



EN Operating instructions. . . . . pages 1 to 6  
Original

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**1. About this document**

**1.1 Function**

This operating instructions manual provides all the information you need for the mounting, set-up and commissioning to ensure the safe operation and disassembly of the safety switchgear. The operating instructions must be available in a legible condition and a complete version in the vicinity of the device.

**1.2 Target group: authorised qualified personnel**

All operations described in this operating instructions manual must be carried out by trained specialist personnel, authorised by the plant operator only.

Please make sure that you have read and understood these operating instructions and that you know all applicable legislations regarding occupational safety and accident prevention prior to installation and putting the component into operation.

The machine builder must carefully select the harmonised standards to be complied with as well as other technical specifications for the selection, mounting and integration of the components.

**1.3 Explanation of the symbols used**



**Information, hint, note:**

This symbol is used for identifying useful additional information.



**Caution:** Failure to comply with this warning notice could lead to failures or malfunctions.

**Warning:** Failure to comply with this warning notice could lead to physical injury and/or damage to the machine.

**1.4 Appropriate use**

The Schmersal range of products is not intended for private consumers.

The products described in these operating instructions are developed to execute safety-related functions as part of an entire plant or machine. It is the responsibility of the manufacturer of a machine or plant to ensure the correct functionality of the entire machine or plant.

The safety switchgear must be exclusively used in accordance with the versions listed below or for the applications authorised by the manufacturer. Detailed information regarding the range of applications can be found in the chapter "Product description".

**1.5 General safety instructions**

The user must observe the safety instructions in this operating instructions manual, the country specific installation standards as well as all prevailing safety regulations and accident prevention rules.



Further technical information can be found in the Schmersal catalogues or in the online catalogue on the Internet: [products.schmersal.com](http://products.schmersal.com).

The information contained in this operating instructions manual is provided without liability and is subject to technical modifications.

There are no residual risks, provided that the safety instructions as well as the instructions regarding mounting, commissioning, operation and maintenance are observed.

### 1.6 Warning about misuse



In case of improper use or manipulation of the safety switch-gear, personal hazards or damages to machinery or plant components cannot be excluded.

### 1.7 Exclusion of liability

We shall accept no liability for damages and malfunctions resulting from defective mounting or failure to comply with this operating instructions manual. The manufacturer shall accept no liability for damages resulting from the use of unauthorised spare parts or accessories.

For safety reasons, invasive work on the device as well as arbitrary repairs, conversions and modifications to the device are strictly forbidden; the manufacturer shall accept no liability for damages resulting from such invasive work, arbitrary repairs, conversions and/or modifications to the device.

## 2. Product description

### 2.1 Ordering code

This operating instructions manual applies to the following types:

#### FWS 2105<sup>①</sup>

No.	Option	Description
①		Standstill frequencies of the inputs X2/X4:
	A	1 Hz/2 Hz
	C	1 Hz/1 Hz



Only if the information described in this operating instructions manual are realised correctly, the safety function and therefore the compliance with the Machinery Directive is maintained.

### 2.2 Special versions

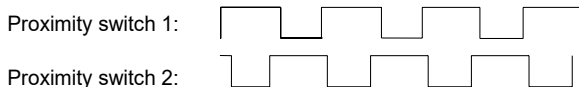
For special versions, which are not listed in the order code below 2.1, these specifications apply accordingly, provided that they correspond to the standard version.

### 2.3 Purpose

The fail-safe standstill monitors are designed for control cabinet mounting. Standstill monitors check for the fail-safe detection of the machine standstill and control of solenoid interlocks. As soon as the fail-safe standstill monitor has detected the standstill, the solenoid interlock is controlled through the potential-free contacts of two safety relays. For the standstill detection, the signals of two proximity switches are evaluated. The fail-safe standstill monitors meet the requirements of PL d or category 3 to EN ISO 13849-1.

To determine the Performance Level (PL) to EN ISO 13849-1 of the entire safety function (e.g. sensor, logic, actuator), an assessment of all relevant components is required.

It is recommended to install the proximity switches on a disc cam so that at least one proximity switch is always actuated. This can be realised by a minimum 1:1 division of the disc cam. When the proximity switches are correctly installed, the following unique signal sequence should be obtained by the utilisation of the switching hysteresis of the proximity switches during the rotation of the disc cam.



The adjustment of the proximity switches is facilitated, when the cam has a 2:1 division (or higher).

### Design

The fail-safe standstill monitor has a dual-channel structure. It includes two safety relays with monitored positive guided contacts, which are controlled by two microprocessors, which are independent from one another. The series-wired NO contacts of the relays build the enabling paths.

The feed cables of both proximity switches (power supply) must be laid so that in case of a wire breakage only one proximity switch is dead (star-shaped routing).



To determine the Performance Level (PL) to EN ISO 13849-1 of the entire safety function (e.g. sensor, logic, actuator), an assessment of all relevant components is required.



The entire concept of the control system, in which the safety component is integrated, must be validated to the relevant standards.

### 2.4 Technical data

Standards:	EN 60947-5-1, EN ISO 13849-1, EN ISO 13849-2
Feedback circuit (Y/N):	no
Standstill frequency:	Version A: X1/X2: 1 Hz / 2 Hz Version C: X1/X2: 1 Hz / 1 Hz other versions: upon request
Rated operating voltage U <sub>e</sub> :	24 ... 230 VAC/DC
Operating current I <sub>e</sub> :	max. 0.4 A
Rated insulation voltage U <sub>i</sub> :	250 V
Internal electronic protection (Y/N):	no
Power consumption:	< 5 W
Readiness after switching on voltage:	< 1.5 s
<b>Inputs monit:</b>	
Short-circuit recognition:	no
Wire breakage detection:	yes
Earth connection detection:	no
Hysteresis:	10% of the standstill frequency
Max. input frequency:	4,000 Hz
Min. impulse duration:	125 µs
<b>Outputs:</b>	
Stop category 0:	1
Stop category 1:	0
Number of safety contacts:	1
Number of auxiliary contacts:	0
Number of signalling outputs:	2
Max. switching capacity of the safety contacts:	6 A
Max. fuse rating:	4 A gG D-fuse
Required short-circuit current:	1,000 A
Utilisation category to EN 60947-5-1:	AC-15: 230 V / 3 A DC-13: 24 V / 2 A
Mechanical life:	> 50 million operations
LED display:	ISD
<b>Ambient conditions:</b>	
Environmental temperature:	0 °C ... +55 °C
Storage and transport temperature:	-25 °C ... +70 °C
Degree of protection:	Enclosure: IP40 Terminals: IP20 Clearance: IP54
Degree of pollution:	2
Mounting:	snaps onto standard rail to EN 60715
Connection type:	Screw connection
Cable type:	solid strand or multi-strand lead
Cable section:	0.2 ... 2.5 mm <sup>2</sup> (incl. conductor ferrules)
Tightening torque:	0.6 Nm
Weight:	275 g

**2.5 Classification**

Standards:	EN ISO 13849-1
PL:	d
Category:	3
PFH-value:	1.0 x 10 <sup>-7</sup> / h, applicable for applications with up to max. 50,000 switching cycles / year and max. 80 % contact load. Diverging applications upon request.
Mission time:	20 years

**3. Mounting**

**3.1 General mounting instructions**

Mounting: snaps onto standard rails to EN 60715.

**3.2 Dimensions**

Device dimensions (H/W/D): 100 x 45 x 121 mm

**4. Electrical connection**

**4.1 General information for electrical connection**



The electrical connection may only be carried out by authorised personnel in a de-energised condition.

Settle length **x** of the conductor: 8 mm



Wiring examples: see appendix



To avoid EMC disturbances, the physical ambient and operational conditions at the place where the product is installed, must meet the provisions laid down in the paragraph "Electromagnetic Compatibility (EMC)" of EN 60204-1.

**5. Operating principle and settings**

**5.1 Operating principle after the operating voltage is switched on**

After the operating voltage has been applied, the internal functions and the condition of the safety relays will be tested by the fail-safe standstill monitor during the initialization phase. After this check, the inputs of the fail-safe standstill monitor will be evaluated.

The cyclic frequency of the connected proximity switches is compared to a programmed limit frequency. If the value drops below the programmed frequency and at least one proximity switch is actuated, both safety relays are actuated and the enabling paths are closed. If the limit frequency is exceeded at one or both cyclic inputs or none of both proximity switches is actuated, the safety relays are switched off.

**When two proximity switches are connected**

If the programmed upper or lower limit frequency is exceeded, the frequencies of both proximity switches are compared. A divergence of over 30% will be considered faulty and signalled. The yellow LED is flashing (refer to ISD table).

**Inputs**

- X1: connection for proximity switch 1 (24 VDC)
- X2: connection for proximity switch 1 (cyclic input)
- X3: connection for proximity switch 2 (24 VDC)
- X4: connection for proximity switch 2 (cyclic input) or bridge to X2
- X5: connection for reset button (24 VDC)
- X6: connection for reset button
- X8: connection for an additional standstill signal  
"high": standstill  
"low": motor runs

**Outputs**

(13/14) NO contact for safety functions (enabling path)

**Additional transistor outputs Y1/Y2**

Y1: "Enabling signal", the enabling paths are closed

Y2: "Fault", if the fail-safe standstill monitor detects a fault, Y2 is enabled.

**Reset input**

A high signal at X6 deletes all detected faults of the fail-safe standstill monitor and causes the safety relays to be switched off.

**Notice**

The additional outputs Y1 and Y2 must not be integrated in the safety circuit. The feed cables of both proximity switches (power supply) must be laid so that in case of a wire breakage only one proximity switch is dead (star-shaped routing). According to EN ISO 13849-1, category 3, an individual fault must not lead to a loss of safety.

**6. Set-up and maintenance**

**6.1 Functional testing**

The safety function of the safety-monitoring module must be tested.

The following conditions must be previously checked and met:

1. Correct fitting of the safety-monitoring module
2. Fitting and integrity of the power cable

**6.2 Maintenance**

In the case of correct installation and adequate use, the safety-monitoring module features maintenance-free functionality.

A regular visual inspection and functional test, including the following steps, is recommended:

- Check the correct fixing of the safety monitoring module
- Check the cable for damage.



The device has to be integrated into the periodic check-ups according to the Ordinance on Industrial Safety and Health, however at least 1x/year.

**Damaged or defective components must be replaced.**

**7. Disassembly and disposal**

**7.1 Disassembly**

The safety monitoring module must be disassembled in the de-energised condition only.

**7.2 Disposal**

The safety monitoring module must be disposed of in an appropriate manner in accordance with the national prescriptions and legislations.

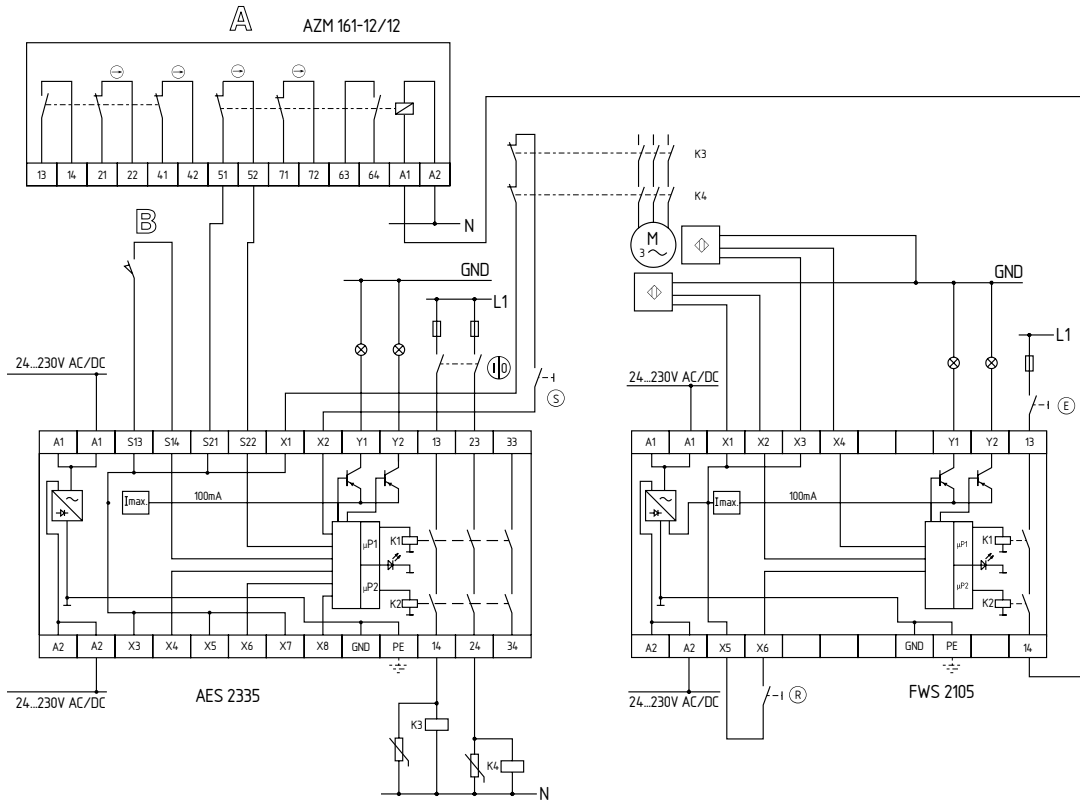
8. Appendix

8.1 Wiring examples

The application examples shown are suggestions. They however do not release the user from carefully checking whether the switchgear and its set-up are suitable for the individual application.

The entire system can achieve PL d or category 3 to EN ISO 13849-1, if the fault exclusion "rupture or loosening of the actuator, error in the solenoid interlock" can be substantiated and documented. If this is impossible, a second switch must be installed on the safety guard as a replacement for the NO contact of the AZM 161 in order to achieve PL d or category 3.








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The wiring diagram is shown with guard doors closed and in a de-energised condition. Inductive loads (e.g. contactors, relays, etc.) are to be provided with suitable interference suppression circuitry.

Avoid laying proximity switch connection cables in areas where strong interference signals are present (e.g. frequency converters or cable leads from powerful electric motors), the utilisation of shielded cables may be necessary.

Requirements of the used proximity switches  
NO contact, p-type  
Output voltage: 20 ... 30 VDC,  
Output current:  $\geq 50$  mA  
e.g. Schmersal IFL ...-10 P

Key	
	Positive break
	Inductive proximity switch
	reset button
	On/off switch
	Start button
	Release button
	Additional standstill signal
<b>A</b>	Solenoid interlock
<b>B</b>	Safety switches

**8.2 Integral System Diagnostics (ISD)**








The LED indication of the safety-monitoring modules shows the different switching conditions and errors. The following tables show the different switching conditions.

**Tables switching condition indication**

Diagnostic LED	System condition
The LED is green.	Enabling paths closed
LED flashes yellow (0.5 Hz)	When two proximity switches are connected, only one switch has exceeded the lower limit frequency, the enabling paths are open
LED flashes yellow (2 Hz)	The motor is running, the limit frequency has been exceeded. The enabling paths are open

In case of error messages, the LED lights orange intermittently. During these intermissions, the LED flashes with short pulses.


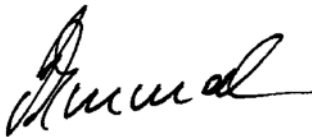
**Table error indications**

Indication (orange) LED	Error	Cause
1 impulse 	Frequency sensor 1 too low, Error input X2	Defective lead Defective proximity switch
2 impulses 	Frequency sensor 2 too low, Error input X4	Defective lead Defective proximity switch
3 impulses 	Fault voltage X2/X4	One or both proximity switches supply no output voltage: defective proximity switch or disconnected cable
4 impulses 	Interference at inputs, no safe evaluation	Too high capacitive or inductive interference at the inputs or the supply voltage lead
5 impulses 	One or both relays did not close within the monitoring time	Too low operating voltage $U_e$ , Defective relay
6 impulses 	Relay not disabled upon the actuation of the switch	Welded relay contact
7 impulses 	Malfunction of internal data lines	Interruption of the internal data transfer due to a high capacitive or inductive interference on the internal data lines

**Deleting the error message**

The error message is deleted, when the error cause is eliminated and the FWS can check all functions.

9. EU Declaration of conformity

<b>EU Declaration of conformity</b>		
Original	K.A. Schmersal GmbH & Co. KG Möddinghofe 30 42279 Wuppertal Germany Internet: <a href="http://www.schmersal.com">www.schmersal.com</a>	
We hereby certify that the hereafter described components both in their basic design and construction conform to the applicable European Directives.		
<b>Name of the component:</b>	FWS 2105	
<b>Type:</b>	See ordering code	
<b>Description of the component:</b>	Fail-safe standstill monitor	
<b>Relevant Directives:</b>	Machinery Directive	2006/42/EC
	EMC-Directive	2014/30/EU
	RoHS-Directive	2011/65/EU
<b>Applied standards:</b>	EN 60947-5-1:2017 + AC:2020 EN ISO 13849-1: 2015 EN ISO 13849-2: 2012	
<b>Notified body, which approved the full quality assurance system, referred to in Appendix X, 2006/42/EC:</b>	TÜV Rheinland Industrie Service GmbH Am Grauen Stein, 51105 Köln ID n°: 0035	
<b>Person authorised for the compilation of the technical documentation:</b>	Oliver Wacker Möddinghofe 30 42279 Wuppertal	
<b>Place and date of issue:</b>	Wuppertal, August 4, 2023	
FWS2105-D-EN		
	Authorised signature <b>Philip Schmersal</b> Managing Director	



The currently valid declaration of conformity can be downloaded from the internet at [products.schmersal.com](http://products.schmersal.com).

