Safety gate monitoring on PMCprotego DS with PNOZmm0p

Product
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Name: PMCprotego D, PMCprotego S2, PNOZmm0p
Manufacturer: Pilz GmbH & Co. KG, Safe Automation

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April 2012

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You can reach our international hotline on:

+49 711 3409-444 or **mailto:support@pilz.com**

Pilz GmbH & Co. KG
Safe Automation
Felix-Wankel-Straße 2
73760 Ostfildern, Germany

Telephone: +49 711 3409-0
Telefax: +49 711 3409-133
E-Mail: pilz.gmbh@pilz.de
Internet: www.pilz.com

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Abbreviations

FB	**F**unction **b**lock	
PMC	**P**ilz **M**otion **C**ontrol	
PNOZ	Pilz E-Stop Positive-guided	(de: **P**ilz **NO**T-AUS-**Z**wangsgeführt)
PRG	**P**rogram	

1. Useful documentation

Reading the documentation listed below is necessary for understanding this application note. The availability of the indicated tools and safe handling are also presupposed with the user.

1.1. Documentation from Pilz GmbH & Co. KG

No.	Description	Item No.
1	Pilz international homepage, download section	www.pilz.com
2	Operating manual PNOZ mm0p	1001274-EN-xx
3	Operating manual PMCprotego D.01…D.24	21 934-EN-xx
4	Operating manual PMCprotego S2	1001432-EN-xx
5	Operating manual PMCtendo AC	21 706-EN-xx
6	User manual Motion Control Tools	21 468-EN-xx
7	Operating manual PSEN cs2.1p	21 096_3FR-xx

1.2. Documentation from other sources of information

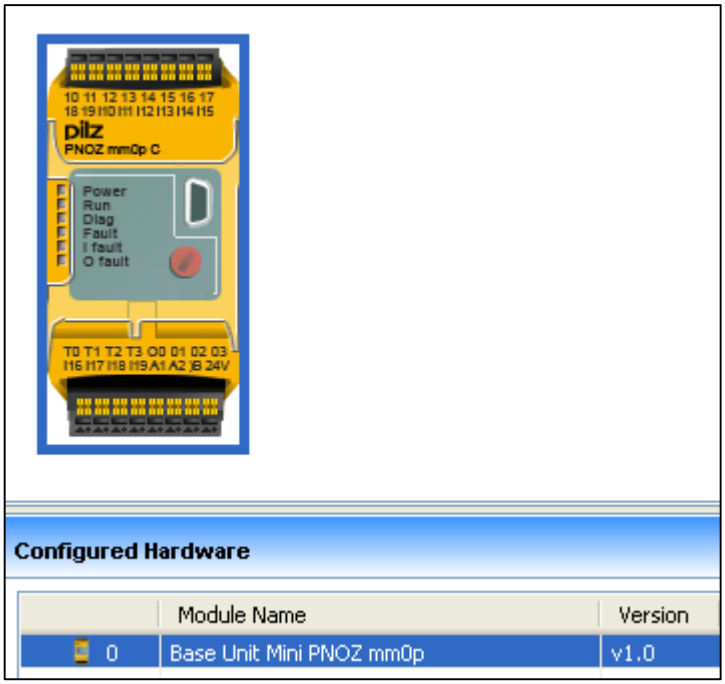
No.	Description	Item No.
1		
2		

2. Hardware configuration

2.1. Pilz products

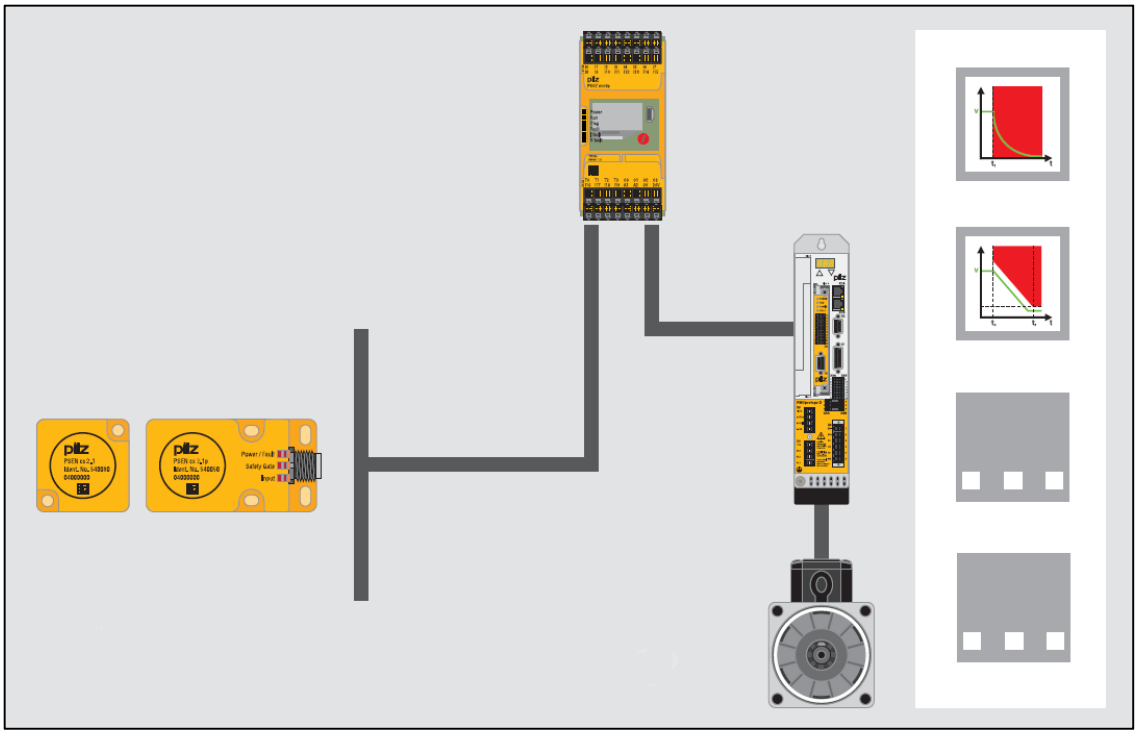
No.	Description	Order number	Version	Number
1	PNOZ mm0p	772 000	-	1
2	PMC protego D.03/000/0	8176 101	-	1
3	PMC protego S2	8176 106	-	1
4	PMCtendo AC3.32/1/M/1/1/4/H/6	8176 090	-	1
5	Cable Power DD4plug>ACplug:L05m	8165 882	-	1
6	Cable Hiperface DD4plug>ACpluf:L05m	8165 879	-	1
7	PSEN cs2.1p	540 100	-	1
8	PNOZmulti Configurator	-	V7.1.0 build 4	1
9	PASconfig SDrive	-	V1.0.0	1
10	PMCtools	-	V3.2	1

2.2. Hardware configuration



3. Application Task

3.1. Description



The example shows the implementation of a safety gate application with a PSENcode, a PNOZmulti Mini and a PMCprotego D in combination with a PMCprotego S2 safety card.

The safe control and evaluation of the signals is performed by the Pilz function block

Safety Gate

from the element selection (function elements).

3.1.1. Safety gate monitoring function

The safety gate switch (S5) is monitored by the controller (PNOZ mm0p) via the user program. An FS function block “Safety Gate” is assigned to the safety gate switch. This FS-FB detects whether the assigned safety gate switch has been operated, as well as detecting invalid input signals and whether the contact synchronisation time has been exceeded, etc.

If the safety gate switch is operated or an error occurs, the enable output of the FS-FB will immediately be reset. The enable output is also reset when the PNOZ is stopped and when the PNOZ is switched on.
The signal of the enable output activates the SS2 function of the safety card by means of a falling edge at the SS2 input of the Protego S safety card. If the configured limit values of the SS2 function are violated, the drive changes to STO.
Please note that no more holding torque exists with STO and relevant additional measures must be employed to ensure that this behaviour does not lead to a hazardous situation (e.g. with suspended loads).
An entry in the error stack can be used to determine why the enable output was reset.

The way in which the error is reset will depend on the operating mode set on FS-FB.
In this application example, parameters for FS-FB have been set in such a way that:
- when cold started (PNOZ switched from off to on),
- when warm started (PNOZ transferring from STOP to RUN) or
- after closing the safety gate

it is necessary to reset (S6) at the FS-FB in order to reset the output parameter.

Caution
Although the safety gate functions are configured to reset themselves, a PNOZ cold start or the closing of the safety gate must not directly enable a machine to start up without further conditions being met.

3.1.2. Wiring of the safety card

PNOZmulti outputs:

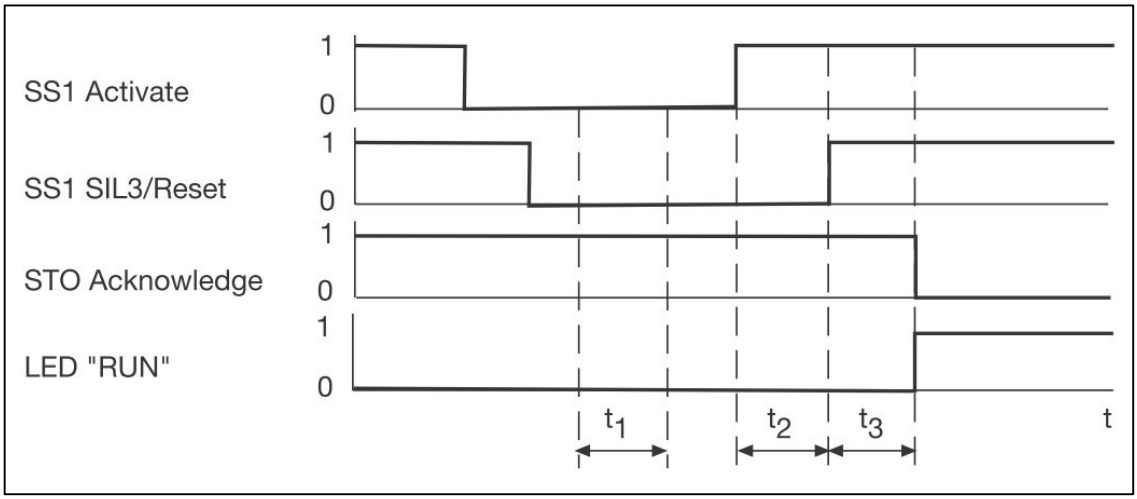
SS1 Activate:	Safe stop 1
SS2 Activate:	Safe stop 2
SS1 SIL3/Reset:	To achieve SIL3 and to reset the safety card after an error

To operate the safety card, the application of the signals SS1 and SS1 SIL3/reset are absolutely necessary. A reset of the safety card is triggered with these two inputs. The reset button (S3) on the PNOZmulti triggers the necessary signal sequence for the reset at the inputs SS1 and SS1 SIL3/reset of the safety card

Rectify the error, noting:
- the error messages in the error stack
- the LED display.

1. Switch both inputs SS1 Activate and SS1 SIL3/Reset to 0 V:
- The safety card performs the safety function SS1 (Safe Stop 1) and switches to a "STOP" condition. The "FAULT" LED is flashing.

2. Switch both inputs SS1 Activate and SS1 SIL3/Reset to 24 V:
- The safety card switches to a "STARTUP" condition. The device and the safe pulse disabler are tested. The "RUN" LED flashes.
- The safety card switches to a RUN" condition. The "RUN" LED is lit continuously.



- t1: At least 2 ms; time during which SS1 Activate and SS1 SIL3/Reset must have a "0" signal
- t2: Operating distance SS1 Activate – SS1 SIL3/Reset
- t3: approx. 2 s, safety card's run-up time
- SS1 Activate: Input for safety function SS1
- SS1 SIL3/Reset: Input for SIL3 and reset
- STO Acknowledge: Output for feedback from safety function STO
- “RUN” LED: System is ready

The additional number of outputs depends on the number of safety functions configured on the safety card.

PNOZmulti inputs:

Reset:	Triggers a reset of the safety card.
Ready:	Reads out the operational readiness of the safety card
STO_ACK:	STO activated

Inputs for triggering the safety functions:
Depending on the application.

Input circuit safety assessment

- A short between the input circuits within a multicore cable is detected as an error by the PSEN cs.
- A short between 24 VDC and an input circuit will be detected as an error by the PSEN cs.
- If the shutdown occurs via the inputs of the PSEN cs, reactivation of the outputs is only possible after both safety inputs were simultaneously disabled (partial operation lock).

PMC safety assessment

- Hazardous situations must not be allowed to arise due to braking ramps of SS1, SS2 and stopping times.
- The best possible mechanics at the drive (overdimensioning) are assumed (fault exclusion for broken shaft).
- The operator must ensure that the function of the safe pulse disabler is tested periodically, after 8 hours at the latest, by triggering safety functions SS1 or STO:
  - by restarting after safety functions SS1 or STO have been triggered as a condition of operation or
  - by restarting after safety function SS1 has been triggered by the operator (see operating manual).

Overall application safety assessment

- The PNOZmulti Mini and the PMCprotego D and PMCprotego S2 combination must be installed in the same mounting area in order to exclude a short circuit between 24 VDC and a safety input of the card.
- An fault on the PNOZmulti Mini or the PMCprotego D and PMCprotego S2 combination does not lead to the loss of the safety function.

3.2. Functional safety

3.2.1. Safety-related characteristics in accordance with EN ISO 13849-1

No.	Safety function	Performance Level	Safety-related parts of the control system
1	Machine shut down when a safety gate is opened	PL d	Sensor (PSEN cs2.1) Input (PNOZ mm0p) Logic (PNOZ mm0p) Output (PNOZ mm0p) Actuator (PMC protego S2) {SS2}

Prerequisites:

No.	Description	Identification
1	Common cause failure (CCF):	Requirements are considered to be met (must be tested on implementation)
2	Mission time:	20 years

Please note the further requirements of EN ISO 13849-1, e.g. requirements for avoiding systematic faults.

CAUTION
The calculation of the performance level is only valid when using a PMCtendo motor.

3.2.2. Safety-related characteristics in accordance with EN 62061

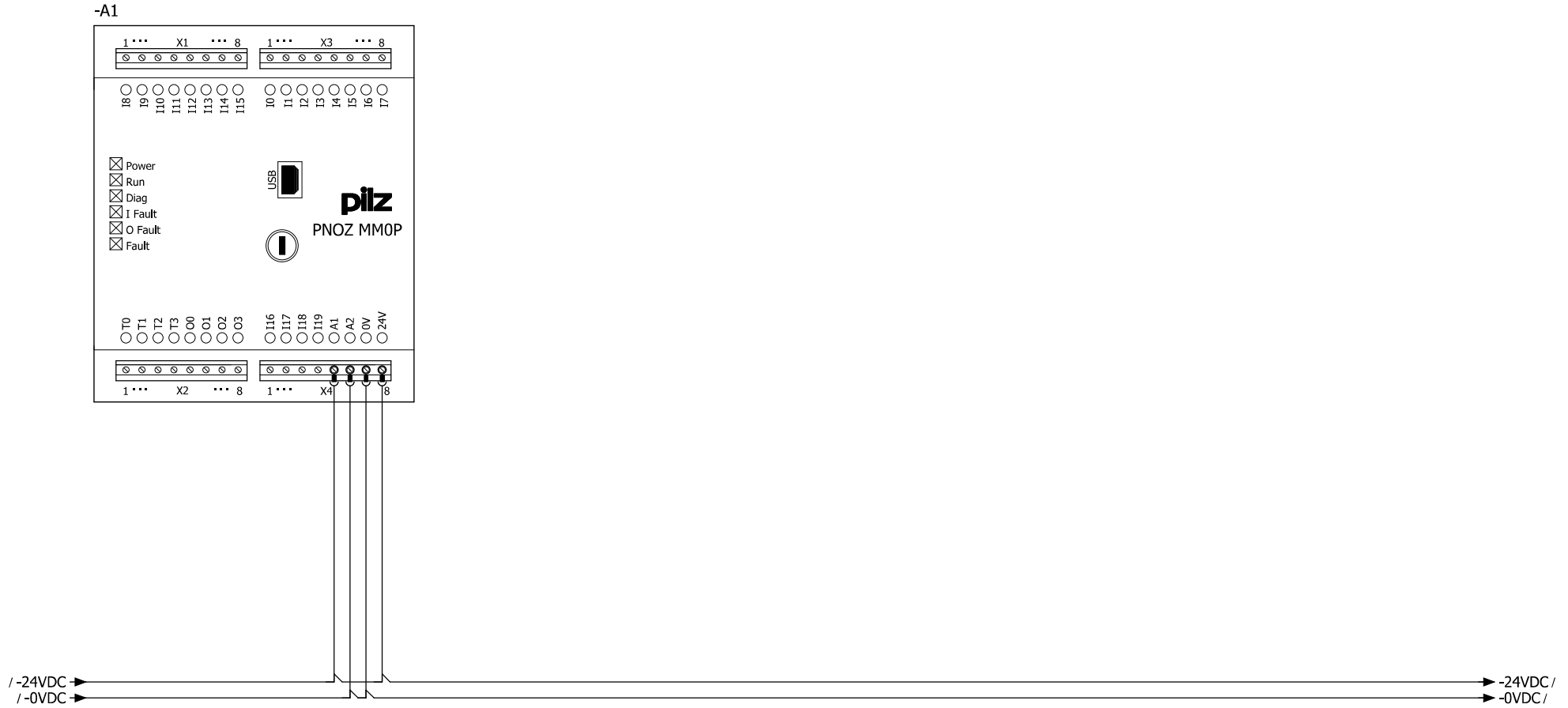
No.	Safety-related control function (SRCF):	Safety Integrity Level	Subsystems
1	Machine shut down when a safety gate is opened	SIL 2	Sensor (PSEN cs2.1) Input (PNOZ mm0p) Logic (PNOZ mm0p) Output (PNOZ mm0p) Actuator (PMC protego S2) {SS2}

Prerequisites:

No.	Description	Identification
1	Common cause failure (CCF)	ß = 2% (must be tested on implementation)
2	Proof test interval	20 years

Please note the further requirements of EN 62061, e.g. requirements for systematic safety integrity.

CAUTION
The calculation of the safety integrity level is only valid when using a PMCtendo motor.



Revision	09.03.2011	Date	09.09.2010	EN ISO 13849-1:2006	PL d	Pilz GmbH & Co. KG Felix-Wankel-Strasse 2 D-73760 Ostfildern	Multi supply	Mounting place + AN_1002085_02
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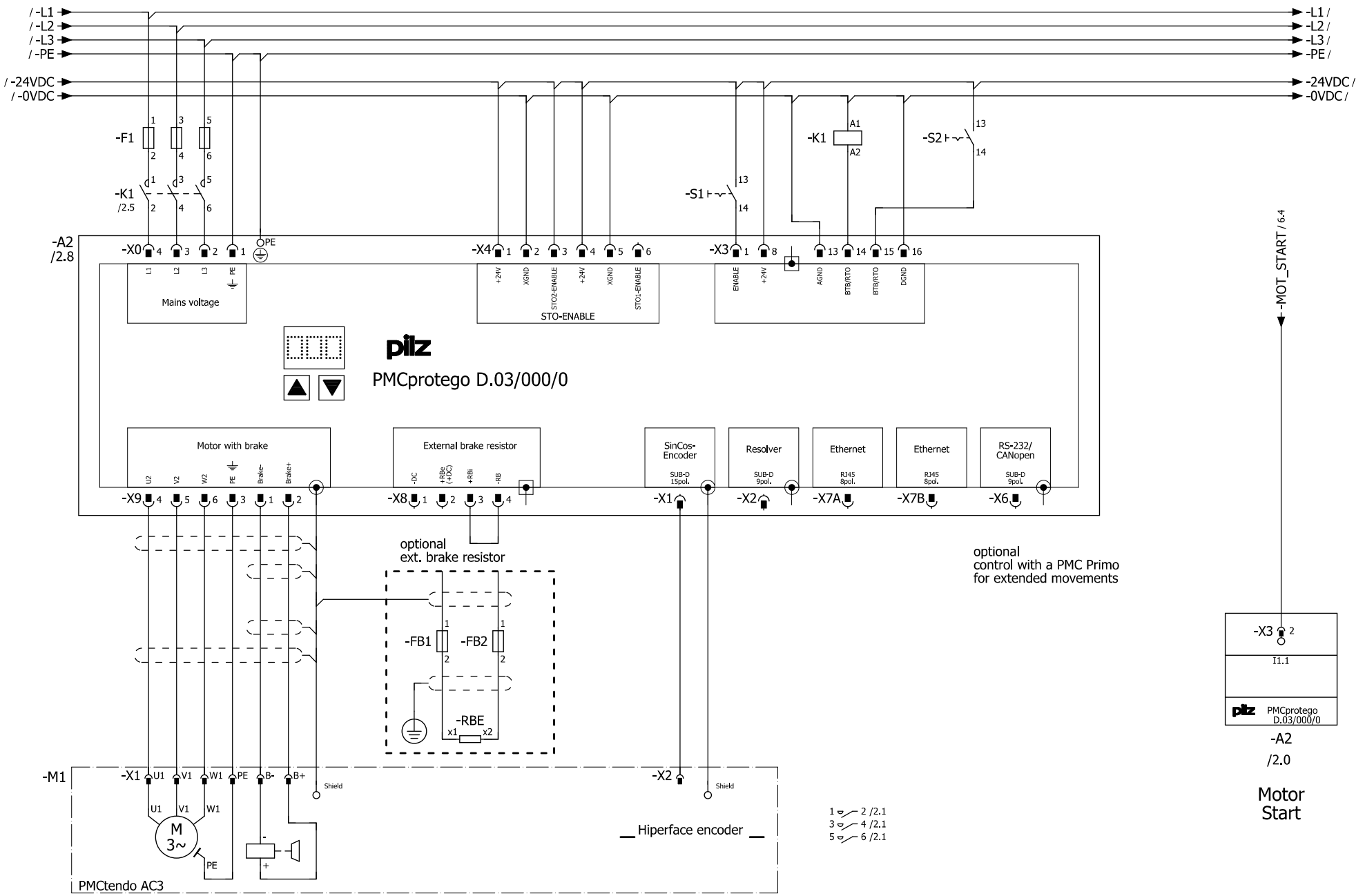
				EN 62061:2005	SIL 2			Page: 1 / 8
		Dep.	CS					



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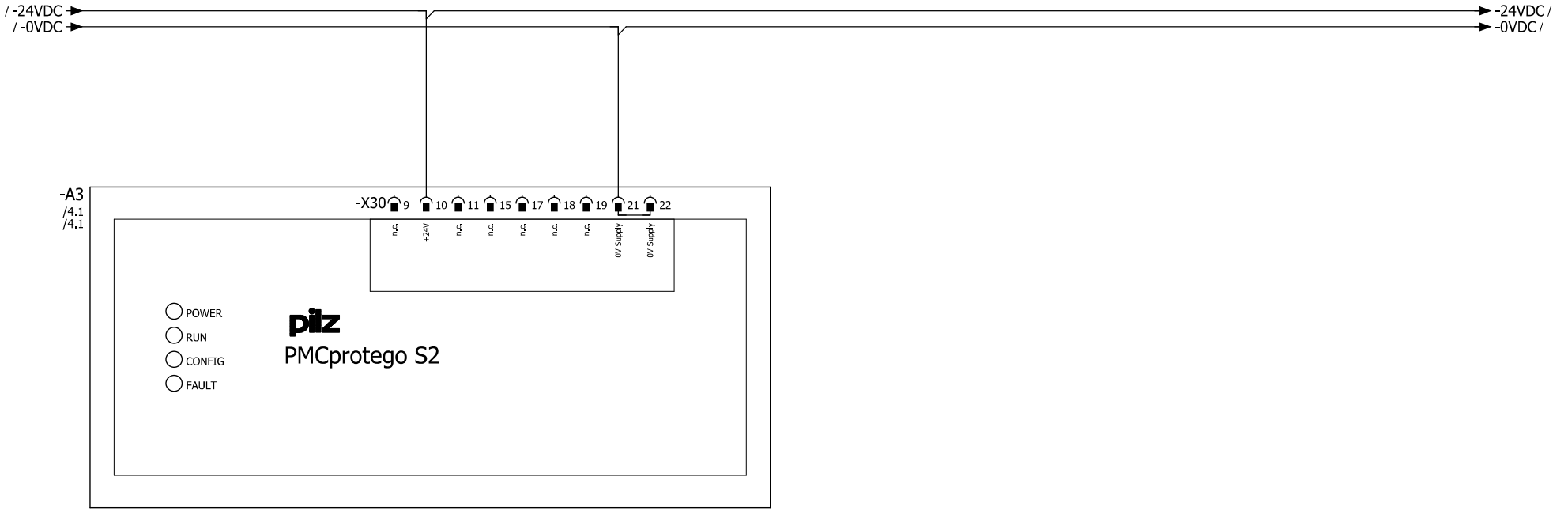
		Dep.	CS					



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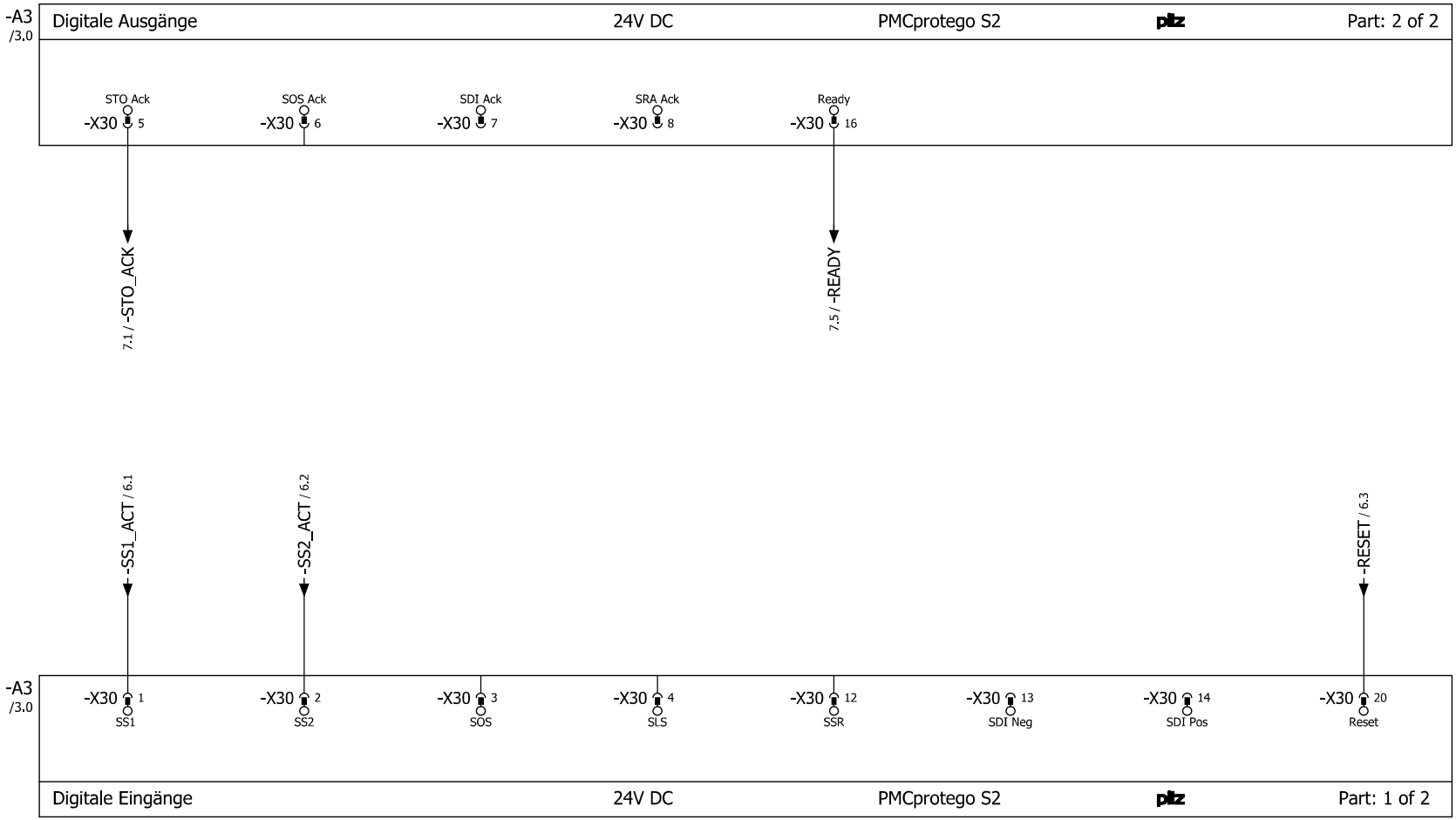

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				EN 62061:2005	SIL 2		Page: 4 / 8
		Dep.	CS				

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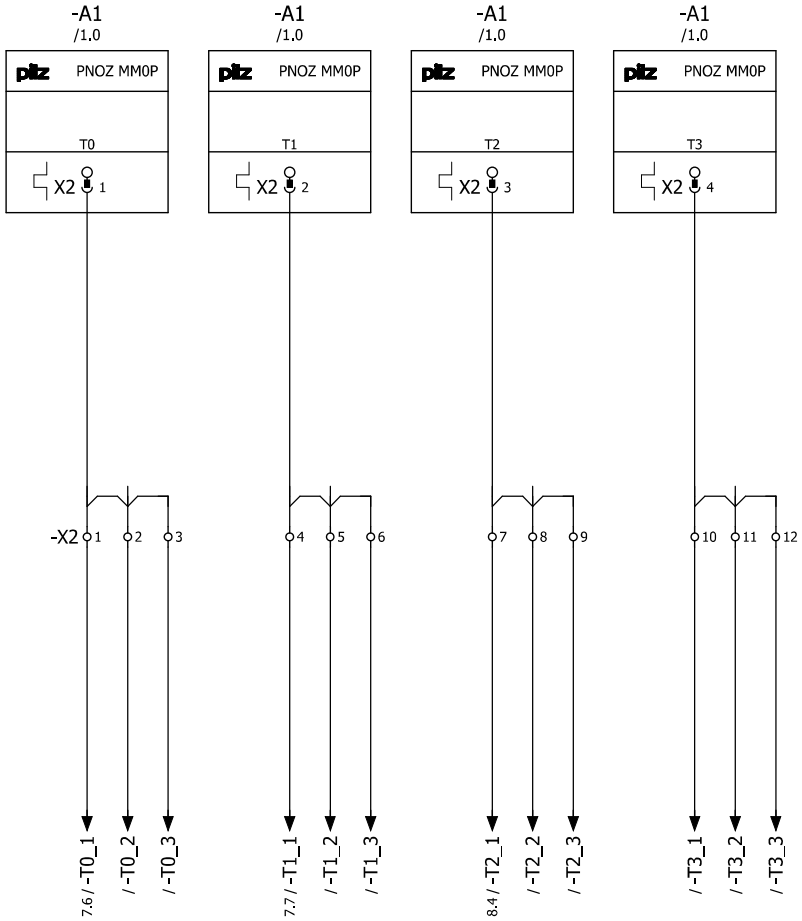
Pilz GmbH & Co. KG
Felix-Wankel-Strasse 2
D-73760 Ostfildern



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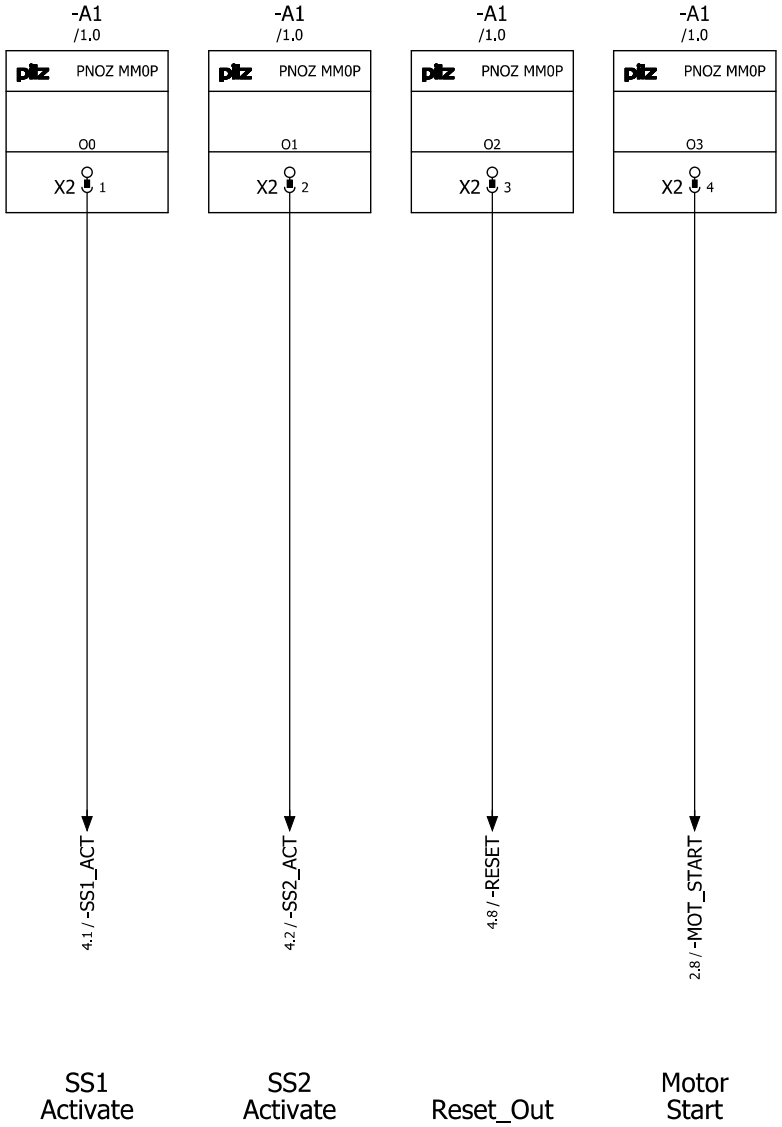
				EN 62061:2005	SIL 2			Page: 5 / 8
		Dep.	CS					



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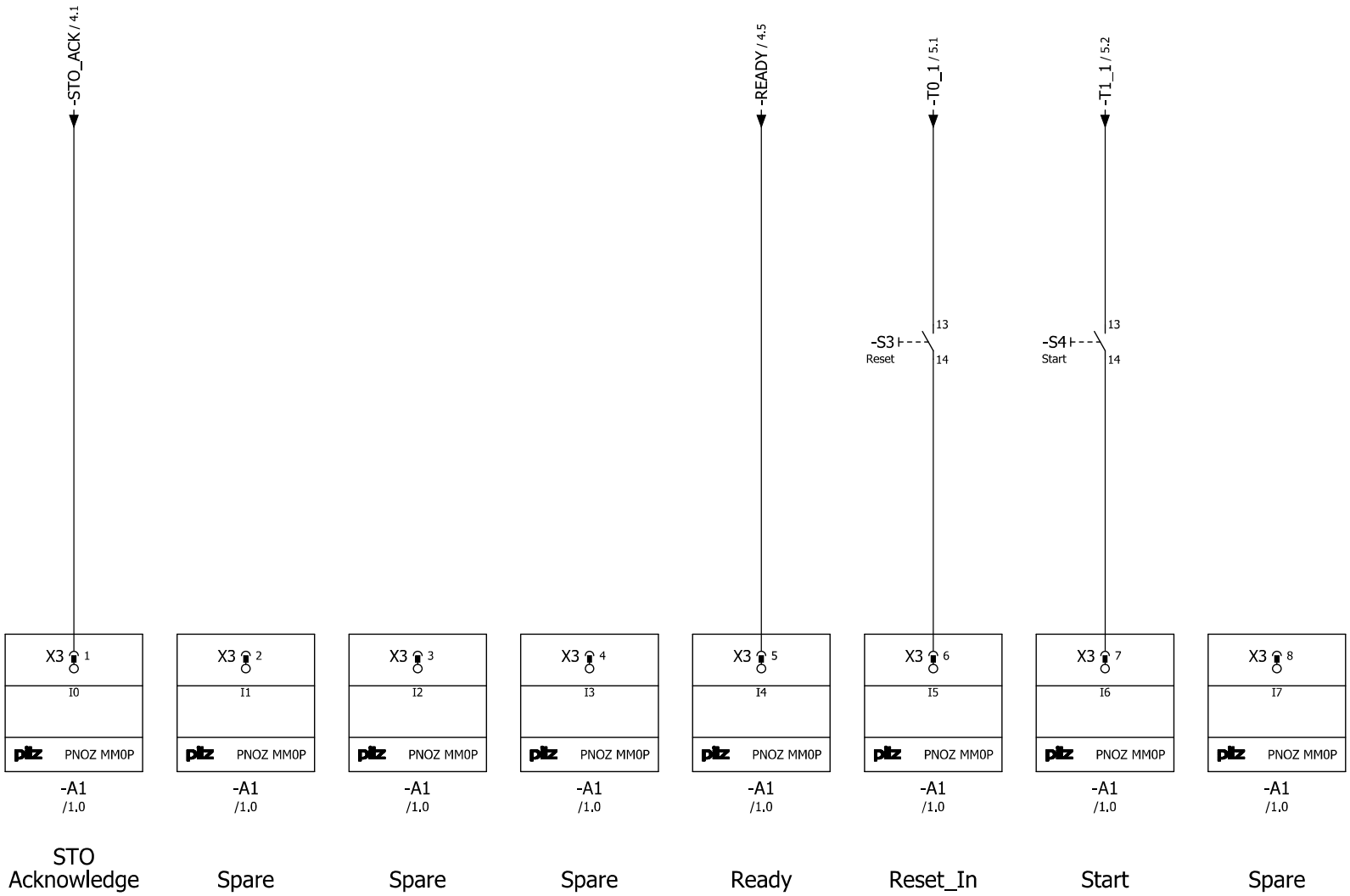

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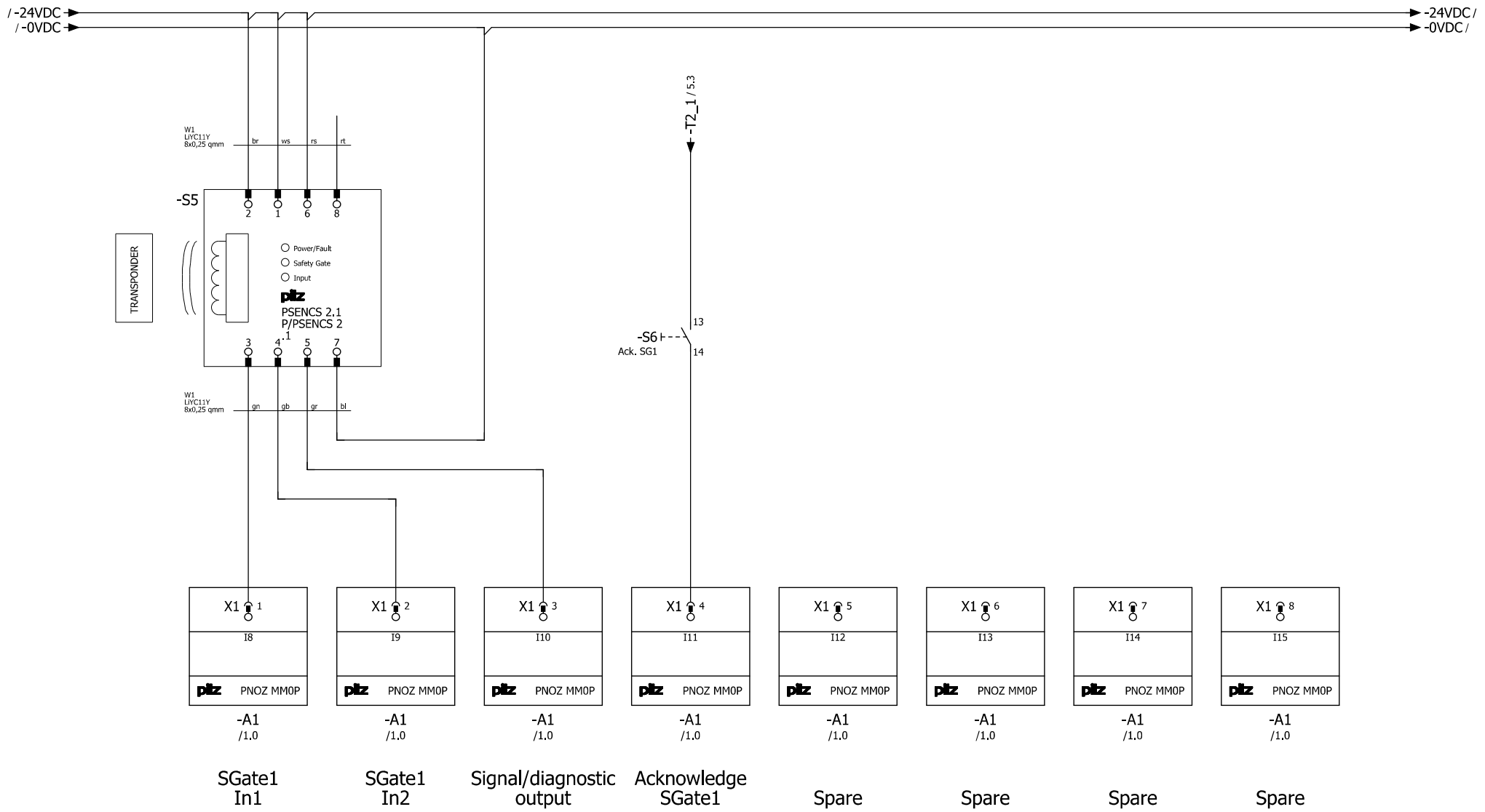
		Dep.	CS					



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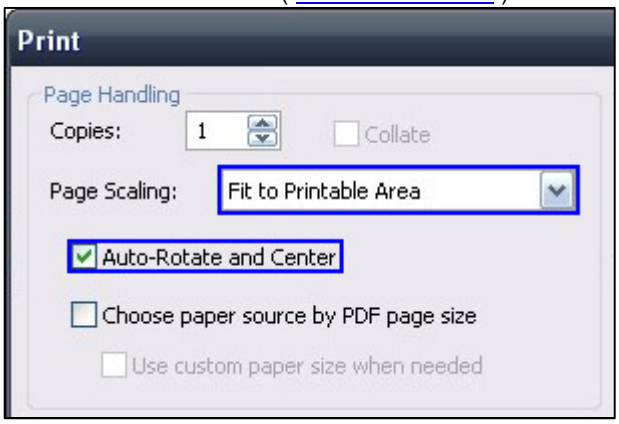
Name	RDS	Name	RDS					
				EN 62061:2005	SIL 2			Page: 8 / 8
		Dep.	CS					

Recommended printer settings

Adobe Acrobat Reader (www.adobe.com)



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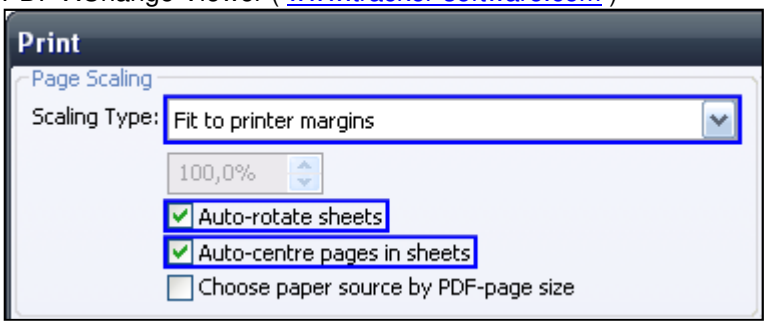

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Technical support

+49 711 3409-444
support@pilz.com

Pilz GmbH & Co. KG
Felix-Wankel-Straße 2
73760 Ostfildern, Germany
Telephone: +49 711 3409-0
Telefax: +49 711 3409-133
E-Mail: pilz.gmbh@pilz.de
Internet: www.pilz.com