Systems* optional package.

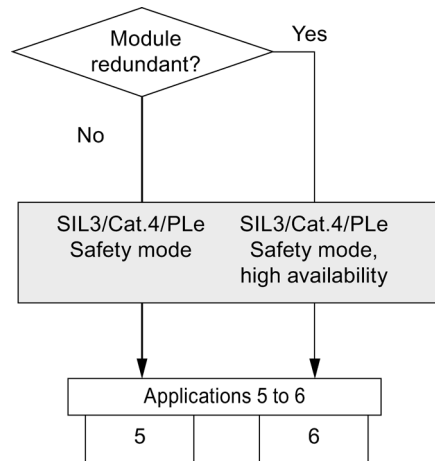


Figure 8-54 Application Selection - SM 326; F-DO 10 x DC 24V/2A PP

Test pulses of the light and dark test

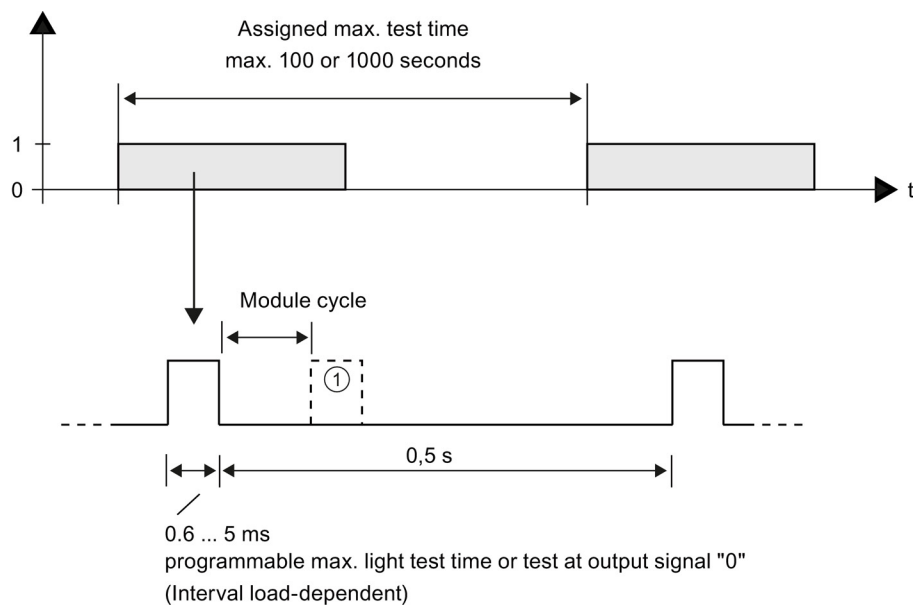


Figure 8-55 Light test, if assigned

8.7.7 Diagnostic messages SM 326; F-DO 10 x DC 24V/2A PP [ID: 14518644107]

Diagnostics using the LED display

The F-SM indicates faults by means of its SF LED (group fault LED). The SF LED is activated when the F-SM generates a diagnostic message.

The SF LED flashes as long as a cleared fault has not been acknowledged. It goes dark when all faults have been eliminated and acknowledged.

The SF LED flashes until you acknowledge passivation following a module fault.

Possible diagnostic messages

The following table provides an overview of the diagnostic messages for SM 326; F-DO 10 x DC 24V/2A PP.

Diagnostic messages are assigned either to a channel or to the entire module. Some diagnostic messages occur only in certain applications.

Table 8- 25 Diagnostic messages of SM 326; F-DO 10 x DC 24V/2A PP

Diagnostic message	Signaled in the application	Effective range of diagnostics	Assignable
Wire break	5, 6	Channel	Yes
Short-circuit of output to M, or defective output driver			No
Short circuit of output to L+, or defective output driver	5	Module	
Module parameters not assigned	5, 6	Module	
Incorrect module parameters			
Communication error			
Internal supply voltage of the module failed			
Time monitoring activated (watchdog)			
EPROM fault; RAM fault			
Internal error in read circuit/test circuit, or defective sensor supply			
Processor failure			
Parameter assignment error (with specification of a consecutive number)			
No external auxiliary voltage			
External load voltage missing			
Defective main switch			
Defective output driver			
Overtemperature at output driver			
Defective load voltage or load voltage not connected		Channel group	
CRC signature error	5, 6		
Timeout of safety message frame monitoring		Module	
Switching frequency too high		Channel	

Causes of the problem and corrective measures

The table below shows possible causes of the problem and appropriate corrective measures for the individual diagnostic messages of SM 326, F-DO 10 x DC 24V/2A PP.

Table 8- 26 Diagnostic messages and associated corrective measures for SM 326; F-DO 10 x DC 24V/2A PP

Diagnostic message	Error detection	Possible causes of the problem	Corrective measures
Wire break	Only if the output = 1 or during light period test	Wire break between the module and actuator	Restore the cable connection
		Channel not connected (open)	Disable the "Group Diagnostics" for the channel in the parameter settings.
		Short-circuit to L+ at the output	Eliminate the short-circuit
		Short-circuit between channels which carry different signals	Eliminate the short-circuit
Short-circuit of output to M, or defective output driver	Only if the output = 1 or during light period test	Output overload	Remove the overload within 100 hours after the fault has occurred.
		Short-circuit to M at the output	Remove the short circuit within 100 hours after the fault has occurred.
		Undervoltage at load voltage supply	Check the load voltage supply
		Defective output driver	Replace the module
Short circuit of output to L+, or defective output driver	For non-redundant operation	Short-circuit to L+ at the output	Remove the short circuit within 100 hours after the fault has occurred. Module reset required (cycle power supply off/on)
		Short-circuit between channels which carry different signals	Remove the short circuit within 100 hours after the fault has occurred. Module reset required (cycle power supply off/on)
	general	Defective output driver	Replace the module
Module parameters not assigned	General	No parameters transferred to module	Assign new module parameters
Incorrect module parameters	general	Faulty parameters transferred to module	Assign new module parameters
Internal supply voltage of the module failed	general	Internal fault at supply voltage 1L+	Replace the module

Diagnostic message	Error detection	Possible causes of the problem	Corrective measures
Time monitoring activated (watchdog)	general	Overload due to diagnostics request (SFCs)	Reduce the number of diagnostics requests
		Electromagnetic interference has exceeded limits	Eliminate the interference
		Defective module	Replace the module
Communication error	general	Error in communication between the CPU and the module, for example, due to defective PROFIBUS connection or electromagnetic interference in excess of limits.	Check the PROFIBUS connection Eliminate the interference
		Timeout of data frame monitoring	Check the monitoring time parameters
		CRC signature error, for example, due to electromagnetic interference in excess of limits.	Eliminate the interference
		CPU is in STOP	Read the diagnostics buffer
EPROM error RAM error	general	Electromagnetic interference has exceeded limits	Eliminate the interference and cycle power supply OFF/ON
		Defective module	Replace the module
Internal error in read / test sequence	General	Defective module	Replace the module
Processor failure	general	Electromagnetic interference has exceeded limits	Eliminate the faults, and then remove and insert the module
		Defective module	Replace the module
		Switching rate exceeded	Reduce switching rate
Parameter assignment error (with specification of a consecutive number)	general	Error in dynamic parameter reassignment	Check the parameter assignment in the user program. Contact SIMATIC Customer Support if necessary
No external auxiliary voltage	general	Supply voltage 1L+ of module missing	Connect 1L+
External load voltage missing	general	Supply voltage 1L+ of module missing	Feed in voltage supply
Defective main switch	general	Defective module	Replace the module
Defective output driver	general	Defective module	Replace the module
Overtemperature at output driver	general	Output overload	Eliminate the cause of overload
		Internal fault at output driver	Replace the module

Diagnostic message	Error detection	Possible causes of the problem	Corrective measures
Defective load voltage or load voltage not connected	general	Load voltage 2L+, 3L not connected	Connect 2L+ and 3L+
		Load voltage external error	Replace the module
CRC signature error	general	CRC signature error during communication between the CPU and the module has occurred, for example, due to electromagnetic interference in excess, faults during sign-of-life monitoring error, in case of voltage drop or standard program accesses F-SM.	Eliminate the interference
Timeout of safety message frame monitoring	general	Assigned monitoring time exceeded	Check the monitoring time parameters
		Startup of the fail-safe signal module	—
Message frame error	general	Sign-of-life and/or CRC signature entered in the data message frame	Check the sign-of-life and CRC signature entries in the data message frame for "0" value
Switching frequency too high	general	Switching frequency too high	Reduce the switching frequency

Note

Note that an inductive load connected to the DO channels can induce voltages due to interference of a strong, magnetic field. This situation can result in the diagnostic message short circuit.

Remedy:

- Create a spatial separation of the inductive loads and shield the magnetic field.
- Configure the read-back time of the dark test with 50 ms or greater.

Note

In case of a wire break at an actuator with redundant control by two modules, both modules will report a wire break. The wire break diagnostic will come at a later time.

Note

If the F-SM detects an external P-short circuit on a channel, it will turn off all channels that route "1" signals and are not configured redundantly.

The channels that are actually affected will be determined afterwards; channels without active fault can be reintegrated at this time.