Safety Control
SafetyBUS p

Application Manual
PSS®-Range/SafetyBUS p®

more than automation
safe automation

PSS programmable safety systems
and the safe, open bus system SafetyBUS p

July 2004 edition

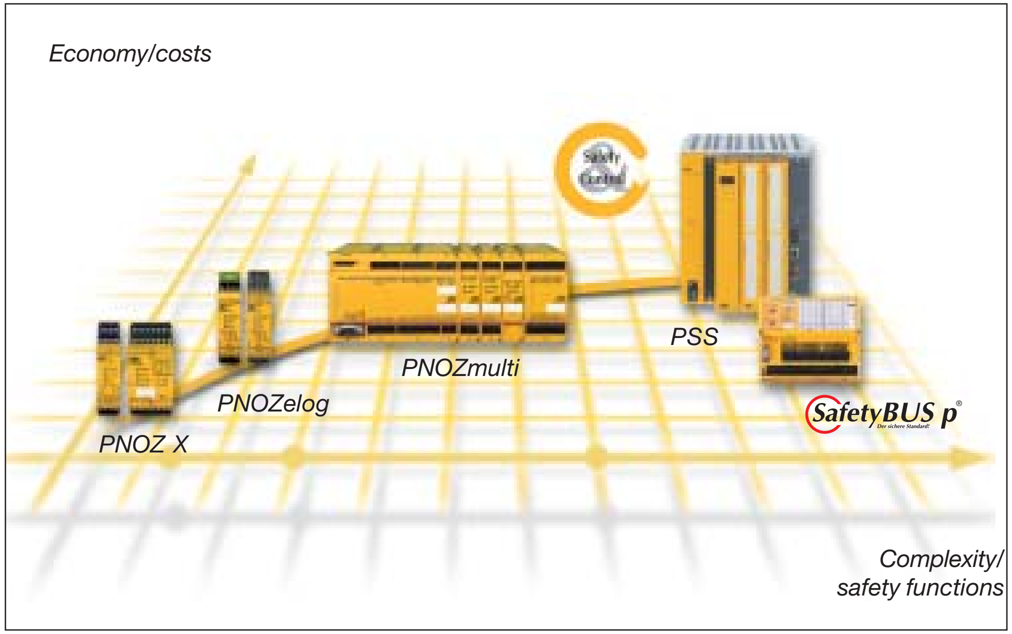
Pilz – The Brand For Safe Automation

Family business with vision

For more than 50 years Pilz has had a tradition as an innovative, medium-sized and independent family business. More than 1000 employees worldwide act as ambassadors for safe automation from Pilz – on all the world's markets. Every day they fulfil the guiding principle "more than automation – safe automation". As technology leader and system supplier, Pilz is the brand for safe automation.

Safe automation is our core competency

Best performance is what you should expect from Pilz. That's why we concentrate on our core competency: safe automation. The main task of our products and solutions is to protect man and machine. Our components and systems perform sensory, control and/or graphics functions. The first two-hand control relay was developed back in 1968 – the first pioneering innovation in the area of safe control technology. The first E-STOP relay, the PNOZ, followed in 1987 and is now used all over the world; in this time its brand name has become synonymous with the term safety relay. After the development of the PSS programmable safety system, Pilz took the first step into a new dimension of safety technology in 1999 with the safe, open bus system SafetyBUS p. In the past Pilz has set standards through its innovations; it will continue along this course in the future, too. To back Pilz means security for the future and safeguarded innovation.



Safe control technology from Pilz

Complete automation

Pilz regards itself as a solution supplier in safety and control, as a supplier of individual, overall solutions based on innovative components and systems that monitor safety-related functions and control standard functions on plant and machinery. The product range includes monitoring relays, control and signal devices, text displays and graphics operator terminals. Safe control technology is a key focus point. Safe sensor technology, safety relays, programmable safety systems and the safe, open bus system SafetyBUS p enable an appropriate solution to be found for each application. Opt for a complete range – everything from one source. In each case an economical, open solution.

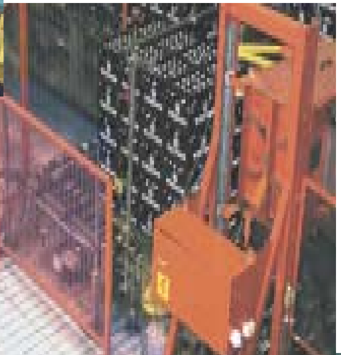
Pilz – The Brand For Safe Automation

The customer is our focus – worldwide

The declared objective of all company activities is to create outstanding benefits for customers and users. Safe automation products, services and solutions are based on comments from our customers and users, paired with the creativity of Pilz's development engineers. All activities are performed under the premise of openness and independence. For us, the customer is both our focus and our benchmark. A strong applications department, with broad expertise and many years of experience, is open to our customers' wishes and provides on-site support. Close by, competent, with short reaction times. With 23 of our own subsidiaries worldwide.

Solutions for the most varied of industries

Pilz automation components and systems can be used in all areas of mechanical engineering: on a series machine in machine tool manufacturing or on special purpose machinery in the food and packaging sector. Whether the requirement is a robot-supported body shop line in car manufacturing, or to safeguard entire rolling plants, control burners in power stations, monitor baggage handling systems at airports or monitor fairground rides at an amusement park – they all rely on Pilz.



Responsibility towards staff and the working world of tomorrow

Our staff live the vision of the Pilz brand – that is something you can rely on. For all have a part in the company's success. And a new generation of engineers, among others, will also benefit from our experiences. Safeguarding the future is just as important to us as our resolve to give young people the chance to develop. That's why we get involved with colleges and universities and provide a wide range of training opportunities.

References

Exclusion of liability

We have taken great care in compiling our application manual for the PSS®-range/ SafetyBUS p®. It contains information about our company and our products PSS®/ SafetyBUS p®. All statements are made in accordance with the current status of technology and to the best of our knowledge and belief. However, we cannot accept liability for the accuracy and entirety of the information provided, except in the case of gross negligence. In particular it should be noted that statements do not have the legal quality of assurances or assured properties. We are grateful for any feedback on the contents.

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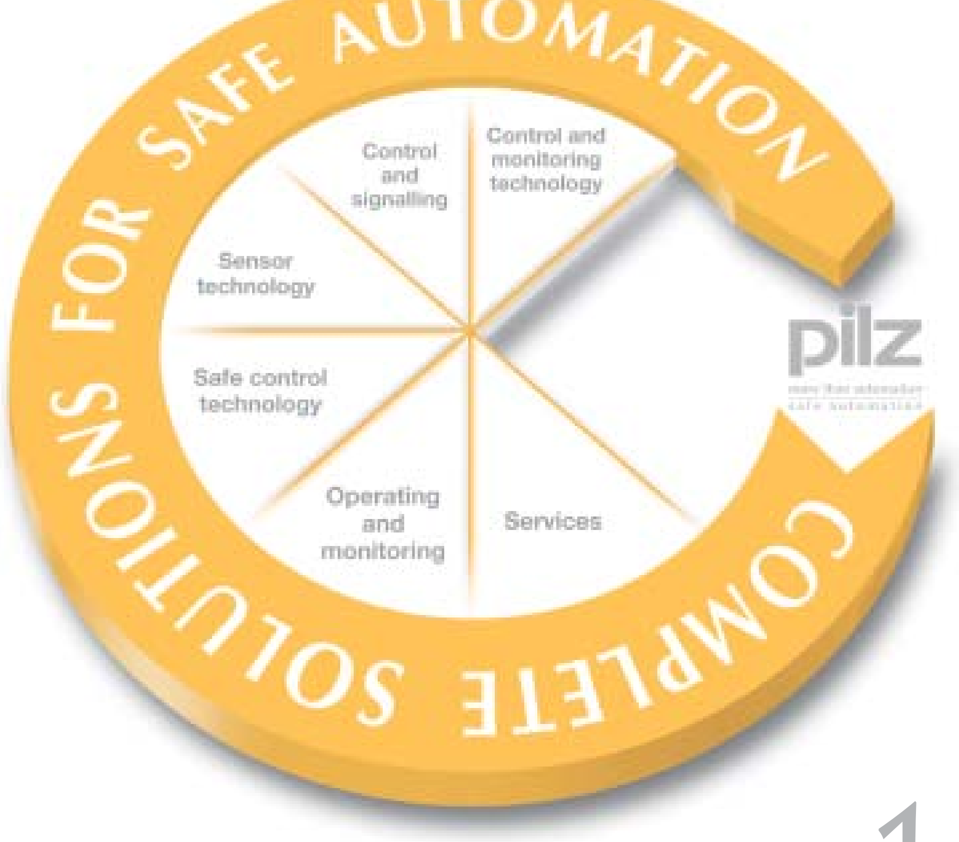
COMPLETE SOLUTIONS FOR SAFE AUTOMATION
Control and signalling
Control and monitoring technology
Sensor technology
Safe control technology
Operating and monitoring
Services
pilz
more than automation
safe automation

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Pilz – Business Activities

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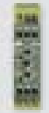
Control and monitoring technology (Electrical safety to IEC 60204-1)	**Electronic monitoring relays**			S-Range						
Control and signalling	**Emergency stop pushbutton**			PITestop						
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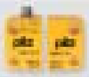
Sensor technology	**Safety switches**		Non-contact, magnetic	PSENmag		◆				
			Non-contact, coded	PSENcode		◆				
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Editorial

pilz
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Editorial

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Preface

Renate Pilz, Pilz GmbH & Co. KG

Renate Pilz,
Managing Partner,
Pilz GmbH & Co. KG, Ostfildern

That plant and machinery are made safe, man and machine are protected and safety considerations become a worldwide standard – this is the task of each and every Pilz employee. For Pilz regards itself as an ambassador for safety. So safety is more than just a product. Safe automation is thorough expertise, demonstrated partly in innovative products, and partly in advice, engineering and training. This application manual is intended to contribute towards this, to provide a guide to help you configure and commission your plant and machinery safely. In this I wish you every success. And should you have any questions: we are happy to provide support, because we want to be an innovative, reliable and successful partner.

Preface

Berthold Heinke, BG engineering and metal

Dipl.-Ing. Berthold Heinke,
Head of the institute for electrical engineering at BG engineering and metal, engineering technical committee for lifts, smelting works and rolling mills (MHHW), acting head of the notified body for technical committee MHHW, Düsseldorf

In the whole area of automation technology, processing functions are increasingly being decentralised via programmable electronic systems (PES) in order to increase the performance of plant and machinery. However, without additional measures as defined in the Machinery Directive 98/37/EC, the European standards DIN EN 954, EN 1050 and elsewhere, the requirements of a safety-related control system cannot be met.

The fact that an individual device conforms to certain directives or EN standards is no guarantee that it is suitable for use within the system network. Only the correct use – application – of individual hardware components and software blocks creates a suitably powerful, safe overall system out of these individual “mosaic blocks”.

That is why tools for the practical configuration and installation of individual safety-related systems play an important part in implementing the required level of safety.

Preface

Christian Schlosser, TÜV Austria

Dipl.-Ing. Christian Schlosser,
TÜV Austria, division:
Machinery, lifts and conveyors,
Machinery and equipment safety, Vienna

When a book is published, it is customary to invite someone to write a preface. When this custom is maintained even for technical literature, in my opinion that is a sign of style and quality, and I am happy to support it with my contribution. First of all I would like to thank Mrs Renate Pilz and all her staff for their personal commitment and effort, who through innovative products and solutions help to create a safe working environment.

This application manual for the PSS-range/ SafetyBUS p will be a valuable guide to users, helping them to make an appropriate product selection and to use the components correctly. By continually monitoring the standards and working with the standards' body, as well as co-operating closely with notified test houses, Pilz is able to produce this manual and provide users with important information on the current status of the standards. As for the support provided by this application manual, I can only encourage all users to take up the technical support offered by Pilz. For practice has shown that with support from Pilz, even in difficult cases, it is possible to find a solution that both conforms with the directives and is attractive economically.

Finally I would like to thank Pilz for their excellent, faithful co-operation and wish the company and all users of its products and solutions every success in the realisation of a safe working environment – whether in the implementation of new technical applications or the upgrade of existing plant and machinery.

Preface

Jürgen Baur, Aalen University of Applied Sciences

Prof. Dr.-Ing. Jürgen Baur,
Aalen University of Applied Sciences,
Mechatronics course,
Aalen

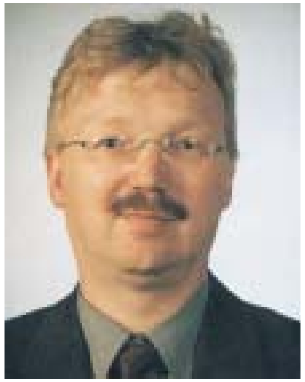
The powerful PSS programmable safety systems from Pilz have been on the market for barely 10 years. In this time they have convinced numerous users by their high level of reliability and quality. Application engineers have gathered experience and expertise in a great many projects, involving the most varied of requirements across the widest range of industries.

This application knowledge has influenced the new edition of this application manual. The Pilz application manual is therefore a valuable tool, removing any potential uncertainties in the application and implementation of the safety regulations. It helps to save time and money and, particularly for newcomers, helps to avoid potentially dangerous situations around plant and machinery. What's more, it represents an important tool for practical training with our young engineers of the future, to make them familiar with the application of modern safety technology. For example, the manual is used in lectures and training courses for mechatronics students at the technical universities of Aalen and Esslingen.

On behalf of the students, at this point I would like to thank the management at Pilz for their committed support of students' training in the surrounding universities, and also for the extensive laboratory equipment. A remarkable, exemplary initiative for a medium-sized company. As a user of these safety systems, I hope that in the future Pilz can maintain the high quality standard and proximity to customers that is practised in the company today.

Preface

Harald Förster, Pilz GmbH & Co. KG



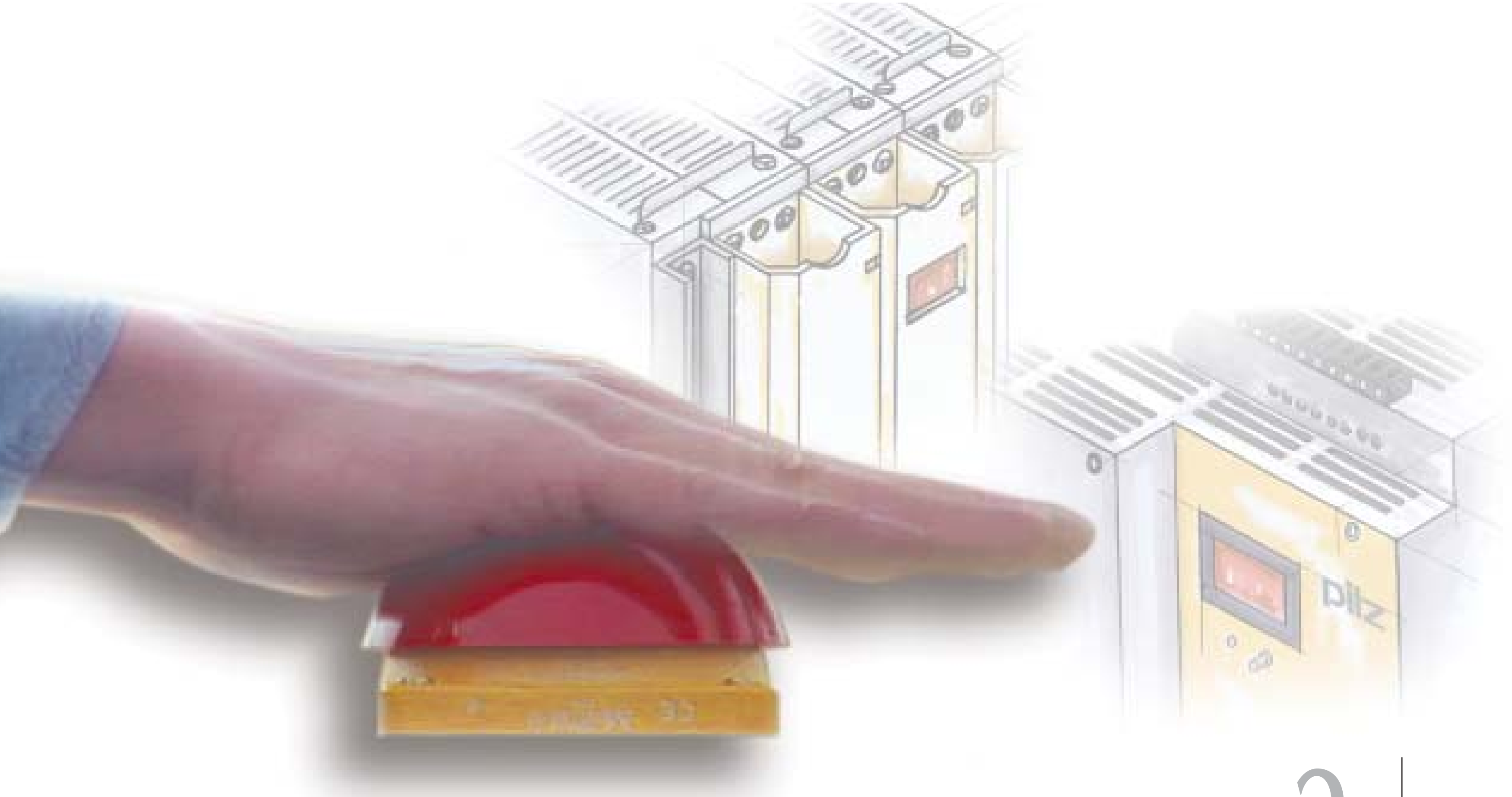
Dipl.-Ing. Harald Förster,
Head of Customer Support,
Pilz GmbH & Co. KG, Ostfildern

For many years Pilz has been seeking a way to offer its customers added value. Every day, numerous colleagues from development to customer support work on developing innovative products, services and the best possible solutions for our customers. They look for constant dialogue with our customers, so that their wishes and requirements can be taken into consideration.

It is not just a question of the right product, but above all of where, how and from whom to find competent, practical implementation support. Products that require explanation need descriptions, descriptions need clarifications, clarifications result in examples. And once again you will find a great number of these in our application manual. They communicate more quickly and directly how products and technologies are applied and used. People working in the field appreciate nothing more than complete, working examples. They can use these as a base, which can be enlarged or expanded quite simply and clearly.

Our application manual will provide guidance and help safety technology to be considered from the very start, in the specification and design phases. The standards' overview, applications, and circuit diagrams show the way, making it easier to deal with safety-related requirements. Despite all the examples and guidance, individual questions will still remain. We will happily share our experiences from numerous applications and a wide range of specific industry applications, as well as our specialist knowledge from working on the standards' committees. We look forward to talking with you and hearing your comments on the manual, and are happy to be able to support you with our comprehensive range of services.

Standards And Directives



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Standards And Directives

more than automation
safe automation

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European directives and status of the standards in Europe

European directives

The concept of a single European internal market in terms of the “New Approach” can be traced right back to the start of the 70s: The low voltage directive was the first piece of European legislation to take into account the approach towards harmonisation of a common internal market.

Products that are covered by one or more of the following directives have to apply a CE-mark, i.e. the product must be accompanied by a declaration of conformity. With a declaration of conformity, the manufacturer confirms that his product meets all the requirements of the European directives applicable to his product. This means he can launch and sell his product within the scope of the EU without consideration of any national regulations.

Lifts	95/16/EC
Construction products	89/106/EEC
Pressure equipment directive	97/23/EC
EMC directive	89/336/EEC
ATEX	94/9/EC
Appliances burning gaseous fuels	90/396/EEC
Machinery directive	98/37/EC
Medical device directive	93/42/EEC
Low voltage directive	73/23/EEC
Personal protective equipment	89/686/EEC
Safety of toys directive	88/378/EEC

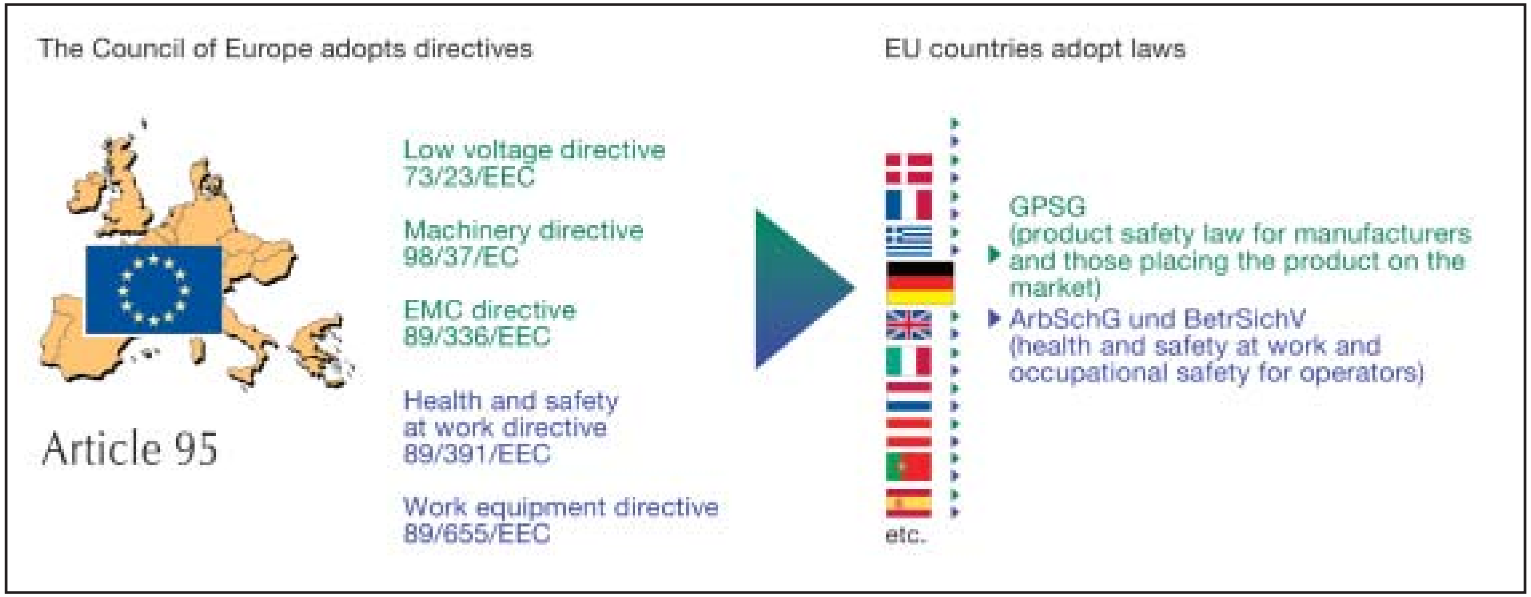

The Council of Europe adopts directives
EU countries adopt laws
Low voltage directive
73/23/EEC
Machinery directive
98/37/EC
EMC directive
89/336/EEC
Health and safety
at work directive
89/391/EEC
Work equipment directive
89/655/EEC
Article 95
GPSG
(product safety law for manufacturers
and those placing the product on the
market)
ArbSchG und BetrSichV
(health and safety at work and
occupational safety for operators)
etc.

Fig. 1: Incorporation of the directives into domestic law (using Germany as an example)

The directives are addressed to member states, who are obliged to incorporate the European directives into domestic law. In Germany, this is normally achieved through the device safety law.

Status of the standards in Europe

The legal status of standards is continuously discussed. Inside Europe, i.e. within the scope of the European directives that are subject to the CE-marking obligation, a manufacturer is not bound by standards or other specifications. He simply needs to comply with the health and safety requirements of the directive(s). The associated benefits of a division between standards and legislation are obvious: it is easier for legislators to agree on the essential requirements than on technical details. Also, the directives do not regularly have to be adapted to the state of technology; member states can use their own legal system for incorporation and the manufacturer is free to select how he implements the requirements of the directive.

So what are the benefits of applying the standards? With so-called harmonised standards with presumption of conformity, there is a shifting of the burden of proof, i.e. if a manufacturer applies these standards, he can assume that he will also comply with the specific requirements of the European directives. It would therefore be up to the

Legal regulations outside Europe

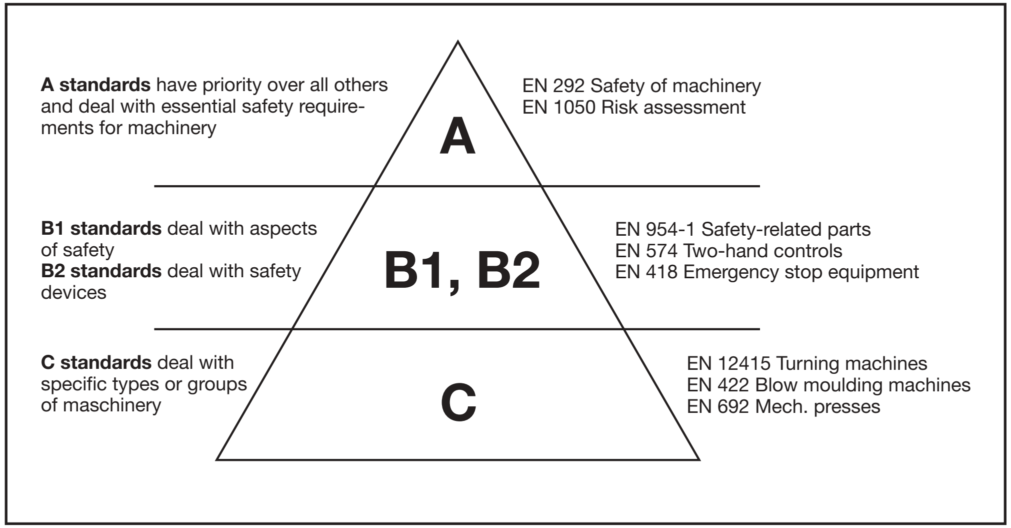

A standards have priority over all others and deal with essential safety requirements for machinery
A
EN 292 Safety of machinery
EN 1050 Risk assessment
B1 standards deal with aspects of safety
B2 standards deal with safety devices
B1, B2
EN 954-1 Safety-related parts
EN 574 Two-hand controls
EN 418 Emergency stop equipment
C standards deal with specific types or groups of maschinery
C
EN 12415 Turning machines
EN 422 Blow moulding machines
EN 692 Mech. presses

Fig. 2: Standards pyramid

regulatory authorities to prove that a manufacturer did not meet the legal requirements.

However, should a manufacturer deviate from the harmonised standards, he himself must prove how he has met the essential safety requirements. This is generally done via a hazard analysis. In practice people endeavour to apply the harmonised standards, unless the products concerned are highly innovative and no harmonised standards yet exist. The standards for which this “presumption effect” applies can be researched in the Official Journal of the EU (e.g. on the Internet). Standards in Europe are subdivided into A, B and C standards.

Legal regulations outside Europe

The situation is somewhat different in the USA: primarily there are two types of standards: ANSI (American National Standards Institute) and OSHA (Occupational Safety and Health Administration).

OSHA standards are published by the state and compliance is mandatory. ANSI standards, on the other hand, are developed by private organisations and generally their application is not strictly essential. However, ANSI standards are still quoted as part of a contract. And yet ANSI standards are being taken over by OSHA. You can still come across the NFPA (National Fire Protection Association), which developed NFPA 79 as a counterpart to EN 60204-1, for example. The OSHA standards can be compared with the European directives. Unlike the European directives, OSHA standards are more involved with formulating requirements for technical specifications than with abstract requirements.

The legal foundations in the USA can be seen as a mix of product standards, fire codes (NFPA), electrical codes (NEC) and national laws. Local government bodies have the authority to monitor that these codes are being enforced and implemented.

Russia and the CIS states implemented GOST-R certification some years ago. This means that technical devices falling within a specific product catalogue must undergo a certain certification process. Machinery and any corresponding technical accessories undergo a type approval test through a European notified body, for example. This test is generally recognised by a Russian-based approvals body. From the point of view of safety, the same requirements apply as in Europe.

China, on the other hand, has introduced CCC certification. Similar to the position in Russia, technical products are subject to mandatory certification through a national approvals body in China. In addition, production sites are inspected. If a technical device falls with the scope of the product catalogue, which is subdivided into 19 categories, certification is mandatory, otherwise it will be necessary to supply a type of “declaration of no objection” from a national notified body.

Japan is currently in a transition period: the plan is for Japan to adopt the European “new approach” – in other words, to keep standards and legislation separate. At the moment the international ISO and IEC standards are being directly incorporated into national legislation, which is why people are currently confronted with frequent amendments to laws and lengthy implementation periods.

Risk parameters and categories

Standards for functional safety

Different standards may be called upon to observe functional safety on control systems, depending on the application. In the area of machine safety, EN 954-1 is the main standard for safety-related control systems. This applies to the whole chain from the sensor to the actuator, irrespective of the technology. The risk graphs and corresponding risk parameters can be used to estimate the potential risk for danger zones on machinery. The category is initially established without the use of risk-reducing measures.

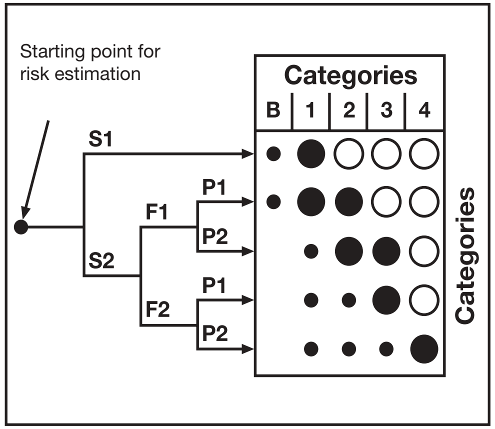


Fig. 3: Risk graph from EN 954

Risk parameters

S = Severity of injury:
1 = Slight (normally reversible) injury
2 = Serious (normally irreversible) injury, including death

F = Frequency and/or exposure to the hazard
1 = Seldom to quite often and/or exposure time is short
2 = Frequent to continuous and/or exposure time is long

P = Possibility of avoiding the hazard
1 = Possible under specific conditions
2 = Scarcely possible

Categories in accordance with EN 954-1

The control system requirements derived from the risk graph are specified as follows:

Category B

Basic category with no special requirements = “good industrial standard”

Category 1

Safety-related parts must be designed and constructed using well-tried components and well-tried safety principles.

Well-tried means: the components have been widely used in the past with successful results in similar applications, or they have been manufactured using principles that demonstrate their suitability and reliability for safety-related applications.

Example: safety switch with forced-opening contacts.

Well-tried safety principles are circuits constructed in such a way that certain faults can be avoided by the appropriate arrangement or layout of components.

Example: avoiding a short circuit through appropriate separation, avoiding component failures that result from over-dimensioning, using the failsafe principle (on switching off).

Note: When a fault occurs it can lead to the loss of the safety function.

Category 2

Safety-related parts of control systems must be designed so that their safety function(s) are checked at suitable intervals by the machine control system. The safety function(s) must be checked: at the machine start-up and prior to the initiation of any hazardous situation; periodically during operation, if the risk assessment and the kind of operation show that it is necessary.

This check may be initiated automatically or manually. Automatically, for example, the check may be initiated by a signal generated from a control system at suitable intervals. The automatic test should be provided by preference. The decision about the type of test depends on the risk assessment and the judgement of the end user or machine builder. If no fault is detected, operation may be approved as a result of the test. If a fault is detected, an output must be generated to initiate an appropriate control action. A second, independent shutdown route is required for this.

Notes: In some cases Category 2 is not applicable because the checking of the safety function cannot be applied to all components and devices. Moreover, the cost involved in implementing Category 2 correctly may be considerable, so that it may make better economic sense to implement a different category.
In general Category 2 can be realised with electronic techniques. The system behaviour allows the occurrence of a fault to lead to the loss of the safety function between checks; the loss of the safety function is detected by the check.

Functional safety and legal status of EN/IEC 61508

Category 3

Safety-related parts of control systems must be designed so that a single fault in any of these parts does not lead to the loss of the safety function.

Whenever reasonably practicable, the single fault shall be detected at or before the next demand upon the safety function. This does not mean that all faults will be detected. The accumulation of undetected faults can lead to an unintended output signal and a hazardous situation at the machine.

Category 4

Safety-related parts of control systems must be designed so that a single fault in any of these parts does not lead to a loss of the safety function; the single fault must be detected at or before the next demand upon the safety functions (e.g. immediately at switch on, at the end of a machine operating cycle).
If this detection is not possible, then an accumulation of faults shall not lead to a loss of the safety function.

Functional safety with EN/IEC 61508?

EN/IEC 61508 is regarded as a generic safety standard, which deals with the functional safety of electrical, electronic and programmable electronic systems, irrespective of the application.

One of the main tasks of EN/IEC 61508 is to serve as a basis for the development of application-oriented standards. Standards' committees are currently busy in the areas of machine safety with EN/IEC 62061, and process safety with EN/IEC 61511. Also under revision is EN 954, the standard harmonised under the scope of the machinery directive, which in future will be listed as EN/ISO 13849.

These sector-specific standards are intended to continue the principle approaches of EN/IEC 61508 and to implement the requirements for the relevant application area in a suitably practical manner.

What is the legal status of EN/IEC 61508?

As EN/IEC 61508 is not listed in the Official Journal of the European Communities for implementation as a European directive, it lacks the so-called “presumption effect”. If the standard is used on its own, a control system designer cannot assume that the relevant requirements of the specific European directive have been met.

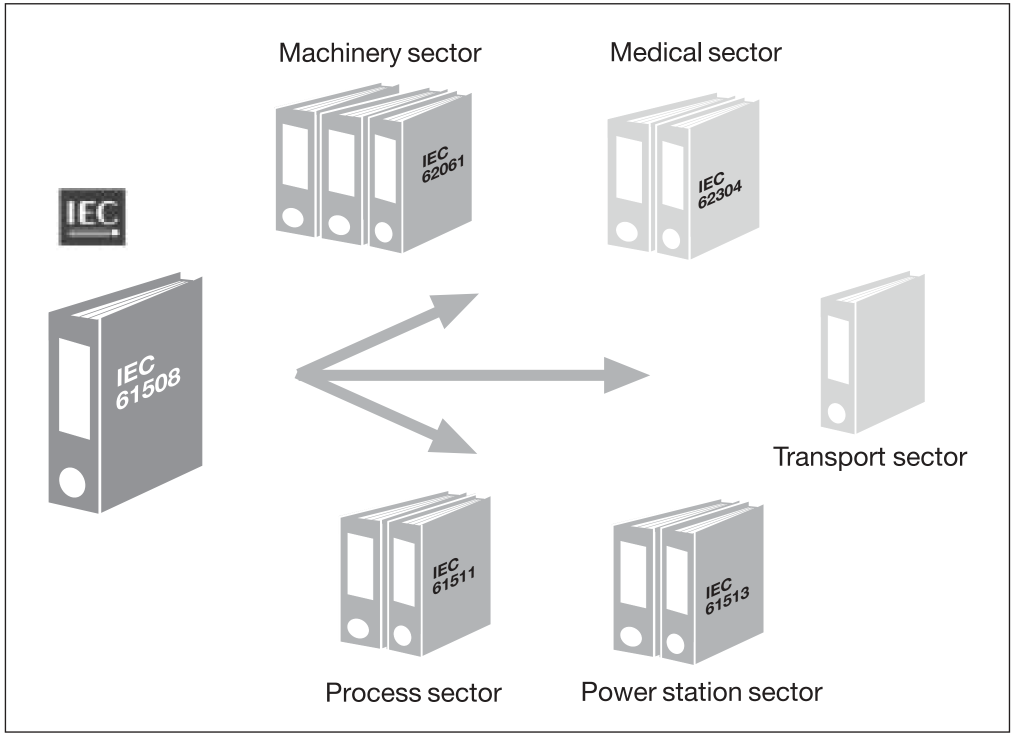


Fig. 4: Sector standards from IEC 61508

Risk analysis

Risk analysis

Under the terms of the machinery directive, a machine manufacturer must carry out a risk analysis in order to identify all the hazards that apply to his machine. This analysis must then be taken into account in the design and construction of the machine. This requirement also applies to operators who act as manufacturers under the terms of the machinery directive. For example, this may occur with machines that are interlinked or for machinery that has been upgraded and substantially modified.

EN 1050 contains "Principles for risk assessment" on machinery. These approaches can be called upon as part of a comprehensive analysis. EN 954-1 expands on EN 1050 with regard to the assessment of safety-related parts of control systems.

The hazards emanating from a machine may be many and varied. For example, it is necessary to consider not just mechanical hazards through crushing and shearing, but also thermal and electrical hazards and hazards from radiation. Risk reduction is therefore an iterative process, i.e. it is carried out before and during the planning phase and after completion of the plant or machine.

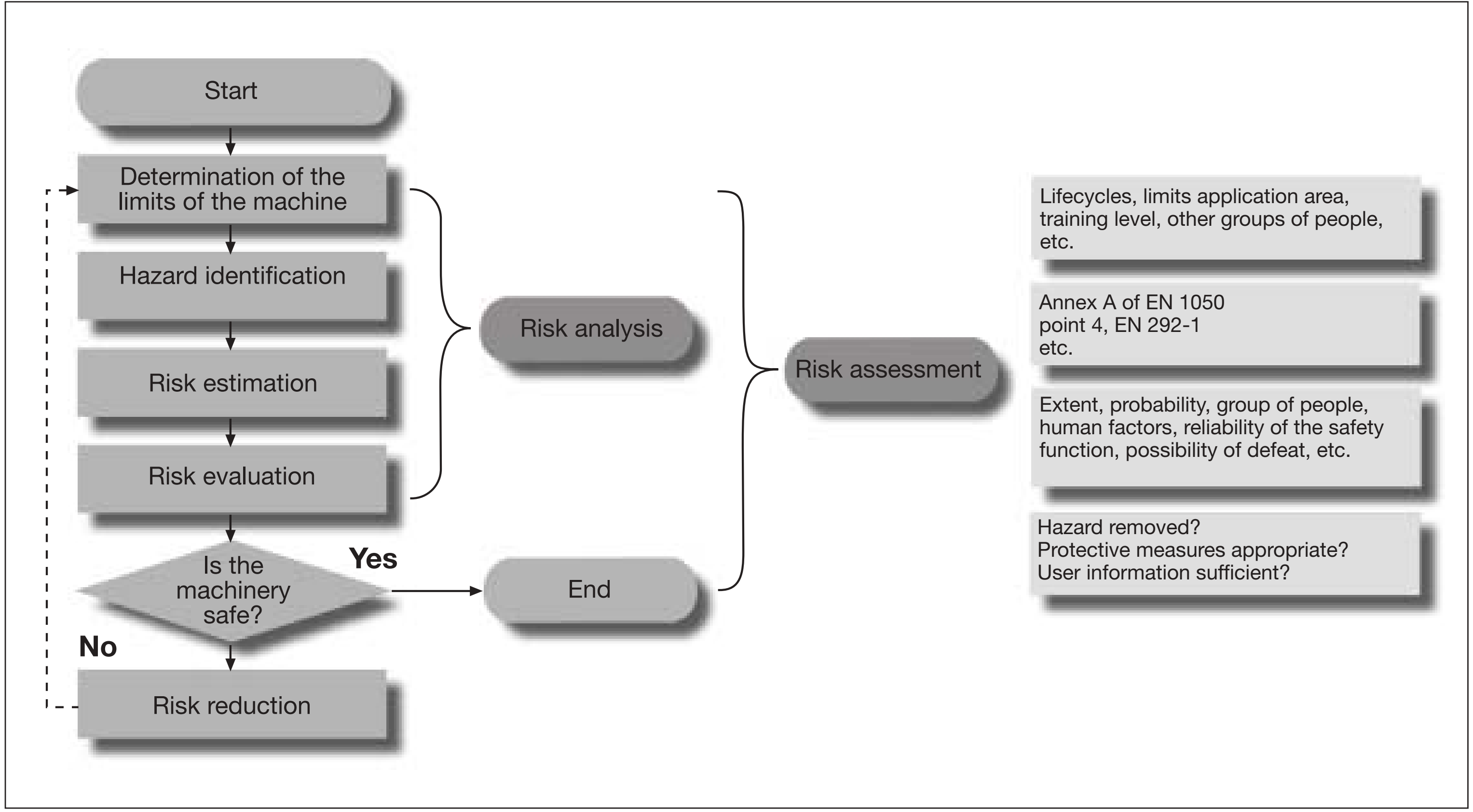
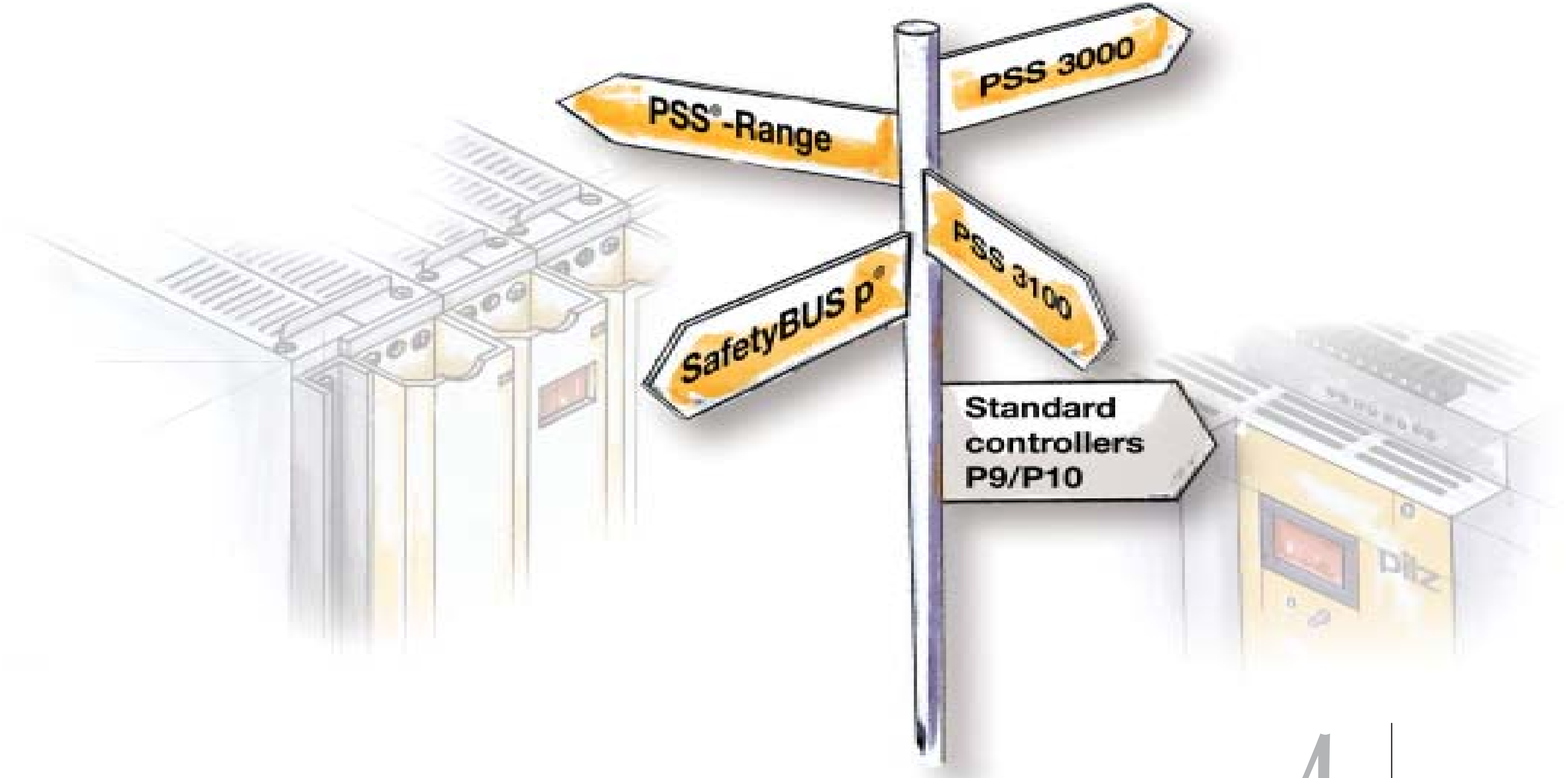

Start
Determination of the limits of the machine
Hazard identification
Risk estimation
Risk evaluation
Is the machinery safe?
Yes
No
Risk reduction
End
Risk analysis
Risk assessment
Lifecycles, limits application area, training level, other groups of people, etc.
Annex A of EN 1050 point 4, EN 292-1 etc.
Extent, probability, group of people, human factors, reliability of the safety function, possibility of defeat, etc.
Hazard removed? Protective measures appropriate? User information sufficient?

Fig. 5: Iterative process in accordance with EN 1050

Configuration Guides
PSS®-Range And SafetyBUS p®


PSS®-Range
PSS 3000
PSS 3100
SafetyBUS p®
Standard controllers P9/P10
pilz

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Configuration Guides PSS®-Range And SafetyBUS p®

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Module rack PSS1 BMP 5/2 4-10

Module rack

PSS BM 4

- ░ Possible
- ▓ Blanking plate possible
- ◆ Max. 32 alarms can be configured

Module	Features	Description	Order No.	Power supply	CPU	Slot No. 0	1	2	3
Basic features									
Module rack	Failsafe	PSS BM 4	301 001						
Power supply	24 VDC 10 A	PSS PS 24	301 051	░					
Power supply	230 V/115 VAC 10 A	PSS PS	301 050	░					
CPU	Without SafetyBUS p	PSS CPU3	301 064		░				
CPU	With SafetyBUS p	PSS SB CPU3	301 071		░				
Failsafe									
Input	32 inputs 24 VDC up to CAT 4	PSS DI 2	301 101			░	░	░	░
Alarm input	16 alarm inputs 24 VDC, 0.5 ms	PSS DIF	301 105			◆	◆	◆	◆
Alarm input	16 alarm inputs 24 VDC, 3 ms	PSS DIF 2	301 106			◆	◆	◆	◆
Analogue input	6 inputs +/- 10 V	PSS AI	301 121			░	░	░	░
Analogue input	6 inputs +4 ... +20 m A, passive	PSS AI Ip	301 123			░	░	░	░
Output	32 outputs 24 VDC, 2 A	PSS DOS	301 111			░	░	░	░
Input/output	16 inputs 24 VDC; 8 outputs 24 VDC, 2 A	PSS DI2O Z	301 109			░	░	░	░
Input/output	16 inputs 24 VDC; max. 16 test pulse outputs 24 VDC, 2 A	PSS DI2O T	301 112			░	░	░	░
Relay output	12 relay outputs, 12 N/O contacts	PSS DOR	301 122			░	░	░	░
Accessories									
Blanking plate	Blanking plate with closed front panel for PSS 3000/P10	LEER	304 525			▓	▓	▓	▓

Module rack

PSS BM 8

░ Possible

▓ Blanking plate possible

◆ Max. 32 alarms can be configured

Module	Features	Description	Order No.	Power supply	CPU	Slot No.								
						0	1	2	3	4	5	6	7	8
Basic features														
Module rack	Failsafe	PSS BM 4	301 001											
Power supply	24 VDC 10 A	PSS PS 24	301 051	░										
Power supply	230 V/115 VAC 10 A	PSS PS	301 050	░										
CPU	Without SafetyBUS p	PSS CPU3	301 064		░									
CPU	With SafetyBUS p	PSS SB CPU3	301 071		░									
Failsafe														
Input	32 inputs 24 VDC up to CAT 4	PSS DI 2	301 101			░	░	░	░	░	░	░	░	░
Alarm input	16 alarm inputs 24 VDC, 0.5 ms	PSS DIF	301 105			◆	◆	◆	◆	◆	◆	◆	◆	◆
Alarm input	16 alarm inputs 24 VDC, 3 ms	PSS DIF 2	301 106			◆	◆	◆	◆	◆	◆	◆	◆	◆
Analogue input	6 inputs +/- 10 V	PSS AI	301 121			░	░	░	░	░	░	░	░	░
Analogue input	6 inputs +4 ... +20 m A, passive	PSS AI Ip	301 123			░	░	░	░	░	░	░	░	░
Output	32 outputs 24 VDC, 2 A	PSS DOS	301 111			░	░	░	░	░	░	░	░	░
Input/output	16 inputs 24 VDC; 8 outputs 24 VDC, 2 A	PSS DI2O Z	301 109			░	░	░	░	░	░	░	░	░
Input/output	16 inputs 24 VDC; max. 16 test pulse outputs 24 VDC, 2 A	PSS DI2O T	301 112			░	░	░	░	░	░	░	░	░
Relay output	12 relay outputs, 12 N/O contacts	PSS DOR	301 122			░	░	░	░	░	░	░	░	░
Accessories														
Blanking plate	Blanking plate with closed front panel for PSS 3000/P10	LEER	304 525			▓	▓	▓	▓	▓	▓	▓	▓	▓

Module rack

PSS BMP 4/2

░ Possible

▒ ST possible

▓ Blanking plate possible

◆ Max. 32 alarms can be configured

Module	Features	Description	Order No.	Power supply	CPU	Slot No. 0	1	2	3
Basic features									
Module rack	Failsafe and standard	PSS BMP 4/2	301 006						
Power supply	24 VDC 10 A	PSS PS 24	301 051	░					
Power supply	230 V/115 VAC 10 A	PSS PS	301 050	░					
CPU	Without SafetyBUS p	PSS CPU3	301 064		░				
CPU	With SafetyBUS p	PSS SB CPU3	301 071		░				
Failsafe									
Input	32 inputs 24 VDC up to CAT 4	PSS DI 2	301 101			░	░	░	░
Alarm input	16 alarm inputs 24 VDC, 0.5 ms	PSS DIF	301 105			░ ◆	░ ◆	░ ◆	░ ◆
Alarm input	16 alarm inputs 24 VDC, 3 ms	PSS DIF 2	301 106			░ ◆	░ ◆	░ ◆	░ ◆
Analogue input	6 inputs +/- 10 V	PSS AI	301 121			░	░	░	░
Analogue input	6 inputs +4 ... +20 m A, passive	PSS AI Ip	301 123			░	░	░	░
Output	32 outputs 24 VDC, 2 A	PSS DOS	301 111			░	░	░	░
Input/output	16 inputs 24 VDC; 8 outputs 24 VDC, 2 A	PSS DI2O Z	301 109			░	░	░	░
Input/output	16 inputs 24 VDC; max. 16 test pulse outputs 24 VDC, 2 A	PSS DI2O T	301 112			░	░	░	░
Relay output	12 relay outputs, 12 N/O contacts	PSS DOR	301 122			░	░	░	░

Module	Features	Description	Order No.	Power supply	CPU	Slot No. 0	1	2	3
Standard									
Input	32 inputs 24 VDC	P10 DI	304 100			▒	▒		
Output	32 outputs 24 VDC, 2 A	P10 DO	304 110			▒	▒		
Input/output	16 inputs 24 VDC, 16 outputs 24 VDC, 2 A	P10 DIO	304 107			▒	▒		
Relay output	16 outputs 2 A	P10 DOR 16	304 122			▒	▒		
Analogue input/output	6 inputs +/- 10 V, 0 ... 20 m A; 2 outputs +/- 10 V, 0 ... 20 m A	P10 AIO	304 120			▒	▒		
Communication									
Serial	2 serial interfaces, RS 232/RS 485	PSS SER	301 159			▒	▒		
Interbus	Slave module with PCP protocol	PSS IBS-S PCP	301 154			▒	▒		
Profibus	DP-Slave module	PSS DP-S	301 151			▒	▒		
DeviceNet	DeviceNet Slave module	PSS DN-S	301 152			▒	▒		
CANopen	CANopen Slave module	PSS CANopen	301 155			▒	▒		
ControlNet	ControlNet-Adapter module	PSS ControlNet	301 156			▒	▒		
Ethernet	Ethernet communications module	PSS Ethernet	301 157			▒	▒		
Expansion									
Blanking plate	Blanking plate with closed front panel for PSS 3000/P10	LEER				▓	▓	▓	▓

░ Possible

▒ ST possible

▓ Blanking plate possible

◆ Max. 32 alarms can be configured

Module rack
PSS BMP 8

░ Possible

▒ ST possible

▓ Blanking plate possible

◆ Max. 32 alarms can be configured

Module	Features	Description	Order No.	Power supply	CPU	Slot No. 0	1	2	3	4	5	6	7	8
Basic features														
Module rack	Failsafe and standard	PSS BMP 8	301 005											
Power supply	24 VDC 10 A	PSS PS 24	301 051	░										
Power supply	230 V/115 VAC 10 A	PSS PS	301 050	░										
CPU	Without SafetyBUS p	PSS CPU3	301 064		░									
CPU	With SafetyBUS p	PSS SB CPU3	301 071		░									
Failsafe														
Input	32 inputs 24 VDC up to CAT 4	PSS DI 2	301 101			░	░	░	░	░	░	░	░	░
Alarm input	16 alarm inputs 24 VDC, 0.5 ms	PSS DIF	301 105			░ ◆	░ ◆	░ ◆	░ ◆	░ ◆	░ ◆	░ ◆	░ ◆	░ ◆
Alarm input	16 alarm inputs 24 VDC, 3 ms	PSS DIF 2	301 106			░ ◆	░ ◆	░ ◆	░ ◆	░ ◆	░ ◆	░ ◆	░ ◆	░ ◆
Analogue input	6 inputs +/- 10 V	PSS AI	301 121			░	░	░	░	░	░	░	░	░
Analogue input	6 inputs +4 ... +20 m A, passive	PSS AI Ip	301 123			░	░	░	░	░	░	░	░	░
Output	32 outputs 24 VDC, 2 A	PSS DOS	301 111			░	░	░	░	░	░	░	░	░
Input/output	16 inputs 24 VDC; 8 outputs 24 VDC, 2 A	PSS DI2O Z	301 109			░	░	░	░	░	░	░	░	░
Input/output	16 inputs 24 VDC; max. 16 test pulse outputs 24 VDC, 2 A	PSS DI2O T	301 112			░	░	░	░	░	░	░	░	░
Relay output	12 relay outputs, 12 N/O contacts	PSS DOR	301 122			░	░	░	░	░	░	░	░	░

Module	**Features**	**Description**	**Order No.**	**Power supply**	**CPU**	**Slot No.**								
						0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Standard														
Input	32 inputs 24 VDC	P10 DI	304 100			▒	▒	▒	▒	▒	▒	▒	▒	▒
Output	32 outputs 24 VDC, 2 A	P10 DO	304 110			▒	▒	▒	▒	▒	▒	▒	▒	▒
Input/output	16 inputs 24 VDC, 16 outputs 24 VDC, 2 A	P10 DIO	304 107			▒	▒	▒	▒	▒	▒	▒	▒	▒
Relay output	16 outputs 2 A	P10 DOR 16	304 122			▒	▒	▒	▒	▒	▒	▒	▒	▒
Analogue input/output	6 inputs +/- 10 V, 0 ... 20 m A; 2 outputs +/- 10 V, 0 ... 20 m A	P10 AIO	304 120			▒	▒	▒	▒	▒	▒	▒	▒	▒
Communication														
Serial	2 serial interfaces, RS 232/RS 485	PSS SER	301 159			▒	▒	▒	▒	▒	▒	▒	▒	▒
Interbus	Slave module with PCP protocol	PSS IBS-S PCP	301 154			▒	▒	▒	▒	▒	▒	▒	▒	▒
Profibus	DP-Slave module	PSS DP-S	301 151			▒	▒	▒	▒	▒	▒	▒	▒	▒
DeviceNet	DeviceNet Slave module	PSS DN-S	301 152			▒	▒	▒	▒	▒	▒	▒	▒	▒
CANopen	CANopen Slave module	PSS CANopen	301 155			▒	▒	▒	▒	▒	▒	▒	▒	▒
ControlNet	ControlNet-Adapter module	PSS ControlNet	301 156			▒	▒	▒	▒	▒	▒	▒	▒	▒
Ethernet	Ethernet communications module	PSS Ethernet	301 157			▒	▒	▒	▒	▒	▒	▒	▒	▒
Expansion														
Expansion module	**Expansion** module for connecting additional module racks	EPB	304 091											▒
Accessories														
Blanking plate	Blanking plate with closed front panel for PSS 3000/P10	LEER	304 525			▓	▓	▓	▓	▓	▓	▓	▓	▓

░ Possible

▒ ST possible

▓ Blanking plate possible

◆ Max. 32 alarms can be configured

Module rack

PSS1 BMPS 3/1

░ Possible

▒ ST possible

▓ Blanking plate possible

◆ Max. 32 alarms can be configured

Module	Features	Description	Order No.	CPU	Slot No.		
					0	1	2
Basic features							
Module rack	Failsafe and standard, integral power supply 24 VDC; 3.5 A	PSS1 BMPS 3/1	302 007				
CPU	Without SafetyBUS p	PSS1 CPU3	302 064	░			
CPU	With SafetyBUS p	PSS1 SB CPU3	302 071	░			
Failsafe							
Input	32 inputs 24 VDC up to CAT 4	PSS1 DI 2	302 101		░	░	░
Alarm input	16 alarm inputs 24 VDC, 0.5 ms	PSS1 DIF	302 105		░ ◆	░ ◆	░ ◆
Analogue input	6 inputs +/- 10 V	PSS1 AI	302 121		░	░	░
Analogue input	6 inputs +4 ... +20 m A, passive	PSS1 AI Ip	302 123		░	░	░
Output	32 outputs 24 VDC, 2 A	PSS1 DOS	302 111		░	░	░
Input/output	16 inputs 24 VDC; 8 outputs 24 V DC, 2 A	PSS1 DI2O Z	302 109		░	░	░
Input/output	16 inputs 24 VDC; max. 16 test pulse outputs 24 VDC, 2 A	PSS1 DI2O T	302 112		░	░	░
Relay output	12 relay outputs, 12 N/O contacts	PSS1 DOR	302 122		░	░	░
Standard							
Input	32 inputs 24 VDC	P9 DI	302 100				▒
Output	32 outputs 24 VDC, 2 A	P9 DO	302 110				▒
Input/output	16 inputs 24 VDC, 16 outputs 24 VDC, 2 A	P9 DIO	302 107				▒
Relay output	16 outputs 2 A	P9 DOR 16	302 122				▒
Analogue input/output	6 inputs +/- 10 V, 0 ... 20 m A; 2 outputs +/- 10 V, 0 ... 20 m A	P9 AIO	302 120				▒

Module	Features	Description	Order No.	CPU	Slot No.		
					0	1	2
Communication							
Serial	2 serial interfaces RS 232/RS 485	PSS1 SER	302 159				▒
Interbus	Slave module with PCP protocol	PSS1 IBS-S PCP	302 154				▒
Profibus	DP-Slave module	PSS1 DP-S	302 151				▒
DeviceNet	DeviceNet Slave module	PSS1 DN-S	302 152				▒
CANopen	CANopen Slave module	PSS1 CANopen	302 155				▒
ControlNet	ControlNet-Adapter module	PSS1 ControlNet	302 156				▒
Ethernet	Ethernet communications module	PSS1 Ethernet	302 157				▒
Accessories							
Front cover	Front cover for unused slots	FB			▓	▓	▓

░ Possible

▒ ST possible

▓ Blanking plate possible

◆ Max. 32 alarms can be configured

Module rack

PSS1 BMP 5/2

░ Possible

▒ ST possible

▓ Blanking plate possible

◆ Max. 32 alarms can be configured

Module	Basic features	Description	Order No.	Power supply	CPU	Slot No. 0	1	2	3	4
Basic features										
Module rack	Failsafe and standard	PSS1 BMP 5/2	302 006							
Power supply	24 VDC, 5 A	PSS1 PS 24	302 051	░						
CPU	Without SafetyBUS p	PSS1 CPU3	302 064		░					
CPU	With SafetyBUS p	PSS1 SB CPU3	302 071		░					
Failsafe										
Input	32 inputs 24 VDC up to CAT 4	PSS1 DI 2	302 101			░	░	░	░	░
Alarm input	16 alarm inputs 24 VDC, 0.5 ms	PSS1 DIF	302 105			░ ◆	░ ◆	░ ◆	░ ◆	░ ◆
Analogue input	6 inputs +/- 10 V	PSS1 AI	302 121			░	░	░	░	░
Analogue input	6 inputs +4 ... +20 m A, passive	PSS1 AI Ip	302 123			░	░	░	░	░
Output	32 outputs 24 VDC, 2 A	PSS1 DOS	302 111			░	░	░	░	░
Input/output	16 inputs 24 VDC; 8 outputs 24 VDC, 2 A	PSS1 DI2O Z	302 109			░	░	░	░	░
Input/output	16 inputs 24 VDC; max. 16 test pulse outputs 24 VDC, 2 A	PSS1 DI2O T	302 112			░	░	░	░	░
Relay output	12 relay outputs, 12 N/O contacts	PSS1 DOR	302 122			░	░	░	░	░
Standard										
Input	32 inputs 24 VDC	P9 DI	303 100			▒	▒			
Output	32 outputs 24 VDC, 2 A	P9 DO	303 110			▒	▒			
Input/output	16 inputs 24 VDC, 16 outputs 24 VDC, 2 A	P9 DIO	303 107			▒	▒			
Relay output	16 outputs 2 A	P9 DOR 16	303 122			▒	▒			
Analogue input/output	6 inputs +/- 10 V, 0 ... 20 m A; 2 outputs +/- 10 V, 0 ... 20 m A	P9 AIO	303 120			▒	▒			

Module	Features	Description	Order No.	Power supply	CPU	Slot No. 0	1	2	3	4
Communication										
Serial	2 serial interfaces, RS 232/RS 485	PSS1 SER	302 159			▒	▒			
Interbus	Slave module with PCP protocol	PSS1 IBS-S PCP	302 154			▒	▒			
Profibus	DP-Slave module	PSS1 DP-S	302 151			▒	▒			
DeviceNet	DeviceNet Slave module	PSS1 DN-S	302 152			▒	▒			
CANopen	CANopen Slave module	PSS1 CANopen	302 155			▒	▒			
ControlNet	ControlNet-Adapter module	PSS1 ControlNet	302 156			▒	▒			
Ethernet	Ethernet communications module	PSS1 Ethernet	302 157			▒	▒			
Accessories										
Front cover	Front cover for unused slots	FB				▓	▓	▓	▓	▓

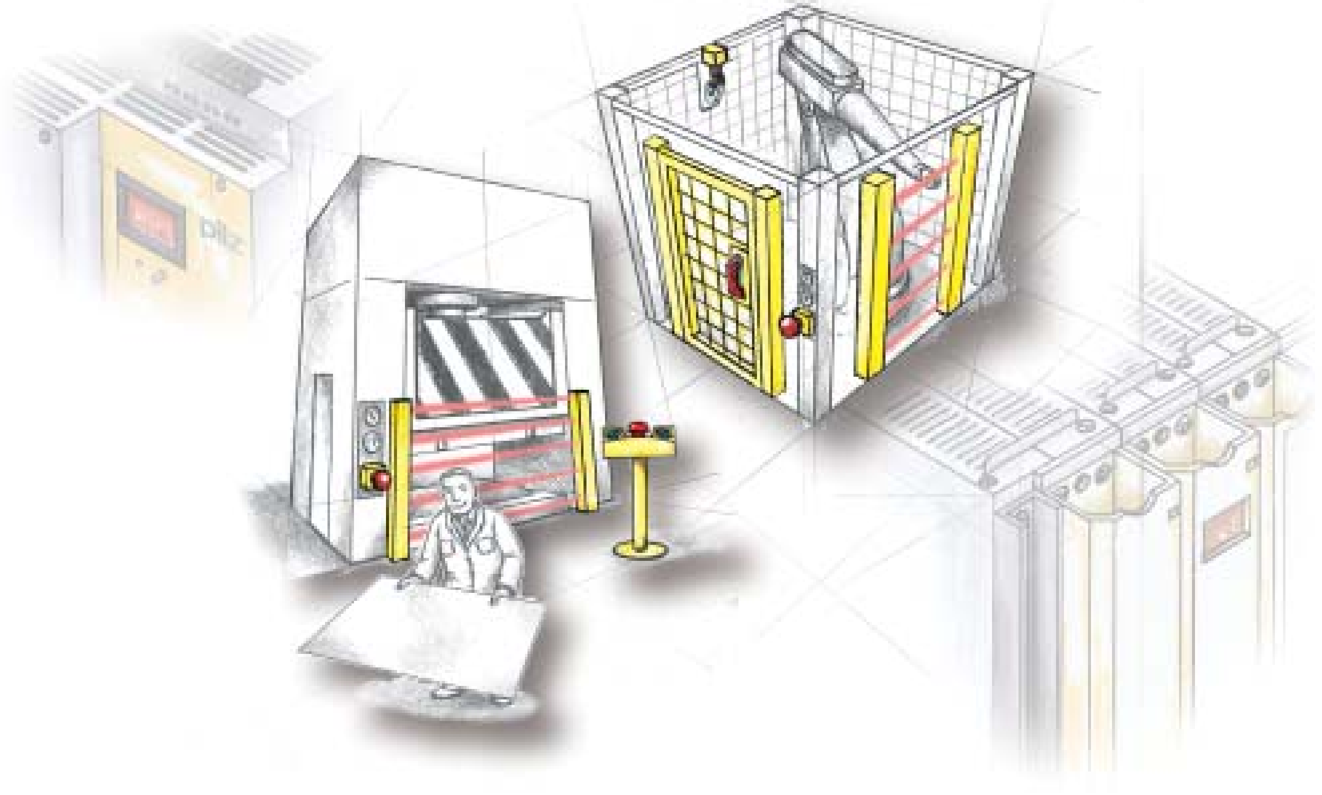
░ Possible

▒ ST possible

▓ Blanking plate possible

◆ Max. 32 alarms can be configured

Application Examples



5

Application Examples

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Two-hand applications 5.4-1
Sensor applications 5.5-1
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Further applications 5.7-1

Emergency Stop Applications

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PSS 3000	–	Emergency stop monitoring	Category 2, EN 954-1	5.1-10
SafetyBUS p	–	Emergency stop monitoring	Category 2, EN 954-1	5.1-14
PSS 3000	–	Pull-wire monitoring	Category 4, EN 954-1	5.1-18
PSS 3000	–	Pull-wire monitoring	Category 2, EN 954-1	5.1-22

Category 4, EN 954-1

PSS 3100 – Emergency stop monitoring

Features

- Dual-channel redundancy with detection of shorts across contacts
- Manual reset when the PSS is cold/warm started
- Manual reset after releasing the E-STOP button and starting the SafetyBUS p I/O-Groups
- Failsafe standard function block used: SB063 (E-STOP)
- Feasibility test on the input signals and monitoring of the contact synchronisation time in SB063

Description

Emergency stop function
In this example the safety system monitors the two E-STOP buttons S1 and S2. Within the user program, one failsafe standard function block SB063 is assigned to each E-STOP button. SB063 detects whether the assigned E-STOP button has been operated, as well as detecting incorrect input signals and whether the contact synchronisation time has been exceeded, etc.
If the E-STOP button is operated or an error occurs, the enable output *ENBL* on the relevant SB063 will immediately be reset. The enable output *ENBL* is also reset when the PSS is stopped and when the PSS is switched on.
The signals from both enable outputs *ENBL* must be evaluated by the user program and trigger an appropriate reaction. SB063 stores a value in DB015 (DB016 or DB017), which can be used to determine why *ENBL* was reset.
The way in which the error is reset will depend on the operating mode set on SB063.
In this application example, parameters for SB063 have been set in such a way that it is necessary to reset by pressing S3 (0/1 pulse edge at *RSET*) in order to reset output parameter *ENBL* on SB063 when the PSS is cold started (PSS switched from off to on), warm started (PSS transferring from STOP to RUN) or when the E-STOP button is released.

Safety assessment
- If a contact on the E-STOP button is overridden, the standard function block will detect this as an error at the next operation.
- A short between the input circuits within a multicore cable will be detected as an error by the programmable safety system.
- A short between 24 VDC and an input circuit will be detected as an error by the programmable safety system.

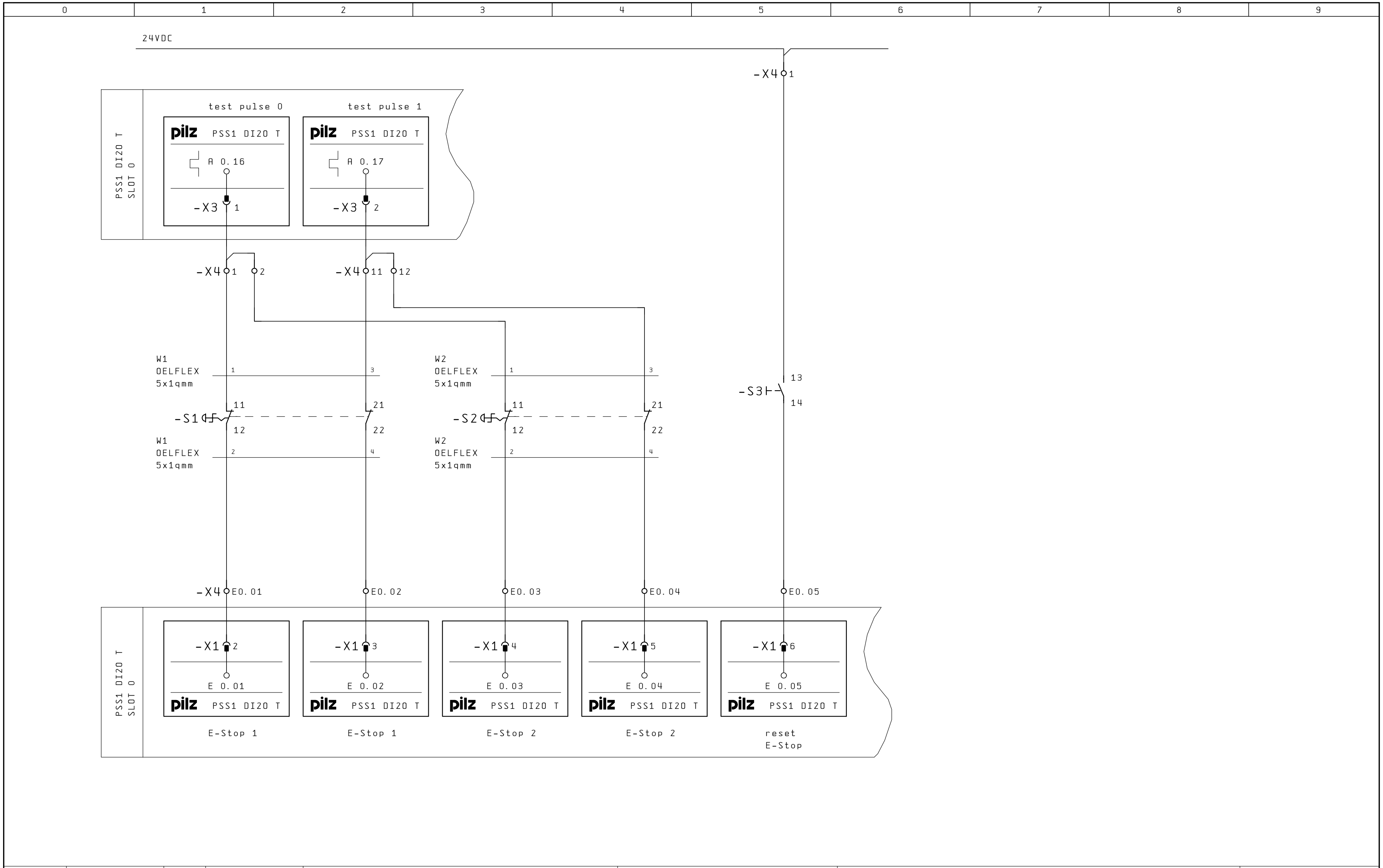
Classification in accordance with EN 954-1
Depending on the application area and its respective regulations, this connection example is suitable for applications up to category 4, in accordance with EN 954-1.

Pilz products

Number	Description	Order number
1	PSS1 CPU 3	302 064
1	PSS1 BMP 3/1	302 007
1	PSS1 DI2O T	302 112

Drawing file

Page 2 in the project “Eplan4/Pilz/APPL0703”


0
1
2
3
4
5
6
7
8
9
24VDC
-X4 1
PSS1 DI20 T
SLOT 0
test pulse 0
test pulse 1
pilz PSS1 DI20 T
A 0.16
-X3 1
pilz PSS1 DI20 T
A 0.17
-X3 2
-X4 1 2
-X4 11 12
W1
OELFLEX
5x1qmm
W2
OELFLEX
5x1qmm
1
3
-S1
11
12
21
22
-S2
11
12
21
22
-S3
13
14
W1
OELFLEX
5x1qmm
W2
OELFLEX
5x1qmm
2
4
-X4 E0.01
E0.02
E0.03
E0.04
E0.05
PSS1 DI20 T
SLOT 0
-X1 2
E 0.01
pilz PSS1 DI20 T
-X1 3
E 0.02
pilz PSS1 DI20 T
-X1 4
E 0.03
pilz PSS1 DI20 T
-X1 5
E 0.04
pilz PSS1 DI20 T
-X1 6
E 0.05
pilz PSS1 DI20 T
E-Stop 1
E-Stop 1
E-Stop 2
E-Stop 2
reset
E-Stop

Revision	29. Apr. 2004	Date	22. Apr. 2003	E-Stop applications	Pilz GmbH & Co. KG Felix-Wankel-Str. 2 73760 Ostfildern	E-Stop monitoring with PSS 3100	Directory: Eplan4/Pilz/App10703
Name	CLE	Name	CLE				
				Category 4 EN 954-1			Page: 2
		Dep.	CS				

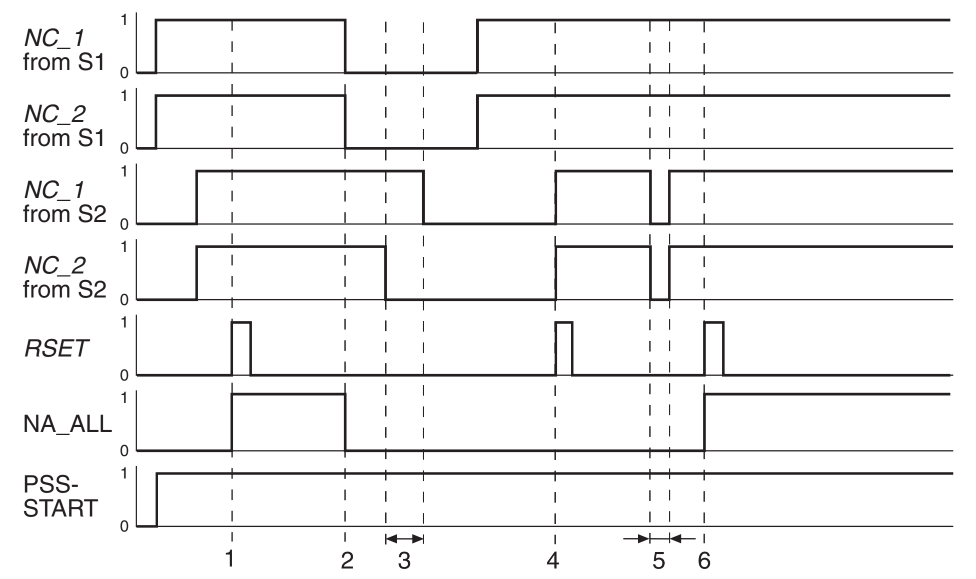
Category 4, EN 954-1

PSS 3100 – Emergency stop monitoring

Timing diagram

Parameters set on SB063

- Without SafetyBUS p connection:
  GRP = RLO-1
- Manual reset when PSS is cold/warm started:
  AuSt = 0
- Manual reset when E-STOP button is released:
  ARst = 0
- A function test must be performed if there is a synchronisation error when the E-STOP button is released:
  FTST = 1



1: Normal operation, start-up reset
2: E-STOP button 1 operated
3: E-STOP button 2 synchronisation error
4: Reset lock
5: Function test E-STOP button
6: Reset lock reset

Program

```
                                      SB063
                                      E-STOP

KF  000003                 - W -  SSNR        ENBL  - X  - M   070.02 .NA_1
M   110.01  .RLO-1         - X -  GRP
E   0.01    .ESTOP1_1      - X -  NC_1
E   0.02    .ESTOP1_2      - X -  NC_2
M   110.00  .RLO-0         - X -  AuSt
M   110.00  .RLO-0         - X -  ARst
M   110.01  .RLO-1         - X -  FTST
E   0.05    .RSET          - X -  RSET
```

```
                                      SB063
                                      E-STOP

KF  000004                 - W -  SSNR        ENBL  - X  - M   070.03 .NA_2
M   110.01  .RLO-1         - X -  GRP
E   0.03    .ESTOP1_1      - X -  NC_1
E   0.04    .ESTOP1_2      - X -  NC_2
M   110.00  .RLO-0         - X -  AuSt
M   110.00  .RLO-0         - X -  ARst
M   110.01  .RLO-1         - X -  FTST
E   0.05    .RSET          - X -  RSET
```

Additional commands:

```
:  L    M070.02     .NA_1
:  U    M070.03     .NA_2
:  =    M080.00     .NA_ALL
```

Please note:
A “Minimum scan time” must be specified in the configurator of the PSS SW PG system software.

Category 4, EN 954-1

PSS 3100 – Emergency stop monitoring

Global parameters used in administration data block DB015, DB016 and DB017

- DW1001: Number of cycles in the contact synchronisation time between 2 N/C contacts on the E-STOP button

Global parameters may be set in OB120 using SB071.

Additional blocks required

- DB015, DB016, DB017: Administration data block
  DB015, DB016 and DB017 must consist of their total length of 1024 data words. DB015, DB016 and DB017 must be declared READ/WRITE.
- SB071: Initialisation of global parameters in DB015, DB016, DB017
- SB255: Operating system call

Category 4, EN 954-1

SafetyBUS p – Emergency stop monitoring

Features

- Dual-channel redundancy with detection of shorts across contacts
- Automatic reset when the PSS is cold/ warm started
- Automatic reset when emergency stop button is released
- Failsafe standard function block used: SB063 (E-STOP)
- Feasibility test on the input signals and monitoring of the contact synchronisation time in SB063

Description

Emergency stop function

In this example the safety system with the safe bus system SafetyBUS p monitors the two E-STOP buttons S1 and S2. Within the user program, one failsafe standard function block SB063 is assigned to each E-STOP button. SB063 detects whether the assigned E-STOP button has been operated, as well as detecting incorrect input signals and whether the contact synchronisation time has been exceeded, etc.

If the E-STOP button is operated or an error occurs, the enable output *ENBL* on the relevant SB063 will immediately be reset.

The enable output *ENBL* is also reset when the PSS is stopped and when the PSS is switched on.

The signals from both enable outputs *ENBL* must be evaluated by the user program and trigger an appropriate reaction. SB063 stores a value in DB015 (DB016 or DB017); this can be used to determine why *ENBL* was reset.

The way in which the error is reset will depend on the operating mode set on SB063.

In this application example, parameters for SB063 have been set in such a way that no reset is required in order to reset output parameter *ENBL* on SB063 when the PSS is cold started (PSS switched from off to on), warm started (PSS transferring from STOP to RUN), SafetyBUS p I/O-Groups are started or when the E-STOP button is released. Although the emergency stop functions are configured to reset themselves, a PSS cold start, a SafetyBUS I/O-Group start or the release of an E-STOP button that has been operated may not directly enable a machine to start up without further conditions being met.

Safety assessment

- If a contact on the E-STOP button is overridden, the standard function block will detect this as an error at the next operation.
- A short between the input circuits within a multicore cable will be detected as an error by the programmable safety system.
- A short between 24 VDC and an input circuit will be detected as an error by the programmable safety system.

Classification in accordance with EN 954-1

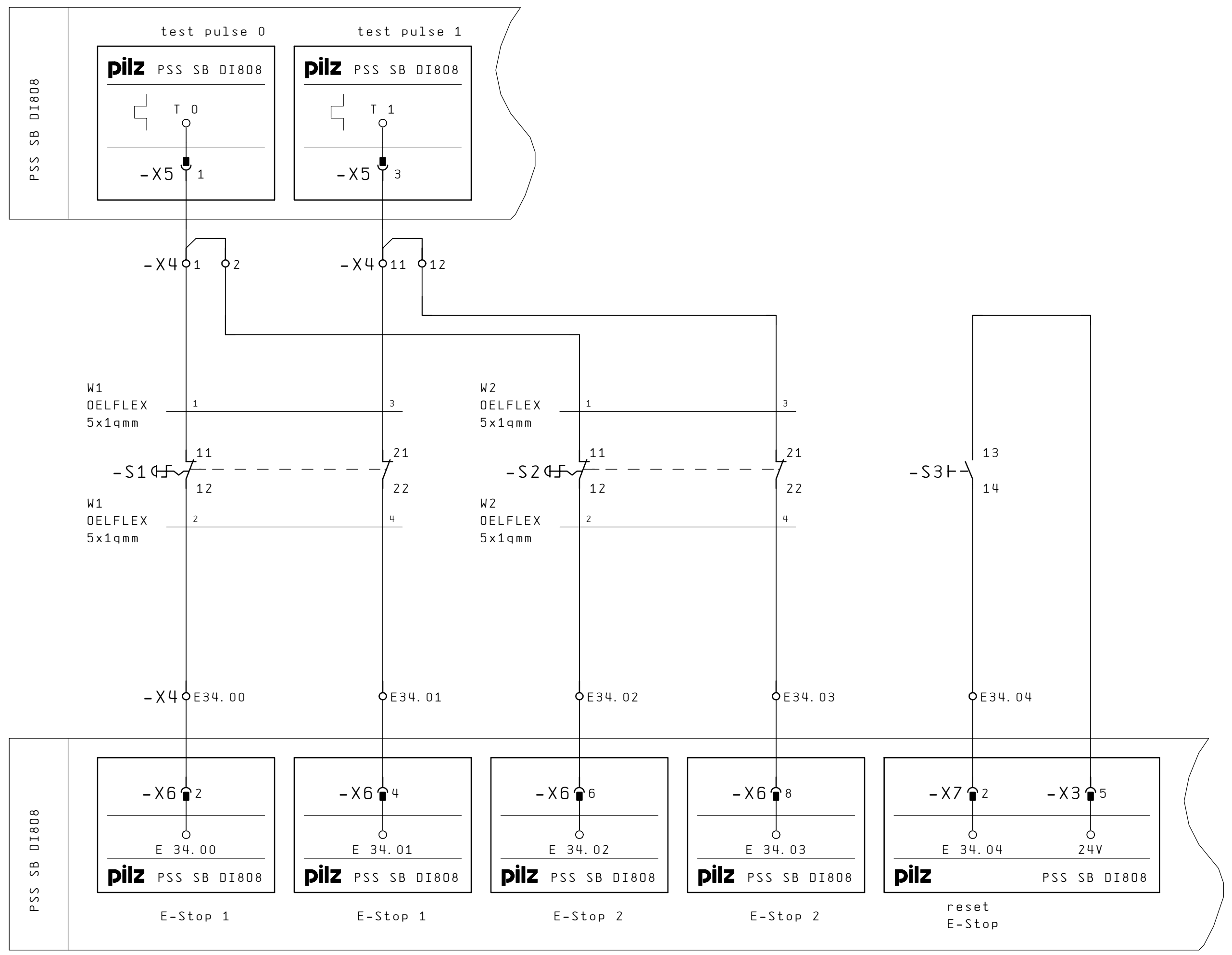
Depending on the application area and its respective regulations, this connection example is suitable for applications up to category 4, in accordance with EN 954-1.

Pilz products

Number	Description	Order number	
1	PSS SB 3006 DP-S	301 460	
1	PSS SB DI8O8	301 140	
1	PSS SB screw connectors	311 060	**or**
1	PSS SB spring-loaded terminals	311 061	
2	PSS SB SUB-D1	311 051	
1	PSS SB cable	311 070	
1	PSS-SB-NOT	301 176B	

Drawing file

Page 18 in the project “Eplan4/Pilz/APPL0703”


PSS SB DI808
test pulse 0
test pulse 1
pilz PSS SB DI808
T 0
-X5 1
pilz PSS SB DI808
T 1
-X5 3
-X4 1 2
-X4 11 12
W1
OELFLEX
5x1qmm
1
3
W2
OELFLEX
5x1qmm
1
3
-S1
11
12
21
22
-S2
11
12
21
22
-S3
13
14
W1
OELFLEX
5x1qmm
2
4
W2
OELFLEX
5x1qmm
2
4
-X4 E34.00
E34.01
E34.02
E34.03
E34.04
PSS SB DI808
-X6 2
E 34.00
pilz PSS SB DI808
E-Stop 1
-X6 4
E 34.01
pilz PSS SB DI808
E-Stop 1
-X6 6
E 34.02
pilz PSS SB DI808
E-Stop 2
-X6 8
E 34.03
pilz PSS SB DI808
E-Stop 2
-X7 2
-X3 5
E 34.04
24V
pilz PSS SB DI808
reset
E-Stop

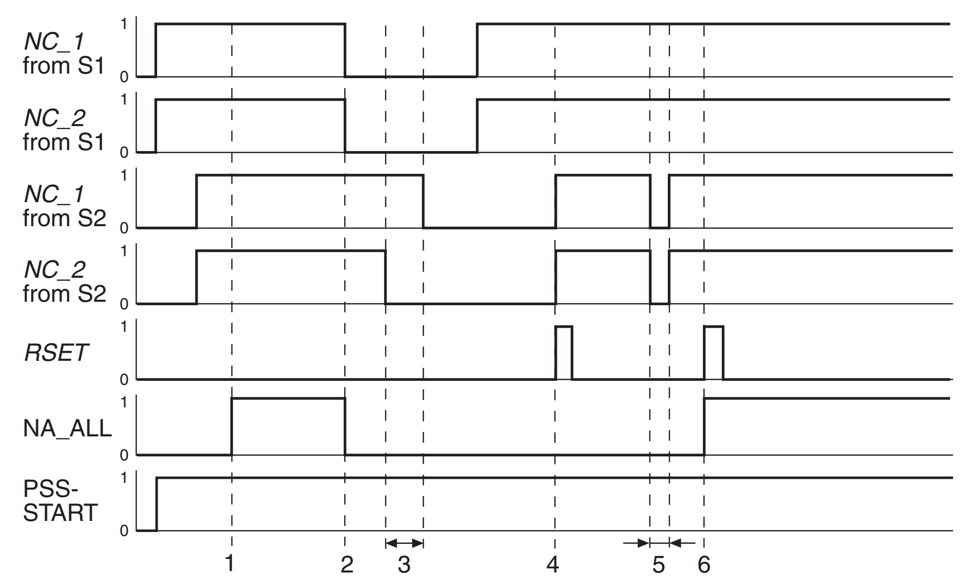
Revision	29.Apr.2004	Date	22.Apr.2003	E-Stop applications	pilz	Pilz GmbH & Co.KG Felix-Wankel-Str.2 73760 Ostfildern	E-Stop monitoring with SafetyBUS p	Directory: Eplan4/Pilz/App10703
Name	CLE	Name	CLE					
				Category 4 EN 954-1				Page: 18
		Dep.	CS					

Category 4, EN 954-1

SafetyBUS p – Emergency stop monitoring

Timing diagram

Parameters set on SB063
- With SafetyBUS p connection:
  GRP = M116.31 for I/O-Group 31
- Automatic reset when PSS is cold/warm started:
  AuSt = 1
- Automatic reset when E-STOP button is released:
  ARst = 1
- A function test must be performed if there is a synchronisation error when the E-STOP button is released:
  FTST = 1



1: Normal operation, start-up reset
2: E-STOP button 1 operated
3: E-STOP button 2 synchronisation error
4: Reset lock
5: Function test E-STOP button
6: Reset lock reset

Program

```
                                       SB063
                                       E-STOP

KF  000234                   - W -  SSNR        ENBL -  X -  M     077.09 .NA_1
M   116.31  .IO_Group_31     -  X - GRP
E   34.00   .E-STOP1_T0      -  X - NC_1
E   34.01   .E-STOP1_T1      -  X - NC_2
M   110.01  .RLO-1           -  X - AuSt
M   110.01  .RLO-1           -  X - ARst
M   110.01  .RLO-1           -  X - FTST
E   34.04   .Reset           -  X - RSET

                                       SB063
                                       E-STOP

KF  000235                   - W -  SSNR        ENBL - X  - M   077.10 .NA_2
M   116.31  .IO_Group_31     -  X - GRP
E   34.02   .E-STOP2_T0      -  X - NC_1
E   34.03   .E-STOP2_T1      -  X - NC_2
M   110.01  .RLO-1           -  X - AuSt
M   110.01  .RLO-1           -  X - ARst
M   110.01  .RLO-1           -  X - FTST
E   34.04   .Reset           -  X - RSET
```

Additional commands:

```
:  L    M077.09     .NA_1
:  U    M077.10     .NA_2
:  =    M088.24     .NA_ALL
```

Category 4, EN 954-1
SafetyBUS p – Emergency stop monitoring

Please note:
A “Minimum scan time” must be specified in the configurator of the PSS SW PG system software.

Global parameters used in administration data block DB015, DB016 and DB017

- DW1001: Number of cycles in the contact synchronisation time between 2 N/C contacts on the E-STOP button

Global parameters may be set in OB120 using SB071.

Additional blocks required

- DB015, DB016, DB017: Administration data block
  DB 015, DB016 and DB017 must consist of their total length of 1024 data words. DB015, DB016 and DB017 must be declared READ/WRITE.
- SB071: Initialisation of global parameters in DB015, DB016 and DB017
- SB255: Operating system call

Category 2, EN 954-1

PSS 3000 – Emergency stop monitoring

Features

- Single-channel
- Manual reset when the PSS is cold/ warm started
- Manual reset when emergency stop button is released
- Failsafe standard function block used: SB060 (NA_Kat_2)

Description

Emergency stop function
In this example the safety system monitors the E-STOP button S1. Within the user program, the failsafe standard function block SB060 is assigned to the E-STOP button. SB060 detects whether an E-STOP button has been operated, as well as detecting incorrect input signals, such as a reset button that is constantly operated.
If the E-STOP button is operated or an error occurs, the enable output *FG* on SB060 will immediately be reset.
The enable output *FG* is also reset when the PSS is stopped and when the PSS is switched on.
The signal at the enable output *FG* must be evaluated by the user program and trigger an appropriate reaction. SB060 stores a value in DB015, which can be used to determine why *FG* was reset.
The way in which the error is reset will depend on the operating mode set on SB060.

In this application example, parameters for SB060 have been set in such a way that it is necessary to reset by pressing S3 (0/1 pulse edge at *EIN*) in order to reset enable output *FG* on SB060 when the PSS is cold started (PSS switched from off to on), warm started (PSS transferring from STOP to RUN) or when the E-STOP button is released.

Safety assessment

- If a contact on the E-STOP button is overridden, the user will detect this as an error at the next test function.
- A short between 24 VDC and an input circuit will be detected as an error by the programmable safety system.

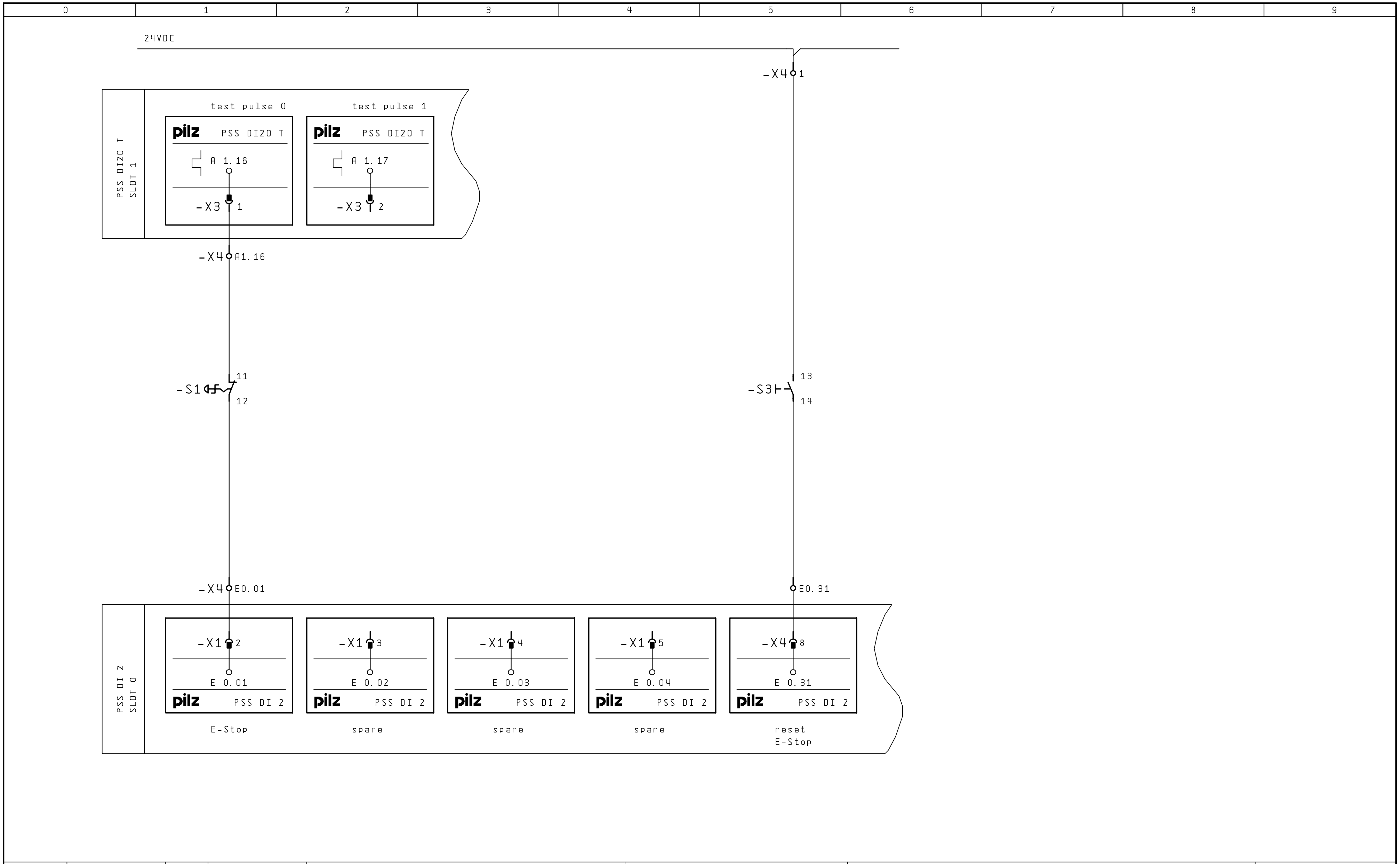
Classification in accordance with EN 954-1
Depending on the application area and its respective regulations, this connection example is suitable for applications up to category 2 in accordance with EN 954-1. The safety function must be tested manually at appropriate intervals, e.g. through organisational measures.

Pilz products

Number	Description	Order number
1	PSS SB CPU 3	301 071
1	PSS BMP 4/2	301 006
1	PSS PS 24	301 051
1	PSS DI2O T	301 112
1	PSS DI 2	301 101
1	PSS-SB-NOT	301 176B

Drawing file

Page 1 in the project “Eplan4/Pilz/APPL0703”


0
1
2
3
4
5
6
7
8
9
24VDC
-X4 1
PSS DI20 T
SLOT 1
test pulse 0
test pulse 1
pilz PSS DI20 T
A 1.16
-X3 1
pilz PSS DI20 T
A 1.17
-X3 2
-X4 A1.16
-S1
11
12
-S3
13
14
-X4 E0.01
E0.31
PSS DI 2
SLOT 0
-X1 2
E 0.01
pilz PSS DI 2
E-Stop
-X1 3
E 0.02
pilz PSS DI 2
spare
-X1 4
E 0.03
pilz PSS DI 2
spare
-X1 5
E 0.04
pilz PSS DI 2
spare
-X4 8
E 0.31
pilz PSS DI 2
reset
E-Stop

Revision	30.Apr.2003	Date	22.Apr.2003	E-Stop applications	pilz	Pilz GmbH & Co. Felix-Wankel-Str.2 73760 Ostfildern	E-Stop monitoring with PSS 3000	Directory: Eplan4/Pilz/Appl0703
Name	CLE	Name	CLE					
				Category 2 EN 954-1				Page: 1
		Dep.	CS					

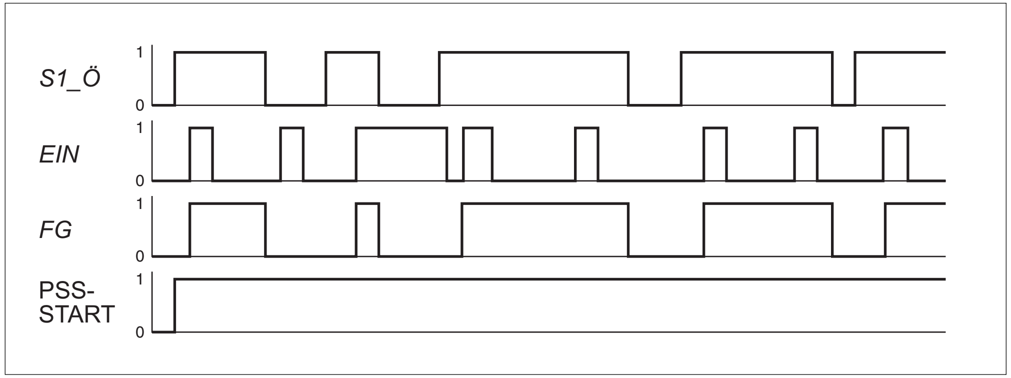
Category 2, EN 954-1

PSS 3000 – Emergency stop monitoring

Timing diagram

Parameters set on SB060

- Manual reset when PSS is cold/warm started:
  QAnf = 1
- Manual reset when E-STOP button is released:
  QAut = 0



Program

```
                                     SB060
                                   NA_Kat_2

KB  003                      - B - SSNR          FG  - X  - M   070.02 .NA_1
E   0.31    .ON              - X - EIN
E   0.01    .E-STOP1         - X - S1_Ö
M   110.01  .RLO-1           - X - QAnf
M   110.00  .RLO-0           - X - QAut
```

Additional commands:
The input parameter *SSNR* on SB060 is monitored. For this reason it must be run in each PSS cycle. The following commands should therefore be entered **once only** at the end of OB 101:

```
: A    DB015
: I    DW1015
```

Effect: The counter for monitoring the *SSNR* in DB015/DW1015 (global parameters) will be incremented.

Please note:
A “Minimum scan time” must be specified in the configurator of the PSS SW PG system software.

Global parameters used in administration data block DB015

- DW1015: Counter for monitoring the *SSNR*

The global parameter may be set in OB120 using SB070.

Additional blocks required

- DB015: Administration data block
  DB015 must consist of its total length of 1024 data words. DB015 must be declared READ/WRITE.
- SB070: Initialisation of global parameters in DB015
- SB255: Operating system call

Notes

Category 2, EN 954-1

SafetyBUS p – Emergency stop monitoring

Features

- Single-channel
- Manual reset when the PSS is cold/ warm started
- Manual reset after releasing the E-STOP button and starting the SafetyBUS p I/O-Groups
- Failsafe standard function block used: SB060 (NA_Kat_2)

Description

Emergency stop function
In this example the safety system with the safe bus system SafetyBUS p monitors the E-STOP button S1. Within the user program, the failsafe standard function block SB060 is assigned to the E-STOP button. SB060 detects whether an E-STOP button has been operated, as well as detecting incorrect input signals, such as a reset button that is constantly operated.
If the E-STOP button is operated or an error occurs, the enable output *FG* on SB060 will immediately be reset.
The enable output *FG* is also reset when the PSS is stopped and when the PSS is switched on.
The signal at the enable output *FG* must be evaluated by the user program and trigger an appropriate reaction. SB060 stores a value in DB015, which can be used to determine why *FG* was reset.
The way in which the error is reset will depend on the operating mode set on SB060.
In this application example, parameters for SB060 have been set in such a way that it is necessary to reset by pressing S3 (0/1 pulse edge at *EIN*) in order to reset enable output *FG* on SB060 when the PSS is cold started (PSS switched from off to on), warm started (PSS transferring from STOP to RUN) or when the E-STOP button is released.

Safety assessment

- If a contact on the E-STOP button is overridden, the user will detect this as an error at the next test function.
- A short between 24 VDC and an input circuit will be detected as an error by the programmable safety system.

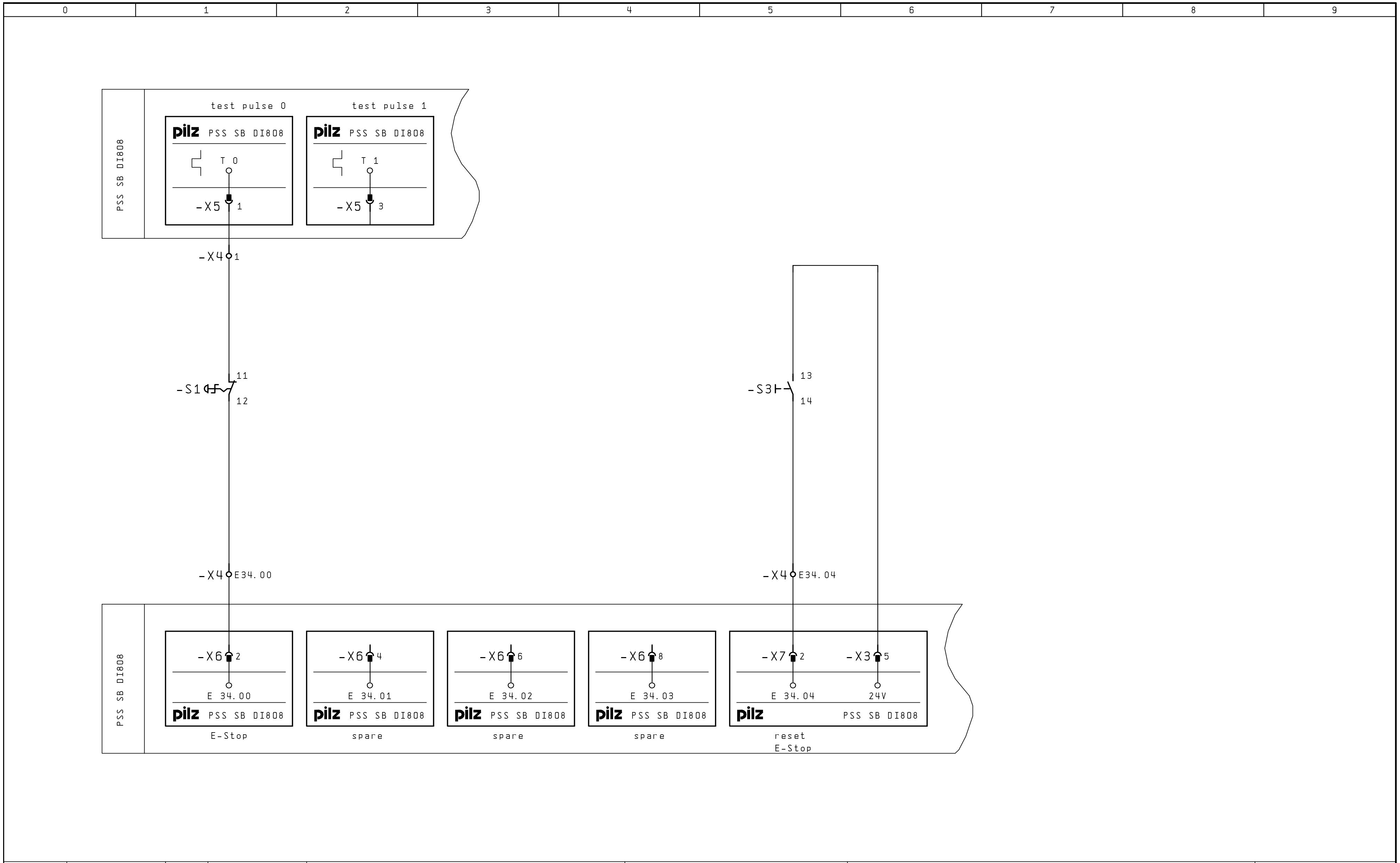
Classification in accordance with EN 954-1
Depending on the application area and its respective regulations, this connection example is suitable for applications up to category 2 in accordance with EN 954-1.
The safety function must be tested manually at appropriate intervals, e.g. through organisational measures.

Pilz products

Number	Description	Order number	
1	PSS SB 3006 DP-S	301 460	
1	PSS SB DI8O8	301 140	
1	PSS SB screw connectors	311 060	**or**
1	PSS SB spring-loaded terminals	311 061	
2	PSS SB SUB-D1	311 051	
1	PSS SB cable	311 070	
1	PSS-SB-NOT	301 176B	

Drawing file

Page 17 in the project “Eplan4/Pilz/APPL0703”


0
1
2
3
4
5
6
7
8
9
PSS SB DI808
test pulse 0
test pulse 1
pilz PSS SB DI808
T 0
-X5 1
pilz PSS SB DI808
T 1
-X5 3
-X4 1
-S1
11
12
-S3
13
14
-X4 E34.00
-X4 E34.04
PSS SB DI808
-X6 2
E 34.00
pilz PSS SB DI808
E-Stop
-X6 4
E 34.01
pilz PSS SB DI808
spare
-X6 6
E 34.02
pilz PSS SB DI808
spare
-X6 8
E 34.03
pilz PSS SB DI808
spare
-X7 2
-X3 5
E 34.04
24V
pilz PSS SB DI808
reset
E-Stop

Revision	30.Apr.2003	Date	22.Apr.2003	E-Stop applications	pilz	Pilz GmbH & Co. Felix-Wankel-Str.2 73760 Ostfildern	E-Stop monitoring with SafetyBUS p	Directory: Eplan4/Pilz/Appl0703
Name	CLE	Name	CLE	Category 2 EN 954-1				Page: 17
		Dep.	CS					

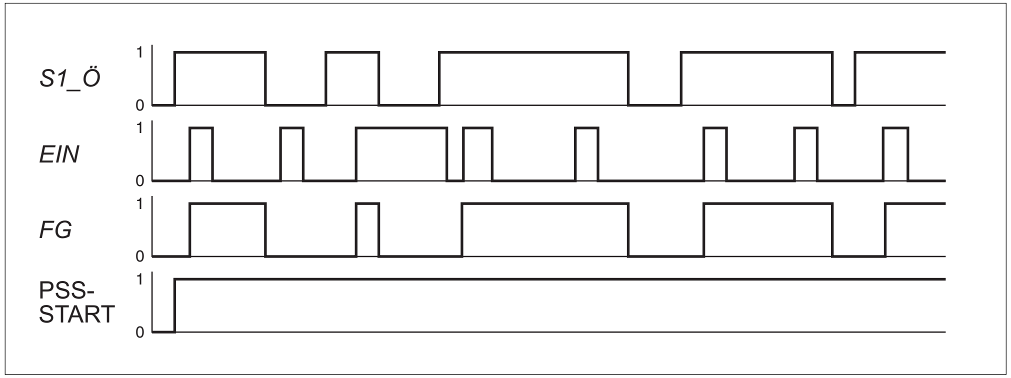
Category 2, EN 954-1

SafetyBUS p – Emergency stop monitoring

Timing diagram

Parameters set on SB060

- Manual reset when PSS is cold/warm started: *QAnf* = 1
- Manual reset when E-STOP button is released: *QAut* = 0



Program

```
                                      SB060
                                    NA_Kat_2

KB  003                     - B -  SSNR          FG  - X  - M   070.02 .NA_1
E   34.04   .ON             - X -  EIN
E   34.00   .E-STOP1        - X -  S1_Ö
M   110.01  .RLO-1          - X -  QAnf
M   110.00  .RLO-0          - X -  QAut
```

Additional commands:
The input parameter *SSNR* on SB060 is monitored. For this reason it must be run in each PSS cycle. The following commands should therefore be entered **once only** at the end of OB 101:

```
:  A    DB015
:  I    DW1015
```

Effect: The counter for monitoring the *SSNR* in DB015/DW1015 (global parameters) will be incremented.

Please note:
A “Minimum scan time” must be specified in the configurator of the PSS SW PG system software.

Global parameters used in administration data block DB015

- DW1015: Counter for monitoring the *SSNR*

The global parameter may be set in OB120 using SB070.

Additional blocks required

- DB015: Administration data block
  DB015 must consist of its total length of 1024 data words. DB015 must be declared READ/WRITE.
- SB070: Initialisation of global parameters in DB015
- SB255: Operating system call

Notes

Category 4, EN 954-1

PSS 3100 – Pull-wire monitoring

Features

- Dual-channel redundancy with detection of shorts across contacts
- Manual reset when the PSS is cold/ warm started
- Manual reset after releasing the pull-wire emergency stop switch and starting the SafetyBUS p I/O-Groups
- Failsafe standard function block used: SB063 (E-STOP)
- Feasibility test on the input signals and monitoring of the contact synchronisation time in SB063

Description

Emergency switch function

In this example the safety system monitors the pull-wire emergency stop switches S1and S2. Within the user program, one failsafe standard function block SB063 is assigned to each pull-wire emergency stop switch. SB063 detects whether the assigned pull-wire emergency stop switch has been operated, as well as detecting incorrect input signals, such as a reset button that is constantly operated.

If the pull-wire emergency stop switch is operated or an error occurs, the enable output on the relevant SB063 will immediately be reset.

The enable output *ENBL* is also reset when the PSS is stopped and when the PSS is switched on. The signals from both enable outputs *ENBL* must be evaluated by the user program and trigger an appropriate reaction. SB063 stores a value in DB015 (DB016 or DB017), which can be used to determine why *ENBL* was reset.

The way in which the error is reset will depend on the operating mode set on SB063. In this application example, parameters for SB063 have been set in such a way that it is necessary to reset by pressing S3 (0/1 pulse edge at *RSET*) in order to reset enable output *ENBL* on SB063 when the PSS is cold started (PSS switched from off to on), warm started (PSS transferring from STOP to RUN) or when the pull-wire emergency stop switch is released.

Safety assessment

- If a contact on the E-STOP button is overridden, the standard function block will detect this as an error at the next operation.
- A short between the input circuits within a multicore cable will be detected as an error by the programmable safety system.
- A short between 24 VDC and an input circuit will be detected as an error by the programmable safety system.

Classification in accordance with EN 954-1

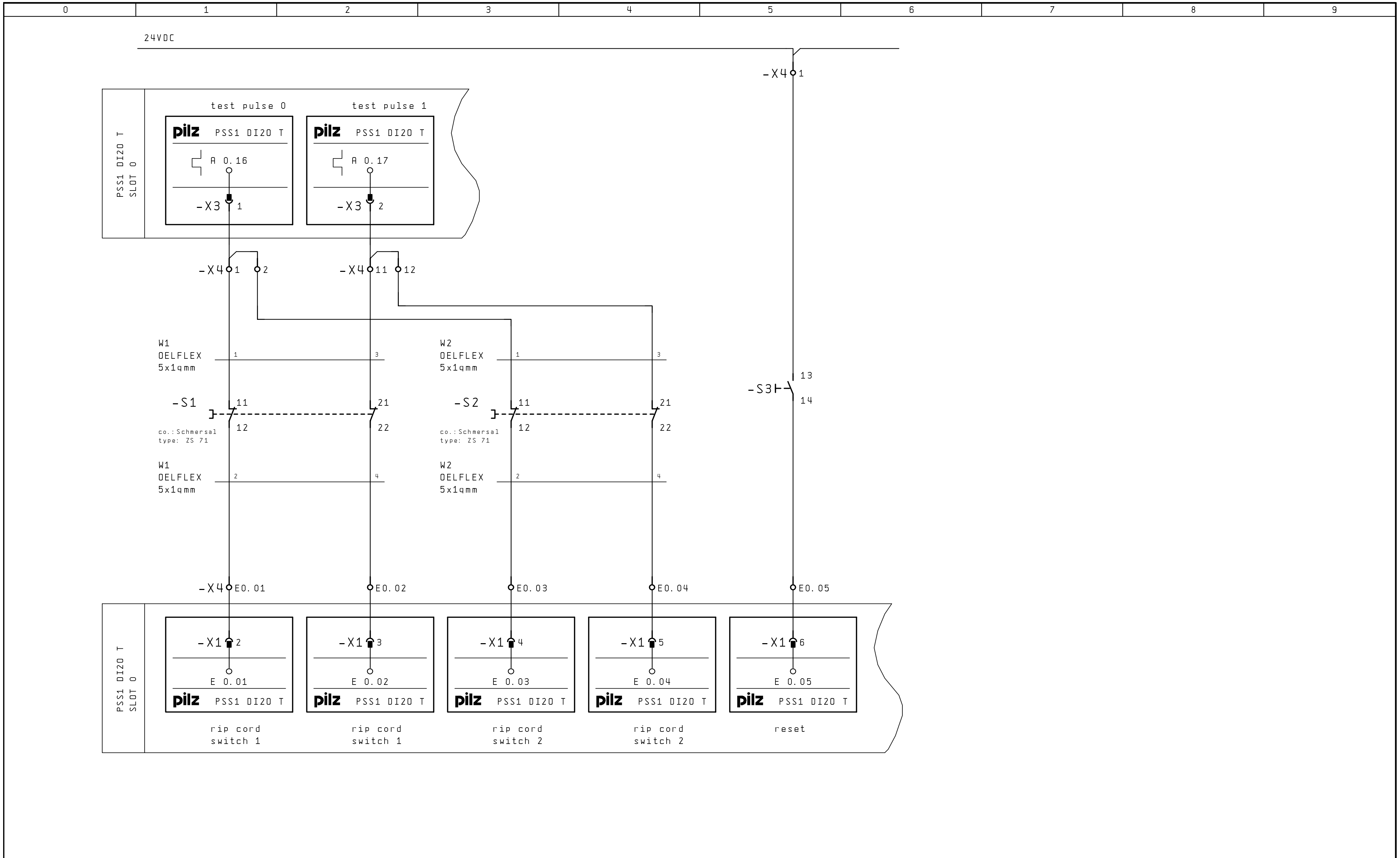
Depending on the application area and its respective regulations, this connection example is suitable for applications up to category 4, in accordance with EN 954-1.

Pilz products

Number	Description	Order number
1	PSS1 CPU 3	302 064
1	PSS1 BMP 3/1	302 007
1	PSS1 DI2O T	301 112

Drawing file

Page 38 in the project “Eplan4/Pilz/APPL0703”


0
1
2
3
4
5
6
7
8
9
24VDC
-X4 1
test pulse 0
test pulse 1
PSS1 DI20 T
SLOT 0
pilz PSS1 DI20 T
A 0.16
-X3 1
pilz PSS1 DI20 T
A 0.17
-X3 2
-X4 1 2
-X4 11 12
W1
OELFLEX
5x1qmm
W2
OELFLEX
5x1qmm
1
3
-S1
11
21
12
22
co.:Schmersal
type: ZS 71
-S2
11
21
12
22
co.:Schmersal
type: ZS 71
-S3
13
14
W1
OELFLEX
5x1qmm
W2
OELFLEX
5x1qmm
2
4
-X4 E0.01
E0.02
E0.03
E0.04
E0.05
PSS1 DI20 T
SLOT 0
-X1 2
E 0.01
pilz PSS1 DI20 T
-X1 3
E 0.02
pilz PSS1 DI20 T
-X1 4
E 0.03
pilz PSS1 DI20 T
-X1 5
E 0.04
pilz PSS1 DI20 T
-X1 6
E 0.05
pilz PSS1 DI20 T
rip cord switch 1
rip cord switch 1
rip cord switch 2
rip cord switch 2
reset

Revision	30.Apr.2003	Date	22.Apr.2003
Name	CLE	Name	CLE
		Dep.	CS

rip cord application

Category 4 EN 954-1

Pilz GmbH & Co.
Felix-Wankel-Str.2
73760 Ostfildern

rip cord switch monitoring with PSS 3100

Directory:
Eplan4/Pilz/Appl0703

Page: 38

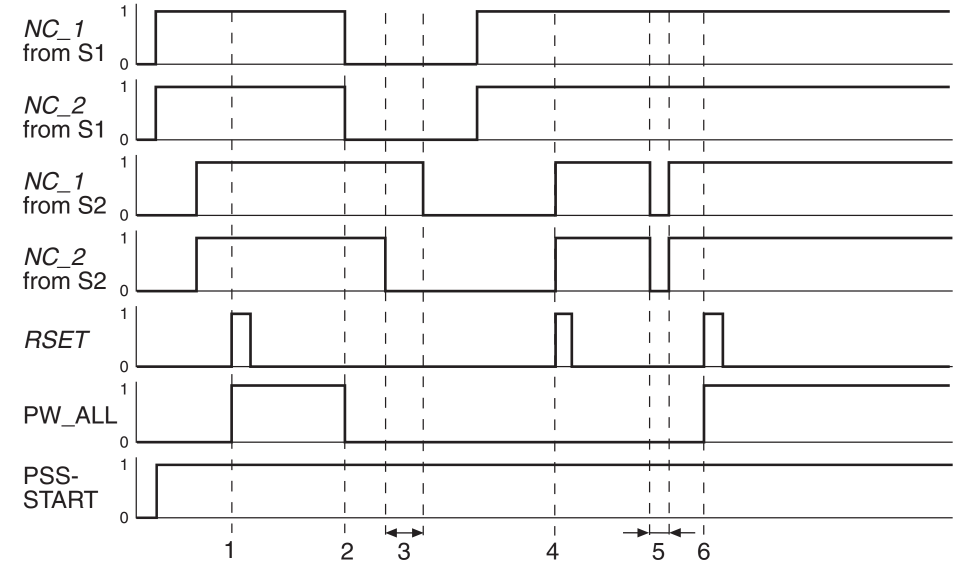
Category 4, EN 954-1

PSS 3100 – Pull-wire monitoring

Timing diagram

Parameters set on SB063

- Without SafetyBUS p connection:
  GRP = RLO-1
- Manual reset/start-up disabler when PSS is warm started:
  AuSt = 0
- Manual reset/reset lock after an error:
  ARst = 0
- A function test must be performed if there is a synchronisation error when the E-STOP button is released:
  FTST = 1



1: Normal operation, start-up reset
2: Pull-wire E/S switch 1 operated
3: Pull-wire E/S switch 2 synchronisation error
4: Reset lock
5: Function test
6: Reset lock reset

Program

```
                                   SB063
                                   E-STOP

KF  000001                 - W -  SSNR      ENBL  - X  - M   070.00 .PW_1
M   110.01  .RLO-1         -  X -  GRP
E   0.01    .E-STOP1       -  X -  NC_1
E   0.02    .E-STOP1       -  X -  NC_2
M   110.00  .RLO-0         -  X -  AuSt
M   110.00  .RLO-0         -  X -  ARst
M   110.01  .RLO-1         -  X -  FTST
E   0.05    .Reset         -  X -  RSET
```

```
                                   SB063
                                   E-STOP

KF  000002                 - W -  SSNR      ENBL  - X  - M   070.01 .PW_2
M   110.01  .RLO-1         -  X -  GRP
E   0.03    .E-STOP2       -  X -  NC_1
E   0.04    .E-STOP2       -  X -  NC_2
M   110.00  .RLO-0         -  X -  AuSt
M   110.00  .RLO-0         -  X -  ARst
M   110.01  .RLO-1         -  X -  FTST
E   0.05    .Reset         -  X -  RSET
```

Additional commands:

```
:  L    M070.00    .PW_1
:  U    M070.01    .PW_2
:  =    M080.00    .PW_ALL
```

Please note:
A “Minimum scan time” must be specified in the configurator of the PSS SW PG system software.

Category 4, EN 954-1

PSS 3100 – Pull-wire monitoring

Global parameters used in administration data block DB015, DB016, DB017

- DW1001: Number of cycles in the contact synchronisation time between 2 N/C contacts on the pull-wire emergency stop switch

Global parameters may be set in OB120 using SB071.

Additional blocks required

- DB015, DB016, DB017: Administration data block
  DB015, DB016 and DB017 must consist of their total length of 1024 data words. DB015, DB016 and DB017 must be declared READ/WRITE.
- SB071: Initialisation of global parameters in DB015, DB016, DB017
- SB255: Operating system call

Category 2, EN 954-1

PSS 3000 – Pull-wire monitoring

Features

- Single-channel
- Manual reset when the PSS is cold/ warm started
- Manual reset after releasing the pull-wire emergency stop switch
- Failsafe standard function block used: SB063 (E-STOP)

Description

Emergency switch function
In this example the safety system monitors the pull-wire emergency stop switches S1 and S2. Within the user program, one failsafe standard function block SB063 is assigned to each pull-wire emergency stop switch. SB063 detects whether the assigned pull-wire emergency stop switch has been operated, as well as detecting incorrect input signals, such as a reset button that is constantly operated.
If the pull-wire emergency stop switch is operated or an error occurs, the enable output on the relevant SB063 will immediately be reset.
The enable output *ENBL* is also reset when the PSS is stopped and when the PSS is switched on. The signals from both enable outputs *ENBL* must be evaluated by the user program and trigger an appropriate reaction. SB063 stores a value in DB015 (DB016 or DB017), which can be used to determine why *ENBL* was reset.
The way in which the error is reset will depend on the operating mode set on SB063. In this application example, parameters for SB063 have been set in such a way that it is necessary to reset by pressing S3 (0/1 pulse edge at *RSET*) in order to reset enable output *ENBL* on SB063 when the PSS is cold started (PSS switched from off to on), warm started (PSS transferring from STOP to RUN) or when the pull-wire emergency stop switch is released.

Safety assessment

- If a contact on the pull-wire emergency stop switch is overridden, the user will detect this as an error at the next test function.
- A short between 24 VDC and an input circuit will be detected as an error by the programmable safety system.

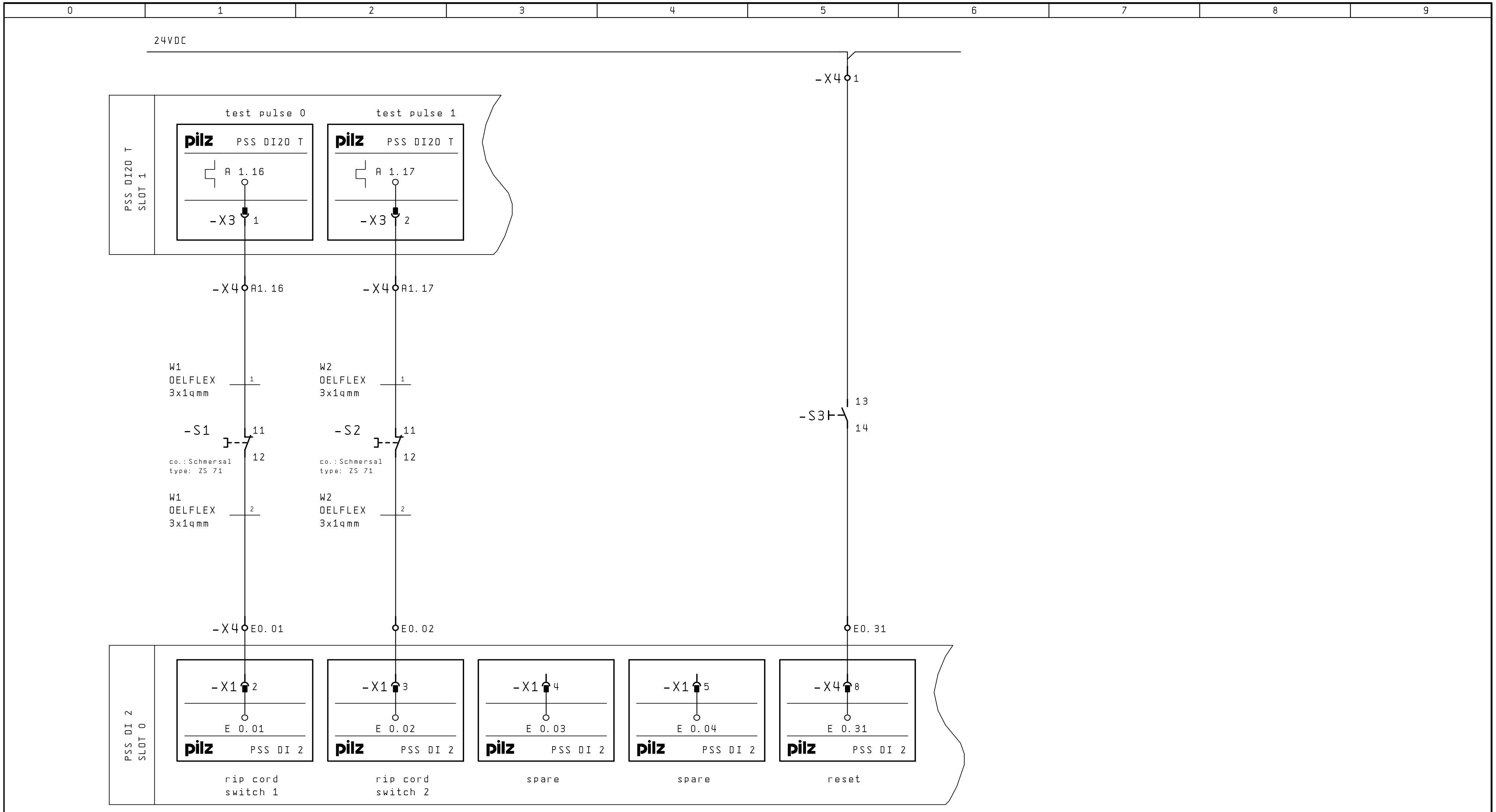
Classification in accordance with EN 954-1
Depending on the application area and its respective regulations, this connection example is suitable for applications up to category 2 in accordance with EN 954-1.
The safety function must be tested manually at appropriate intervals, e.g. through organisational measures.

Pilz products

Number	Description	Order number
1	PSS CPU 3	301 064
1	PSS BMP 4/2	301 006
1	PSS PS 24	301 051
1	PSS DI2O T	301 112
1	PSS DI 2	301 101
1	PSS-SB-NOT	301 176B

Drawing file

Page 37 in the project “Eplan4/Pilz/APPL0703”


0
1
2
3
4
5
6
7
8
9
24VDC
-X4 1
PSS DI20 T
SLOT 1
test pulse 0
test pulse 1
pilz PSS DI20 T
A 1.16
-X3 1
pilz PSS DI20 T
A 1.17
-X3 2
-X4 A1.16
-X4 A1.17
W1
OELFLEX
3x1qmm
1
W2
OELFLEX
3x1qmm
1
-S1
11
12
co.:Schmersal
type: ZS 71
-S2
11
12
co.:Schmersal
type: ZS 71
-S3
13
14
W1
OELFLEX
3x1qmm
2
W2
OELFLEX
3x1qmm
2
-X4 E0.01
E0.02
E0.31
PSS DI 2
SLOT 0
-X1 2
E 0.01
pilz PSS DI 2
-X1 3
E 0.02
pilz PSS DI 2
-X1 4
E 0.03
pilz PSS DI 2
-X1 5
E 0.04
pilz PSS DI 2
-X4 8
E 0.31
pilz PSS DI 2
rip cord
switch 1
rip cord
switch 2
spare
spare
reset

Revision	30.Apr.2003	Date	22.Apr.2003	rip cord switch applications	Pilz GmbH & Co. Felix-Wankel-Str.2 73760 Ostfildern	rip cord switch monitoring with PSS 3000	Directory: Eplan4/Pilz/Appl0703
Name	CLE	Name	CLE				
				Category 2 EN 954-1			Page: 37
		Dep.	CS				

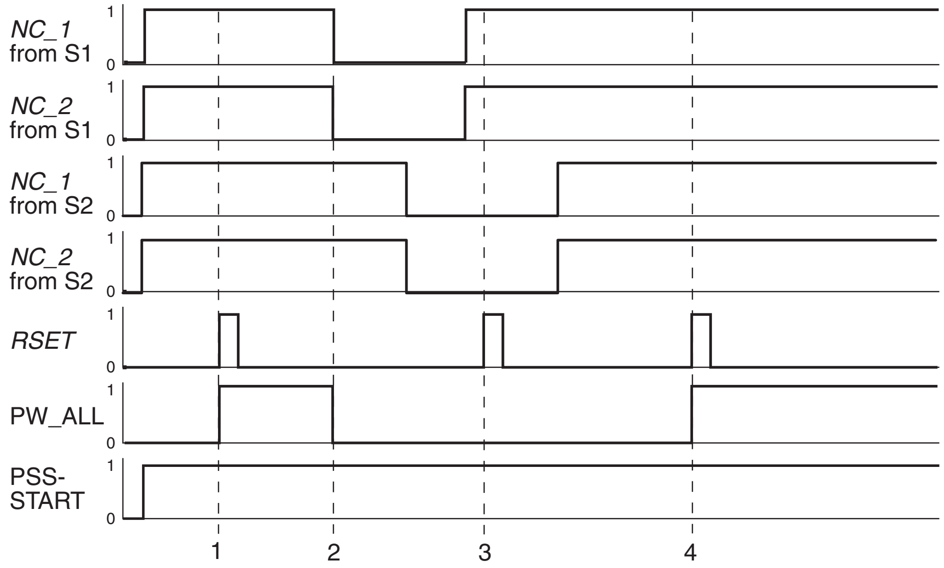
Category 2, EN 954-1

PSS 3000 – Pull-wire monitoring

Timing diagram

Parameters set on SB063

- Without SafetyBUS p connection:
  GRP = RLO-1
- Manual reset/start-up disabler when PSS is warm started:
  AuSt = 0
- Manual reset/reset lock after an error:
  ARst = 0
- No function test required:
  FTST = 0



1: Normal operation, start-up reset
2: Pull-wire switch 1 operated
3: Start-up disabler as pull-wire switch S2operated
4: Reset lock reset

Program

```
                                           SB063
                                           E-STOP

KF  000001                     - W -  SSNR        ENBL  - X  - M   070.00 .PW_1
M   110.01  .RLO-1             -  X -  GRP
E   0.01    .PULLWIRE_1        -  X -  NC_1
E   0.01    .PULLWIRE_1        -  X -  NC_2
M   110.00  .RLO-0             -  X -  AuSt
M   110.00  .RLO-0             -  X -  ARst
M   110.00  .RLO-0             -  X -  FTST
E   0.31    .Reset             -  X -  RSET

                                           SB063
                                           E-STOP

KF  000002                     - W -  SSNR        ENBL  - X  - M   070.01 .PW_2
M   110.01  .RLO-1             -  X -  GRP
E   0.02    .PULLWIRE_2        -  X -  NC_1
E   0.02    .PULLWIRE_2        -  X -  NC_2
M   110.00  .RLO-0             -  X -  AuSt
M   110.00  .RLO-0             -  X -  ARst
M   110.00  .RLO-0             -  X -  FTST
E   0.31    .Reset             -  X -  RSET
```

Additional commands:

```
:  L    M070.00    .PW_1
:  U    M070.01    .PW_2
:  =    M080.00    .PW_ALL
```

Please note:
A “Minimum scan time” must be specified in the configurator of the PSS SW PG system software.

Category 2, EN 954-1

PSS 3000 – Pull-wire monitoring

Global parameters used in administration data block DB015, DB016, DB017

- DW1001: Number of cycles in the contact synchronisation time between 2 N/C contacts on the pull-wire emergency stop switch

Global parameters may be set in OB120 using SB071.

Additional blocks required

- DB015, DB016, DB017: Administration data block
  DB015, DB016 and DB017 must consist of their total length of 1024 data words. DB015, DB016 and DB017 must be declared READ/WRITE.
- SB071: Initialisation of global parameters in DB015, DB016, DB017
- SB255: Operating system call

Safety Gate Applications

Contents **Page**

Safety gate applications

PSS 3100	–	Safety gate monitoring	Category 4, EN 954-1	5.2-2
SafetyBUS p	–	Safety gate monitoring	Category 4, EN 954-1	5.2-6
PSS 3000	–	Safety gate monitoring with guard locking	Category 3, EN 954-1	5.2-10
PSS 3000	–	Safety gate monitoring	Category 2, EN 954-1	5.2-16
SafetyBUS p	–	Safety gate monitoring	Category 3, EN 954-1	5.2-20

Category 4, EN 954-1

PSS 3100 – Safety gate monitoring

Features

- Dual-channel redundancy with detection of shorts across contacts
- Manual reset when the PSS is cold/warm started
- Reset lock
- No function test required on the gate when the PSS is cold and warm started
- Function test on the gate when machine stops
- Failsafe standard function block used: SB066 (ST_K4)
- Feasibility test on the input signals and monitoring of the contact synchronisation time in SB066 when closing the gate

Description

Safety gate monitoring function

In this example the safety system monitors the two safety gate switches S1 and S2. Within the user program, the failsafe standard function block SB066 is assigned to the safety gate switches. SB066 detects an open safety gate, as well as detecting incorrect input signals, such as a reset button that is constantly operated.
If the safety gate is opened or an error occurs, the enable output *FG* on SB066 will immediately be reset.
The enable output *FG* is also reset when the PSS is stopped and when the PSS is switched on.
The signal at the enable output *FG* must be evaluated by the user program and trigger an appropriate reaction. SB066 stores a value in DB015, which can be used to determine why *FG* was reset.
The way in which the error is reset will depend on the operating mode set on SB066.
In this application example, parameters for SB066 have been set in such a way that it is necessary to reset by pressing S3 (0/1 pulse edge at *Strt*) in order to reset enable output *FG* on SB066 when the PSS is cold started (PSS switched from off to on), warm started (PSS transferring from STOP to RUN) or after closing the safety gate (restart).
No function test is required on the safety gate (opening and closing the gate) after a cold/warm start.
When the machine is at a standstill, both the relay contacts K2 and K3 open and reset the enable output *FG*. A function test must then be performed on the gate, i.e. the enable output *FG* cannot be set by pressing S3 until the safety gate has been opened and closed.

Safety assessment

- If a contact on the safety gate switch is overridden, the standard function block will detect this as an error at the next operation.
- A short between the input circuits within a multicore cable will be detected as an error by the programmable safety system.
- A short between 24 VDC and an input circuit will be detected as an error by the programmable safety system.

Classification in accordance with EN 954-1

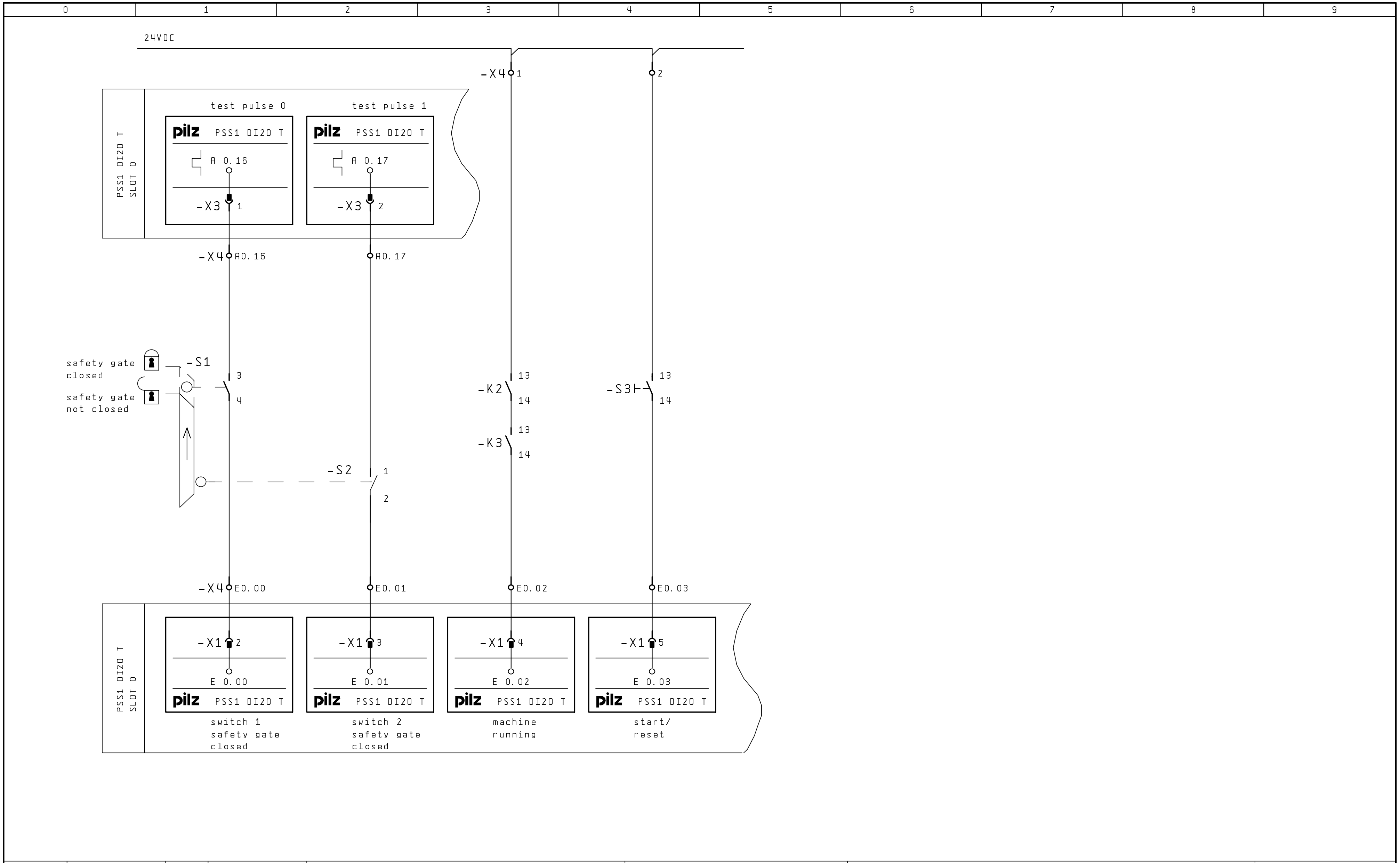
Depending on the application area and its respective regulations, this connection example is suitable for applications up to category 4, in accordance with EN 954-1.

Pilz products

Number	Description	Order number
1	PSS1 CPU 3	302 064
1	PSS1 BMP 3/1	302 007
1	PSS1 DI2O T	301 112

Drawing file

Page 4 in the project “Eplan4/Pilz/APPL0703”


0
1
2
3
4
5
6
7
8
9
24VDC
-X4 1
2
PSS1 DI20 T
SLOT 0
test pulse 0
test pulse 1
pilz PSS1 DI20 T
A 0.16
-X3 1
pilz PSS1 DI20 T
A 0.17
-X3 2
-X4 A0.16
A0.17
safety gate closed
safety gate not closed
-S1
3
4
-S2
1
2
-K2
13
14
-K3
13
14
-S3
13
14
-X4 E0.00
E0.01
E0.02
E0.03
PSS1 DI20 T
SLOT 0
-X1 2
E 0.00
pilz PSS1 DI20 T
-X1 3
E 0.01
pilz PSS1 DI20 T
-X1 4
E 0.02
pilz PSS1 DI20 T
-X1 5
E 0.03
pilz PSS1 DI20 T
switch 1 safety gate closed
switch 2 safety gate closed
machine running
start/ reset

Revision	30.Apr.2003	Date	22.Apr.2003	safety gate monitoring	pilz Pilz GmbH & Co. Felix-Wankel-Str.2 73760 Ostfildern	safety gate monitoring with PSS 3100	Directory: Eplan4/Pilz/Appl0703
Name	CLE	Name	CLE	Category 4 EN 954-1			Page: 4
		Dep.	CS				

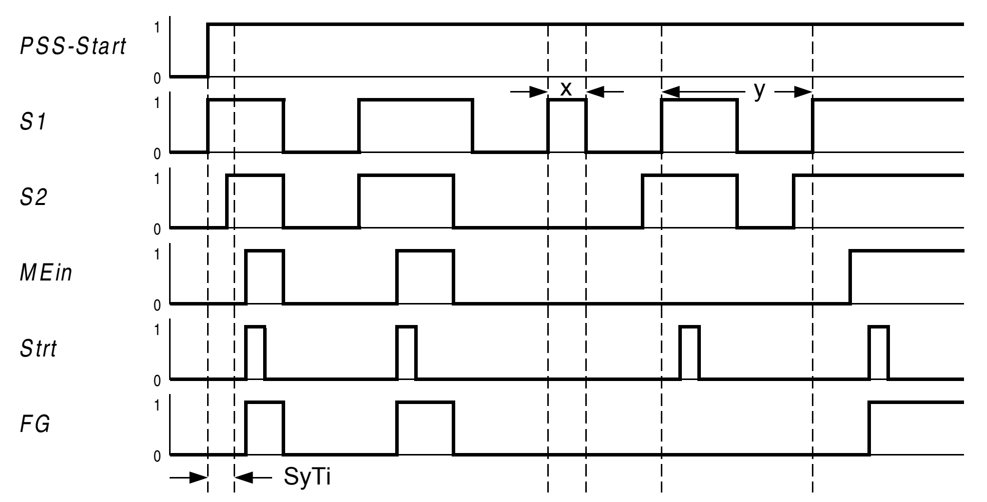
Category 4, EN 954-1

PSS 3100 – Safety gate monitoring

Timing diagram

Parameters set on SB066

- Function test when machine stops (1/0 pulse edge):
  MEin = E0.02
- Manual reset when PSS is cold/warm started:
  AuST = 0
- Reset lock:
  ARSt = 0
- No function test on the gate when the PSS is cold and warm started:
  NFkT = 1



SyTi: Synchronisation time between S1 and S2, to be specified by user
x: Synchronisation error
y: Function test on safety gate

Program

```
                                      SB066
                                      ST_K4

KB  001                      - B -  SSNR        FG  - X  - M   070.00
E   0.00    .GateSwitch1     - X -  S1
E   0.01    .GateSwitch2     - X -  S2
KF  01000   .Syn.Time        - W -  SyTi
E   0.02    .MC_running      - X -  MEin
E   0.03    .Reset           - X -  Strt
M   110.00  .RLO-0           - X -  ARSt
M   110.00  .RLO-0           - X -  AuSt
M   110.01  .RLO-1           - X -  NFkT
```

Please note:
A “Minimum scan time” must be specified in the configurator of the PSS SW PG system software.

Global parameters used in administration data block DB015

- DW1022: Minimum scan time

The global parameter may be set in OB120 using SB070.

Additional blocks required

- DB015: Administration data block
  DB015 must consist of its total length of 1024 data words.
  DB015 must be declared READ/WRITE.
- SB070: Initialisation of global parameters in DB015

Notes

Category 4, EN 954-1

SafetyBUS p – Safety gate monitoring

Features

- Dual-channel redundancy with detection of shorts across contacts
- Manual reset when the PSS is cold/warm started
- Reset lock
- No function test required on the gate when the PSS is cold and warm started
- Failsafe standard function block used: SB066 (ST_K4)
- Feasibility test on the input signals and monitoring of the contact synchronisation time in SB066 when closing the gate

Description

Safety gate monitoring function

In this example the safety system with the safe bus system SafetyBUS p monitors the two safety gate switches S1 and S2. Within the user program, the failsafe standard function block SB066 is assigned to the safety gate switches. SB066 detects an open safety gate, as well as detecting incorrect input signals, such as a reset button that is constantly operated.

If the safety gate is opened or an error occurs, the enable output *FG* on SB066 will immediately be reset.

The enable output *FG* is also reset when the PSS is stopped and when the PSS is switched on.

The signal at the enable output *FG* must be evaluated by the user program and trigger an appropriate reaction. SB066 stores a value in DB015, which can be used to determine why *FG* was reset.

The way in which the error is reset will depend on the operating mode set on SB066.

In this application example, parameters for SB066 have been set in such a way that it is necessary to reset by pressing S3 (0/1 pulse edge at *Strt*) in order to reset enable output *FG* on SB066 when the PSS is cold started (PSS switched from off to on), warm started (PSS transferring from STOP to RUN) or after closing the safety gate (restart).

No function test is required on the safety gate (opening and closing the gate) after a cold/warm start.

When the machine is at a standstill, both the relay contacts K12 and K13 open and reset the enable output *FG*. A function test must then be performed on the gate, i.e. the enable output *FG* cannot be set by pressing S3 until the safety gate has been opened and closed.

Safety assessment

- If a contact on the safety gate switch is overridden, the standard function block will detect this as an error at the next operation.
- A short between the input circuits within a multicore cable will be detected as an error by the programmable safety system.
- A short between 24 VDC and an input circuit will be detected as an error by the programmable safety system.

Classification in accordance with EN 954-1

Depending on the application area and its respective regulations, this connection example is suitable for applications up to category 4, in accordance with EN 954-1.

Pilz products

Number	Description	Order number	
1	PSS SB 3006 DP-S	301 460	
1	PSS SB DI8O8	301 140	
1	PSS SB screw connectors	311 060	**or**
1	PSS SB spring-loaded terminals	311 061	
2	PSS SB SUB-D1	311 051	
1	PSS SB cable	311 070	
1	PSS-SB-TRA	301 175B	

Drawing file

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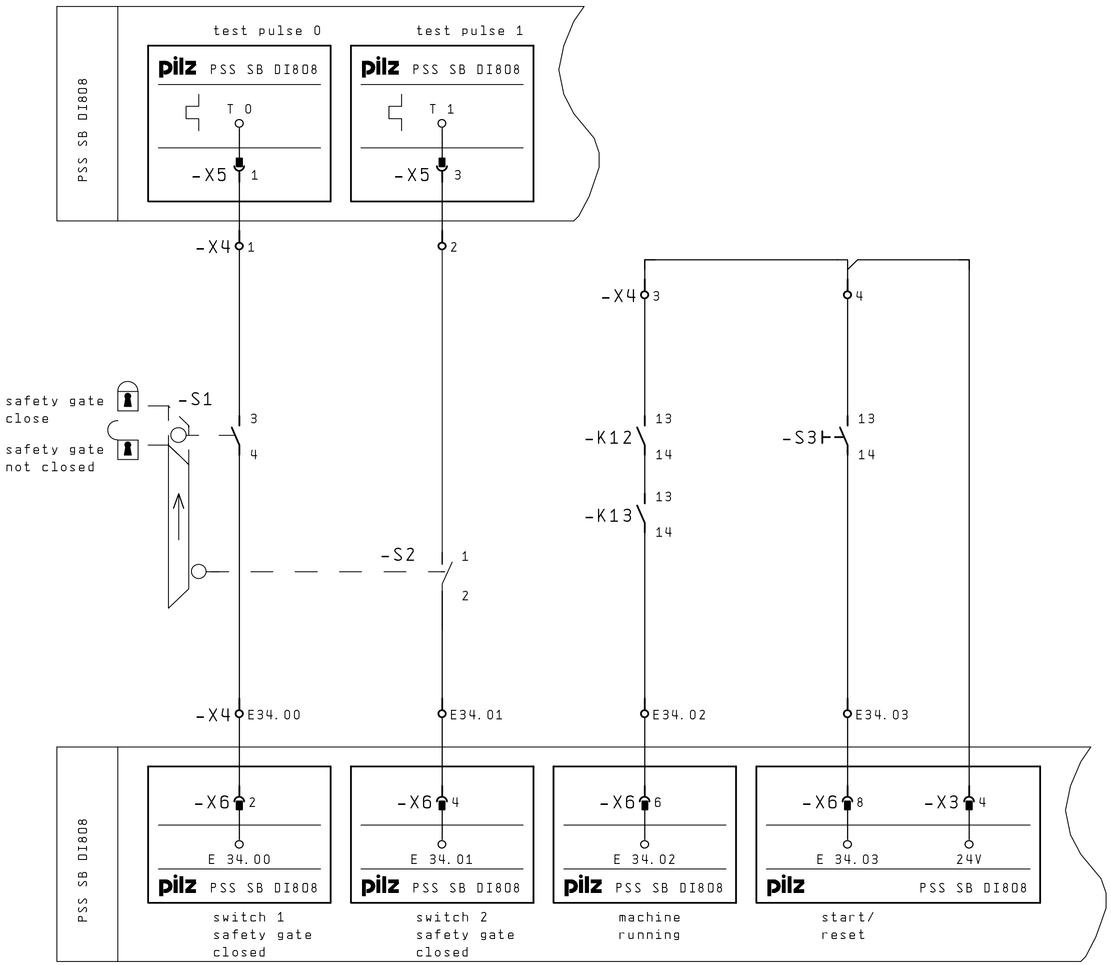

PSS SB DI808
test pulse 0
test pulse 1
pilz PSS SB DI808
T 0
-X5 1
pilz PSS SB DI808
T 1
-X5 3
-X4 1
2
-X4 3
4
safety gate close
safety gate not closed
-S1
3
4
-S2
1
2
-K12
13
14
-K13
13
14
-S3
13
14
-X4 E34.00
E34.01
E34.02
E34.03
PSS SB DI808
-X6 2
E 34.00
pilz PSS SB DI808
-X6 4
E 34.01
pilz PSS SB DI808
-X6 6
E 34.02
pilz PSS SB DI808
-X6 8
-X3 4
E 34.03
24V
pilz
PSS SB DI808
switch 1 safety gate closed
switch 2 safety gate closed
machine running
start/ reset

Revision	30.Apr.2003	Date	22.Apr.2003	safety gate monitoring	Pilz GmbH & Co. Felix-Wankel-Str.2 73760 Ostfildern	safety gate monitoring with SafetyBUS p	Directory: Eplan4/Pilz/Appl0703
Name	CLE	Name	CLE				
				Category 4 EN 954-1			Page: 20
		Dep.	CS				

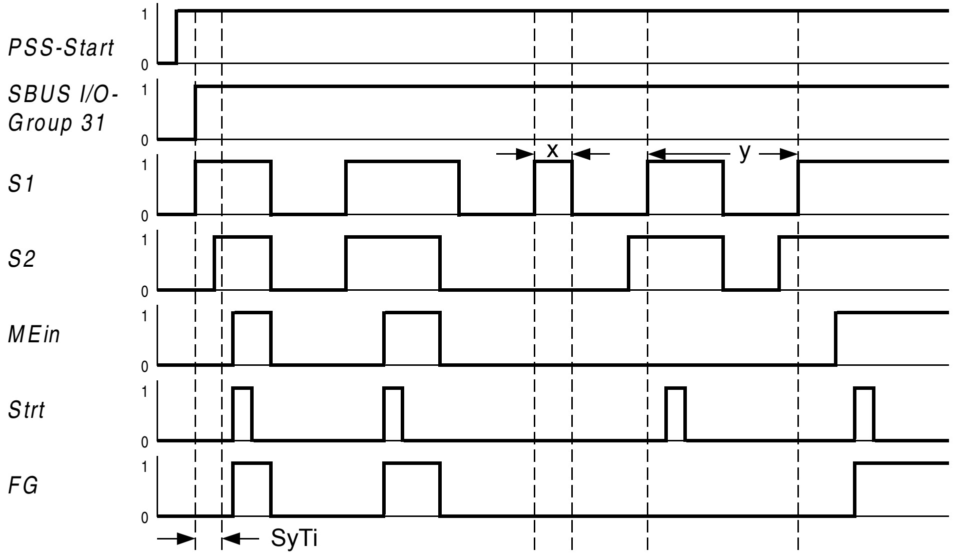
Category 4, EN 954-1

SafetyBUS p – Safety gate monitoring

Timing diagram

Parameters set on SB066

- Function test when machine stops (1/0 pulse edge):
  MEin = E34.02
- Manual reset when PSS is cold/warm started:
  AuST = 0
- Reset lock:
  ARSt = 0
- No function test on the gate when the PSS is cold and warm started:
  NFkT = 1



SyTi: Synchronisation time between S1 and S2, to be specified by user
x: Synchronisation error
y: Function test on safety gate

Program

```
                                        SB066
                                        ST_K4

KB  001                        - B -  SSNR         FG  - X  - M   070.00
E   34.00   .GateSwitch1       - X -  S1
E   34.01   .GateSwitch2       - X -  S2
KF  01000   .Syn.Time          - W -  SyTi
E   34.02   .MC_running        - X -  MEin
E   34.03   .Reset             - X -  Strt
M   110.00  .RLO-0             - X -  ARSt
M   110.00  .RLO-0             - X -  AuSt
M   110.01  .RLO-1             - X -  NFkT
```

Please note:
A “Minimum scan time” must be specified in the configurator of the PSS SW PG system software.

Global parameters used in administration data block DB015

- DW1022: Minimum scan time

The global parameter may be set in OB120 using SB070.

Additional blocks required

- DB015: Administration data block
  DB015 must consist of its total length of 1024 data words.
  DB015 must be declared READ/WRITE.
- SB070: Initialisation of global parameters in DB015

Notes

Category 3, EN 954-1

PSS 3000 – Safety gate monitoring with guard locking device

Features

- Dual-channel redundancy
- Manual reset when the PSS is cold/warm started
- Reset lock
- Safety gate switch with spring applied guard locking device
- Additional switch to monitor the position of the safety gate
- Failsafe standard function block used: SB075 (GRD_LCK)

Description

Safety gate monitoring function
In this example the safety system monitors a safety gate switch with a magnetic interlock plus an additional switch.
Once safe standstill has been detected, the guard locking device is released by pressing S2 “Request to open the gate”; the gate can then be opened. If the safety gate is closed again, the guard locking device must be locked by pressing S2 once more. The safety gate is re-enabled by resetting via S3. The status of the safety gate and the guard locking device is displayed via a lamp. Within the user program, failsafe standard function block SB075 is assigned to the safety gate switches.

SB075 has extensive fault detection features, for example:

- Safety gate closed and S1 or S2 was not open
- The guard locking control (*UNLK*) does not match the signal from the monitoring circuit (*LCKD*)
- Invalid input signals
- Contact synchronisation time exceeded

If an error occurs, the enable output *ENBL* on SB075 will immediately be reset. The enable output *ENBL* is also reset when the PSS is stopped and when the PSS is switched on. The signal at the enable output *ENBL* must be evaluated by the user program and trigger an appropriate reaction. SB075 stores a value in DB015 (DB016 or DB017); this can be used to determine why *ENBL* was reset. The way in which the error is reset will depend on the operating mode set on SB075. In this application example, parameters for SB075 have been set in such a way that it is necessary to reset by pressing S3 (0/1 pulse edge at *RSET*) in order to reset enable output *ENBL* on SB075 when the PSS is cold started (PSS switched from off to on), warm started (PSS transferring from STOP to RUN) or after the safety gate is closed and locked (restart).

Safety assessment

- If a contact on the safety gate switch is overridden, the standard function block will detect this as an error at the next operation.
- A short between 24 VDC and an input circuit will be detected as an error by the standard function block at the next operation.
- A short between the input circuits on the safety gate switch will not be detected.
- Feasibility test on the control of the guard locking device and on the monitoring circuit for the guard locking device.
- When the gate is closed, the contact synchronisation time in the standard function block is monitored.

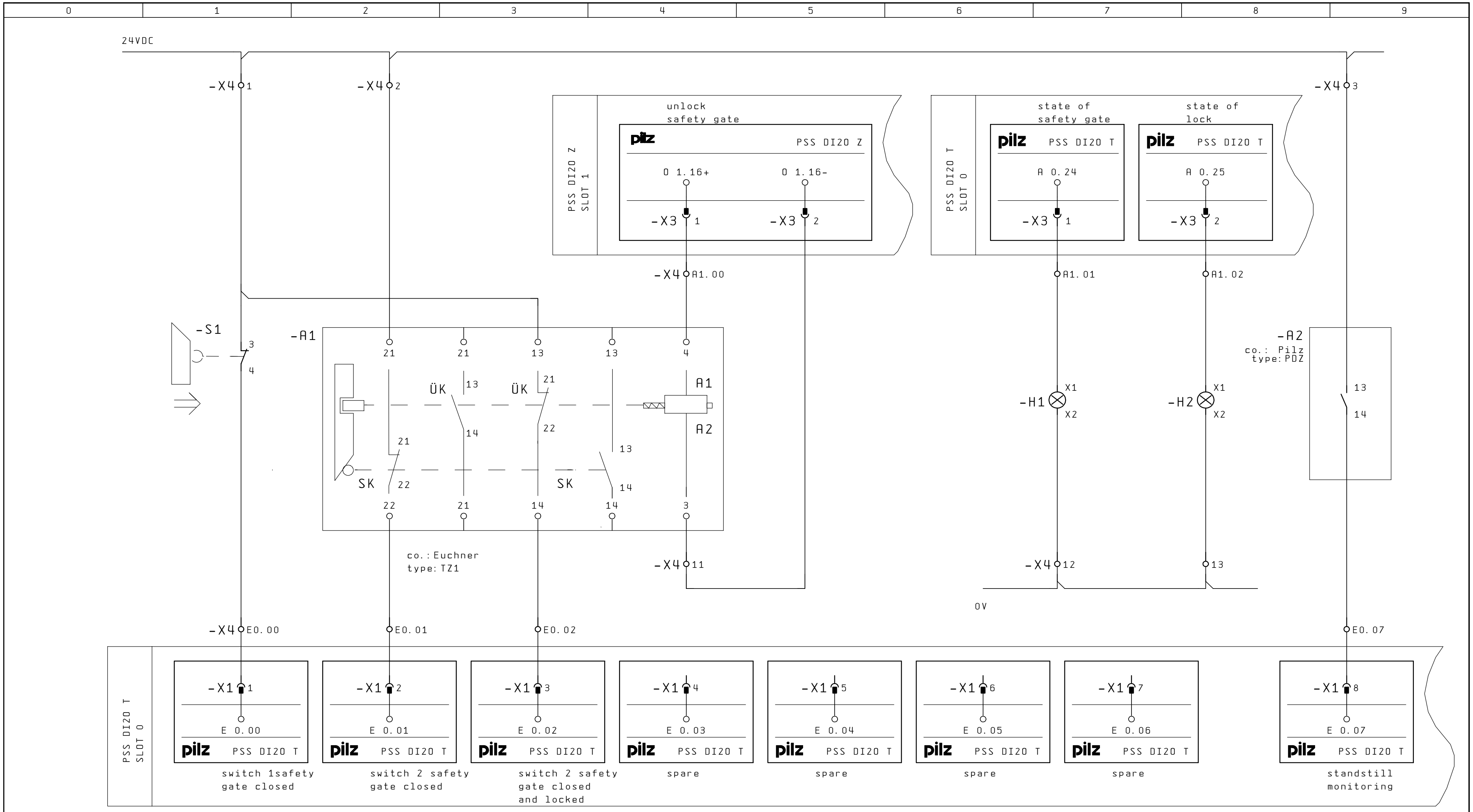
Pilz products

Number	Description	Order number
1	PSS CPU 3	301 064
1	PSS BMP 4/2	301 006
1	PSS PS 24	301 051
1	PSS DI2O T	301 121
1	PSS DI2O Z	301 109
1	PSS-SB-TRA	301 175B

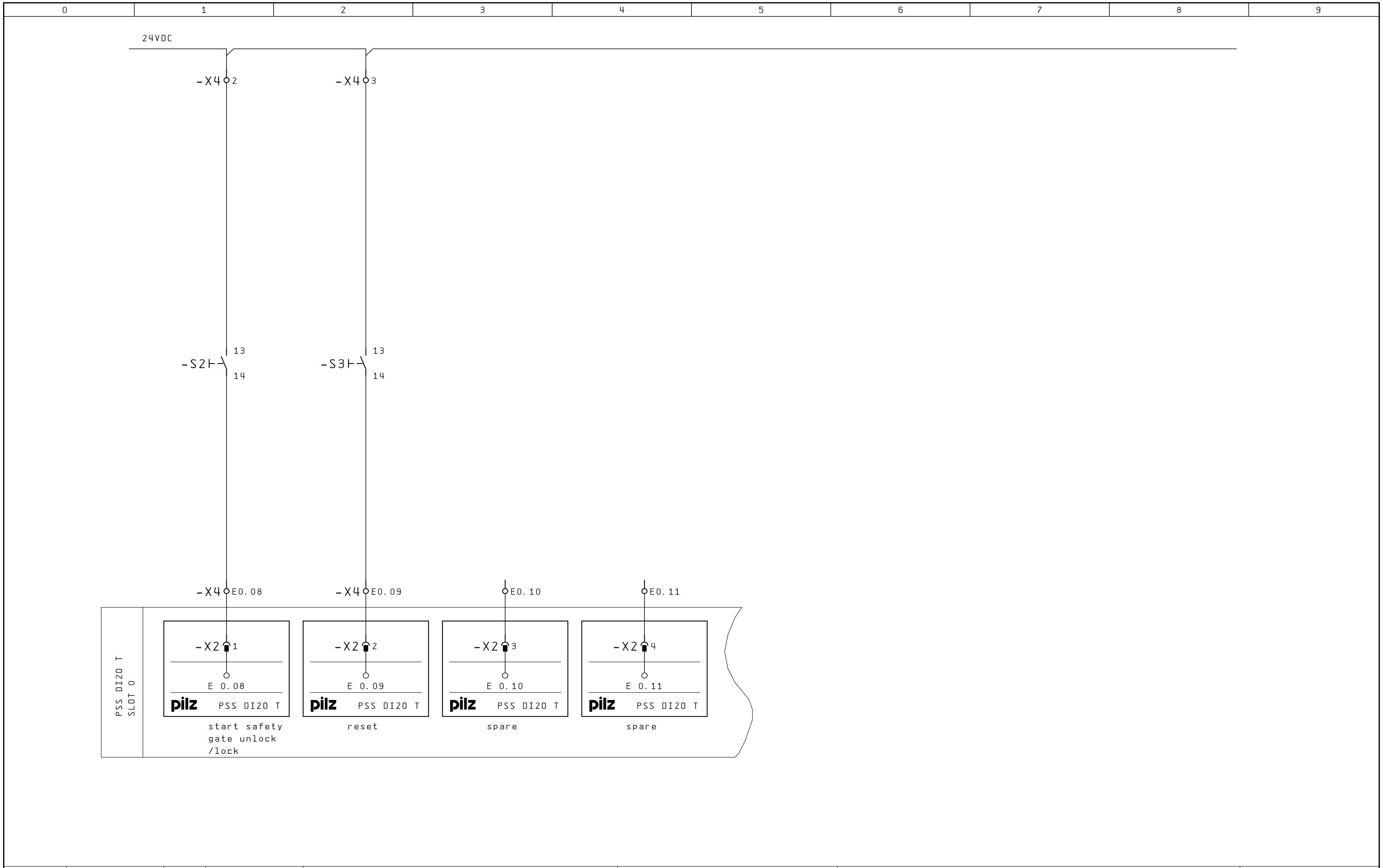
Drawing file

Page 60, 61 in the project “Eplan4/Pilz/APPL0703”

Classification in accordance with EN 954-1
Safe standstill monitoring in accordance with category 3, e.g. with the PDZ standstill monitor. The evaluation device for standstill monitoring must be in the same control cabinet as the PSS.


0
1
2
3
4
5
6
7
8
9
24VDC
-X4 1
-X4 2
-X4 3
PSS DI20 Z
SLOT 1
unlock
safety gate
pilz PSS DI20 Z
O 1.16+
O 1.16-
-X3 1
-X3 2
PSS DI20 T
SLOT 0
state of
safety gate
state of
lock
pilz PSS DI20 T
A 0.24
A 0.25
-X4 A1.00
A1.01
A1.02
-S1
3
4
-A1
21
21
13
13
4
ÜK
ÜK
A1
A2
SK
SK
22
21
14
14
3
co.: Euchner
type: TZ1
-X4 11
-X4 12
13
0V
-A2
co.: Pilz
type: PDZ
-H1
-H2
X1
X2
-X4 E0.00
E0.01
E0.02
E0.07
-X1 1
-X1 2
-X1 3
-X1 4
-X1 5
-X1 6
-X1 7
-X1 8
E 0.00
E 0.01
E 0.02
E 0.03
E 0.04
E 0.05
E 0.06
E 0.07
pilz PSS DI20 T
switch 1safety
gate closed
switch 2 safety
gate closed
switch 2 safety
gate closed
and locked
spare
spare
spare
spare
standstill
monitoring

Revision	27. Apr. 2004	Date	22. Apr. 2003	safety gate monitoring	Pilz GmbH & Co.KG Felix-Wankel-Str. 2 73760 Ostfildern	safety gate monitoring and interlock with PSS 3000	Directory: Eplan4/Pilz/Appl0703
Name	CLE	Name	CLE	Category 3 EN 954-1			Page: 60
		Dep.	CS				


0
1
2
3
4
5
6
7
8
9
24VDC
-X4 2
-X4 3
-S2
13
14
-S3
13
14
-X4 E0.08
-X4 E0.09
E0.10
E0.11
PSS DI20 T
SLOT 0
-X2 1
E 0.08
pilz PSS DI20 T
-X2 2
E 0.09
pilz PSS DI20 T
-X2 3
E 0.10
pilz PSS DI20 T
-X2 4
E 0.11
pilz PSS DI20 T
start safety gate unlock /lock
reset
spare
spare

Revision	27.Apr.2004	Date	22.Apr.2003	safety gate monitoring
Name	CLE	Name	CLE	
				Category 3 EN 954-1
		Dep.	CS	

pilz
Pilz GmbH & Co.KG
Felix-Wankel-Str.2
73760 Ostfildern

safety gate monitoring and interlock with PSS 3000

Directory: Eplan4/Pilz/Appl0703
Page: 61

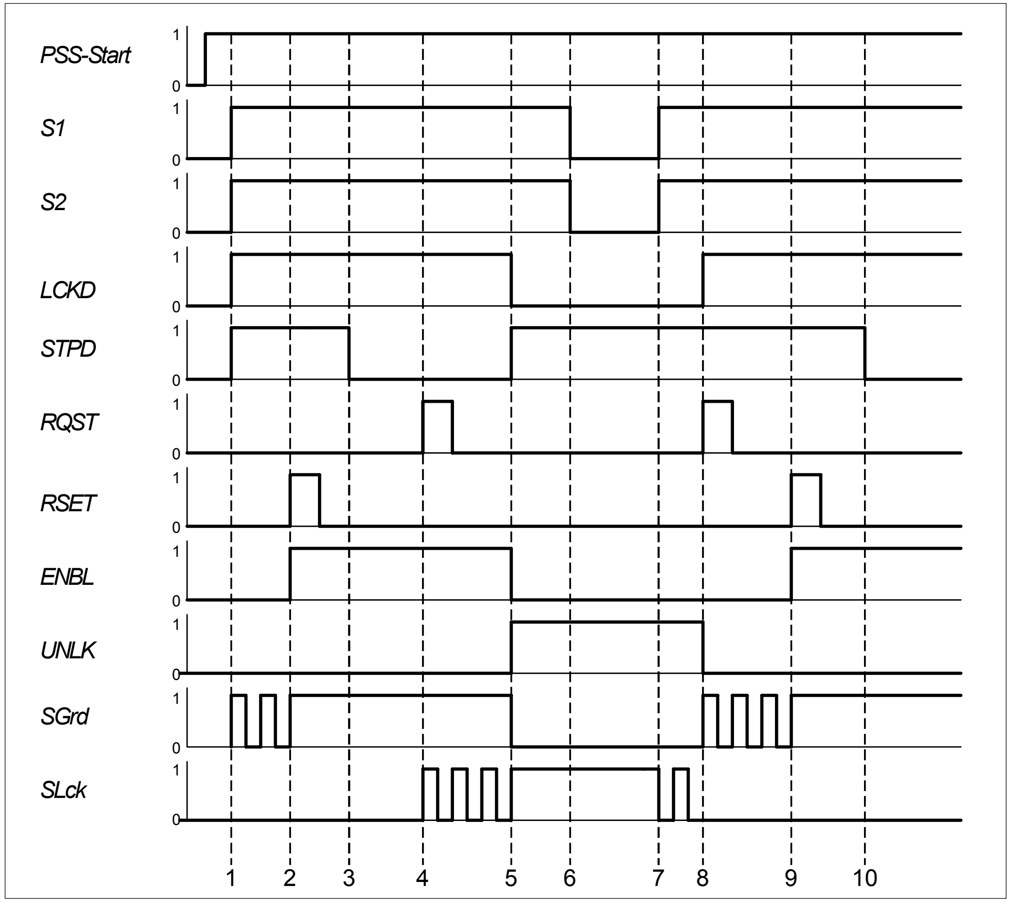
Category 3, EN 954-1

PSS 3000 – Safety gate monitoring with guard locking device

Timing diagram

Parameters set on SB075

- Synchronisation time monitoring on: *SyTi* = 1000
- Start-up disabler: *AuST* = 0
- Reset lock: *ARSt* = 0
- No function test *NoFT* = 1



1: PSS start, safety gate closed and locked and machine stopped.
2: Reset: *RSET* = 1
3: Machine running: *STPD* = 0
4: Request to open gate: *RQST* = 1
5: Machine standing: *STPD* = 1
6: Open the safety gate
7: Close the safety gate
8: Interlock safety gate: *RQST* = 1
9: Reset: *RSET* = 1
10: Machine running: *STPD* = 0

Category 3, EN 954-1

PSS 3000 – Safety gate monitoring with guard locking device

Program

```
:  A    DB002
:  L    KF500
:  =    DW0002
:  <    MW099.00   .Counter
:  SPB = Change
:  I    MW 099.00  .Counter
:  SPA= Next

Change : Network 00

:  L    M090.00     .Flashing
:  =N  M090.00     .Flashing
:  L    KF0
:  T    MW099.00   .Counter

Next    : Segment 01
```

```
                                          SB075
                                         GRD_LCK

KF  000001                -  W -  SSNR         ENBL  - X   - M   070.00 .Enable_Gate
M   110.01  .RLO-1        -  X -  GRP          UNLK  - X   - A   1.16    .Guard_lock
E   0.00    .GateSwitch_1 -  X -  S1           SGrd  - X   - A   0.24     .MC_Status
E   0.01    .GateSwitch_2 -  X -  S2           SLck  - X   - A   0.25     .Lock_Status
E   0.02    .Locked       -  X -  LCKD
KF  1000    .Sy.-Time     -  W -  SyTi
M   110.00  .RLO-0        -  X -  MRun
E   0.07    .Standstill   -  X -  STPD
E   0.08    .Release      -  X -  RQST
M   110.00  .RLO-0        -  X -  ARSt
M   110.00  .RLO-0        -  X -  AuSt
M   110.01  .RLO-1        -  X -  NoFT
M   90.00   .Flashing     -  X -  BLNK
E   0.09    .Reset        -  X -  RSET
```

Please note:
A “Minimum scan time” must be specified in the configurator of the PSS SW PG system software.

Global parameters used in administration data block DB015, DB016, DB017

- DW1022: Minimum scan time

The global parameter may be set in OB120 using SB071.

Additional blocks required

- DB015, DB016, DB017: Administration data block
  DB015, DB016 and DB017 must consist of their total length of 1024 data words. DB015, DB016 and DB017 must be declared READ/WRITE.
- SB071: Initialisation of global parameters in DB015, DB016, DB017
- SB255: Operating system call

Notes

Category 2, EN 954-1

PSS 3000 – Safety gate monitoring

Features

- Single-channel
- Manual reset when the PSS is cold/ warm started
- Reset lock
- Function test required when PSS is cold and warm started or the machine stops
- Failsafe standard function block used: SB066 (ST_K4)

Description

Safety gate monitoring function
In this example the safety system monitors the safety gate switch S1. Within the user program, the failsafe standard function block SB066 is assigned to the safety gate switch. SB066 detects an open safety gate, as well as detecting incorrect input signals, such as a reset button that is constantly operated.
If the safety gate is opened or an error occurs, the enable output *FG* on SB066 will immediately be reset.
The enable output *FG* is also reset when the PSS is stopped and when the PSS is switched on.
The signal at the enable output *FG* must be evaluated by the user program and trigger an appropriate reaction. SB066 stores a value in DB015, which can be used to determine why *FG* was reset.
The way in which the error is reset will depend on the operating mode set on SB066.
In this application example, parameters for SB066 have been set in such a way that it is necessary to reset by pressing S2 (0/1 pulse edge at *Strt*) in order to reset enable output *FG* on SB066 when the PSS is cold started (PSS switched from off to on), warm started (PSS transferring from STOP to RUN) or after closing the safety gate (restart).
Parameters on SB066 also stipulate that the safety gate must undergo a function test (opening and closing the gate) when the PSS is cold and warm started or when the machine stops.

Safety assessment

- If a contact on the safety gate switch is overridden, the user will detect this as an error at the next test function.
- A short between 24 VDC and an input circuit will be detected as an error by the programmable safety system.

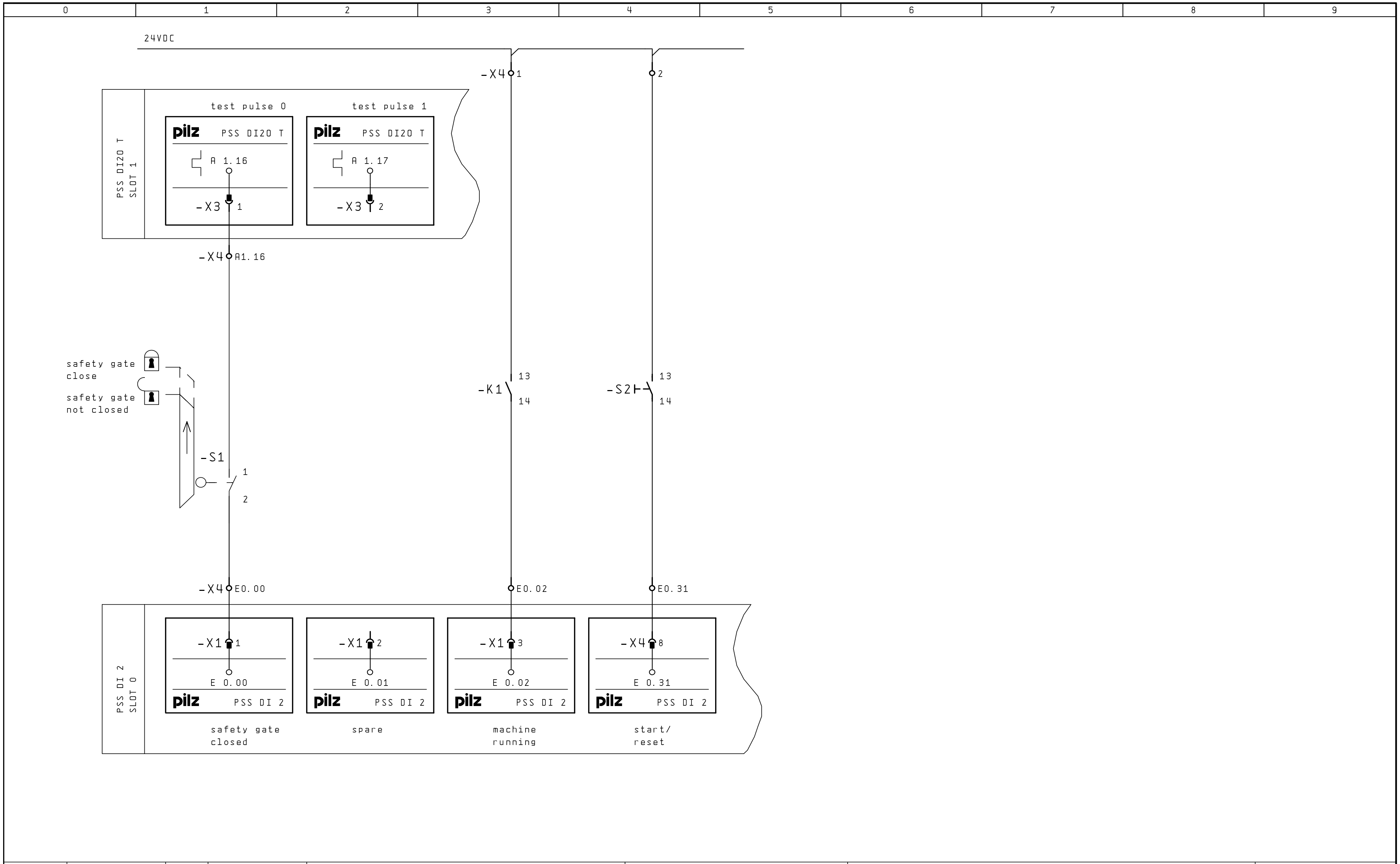
Classification in accordance with EN 954-1
Depending on the application area and its respective regulations, this connection example is suitable for applications up to category 2 in accordance with EN 954-1.
The safety function must be tested manually at appropriate intervals, e.g. through organisational measures.

Pilz products

Number	Description	Order number
1	PSS CPU 3	301 064
1	PSS BMP 4/2	301 006
1	PSS PS 24	301 051
1	PSS DI2O T	301 112
1	PSS DI 2	301 101
1	PSS-SB-TRA	301 175B

Drawing file

Page 3 in the project “Eplan4/Pilz/APPL0703”


0
1
2
3
4
5
6
7
8
9
24VDC
-X4 1
2
PSS DI20 T
SLOT 1
test pulse 0
test pulse 1
pilz PSS DI20 T
A 1.16
-X3 1
pilz PSS DI20 T
A 1.17
-X3 2
-X4 A1.16
safety gate close
safety gate not closed
-S1
1
2
-K1
13
14
-S2
13
14
-X4 E0.00
E0.02
E0.31
PSS DI 2
SLOT 0
-X1 1
E 0.00
pilz PSS DI 2
-X1 2
E 0.01
pilz PSS DI 2
-X1 3
E 0.02
pilz PSS DI 2
-X4 8
E 0.31
pilz PSS DI 2
safety gate closed
spare
machine running
start/ reset

Revision	30. Apr. 2003	Date	22. Apr. 2003	safety gate monitoring	Pilz GmbH & Co. Felix-Wankel-Str. 2 73760 Ostfildern	safety gate monitoring with PSS 3100	Directory: Eplan4/Pilz/Appl0703
Name	CLE	Name	CLE				
				Category 2 EN 954-1			Page: 3
		Dep.	CS				

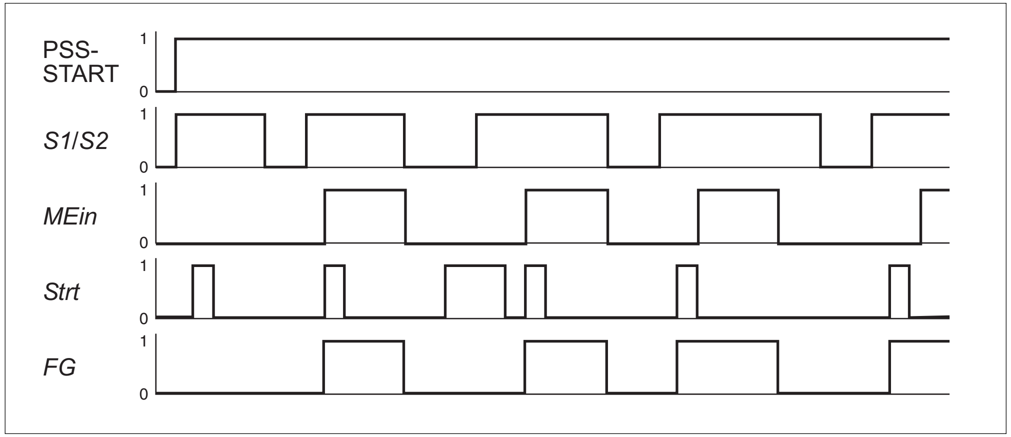
Category 2, EN 954-1

PSS 3000 – Safety gate monitoring

Timing diagram

Parameters set on SB066

- Function test on the safety gate (1/0 pulse edge):
  MEin = E0.02
- Reset lock:
  ARSt = 0
- Manual reset when PSS is cold/warm started:
  AuST = 0
- Function test on the gate when the PSS is cold and warm started:
  NFkT = 0



Program

```
                                      SB066
                                      ST_K4

KB  008                   - B -  SSNR          FG  - X  - M   070.07
E   0.00    .GateSwitch   - X -  S1
E   0.00    .GateSwitch   - X -  S2
KF  01000   .Syn.Time     - W -  SyTi
E   0.02    .MC_running   - X -  MEin
E   0.31    .Reset        - X -  Strt
M   110.00  .RLO-0        - X -  ARSt
M   110.00  .RLO-0        - X -  AuSt
M   110.00  .RLO-0        - X -  NFkT
```

Please note:
A "Minimum scan time" must be specified in the configurator of the PSS SW PG system software.

Global parameters used in administration data block DB015

- DW1022: Minimum scan time

The global parameter may be set in OB120 using SB070.

Additional blocks required

- DB015: Administration data block
  DB015 must consist of its total length of 1024 data words.
  DB015 must be declared READ/WRITE.
- SB070: Initialisation of global parameters in DB015

Notes

Category 3, EN 954-1

SafetyBUS p – Safety gate monitoring

Features

- Dual-channel redundancy
- Manual reset when the PSS is cold/warm started
- Reset lock
- Function test required when PSS is cold and warm started or the machine stops
- Failsafe standard function block used: SB064 (ST_K4)

Description

Safety gate monitoring function
In this example the safety system with the safe bus system SafetyBUS p monitors the safety gate switch S1. Within the user program, the failsafe standard function block SB064 is assigned to the safety gate switch. SB064 detects an open safety gate, as well as detecting incorrect input signals, such as a reset button that is constantly operated.
If the safety gate is opened or an error occurs, the enable output *ENBL* on SB064 will immediately be reset.
The enable output *ENBL* is also reset when the PSS is cold and warm started.
The signal at the enable output *ENBL* must be evaluated by the user program and trigger an appropriate reaction. SB064 stores a value in DB015 (or DB016 / DB017); this can be used to determine why *ENBL* was reset.
The way in which the error is reset will depend on the operating mode set on SB064.
In this application example, parameters for SB064 have been set in such a way that it is necessary to reset by pressing S3 (0/1 pulse edge at *RSET*) in order to reset enable output *ENBL* on SB064 when the PSS is cold started (PSS switched from off to on), warm started (PSS transferring from STOP to RUN) or after closing the safety gate (restart).
Parameters on SB064 also stipulate that the safety gate must undergo a function test (opening and closing the gate) when the PSS is cold and warm started, after I/O-Group 17 of SafetyBUS p or when the machine stops.

Safety assessment

- If a contact on the safety gate switch is overridden, the standard function block will detect this as an error at the next operation.
- A short between 24 VDC and an input circuit will be detected as an error by the standard function block at the next operation.
- A short between the input circuits will not be detected.

Classification in accordance with EN 954-1
Depending on the application area and its respective regulations, this connection example is suitable for applications up to category 3, in accordance with EN 954-1.

Pilz products

Number	Description	Order number	
1	PSS SB 3006 DP-S	301 460	
1	PSS SB DI8O8	301 140	
1	PSS SB screw connectors	311 060	**or**
1	PSS SB spring-loaded terminals	311 061	
2	PSS SB SUB-D1	311 051	
1	PSS SB cable	311 070	
1	PSS-SB-TRA	301 175B	

Drawing file

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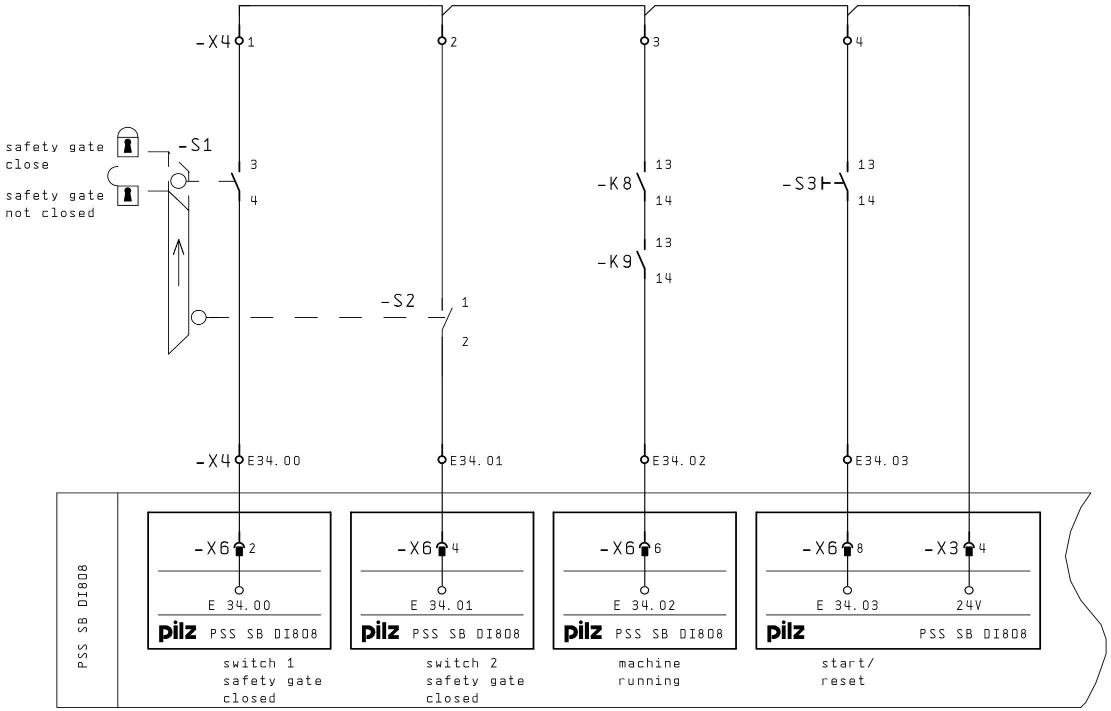

-X4
1
2
3
4
safety gate close
safety gate not closed
-S1
3
4
-K8
13
14
-K9
13
14
-S3
13
14
-S2
1
2
-X4
E34.00
E34.01
E34.02
E34.03
PSS SB DI808
-X6 2
E 34.00
pilz PSS SB DI808
-X6 4
E 34.01
pilz PSS SB DI808
-X6 6
E 34.02
pilz PSS SB DI808
-X6 8
-X3 4
E 34.03
24V
pilz PSS SB DI808
switch 1 safety gate closed
switch 2 safety gate closed
machine running
start/ reset

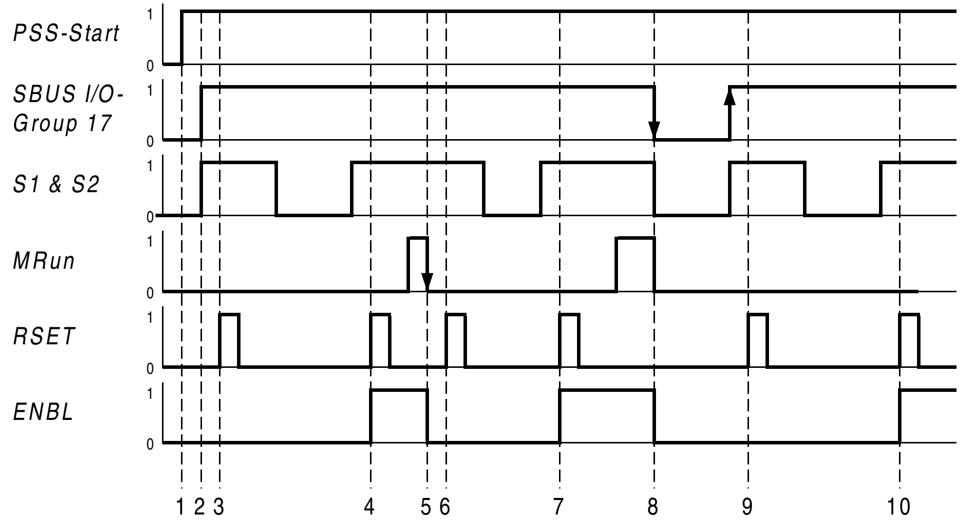
Revision	30.Apr.2003	Date	22.Apr.2003	safety gate monitoring	pilz	safety gate monitoring with SafetyBUS p	Directory: Eplan4/Pilz/Appl0703
Name	CLE	Name	CLE		Pilz GmbH & Co. Felix-Wankel-Str.2 73760 Ostfildern		
		Dep.	CS	Category 3 EN 954-1			Page: 19

Category 3, EN 954-1

SafetyBUS p – Safety gate monitoring

Timing diagram

Parameters set on SB064
- I/O-Group 17: *GRP* = M116.17
- Monitoring of synchronisation time on: *SyTi* = 010000
- Function test after machine stops (1/0 pulse edge): *MRun* = E34.02
- Start-up disabler: *AuST* = 0
- Reset lock: *ARSt* = 0
- Function test on the gate when the PSS is cold and warm started: *NoFT* = 0
- Reset button: *RSET* = E34.03



1: PSS start, safety gate closed
2: Start I/O-Group 17, safety gate closed
3: Start attempt with RSET
4: Reset
5: Machine stopped
6: Start attempt with RSET unsuccessful
7: Reset
8: I/O-Group 17 stopped
9: Start attempt with RSET unsuccessful
10: Reset

Program

```
                                     SB064

KF 000201                     - B - SSNR        ENBL  - X  - M   76.07
M   116.17  I/O_Group_17      - X - GRP
E   34.00   .GateSwitch       - X - S1
E   34.01   .GateSwitch       - X - S2
KF  01000   .Syn.Time         - W - SyTi
E   34.02   .MC_running       - X - MRun
M   110.00  .RLO-0            - X - AuSt
M   110.00  .RLO-0            - X - ARSt
M   110.00  .RLO-0            - X - NoFT
E   34.03   .Reset            - X - RSET
```

Please note:
A “Minimum scan time” must be specified in the configurator of the PSS SW PG system software.

Global parameters used in administration data block DB015, DB016 and DB017
- DW1022: Minimum scan time

The global parameter may be set in OB120 using SB071.

Additional blocks required
- DB015, DB016, DB017: Administration data blocks DB015, DB016 and DB017 must consist of their total length of 1024 data words. The data blocks must be declared READ/WRITE.
- SB070: Initialisation of global parameters in DB015, DB016 and DB017

Notes

Feedback Loop Applications

Contents				Page
Feedback loop applications				
PSS 3100	–	Feedback loop monitoring	Category 4, EN 954-1	5.3-2
PSS 3000	–	Feedback loop monitoring	Category 4, EN 954-1	5.3-6
SafetyBUS p	–	Feedback loop monitoring	Category 4, EN 954-1	5.3-10
PSS 3000	–	Feedback loop monitoring on the PZE X4 (Pilz)	Category 4, EN 954-1	5.3-14
SafetyBUS p	–	Feedback loop monitoring on the PZE X4 (Pilz)	Category 4, EN 954-1	5.3-18
PSS 3000	–	Feedback loop monitoring on the PZE 9 (Pilz)	Category 4, EN 954-1	5.3-22
SafetyBUS p	–	Feedback loop monitoring on the PZE 9 (Pilz)	Category 4, EN 954-1	5.3-26
PSS 3000	–	Feedback loop monitoring	Category 2, EN 954-1	5.3-30
SafetyBUS p	–	Feedback loop monitoring	Category 2, EN 954-1	5.3-34
PSS 3000	–	Feedback loop monitoring on a SIMATIC S7	Category 1, EN 954-1	5.3-38

Category 4, EN 954-1

PSS 3100 – Feedback loop monitoring

Features

- Dual-channel redundancy
- Failsafe standard function block used: SB067 (RFK_K4)
- Feasibility test and time monitoring of the start-up condition, the feedback loop signals and the output status through standard function block SB067

Description

The plant conditions are logically connected within the user program through various SBs. Flag M88.14 contains the result of these logic operations and switches the three-phase motor on and off.

Feedback loop monitoring function

The safety system monitors the contacts on the two contactors K5 and K6. Within the user program, the failsafe standard function block SB067 is assigned to the N/C contacts K5 and K6. SB067 drives the contactors as well as monitoring the feedback loop. A 0/1 pulse edge at input parameter *Ein* of SB067 (M88.14) sets the output that drives the contactors, *K*, to “1”; a 1/0 pulse edge sets it to “0”.

SB067 has extensive fault detection features. For example, SB067 automatically detects errors such as “FL remains open” or “FL remains closed”.

If an error occurs, the enable output *FG* on SB067 will immediately be reset, along with *K*, the output that drives the contactors. Both outputs are also reset when the PSS is stopped and when the PSS is switched on. The signal at the enable output *FG* can be evaluated by the user program and trigger an appropriate reaction. SB067 stores a value in DB015, which can be used to determine why *FG* was reset.

If an error occurs, once the error has been rectified, a reset must be performed by pressing S1 (0/1 pulse edge at *RSet*) in order to also reset enable output *FG* of SB067. Output K can then also be reset by setting flag M88.14.

Safety assessment

- A short between 24 VDC and a safety output or a feedback loop input will be detected as an error by the programmable safety system. The load can be switched off via the second shutdown route.
- The centralised module PSS DI2O Z will detect an open circuit in the output circuit.

Classification in accordance with EN 954-1

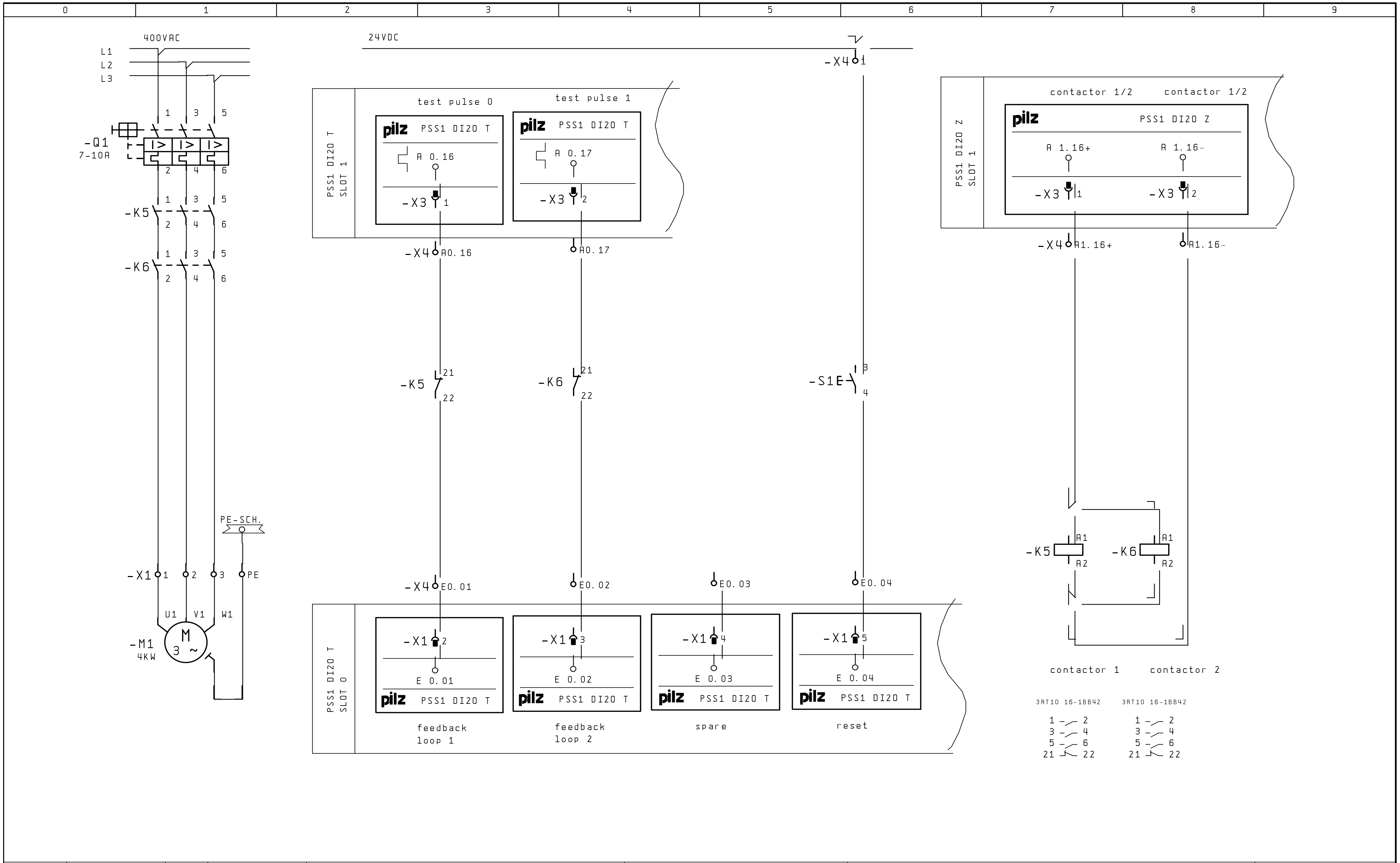
Depending on the application area and its respective regulations, this connection example is suitable for applications up to category 4, in accordance with EN 954-1.

Pilz products

Number	Description	Order number
1	PSS1 CPU 3	302 064
1	PSS1 BMP 3/1	302 007
1	PSS1 DI2O T	302 112
1	PSS1 DI2O Z	302 109
1	PSS-SB-NOT	301 176B

Drawing file

Page 6 in the project “Eplan4/Pilz/APPL0703”


0
1
2
3
4
5
6
7
8
9
400VAC
L1
L2
L3
1
3
5
-Q1
7-10A
2
4
6
-K5
-K6
PE-SCH.
-X1
1
2
3
PE
U1
V1
W1
-M1
4KW
M
3 ~
24VDC
-X4
PSS1 DI20 T
SLOT 1
test pulse 0
test pulse 1
pilz
PSS1 DI20 T
A 0.16
A 0.17
-X3
-X4
A0.16
A0.17
-K5
-K6
21
22
-S1E
3
4
E0.01
E0.02
E0.03
E0.04
PSS1 DI20 T
SLOT 0
-X1
E 0.01
E 0.02
E 0.03
E 0.04
feedback loop 1
feedback loop 2
spare
reset
PSS1 DI20 Z
SLOT 1
contactor 1/2
contactor 1/2
PSS1 DI20 Z
A 1.16+
A 1.16-
-X3
A1.16+
A1.16-
A1
A2
contactor 1
contactor 2
3RT10 16-1BB42
3RT10 16-1BB42
1 – 2
3 – 4
5 – 6
21 – 22

Revision	30.Apr.2003	Date	22.Apr.2003
Name	CLE	Name	CLE
		Dep.	CS

feedback loop monitoring

Category 4 EN 954-1

Pilz GmbH & Co.
Felix-Wankel-Str.2
73760 Ostfildern

feedback loop monitoring on contactor with PSS 3100

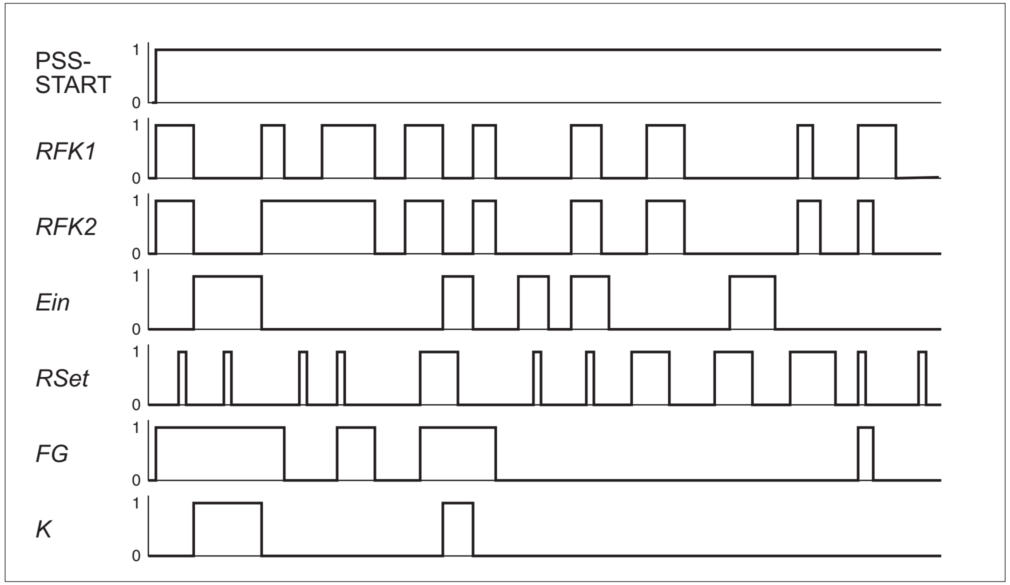
Directory:
Eplan4/Pilz/Appl0703

Page: 6

Category 4, EN 954-1

PSS 3100 – Feedback loop monitoring

Timing diagram



Program

```
                                        SB067
                                        RFK_K4
KB  007                      - B -  SSNR          FG  - X  - M   070.06 .Enable-M1
E   0.01   .FL-K-M1.1        - X -  FL1           K   - X  - A   1.16   .K-M1.1/2
E   0.02   .FL-K-M1.2        - X -  FL2
E   0.04   .Reset            - X -  RSet
M   88.14  .M1_ON            - X -  Ein
```

Please note:
A “Minimum scan time” must be specified in the configurator of the PSS SW PG system software.

Global parameters used in administration data block DB015

- DW1002: Number of cycles for the reaction time of the feedback loop

The global parameter may be set in OB120 using SB070.

Additional blocks required

- DB015: Administration data block
  DB015 must consist of its total length of 1024 data words.
  DB015 must be declared READ/WRITE.
- SB070: Initialisation of global parameters in DB015

Notes

Category 4, EN 954-1

PSS 3000 – Feedback loop monitoring

Features

- Dual-channel redundancy
- Failsafe standard function block used: SB065 (FBL)
- Feasibility test and time monitoring of the start-up condition, the feedback loop signals and the output status through standard function block SB065

Description

The plant conditions are logically connected within the user program through various SBs. Flag M88.14 contains the result of this logic operation and switches the three-phase motor on and off.

Feedback loop monitoring function

The safety system monitors the contacts on the two contactors K38 and K39. Within the user program, the failsafe standard function block SB065 is assigned to the N/C contacts K38 and K39. SB065 drives the contactors as well as monitoring the feedback loop. A 0/1 pulse edge at input parameter *ON* of SB065 (M88.14) sets the outputs that drive the contactors, *K1* and *K2*, to “1”; a 1/0 pulse edge sets them to “0”.

SB065 has extensive fault detection features. For example, SB065 automatically detects errors such as “FL remains open” or “FL remains closed”. If an error occurs, the enable output *ENBL* on SB065 will immediately be reset, along with the outputs that drive the contactors, *K1* and *K2*. Both outputs are also reset when the PSS is stopped and when the PSS is switched on. The signal at the enable output *ENBL* can be evaluated by the user program and trigger an appropriate reaction. SB065 stores a value in DB015 (DB016 or DB017); this can be used to determine why *ENBL* was reset. If an error occurs, once the error has been rectified, a reset must be performed by pressing S1 (0/1 pulse edge at *RSET*) in order to also reset the enable output *ENBL* on SB065. Outputs *K1* and *K2* can then also be reset by setting flag M88.14.

Safety assessment

- A short between 24 VDC and a safety output or a feedback loop input will be detected as an error by the programmable safety system. The load can be switched off via the second shutdown route.
- The feedback loops may be connected in series if the safety system and the N/C contacts are installed in the same location (faults excluded in the case of short circuits and shorts between contacts).
- To achieve Category 4, dual actuators must be connected to adjacent blocks of 8 outputs (in this case A1.00 and A1.08).

Pilz products

Number	Description	Order number
1	PSS CPU 3	301 064
1	PSS BMP 4/2	301 006
1	PSS PS 24	301 051
1	PSS DI2O T	301 112
1	PSS DOS	301 111
1	PSS-SB-NOT	301 176B

Drawing file

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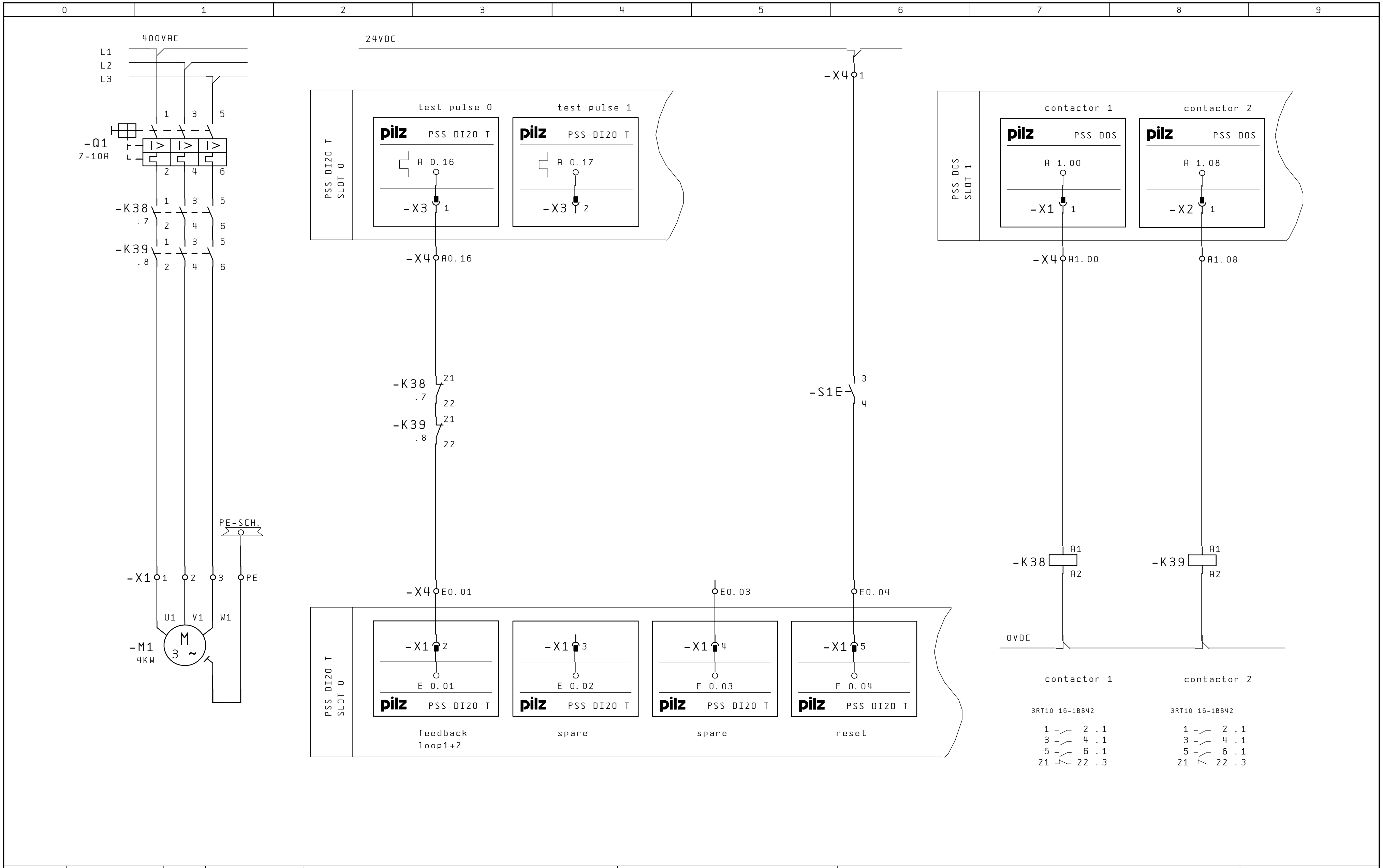
Classification in accordance with EN 954-1

Depending on the application area and its respective regulations, this connection example is suitable for applications up to category 4, in accordance with EN 954-1.

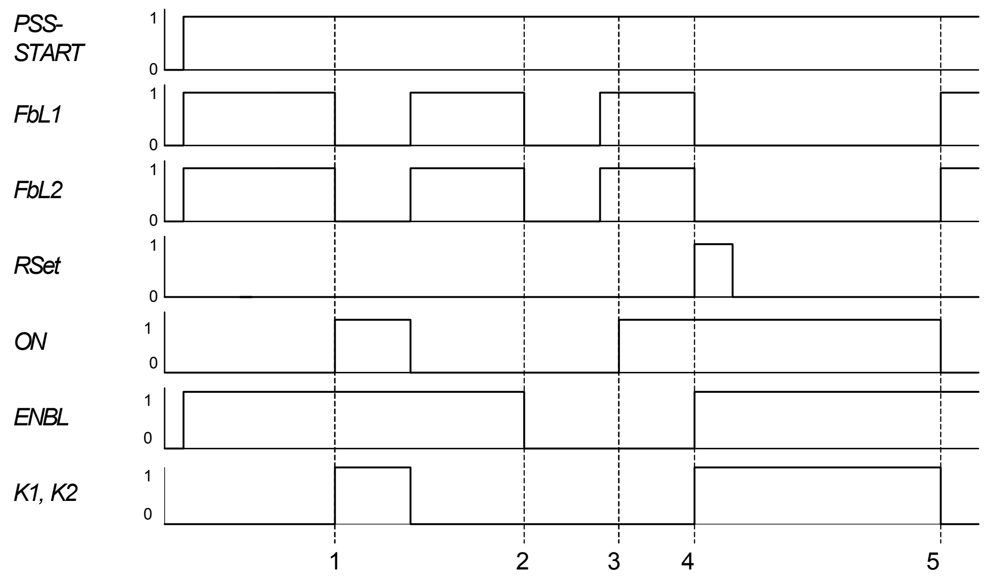

0
1
2
3
4
5
6
7
8
9
400VAC
L1
L2
L3
-Q1
7-10A
-K38
.7
-K39
.8
PE-SCH.
-X1
1
2
3
PE
U1
V1
W1
-M1
4KW
M
3 ~
24VDC
-X4
1
PSS DI20 T
SLOT 0
test pulse 0
test pulse 1
pilz
PSS DI20 T
A 0.16
A 0.17
-X3
-X4
A0.16
-K38
.7
21
22
-K39
.8
21
22
-S1E
3
4
-X4
E0.01
E0.03
E0.04
-X1
2
3
4
5
E 0.01
E 0.02
E 0.03
E 0.04
feedback
loop1+2
spare
spare
reset
PSS DOS
SLOT 1
contactor 1
contactor 2
PSS DOS
A 1.00
A 1.08
-X1
-X2
-X4
A1.00
A1.08
-K38
-K39
A1
A2
0VDC
contactor 1
contactor 2
3RT10 16-1BB42
1 2 .1
3 4 .1
5 6 .1
21 22 .3

Revision	27. Apr. 2004	Date	22. Apr. 2003	feedback loop monitoring	Pilz GmbH & Co. KG Felix-Wankel-Str. 2 73760 Ostfildern	feedback loop monitoring with single pole output with PSS 3000	Directory: Eplan4/Pilz/App10703
Name	CLE	Name	CLE	Category 4 EN 954-1			Page: 50
		Dep.	CS				

Category 4, EN 954-1

PSS 3000 – Feedback loop monitoring

Timing diagram



1: Outputs *K1*, *K2* = 1
2: Error in the feedback loop -> *ENBL* = 0
3: Reset lock after error
4: Error reset *RSET* = 0/1 -> *ENBL* = 1
5: Outputs *K1*, *K2* = 0

Program

```
                                         SB065
                                          FBL

KF  000001                  - W -  SSNR        ENBL  - X  - M   70.06  .Enable
M   110.01  .RLO-1          -  X -  GRP          K1  - X  - A   1.00   .Contactor 1
M   88.14   .M1_ON          -  X -  ON           K2  - X  - A   1.08   .Contactor 2
E   0.01    .FL-K-M1.1      -  X -  FbL1
E   0.01    .FL-K-M1.1      -  X -  FbL2
KF  000150                  - W -  TFbL
E   0.04    .Reset          -  X -  RSET
```

Please note:
A “Minimum scan time” must be specified in the configurator of the PSS SW PG system software.

Global parameters used in administration data block DB015, DB016, DB017

- DW1022: Global parameters must be set in OB120 using SB071.

Additional blocks required

- DB015, DB016, DB017: Administration data block
  DB015, DB016 and DB017 must consist of their total length of 1024 data words. DB015, DB016 and DB017 must be declared READ/WRITE.
- SB071: Initialisation of global parameters in DB015, DB016, DB017
- SB255: Operating system call

Notes

Category 4, EN 954-1

SafetyBUS p – Feedback loop monitoring

Features

- Dual-channel redundancy
- Open circuit detection
- Failsafe standard function block used: SB067 (RFK_K4)
- Feasibility test and time monitoring of the start-up condition, the feedback loop signals and the output status through standard function block SB067.

Description

The plant conditions are logically connected within the user program through various SBs. Flag M88.14 contains the result of these logic operations and switches the three-phase motor on and off.

Feedback loop monitoring function

The safety system with the safe bus system SafetyBUS p monitors the contacts on the two contactors K15 and K16. Within the user program, the failsafe standard function block SB067 is assigned to the N/C contacts K15 and K16. SB067 drives the contactors as well as monitoring the feedback loop. A 0/1 pulse edge at input parameter *Ein* of SB067 (M88.14) sets the output that drives the contactors, *K*, to “1”; a 1/0 pulse edge sets it to “0”.

SB067 has extensive fault detection features. For example, SB067 automatically detects errors such as “FL remains open” or “FL remains closed”.

If an error occurs, the enable output *FG* on SB067 will immediately be reset, along with *K*, the output that drives the contactors. Both outputs are also reset when the PSS is stopped and when the PSS is switched on. The signal at the enable output *FG* can be evaluated by the user program and trigger an appropriate reaction. SB067 stores a value in DB015, which can be used to determine why *FG* was reset.

If an error occurs, once the error has been rectified, a reset must be performed by pressing S1 (0/1 pulse edge at *RSet*) in order to also reset enable output *FG* on SB067. Output *K* can then also be reset by setting flag M88.14.

Safety assessment

- A short between 24 VDC and a safety output or a feedback loop input will be detected as an error by the programmable safety system. The load can be switched off via the second shutdown route.

Classification in accordance with EN 954-1

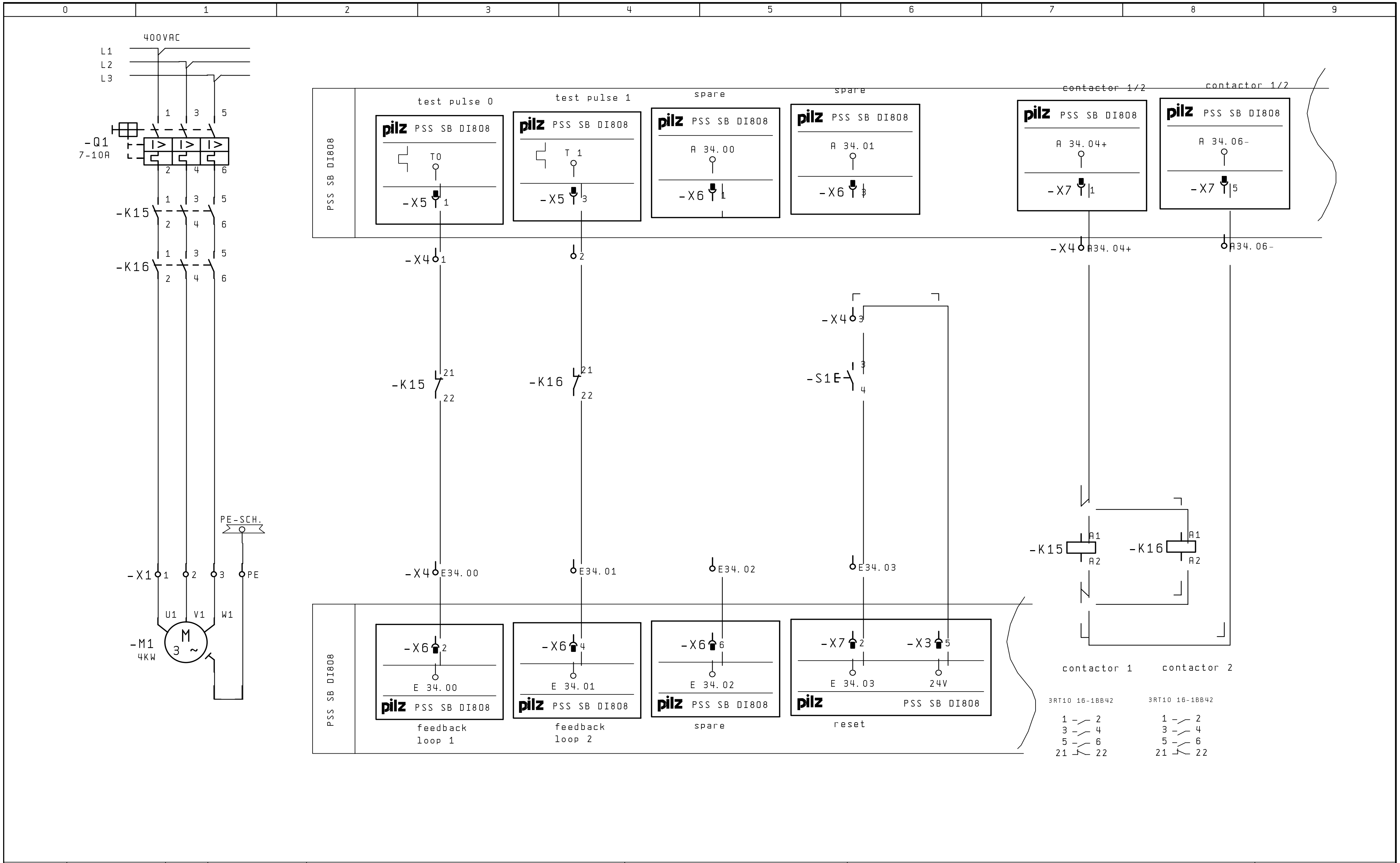
Depending on the application area and its respective regulations, this connection example is suitable for applications up to category 4, in accordance with EN 954-1.

Pilz products

Number	Description	Order number	
1	PSS SB 3006 DP-S	301 460	
1	PSS SB DI8O8	301 140	
1	PSS SB screw connectors	311 060	**or**
1	PSS SB spring-loaded terminals	311 061	
2	PSS SB SUB-D1	311 051	
1	PSS SB cable	311 070	
1	PSS-SB-NOT	301 176B	

Drawing file

Page 22 in the project “Eplan4/Pilz/APPL0703”


0
1
2
3
4
5
6
7
8
9
400VAC
L1
L2
L3
-Q1
7-10A
-K15
-K16
-X1
PE-SCH.
PE
U1
V1
W1
-M1
4KW
M
3 ~
PSS SB DI808
test pulse 0
test pulse 1
spare
spare
contactor 1/2
contactor 1/2
pilz PSS SB DI808
T0
T 1
A 34.00
A 34.01
A 34.04+
A 34.06-
-X5
-X6
-X7
-X4
A34.04+
A34.06-
-S1E
E34.00
E34.01
E34.02
E34.03
-X3
E 34.00
E 34.01
E 34.02
E 34.03
24V
feedback loop 1
feedback loop 2
spare
reset
A1
A2
contactor 1
contactor 2
3RT10 16-1BB42
1 2
3 4
5 6
21 22

Revision	10.Jul.2003	Date	22.Apr.2003	feedback loop monitoring	
Name	CLE	Name	CLE		
				Category 4 EN 954-1	
		Dep.	CS		

Pilz GmbH & Co.
Felix-Wankel-Str.2
73760 Ostfildern

feedback loop monitoring on contactor with SafetyBUS p

Directory:
Eplan4/Pilz/Appl0703

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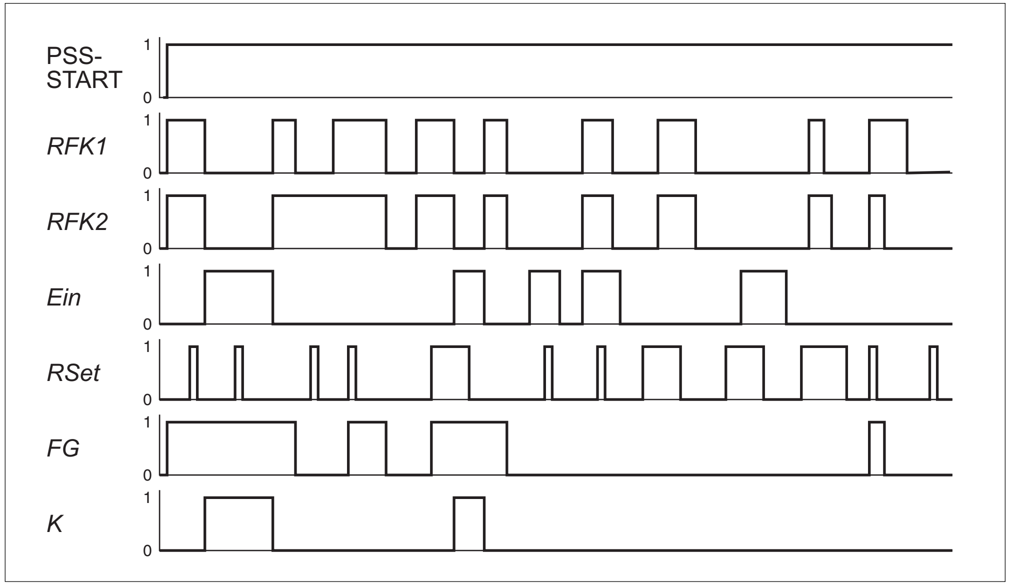
Category 4, EN 954-1

SafetyBUS p – Feedback loop monitoring

Timing diagram



Program

```
                                          SB067
                                          RFK_K4

KB  007                       - B -  SSNR           FG  - X  - M   070.06 .Enable-M1
E   34.00   .FL-K-M1.1        - X -  FL1            K   - X  - A   34.04  .K-M1.1/2
E   34.01   .FL-K-M1.2        - X -  FL2
E   34.13   .Reset            - X -  RSet
M   88.14   .M1_ON            - X -  Ein
```

Please note:
A “Minimum scan time” must be specified in the configurator of the PSS SW PG system software.

Global parameters used in administration data block DB015

- DW1002: Number of cycles for the reaction time of the feedback loop

The global parameter may be set in OB120 using SB070.

Additional blocks required

- DB015: Administration data block
  DB015 must consist of its total length of 1024 data words.
  DB015 must be declared READ/WRITE.
- SB070: Initialisation of global parameters in DB015

Notes

Category 4, EN 954-1

PSS 3000 – Feedback loop monitoring on the PZE X4 (Pilz)

Features

- Dual-channel redundancy
- Feedback loop implemented with PZE X4
- Failsafe standard function block used: SB067 (RFK_K4)

Description

The start-up conditions for the plant and the two-hand control are logically connected within the user program through various SBs. Flag M80.02 contains the result of these logic operations and switches the loads on the PZE X4 on and off.

Feedback loop monitoring function

The safety system monitors the N/C contact on the feedback loop Y1/Y2. The N/C contact is switched by contactor K7. Both the N/C contact and the contactor are located on the contact expander module PZE X4.

Within the user program, the failsafe standard function block SB067 is assigned to the N/C contact K7. SB067 drives the contactor as well as monitoring the feedback loop. A 0/1 pulse edge at input parameter *Ein* of SB067 sets the output that drives the contactor, *K*, to “1”; a 1/0 pulse edge sets it to “0”.

SB067 has extensive fault detection features. For example, SB067 automatically detects errors such as “FL remains open” or “FL remains closed”.

If an error occurs, the enable output *FG* on SB067 will immediately be reset, along with *K*, the output that drives the contactor. Both outputs are also reset when the PSS is stopped and when the PSS is switched on. The signal at the enable output *FG* can be evaluated by the user program and trigger an appropriate reaction. SB067 stores a value in DB015, which can be used to determine why *FG* was reset.

If an error occurs, once the error has been rectified, a reset must be performed by pressing S1 (0/1 pulse edge at *RSet*) in order to also reset enable output *FG* on SB067. Output *K* can then also be reset by setting flag M80.02.

Safety assessment

- A short between 24 VDC and a safety output or a feedback loop input will be detected as an error by the programmable safety system. The load can be switched off via the second shutdown route.
- The centralised module PSS DI2OZ will detect an open circuit in the output circuit.

Note:

A maximum voltage of 150 V_{eff} (conductor-earth on three-phase systems) may be applied to the N/O contacts on the PZE X4. This meets the requirements for protective extra low voltage (safe separation) on the PSS system.

From Version 7.2 of the PZE X4 (order no. 774 585, ca. October 2004), three N/O contacts are safely separated, so that higher voltages may also be applied. It is essential that you refer to the operating instructions for the PZE X4.

Classification in accordance with EN 954-1

Depending on the application area and its respective regulations, this connection example is suitable for applications up to category 4, in accordance with EN 954-1.

Pilz products

Number	Description	Order number
1	PSS CPU 3	301 064
1	PSS BMP 4/2	301 006
1	PSS PS 24	301 051
1	PSS DIO Z	301 108
1	PSS DI2O T	301 112
1	PSS DI 2	301 101
1	PSS-SB-NOT	301 176B
1	PZE X4	774 585

Drawing file

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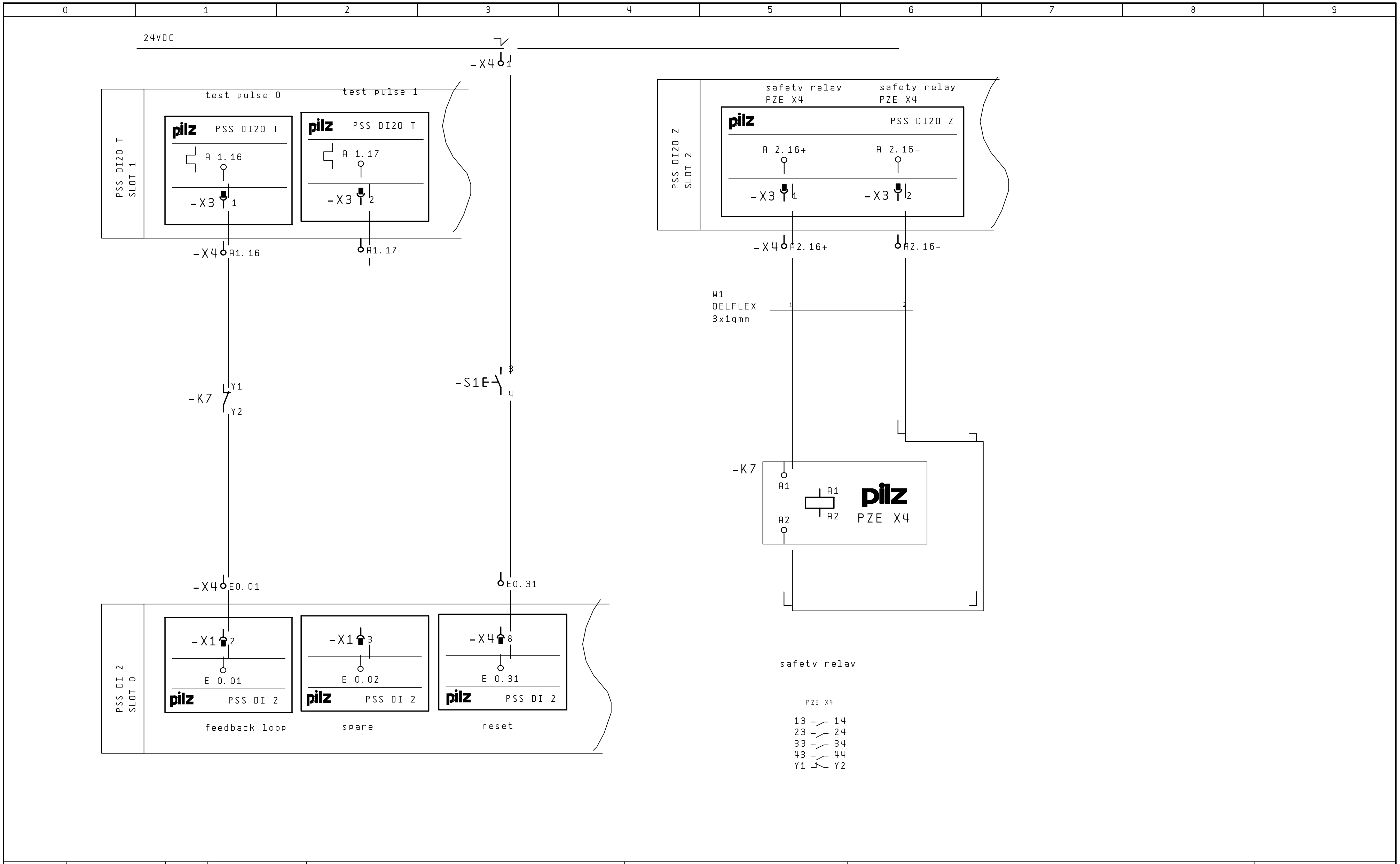
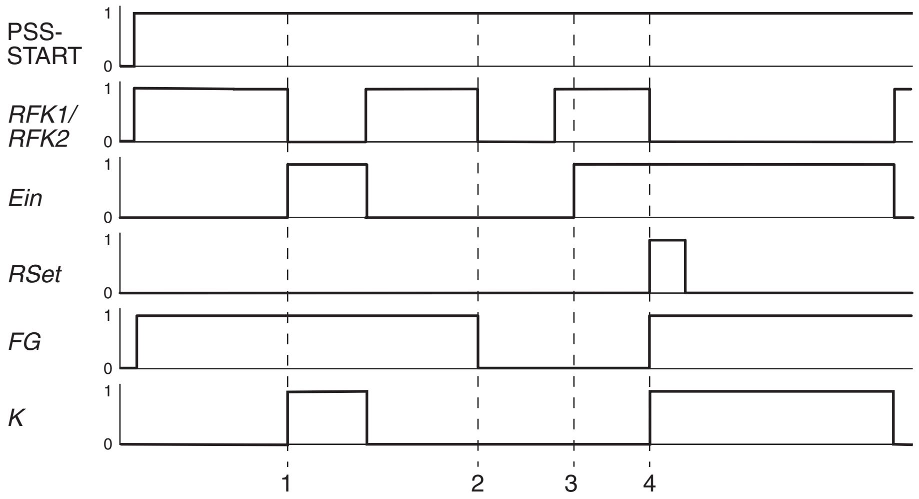

0
1
2
3
4
5
6
7
8
9
24VDC
-X4 1
test pulse 0
test pulse 1
PSS DI20 T
SLOT 1
pilz PSS DI20 T
A 1.16
-X3 1
pilz PSS DI20 T
A 1.17
-X3 2
-X4 A1.16
A1.17
PSS DI20 Z
SLOT 2
safety relay
PZE X4
safety relay
PZE X4
pilz PSS DI20 Z
A 2.16+
A 2.16-
-X3 1
-X3 2
-X4 A2.16+
A2.16-
W1
OELFLEX
3x1qmm
1
2
-S1E 3
4
-K7 Y1
Y2
-K7
A1
A2
A1
A2
pilz
PZE X4
-X4 E0.01
E0.31
PSS DI 2
SLOT 0
-X1 2
E 0.01
pilz PSS DI 2
feedback loop
-X1 3
E 0.02
pilz PSS DI 2
spare
-X4 8
E 0.31
pilz PSS DI 2
reset
safety relay
PZE X4
13 14
23 24
33 34
43 44
Y1 Y2

Revision	30. Apr. 2003	Date	22. Apr. 2003	feedback loop with PZEX4	pilz	feedback loop monitoring on safety relay PZEX4 with PSS 3000	Directory: Eplan4/Pilz/Appl0703
Name	CLE	Name	CLE	Category 4 EN 954-1	Pilz GmbH & Co. Felix-Wankel-Str. 2 73760 Ostfildern		Page: 12
		Dep.	CS				

Category 4, EN 954-1

PSS 3000 – Feedback loop monitoring on the PZE X4 (Pilz)

Timing diagram



1: Output parameter *K* = 1
2: Error in the feedback loop: *FG* = 0
3: Reset lock after error
4: Error reset *RSet* = 0/1 -> *FG* = 1

Program

```
                                              SB067
                                             RFK_K4

KB  006                        - B -  SSNR          FG - X - M  070.05 .Enable-K7
E   0.01     .FL-K7            - X -  FL1            K - X - A  2.16   .K7
E   0.01     .FL-K7            - X -  FL2
E   0.31     .Reset            - X -  RSet
M   80.02    .Enable-THC       - X -  Ein
```

Please note:
A “Minimum scan time” must be specified in the configurator of the PSS SW PG system software.

Global parameters used in administration data block DB015

- DW1002: Number of cycles for the reaction time of the feedback loop

The global parameter may be set in OB120 using SB070.

Additional blocks required

- DB015: Administration data block
  DB015 must consist of its total length of 1024 data words.
  DB015 must be declared READ/WRITE.
- SB070: Initialisation of global parameters in DB015.

Notes

Category 4, EN 954-1
SafetyBUS p – Feedback loop monitoring on the PZE X4 (Pilz)

Features

- Dual-channel redundancy
- Feedback loop implemented with PZE X4
- Failsafe standard function block used: SB067 (RFK_K4)

Description

The start-up conditions for the plant and the two-hand control are logically connected within the user program through various SBs. Flag M80.02 contains the result of these logic operations and switches the loads on the PZE X4 on and off.

Feedback loop monitoring function

The safety system with the safe bus system SafetyBUS p monitors the N/C contact on the feedback loop Y1/Y2. The N/C contact is switched by contactor K18. Both the N/C contact and the contactor are located on the contact expander module PZE X4.
Within the user program, the failsafe standard function block SB067 is assigned to the N/C contact K18. SB067 drives the contactor as well as monitoring the feedback loop. A 0/1 pulse edge at input parameter *Ein* of SB067 sets the output that drives the contactor, *K*, to “1”; a 1/0 pulse edge sets it to “0”.
SB067 has extensive fault detection features. For example, SB067 automatically detects errors such as “FL remains open” or “FL remains closed”.
If an error occurs, the enable output *FG* on SB067 will immediately be reset, along with *K*, the output that drives the contactor. Both outputs are also reset when the PSS is stopped and when the PSS is switched on. The signal at the enable output *FG* can be evaluated by the user program and trigger an appropriate reaction. SB067 stores a value in DB015, which can be used to determine why *FG* was reset.
If an error occurs, once the error has been rectified, a reset must be performed by pressing S1 (0/1 pulse edge at *RSet*) in order to also reset enable output *FG* on SB067. Output *K* can then also be reset by setting flag M80.02 (M80.02 may represent the enable output of another block, for example).

Safety assessment

- A short between 24 VDC and a safety output or a feedback loop input will be detected as an error by the programmable safety system. The load can be switched off via the second shutdown route.

Note:
A maximum voltage of 150 V_{eff} (conductor-earth on three-phase systems) may be applied to the N/O contacts on the PZE X4. This meets the requirements for protective extra low voltage (safe separation) on the PSS system.

From Version 7.2 of the PZE X4 (order no. 774 585, ca. October 2004), three N/O contacts are safely separated, so that higher voltages may also be applied. It is essential that you refer to the operating instructions for the PZE X4.

Classification in accordance with EN 954-1
Depending on the application area and its respective regulations, this connection example is suitable for applications up to category 4, in accordance with EN 954-1.

Pilz products

Number	Description	Order number	
1	PSS SB 3006 DP-S	301 460	
1	PSS SB DI8O8	301 140	
1	PSS SB screw connectors	311 060	**or**
1	PSS SB spring-loaded terminals	311 061	
2	PSS SB SUB-D1	311 051	
1	PSS SB cable	311 070	
1	PSS-SB-NOT	301 176B	
1	PZE X4	774 585	

Drawing file

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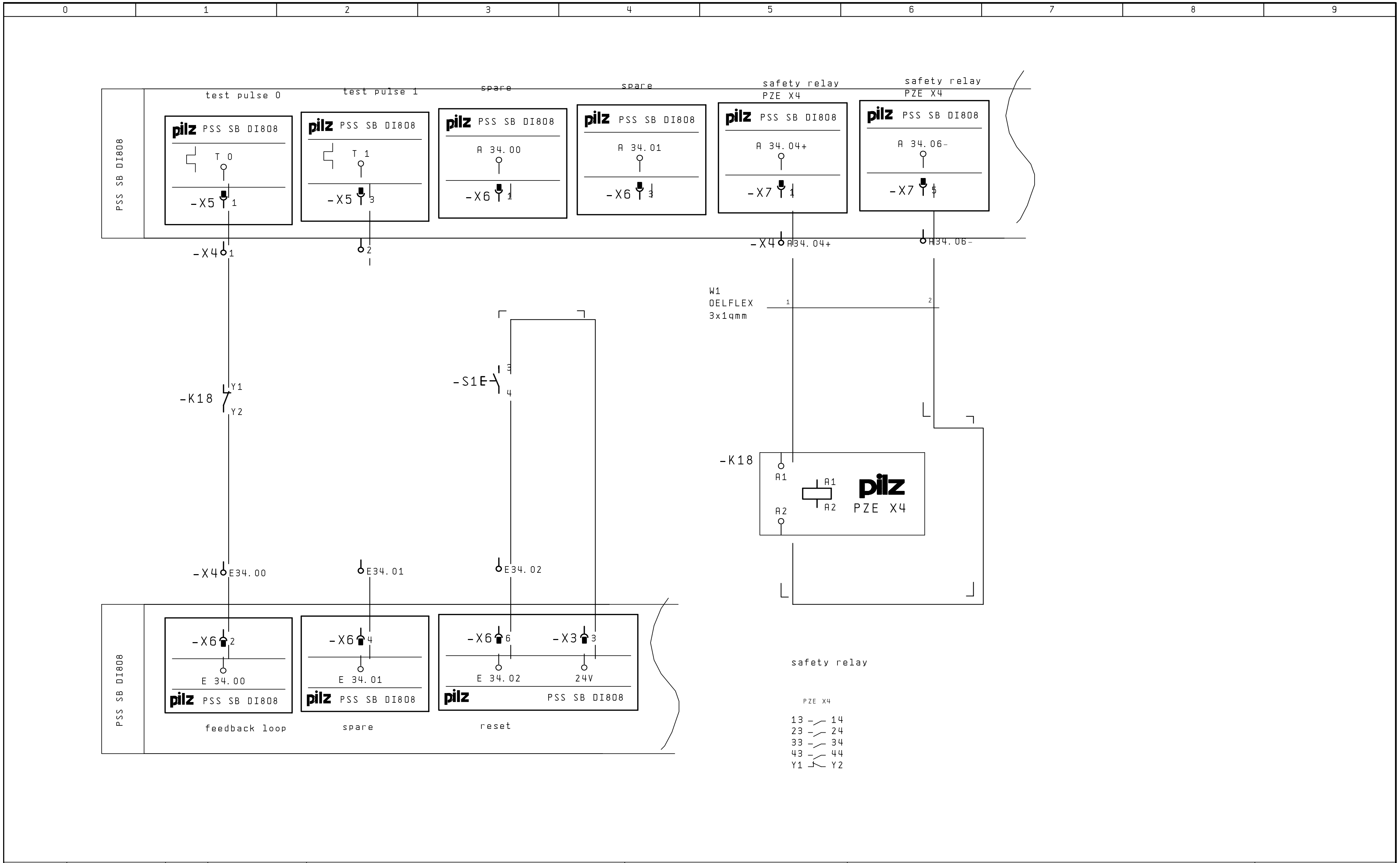
0
1
2
3
4
5
6
7
8
9
PSS SB DI808
test pulse 0
test pulse 1
spare
spare
safety relay
PZE X4
safety relay
PZE X4
pilz PSS SB DI808
T 0
-X5 1
T 1
-X5 3
A 34.00
-X6 1
A 34.01
-X6 3
A 34.04+
-X7 1
A 34.06-
-X7 5
-X4 1
2
-X4 A34.04+
A34.06-
W1
OELFLEX
3x1qmm
1
2
-K18 Y1 Y2
-S1E 3 4
-K18
A1
A2
A1
A2
pilz
PZE X4
-X4 E34.00
E34.01
E34.02
-X6 2
E 34.00
-X6 4
E 34.01
-X6 6
E 34.02
-X3 3
24V
feedback loop
spare
reset
safety relay
PZE X4
13 — 14
23 — 24
33 — 34
43 — 44
Y1 — Y2

Revision 30.Apr.2003 | Date 22.Apr.2003
Name CLE | Name CLE
Dep. CS

feedback loop with PZEX4

Category 4 EN 954-1

Pilz GmbH & Co.
Felix-Wankel-Str.2
73760 Ostfildern

feedback loop monitoring on safety relay
PZEX4 with SafetyBUS p

Directory:
Eplan4/Pilz/Appl0703
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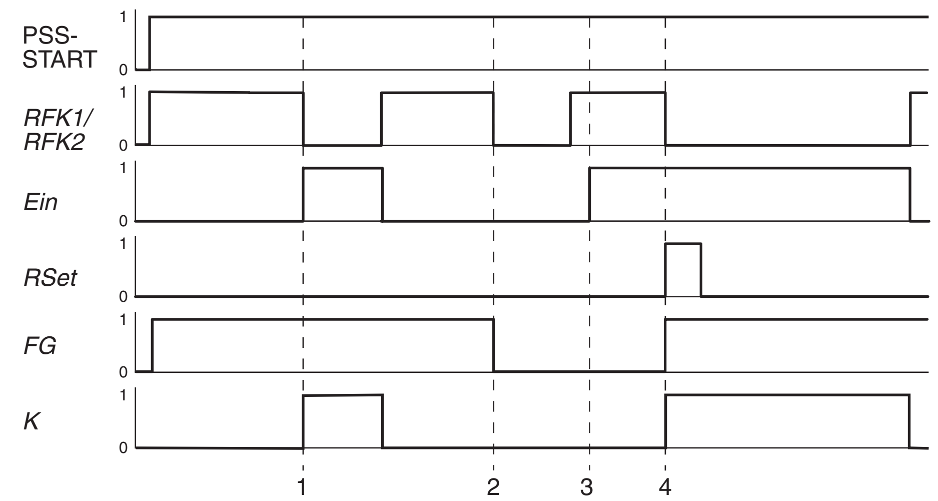
Category 4, EN 954-1

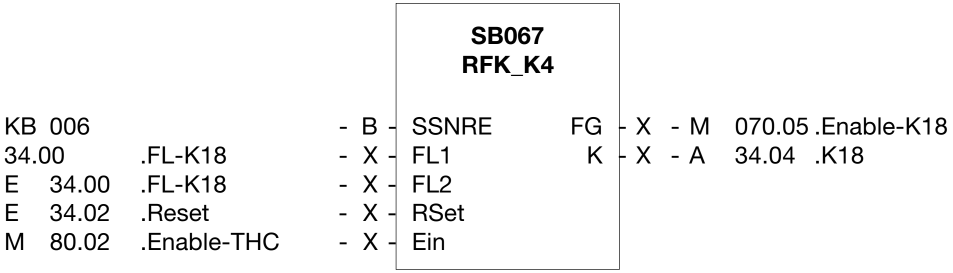
SafetyBUS p – Feedback loop monitoring on the PZE X4 (Pilz)

Timing diagram



1: Output parameter *K* = 1
2: Error in the feedback loop: *FG* = 0
3: Reset lock after error
4: Error reset *RSet* = 0/1 -> *FG* = 1

Program



```
                                                   SB067
                                                   RFK_K4

KB  006                       - B -  SSNRE         FG  - X  - M   070.05 .Enable-K18
34.00       .FL-K18           - X -  FL1            K  - X  - A   34.04  .K18
E   34.00   .FL-K18           - X -  FL2
E   34.02   .Reset            - X -  RSet
M   80.02   .Enable-THC       - X -  Ein
```

Please note:
A “Minimum scan time” must be specified in the configurator of the PSS SW PG system software.

Global parameters used in administration data block DB015

- DW1002: Number of cycles for the reaction time of the feedback loop

The global parameter may be set in OB120 using SB070.

Additional blocks required

- DB015: Administration data block
  DB015 must consist of its total length of 1024 data words.
  DB015 must be declared READ/WRITE.
- SB070: Initialisation of global parameters in DB015.

Notes

Category 4, EN 954-1

PSS 3000 – Feedback loop monitoring on the PZE 9 (Pilz)

Features

- Dual-channel redundancy
- Feedback loop implemented with PZE 9
- Failsafe standard function block used: SB065 (FBL)

Description

The plant conditions are logically connected within the user program through various SBs. Flag M88.14 contains the result of this logic operation and switches the PZE 9 on and off.

Feedback loop monitoring function

The safety system monitors the contact on feedback loop K40. Within the user program, the failsafe standard function block SB065 is assigned to the N/C contact K40. SB065 drives the contact expander module PZE 9 as well as monitoring the feedback loop.

A 0/1 pulse edge at input parameter *ON* of SB065 (M88.14) sets the outputs that drive the PZE 9, *K1* and *K2*, to “1”; a 1/0 pulse edge sets them to “0”. SB065 has extensive fault detection features. For example, SB065 automatically detects errors such as “FL remains open” or “FL remains closed”. If an error occurs, the enable output *ENBL* on SB065 will immediately be reset, along with the outputs that drive the PZE 9, *K1 and K2*. Both outputs are also reset when the PSS is stopped and when the PSS is switched on. The signal at the enable output *ENBL* can be evaluated by the user program and trigger an appropriate reaction. SB065 stores a value in DB015 (DB016 or DB017); this can be used to determine why *ENBL* was reset. If an error occurs, once the error has been rectified, a reset must be performed by pressing S1 (0/1 pulse edge at *RSET*) in order to also reset enable output *ENBL* on SB065. Outputs K1 and K2 can then also be reset by setting flag M88.14.

Safety assessment

- A short between 24 VDC and a safety output will be detected as an error by the programmable safety system. The load can be switched off via the second shutdown route.
- The feedback loop may be wired without a test pulse signal if the safety system and the N/C contacts are installed in the same location (faults excluded in the case of short circuits and shorts between contacts).
- To achieve Category 4, dual actuators must be connected to adjacent blocks of 8 outputs.

Please note:
A maximum voltage of 150 V_{eff} (conductor-earth on three-phase systems) may be applied to the N/O contacts on the PZE 9. This meets the requirements for protective extra low voltage (safe separation) on the PSS system.

Pilz products

Number	Description	Order number:
1	PSS CPU 3	301 064
1	PSS BMP 4/2	301 006
1	PSS PS 24	301 051
1	PSS DI2O T	301 112
1	PSS DOS	301 111
1	PSS-SB-NOT	301 176B
1	PZE 9	774 150

Drawing file

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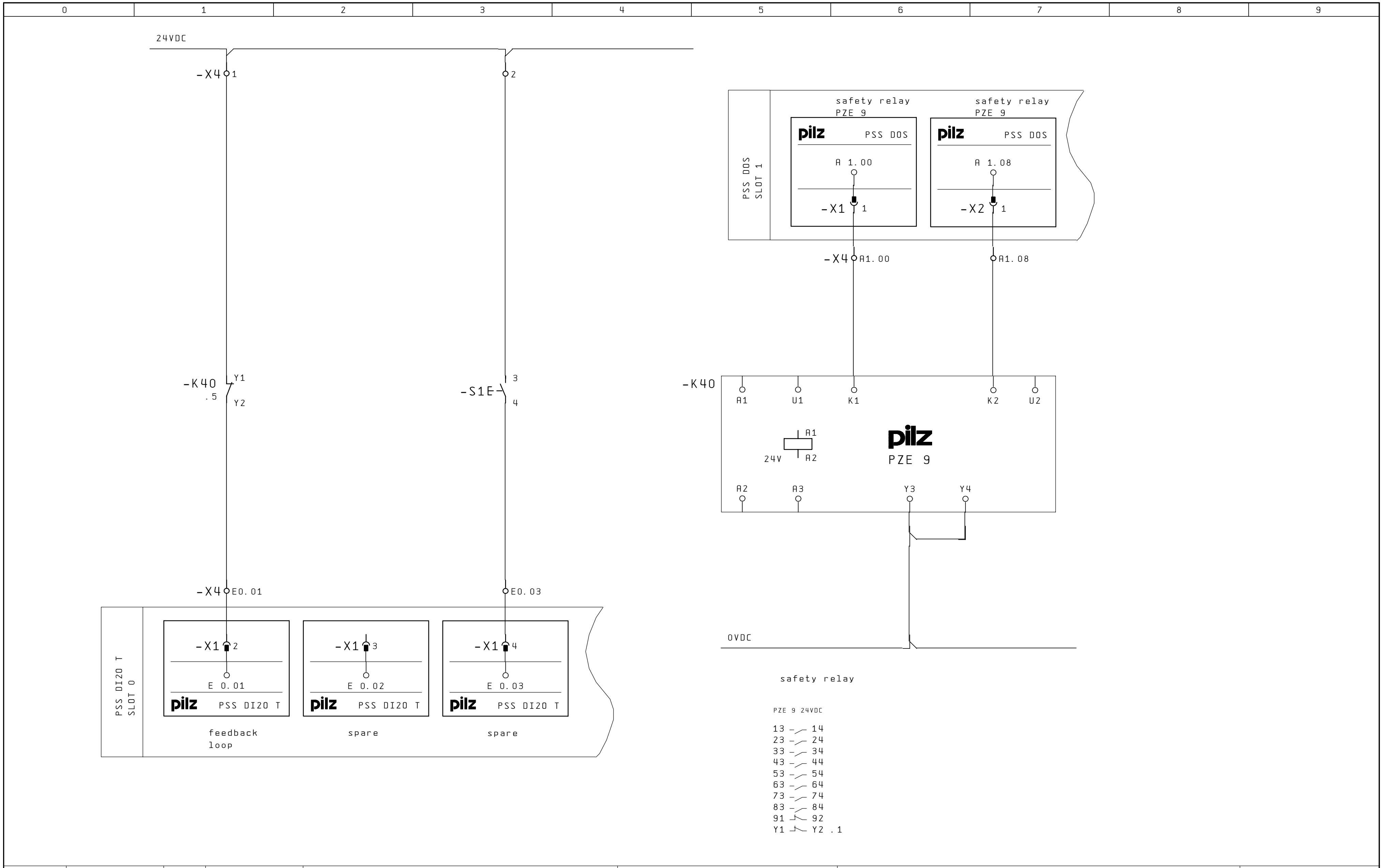
Classification in accordance with EN 954-1

Depending on the application area and its respective regulations, this connection example is suitable for applications up to category 4, in accordance with EN 954-1.

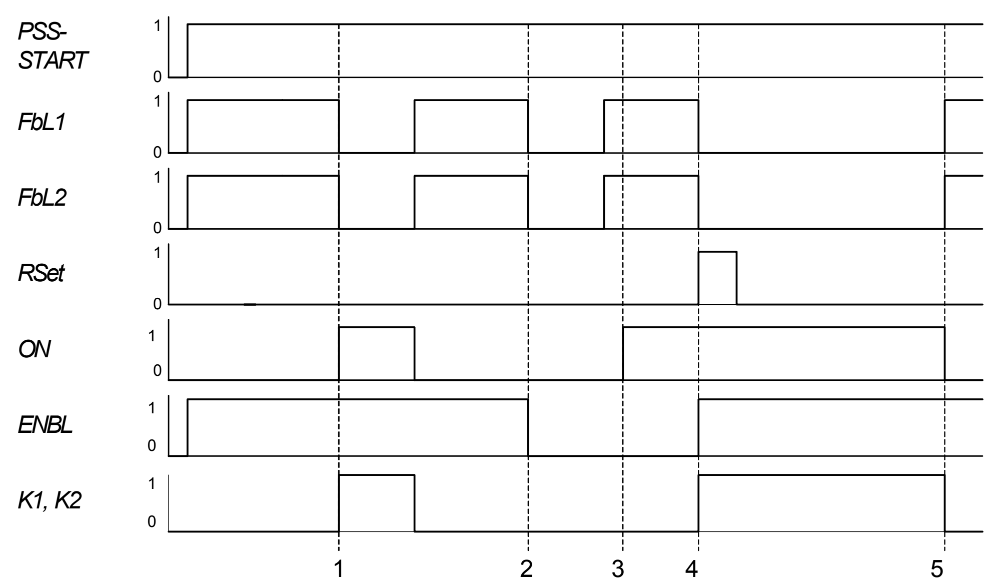

0
1
2
3
4
5
6
7
8
9
24VDC
-X4 1
2
safety relay
PZE 9
pilz PSS DOS
A 1.00
-X1 1
safety relay
PZE 9
pilz PSS DOS
A 1.08
-X2 1
PSS DOS
SLOT 1
-X4 A1.00
A1.08
-K40 Y1
.5 Y2
-S1E 3
4
-K40
A1
U1
K1
K2
U2
A1
24V A2
pilz
PZE 9
A2
A3
Y3
Y4
-X4 E0.01
E0.03
0VDC
PSS DI20 T
SLOT 0
-X1 2
E 0.01
pilz PSS DI20 T
-X1 3
E 0.02
pilz PSS DI20 T
-X1 4
E 0.03
pilz PSS DI20 T
feedback
loop
spare
spare
safety relay
PZE 9 24VDC
13 14
23 24
33 34
43 44
53 54
63 64
73 74
83 84
91 92
Y1 Y2 .1

Revision	27.Apr.2004	Date	22.Apr.2003	feedback loop monitoring	Pilz GmbH & Co.KG Felix-Wankel-Str.2 73760 Ostfildern	feedback loop monitoring with single pole output on safety relay PZE9 with PSS 3000	Directory: Eplan4/Pilz/Appl0703
Name	CLE	Name	CLE				
				Category 4 EN 954-1			Page: 53
		Dep.	CS				

Category 4, EN 954-1

PSS 3000 – Feedback loop monitoring on the PZE 9 (Pilz)

Timing diagram



1: Outputs *K1*, *K2* = 1
2: Error in the feedback loop -> *ENBL* = 0
3: Reset lock after error
4: Error reset *RSET* = 0/1 -> *ENBL* = 1
5: Outputs *K1*, *K2* = 0

Program

```
                                          SB065
                                           FBL

KF  000001                   - W -  SSNR        ENBL  - X  - M   70.00
M   110.01  .RLO-1           -  X -  GRP          K1  - X  - A   1.00
M   88.14   .ON              -  X -  ON           K2  - X  - A   1.08
E   0.01    .FL-PZE9         -  X -  FbL1
E   0.01    .FL-PZE9         -  X -  FbL2
KF  000150                   - W -  TFbL
E   0.03    .Reset           -  X -  RSET
```

Please note:
A “Minimum scan time” must be specified in the configurator of the PSS SW PG system software.

Global parameters used in administration data block DB015, DB016, DB017

- DW1022: Global parameters must be set in OB120 using SB071.

Additional blocks required

- DB015, DB016, DB017: Administration data block
  DB015, DB016 and DB017 must consist of their total length of 1024 data words. DB015, DB016 and DB017 must be declared READ/WRITE.
- SB071: Initialisation of global parameters in DB015, DB016, DB017
- SB255: Operating system call

Notes

Category 4, EN 954-1

SafetyBUS p – Feedback loop monitoring on the PZE 9 (Pilz)

Features

- Dual-channel redundancy
- Feedback loop implemented with PZE 9
- Failsafe standard function block used: SB065 (FBL)

Description

The plant conditions are logically connected within the user program through various SBs. Flag M88.14 contains the result of this logic operation and switches the PZE 9 on and off.

Feedback loop monitoring function
The safety system monitors the contact on feedback loop K41. Within the user program, the failsafe standard function block SB065 is assigned to the N/C contact K41. SB065 drives the contact expander module PZE 9 as well as monitoring the feedback loop. A 0/1 pulse edge at input parameter *ON* of SB065 (M88.14) sets the outputs that drive the PZE 9, *K1* and *K2*, to “1”; a 1/0 pulse edge sets them to “0”.
The input parameter *GRP* records the status of the SafetyBUS I/O-Group.
SB065 has extensive fault detection features. For example, SB065 automatically detects errors such as “FL remains open” or “FL remains closed”. If an error occurs, the enable output *ENBL* on SB065 will immediately be reset, along with the outputs that drive the PZE 9, *K1*and *K2*. Both outputs are also reset when the PSS is stopped and when the PSS is switched on. The signal at the enable output *ENBL* can be evaluated by the user program and trigger an appropriate reaction. SB065 stores a value in DB015 (DB016 or DB017); this can be used to determine why *ENBL* was reset. If an error occurs, once the error has been rectified, a reset must be performed by pressing S1 (0/1 pulse edge at *RSET*) in order to also reset enable output *ENBL* on SB065. Outputs *K1* and *K2* can then also be reset by setting flag M88.14.

Safety assessment

- A short between 24 VDC and a safety output will be detected as an error by the programmable safety system. The load can be switched off via the second shutdown route.

Please note:
A maximum voltage of 150 V_{eff} (conductor-earth on three-phase systems) may be applied to the N/O contacts on the PZE 9. This meets the requirements for protective extra low voltage (safe separation) on the PSS system.

Classification in accordance with EN 954-1

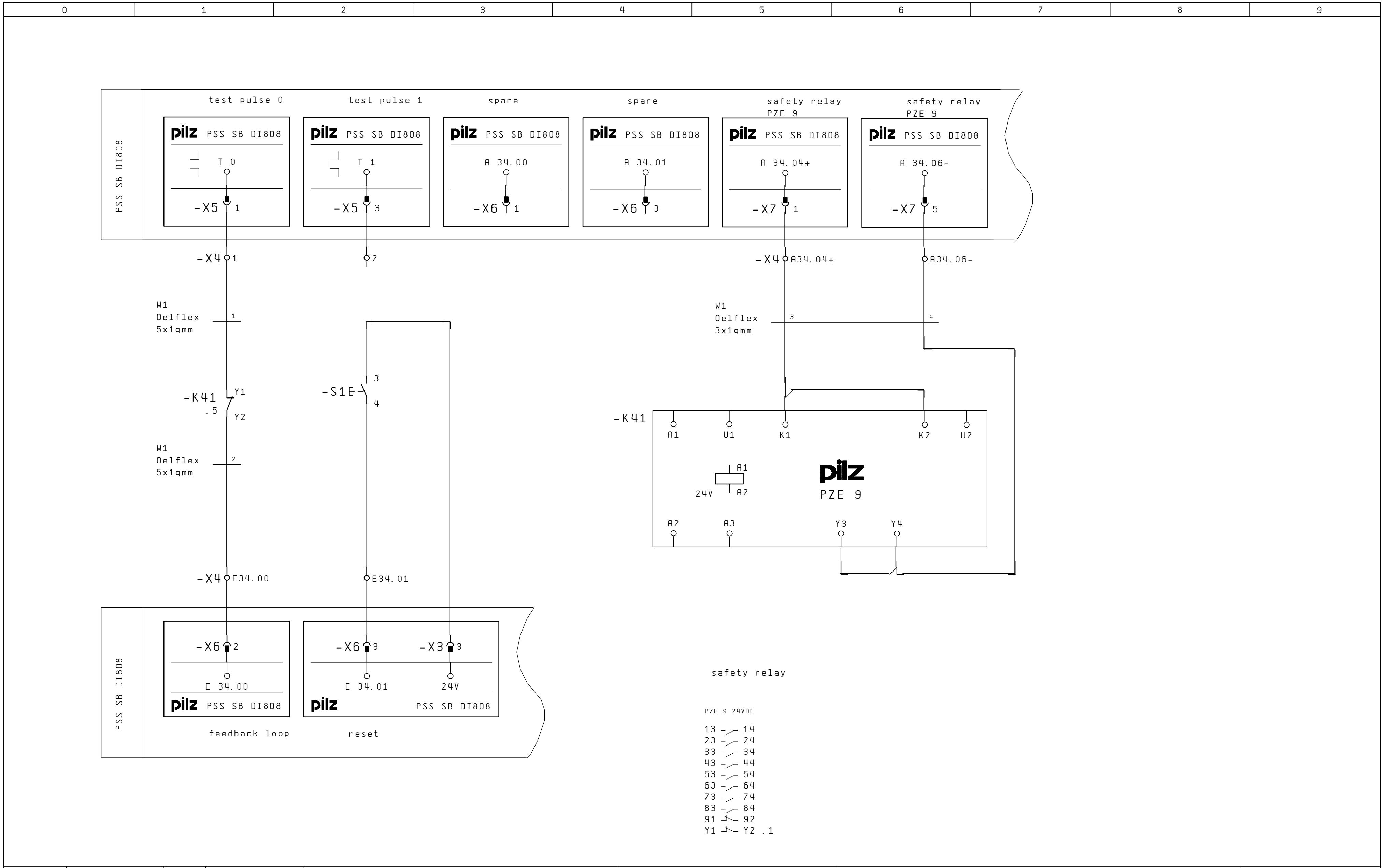
Depending on the application area and its respective regulations, this connection example is suitable for applications up to category 4, in accordance with EN 954-1.

Pilz products

Number	Description	Order number:
1	PSS SB 3006 DP-S	301 460
1	PSS SB DI8O8	301 140
1	PSS SB screw connectors	301 060
1	PSS SB spring-loaded terminals	301 061
1	PSS SB SUB-D1	311 051
1	PSS SB cable	311 070
1	PSS-SB-NOT	301 176B
1	PZE 9	774 150

Drawing file

Page 54 in the project “Eplan4/Pilz/APPL0703”

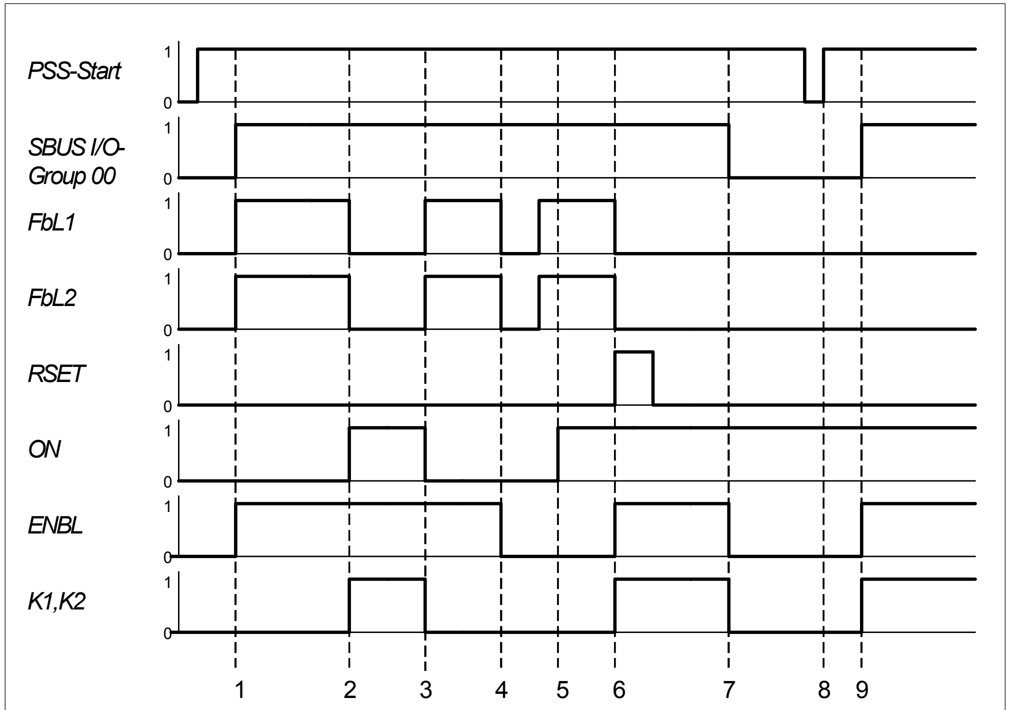

0
1
2
3
4
5
6
7
8
9
PSS SB DI808
test pulse 0
test pulse 1
spare
spare
safety relay PZE 9
safety relay PZE 9
pilz PSS SB DI808
T 0
T 1
A 34.00
A 34.01
A 34.04+
A 34.06-
-X5 1
-X5 3
-X6 1
-X6 3
-X7 1
-X7 5
-X4 1
2
-X4 A34.04+
A34.06-
W1
Oelflex
5x1qmm
1
W1
Oelflex
3x1qmm
3
4
-K41 .5
Y1
Y2
-S1E
3
4
W1
Oelflex
5x1qmm
2
-K41
A1
U1
K1
K2
U2
A1
24V
A2
pilz
PZE 9
A2
A3
Y3
Y4
-X4 E34.00
E34.01
-X6 2
-X6 3
-X3 3
E 34.00
E 34.01
24V
feedback loop
reset
safety relay
PZE 9 24VDC
13 – 14
23 – 24
33 – 34
43 – 44
53 – 54
63 – 64
73 – 74
83 – 84
91 – 92
Y1 – Y2 .1

Revision	27.Apr.2004	Date	22.Apr.2003	feedback loop with PZEX4	Pilz GmbH & Co.KG Felix-Wankel-Str.2 73760 Ostfildern	feedback loop monitoring with double pole output on safety relay PZE9 with SafetyBUS p	Directory: Eplan4/Pilz/Appl0703
Name	CLE	Name	CLE				
		Dep.	CS	Category 4 EN 954-1			Page: 54

Category 4, EN 954-1

SafetyBUS p – Feedback loop monitoring on the PZE 9 (Pilz)

Timing diagram



1: Start I/O-Group 00
2: Machine ON -> *K1*, *K2* = 1
3: Machine OFF -> *K1*, *K2* = 0
4: Error in the feedback loop *ENBL* = 0
5: Reset lock after error
6: Reset S1 -> *K1*, *K2* = 1
7: I/O-Group 00 Stop
8: PSS cold start
9: Start I/O-Group 00

Program

```
                                        SB065
                                         FBL

KF  000001                  - W -  SSNR         ENBL  - X  - M   70.00
M   116.00  .I/O-Group 00   - X -  GRP            K1  - X  - A   34.04
M   88.14   .ON             - X -  ON             K2  - X  - A   34.04
E   34.00   .FL-PZE9        - X -  FbL1
E   34.00   .FL-PZE9        - X -  FbL2
KF  000150                  - W -  TFbL
E   34.01   .Reset          - X -  RSET
```

Please note:
A “Minimum scan time” must be specified in the configurator of the PSS SW PG system software.

Global parameters used in administration data block DB015, DB016, DB017

- DW1022: Global parameters must be set in OB120 using SB071.

Additional blocks required

- DB015, DB016, DB017: Administration data block
  DB015, DB016 and DB017 must consist of their total length of 1024 data words. DB015, DB016 and DB017 must be declared READ/WRITE.
- SB071: Initialisation of global parameters in DB015, DB016, DB017
- SB255: Operating system call

Notes

Category 2, EN 954-1

PSS 3000 – Feedback loop monitoring

Features

- Single-channel
- Failsafe standard function block used: SB067 (RFK_K4)

Description

The plant's start-up conditions are logically connected within the user program through various SBs. Flag M88.14 contains the result of these logic operations and switches the three-phase motor on and off.

Feedback loop monitoring function

The safety system monitors the contacts on contactor K4. Within the user program, the failsafe standard function block SB067 is assigned to the N/C contact K4. SB067 drives the contactor as well as monitoring the feedback loop. A 0/1 pulse edge at input parameter *Ein* of SB067 (M88.14) sets the output that drives the contactor, *K*, to “1”; a 1/0 pulse edge sets it to “0”.
SB067 has extensive fault detection features. For example, SB067 automatically detects errors such as “FL remains open” or “FL remains closed”.
If an error occurs, the enable output *FG* on SB067 will immediately be reset, along with *K*, the output that drives the contactor.
Both outputs are also reset when the PSS is stopped and when the PSS is switched on.
The signal at the enable output *FG* can be evaluated by the user program and trigger an appropriate reaction. SB067 stores a value in DB015, which can be used to determine why *FG* was reset.
If an error occurs, once the error has been rectified, a reset must be performed by pressing S1 (0/1 pulse edge at *RSet*) in order to also reset enable output *FG* on SB067. Output *K* can then also be reset by setting flag M88.14.

Safety assessment

- A short between 24 VDC and a safety output or a feedback loop input will be detected as an error by the programmable safety system. However, the load cannot be switched off as there is no second shutdown route.
- The contactor's switching function must be tested at appropriate intervals.

Classification in accordance with EN 954-1

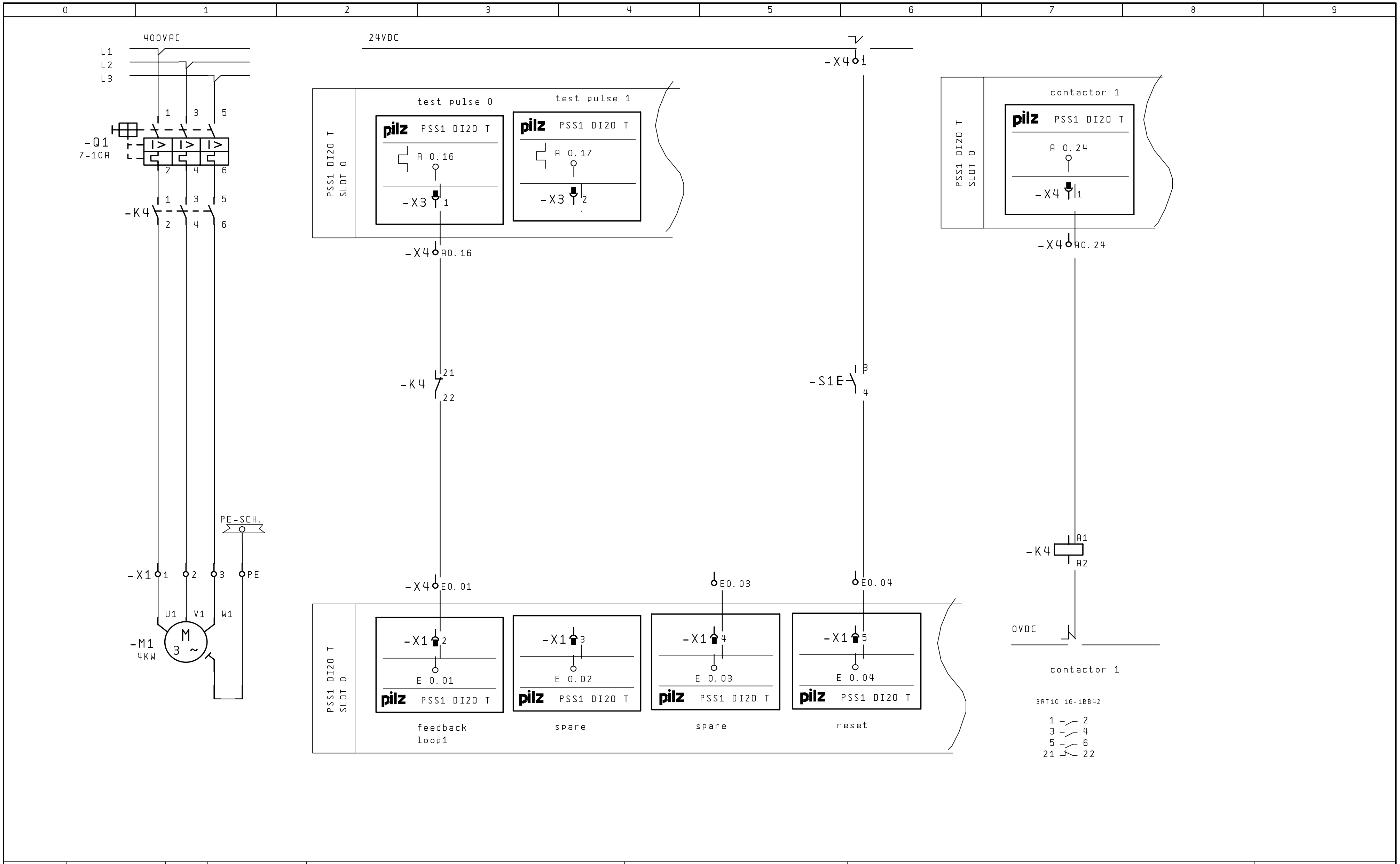
Depending on the application area and its respective regulations, this connection example is suitable for applications up to category 2 in accordance with EN 954-1.
The safety function must be tested manually at appropriate intervals, e.g. through organisational measures.

Pilz products

Number	Description	Order number
1	PSS CPU 3	301 064
1	PSS BMP 4/2	301 006
1	PSS PS 24	301 051
1	PSS DI2O T	301 112
1	PSS-SB-NOT	301 176B

Drawing file

Page 5 in the project “Eplan4/Pilz/APPL0703”

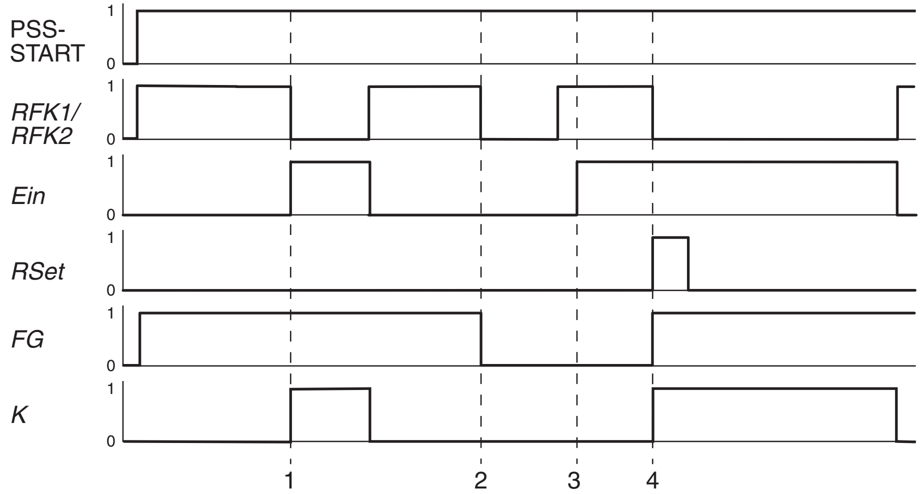

0
1
2
3
4
5
6
7
8
9
400VAC
L1
L2
L3
1
3
5
-Q1
7-10A
2
4
6
-K4
1
3
5
2
4
6
24VDC
-X4 1
PSS1 DI20 T
SLOT 0
test pulse 0
pilz PSS1 DI20 T
A 0.16
-X3 1
test pulse 1
pilz PSS1 DI20 T
A 0.17
-X3 2
-X4 A0.16
contactor 1
PSS1 DI20 T
SLOT 0
pilz PSS1 DI20 T
A 0.24
-X4 1
-X4 A0.24
-K4 21 22
-S1E 3 4
PE-SCH.
-X1 1 2 3 PE
U1 V1 W1
-M1
4KW
M
3 ~
-X4 E0.01
E0.03
E0.04
-K4 A1 A2
PSS1 DI20 T
SLOT 0
-X1 2
E 0.01
pilz PSS1 DI20 T
feedback
loop1
-X1 3
E 0.02
pilz PSS1 DI20 T
spare
-X1 4
E 0.03
pilz PSS1 DI20 T
spare
-X1 5
E 0.04
pilz PSS1 DI20 T
reset
0VDC
contactor 1
3RT10 16-1BB42
1 2
3 4
5 6
21 22

Revision	30. Apr. 2003	Date	22. Apr. 2003	feedback loop monitoring	pilz Pilz GmbH & Co. Felix-Wankel-Str. 2 73760 Ostfildern	single chanel feedback loop dual pole output with PSS 3100	Directory: Eplan4/Pilz/Appl0703
Name	CLE	Name	CLE	Category 2 EN 954-1			Page: 5
		Dep.	CS				

Category 2, EN 954-1

PSS 3000 – Feedback loop monitoring

Timing diagram



1: Output parameter *K* = 1
2: Error in the feedback loop: *FG* = 0
3: Reset lock after error
4: Error reset *RSet* = 0/1 -> *FG* = 1

Program

```
                                          SB067
                                          RFK_K4

KB  006                     - B -  SSNR          FG  - X  - M   070.05 .Enable-M1
E   0.01    .FL-K-M1.1      - X -  FL1            K  - X  - A   0.24   .K-M1
E   0.01    .FL-K-M1.1      - X -  FL2
E   0.04    .Reset          - X -  RSet
E   88.14   .M1_ON          - X -  Ein
```

Please note:
A “Minimum scan time” must be specified in the configurator of the PSS SW PG system software.

Global parameters used in administration data block DB015

- DW1002: Number of cycles for the reaction time of the feedback loop

The global parameter may be set in OB120 using SB070.

Additional blocks required

- DB015: Administration data block
  DB015 must consist of its total length of 1024 data words.
  DB015 must be declared READ/WRITE.
- SB070: Initialisation of global parameters in DB015.

Notes

Category 2, EN 954-1

SafetyBUS p – Feedback loop monitoring

Features

- Single-channel
- Failsafe standard function block used: SB067 (RFK_K4)

Description
The plant's start-up conditions are logically connected within the user program through various SBs. Flag M88.14 contains the result of these logic operations and switches the three-phase motor on and off.

Feedback loop monitoring function
The safety system with the safe bus system SafetyBUS p monitors the contacts on the contactor K14. Within the user program, the failsafe standard function block SB067 is assigned to the N/C contact K14. SB067 drives the contactor as well as monitoring the feedback loop. A 0/1 pulse edge at input parameter *Ein* of SB067 (M88.14) sets the output that drives the contactor, *K*, to "1"; a 1/0 pulse edge sets it to "0".
SB067 has extensive fault detection features. For example, SB067 automatically detects errors such as "FL remains open" or "FL remains closed".
If an error occurs, the enable output *FG* on SB067 will immediately be reset, along with *K*, the output that drives the contactor.
Both outputs are also reset when the PSS is stopped and when the PSS is switched on.
The signal at the enable output *FG* can be evaluated by the user program and trigger an appropriate reaction. SB067 stores a value in DB015, which can be used to determine why *FG* was reset.
If an error occurs, once the error has been rectified, a reset must be performed by pressing S1 (0/1 pulse edge at *RSet*) in order to also reset enable output *FG* on SB067. Output *K* can then also be reset by setting flag M88.14.

Safety assessment

- A short between 24 VDC and a safety output or a feedback loop input will be detected as an error by the programmable safety system. However, the load cannot be switched off as there is no second shutdown route.
- The contactor's switching function must be tested at appropriate intervals.

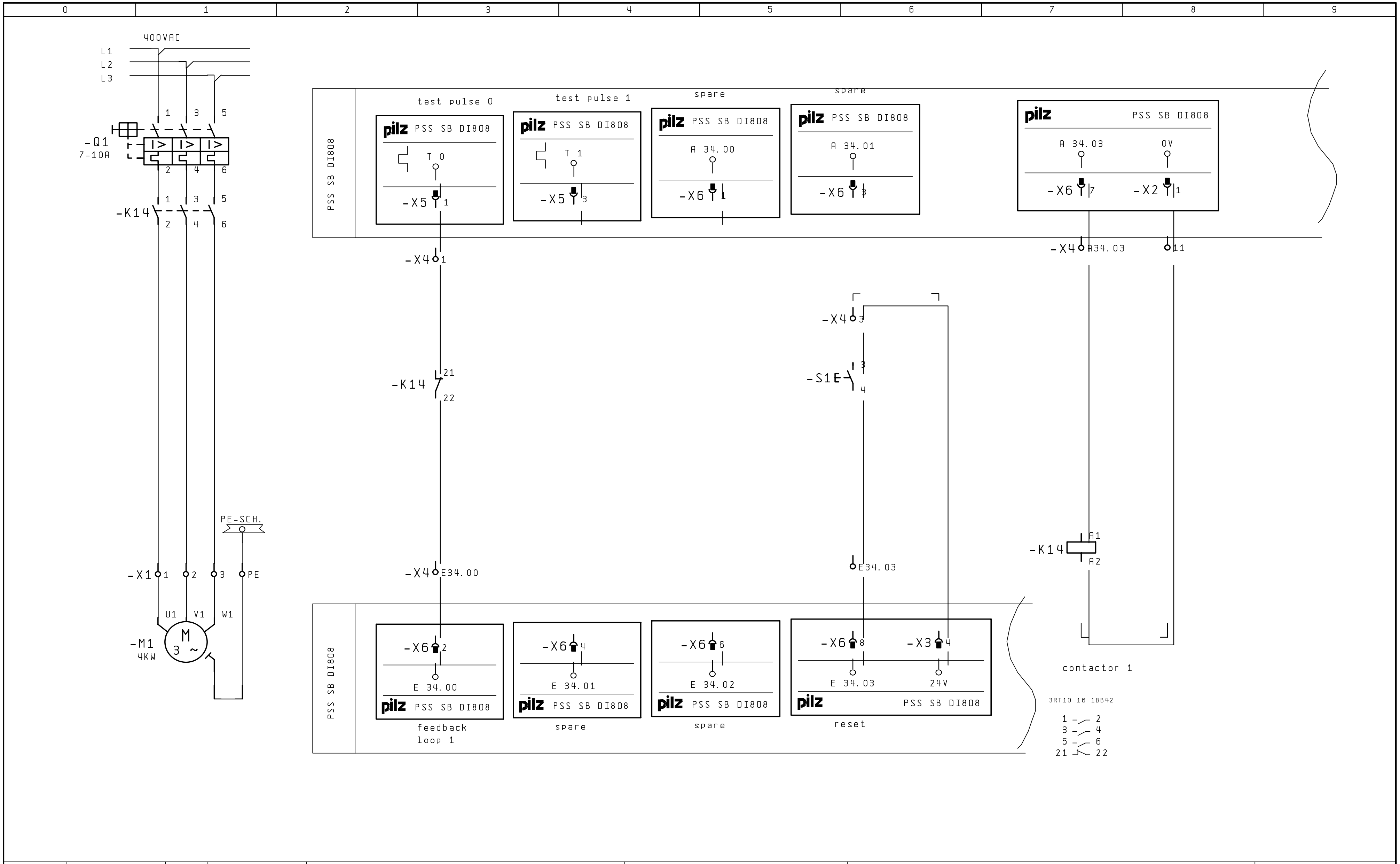
Classification in accordance with EN 954-1
Depending on the application area and its respective regulations, this connection example is suitable for applications up to category 2 in accordance with EN 954-1. The safety function must be tested manually at appropriate intervals, e.g. through organisational measures.

Pilz products

Number	Description	Order number	
1	PSS SB 3006 DP-S	301 460	
1	PSS SB DI8O8	301 140	
1	PSS SB screw connectors	311 060	**or**
1	PSS SB spring-loaded terminals	311 061	
2	PSS SB SUB-D1	311 051	
1	PSS SB cable	311 070	
1	PSS-SB-NOT	301 176B	

Drawing file

Page 21 in the project "Eplan4/Pilz/APPL0703"


0
1
2
3
4
5
6
7
8
9
400VAC
L1
L2
L3
-Q1
7-10A
1
3
5
2
4
6
-K14
PSS SB DI8O8
test pulse 0
test pulse 1
spare
spare
pilz PSS SB DI8O8
T 0
-X5 1
T 1
-X5 3
A 34.00
-X6 1
A 34.01
-X6 3
A 34.03
0V
-X6 7
-X2 1
-X4 1
-X4 A34.03
11
-X4 3
-K14 21 22
-S1E 3 4
-K14 A1 A2
PE-SCH.
-X1 1 2 3 PE
-X4 E34.00
E34.03
U1
V1
W1
-M1
4KW
M
3 ~
-X6 2
E 34.00
-X6 4
E 34.01
-X6 6
E 34.02
-X6 8
-X3 4
E 34.03
24V
feedback
loop 1
spare
spare
reset
contactor 1
3RT10 16-1BB42
1 2
3 4
5 6
21 22

Revision	10.Jul.2003	Date	22.Apr.2003
Name	CLE	Name	CLE
		Dep.	CS

feedback loop monitoring

Category 2 EN 954-1

Pilz GmbH & Co.
Felix-Wankel-Str.2
73760 Ostfildern

single chanel feedback loop dual pole output
with SafetyBUS p

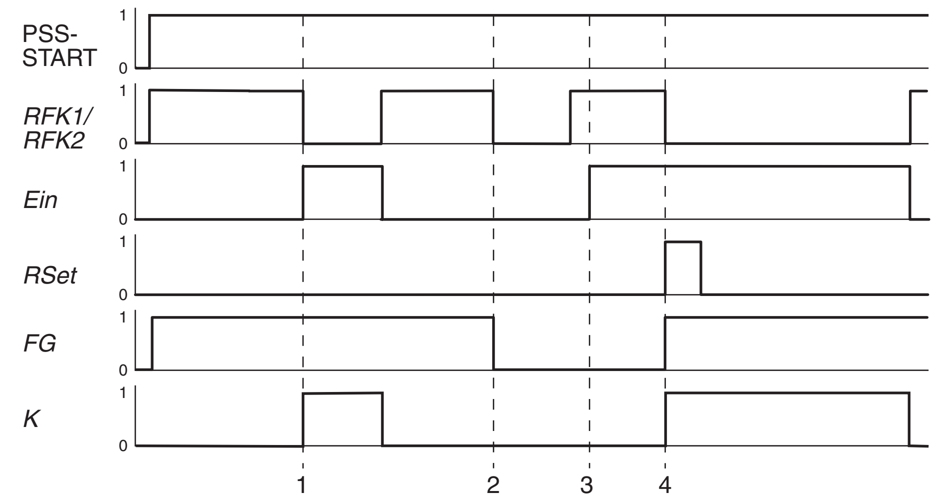
Directory:
Eplan4/Pilz/Appl0703

Page: 21

Category 2, EN 954-1

SafetyBUS p – Feedback loop monitoring

Timing diagram



1: Output parameter *K* = 1
2: Error in the feedback loop: *FG* = 0
3: Reset lock after error
4: Error reset *RSet* = 0/1 -> *FG* = 1

Program

```
                                          SB067
                                          RFK_K4

KB  006                      - B - SSNR            FG - X - M  070.05 .Enable-M1
E   34.00  .FL-K-M1.1        - X - FL1              K - X - A  34.03  .K-M1
E   34.00  .FL-K-M1.1        - X - FL2
E   34.03  .Reset            - X - RSet
M   88.14  .M1_ON            - X - Ein
```

Please note:
A “Minimum scan time” must be specified in the configurator of the PSS SW PG system software.

Global parameters used in administration data block DB015

- DW1002: Number of cycles for the reaction time of the feedback loop

The global parameter may be set in OB120 using SB070.

Additional blocks required

- DB015: Administration data block
  DB015 must consist of its total length of 1024 data words.
  DB015 must be declared READ/WRITE.
- SB070: Initialisation of global parameters in DB015.

Notes

Category 1, EN 954-1

PSS 3000 – Feedback loop monitoring on a SIMATIC S7

Features

- Single-channel
- Internal short circuit of the outputs in the SIMATIC S7 module cannot be excluded
- Sticking or welding of contactor K32 will not be detected
- Blocking of valve Y1 will not be detected
- Failsafe standard function block used: SB067 (RFK_K4)

Description

Feedback loop monitoring function
In this example the safety system monitors the contacts on contactor K31. Within the user program, the failsafe standard function block SB067 is
assigned to the N/C contact K31. SB067 drives the contactor as well as monitoring the feedback loop. A 0/1 pulse edge at input parameter *Ein* of SB067 (flag M71.00 E-STOP enable) sets the output that drives the contactor, *K*, to “1”; a 1/0 pulse edge sets it to “0”.
SB067 has extensive fault detection features. For example, SB067 automatically detects errors such as “FL remains open” or “FL remains closed”.
If an error occurs, the enable output *FG* on SB067 will immediately be reset, along with *K*, the output that drives the contactor.
Both outputs are also reset when the PSS is stopped and when the PSS is switched on. The signal at the enable output *FG* can be evaluated by the user program and trigger an appropriate reaction. SB067 stores a value in DB015, which can be used to determine why *FG* was reset.
If an error occurs, once the error has been rectified, a reset must be performed by pressing S1 (0/1 pulse edge at *RSet*) in order to also reset enable output *FG* on SB067. Output *K* can then also be reset through the enable flag on the E-STOP (M 71.00).

Safety assessment

- A short between 24 VDC and a safety output will be detected as an error by the programmable safety system. However, the load cannot be switched off as there is no second shutdown route.

Classification in accordance with EN 954-1

Depending on the application area and its respective regulations, this connection example is suitable for applications up to category 1, in accordance with EN 954-1.

Pilz products

Number	Description	Order number
1	PSS CPU 3	301 064
1	PSS BMP 4/2	301 006
1	PSS PS 24	301 051
1	PSS DI 2	301 101
1	PSS DOS	301 111
1	PSS DI2O T	301 112
1	PSS-SB-NOT	301 176B

Drawing file

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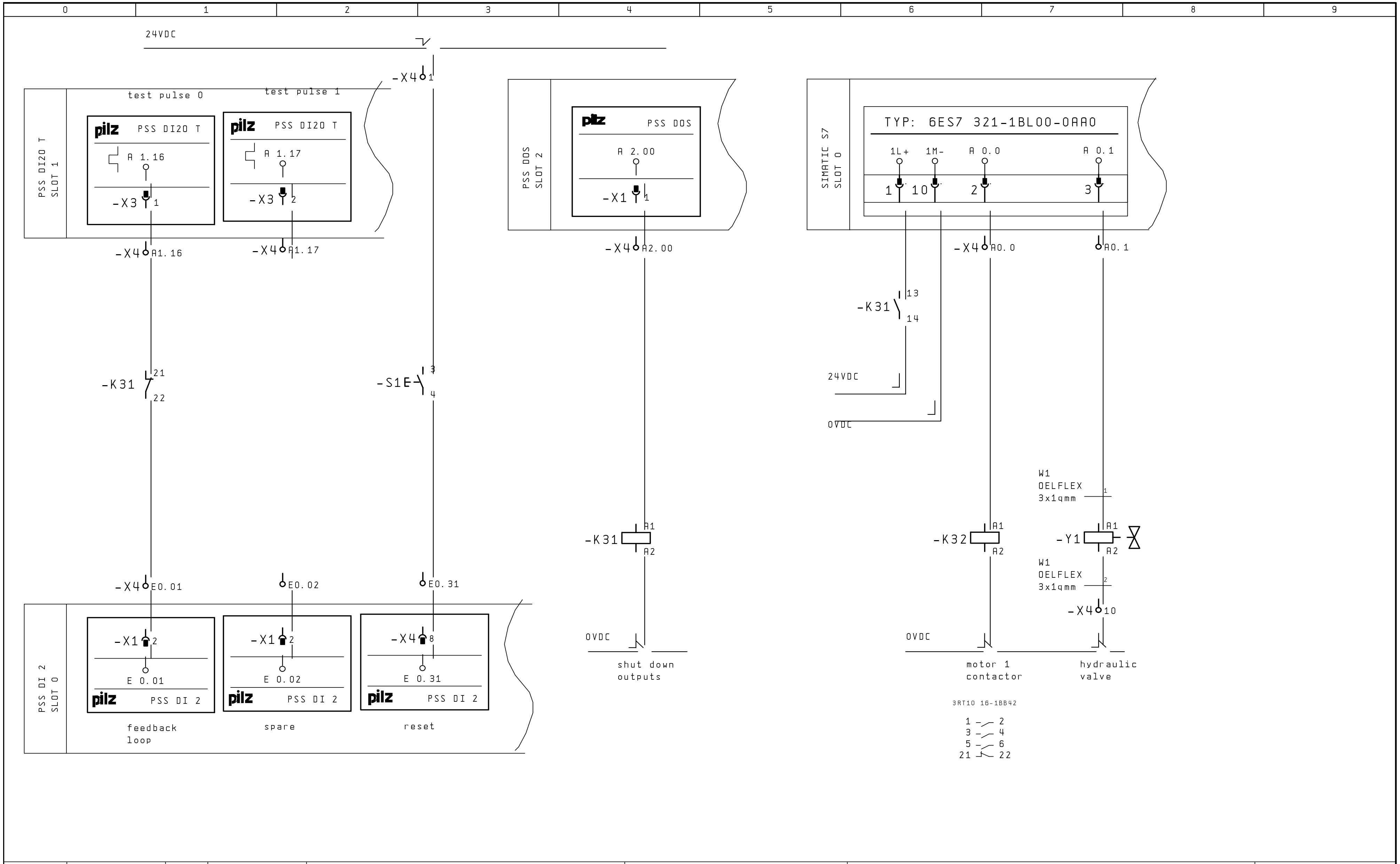
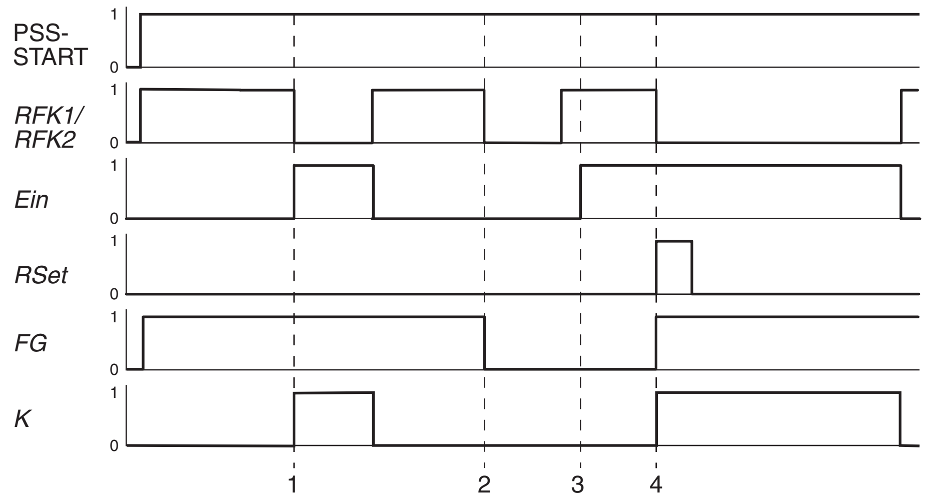

0
1
2
3
4
5
6
7
8
9
24VDC
-X4 1
test pulse 0
test pulse 1
PSS DI20 T
SLOT 1
pilz PSS DI20 T
A 1.16
-X3 1
pilz PSS DI20 T
A 1.17
-X3 2
-X4 A1.16
-X4 A1.17
-K31 21 22
-S1E 3 4
-X4 E0.01
E0.02
E0.31
PSS DI 2
SLOT 0
-X1 2
E 0.01
pilz PSS DI 2
feedback
loop
-X1 2
E 0.02
pilz PSS DI 2
spare
-X4 8
E 0.31
pilz PSS DI 2
reset
PSS DOS
SLOT 2
pilz PSS DOS
A 2.00
-X1 1
-X4 A2.00
-K31 A1 A2
0VDC
shut down
outputs
SIMATIC S7
SLOT 0
TYP: 6ES7 321-1BL00-0AA0
1L+
1M-
A 0.0
A 0.1
1
10
2
3
-X4 A0.0
A0.1
-K31 13 14
24VDC
0VDC
W1
OELFLEX
3x1qmm
1
-K32 A1 A2
-Y1 A1 A2
W1
OELFLEX
3x1qmm
2
-X4 10
0VDC
motor 1
contactor
hydraulic
valve
3RT10 16-1BB42
1 2
3 4
5 6
21 22

Revision	30.Apr.2003	Date	22.Apr.2003	plc output modul application	**pilz**	shut down plc simatic s7-300 output modul with PSS 3000	Directory: Eplan4/Pilz/Appl0703
Name	CLE	Name	CLE		Pilz GmbH & Co. Felix-Wankel-Str.2 73760 Ostfildern		
				Category 1 EN 954-1			Page: 41
		Dep.	CS				

Category 1, EN 954-1

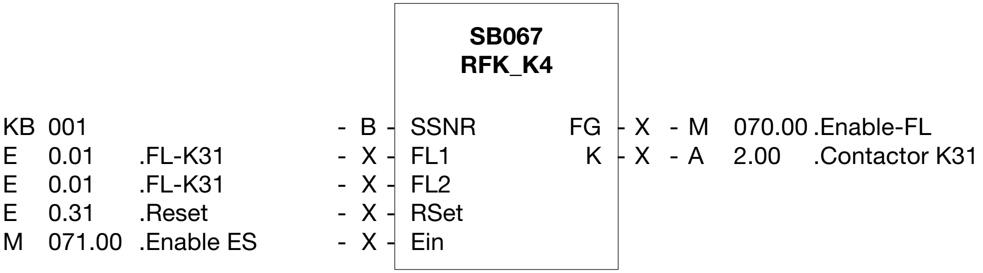
PSS 3000 – Feedback loop monitoring

Timing diagram



1: Output parameter *K* = 1
2: Error in the feedback loop: *FG* = 0
3: Reset lock after error
4: Error reset *RSet* = 0/1 -> *FG* = 1

Program



```
                                          SB067
                                          RFK_K4

KB  001                       - B -  SSNR          FG  - X  - M   070.00 .Enable-FL
E   0.01     .FL-K31          - X -  FL1            K  - X  - A   2.00   .Contactor K31
E   0.01     .FL-K31          - X -  FL2
E   0.31     .Reset           - X -  RSet
M   071.00   .Enable ES       - X -  Ein
```

Please note:
A “Minimum scan time” must be specified in the configurator of the PSS SW PG system software.

Global parameters used in administration data block DB015

- DW1002: Number of cycles for the reaction time of the feedback loop

The global parameter may be set in OB120 using SB070.

Additional blocks required

- DB015: Administration data block
  DB015 must consist of its total length of 1024 data words.
  DB015 must be declared READ/WRITE.
- SB070: Initialisation of global parameters in DB015.

Notes

Two-Hand Applications

Contents				Page
Two-hand applications				
PSS 3000	–	Two-hand monitoring	Category 4, EN 954-1	5.4-2
SafetyBUS p	–	Two-hand monitoring	Category 4, EN 954-1	5.4-6

Category 4, EN 954-1
PSS 3100 – Two-hand monitoring

Features

- Dual-channel redundancy
- “Jog” mode (jog mode using a pushbutton) not activated
- “Up” mode (ability to activate upward movement using a pushbutton) is not activated
- Without single-stroke protection
- Failsafe standard function block used: SB059 (2_HAND)
- Feasibility test on the input signals and simultaneity monitoring in SB059.

Description

Two-hand monitoring function

In this example the safety system monitors pushbuttons S1 and S2 on a two-hand control. Within the user program, the failsafe standard function block SB059 is assigned to the pushbuttons. SB059 monitors the operation of the pushbuttons as well as detecting incorrect input signals, synchronisation errors, feasibility errors, etc.
If an error occurs, the enable output *FG* will immediately be reset.
The enable output *FG* is also reset when the PSS is stopped and when the PSS is switched on.
The signal at the enable output *FG* must be evaluated by the user program and trigger an appropriate reaction. Three other output parameters can also be evaluated alongside *FG*, but these are not referred to in this example.
SB059 stores a value in DB015, which can be used to determine why *FG* was reset.
If an error occurs, once the error has been rectified, a reset must be performed by pressing S3 (0/1 pulse edge at *RSet*) in order to also reset enable output *FG* of SB059.

Safety assessment

- If a switch contact in the input circuit is overridden, the standard function block will detect this as an error at the next operation.
- A short between a pushbutton’s switch contacts will be detected as an error by the standard function block at the next operation.
- A short between the input circuits of both pushbuttons will be detected as an error by the programmable safety system.
- A short between 24 VDC and an input circuit will be detected as an error by the programmable safety system.

Classification in accordance with EN 954-1

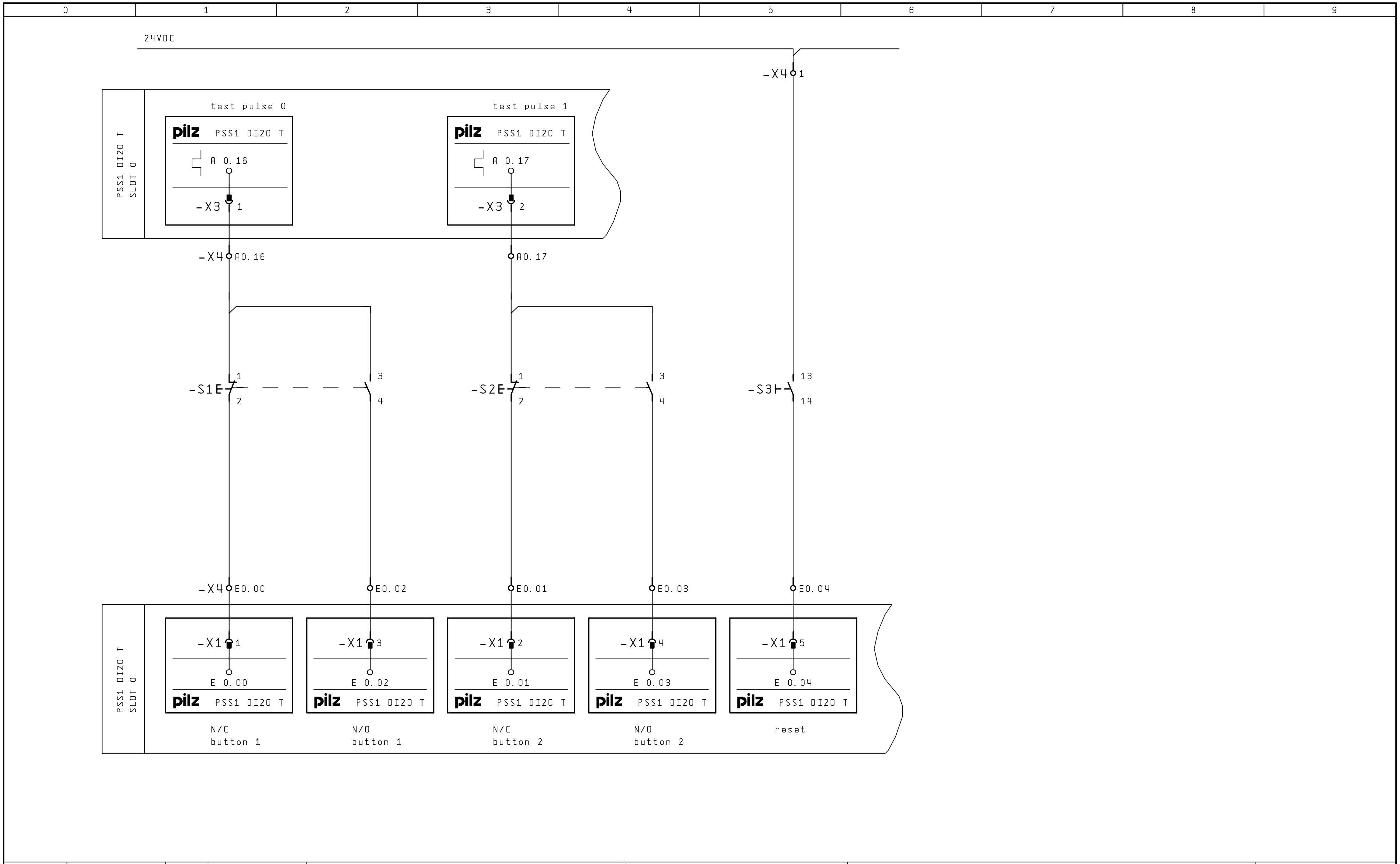
Depending on the application area and its respective regulations, this connection example is suitable for applications up to category 4, in accordance with EN 954-1.

Pilz products

Number	Description	Order number
1	PSS1 CPU 3	302 064
1	PSS1 BMPS 3/1	302 007
1	PSS1 DI2O T	302 112
1	PSS-SB-EXZ2	301 172B

Drawing file

Page 7 in the project “Eplan4/Pilz/APPL0703”


0
1
2
3
4
5
6
7
8
9
24VDC
-X4 1
PSS1 DI20 T
SLOT 0
test pulse 0
pilz PSS1 DI20 T
A 0.16
-X3 1
test pulse 1
pilz PSS1 DI20 T
A 0.17
-X3 2
-X4 A0.16
A0.17
-S1E 1 2 3 4
-S2E 1 2 3 4
-S3 13 14
-X4 E0.00
E0.02
E0.01
E0.03
E0.04
PSS1 DI20 T
SLOT 0
-X1 1
E 0.00
pilz PSS1 DI20 T
-X1 3
E 0.02
pilz PSS1 DI20 T
-X1 2
E 0.01
pilz PSS1 DI20 T
-X1 4
E 0.03
pilz PSS1 DI20 T
-X1 5
E 0.04
pilz PSS1 DI20 T
N/C
button 1
N/O
button 1
N/C
button 2
N/O
button 2
reset

Revision	30.Apr.2003	Date	22.Apr.2003	two-hand monitoring	pilz	Pilz GmbH & Co. Felix-Wankel-Str.2 73760 Ostfildern	two-hand monitoring with PSS 3100	Directory: Eplan4/Pilz/Appl0703
Name	CLE	Name	CLE					
				Category 4 EN 954-1				Page: 7
		Dep.	CS					

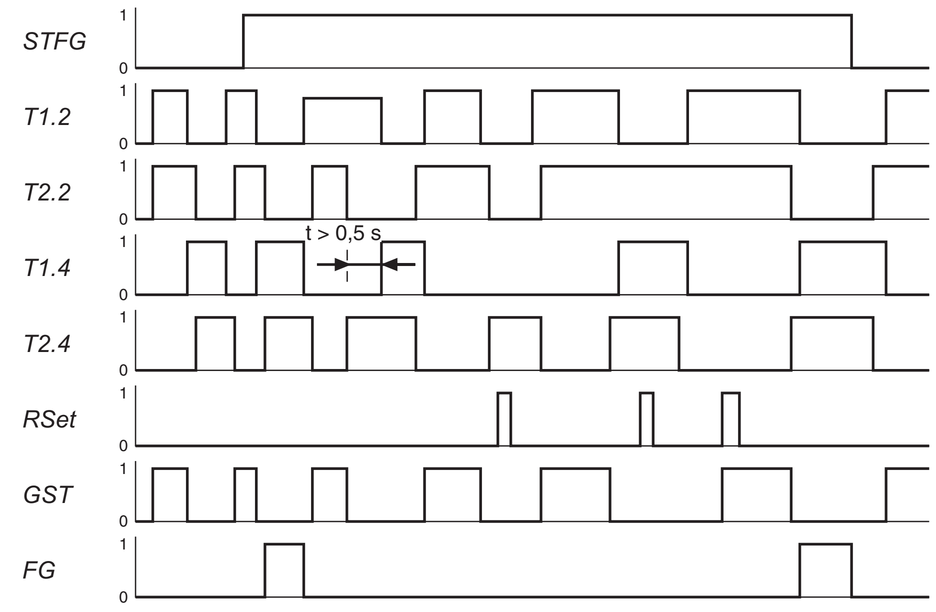
Category 4, EN 954-1

PSS 3100 – Two-hand monitoring

Timing diagram

Parameters set on SB059

- No single-stroke protection:
  MEin = 0
- Contact switchover time between N/O and N/C contact
  KU_S = 150 (ms)
- Disable “Jog using pushbutton” mode:
  Tipp = 0
- Disable “Ability to activate upward movement using pushbutton” mode:
  Auf = 0



t > 0.5 s: Simultaneity monitoring

Program

```
                                          SB059
                                          2_HAND
KB  001                       - B -  SSNR          FG  - X  - M  070.00    .Enable
M   070.00  .STAT_Enable      - X -  STFG         GST  - X  - M  080.01    .Strt.Pos
M   110.00  .RLO-0            - X -  MEin         AUF  - X  - M  080.02    .Press_up
E   0.00    .TH_NC-1          - X -  T1.2         OFF  - X  - M  080.03    .Deselect
E   0.02    .TH_NO-1          - X -  T1.4
E   0.01    .TH_NC-2          - X -  T2.2
E   0.03    .TH_NO-2          - X -  T2.4
KF  000150                    - W -  KU_S
E   0.04    .Reset            - X -  RSet
M   110.00  .RLO-0            - X -  Tipp
M   110.00  .RLO-0            - X -  Auf
M   110.00  .RLO-0            - X -  Off
```

Please note:
A “Minimum scan time” must be specified in the configurator of the PSS SW PG system software.

Global parameters used in administration data block DB015

- DW1022: Minimum scan time

The global parameter may be set in OB120 using SB070.

Additional blocks required

- DB015: Administration data block
  DB015 must consist of its total length of 1024 data words. DB015 must be declared READ/WRITE.
- SB070: Initialisation of global parameters in DB015

Notes

Category 4, EN 954-1

SafetyBUS p – Two-hand monitoring

Features

- Dual-channel redundancy
- “Jog” mode (jog mode using a pushbutton) not activated
- “Up” mode (ability to activate upward movement using a pushbutton) is not activated
- Without single-stroke protection
- Failsafe standard function block used: SB059 (2_HAND)
- Feasibility test on the input signals and simultaneity monitoring in SB059.

Description

Two-hand monitoring function
In this example the safety system with the safe bus system SafetyBUS p monitors pushbuttons S1 and S2 on a two-hand control. Within the user program, the failsafe standard function block SB059 is assigned to the pushbuttons. SB059 monitors the operation of the pushbuttons as well as detecting incorrect input signals, synchronisation errors, feasibility errors, etc. If an error occurs, the enable output *FG* will immediately be reset.
The enable output *FG* is also reset when the PSS is stopped and when the PSS is switched on.
The signal at the enable output *FG* must be evaluated by the user program and trigger an appropriate reaction. Three other output parameters can also be evaluated alongside *FG*, but these are not referred to in this example.
SB059 stores a value in DB015, which can be used to determine why *FG* was reset.
If an error occurs, once the error has been rectified, a reset must be performed by pressing S3 (0/1 pulse edge at *RSet*) in order to also reset enable output *FG* of SB059.

Safety assessment

- If a switch contact in the input circuit is overridden, the standard function block will detect this as an error at the next operation.
- A short between a pushbutton’s switch contacts will be detected as an error by the standard function block at the next operation.
- A short between the input circuits of both pushbuttons will be detected as an error by the programmable safety system.
- A short between 24 VDC and an input circuit will be detected as an error by the programmable safety system.

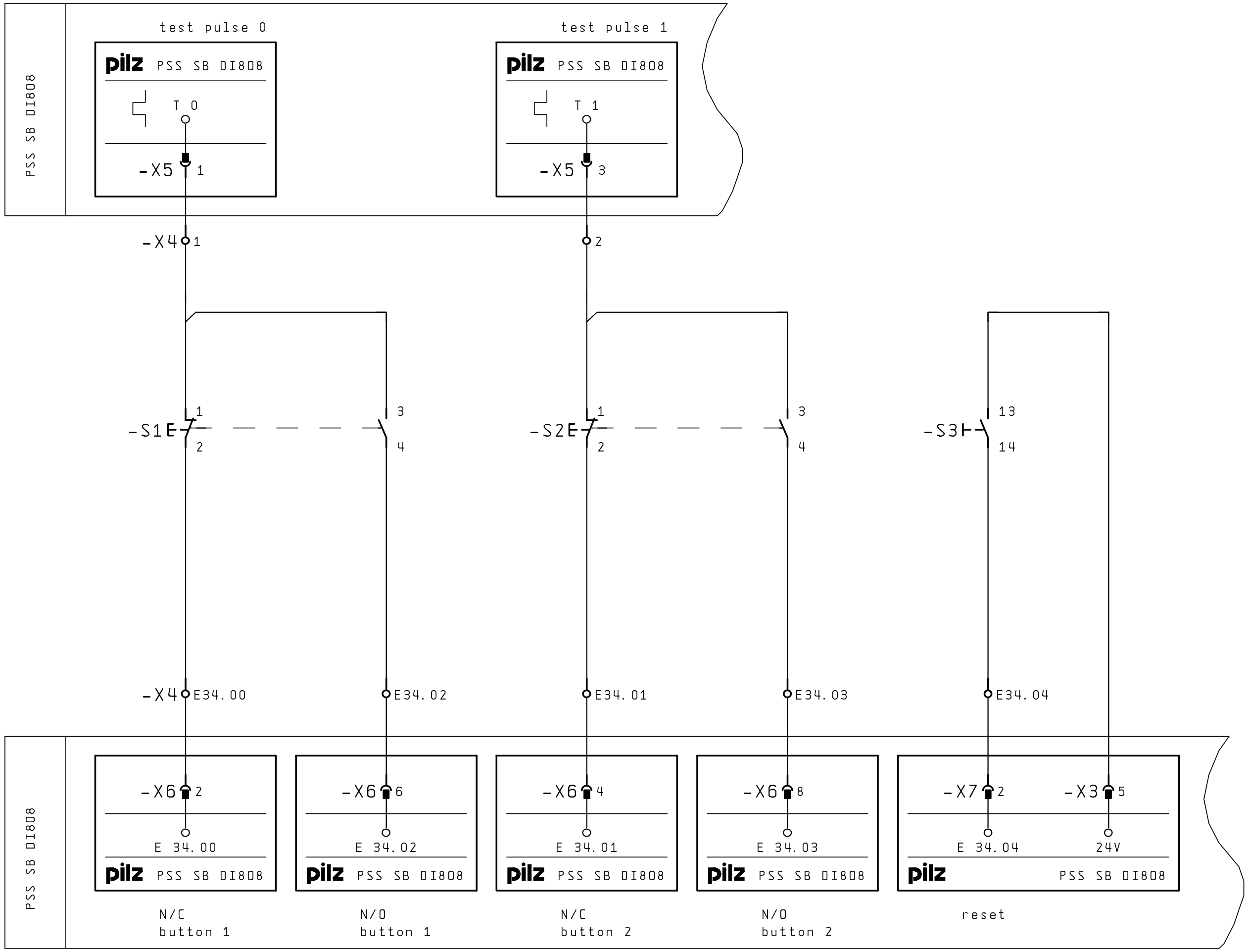
Classification in accordance with EN 954-1
Depending on the application area and its respective regulations, this connection example is suitable for applications up to category 4, in accordance with EN 954-1.

Pilz products

Number	Description	Order number	
1	PSS SB 3006 DP-S	301 460	
1	PSS SB DI8O8	301 140	
1	PSS SB screw connectors	311 060	**or**
1	PSS SB spring-loaded terminals	311 061	
2	PSS SB SUB-D1	311 051	
1	PSS SB cable	311 070	
1	PSS-SB-EXZ2	301 172B	

Drawing file

Page 23 in the project “Eplan4/Pilz/APPL0703”


PSS SB DI808
test pulse 0
pilz PSS SB DI808
T 0
-X5 1
test pulse 1
pilz PSS SB DI808
T 1
-X5 3
-X4 1
2
-S1E 1 2 3 4
-S2E 1 2 3 4
-S3 13 14
-X4 E34.00
E34.02
E34.01
E34.03
E34.04
PSS SB DI808
-X6 2
E 34.00
pilz PSS SB DI808
-X6 6
E 34.02
pilz PSS SB DI808
-X6 4
E 34.01
pilz PSS SB DI808
-X6 8
E 34.03
pilz PSS SB DI808
-X7 2
-X3 5
E 34.04
24V
pilz PSS SB DI808
N/C button 1
N/O button 1
N/C button 2
N/O button 2
reset

Revision	05. Mai. 2003	Date	22. Apr. 2003	two-hand monitoring	Pilz GmbH & Co. Felix-Wankel-Str. 2 73760 Ostfildern	two-hand monitoring with SafetyBUS p	Directory: Eplan4/Pilz/App10703
Name	CLE	Name	CLE				
		Dep.	CS	Category 4 EN 954-1			Page: 23

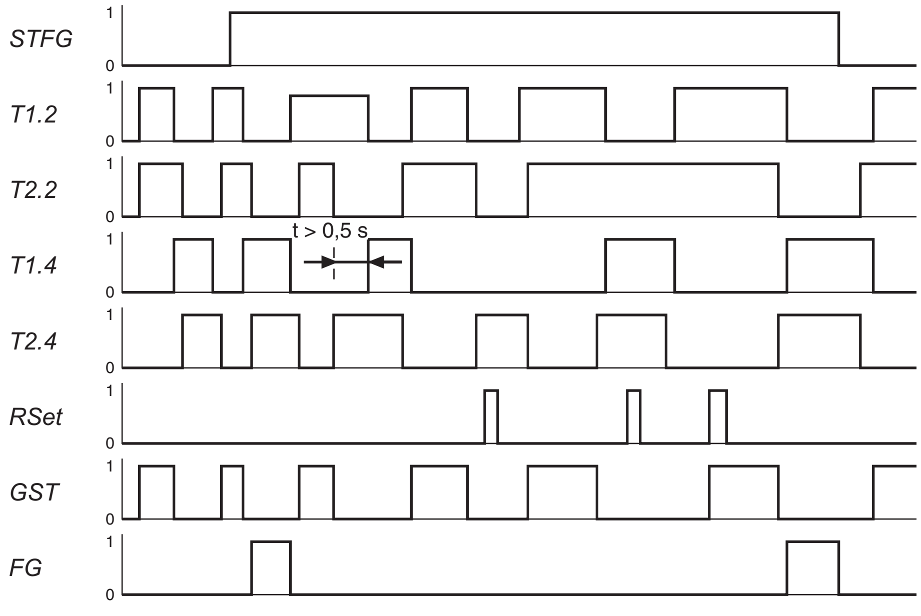
Category 4, EN 954-1

SafetyBUS p – Two-hand monitoring

Timing diagram

Parameters set on SB059

- No single-stroke protection:
  MEin = 0
- Contact switchover time between N/O and N/C contact
  KU_S = 150 (ms)
- Disable "Jog using pushbutton" mode:
  Tipp = 0
- Disable "Ability to activate upward movement using pushbutton" mode:
  Auf = 0



t > 0.5 s: Simultaneity monitoring

Program

```
                                          SB059
                                         2_HAND

KB  001                         - B -  SSNR        FG  - X  - M   070.00    .Enable
M   070.00  .STAT_Enable        - X -  STFG       GST  - X  - M   080.01    .Strt.Pos
M   110.00  .RLO-0              - X -  MEin       AUF  - X  - M   080.02    .Press_up
E   34.00   .TH_NC-1            - X -  T1.2       OFF  - X  - M   080.03    .Deselect
E   34.02   .TH_NO-1            - X -  T1.4
E   34.01   .TH_NC-2            - X -  T2.2
E   34.03   .TH_NO-2            - X -  T2.4
KF  000150                      - W -  KU_S
E   34.04   .Reset              - X -  RSet
M   110.00  .RLO-0              - X -  Tipp
M   110.00  .RLO-0              - X -  Auf
M   110.00  .RLO-0              - X -  Off
```

Please note:
A "Minimum scan time" must be specified in the configurator of the PSS SW PG system software.

Global parameters used in administration data block DB015

- DW1022: Minimum scan time

The global parameter may be set in OB120 using SB070.

Additional blocks required

- DB015: Administration data block
  DB015 must consist of its total length of 1024 data words. DB015 must be declared READ/WRITE.
- SB070: Initialisation of global parameters in DB015

Notes

Sensor Applications

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Sensor applications

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PSS 3000	–	Monitoring AOPD muting	Category 4, EN 954-1	5.5-6
SafetyBUS p	–	Monitoring AOPD muting	Category 4, EN 954-1	5.5-12
PSS 3000	–	Monitoring a light barrier (various manufacturers)	Category 4, EN 954-1	5.5-16
SafetyBUS p	–	Monitoring a light barrier (various manufacturers)	Category 4, EN 954-1	5.5-20
PSS 3000	–	Monitoring a “PLS” area scanner (Sick)	Category 3, EN 954-1	5.5-24
SafetyBUS p	–	Monitoring a “PLS” area scanner (Sick)	Category 3, EN 954-1	5.5-28
PSS 3000	–	AOPD monitoring	Category 2, EN 954-1	5.5-32
SafetyBUS p	–	AOPD monitoring	Category 2, EN 954-1	5.5-36
PSS 3000	–	Safety mat monitoring	Category 3, EN 954-1	5.5-40
SafetyBUS p	–	Pendulum flap monitoring	Category 4, EN 954-1	5.5-44
PSS 3000	–	Safety gate monitoring with PSEN	Category 3, EN 954-1	5.5-50
SafetyBUS p	–	Safety gate monitoring with PSEN	Category 4, EN 954-1	5.5-54
PSS 3100	–	Operating modes of a press with AOPD	Category 4, EN 954-1	5.5-58

Category 4, EN 954-1

PSS 3000 – Monitoring AOPD muting

Features

- Redundant dual-channel AOPD
- Manual reset when the PSS is cold/warm started
- Reset lock
- Failsafe standard function block used: SB072 (MUTING)
- Feasibility test on the input signals and monitoring of the contact synchronisation time in SB072.
- Time monitoring of muting sequence
- PSS inputs monitored for input errors via output test on AOPD

Description

Monitoring AOPD muting
In this example the safety system monitors muting on an active optoelectronic protective device (AOPD). Muting is the temporary suspension of the AOPD. It is used to allow a conveyed item (e.g. pallets) to pass through the protected field unhindered. Muting is started and ended via muting signals positioned before and after the AOPD. In this example, two muting signals (S1 and S2) are arranged in sequence and detect entry into the danger area. Two additional muting signals (S3 and S4) are positioned at the same height, behind the AOPD to the left and right; these monitor the exit from the danger area.
Muting status is displayed via a lamp. If a lamp should fail, the PSS will be stopped.
Within the user program, the failsafe standard function block SB072 is assigned to the two short-circuit protected semiconductor outputs on the AOPD and the muting signals. SB072 detects an unauthorised interruption to the protected field (AOPD interrupted while muting is inactive), as well as detecting incorrect input signals, such as non-feasible signals from the muting sensors.
If the protected field is interrupted without authorisation or an error occurs, the enable output *ENBL* on SB072 will immediately be reset.
The enable output *ENBL* is also reset when the PSS is stopped.
The signal at the enable output *ENBL* must be evaluated by the user program and trigger an appropriate reaction. SB072 stores a value in DB015, which can be used to determine why *ENBL* was reset.
In this application example, parameters for SB072 have been set in such a way that it is necessary to reset by pressing the key switch S5 (0/1 pulse edge at *RSET)*, in order to reset enable output *ENBL* on SB072 when the PSS is cold started (PSS switched from off to on) and warm started (PSS transferring from STOP to RUN).
If the AOPD has been interrupted without authorisation, the fact that the protected field has been cleared (restart) must always be acknowledged via a reset.

Safety assessment

- If a switch contact in the input circuit is overridden, standard function block SB095 will detect this as an error at the next operation or in conjunction with the muting function.
- A short between 24 VDC and a PSS input circuit will be detected as an error by the programmable safety system.
- A short between 24 VDC and a PSS input circuit will be detected as an error by the AOPD; the inputs are shut down.
- A short between the PSS input circuits will be detected as an error by the AOPD; the inputs are shut down.
- A broken wire in the lamp’s filament will be detected as an error by the programmable safety system.

Classification in accordance with EN 954-1

Depending on the application area and its respective regulations, this connection example is suitable for applications up to category 4, in accordance with EN 954-1.

Pilz products

Number	Description	Order number
1	PSS CPU3	301 064
1	PSS BMP 4/2	301 006
1	PSS PS 24	301 051
1	PSS DI2OT	301 112
1	PSS DI2OZ	301 109
1	PSS DI 2	301 101
1	PSS-SB-TRA	301 175B

Drawing file

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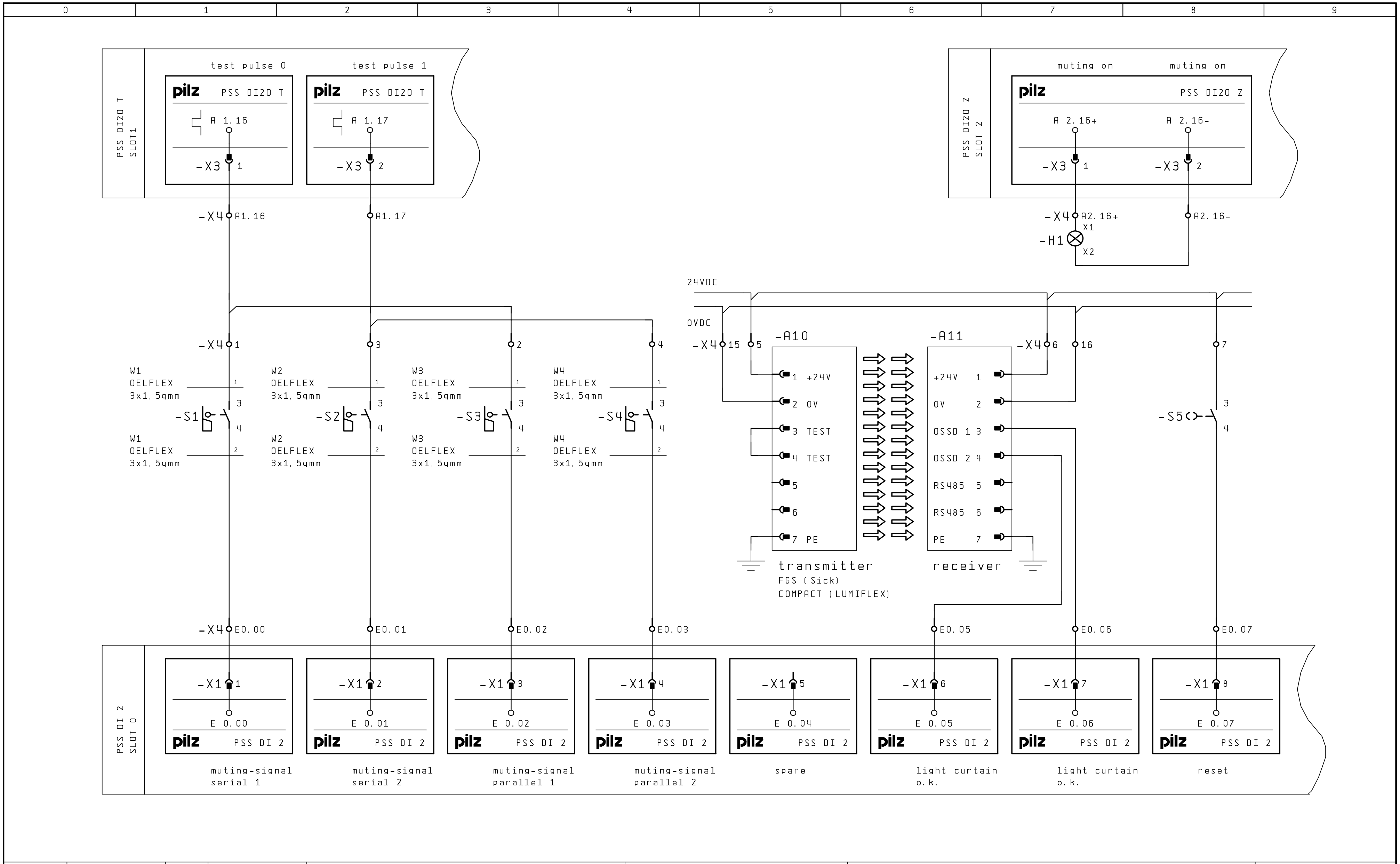

0
1
2
3
4
5
6
7
8
9
PSS DI20 T
SLOT1
test pulse 0
test pulse 1
pilz PSS DI20 T
A 1.16
-X3 1
pilz PSS DI20 T
A 1.17
-X3 2
PSS DI20 Z
SLOT 2
muting on
muting on
pilz PSS DI20 Z
A 2.16+
A 2.16-
-X3 1
-X3 2
-X4 A1.16
A1.17
-X4 A2.16+
A2.16-
X1
-H1
X2
24VDC
0VDC
-X4 1
3
2
4
W1 OELFLEX 3x1,5qmm
W2 OELFLEX 3x1,5qmm
W3 OELFLEX 3x1,5qmm
W4 OELFLEX 3x1,5qmm
-S1
-S2
-S3
-S4
-S5
-X4 15
5
-A10
-A11
-X4 6
16
7
1 +24V
2 0V
3 TEST
4 TEST
5
6
7 PE
+24V 1
0V 2
OSSD 1 3
OSSD 2 4
RS485 5
RS485 6
PE 7
transmitter
receiver
FGS (Sick)
COMPACT (LUMIFLEX)
-X4 E0.00
E0.01
E0.02
E0.03
E0.05
E0.06
E0.07
PSS DI 2
SLOT 0
-X1 1
-X1 2
-X1 3
-X1 4
-X1 5
-X1 6
-X1 7
-X1 8
E 0.00
E 0.01
E 0.02
E 0.03
E 0.04
E 0.05
E 0.06
E 0.07
pilz PSS DI 2
muting-signal serial 1
muting-signal serial 2
muting-signal parallel 1
muting-signal parallel 2
spare
light curtain o.k.
light curtain o.k.
reset

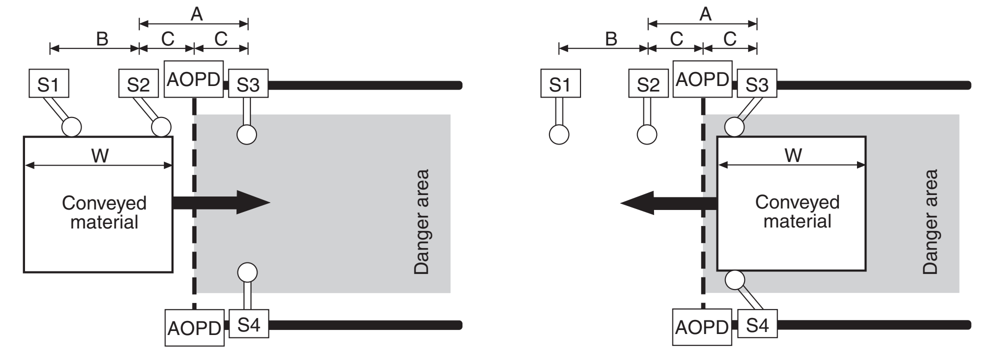
Revision	30.Apr.2003	Date	22.Apr.2003	AOPD muting	Pilz GmbH & Co. Felix-Wankel-Str.2 73760 Ostfildern	temporary suspension of safety function (ESPE/AOPD) muting with PSS 3000	Directory: Eplan4/Pilz/Appl0703
Name	CLE	Name	CLE	Category 4 EN 954-1			Page: 11
		Dep.	CS				

Category 4, EN 954-1

PSS 3000 – Monitoring AOPD muting

Muting signal arrangement

- Distance B should be as long as possible, but less than length W of the conveyed material. Therefore: W > B and W > A
- S2 and S3 are positioned as close as possible to the AOPD, i.e. C is as short as possible.
- S3 and S4 are positioned at the same height to the left and right of the conveyed material.


A
B
C
C
S1
S2
AOPD
S3
W
Conveyed material
Danger area
AOPD
S4
A
B
C
C
S1
S2
AOPD
S3
W
Conveyed material
Danger area
AOPD
S4

Entering the danger area

Leaving the danger area

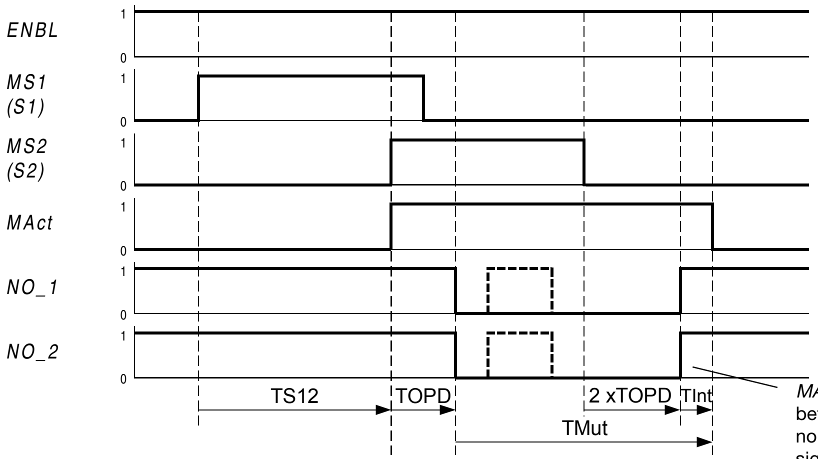
Timing diagrams

Parameters set on SB072

- Manual reset when the PSS is cold/warm started: *AuSt* = 0
- For “Muting On”, S2 must be operated after S1: *SMd2* = 1

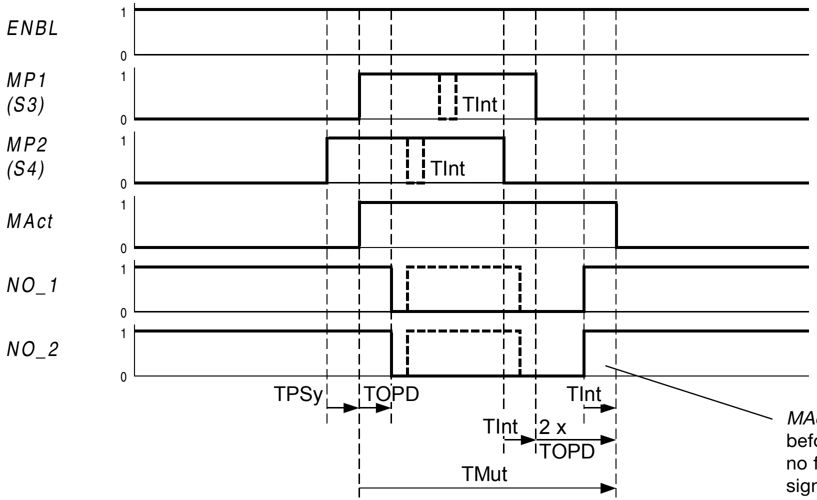
The specified time values will depend on the arrangement of the muting signals within the muting station. This example uses the following values:

- Maximum time between operation of S1 and S2*: TS12* = 5000 ms
- Maximum synchronisation time of S3 and S4*: TPSy* = 500 ms
- Maximum permitted release time of the AOPD / maximum permitted interruption time of S3 and S4: *TInt* = 1000 ms
- Maximum permitted muting time: *TMut* = 15 s
- Maximum permitted time between the start of muting and the interruption of the AOPD (1 x *TOPD*) / between leaving the last muting sensor and the release of the AOPD (2 x *TOPD*): *TOPD* = 2000 ms
- The timer is not halted, e.g. if the conveyed material is interrupted: *Toff* = 0


ENBL
MS1 (S1)
MS2 (S2)
MAct
NO_1
NO_2
1
0
TS12
TOPD
2 xTOPD
TInt
TMut

Entering the danger area

MAct switches off before *TInt* has run, if no further muting signals (incl. S3 and S4) are operated


ENBL
MP1 (S3)
MP2 (S4)
MAct
NO_1
NO_2
1
0
TInt
TInt
TPSy
TOPD
TInt
TInt
2 x TOPD
TMut

Leaving the danger area

MAct switches off before *TInt* has run, if no further muting signals (incl. S1 and S2) are operated

Category 4, EN 954-1

PSS 3000 – Monitoring AOPD muting

Program

Additional commands (insert before SB072 in the program):

```
:  L    PB 00.00
:  OR  EB 00.00
:  T    EB 00.00
```

```
                                          SB072
                                          MUTING

KB  001                          - B -  SSNR       ENBL - X  - M   70.00  .Enable
E   0.05     .AOPD-NO_1          - X -  NO_1       MAct - X  - A   2.16   .Lamp
E   0.06     .AOPD-NO_2           -X -  NO_2
E   0.00     .S1                 - X -  MS1
E   0.01     .S2                 - X -  MS2
E   0.02     .S3                 - X -  MP1
E   0.03     .S4                 - X -  MP2
KF  5000                         - W -  TS12
KF  500                          - W -  TPSy
KF  1000                         - W -  TInt
KF  15                           - W -  TMut
KF  2000                         - W -  TOPD
M   110.00   .RLO-0              - X -  TOff
M   110.00   .RLO-0              - X -  AuSt
M   110.01   .RLO-1              - X -  SMd2
MW80.00      .AuxVal             - W -  THIp
E   0.07     .Reset_button       - X -  RSET
```

Please note:
A “Minimum scan time” must be specified in the configurator of the PSS SW PG system software.

Global parameters used in administration data block DB015

- DW1001: Contact synchronisation time of 2 N/O contacts (NO_1 and NO_2 of the AOPD)
- DW1022: Minimum scan time

Global parameters may be set in OB120 using SB070.

Additional blocks required

- DB015: Administration data block
  DB015 must consist of its total length of 1024 data words. DB015 must be declared READ/WRITE.
- SB070: Initialisation of global parameters in DB015.

Category 4, EN 954-1
PSS 3000 – Monitoring AOPD muting

Features:

- Redundant dual-channel AOPD
- Failsafe standard function block used: SB095 (ESPE/AOPD muting)
- Time monitoring of muting sequence
- Feasibility test on the input signals and monitoring of the contact synchronisation time in SB095
- PSS inputs monitored for input errors via output test on AOPD

Description

Monitoring AOPD muting
In this example the safety system monitors muting on an active optoelectronic protective device (AOPD). Muting is the temporary suspension of the AOPD. It is used to allow a conveyed item (e.g. pallets) to pass through the protected field unhindered. Muting is started and ended via muting signals positioned before and after the AOPD. In this example, two muting signals (S1 and S2) are arranged in sequence and detect entry into the danger area. Two additional muting signals (S3 and S4) are positioned behind the AOPD, one after the other; these monitor the exit from the danger area. Muting status is displayed via a lamp. If a lamp should fail, the PSS will be stopped.
Within the user program, the failsafe standard function block SB069 is assigned to the two short-circuit protected semiconductor outputs on the AOPD. The muting signals and the enable signal from SB069 (M70.01) are assigned to the failsafe standard function block SB095 within the user program. SB095 detects an unauthorised interruption to the protected field (AOPD interrupted while muting is inactive), as well as detecting incorrect input signals, such as non-feasible signals from the muting sensors.
If the protected field is interrupted without authorisation or an error occurs, the enable output *ENBL* on SB095 will immediately be reset.
The enable output *ENBL* is also reset when the PSS is stopped.
The signal at the enable output *ENBL* must be evaluated by the user program and trigger an appropriate reaction. SB095 stores a value in DB015 (DB016 or DB017), which can be used to determine why *ENBL* was reset. In this example, parameters for SB095 have been set in such a way that it is necessary to reset by pressing S5 when the PSS is cold started (PSS switched from off to on). With a warm start (PSS transferring from STOP to RUN), the enable output *ENBL* on SB095 is set automatically.
If the AOPD has been interrupted without authorisation, the fact that the protected field has been cleared (restart) must always be acknowledged via a reset (0/1 pulse edge at *RSET*).

Safety assessment

- If a switch contact in the input circuit is overridden, standard function block SB072 will detect this as an error at the next operation or in conjunction with the muting function.
- A short between 24 VDC and a PSS input circuit will be detected as an error by the programmable safety system.
- A short between 24 VDC and a PSS input circuit will be detected as an error by the AOPD; the inputs are shut down.
- A short between the PSS input circuits will be detected as an error by the AOPD; the inputs are shut down.
- A broken wire in the lamp’s filament will be detected as an error by the programmable safety system.

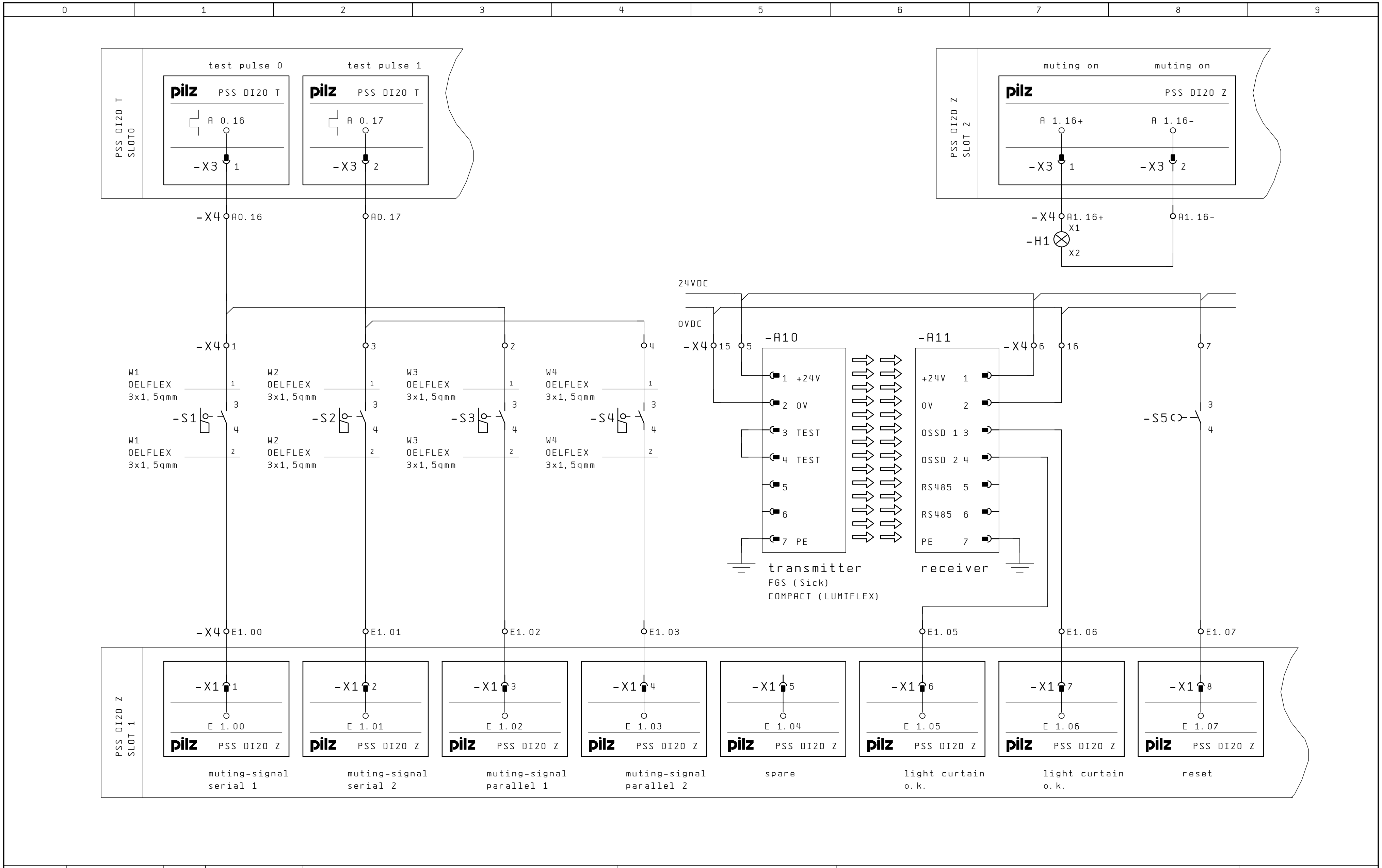
Pilz products

Number	Description	Order number
1	PSS CPU 3	301 064
1	PSS BMP 4/2	301 006
1	PSS PS 24	301 051
1	PSS DI2O T	301 112
1	PSS DI2O Z	301 109
1	PSS-SB-TRA	301 175B

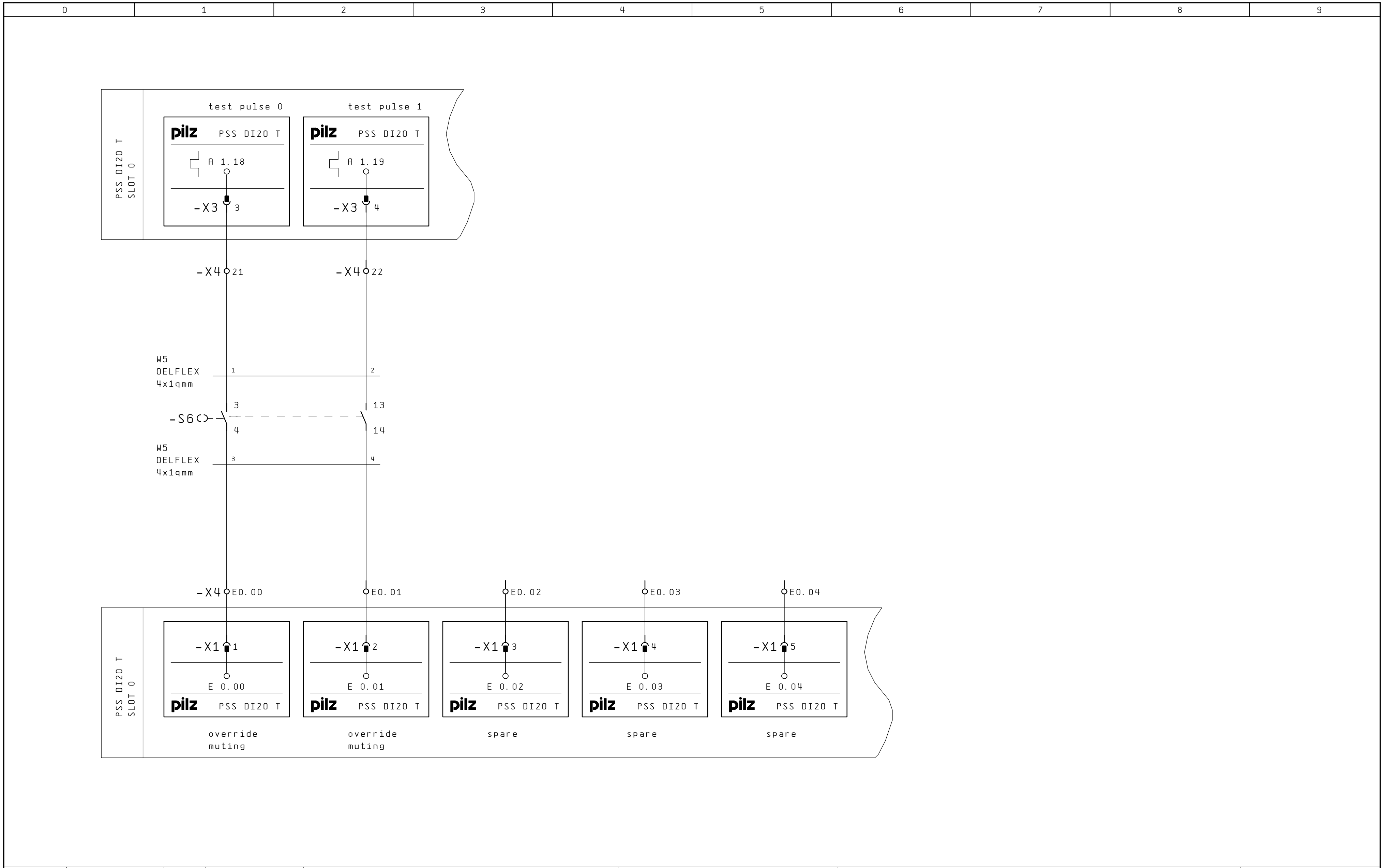
Drawing file

Page 58, 59 in the project “Eplan4/Pilz/APPL0703”

Classification in accordance with EN 954-1
Depending on the application area and its respective regulations, this connection example is suitable for applications up to category 4, in accordance with EN 954-1.


0
1
2
3
4
5
6
7
8
9
PSS DI20 T
SLOT0
test pulse 0
test pulse 1
pilz PSS DI20 T
A 0.16
-X3 1
pilz PSS DI20 T
A 0.17
-X3 2
-X4 A0.16
A0.17
PSS DI20 Z
SLOT 2
muting on
muting on
pilz PSS DI20 Z
A 1.16+
A 1.16-
-X3 1
-X3 2
-X4 A1.16+
A1.16-
X1
-H1
X2
24VDC
0VDC
-X4 1
3
2
4
-X4 15
5
-A10
-A11
-X4 6
16
7
W1 OELFLEX 3x1,5qmm
W2 OELFLEX 3x1,5qmm
W3 OELFLEX 3x1,5qmm
W4 OELFLEX 3x1,5qmm
-S1
-S2
-S3
-S4
-S5
1 +24V
2 0V
3 TEST
4 TEST
5
6
7 PE
+24V 1
0V 2
OSSD 1 3
OSSD 2 4
RS485 5
RS485 6
PE 7
transmitter
FGS (Sick)
COMPACT (LUMIFLEX)
receiver
-X4 E1.00
E1.01
E1.02
E1.03
E1.05
E1.06
E1.07
PSS DI20 Z
SLOT 1
-X1 1
E 1.00
pilz PSS DI20 Z
-X1 2
E 1.01
-X1 3
E 1.02
-X1 4
E 1.03
-X1 5
E 1.04
-X1 6
E 1.05
-X1 7
E 1.06
-X1 8
E 1.07
muting-signal serial 1
muting-signal serial 2
muting-signal parallel 1
muting-signal parallel 2
spare
light curtain o.k.
light curtain o.k.
reset

Revision	27.Apr.2004	Date	22.Apr.2003	AOPD muting	pilz Pilz GmbH & Co.KG Felix-Wankel-Str.2 73760 Ostfildern	temporary suspension of safety function (ESPE/AOPD) muting with PSS 3000	Directory: Eplan4/Pilz/App10703
Name	CLE	Name	CLE				
		Dep.	CS	Category 4 EN 954-1			Page: 58


0
1
2
3
4
5
6
7
8
9
PSS DI20 T
SLOT 0
test pulse 0
test pulse 1
pilz PSS DI20 T
A 1.18
-X3 3
pilz PSS DI20 T
A 1.19
-X3 4
-X4 21
-X4 22
W5
OELFLEX
4x1qmm
1
2
3
13
-S6
4
14
W5
OELFLEX
4x1qmm
3
4
-X4 E0.00
E0.01
E0.02
E0.03
E0.04
PSS DI20 T
SLOT 0
-X1 1
E 0.00
pilz PSS DI20 T
-X1 2
E 0.01
pilz PSS DI20 T
-X1 3
E 0.02
pilz PSS DI20 T
-X1 4
E 0.03
pilz PSS DI20 T
-X1 5
E 0.04
pilz PSS DI20 T
override muting
override muting
spare
spare
spare

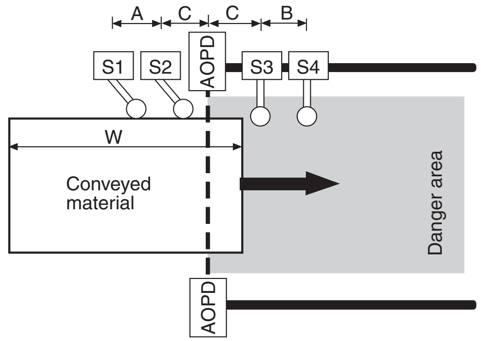
Revision	27.Apr.2004	Date	22.Apr.2003	AOPD muting	pilz	Pilz GmbH & Co.KG Felix-Wankel-Str.2 73760 Ostfildern	temporary suspension of safety function (ESPE/AOPD) muting with PSS 3000	Directory: Eplan4/Pilz/App10703
Name	CLE	Name	CLE					
		Dep.	CS	Category 4 EN 954-1				Page: 59

Category 4, EN 954-1

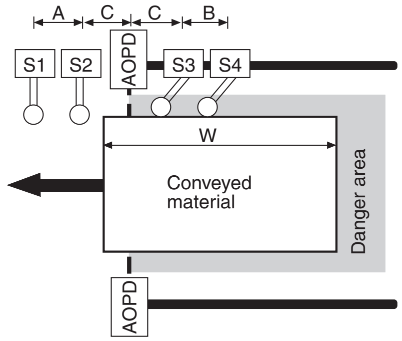
PSS 3000 – Monitoring AOPD muting

Muting signal arrangement

- Distances A and B should be as long as possible. However, the distance between S1 and S4 must be less than length W of the conveyed material.
- S2 and S3 are positioned as close as possible to the AOPD, i.e. C is as short as possible.

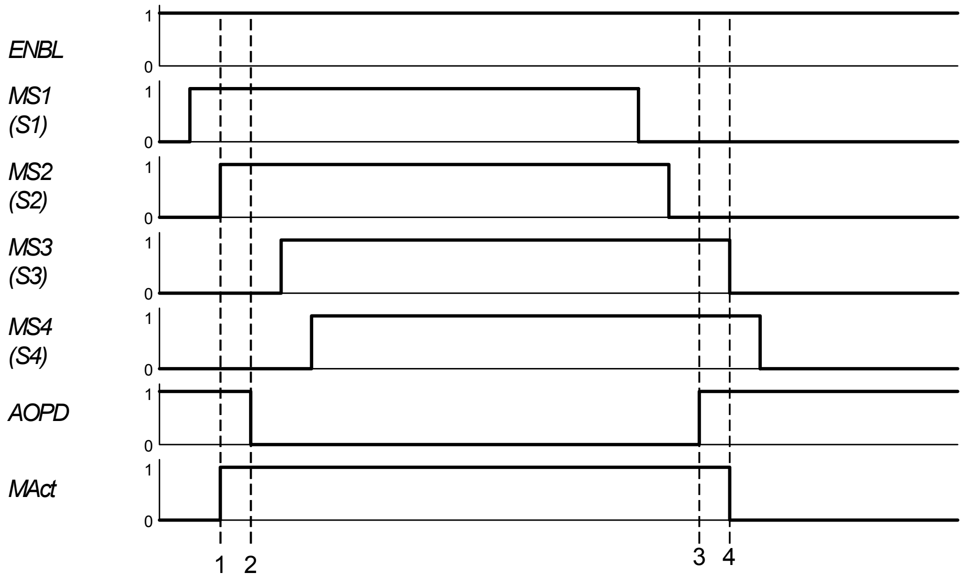

A
C
C
B
S1
S2
AOPD
S3
S4
W
Conveyed material
Danger area
AOPD

Entering the danger area


A
C
C
B
S1
S2
AOPD
S3
S4
W
Conveyed material
Danger area
AOPD

Leaving the danger area

Timing diagrams

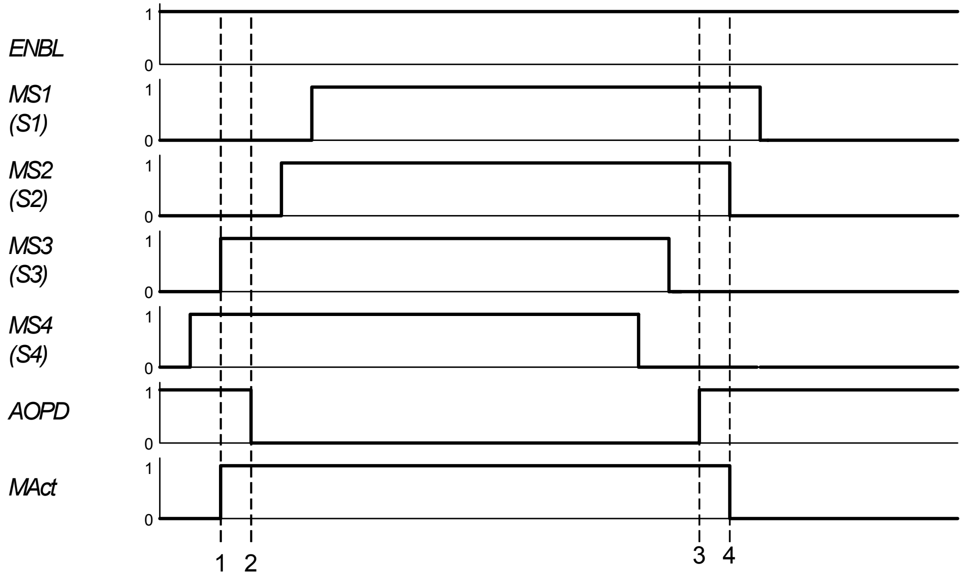

ENBL
MS1
(S1)
MS2
(S2)
MS3
(S3)
MS4
(S4)
AOPD
MAct
1
0
1 2
3 4

1: Muting active
2: Protected field broken
3: Protected field clear
4: Muting deactivated

Entering the danger area

Category 4, EN 954-1

PSS 3000 – Monitoring AOPD muting



1: Muting active
2: Protected field broken
3: Protected field clear
4: Muting deactivated

Leaving the danger area

Program:

Parameters set on SB063
- Automatic reset when the PSS is cold/warm started: *AuSt* = 1
- Automatic reset after the key switch is operated: *Arst* = 1
- No function test: *FTST* = 0

Parameters set on SB069
- Operating mode “AOPD operates as guarding device”: *GdOn* = 1
- Automatic reset of error “Protected field interrupted”: *ARSt* = 1
- No automatic start-up (start-up disabler), no function test required, reset required (*RSET* = 1): *SSeq* = 1

Parameters set on SB095
- For “Muting On”, *MS1* and *MS2* must be operated consecutively
- Maximum permitted synchronisation time of *MS1* and *MS2* or *MS3* and *MS4*: *SYNC* = 5 s
- Muting is lifted as soon as only *MS1* or *MS4* are operated: *MEnd* = 1
- Sequential muting mode selected: *MODE* =1
- Bounce time when the conveyor drive is shut down, triggered by vibration of the conveyed material in the AOPD area: *INTR* = 1 s.
- Muting function override in the case of a fault is only permitted in a separate operating mode *OVER* = 1
- Timer (*Tmut*, *SYNC*, *INTR*) is stopped when the drive is shut down (*DRIV*)
- Maximum permitted muting time: *Tmut* = 25 s

```
: CAL SB 063
                                   SB063
                                   E-STOP

KF  000001                  - W -  SSNR      ENBL - X -  M    70.0   .Override
M   110.01  .RLO-1          - X -  GRP
E   0.00    .Override_1     - X -  NC_1
E   0.01    .Override_2     - X -  NC_2
M   110.01  .RLO-1          - X -  AuSt
M   110.01  .RLO-1          - X -  ARst
M   110.00  .RLO-0          - X -  FTST
E   1.07    .Reset          - X -  RSET
```

```
: CAL SB 069

                                    SB069
                                  AOPD_GDO

KB  002                   - B - SSNR      ENBL - X  - M  70.01  .AOPD_enable
E   1.06   .AOPD-NO_1     - X - NO_1      TEST - X  - M  99.00  .Test
E   1.05   .AOPD-NO_2     - X - NO_2       PWR - X  - M  99.01  .AOPD_on
M   110.01 .RLO-1         - X - GdOn
KB  155                   - B - MTD
M   110.01 .RLO-1         - X - SSeq
M   110.01 .RLO-1         - X - ARSt
M   110.00 .RLO-0         - X - Test
E   1.07   .Reset-Button  - X - RSET

: CAL SB 095

                                    SB095
                                    MUTE

KB  003                   - B - SSNR      ENBL - X  - M  70.02  .Enable-MUTE
M   110.01 .RLO-1         - X - GRP       MAct - X  - A  1.16   .Lamp
M   70.01  .AOPD_Enable   - X - AOPD
E   1.00   .S1            - X - MS1
E   1.01   .S2            - X - MS2
E   1.03   .S3            - X - MS3
E   1.04   .S4            - X - MS4
M   70.00  .Override      - X - OVER
M   110.01 .RLO-01        - X - LAMP
M   99.02  .Convey_on     - X - DRIV
M   110.01 .RLO-1         - X - MODE
M   110.00 .RLO-0         - X - MEnd
KB  005                   - B - SYNC
KB  001                   - B - INTR
KF  25                    - W - TMut
T   64                    - Z - T1
T   65                    - Z - T2
E   1.07   .RESET         - X - RSET
```

Please note:
A “Minimum scan time” must be specified in the configurator of the PSS SW PG system software.

Global parameters used in administration data block DB015, DB016, DB017

- DW1001: Contact synchronisation time of 2 N/O contacts (NO_1 and NO_2 of the AOPD)
- DW1022: Minimum scan time

Global parameters may be set in OB120 using SB071.

Additional blocks required

- DB015, DB016, DB017: Administration data block
  DB015, DB016 and DB017 must consist of their total length of 1024 data words. DB015, DB016 and DB017 must be declared READ/WRITE.
- SB071: Initialisation of global parameters in DB015, DB016, DB017
- SB096: SUBMUTE
  Sub-block of SB095. This block
  - must be available in the project directory,
  - may not be called by the user,
  - must have the same version number as the SB095.
- SB255: Operating system call

Category 4, EN 954-1

SafetyBUS p – Monitoring AOPD muting

Features

- Redundant dual-channel AOPD
- Manual reset when the PSS is cold/ warm started
- Reset lock
- Failsafe standard function block used: SB072 (MUTING)
- Feasibility test on the input signals and monitoring of the contact synchronisation time in SB072.
- Time monitoring of muting sequence
- PSS inputs monitored for input errors via output test on AOPD

Description

Monitoring AOPD muting
In this example the safety system with the safe bus system SafetyBUS p monitors muting on an active optoelectronic protective device (AOPD). Muting is the temporary suspension of the AOPD. It is used to allow a conveyed item (e.g. pallets) to pass through the protected field unhindered. Muting is started and ended via muting signals positioned before and after the AOPD. In this example, two muting signals (S1 and S2) are arranged in sequence and detect entry into the hazardous area. Two additional muting signals (S3 and S4) are positioned at the same height, behind the AOPD to the left and right; these monitor the exit from the hazardous area. Muting status is displayed via a lamp. If a lamp should fail, the PSS will not be stopped.
SB097 is used to check for a break in the lamp's filament. If the filament is broken, the enable output *ENBL* on SB097 will be reset. When the fault has been rectified, the enable output can be reset by operating the key switch S5.
Within the user program, the failsafe standard function block SB072 is assigned to the two short-circuit protected semiconductor outputs on the AOPD and the muting signals. SB072 detects an unauthorised interruption to the protected field (AOPD interrupted while muting is inactive), as well as detecting incorrect input signals, such as non-feasible signals from the muting sensors.
If the protected field is interrupted without authorisation or an error occurs, the enable output *ENBL* on SB072 will immediately be reset.
The enable output *ENBL* is also reset when the PSS is stopped.
The signal at the enable output *ENBL* must be evaluated by the user program and trigger an appropriate reaction. SB072 stores a value in DB015, which can be used to determine why *ENBL* was reset.
In this application example, parameters for SB072 have been set in such a way that it is necessary to reset by pressing the key switch S5 (0/1 pulse edge at *RSET)*, in order to reset enable output *ENBL* on SB072 when the PSS is cold started (PSS switched from off to on) and warm started (PSS transferring from STOP to RUN).
If the AOPD has been interrupted without authorisation, the fact that the protected field has been cleared (restart) must always be acknowledged via a reset.
Using a second muting lamp (extra expense: one input and a negative-switching output) can increase the plant's availability. If the first muting lamp fails, output parameter WARN on SB097 is set and the lamp can be exchanged without interrupting operation.

Safety assessment

- If a switch contact in the input circuit is overridden, standard function block SB072 will detect this as an error at the next operation or in conjunction with the muting function.
- A short between 24 VDC and a PSS input circuit will be detected as an error by the programmable safety system.
- A short between 24 VDC and a PSS input circuit will be detected as an error by the AOPD; the inputs are shut down.
- A short between the PSS input circuits will be detected as an error by the AOPD; the inputs are shut down.
- A broken wire in the lamp's filament will be detected as an error by standard function block SB097.

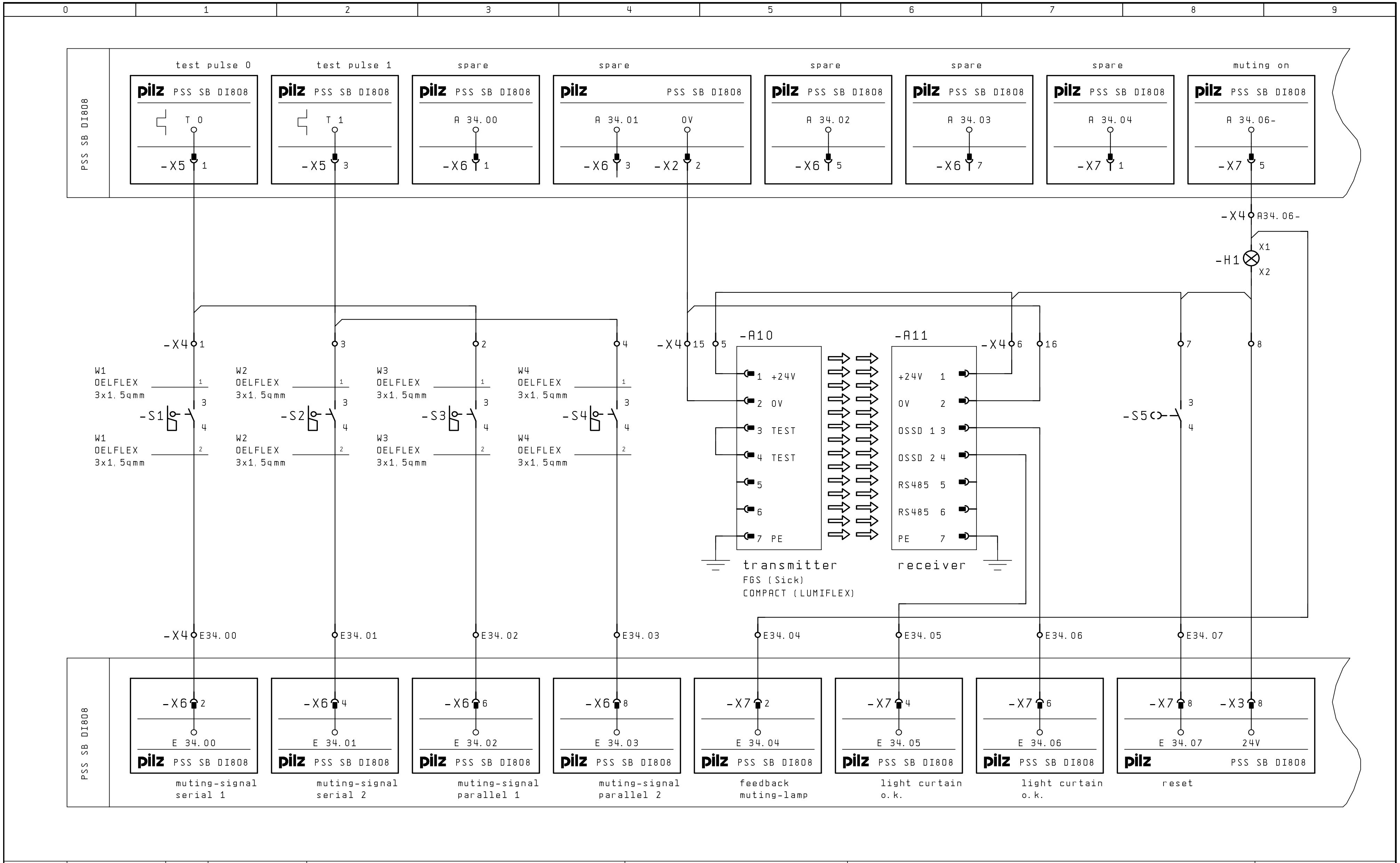
Classification in accordance with EN 954-1
Depending on the application area and its respective regulations, this connection example is suitable for applications up to category 4, in accordance with EN 954-1.

Pilz products

Number	Description	Order number	
1	PSS SB 3006 DP-S	301 460	
1	PSS SB DI8O8	301 140	
1	PSS SB screw connectors	311 060	**or**
1	PSS SB spring-loaded terminals	311 061	
2	PSS SB SUB-D1	311 051	
1	PSS SB cable	311 070	
1	PSS-SB-TRA	301 175B	

Drawing file

Page 27 in the project "Eplan4/Pilz/APPL0703"


0
1
2
3
4
5
6
7
8
9
PSS SB DI808
test pulse 0
test pulse 1
spare
spare
spare
spare
spare
muting on
pilz PSS SB DI808
T 0
T 1
A 34.00
A 34.01
0V
A 34.02
A 34.03
A 34.04
A 34.06-
-X5 1
-X5 3
-X6 1
-X6 3
-X2 2
-X6 5
-X6 7
-X7 1
-X7 5
-X4 A34.06-
-H1
X1
X2
-X4 1
3
2
4
-X4 15
5
-X4 6
16
7
8
W1 OELFLEX 3x1,5qmm
W2 OELFLEX 3x1,5qmm
W3 OELFLEX 3x1,5qmm
W4 OELFLEX 3x1,5qmm
-S1
-S2
-S3
-S4
-S5
-A10
-A11
1 +24V
2 0V
3 TEST
4 TEST
5
6
7 PE
+24V 1
0V 2
OSSD 1 3
OSSD 2 4
RS485 5
RS485 6
PE 7
transmitter
receiver
FGS (Sick)
COMPACT (LUMIFLEX)
-X4 E34.00
E34.01
E34.02
E34.03
E34.04
E34.05
E34.06
E34.07
-X6 2
-X6 4
-X6 6
-X6 8
-X7 2
-X7 4
-X7 6
-X7 8
-X3 8
E 34.00
E 34.01
E 34.02
E 34.03
E 34.04
E 34.05
E 34.06
E 34.07
24V
muting-signal serial 1
muting-signal serial 2
muting-signal parallel 1
muting-signal parallel 2
feedback muting-lamp
light curtain o.k.
light curtain o.k.
reset

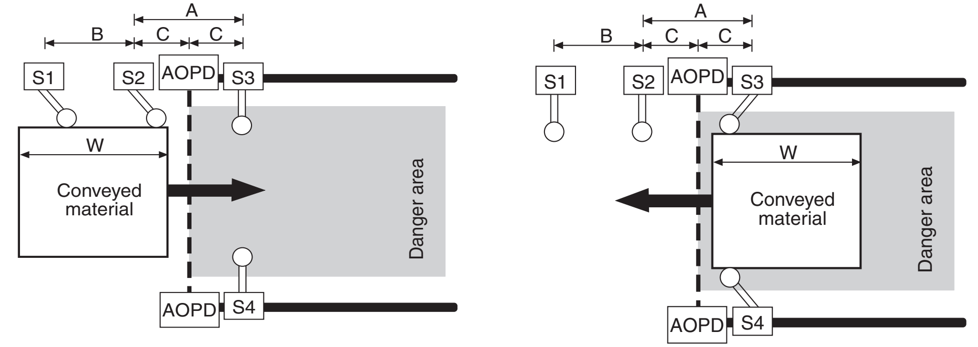
Revision	30.Apr.2003	Date	22.Apr.2003	AOPD muting	pilz	Pilz GmbH & Co. Felix-Wankel-Str.2 73760 Ostfildern	temporary suspension of safety function (ESPE/AOPD) muting with SafetyBUS p	Directory: Eplan4/Pilz/Appl0703
Name	CLE	Name	CLE					
		Dep.	CS	Category 4 EN 954-1				Page: 27

Category 4, EN 954-1

SafetyBUS p – Monitoring AOPD muting

Muting signal arrangement

- Distance B should be as long as possible, but less than length W of the conveyed material. Therefore: W > B and W > A
- S2 and S3 are as close as possible to the AOPD, i.e. C is as short as possible.
- S3 and S4 are positioned at the same height to the left and right of the conveyed material.


A
B
C
C
S1
S2
AOPD
S3
W
Conveyed material
Danger area
AOPD
S4
A
B
C
C
S1
S2
AOPD
S3
W
Conveyed material
Danger area
AOPD
S4

Entering the danger area

Leaving the danger area

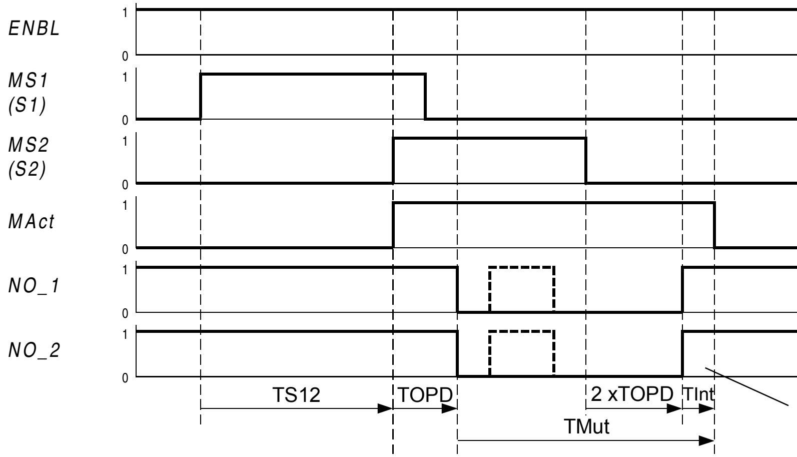
Timing diagrams

Parameters set on SB072

- Manual reset when the PSS is cold/warm started: *AuSt* = 0
- For “Muting On”, S2 must be operated after S1: *SMd2* = 1

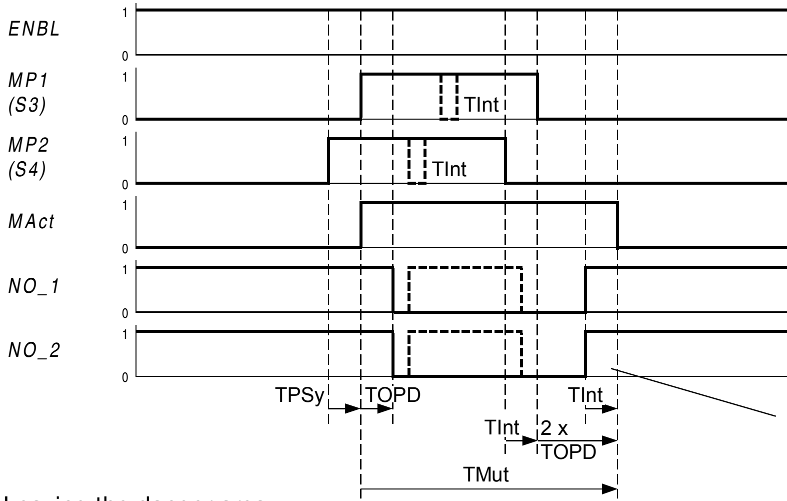
The specified time values will depend on the arrangement of the muting signals within the muting station. This example uses the following values:

- Maximum time between operation of S1 and S2*: TS12* = 5000 ms
- Maximum synchronisation time of S3 and S4*: TPSy* = 500 ms
- Maximum permitted release time of the AOPD / maximum permitted interruption time of S3 and S4: *TInt* = 1000 ms
- Maximum permitted muting time: *TMut* = 15 s
- Maximum permitted time between the start of muting and the interruption of the AOPD (1 x *TOPD*) / between leaving the last muting sensor and the release of the AOPD (2 x *TOPD*): *TOPD* = 2000 ms
- The timer is not halted, e.g. if the conveyed material is interrupted: *Toff* = 0


ENBL
MS1 (S1)
MS2 (S2)
MAct
NO_1
NO_2
1
0
TS12
TOPD
2 xTOPD
TInt
TMut

MAct switches off before *TInt* has run, if no further muting signals (incl. S3 and S4) are operated

Entering the danger area


ENBL
MP1 (S3)
MP2 (S4)
MAct
NO_1
NO_2
1
0
TInt
TInt
TPSy
TOPD
TInt
TInt
2 x TOPD
TMut

Act switches off before *TInt* has run, if no further muting signals (incl. S1 and S2) are operated

Leaving the danger area

Category 4, EN 954-1

SafetyBUS p – Monitoring AOPD muting

Program

We recommend calling SB097 before SB072:

```
                                      SB097
                                    MUT_LAMP

KB  002                  - B - SSNR      ENBL - X - M  70.01 .EnableLamps
M   116.01 .I/O-Group 01 - X - GRP       WARN - X - M  81.03 .AuxFlag
M   81.01  .Muting_active - X - ON       LMP1 - X - A  34.06 .Lamp
E   34.04  .FL1          - X - FbL1      LMP2 - X - A  34.06 .Lamp
E   34.04  .FL1          - X - FbL2
M   110.01 .RLO-1        - X - 1OUT
E   34.07  .Reset_button - X - RSET
```

```
                                      SB072
                                     MUTING

KB  001                  - B - SSNR      ENBL - X - M  70.00 .Enable
E   34.05  .AOPD-NO_1    - X - NO_1      MAct - X - M  81.01 .Muting_active
E   34.06  .AOPD-NO_2    - X - NO_2
E   34.00  .S1           - X - MS1
E   34.01  .S2           - X - MS2
E   34.02  .S3           - X - MP1
E   34.03  .S4           - X - MP2
KF  5000                 - W - TS12
KF  500                  - W - TPSy
KF  1000                 - W - TInt
KF  15                   - W - TMut
KF  2000                 - W - TOPD
M   110.00 .RLO-0        - X - TOff
M   110.00 .RLO-0        - X - AuSt
M   110.01 .RLO-1        - X - SMd2
MW80.00    .AuxVal       - W - THIp
E   34.07  .Reset_button - X - RSET
```

```
:
:L   M  70.00 .EnableMuting
:U   M  70.01 .EnableLamps
:=   M  90.00 .OverallEnable
```

Please note:
A “Minimum scan time” must be specified in the configurator of the PSS SW PG system software.

Global parameters used in administration data block DB015

- DW1001: Contact synchronisation time of 2 N/O contacts (NO_1 and NO_2 of the AOPD)
- DW1022: Minimum scan time

Global parameters may be set in OB120 using SB070.

Additional blocks required

- DB015: Administration data block
  DB015 must consist of its total length of 1024 data words. DB015 must be declared READ/WRITE.
- SB070: Initialisation of global parameters in DB015.

Category 4, EN 954-1

PSS 3000 – Monitoring a light barrier (various manufacturers)

Features

- Dual-channel redundancy
- Manual reset when the PSS is cold/warm started
- Reset lock
- Function test required on the light barrier when the PSS is cold and warm started
- Failsafe standard function block used: SB069 (AOPD_GDO)
- Feasibility test on the input signals and monitoring of the contact synchronisation time in SB069.

Description

Light barrier monitoring function

In this example the safety system monitors the two short-circuit protected semiconductor outputs on the “ULVT” light barrier from Fiessler. The example could also be used on safety light barriers made by other manufacturers (see table: “Other safety light barriers”).

Within the user program, the failsafe standard function block SB069 is assigned to the semiconductor outputs. SB069 detects an interruption to the protected field, as well as detecting incorrect input signals, such as a reset button that is constantly operated.

If the protected field is interrupted or an error occurs, the enable output *ENBL* on SB069 will immediately be reset.

The enable output *ENBL* is also reset when the PSS is stopped and when the PSS is switched on.

The signal at the enable output *ENBL* must be evaluated by the user program and trigger an appropriate reaction. SB069 stores a value in DB015, which can be used to determine why *ENBL* was reset.

The way in which the error is reset will depend on the operating mode set on SB069.

In this application example, parameters for SB069 have been set in such a way that it is necessary to reset by pressing the key switch S1 (0/1 pulse edge at *RSET*) in order to reset enable output *ENBL* on SB069 when the PSS is cold started (PSS switched from off to on), warm started (PSS transferring from STOP to RUN) or after the protected field has been cleared (restart).

Parameters on SB069 also stipulate that the AOPD must undergo a function test (protected field interrupted and then cleared) during a cold and warm start.

Safety assessment

- A short between 24 VDC and a PSS input circuit will be detected as an error by the AOPD; the inputs are shut down.
- A short between the PSS input circuits will be detected as an error by the AOPD; the inputs are shut down.

Classification in accordance with EN 954-1

Depending on the application area and its respective regulations, this connection example is suitable for applications up to category 4, in accordance with EN 954-1.

Pilz products

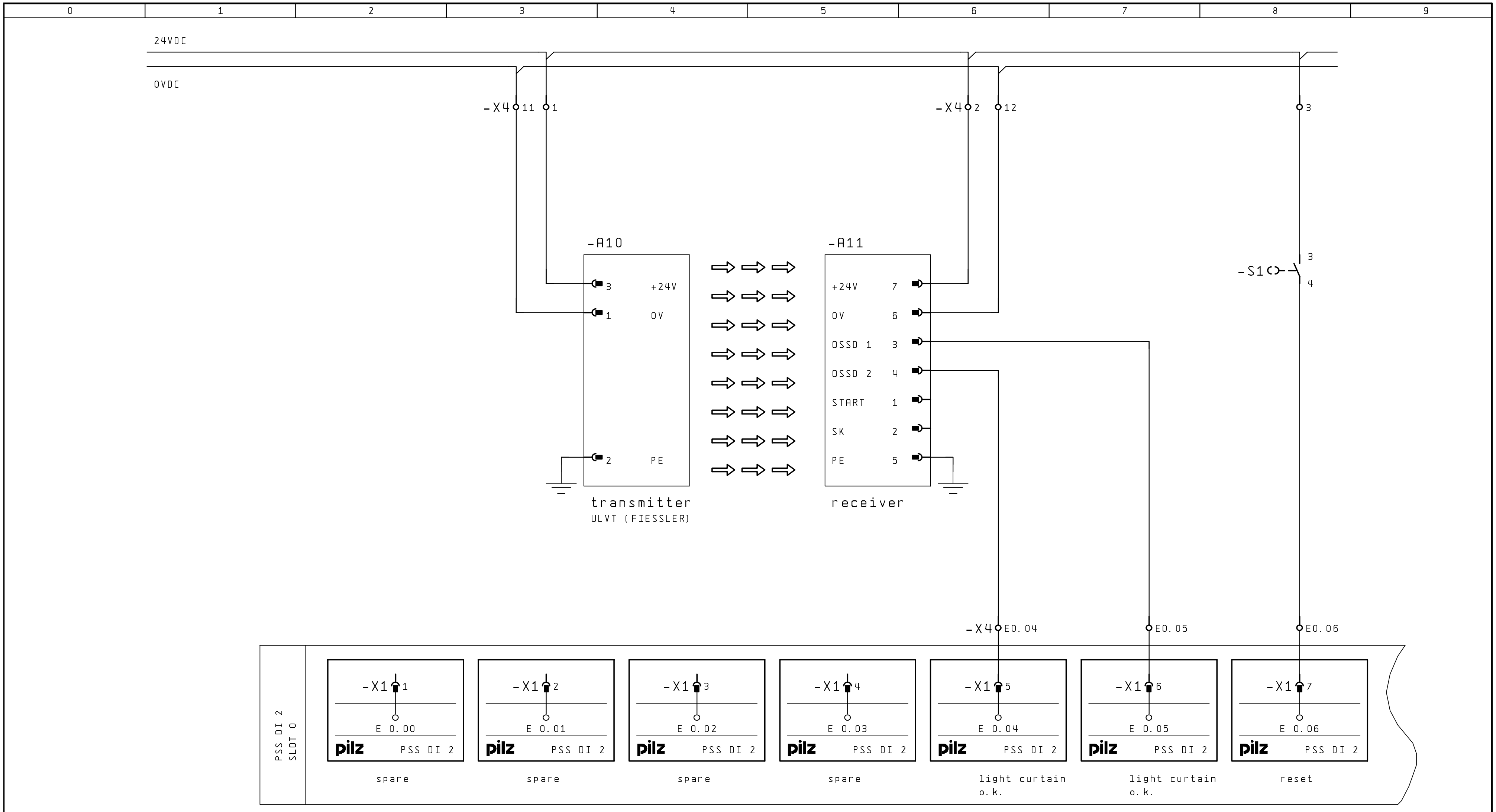
Number	Description	Order number
1	PSS CPU 3	301 064
1	PSS BMP 4/2	301 006
1	PSS PS 24	301 051
1	PSS DI 2	301 101
1	PSS-SB-TRA	301 175B

Other safety light barriers

Manufacturer	Type
Sick	FGS
Leuze lumiflex	Compact
Pepperl & Fuchs/Visolux	SLC

Drawing file

Page 15 in the project “Eplan4/Pilz/APPL0703”


0
1
2
3
4
5
6
7
8
9
24VDC
0VDC
-X4 11
1
-X4 2
12
3
-A10
3 +24V
1 0V
2 PE
transmitter
ULVT (FIESSLER)
-A11
+24V 7
0V 6
OSSD 1 3
OSSD 2 4
START 1
SK 2
PE 5
receiver
-S1
3
4
-X4 E0.04
E0.05
E0.06
PSS DI 2
SLOT 0
-X1 1
E 0.00
pilz PSS DI 2
spare
-X1 2
E 0.01
pilz PSS DI 2
spare
-X1 3
E 0.02
pilz PSS DI 2
spare
-X1 4
E 0.03
pilz PSS DI 2
spare
-X1 5
E 0.04
pilz PSS DI 2
light curtain o.k.
-X1 6
E 0.05
pilz PSS DI 2
light curtain o.k.
-X1 7
E 0.06
pilz PSS DI 2
reset

Revision	30.Apr.2003	Date	22.Apr.2003	AOPD in guard mode	pilz	Pilz GmbH & Co. Felix-Wankel-Str.2 73760 Ostfildern	PSS 3000 light curtain monitoring of the type ULVT (Co.Fiesseler)	Directory: Eplan4/Pilz/Appl0703
Name	CLE	Name	CLE	Category 4 EN 954-1				Page: 15
		Dep.	CS					

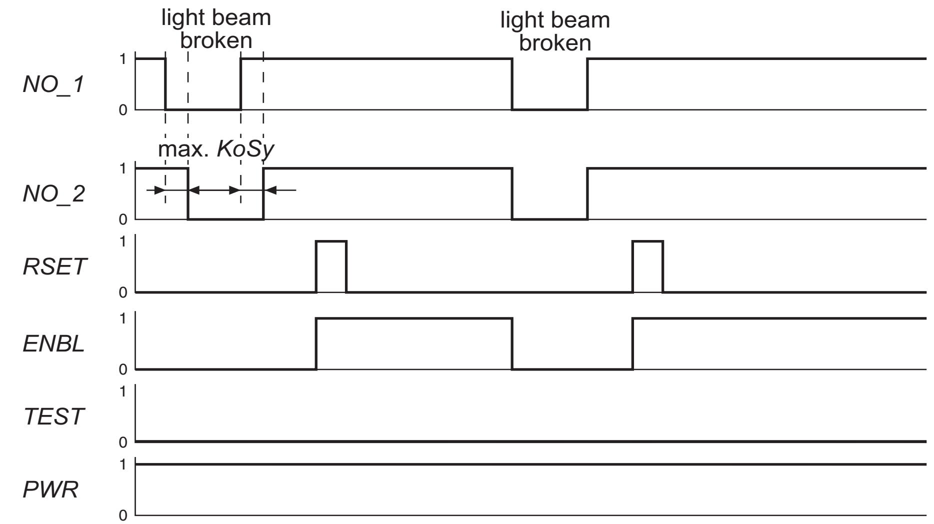
Category 4, EN 954-1

PSS 3000 – Monitoring a light barrier (various manufacturers)

Timing diagram

Parameters set on SB069

- Operating mode “AOPD operates as guarding device”:
  GdOn = 1
- Reset lock (acknowledgement required after clearing the protected field):
  ARSt = 0
- Function test on PSS warm start, PSS cold start and after the protected field is interrupted: *SSeq* = 0



KoSy: Contact synchronisation time between 2 N/O contacts, entered by the user

Program

Additional commands (insert before SB069 in the program):

```
: L    PB00.00
: OR   EB00.00
: T    EB00.00
```

```
                                           SB069
                                         AOPD_GDO

KB  001                        - B -  SSNR        ENBL  - X  - M  080.00 .Enable
E   0.04    .AOPD-NO_1         - X -  NO_1        TEST  - X  - M  099.30 .Test_output
E   0.05    .AOPD-NO_2         - X -  NO_2         PWR  - X  - M  099.31 .Sply.-Volt. AOPD
M   110.01  .RLO-1             - X -  GdOn
KB  150                        - B -  MTD
M   110.00  .RLO-0             - X -  SSeq
M   110.00  .RLO-0             - X -  ARSt
M   110.00  .RLO-0             - X -  Test
E   0.06    .Reset_button      - X -  RSET
```

Please note:
A “Minimum scan time” must be specified in the configurator of the PSS SW PG system software.

Global parameters used in administration data block DB015

- DW1001: Cycles for the contact synchronisation time N/O / N/O

The global parameter may be set in OB120 using SB070.

Additional blocks required

- DB015: Administration data block
  DB015 must consist of its total length of 1024 data words. DB015 must be declared READ/WRITE.
- SB070: Initialisation of global parameters in DB015.

Notes

Category 4, EN 954-1

SafetyBUS p – Monitoring a light barrier (various manufacturers)

Features

- Dual-channel redundancy
- Manual reset when the PSS is cold/ warm started
- Reset lock
- Function test required on the light barrier when the PSS is cold and warm started
- Failsafe standard function block used: SB069 (AOPD_GDO)
- Feasibility test on the input signals and monitoring of the contact synchronisation time in SB069.

Description

Light barrier monitoring function

In this example the safety system with the safe bus system SafetyBUS p monitors the two short-circuit protected semiconductor outputs on the “Compact” light barrier from Lumiflex. The example could also be used on safety light barriers made by other manufacturers (see table: “Other safety light barriers”).

Within the user program, the failsafe standard function block SB069 is assigned to the semiconductor outputs. SB069 detects an interruption to the protected field, as well as detecting incorrect input signals, such as a reset button that is constantly operated.

If the protected field is interrupted or an error occurs, the enable output *ENBL* on SB069 will immediately be reset.

The enable output *ENBL* is also reset when the PSS is stopped and when the PSS is switched on.

The signal at the enable output *ENBL* must be evaluated by the user program and trigger an appropriate reaction. SB069 stores a value in DB015, which can be used to determine why *ENBL* was reset.

The way in which the error is reset will depend on the operating mode set on SB069.

In this application example, parameters for SB069 have been set in such a way that it is necessary to reset by pressing the key switch S1 (0/1 pulse edge at *RSET*) in order to reset enable output *ENBL* on SB069 when the PSS is cold started (PSS switched from off to on), warm started (PSS transferring from STOP to RUN) or after the protected field has been cleared (restart).

Parameters on SB069 also stipulate that the AOPD must undergo a function test (protected field interrupted and then cleared) during a cold and warm start.

Safety assessment

- A short between 24 VDC and a PSS input circuit will be detected as an error by the AOPD; the inputs are shut down.
- A short between the PSS input circuits will be detected as an error by the AOPD; the inputs are shut down.

Classification in accordance with EN 954-1

Depending on the application area and its respective regulations, this connection example is suitable for applications up to category 4, in accordance with EN 954-1.

Pilz products

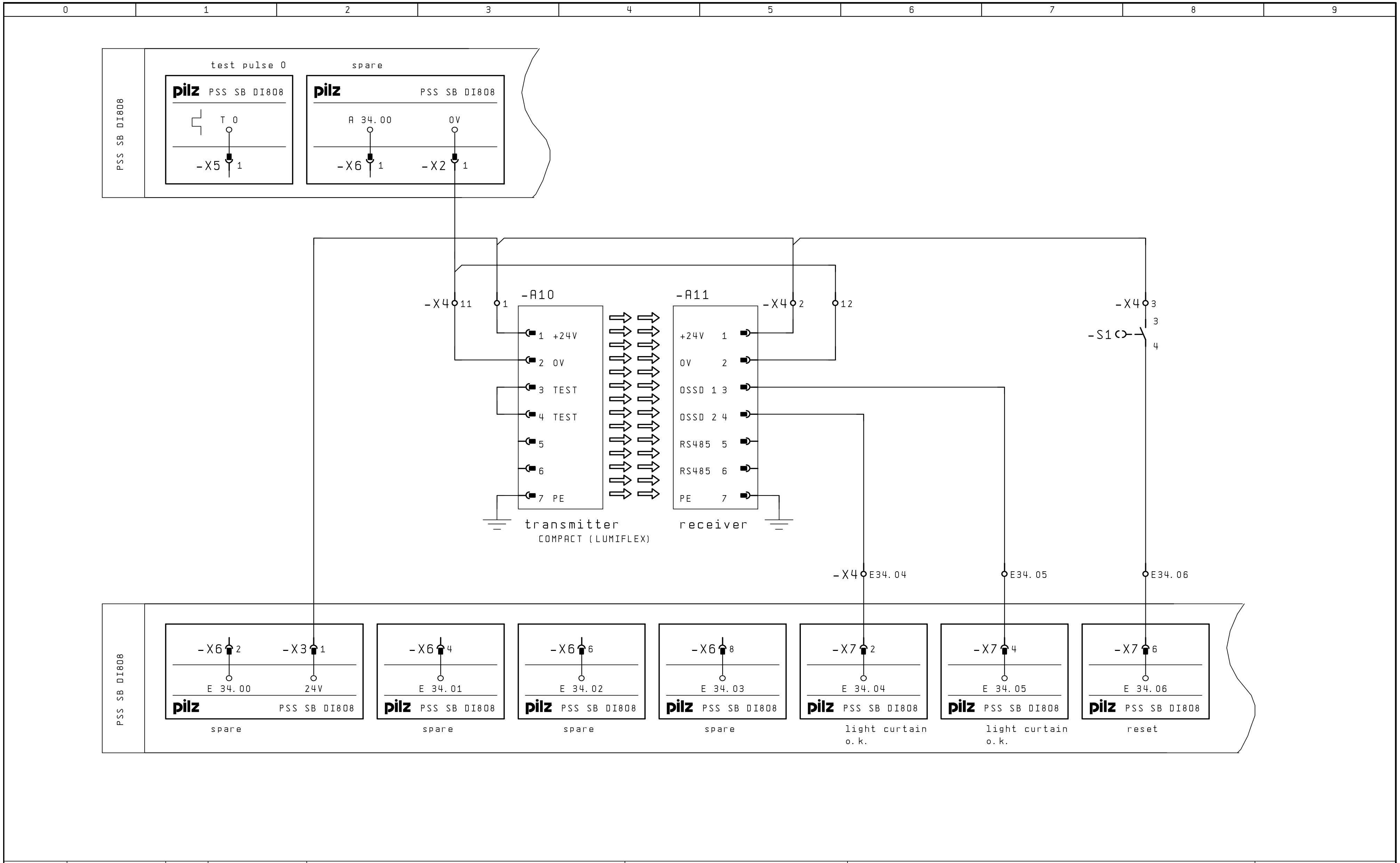
Number	Description	Order number	
1	PSS SB 3006 DP-S	301 460	
1	PSS SB DI8O8	301 140	
1	PSS SB screw connectors	311 060	**or**
1	PSS SB spring-loaded terminals	311 061	
2	PSS SB SUB-D1	311 051	
1	PSS SB cable	311 070	
1	PSS-SB-TRA	301 175B	

Other safety light barriers

Manufacturer	Type
Sick	FGS
Fiessler	ULVT
Pepperl & Fuchs/Visolux	SLC

Drawing file

Page 30 in the project “Eplan4/Pilz/APPL0703”


0
1
2
3
4
5
6
7
8
9
PSS SB DI8O8
test pulse 0
spare
pilz PSS SB DI8O8
T 0
-X5 1
pilz PSS SB DI8O8
A 34.00
0V
-X6 1
-X2 1
-X4 11
1
-A10
-A11
-X4 2
12
-X4 3
3
-S1
4
1 +24V
2 0V
3 TEST
4 TEST
5
6
7 PE
+24V 1
0V 2
OSSD 1 3
OSSD 2 4
RS485 5
RS485 6
PE 7
transmitter
COMPACT (LUMIFLEX)
receiver
-X4 E34.04
E34.05
E34.06
PSS SB DI8O8
-X6 2
-X3 1
E 34.00
24V
pilz PSS SB DI8O8
spare
-X6 4
E 34.01
pilz PSS SB DI8O8
spare
-X6 6
E 34.02
pilz PSS SB DI8O8
spare
-X6 8
E 34.03
pilz PSS SB DI8O8
spare
-X7 2
E 34.04
pilz PSS SB DI8O8
light curtain o.k.
-X7 4
E 34.05
pilz PSS SB DI8O8
light curtain o.k.
-X7 6
E 34.06
pilz PSS SB DI8O8
reset

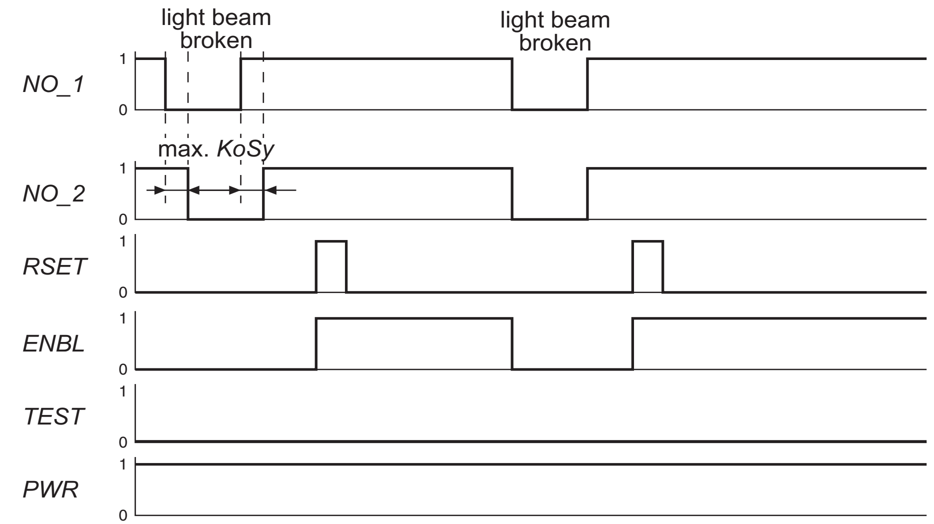
Revision	30.Apr.2003	Date	22.Apr.2003	AOPD in guard mode	pilz	Pilz GmbH & Co. Felix-Wankel-Str.2 73760 Ostfildern	SafetyBUS p light curtain monitoring of the type Compact (Co.Lumiflex)	Directory: Eplan4/Pilz/Appl0703
Name	CLE	Name	CLE					
				Category 4 EN 954-1				Page: 30
		Dep.	CS					

Category 4, EN 954-1

SafetyBUS p – Monitoring a light barrier (various manufacturers)

Timing diagram

Parameters set on SB069
- Operating mode “AOPD operates as guarding device”: *GdOn* = 1
- Reset lock (acknowledgement required after clearing the protected field): *ARSt* = 0
- Function test on PSS warm start, PSS cold start and after the protected field is interrupted: *SSeq* = 0



KoSy: Contact synchronisation time between 2 N/O contacts, entered by the user

Program

```
                                    SB069
                                  AOPD_GDO

KB  001                    - B -  SSNR       ENBL  - X  - M   080.00 .Enable
E   34.04   .AOPD-NO_1     - X -  NO_1       TEST  - X  - M   099.30 .TestOutput
E   34.05   .AOPD-NO_2     - X -  NO_2       PWR   - X  - M   099.31 .Sply.Volt. AOPD
M   110.01  .RLO-1         - X -  GdOn
KB  150                    - B -  MTD
M   110.00  .RLO-0         - X -  SSeq
M   110.00  .RLO-0         - X -  ARSt
M   110.00  .RLO-0         - X -  Test
E   34.06   .Reset_button  - X -  RSET
```

Please note:
A “Minimum scan time” must be specified in the configurator of the PSS SW PG system software.

Global parameters used in administration data block DB015
- DW1001: Cycles for the contact synchronisation time N/O / N/O

The global parameter may be set in OB120 using SB070.

Additional blocks required
- DB015: Administration data block
  DB015 must consist of its total length of 1024 data words. DB015 must be declared READ/WRITE.
- SB070: Initialisation of global parameters in DB015.

Notes

Category 3, EN 954-1

PSS 3100 – Monitoring a “PLS” area scanner (Sick)

Features

- Dual-channel redundancy
- Manual reset when the PSS is cold/ warm started
- Reset lock
- Failsafe standard function block used: SB063 (E-STOP)
- Contact synchronisation time monitored in SB063
- PSS inputs monitored for input errors via output test on AOPD

Description

Area scanner monitoring function

In this example the safety system monitors the two safe semiconductor outputs on the “PLS” area scanner from Sick. Within the user program, the failsafe standard function block SB063 is assigned to the semiconductor outputs. SB063 detects an interruption to the protected field, as well as detecting incorrect input signals, such as a reset button that is constantly operated.

If the protected field is interrupted or an error occurs, the enable output *ENBL* on SB063 will immediately be reset.

The enable output *ENBL* is also reset when the PSS is stopped and when the PSS is switched on.

The signal at the enable output *ENBL* must be evaluated by the user program and trigger an appropriate reaction. SB063 stores a value in DB015, which can be used to determine why *ENBL* was reset.

The way in which the error is reset will depend on the operating mode set on SB063.

In this application example, parameters for SB063 have been set in such a way that it is necessary to reset by pressing the key switch S1 (0/1 pulse edge at *RSET)* in order to reset enable output *ENBL* on SB063 when the PSS is cold started (PSS switched from off to on), warm started (PSS transferring from STOP to RUN) or after the protected field has been cleared (restart).

Safety assessment

- A short between 24 VDC and a PSS input circuit will be detected as an error by the AOPD; the inputs are shut down.
- A short between the PSS input circuits will be detected as an error by the AOPD; the inputs are shut down.

Classification in accordance with EN 954-1

Depending on the application area and its respective regulations, this connection example is suitable for applications up to category 3 in accordance with EN 954-1, as the area scanner may only be used up to category 3 due to a design restriction.

Pilz products

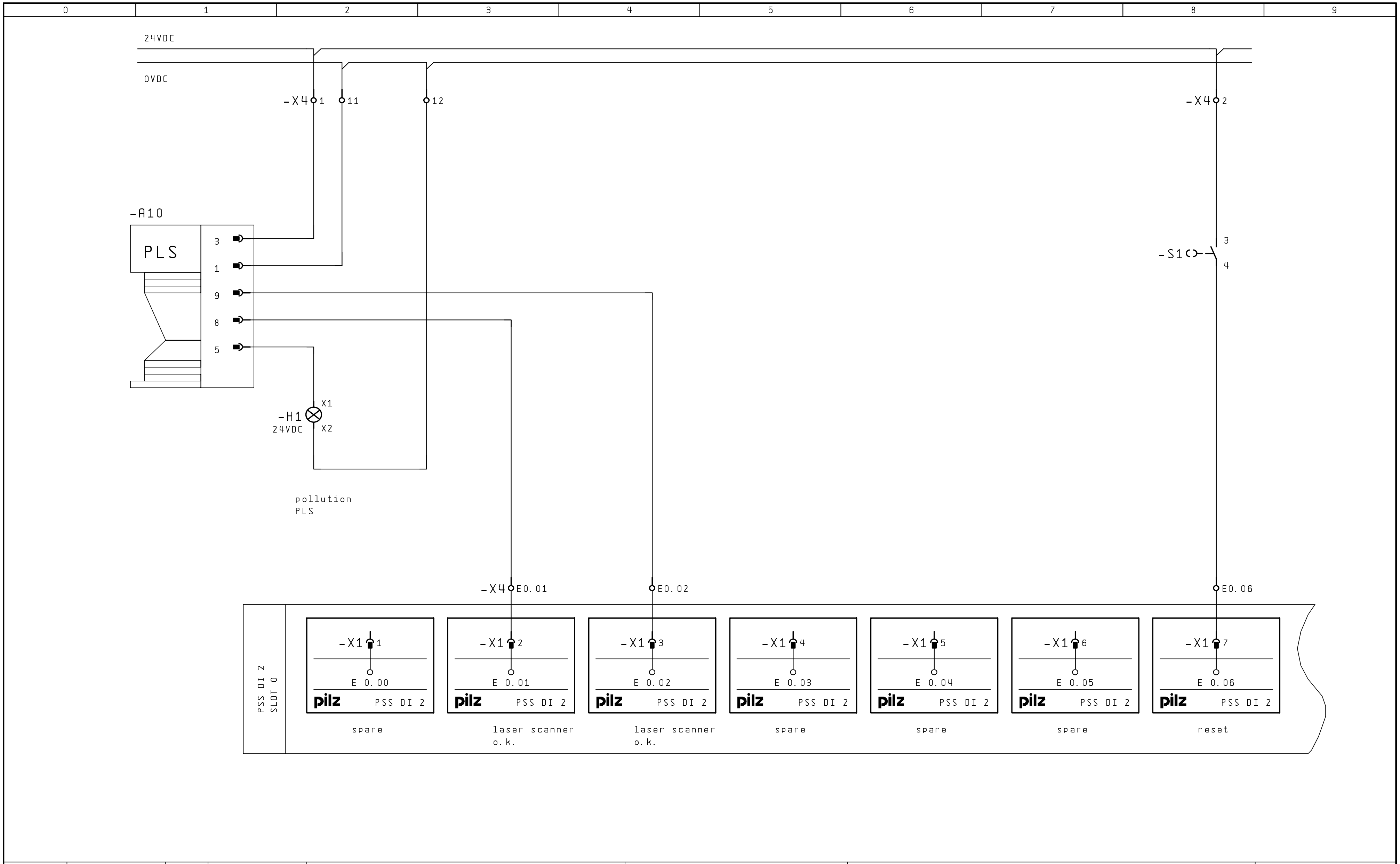
Number	Description	Order number
1	PSS1 CPU 3	302 064
1	PSS1 BMP 3/1	302 007
1	PSS1 DI 2	302 101
1	PSS-SB-NOT	301 176B

Other area scanners

Manufacturer	Type-Series	Example type
Schmersal	LSS 300-1	LS 300-1110
Schmersal	LSS 300-2	LS 300-2110
Leuze Lumiflex		Rotoscan RS4-4

Drawing file

Page 16 in the project “Eplan4/Pilz/APPL0703”


0
1
2
3
4
5
6
7
8
9
24VDC
0VDC
-X4 1
11
12
-X4 2
-A10
PLS
3
1
9
8
5
-S1
3
4
-H1
24VDC
X1
X2
pollution
PLS
-X4 E0.01
E0.02
E0.06
PSS DI 2
SLOT 0
-X1 1
E 0.00
pilz PSS DI 2
spare
-X1 2
E 0.01
pilz PSS DI 2
laser scanner o.k.
-X1 3
E 0.02
pilz PSS DI 2
laser scanner o.k.
-X1 4
E 0.03
pilz PSS DI 2
spare
-X1 5
E 0.04
pilz PSS DI 2
spare
-X1 6
E 0.05
pilz PSS DI 2
spare
-X1 7
E 0.06
pilz PSS DI 2
reset

Revision	30.Apr.2003	Date	22.Apr.2003	laser scanner in guard mode	Pilz GmbH & Co. Felix-Wankel-Str.2 73760 Ostfildern	PSS 3000 laser scanner monitoring of the type PLS (Co.Sick)	Directory: Eplan4/Pilz/Appl0703
Name	CLE	Name	CLE	Category 3 EN 954-1			Page: 16
		Dep.	CS				

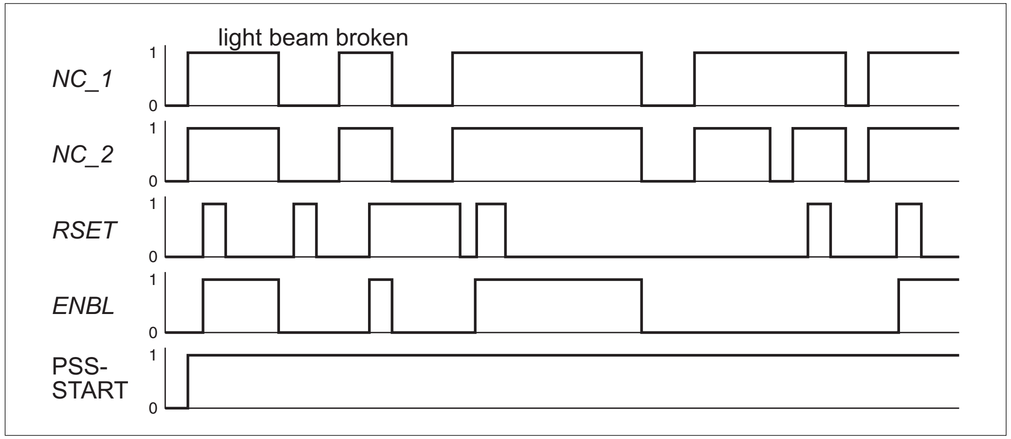
Category 3, EN 954-1

PSS 3100 – Monitoring a “PLS” area scanner (Sick)

Timing diagram

Parameters set on SB063

- Without SafetyBUS p connection:
  GRP = RLO-1
- Manual reset when PSS is cold/warm started:
  AuSt = 0
- Manual reset after clearing the protected field:
  ARSt = 0
- Function test required:
  FTST = 1



Program

Additional commands (insert before SB063 in the program):

```
: L    PB00.00
: OR  EB00.00
: T    EB00.00
```

```
                                      SB063
                                     E-STOP

KB  000003                - W -  SSNR       ENBL  - X  - M   070.02 .Enable-PLS
M    110.01  .RLO-1       -  X -  GRP
E    0.01    .PLS-Outp-1  -  X -  NC_1
E    0.02    .PLS-Outp-2  -  X -  NC_2
M    110.00  .RLO-0       -  X -  AuSt
M    110.00  .RLO-0       -  X -  ARst
M    110.01  .RLO-1       -  X -  FTST
E    0.06    .RESET       -  X -  RSET
```

Please note:
A “Minimum scan time” must be specified in the configurator of the PSS SW PG system software.

Global parameters used in administration data block DB015, DB016, DB017

- DW1001: Number of cycles in the contact synchronisation time between the 2 semiconductor outputs on the area scanner

Global parameters may be set in OB120 using SB071.

Additional blocks required

- DB015, DB016, DB017: Administration data block
  DB015, DB016 and DB017 must consist of their total length of 1024 data words. DB015, DB016 and DB017 must be declared READ/WRITE.
- SB071: Initialisation of global parameters in DB015, DB016, DB017
- SB255: Operating system call

Notes

Category 3, EN 954-1
SafetyBUS p – Monitoring a “PLS” area scanner (Sick)

Features

- Dual-channel redundancy
- Manual reset when the PSS is cold/warm started and when starting the SafetyBUS p I/O-Groups
- Reset lock
- Failsafe standard function block used: SB063 (E-STOP)

Description

Area scanner monitoring function
In this example the safety system with the safe bus system SafetyBUS p monitors the two safe semiconductor outputs on the “PLS” area scanner from Sick. Within the user program, the failsafe standard function block SB063 is assigned to the semiconductor outputs. SB063 detects an interruption to the protected field, as well as detecting incorrect input signals, such as a reset button that is constantly operated.
If the protected field is interrupted or an error occurs, the enable output *ENBL* on SB063 will immediately be reset.
The enable output *ENBL* is also reset when the PSS is stopped and when the PSS is switched on.
The signal at the enable output *ENBL* must be evaluated by the user program and trigger an appropriate reaction. SB063 stores a value in DB015, which can be used to determine why *ENBL* was reset.
The way in which the error is reset will depend on the operating mode set on SB063.
In this application example, parameters for SB063 have been set in such a way that it is necessary to reset by pressing the key switch S1 (0/1 pulse edge at *RSET*) in order to reset enable output *ENBL* on SB063 when the PSS is cold started (PSS switched from off to on), warm started (PSS transferring from STOP to RUN) or after the protected field has been cleared (restart).

Safety assessment

- A short between 24 VDC and a PSS input circuit will be detected as an error by the AOPD; the inputs are shut down.
- A short between the PSS input circuits will be detected as an error by the AOPD; the inputs are shut down.

Classification in accordance with EN 954-1
Depending on the application area and its respective regulations, this connection example is suitable for applications up to category 3 in accordance with EN 954-1, as the area scanner may only be used up to category 3 due to a design restriction.

Pilz products

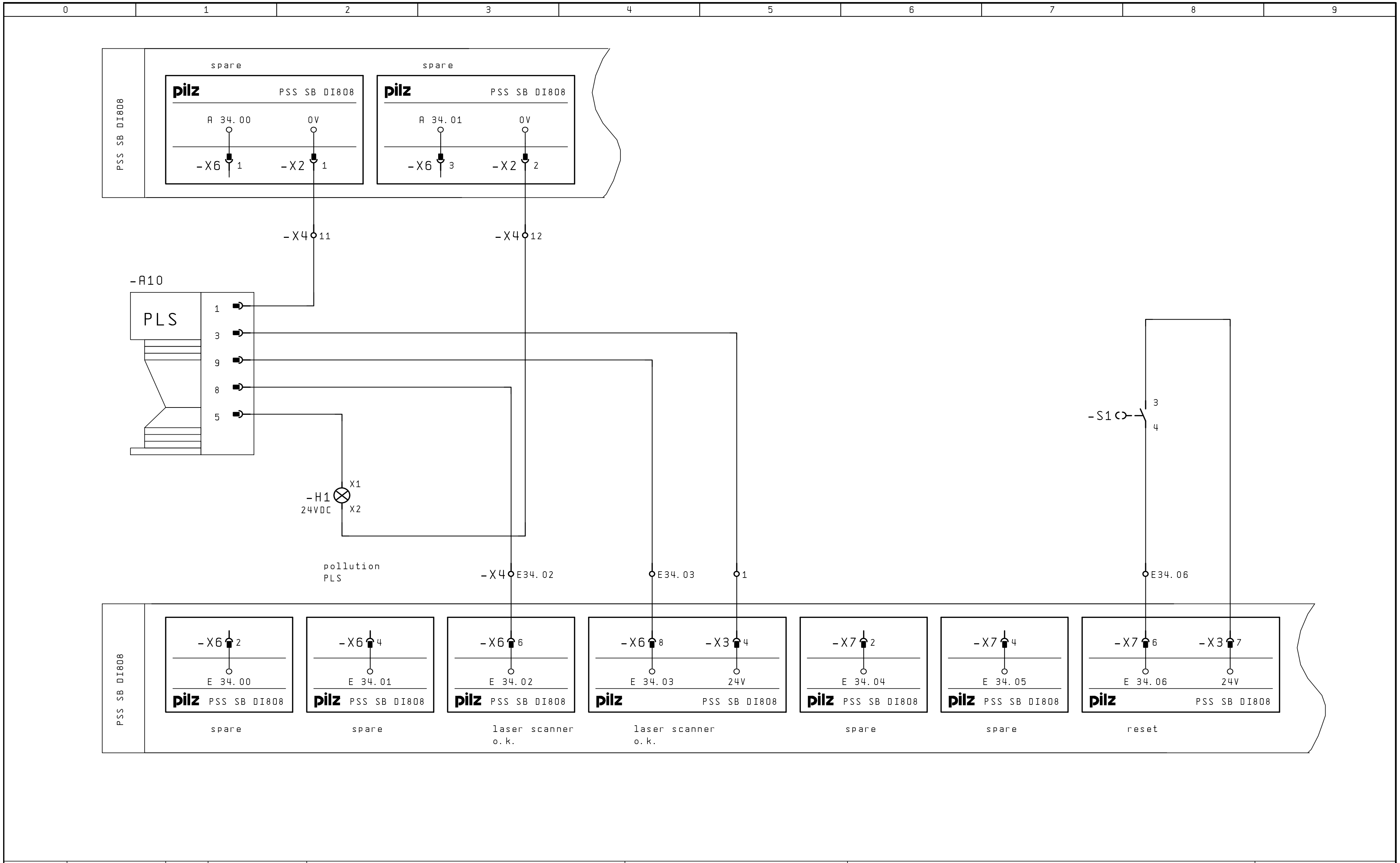
Number	Description	Order number	
1	PSS SB 3006 DP-S	301 460	
1	PSS SB DI8O8	301 140	
1	PSS SB screw connectors	311 060	**or**
1	PSS SB spring-loaded terminals	311 061	
2	PSS SB SUB-D1	311 051	
1	PSS SB cable	311 070	
1	PSS-SB-NOT	301 176B	

Other area scanners

Manufacturer	Type-Series	Example type
Schmersal	LSS 300-1	LS 300-1110
Schmersal	LSS 300-2	LS 300-2110
Leuze Lumiflex		Rotoscan RS4-4

Drawing file

Page 32 in the project “Eplan4/Pilz/APPL0703”


0
1
2
3
4
5
6
7
8
9
PSS SB DI808
spare
spare
pilz PSS SB DI808
A 34.00
0V
-X6 1
-X2 1
pilz PSS SB DI808
A 34.01
0V
-X6 3
-X2 2
-X4 11
-X4 12
-A10
PLS
1
3
9
8
5
-H1
24VDC
X1
X2
-S1
3
4
pollution
PLS
-X4 E34.02
E34.03
1
E34.06
PSS SB DI808
-X6 2
E 34.00
pilz PSS SB DI808
spare
-X6 4
E 34.01
pilz PSS SB DI808
spare
-X6 6
E 34.02
pilz PSS SB DI808
laser scanner
o.k.
-X6 8
-X3 4
E 34.03
24V
pilz PSS SB DI808
laser scanner
o.k.
-X7 2
E 34.04
pilz PSS SB DI808
spare
-X7 4
E 34.05
pilz PSS SB DI808
spare
-X7 6
-X3 7
E 34.06
24V
pilz PSS SB DI808
reset

Revision	10. Jul. 2003	Date	22. Apr. 2003	laser scanner in guard mode	pilz	Pilz GmbH & Co. Felix-Wankel-Str. 2 73760 Ostfildern	SafetyBUS p laser scanner monitoring of the type PLS (Co. Sick)	Directory: Eplan4/Pilz/Appl0703
Name	CLE	Name	CLE					
				Category 3 EN 954-1				Page: 32
		Dep.	CS					

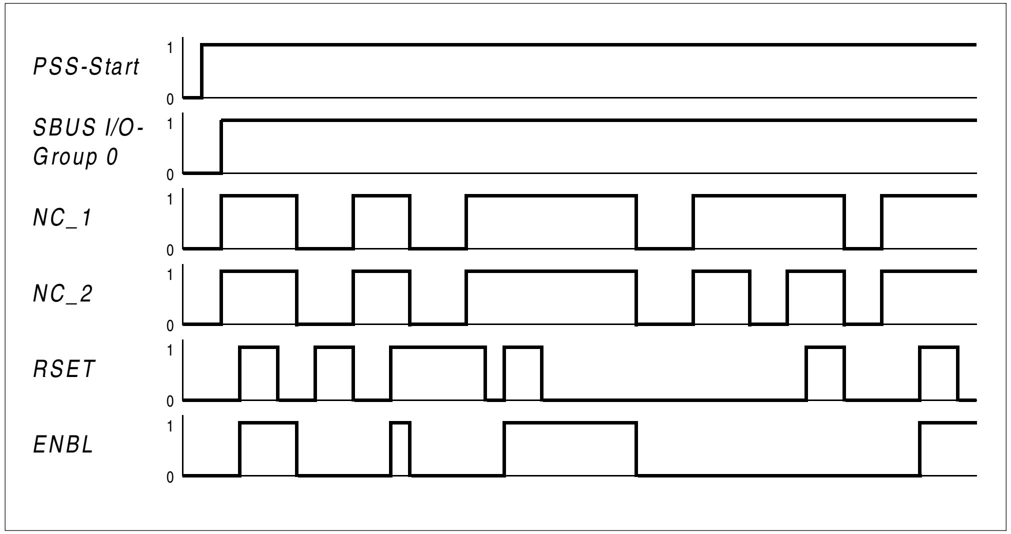
Category 3, EN 954-1

SafetyBUS p – Monitoring a “PLS” area scanner (Sick)

Timing diagram

Parameters set on SB063

- With SafetyBUS p connection:
  GRP = M116.00 for I/O-Group 0
- Manual reset when PSS is cold/warm started:
  AuSt = 0
- Manual reset after clearing the protected field:
  ARSt = 0
- Function test required:
  FTST = 1



```
                                             SB063
                                            E-STOP

KF  000003                     - W -  SSNR        ENBL  - X  - M   70.02  .Enable-PLS
M   116.00  .IO-Group_00       - X -  GRP
E   34.02   .PLS-Outp-1        - X -  NC_1
E   34.03   .PLS-Outp-2        - X -  NC_2
M   110.00  .RLO-0             - X -  AuSt
M   110.00  .RLO-0             - X -  ARst
M   110.01  .RLO-1             - X -  FTST
E   34.06   .RESET             - X -  RSET
```

Please note:
A “Minimum scan time” must be specified in the configurator of the PSS SW PG system software.

Global parameters used in administration data block DB015, DB016, DB017

- DW1001: Number of cycles in the contact synchronisation time between the 2 semiconductor outputs on the area scanner

Global parameters may be set in OB120 using SB071.

Additional blocks required

- DB015, DB016, DB017: Administration data block
  DB015, DB016 and DB017 must consist of their total length of 1024 data words. DB015, DB016 and DB017 must be declared READ/WRITE.
- SB071: Initialisation of global parameters in DB015, DB016, DB017
- SB255: Operating system call

Notes

Category 2, EN 954-1

PSS 3000 – AOPD monitoring

Features

- Single-channel
- Manual reset when the PSS is cold/ warm started
- Reset lock
- Function test required on the AOPD when the PSS is cold and warm started
- Failsafe standard function block used: SB069 (AOPD_GDO)
- External function test on the light barriers, periodic test required through PSS or manually through operator

Description

AOPD monitoring function
On an operator field, the possibility of defeating a mechanical guard is to be prevented.
In this example the safety system monitors the semiconductor output on an active optoelectronic protective device (AOPD). Within the user program, the failsafe standard function block SB069 is assigned to the semiconductor output. SB069 detects an interruption to the protected field, as well as detecting incorrect input signals, such as a reset button that is constantly operated. If the protected field is interrupted or an error occurs, the enable output *ENBL* on SB069 will immediately be reset. The enable output *ENBL* is also reset when the PSS is stopped and when the PSS is switched on.
The signal at the enable output *ENBL* must be evaluated by the user program and trigger an appropriate reaction. SB069 stores a value in DB015, which can be used to determine why *ENBL* was reset.
The way in which the error is reset will depend on the operating mode set on SB069. In this application example, parameters for SB069 have been set in such a way that it is necessary to reset by pressing the key switch S1 (0/1 pulse edge at *RSET*) in order to reset enable output *ENBL* on SB069 when the PSS is cold started (PSS switched from off to on), warm started (PSS transferring from STOP to RUN) or when the protected field is cleared (restart). Parameters on SB069 also stipulate that the AOPD must undergo a function test (protected field interrupted and then cleared) during a cold and warm start.
The function of the AOPD must also be tested at suitable intervals during operation (IEC 61 496). In the PSS program, standard function block SB069 triggers an external function test at four-hourly intervals or via a manual request (pushbutton S2). At the time the test is required (M88.16 = RLO-1), the machine must be in a safe condition for any potential operator access.
The external test may last a maximum of 150 ms (in accordance with EN 61 496-1, section 5.2.4, 06/98, see input parameter MTD).
Please note: The Sick Type 2 light barrier from the C2000 BWS series performs a self check. If both OSSD outputs are used, there is no need for an external test. If output A0.24 is used to fulfil the test requirement in the PSS program, a maximum of 8 different test pulses may be used to feed the input circuit (A0.16 to A0.23).

Safety assessment

- A short between 24 VDC and an OSSD output will be detected as an error by the AOPD. Both OSSD outputs will be shut down. However, as only one OSSD output is wired, this error will not be detected until the next time standard function block SB069 runs the test.

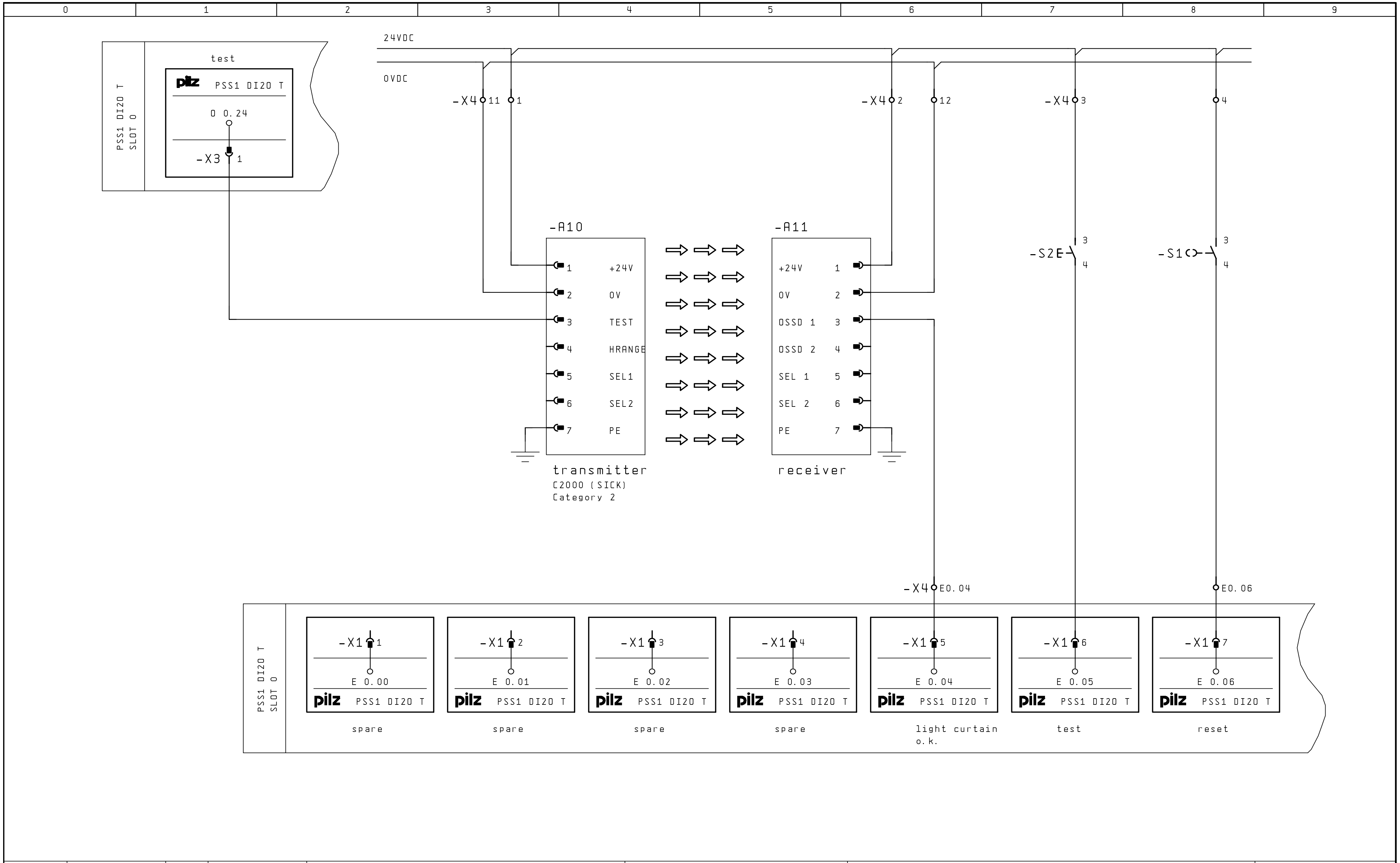
Pilz products

Number	Description	Order number
1	PSS1 CPU 3	302 064
1	PSS1 BMPS 3/1	302 007
1	PSS1 DI2O T	302 112
1	PSS-SB-TRA	301 175B

Drawing file

Page 8 in the project “Eplan4/Pilz/APPL0703”

Classification in accordance with EN 954-1
Depending on the application area and its respective regulations, this connection example is suitable for applications up to category 2, in accordance with EN 954-1.


0
1
2
3
4
5
6
7
8
9
PSS1 DI20 T
SLOT 0
test
pilz PSS1 DI20 T
O 0.24
-X3 1
24VDC
0VDC
-X4 11
1
-X4 2
12
-X4 3
4
-A10
1 +24V
2 0V
3 TEST
4 HRANGE
5 SEL1
6 SEL2
7 PE
transmitter
C2000 (SICK)
Category 2
-A11
+24V 1
0V 2
OSSD 1 3
OSSD 2 4
SEL 1 5
SEL 2 6
PE 7
receiver
-S2E 3 4
-S1 3 4
-X4 E0.04
E0.06
PSS1 DI20 T
SLOT 0
-X1 1
E 0.00
pilz PSS1 DI20 T
spare
-X1 2
E 0.01
pilz PSS1 DI20 T
spare
-X1 3
E 0.02
pilz PSS1 DI20 T
spare
-X1 4
E 0.03
pilz PSS1 DI20 T
spare
-X1 5
E 0.04
pilz PSS1 DI20 T
light curtain
o.k.
-X1 6
E 0.05
pilz PSS1 DI20 T
test
-X1 7
E 0.06
pilz PSS1 DI20 T
reset

Revision	05.Mai.2003	Date	22.Apr.2003	AOPD in guard mode
Name	CLE	Name	CLE	
				Category 2 EN 954-1
		Dep.	CS	

pilz
Pilz GmbH & Co.
Felix-Wankel-Str. 2
73760 Ostfildern

light curtain monitoring with PSS 3100

Directory:
Eplan4/Pilz/Appl0703

Page: 8

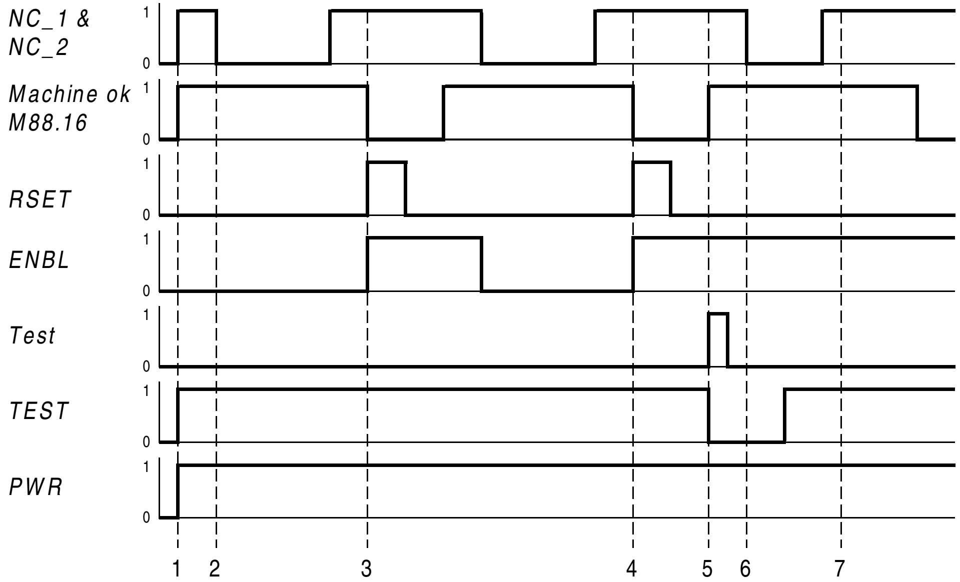
Category 2, EN 954-1

PSS 3000 – AOPD monitoring

Timing diagram

Parameters set on SB069

- Operating mode “AOPD operates as guarding device”: *GdOn* = 1
- Maximum permitted duration of the whole automatic function test on the ESPE/AOPD: MTD = 150ms
- Function test on PSS warm start/PSS cold start and after the protected field is interrupted: SSeq = 0
- Reset lock (acknowledgement required after clearing the protected field): *ARSt* = 0
- Test input (simulating a break in the protected field)
  Test = 0/1-pulse edge: A test cycle is started. Output parameter *TEST* is set to “0”, i.e. the ESPE/AOPD transmitter is switched off.
- Reset button (N/O), reset occurs at a 0/1 pulse edge:
  RSET = E0.06
- Test output:
  TEST = 0: Simulated break in protected field/function test of ESPE/AOPD by switching off the ESPE/AOPD transmitter
  TEST = 1: ESPE/AOPD transmitter in operation
- Voltage supply to light barrier is not switched off:
  PWR = M99.31 (do not use this flag elsewhere)



1: Status after PSS starts
2: Function test on light barrier via operator intervention
3: Monitoring of light barrier starts
4: Monitoring of light barrier starts again
5: External test requirement, formed within PSS logic
6: External test requirement, start testing with light barrier
7: External test requirement, testing of light barrier successful (ENBL=1)

Category 2, EN 954-1

PSS 3000 – AOPD monitoring

Program

Additional commands (insert before SB069 in the program):

```
:  L    KF000240
:  LN   T064.4      Timer-Test
:  SE   T064.2      Timer-Test
:  =N   M77.00      Auto-Test

:  L    M77.00      Auto_Test
:  O    E0.05       Manu-Test
:  U    M70.00      Enable
:  U    M88.16      Ms_Pos_OK
:  =    M77.00      Auto-Test
```

```
                                  SB069
                                AOPD_GDO

KB  001                    - B - SSNR      ENBL - X  - M  70.00  .Enable
E   0.04    .AOPD-NO       - X - NO_1      TEST - X  - A  0.24   .Test
E   0.04    .AOPD-NO       - X - NO_2       PWR - X  - M  99.31  .temp
M   110.01  .RLO-1         - X - GdOn
KB  150                    - B - MTD
M   110.00  .RLO-0         - X - SSeq
M   110.00  .RLO-0         - X - ARSt
M   77.00   .Auto_Test     - X - Test
E   0.06    .Reset_button  - X - RSET
```

Please note:
A “Minimum scan time” must be specified in the configurator of the PSS SW PG system software.

Global parameters used in administration data block DB015

- DW1001: Number of cycles in the switch synchronisation time between the two AOPD input circuits
- DW1022: Minimum scan time

The global parameter may be set in OB120 using SB070.

Additional blocks required

- DB015: Administration data block
  DB015 must consist of its total length of 1024 data words. DB015 must be declared READ/WRITE.
- SB070: Initialisation of global parameters in DB015

Category 2, EN 954-1

SafetyBUS p – AOPD monitoring

Features

- Single-channel
- Manual reset when the PSS is cold/ warm started
- Reset lock
- Function test required on the AOPD when the PSS is cold and warm started
- Failsafe standard function block used: SB069 (AOPD_GDO)
- External function test on the light barriers, periodic test required through PSS or manually through operator

Description

AOPD monitoring function
On an operator field, the possibility of defeating a mechanical guard is to be prevented.
In this example the safety system with the safe bus system SafetyBUS p monitors the semiconductor output on an active optoelectronic protective device (AOPD). Within the user program, the failsafe standard function block SB069 is assigned to the semiconductor output. SB069 detects an interruption to the protected field, as well as detecting incorrect input signals, such as a reset button that is constantly operated. If the protected field is interrupted or an error occurs, the enable output *ENBL* on SB069 will immediately be reset. The enable output *ENBL* is also reset when the PSS is stopped and when the PSS is switched on.
The signal at the enable output *ENBL* must be evaluated by the user program and trigger an appropriate reaction. SB069 stores a value in DB015, which can be used to determine why *ENBL* was reset.
The way in which the error is reset will depend on the operating mode set on SB069. In this application example, parameters for SB069 have been set in such a way that it is necessary to reset by pressing the key switch S1 (0/1 pulse edge at *RSET*) in order to reset enable output *ENBL* on SB069 when the PSS is cold started (PSS switched from off to on), warm started (PSS transferring from STOP to RUN) or when the protected field is cleared (restart). Parameters on SB069 also stipulate that the AOPD must undergo a function test (protected field interrupted and then cleared) during a cold and warm start.
The function of the AOPD must also be tested at suitable intervals during operation (IEC 61 496). In the PSS program, standard function block SB069 triggers an external function test at four-hourly intervals (in this example) or via a manual request (pushbutton S2). At the time the test is required (M88.16 = RLO-1), the machine must be in a safe condition for any potential operator access.
The external test may last a maximum of 150 ms (in accordance with EN 61 496-1, section 5.2.4, 06/98, see input parameter MTD).
Please note: The Sick Type 2 light barrier from the C2000 BWS series performs a self check. If both OSSD outputs are used, there is no need for an external test. If output A0.24 is used to fulfil the test requirement in the PSS program, a maximum of 8 different test pulses may be used to feed the input circuit (A0.16 to A0.23).

Safety assessment

- A short between 24 VDC and an OSSD output will be detected as an error by the AOPD. Both OSSD outputs will be shut down. However, as only one OSSD output is wired, this error will not be detected until the next time standard function block SB069 runs the test.

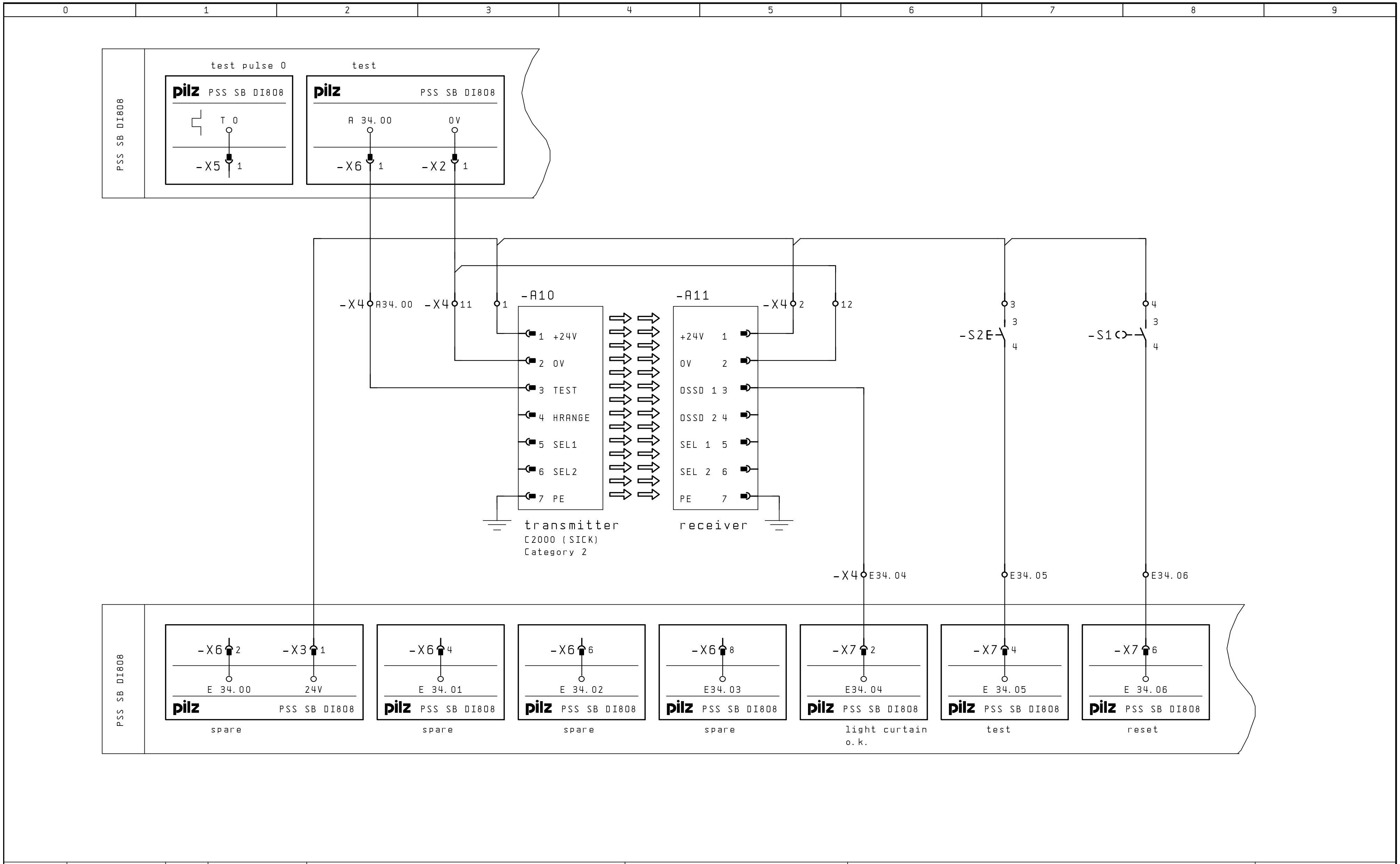
Pilz products

Number	Description	Order number	
1	PSS SB 3006 DP-S	301 460	
1	PSS SB DI8O8	301 140	
1	PSS SB screw connectors	311 060	**or**
1	PSS SB spring-loaded terminals	311 061	
2	PSS SB SUB-D3	311 058	
1	PSS SB cable	311 070	
1	PSS-SB-TRA	301 175B	

Drawing file

Page 24 in the project “Eplan4/Pilz/APPL0703”

Classification in accordance with EN 954-1
Depending on the application area and its respective regulations, this connection example is suitable for applications up to category 2, in accordance with EN 954-1.


0
1
2
3
4
5
6
7
8
9
PSS SB DI808
test pulse 0
test
pilz PSS SB DI808
T 0
-X5 1
pilz PSS SB DI808
A 34.00
0V
-X6 1
-X2 1
-X4 A34.00
-X4 11
1
-A10
-A11
-X4 2
12
3
4
1 +24V
2 0V
3 TEST
4 HRANGE
5 SEL1
6 SEL2
7 PE
+24V 1
0V 2
OSSD 1 3
OSSD 2 4
SEL 1 5
SEL 2 6
PE 7
-S2E 3 4
-S1 3 4
transmitter
C2000 (SICK)
Category 2
receiver
-X4 E34.04
E34.05
E34.06
PSS SB DI808
-X6 2
-X3 1
E 34.00
24V
pilz PSS SB DI808
spare
-X6 4
E 34.01
pilz PSS SB DI808
spare
-X6 6
E 34.02
pilz PSS SB DI808
spare
-X6 8
E34.03
pilz PSS SB DI808
spare
-X7 2
E34.04
pilz PSS SB DI808
light curtain o.k.
-X7 4
E 34.05
pilz PSS SB DI808
test
-X7 6
E 34.06
pilz PSS SB DI808
reset

Revision	30.Apr.2003	Date	22.Apr.2003	AOPD in guard mode	pilz Pilz GmbH & Co. Felix-Wankel-Str.2 73760 Ostfildern	light curtain monitoring with SafetyBUS p	Directory: Eplan4/Pilz/Appl0703
Name	CLE	Name	CLE				
				Category 2 EN 954-1			Page: 24
		Dep.	CS				

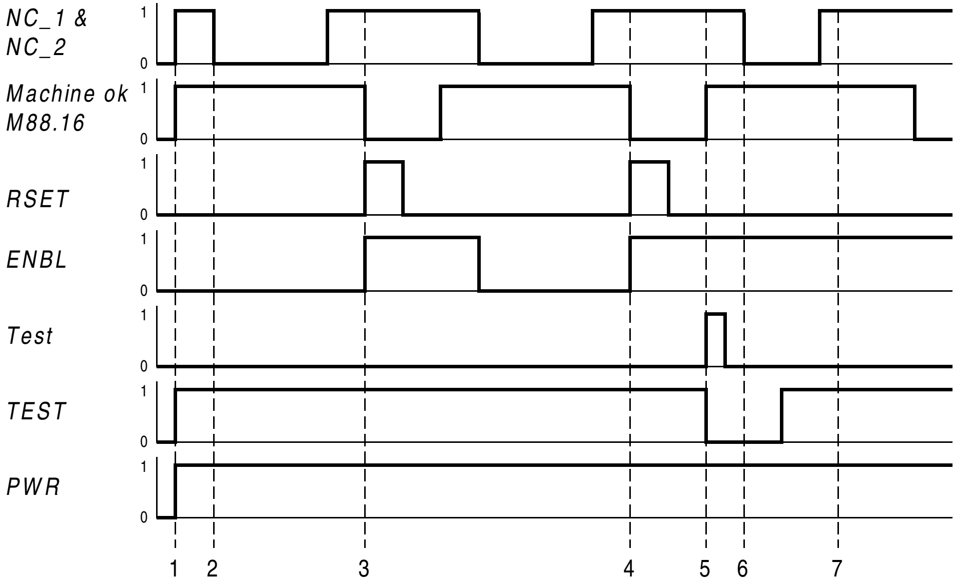
Category 2, EN 954-1

SafetyBUS p – AOPD monitoring

Timing diagram

Parameters set on SB069

- Operating mode “AOPD operates as guarding device”:
  GdOn = 1
- Maximum permitted duration of the whole automatic function test on the ESPE/AOPD:
  MTD = 150ms
- Function test on PSS warm start/PSS cold start and after the protected field is interrupted: SSeq = 0
- Reset lock (acknowledgement required after clearing the protected field): *ARSt* = 0
- Test input (simulating a break in the protected field)
  Test = 0/1-pulse edge: A test cycle is started. Output parameter *TEST* is set to “0”, i.e. the ESPE/AOPD transmitter is switched off.
- Reset button (N/O), reset occurs at a 0/1 pulse edge:
  RSET = E34.06
- Test output:
  TEST = 0: Simulated break in protected field/function test of ESPE/AOPD by switching off the ESPE/AOPD transmitter
  TEST = 1: ESPE/AOPD transmitter in operation
- Voltage supply to light barrier is not switched off:
  PWR = M99.31 (do not use this flag elsewhere)



1: Status after PSS starts
2: Function test on light barrier via operator intervention
3: Monitoring of light barrier starts
4: Monitoring of light barrier starts again
5: External test requirement, formed within PSS logic
6: External test requirement, start testing with light barrier
7: External test requirement, testing of light barrier successful (ENBL=1)

Category 2, EN 954-1

SafetyBUS p – AOPD monitoring

Program

Additional commands (insert before SB069 in the program):

```
:  L    KF000240
:  LN   T064.4      Timer-Test
:  SE   T064.2      Timer-Test
:  =N   M77.00      Auto-Test

:  L    M77.00      Auto_Test
:  O    E34.05      Manu-Test
:  U    M70.00      Enable
:  U    M88.16      Ms_Pos_OK
:  =    M77.00      Auto-Test
```

```
                                    +------------------+
                                    |      SB069       |
                                    |     AOPD_GDO     |
                                    |                  |
KB  001                       - B - | SSNR        ENBL | - X  - M  070.00 .Enable
E   34.04   .AOPD-NO          - X - | NO_1        TEST | - X  - A  34.00  .Test
E   34.04   .AOPD-NO          - X - | NO_2         PWR | - X  - M  099.31 .tempp
M   110.01  .RLO-1            - X - | GdOn             |
KB  150                       - B - | MTD              |
M   110.00  .RLO-0            - X - | SSeq             |
M   110.00  .RLO-0            - X - | ARSt             |
M   77.00   .Auto_Test        - X - | Test             |
E   34.06   .Reset_button     - X - | RSET             |
                                    +------------------+
```

Please note:
A “Minimum scan time” must be specified in the configurator of the PSS SW PG system software.

Global parameters used in administration data block DB015

- DW1001: Number of cycles in the switch synchronisation time between the two AOPD input circuits
- DW1022: Minimum scan time

The global parameter may be set in OB120 using SB070.

Additional blocks required

- DB015: Administration data block
  DB015 must consist of its total length of 1024 data words. DB015 must be declared READ/WRITE.
- SB070: Initialisation of global parameters in DB015

Category 3, EN 954-1

PSS 3000 – Safety mat monitoring

Features

- Single-channel
- Manual reset when the PSS is cold/warm started
- Manual reset after safety mat is cleared
- Structure of safety mats: positive-guided N/C contacts connected in series
- Failsafe standard function block used: SB063 (E-STOP)

Description

Safety mat monitoring function:
In this example the safety system monitors the HSM safety mat A1. Within the user program, the failsafe standard function block SB063 is assigned to the safety mat. SB063 detects whether the safety mat has been accessed, as well as detecting incorrect input signals, such as a reset button that is constantly operated.
If the safety mat is accessed or an error occurs, the enable output on the relevant SB063 will immediately be reset. The enable output *ENBL* is also reset when the PSS is stopped and when the PSS is switched on. The signal at the enable output *ENBL* must be evaluated by the user program and trigger an appropriate reaction. SB063 stores a value in DB015, which can be used to determine why *ENBL* was reset.
The way in which the error is reset will depend on the operating mode set on SB063. In this application example, parameters for SB063 have been set in such a way that it is necessary to reset by pressing S1 (0/1 pulse edge at *RSET*) in order to reset enable output *ENBL* on SB063 when the PSS is cold started (PSS switched from off to on), warm started (PSS transferring from STOP to RUN) or when the safety mat is cleared.
When using a safety mat it is important to note that the permitted load depends on the size of the activated area; this should be clarified with the manufacturer (in accordance with EN 1760-1).

Safety assessment

- If the contacts on the safety mat are overridden in the input circuit, this will not be detected. This error must be excluded by installing the safety mat appropriately.
- A short between 24 VDC and a PSS input circuit will be detected as an error by the programmable safety system.

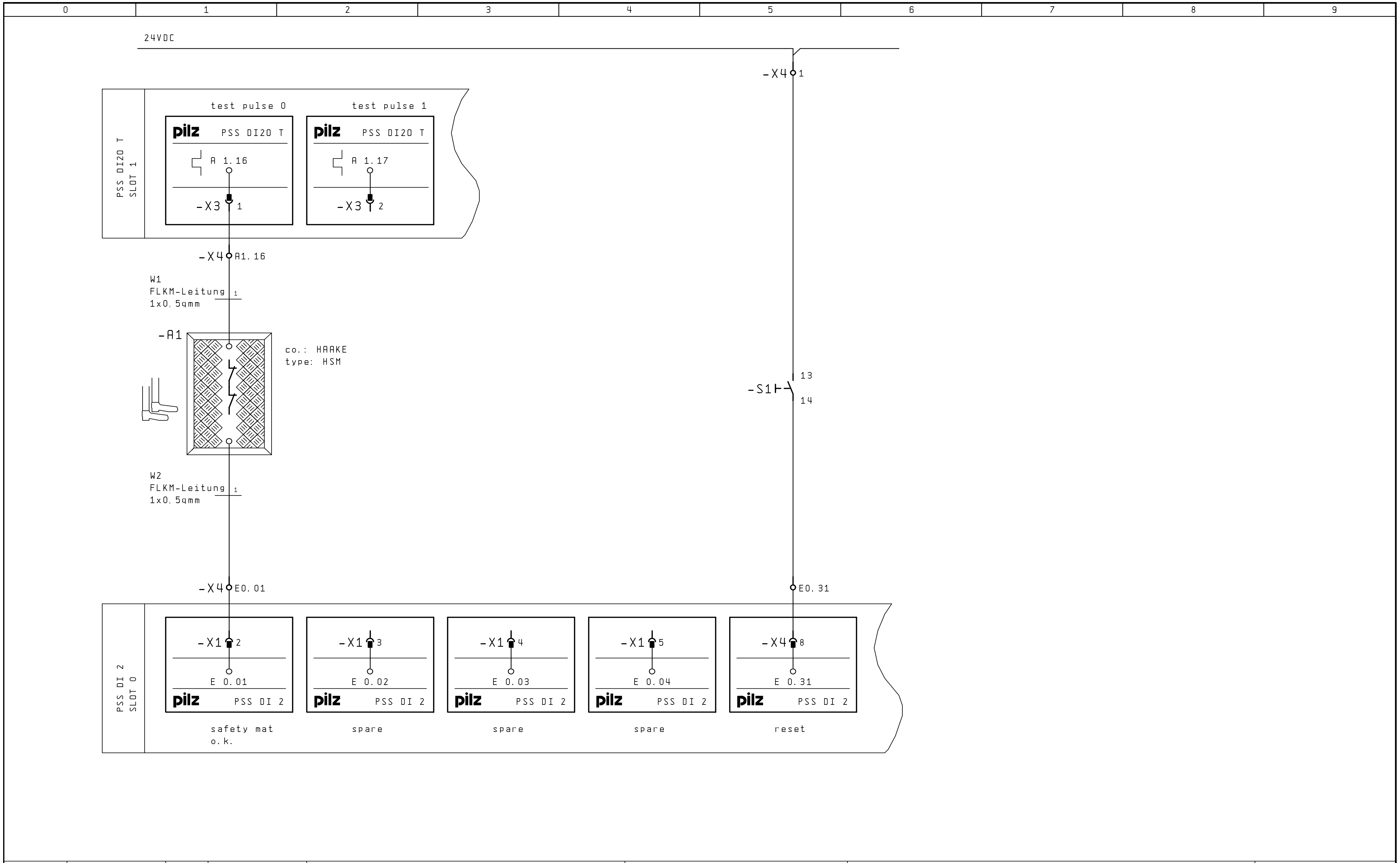
Classification in accordance with EN 954-1
Depending on the application area and its respective regulations, this connection example is suitable for applications up to category 3, in accordance with EN 954-1.

Pilz products

Number	Description	Order number
1	PSS CPU 3	301 064
1	PSS BMP 4/2	301 006
1	PSS PS 24	301 051
1	PSS DI2O T	301 112
1	PSS DI 2	301 101
1	PSS-SB-NOT	301 176B

Drawing file

Page 36 in the project “Eplan4/Pilz/APPL0703”


0
1
2
3
4
5
6
7
8
9
24VDC
-X4 1
PSS DI20 T
SLOT 1
test pulse 0
test pulse 1
pilz PSS DI20 T
A 1.16
-X3 1
pilz PSS DI20 T
A 1.17
-X3 2
-X4 A1.16
W1
FLKM-Leitung 1
1x0,5qmm
-A1
co.: HAAKE
type: HSM
-S1
13
14
W2
FLKM-Leitung 1
1x0,5qmm
-X4 E0.01
E0.31
PSS DI 2
SLOT 0
-X1 2
E 0.01
pilz PSS DI 2
safety mat
o.k.
-X1 3
E 0.02
pilz PSS DI 2
spare
-X1 4
E 0.03
pilz PSS DI 2
spare
-X1 5
E 0.04
pilz PSS DI 2
spare
-X4 8
E 0.31
pilz PSS DI 2
reset

Revision	30.Apr.2003	Date	22.Apr.2003	safety mat applications	Pilz GmbH & Co. Felix-Wankel-Str.2 73760 Ostfildern	safety mat monitoring with PSS 3000	Directory: Eplan4/Pilz/Appl0703
Name	CLE	Name	CLE				
				Category 3 EN 954-1			Page: 36
		Dep.	CS				

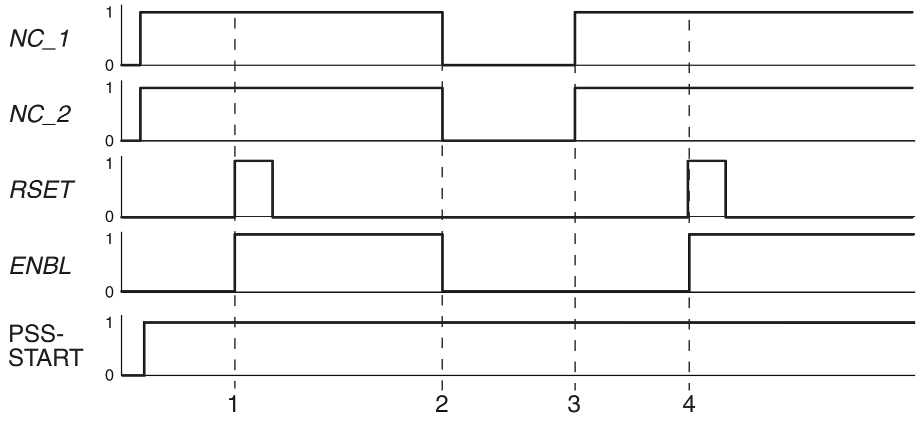
Category 3, EN 954-1

PSS 3000 – Safety mat monitoring

Timing diagram

Parameters set on SB069

- Without SafetyBUS p connection:
  GRP = RLO-1
- Manual reset when PSS is cold/warm started:
  AuSt = 0
- Manual reset after safety mat is cleared:
  ARst = 0
- No function test required
  FTST = 0



1: Normal operation, start-up reset
2: Safety mat accessed
3: Reset lock activated
4: Reset lock reset

Program

```
                                      SB063
                                      E-STOP

KF  000001                    - B -  SSNR        ENBL  - X  - M   70.00  .SM
M   110.01  .RLO_ONE          - X -  GRP
E   0.01    .SM_1             - X -  NC_1
E   0.01    .SM_1             - X -  NC_2
M   110.00  .RLO-0            - X -  AuSt
M   110.00  .RLO-0            - X -  ARst
M   110.00  .RLO-0            - X -  FTST
E   0.31    .Reset            - X -  RSET
```

Please note:
A “Minimum scan time” must be specified in the configurator of the PSS SW PG system software.

Global parameters used in administration data block DB015, DB016, DB017

- DW1001: Number of cycles in the contact synchronisation time between the 2 N/C contacts on the safety mat

The global parameter may be set in OB120 using SB071.

Additional blocks required

- DB015, DB016, DB017: Administration data block
  DB015, DB016 and DB017 must consist of their total length of 1024 data words. DB015, DB016 and DB017 must be declared READ/WRITE.
- SB071: Initialisation of global parameters in DB015, DB016, DB017
- SB255: Operating system call

Notes

Category 4, EN 954-1

SafetyBUS p – Pendulum flap monitoring

Features

- Four-channel redundancy (mechanical switches replaced)
- Automatic reset when the PSS is cold/ warm started and when starting the SafetyBUS p I/O-Groups
- Automatic reset when the pendulum flaps close
- Failsafe standard function block used: SB066 (ST_K4)
- Feasibility test on the input signals in SB066

Description

Two pendulum flaps provide protection from shredder ejections. The shredder may only be switched on when the pendulum flaps are closed. When the pendulum flaps are closed, all the sensors are energised.
In this example the safety system with the safe bus system SafetyBUS p monitors the electrosensitive series proximity switches -A1 and -A2. Each SB066 standard function block resets its enable flag if the assigned N/O contact on the proximity switch opens or the assigned N/C contact closes. SB066 also resets the enable flag if, for example, the input signal at input S1 changes state while the input signal at S2 is constantly set at 1.
The way in which the error is reset will depend on the selected operating mode. In this application example, parameters for SB066 have been set for the system to reset automatically when the PSS is cold started (PSS switched from off to on), warm started (PSS transferring from STOP to RUN after an error has been rectified), when starting the SafetyBUS p I/O-Groups or when closing the pendulum flaps. The output parameter *FG* of SB066 is then reset.
The signal at the enable output *FG* must be evaluated by the user program and trigger an appropriate reaction.
As the switch contacts in this example are replaced by single sensors, the proximity switches are duplicated (four-channel).

Safety assessment

- If a contact on the proximity switch is overridden, standard function block SB066 will detect this as an error at the next operation (opening/closing the pendulum flap).
- A short between the input circuits on a sensor will be detected as an error by standard function block SB066 at the next operation.
- A short between 24 VDC and an input circuit will be detected as an error by standard function block SB066 at the next operation.
- The layout of the installation must exclude the possibility of defeat and must also exclude any external influences that would affect all the sensors on a pendulum flap simultaneously.

Classification in accordance with EN 954-1

Depending on the application area and its respective regulations, this connection example is suitable for applications up to category 4, in accordance with EN 954-1.

Pilz products

Number	Description	Order number	
1	PSS SB 3006 DP-S	301 460	
1	PSS SB DI8O8	301 140	
1	PSS SB screw connectors	311 060	**or**
1	PSS SB spring-loaded terminals	311 061	
2	PSS SB SUB-D1	311 051	
1	PSS SB cable	311 070	
1	PSS-SB-TRA	301 175B	

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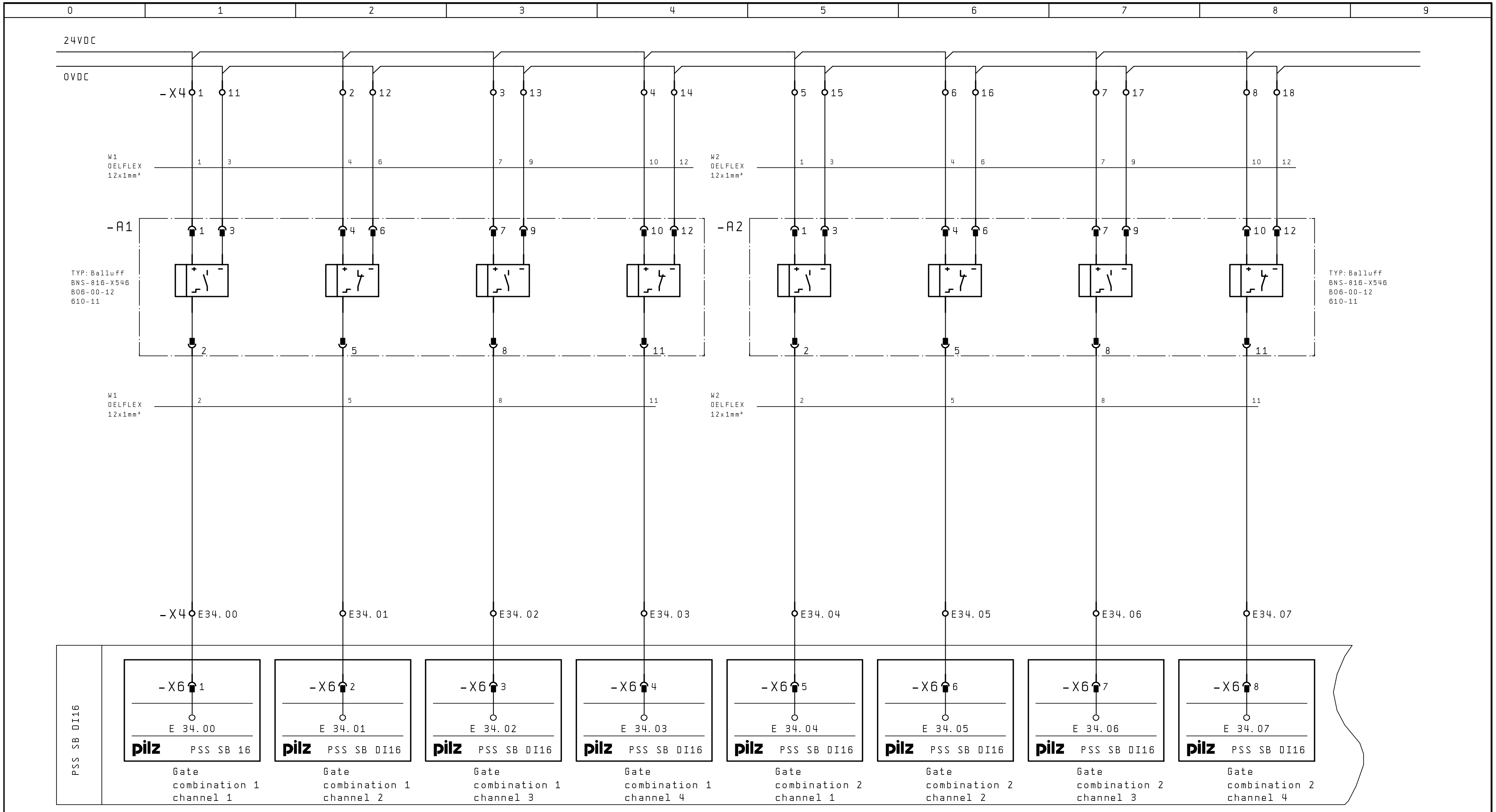
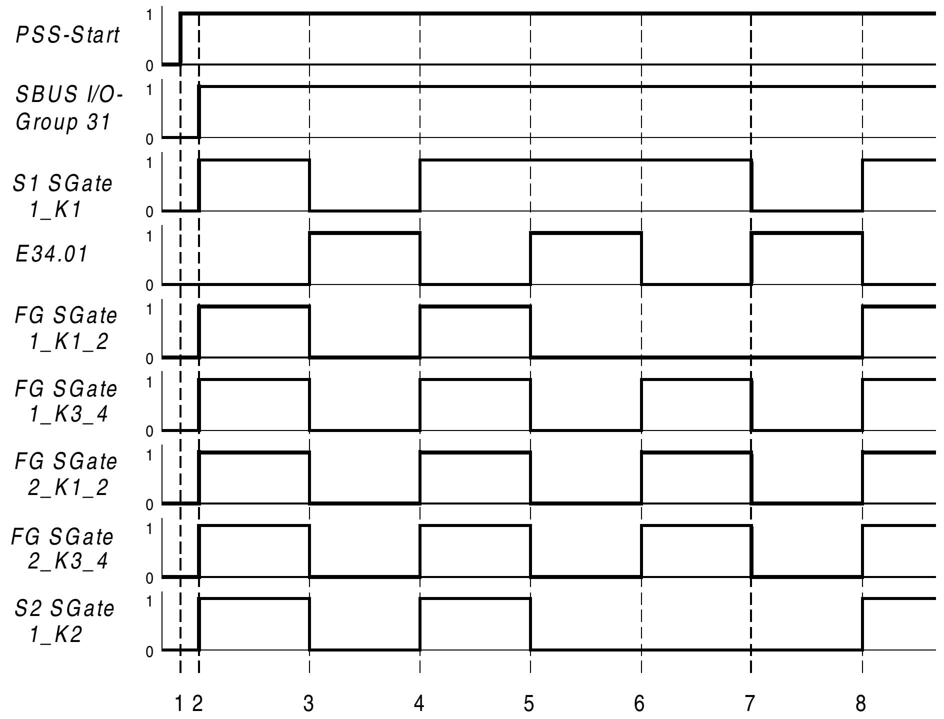

0
1
2
3
4
5
6
7
8
9
24VDC
0VDC
-X4
1
11
2
12
3
13
4
14
5
15
6
16
7
17
8
18
W1
OELFLEX
12x1mm²
W2
OELFLEX
12x1mm²
-A1
-A2
1
3
4
6
7
9
10
12
TYP: Balluff
BNS-816-X546
B06-00-12
610-11
2
5
8
11
-X4
E34.00
E34.01
E34.02
E34.03
E34.04
E34.05
E34.06
E34.07
PSS SB DI16
-X6
E 34.00
E 34.01
E 34.02
E 34.03
E 34.04
E 34.05
E 34.06
E 34.07
pilz
PSS SB 16
PSS SB DI16
Gate
combination 1
channel 1
channel 2
channel 3
channel 4
combination 2

Revision	30.Apr.2003	Date	22.Apr.2003	safety gate monitoring	pilz	driving and monitoring a press safety valve with SafetyBUS p	Directory: Eplan4/Pilz/Appl0703
Name	CLE	Name	CLE		Pilz GmbH & Co. Felix-Wankel-Str.2 73760 Ostfildern		
		Dep.	CS	Category 4 EN 954-1			Page: 47

Category 4, EN 954-1

SafetyBUS p – Pendulum flap monitoring

Timing diagram


PSS-Start
SBUS I/O-Group 31
S1 SGate 1_K1
E34.01
FG SGate 1_K1_2
FG SGate 1_K3_4
FG SGate 2_K1_2
FG SGate 2_K3_4
S2 SGate 1_K2
1
0
1 2
3
4
5
6
7
8

2: Start I/O-Group, pendulum flaps closed
3: Pendulum flaps open
4: Pendulum flaps closed
5: Pendulum flaps open, short circuit between 24 VDC and S1 SGate_K1
6: Pendulum flaps closed, rectify error at E34.00 (function test required)
7: Pendulum flaps open, function test not complete
8: Pendulum flaps closed, function test complete

Category 4, EN 954-1

SafetyBUS p – Pendulum flap monitoring

Program

```
Gate.comb1.        :Network 00


:LN    E  34.01     .SGate1_K2
:=     M  80.00     .M_SGate1_K2
:
:CAL  SB 066

                                   +-----------------+
                                   |     SB066       |
                                   |     ST_K4       |
                                   |                 |
KB  100                        - B - SSNR         FG - X  - M  73.03 .SGate1_K1_2
E   34.00  .SGate1_K1          - X - S1              |
M   80.00  .M_SGate1_K2        - X - S2              |
KF  00000                      - W - SyTi            |
M   110.00 .RLO-0              - X - MEin            |
M   110.00 .RLO-0              - X - Strt            |
M   110.01 .RLO-1              - X - ARSt            |
M   110.01 .RLO-1              - X - AuSt            |
M   110.01 .RLO-1              - X - NFkT            |
                                   +-----------------+


:
:LN    E  34.03     .SGate1_K4
:=     M  80.01     .M_SGate1_K4
:
```

```
:  CAL  SB 066

                                   +-----------------+
                                   |     SB066       |
                                   |     ST_K4       |
                                   |                 |
KB  101                        - B - SSNR         FG - X  - M  73.04 .SGate1_K3_4
E   34.02  .SGate1_K3          - X - S1              |
M   80.01  .M_SGate1_K4        - X - S2              |
KF  00000  .                   - W - SyTi            |
M   110.00 .RLO-0              - X - MEin            |
M   110.00 .RLO-0              - X - Strt            |
M   110.01 .RLO-1              - X - ARSt            |
M   110.01 .RLO-1              - X - AuSt            |
M   110.01 .RLO-1              - X - NFkT            |
                                   +-----------------+
  :
  :

Gate.comb2.        :Network 01

:LN    E  34.05     .SGate2_K2
:=     M  80.02     .M_SGate2_K2
:
       :CAL  SB 066
                                   +-----------------+
                                   |     SB066       |
                                   |     ST_K4       |
                                   |                 |
KB  102                        - B - SSNR         FG - X  - M  73.05 .SGate2_K1_2
E   34.04  .SGate2_K1          - X - S1              |
M   80.02  .M_SGate2_K2        - X - S2              |
KF  00000  .                   - W - SyTi            |
M   110.00 .RLO-0              - X - MEin            |
M   110.00 .RLO-0              - X - Strt            |
M   110.01 .RLO-1              - X - ARSt            |
M   110.01 .RLO-1              - X - AuSt            |
M   110.01 .RLO-1              - X - NFkT            |
                                   +-----------------+
```

Category 4, EN 954-1

SafetyBUS p – Pendulum flap monitoring

```
:
:LN    E  34.07  .SGate2_K4
:=     M  80.03 .M_SGate2_K4
:
:CAL                  SB 066
                                        +-------------+
                                        |   SB066     |
                                        |   ST_K4     |
                                        |             |
KB  103                          - B -  SSNR       FG  - X  - M  73.06  .SGate2_K3_4
E   34.06    .SGate2_K3          - X -  S1            |
M   80.03    .M_SGate2_K4        - X -  S2            |
KF  00000    .                   - W -  SyTi          |
M   110.00  .RLO-0               - X -  MEin          |
M   110.00  .RLO-0               - X -  Strt          |
M   110.01  .RLO-1               - X -  ARSt          |
M   110.01  .RLO-1               - X -  AuSt          |
M   110.01  .RLO-1               - X -  NFkT          |
                                        +-------------+

:
:L     M  73.03 .SGate1_K1_2
:U     M  73.04 .SGate1_K3_4
:U     M  73.05 .SGate2_K1_2
:U     M  73.06 .SGate2_K3_4
:=     M  80.04 .M_SGate1_2
:
:
:BE
```

Please note:
A “Minimum scan time” must be specified in the configurator of the PSS SW PG system software.

Global parameters used in administration data block DB015

- DW1002: Number of cycles for the reaction time of the feedback loop
- DW1022: Minimum scan time

The global parameter may be set in OB120 using SB070.

Additional blocks required

- DB015: Administration data block
  DB015 must consist of its total length of 1024 data words. DB015 must be declared READ/WRITE.
- SB070: Initialisation of global parameters in DB015

Notes

Category 3, EN 954-1

PSS 3000 – Safety gate monitoring with PSEN

Features

- Dual-channel redundancy
- Manual reset when the PSS is cold/ warm started
- Reset lock
- Function test required on the gate when the PSS is cold and warm started
- Failsafe standard function block used: SB066 (ST_K4)
- Feasibility test on the input signals through standard function block SB066.

Description

Safety gate monitoring with non-contact safety switch PSEN
In this example the safety system monitors the two contacts on the non-contact safety switch S1. The safety system checks the feasibility of the N/C / N/O combination to differentiate between the positions “operated”, “undefined” and “open”.
Within the user program, the failsafe standard function block SB066 is assigned to the safety switch. SB066 detects an open safety gate, as well as detecting incorrect input signals, such as a reset button that is constantly operated.
As the input circuit between sensor connections 3 and 4 is designed as an unoperated N/C contact, this input signal is inverted before calling SB066.
Synchronisation time monitoring may be set if necessary.
If the safety gate is opened or an error occurs, the enable output *FG* on SB066 will immediately be reset. The signal at the enable output *FG* must be evaluated by the user program and trigger an appropriate reaction. SB066 stores a value in DB015, which can be used to determine why *FG* was reset.
The reset will depend on the operating mode set on SB066.
In this application example, parameters for SB066 have been set in such a way that it is necessary to reset by pressing S2 (0/1 pulse edge at Strt) in order to reset enable output FG on SB066 when the PSS is cold started (PSS switched from off to on), warm started (PSS transferring from STOP to RUN) or after closing the safety gate (restart).
Parameters on SB066 also stipulate that the safety gate must undergo a function test (gate opened and closed) during a cold and warm start.

Safety assessment

- If a contact on the safety switch is overridden, the standard function block will detect this as an error at the next operation (opening/closing the safety gate).
- A short between the input circuits on the safety switch will be detected as an error by the standard function block at the next operation.
- A short between 24 VDC and an input circuit on the safety switch will be detected as an error by the standard function block at the next operation.

Classification in accordance with EN 954-1
Depending on the application area and its respective regulations, this connection example is suitable for applications up to category 3, in accordance with EN 954-1.

Pilz products

Number	Description	Order number
1	PSS CPU 2	301 063
1	PSS BMP 4/2	301 006
1	PSS PS 24	301 051
1	PSS DI 2	301 101
1	PSEN 2.1p-10	502 210
1	PSS-SB-TRA	301 175B

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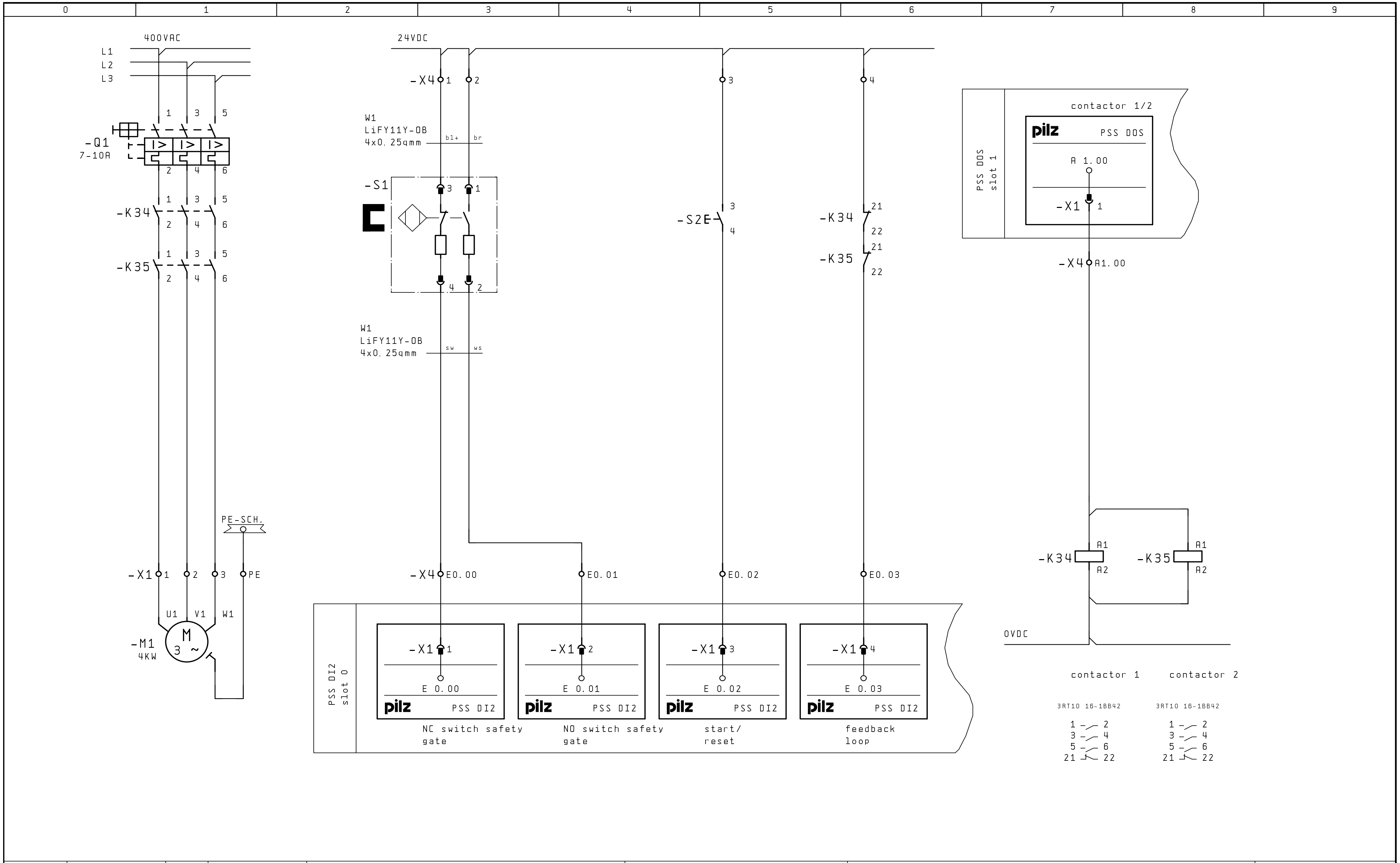
0
1
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6
7
8
9
400VAC
L1
L2
L3
-Q1
7-10A
-K34
-K35
PE-SCH.
-X1
PE
U1
V1
W1
-M1
4KW
M
3 ~
24VDC
-X4
W1
LiFY11Y-OB
4x0,25qmm
bl+
br
-S1
sw
ws
-S2E
E0.00
E0.01
E0.02
E0.03
PSS DI2
slot 0
E 0.00
E 0.01
E 0.02
E 0.03
pilz
NC switch safety gate
NO switch safety gate
start/ reset
feedback loop
PSS DOS
slot 1
contactor 1/2
A 1.00
A1.00
A1
A2
0VDC
contactor 1
contactor 2
3RT10 16-1BB42
1 - 2
3 - 4
5 - 6
21 - 22

Revision	30.Apr.2003	Date	22.Apr.2003	safety gate monitoring	Pilz GmbH & Co. Felix-Wankel-Str.2 73760 Ostfildern	safety gate monitoring with PSS 3000 and PSEN	Directory: Eplan4/Pilz/Appl0703
Name	CLE	Name	CLE	Category 3 EN 954-1			Page: 45
		Dep.	CS				

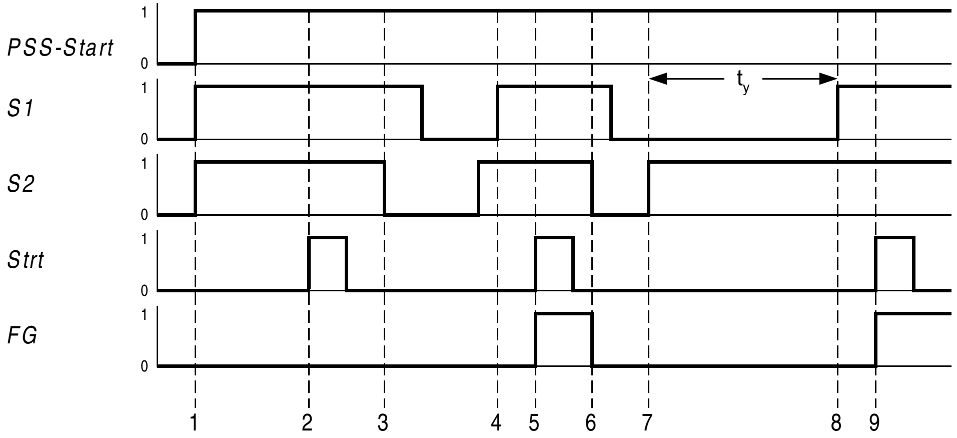
Category 3, EN 954-1

PSS 3000 – Safety gate monitoring with PSEN

Timing diagram

Parameters set on SB066

- Synchronisation time monitoring switched off (synchronisation time: ty)
- No function test after machine stops:
  MEin = 0
- No automatic reset after PSS cold start
  ARSt = 0
- Start-up disabler
  AuSt = 0
- Function test after the PSS is cold and warm started:
  NFkT = 0



1: PSS start, safety gate is closed
2: No function test, no enable (FG)
3: Safety gate is opened
4: Safety gate is closed
5: Enable (FG)
6: Safety gate is opened
7: Safety gate contact S2 is closed
8: Safety gate contact S1 is closed
9: Enable (FG)

Category 3, EN 954-1

PSS 3000 – Safety gate monitoring with PSEN

Program

```
:  LN  E  00.00      .PSEN_K1
:  =      M  99.00   .M_PSEN_K1
:  CAL  SB 066
```

```
                                     SB066
                                     ST_K4

KB  100                      - W -  SSNR        FG  - X  - M  73.03
M   99.00   .M_PSEN_K1       - X -  S1
E   00.01   .PSEN_K2         - X -  S2
KF  000000                   - W -  SyTi
M   110.00  .RLO-0           - X -  MEin
E   00.02   .Start           - X -  Strt
M   110.00  .RLO-0           - X -  ARSt
M   110.00  .RLO-0           - X -  AuSt
M   110.00  .RLO-0           - X -  NFkT
```

Please note:
A “Minimum scan time” must be specified in the configurator of the PSS SW PG system software.

Global parameters used in administration data block DB015, DB016 and DB017

- DW1022: Minimum scan time

The global parameter may be set in OB120 using SB071.

Additional blocks required

- DB015, DB016, DB017: Administration data block
  DB015, DB016, DB017 must consist of their total length of 1024 data words and must be declared READ/WRITE.
- SB071: Initialisation of global parameters in DB015, DB016 and DB017

Category 4, EN 954-1

SafetyBUS p – Safety gate monitoring with PSEN

Features

- Dual-channel redundancy with detection of shorts across the sensor contacts
- Manual reset after the PSS is cold/warm started and after starting the SafetyBUS p I/O-Groups
- Reset lock
- No function test on the gate when the PSS is cold/warm started and when starting the SafetyBUS p I/O-Groups
- Failsafe standard function block used: SB064 (S-GATE)
- Feasibility test on the input signals and monitoring of the contact synchronisation time in SB064
- Failsafe standard function block used: SB065 (FBL)
- Feasibility test and time monitoring of the start-up condition, the feedback loop signals and the output statuses through standard function block SB065

Description

Safety gate monitoring with non-contact safety switch PSEN
In this example the safety system with the safe bus system SafetyBUS p monitors the two contacts on the non-contact safety switch S1. The safety system checks the feasibility of the N/C / N/O combination to differentiate between the positions “operated”, “undefined” and “open”.

Within the user program, the failsafe standard function block SB064 is assigned to the safety switch. SB064 detects an open safety gate, as well as detecting incorrect input signals, such as a reset button that is constantly operated.
As the input circuit between sensor connections 3 and 4 is designed as an unoperated N/C contact, this input signal is inverted before calling SB064.
The status of the SafetyBUS I/O-Group is recorded through input parameter “GRP”.
Synchronisation time monitoring may be set if necessary.
If the safety gate is opened or an error occurs, the enable output *ENBL* on SB064 will immediately be reset. The signal at the enable output *ENBL* must be evaluated by the user program and trigger an appropriate reaction. SB064 stores a value in DB015 (or DB016 / DB017); this can be used to determine why *ENBL* was reset.
The reset will depend on the operating mode set on SB064.
In this application example, parameters for SB064 have been set in such a way that it is necessary to reset by pressing S2 (0/1 pulse edge at RSET) in order to reset enable output *ENBL* on SB064 when the PSS is cold started (PSS switched from off to on), warm started (PSS transferring from STOP to RUN), after starting the SafetyBUS p I/O-Group or after closing the safety gate (restart). Parameters on SB064 also stipulate that the safety gate does **not** have to undergo a function test (gate opened and closed) during a cold and warm start.

Safety assessment

- If a contact on the safety switch is overridden, standard function block SB064 will detect this as an error at the next operation (opening/closing the safety gate).
- A short between the input circuits on the safety switch will be detected as an error by the programmable safety system.
- A short between 24 VDC and an input circuit on the safety switch or feedback loop input will be detected as an error by the programmable safety system.
- A short between 24 VDC and the safety output will be detected as an error by the programmable safety system. The load will be switched off via the second shutdown route.

Pilz products

Number	Description	Order number	
1	PSS1 SB CPU 3	302 071	
1	PSS1 BMPS 3/1	302 007	
1	PSS SB DI8OZ4	301 120	
1	PSS SB screw connectors	311 060	**or**
1	PSS SB spring-loaded terminals	311 061	
2	PSS SB SUB-D3	311 058	
1	PSS SB BUSCABLE0	311 070	
1	PSEN 2.1p-10	502 210	
1	5 m cable with angled plug	533 120	
1	PSS-SB-TRA	301 175B	

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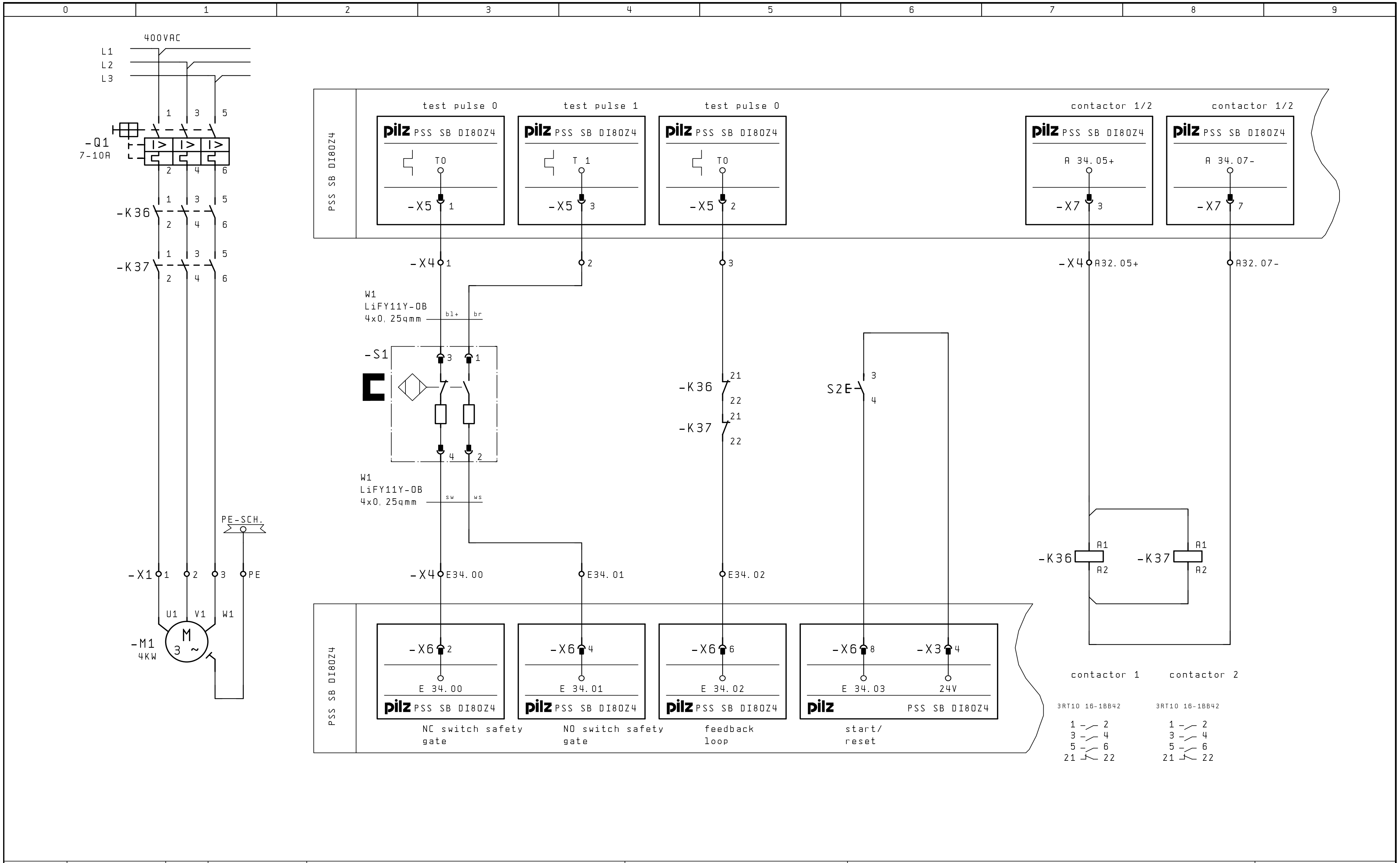
Classification in accordance with EN 954-1
Depending on the application area and its respective regulations, this connection example is suitable for applications up to category 4, in accordance with EN 954-1.


0
1
2
3
4
5
6
7
8
9
400VAC
L1
L2
L3
-Q1
7-10A
-K36
-K37
PE-SCH.
-X1
U1
V1
W1
PE
-M1
4KW
M
3 ~
PSS SB DI8OZ4
test pulse 0
test pulse 1
test pulse 0
contactor 1/2
contactor 1/2
pilz PSS SB DI8OZ4
T0
T 1
A 34.05+
A 34.07-
-X5
-X7
-X4
A32.05+
A32.07-
W1
LiFY11Y-OB
4x0,25qmm
bl+
br
sw
ws
-S1
-K36
-K37
S2E
21
22
-X4
E34.00
E34.01
E34.02
-X6
-X3
E 34.00
E 34.01
E 34.02
E 34.03
24V
NC switch safety gate
NO switch safety gate
feedback loop
start/ reset
A1
A2
contactor 1
contactor 2
3RT10 16-1BB42
3RT10 16-1BB42
1 2
3 4
5 6
21 22

Revision	30.Apr.2003	Date	22.Apr.2003	safety gate monitoring	**pilz**	safety gate monitoring with SafetyBUS p and PSEN	Directory: Eplan4/Pilz/Appl0703
Name	CLE	Name	CLE		Pilz GmbH & Co. Felix-Wankel-Str.2 73760 Ostfildern		
				Category 4 EN 954-1			Page: 46
		Dep.	CS				

Category 4, EN 954-1

SafetyBUS p – Safety gate monitoring with PSEN

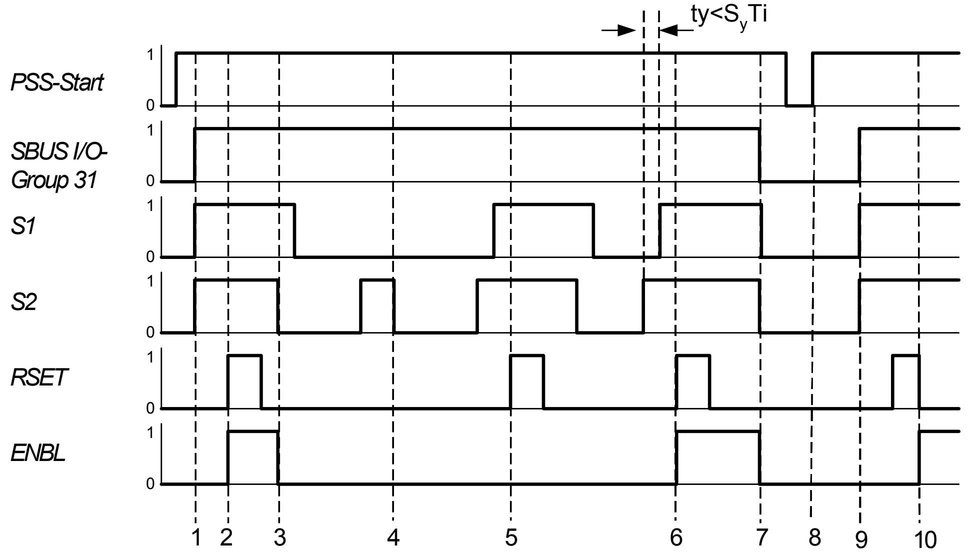
Timing diagram

Parameters set on SB064

- Device 34 with I/O-Group 31
  GRP = M116.31
- Synchronisation time monitoring switched on
  SyTi = 03000 (3 seconds)
- No function test after machine stops
  MRun = 0
- Start-up disabler
  *AuS*t = 0
- No automatic reset after PSS cold start
  ARSt = 0
- No function test
  NoFT = 1

Parameters set on SB065

- Device 34 with I/O-Group 31
  GRP = M116.31
- Time for feedback loop monitoring: 0.15 s
  TFbL =150



1: Start I/O-Group 31, safety gate is closed
2: Enable
3: Safety gate is opened
4: Synchronisation error (partial operation)
5: Partial operation, safety gate closed
6: Safety gate is closed, enable
7: Safety gate closed, I/O-Group 31 stopped, no enable
8: PSS cold start
9: Start I/O-Group
10: Enable

Category 4, EN 954-1

SafetyBUS p – Safety gate monitoring with PSEN

Program

```
:  LN  E  34.00       .PSEN_K1
:  =      M 99.00     .M_PSEN_K1
:  CAL SB 064

                                                SB064
                                               S-GATE

KF  000555                   - W -  SSNR       ENBL  - X  - M  87.10  .SGate
M   116.31  .I/O-Group 31    -  X -  GRP
M   99.00   .M_PSEN_K1       -  X -  S1
E   34.01   .PSEN_K2         -  X -  S2
KF  003000                   - W -  SyTi
M   110.00  .RLO-0           -  X -  MRun
M   110.00  .RLO-0           -  X -  AuSt
M   110.00  .RLO-0           -  X -  ARSt
M   110.01  .RLO-1           -  X -  NoFT
E   34.03   .Reset           -  X -  RSET


:  CAL SB 065

                                                SB065
                                                 FBL

KF  000556                   - W -  SSNR       ENBL  - X  - M  87.11  .FL_OK
M   116.31  .I/O-Group 31    -  X -  GRP         K1  - X  - A  34.05  .K36/K37
M   87.10   .SGate           -  X -  ON          K2  - X  - A  34.05  .K36/K37
E   34.02   .FBack_Loop      -  X -  FbL1
E   34.02   .FBack_Loop      - W -  FbL2
KF  000150                   -  X -  TFbL
E   34.03   .Reset           -  X -  RSET
```

Please note:
A “Minimum scan time” must be specified in the configurator of the PSS SW PG system software.

Global parameters used in administration data block DB015, DB016 and DB017

- DW1022: Minimum scan time

The global parameter may be set in OB120 using SB071.

Additional blocks required

- DB015, DB016, DB017: Administration data block
  DB015, DB016, DB017 must consist of their total length of 1024 data words and must be declared READ/WRITE.
- SB071: Initialisation of global parameters in DB015, DB016 and DB017

Category 4, EN 954-1

PSS 3100 – Operating modes of a press with AOPD

Features

- Select between 6 operating modes
- Manual reset when changing operating mode after press operation
- Change of operating mode can be disabled
- Failsafe standard function block used: SB051 (BA_1AUS8)
- Feasibility test on the input signals and monitoring of the contact synchronisation time in SB051.
- AOPD cycle control depending on operating mode
- Shutdown of protected field depending on operating mode
- Signal lamp for cycle mode
- Failsafe standard function block used: SB068 (BWS_AOS)
- Feasibility test on the input signals and monitoring of the contact synchronisation time in SB068.

Description

Press operating modes with AOPD monitoring

The PSS is to monitor an operating mode selector switch on a press (e.g. an eccentric press); the switch has 6 positions for the following operating modes: “Press off”, “Set-up mode”, “Single stroke”, “Single break mode”, “Double break mode” and “Automatic mode”. Access to the press is monitored by a light barrier or light guard, depending on the operating mode.
Within the user program, the failsafe standard function block SB051 is assigned to the operating mode inputs. SB051 monitors the time taken during the changeover process and detects non-feasible operating modes, such as no operating mode selected (all the inputs on the operating mode selector switch are 0). If an error occurs, the enable output *FG* on SB051 will immediately be reset. The enable output *FG* is also reset when the PSS is stopped and when the PSS is switched on.
The signal at the enable output *FG* must be evaluated by the user program and trigger an appropriate reaction. SB051 stores a value in DB015, which can be used to determine why *FG* was reset.
The error is reset on SB051 via a 0/1 pulse edge at the *RSet* input.
Within the user program, the failsafe standard function block SB068 is assigned to the protected area (light barrier). SB068 detects an interruption to the protected field, as well as detecting non-feasible input signals, such as no operating mode selected. If the protected field is interrupted or an error occurs, the enable output *ENBL* on SB068 will immediately be reset. The enable output *ENBL* is also reset when the PSS is stopped and when the PSS is switched on.
The signal at the enable output *ENBL* must be evaluated by the user program and trigger an appropriate reaction. SB068 stores a value in DB015, which can be used to determine why *ENBL* was reset.
The way in which the error is reset will depend on the operating mode set on SB068. In this application example, parameters for SB068 have been set in such a way that it is necessary to reset by pressing S3 (0/1 pulse edge at *RSET*) in order to reset enable output ENBL on SB068 under stated boundary conditions when the PSS is cold started (PSS switched from off to on), warm started (PSS transferring from STOP to RUN) or when the protected field is cleared (restart).

If outputs A 0.24 and A 0.25 are used, a maximum of 8 different test pulses may be used to feed the input circuit (A 0.16 to A 0.23).

Press operating modes

- Press off mode
  The press is at standstill.
  Safety:
  - all electrical, mechanical, hydraulic and pneumatic drives are switched off.
  - the protected field (light barrier and light guard) is deactivated.
- Set-up mode
  Manual control operations are being performed, e.g. as the plant starts up, as the plant restarts after a fault. The press travels at a much reduced speed.
  Safety:
  - static safety enable (E-STOP, fault monitoring on standard function blocks)
  - the protected field (light barrier and light guard walls) is deactivated.
  - reduced, monitored speed with two-hand control
  - jog mode is possible
- Single stroke mode with two-hand control
  The two-hand control initiates the press operating stroke after the workpiece is inserted. When the enable cam is reached, the press travels to top dead centre automatically (without two-hand control).
  Safety:
  - static safety enable (E-STOP, fault monitoring on standard function blocks)
  - the protected field (light barrier and light guard walls) is deactivated.
  - two-hand control prevents operator access
- Single break mode
  The operator inserts the workpiece; the workpiece can either be removed during the same intervention or by means of an automatic removal device.
  Start-up disabler:
  When starting single break mode, the protected field must be interrupted once and then cleared (function test). The test must then be reset. Once cycle mode is started, the work processes of the press are started/controlled through operator intervention. If production is halted for longer than 30 s or the protected field is interrupted during the hazardous movement, the function test must be performed again.

Category 4, EN 954-1

PSS 3100 – Operating modes of a press with AOPD

Safety:
- static safety enable (E-STOP, fault monitoring on standard function blocks)
- start-up procedure (see above)
- the safety function of the light barrier is activated.
- the safety function of the light guard walls is deactivated.

- Double break mode
  The operator inserts and removes the workpiece.
  Start-up disabler:
  When starting double break mode, the protected field must be interrupted twice and then cleared. The test must then be reset. Once break mode is started, the work processes of the press are started/controlled through operator intervention. If production is halted for longer than 30 s or the protected field is interrupted during the hazardous movement, the function test must be performed again
  - static safety enable (E-STOP, fault monitoring on standard function blocks)
  - start-up procedure (see above)
  - the safety function of the light barrier is activated.
  - the safety function of the light guard walls is deactivated.
- Automatic mode
  The press performs the set number of cyclical production strokes. The workpiece is inserted and removed automatically without operator intervention.

  Safety:
  - static safety enable (E-STOP, fault monitoring on standard function blocks)
  - the safety function of the light barrier is deactivated.
  - the safety function of the light guard walls is activated, i.e. the entire feed in area is blocked by the light guard walls.

Safety assessment
- A short between 24 VDC and an input with an undefined operating mode will be detected as an error by standard function block SB051.
- A short between 24 VDC and an input with a permitted operating mode will be detected as an error by standard function block SB051 after the next operation.
- A short between 24 VDC and an OSSD output will be detected as an error by the AOPD and leads to both OSSD outputs being shut down.
- A short between the OSSD outputs will be detected as an error by the AOPD and leads to both OSSD outputs being shut down.

Classification in accordance with EN 954-1
Depending on the application area and its respective regulations, this connection example is suitable for applications up to category 4, in accordance with EN 954-1.

Pilz products

Number	Description	Order number
1	PSS1 CPU 3	302 064
1	PSS1 BMPS 3/1	302 007
1	PSS DI20 T	302 112
1	PSS-SB-TRA	301 175B

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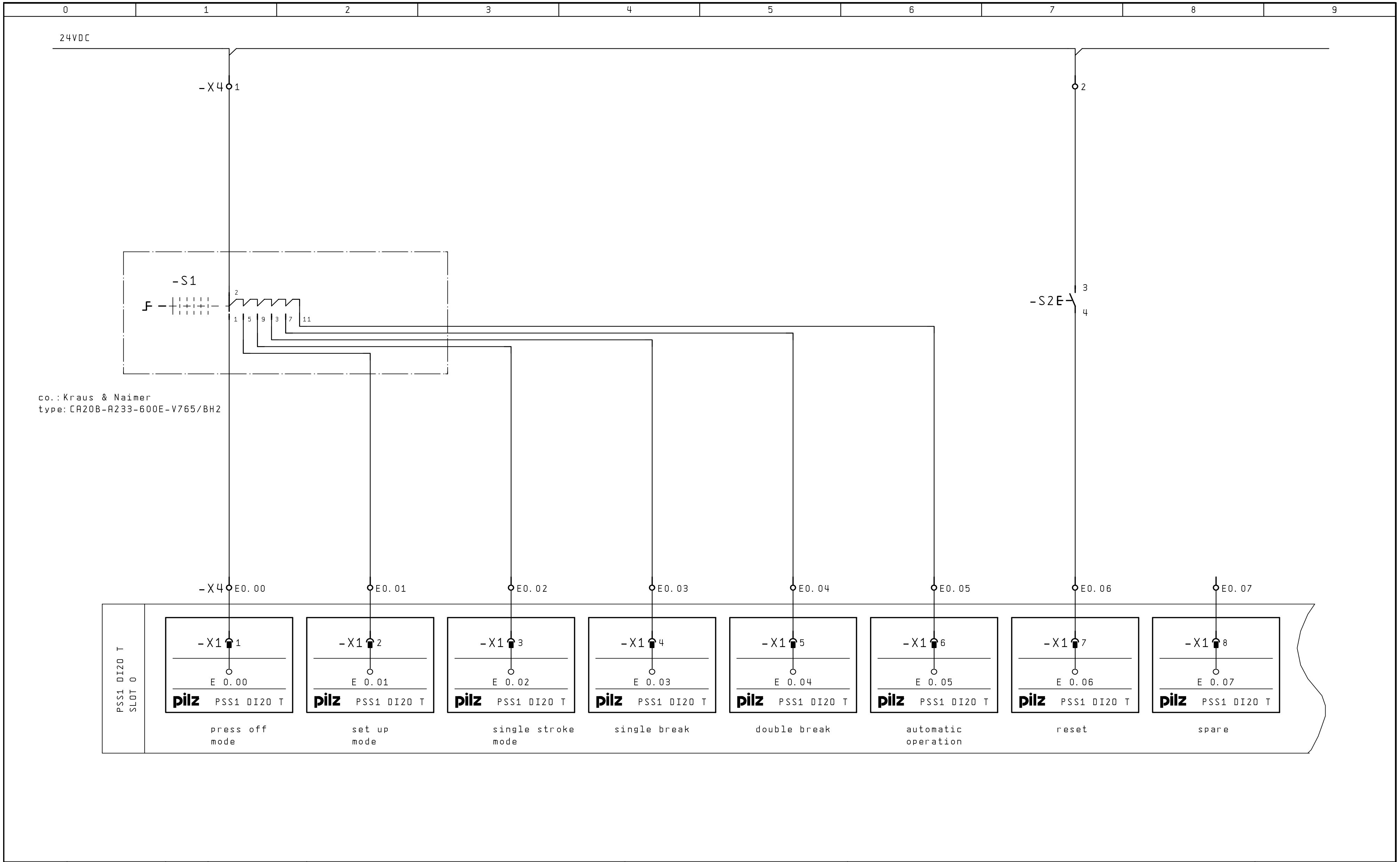

0
1
2
3
4
5
6
7
8
9
24VDC
-X4 1
2
-S1
2
1 5 9 3 7 11
-S2 E
3
4
co.: Kraus & Naimer
type: CA20B-A233-600E-V765/BH2
-X4 E0.00
E0.01
E0.02
E0.03
E0.04
E0.05
E0.06
E0.07
PSS1 DI20 T
SLOT 0
-X1 1
E 0.00
pilz PSS1 DI20 T
-X1 2
E 0.01
pilz PSS1 DI20 T
-X1 3
E 0.02
pilz PSS1 DI20 T
-X1 4
E 0.03
pilz PSS1 DI20 T
-X1 5
E 0.04
pilz PSS1 DI20 T
-X1 6
E 0.05
pilz PSS1 DI20 T
-X1 7
E 0.06
pilz PSS1 DI20 T
-X1 8
E 0.07
pilz PSS1 DI20 T
press off mode
set up mode
single stroke mode
single break
double break
automatic operation
reset
spare

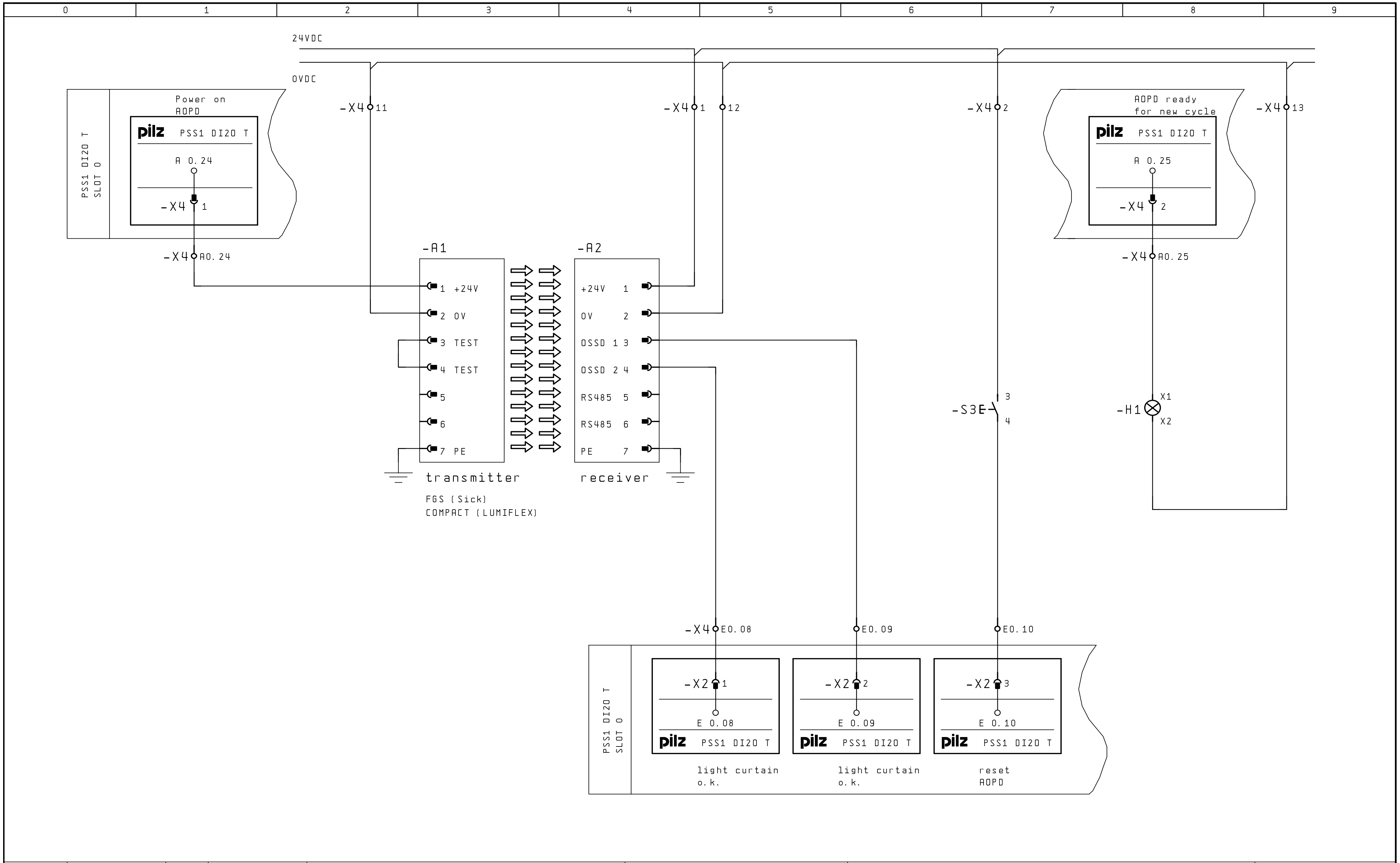
Revision	30. Apr. 2003	Date	22. Apr. 2003	double light curtain mode
Name	CLE	Name	CLE	
				Category 4 EN 954-1
		Dep.	CS	

Pilz GmbH & Co.
Felix-Wankel-Str. 2
73760 Ostfildern

operation mode switch with double light curtain mode

Directory:
Eplan4/Pilz/Appl0703

Page: 48


0
1
2
3
4
5
6
7
8
9
24VDC
0VDC
PSS1 DI20 T
SLOT 0
Power on
AOPD
pilz PSS1 DI20 T
A 0.24
-X4 1
-X4 A0.24
-X4 11
-X4 1
12
-X4 2
AOPD ready
for new cycle
pilz PSS1 DI20 T
A 0.25
-X4 2
-X4 A0.25
-X4 13
-A1
1 +24V
2 0V
3 TEST
4 TEST
5
6
7 PE
transmitter
FGS (Sick)
COMPACT (LUMIFLEX)
-A2
+24V 1
0V 2
OSSD 1 3
OSSD 2 4
RS485 5
RS485 6
PE 7
receiver
-S3
3
4
-H1
X1
X2
-X4 E0.08
E0.09
E0.10
PSS1 DI20 T
SLOT 0
-X2 1
E 0.08
pilz PSS1 DI20 T
-X2 2
E 0.09
pilz PSS1 DI20 T
-X2 3
E 0.10
pilz PSS1 DI20 T
light curtain
o.k.
light curtain
o.k.
reset
AOPD

Revision	30.Apr.2003	Date	22.Apr.2003	double light curtain mode	pilz Pilz GmbH & Co. Felix-Wankel-Str.2 73760 Ostfildern	operation mode switch with double light curtain mode	Directory: Eplan4/Pilz/Appl0703
Name	CLE	Name	CLE				
				Category 4 EN 954-1			Page: 49
		Dep.	CS				

Category 4, EN 954-1

PSS 3100 – Operating modes of a press with AOPD

Timing diagram

Parameters set on SB051

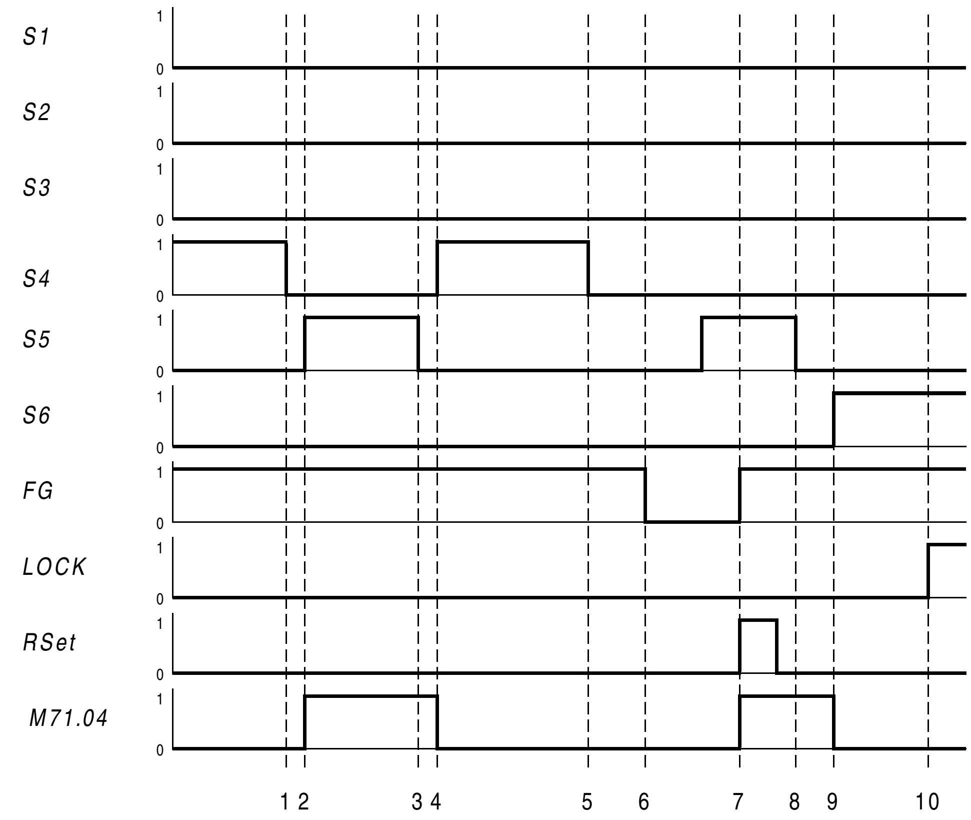
- Switch settings on the operating mode selector switch
  S1 = E 0.00 Press off
  S2 = E 0.01 Set-up mode
  S3 = E 0.02 Single stroke
  S4 = E 0.03 Single break mode
  S5 = E 0.04 Double break mode
  S6 = E 0.05 Autom. mode
- Reset input for error reset
  RSet = 0/1-pulse edge: reset occurs
- Lock switch position
  LOCK = 0: Switch position unlocked
  LOCK = 1: Switch position locked
- Max. permitted contact switchover time between two permitted switch settings
  TIME = 1000 (ms)
- Enable bit
  FG = 1: Enable occurs, selected operating mode active
- Press operating mode *BA*
  M071.00 = RLO-1 Press off
  M071.01 = RLO-1 Set-up mode
  M071.02 = RLO-1 Single stroke
  M071.03 = RLO-1 Single break mode
  M071.04 = RLO-1 Double break mode
  M071.05 = RLO-1 Autom. mode
- Reset output
  RSET = 1: Operating mode was changed

Parameters set on SB068

- N/O contact 1 on the light barrier
  NO_1 = 0: Protected field broken
  NO_1 = 1: Protected field clear
- N/O contact 2 on the light barrier
  NO_2 = 0: Protected field broken
  NO_2 = 1: Protected field clear
- Protected field off
  OFF = 1
  GdO = 0
  SBrk = 0
  DBrk = 0
  In the example, the supply voltage is switched off in the operating modes “Press off”, “Set-up mode” and “Automatic mode”, so that the operator recognises that the protected field is deactivated.
- Protected field on
  OFF = 0
  GdO = 1
  SBrk = 0
  DBrk = 0
  The light barrier is not used for cycle control but for additional monitoring in “Single stroke” mode.
- Protected field with press in single break mode
  OFF = 0
  GdO = 0
  SBrk = 1
  DBrk = 0
  In the example, the status of the operating mode “Single break mode” is signalled directly to the input SBrk.
- Protected field with press in double break mode
  OFF = 0
  GdO = 0
  SBrk = 0
  DBrk = 1
  In the example, the status of the operating mode “Double break mode” is signalled directly to the input DBrk.
- Static enable of protected field
  RUN = RLO-1
- Cycle reset for single break and double break mode
  CyRs = 0 Hazardous downward movement
  CyRs = 1 Top dead centre
- Start-up disabler of protected field
  SSeq = RLO-0: Function test: Protected field interrupted and then cleared, press reset button
- Reset lock of protected field
  ARSt = 0: “Protected field interrupted” error cannot be reset automatically
  ARSt = 1: “Protected field interrupted” error is reset automatically
  In the example, the upward movement of the press outside of “Automatic mode” is not potentially hazardous, i.e. in this specific condition the reset lock is deactivated.
- Start-up procedure with cycle mode
  STyp = RLO-0: First access the protected field and then press the reset button
- Test input
  Test = RLO-0 test deactivated.
- Reset button (N/O contact)
  RSET = 0/1 pulse edge: reset occurs
- Enable bit
  ENBL = 0: Protected field not clear
  ENBL = 1: Protected field clear
  The enable signal from SB068 is linked to the movement of the press in conjunction with other conditions.
- Test output
  TEST = 0: Simulated break
  TEST = 1: Protected field active
  The light barrier used in the example is self-monitoring, so in this case, no external monitoring is required.
- Output signal “Ready for cycle mode”
  RdCy = RLO-0: Cycle mode not selected, or cycle mode selected but protected field is not ready for break
  RdCy = RLO-1: Cycle mode is selected and protected field is ready for break
  In the example, the status “Cycle mode selected and protected field ready for break” is signalled to the operator via an additional lamp.
- Supply voltage to protected field
  PWR = 0: Supply voltage off (*OFF* = 1; *RUN* any)
  PWR = 1: Supply voltage on (*GdO*/*SBrk*/ DBrk = 1; *RUN* any)
  The light barrier’s switch-off condition is defined at the input parameter *OFF*.

Category 4, EN 954-1

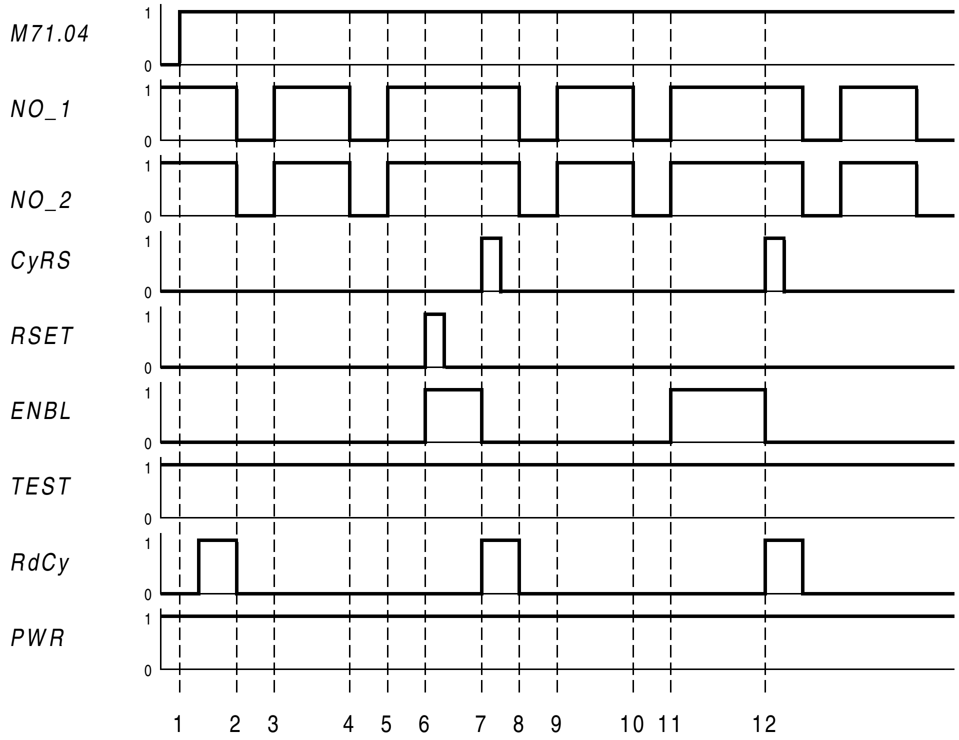
PSS 3100 – Operating modes of a press with AOPD



1 Single break mode; press at standstill, start changeover process from single break mode -> double break mode
2 Changeover process from single break mode -> double break mode; double break mode active, press at standstill
3 Start changeover process from double break mode -> single break mode
4 Changeover process from double break mode -> single break mode; single break mode active, press at standstill
5 Start changeover process from single break mode -> double break mode
6 Time range exceeded during changeover process from single break mode -> double break mode; no operating mode active, press at standstill
7 Time monitoring error is reset; double break mode active, press at standstill
8 Start changeover process from double break mode -> automatic mode
9 Changeover process from double break mode -> automatic mode; automatic mode active, press at standstill
10 Press operating

Category 4, EN 954-1

PSS 3100 – Operating modes of a press with AOPD



1 Double break mode active
2 First break of protected field (function test), press at standstill
3 First clearing of protected field (function test), press at standstill
4 Second break of protected field (function test), press at standstill
5 Second clearing of protected field (function test), press at standstill
6 Reset after completed function test, press starts
7 Top dead centre reached
8 First operating stroke completed; first break of protected field, press at standstill
9 First clearing of protected field
10 Second break of protected field, press at standstill
11 Second clearing of protected field, press starts second operating stroke
12 Corresponds to point 7

Category 4, EN 954-1

PSS 3100 – Operating modes of a press with AOPD

Program

```
: CAL  SB 051

                                                  SB051
                                                BA_1AUS8

KB  002                    - W -  SSNR          FG  - X  - M  70.01   .Stat_Enable
E    0.00    .Press off     - X -  S1            BA  - X  - MB 71.00   .OpMode_Status
E    0.01    .Set-up_mode   - X -  S2          RSET  - X  - M 99.16    .Temp
E    0.02    .SingleStroke  - X -  S3
E    0.03    .SingleBrkMode - X -  S4
E    0.04    .DoubleBrkMode - X -  S5
E    0.05    .Auto_Mode     - X -  S6
M    110.00  .RLO-0         - X -  S7
M    110.00  .RLO-0         - X -  S8
E    0.06    .Reset         - X -  RSet
E    88.16   .Press_Start   - X -  LOCK
KF   001000                 - W -  TIME

: L    M  071.00 .Press off
: O    M  071.01 .Set-up_mode
: O    M  071.05 .Auto_mode
: =    M  070.09 .OFF SB068
:
: L    M  071.02 .SingleStroke
: =    M  070.10 .GdO SB068
:
: L    M  071.03 .SingleBrkMode
: =    M  070.11 .SBrk SB068
:
: L    M  071.04 .DoubleBrkMode
: =    M  070.13 .DBrk SB068
:
: LN   M  071.20 .TDC
: UN   M  071.21 .Start
: R    M  072.01 .ARSt SB068
```

```
:
: L    M  071.21 .Start
: UN   M  071.05 .Auto_mode
: S    M  072.01 .ARSt SB068

: CAL SB068

                                              SB068
                                             BWS_AOS

KB  004                       - B -  SSNR       ENBL  - X - M  70.03  .Start
E    0.08    .LightBarr_1_K1  - X -  NO_1       TEST  - X - M  99.16  .Temp
E    0.09    .LichtBarr_1_K2  - X -  NO_2       RdCy  - X -A  0.25    . Lamp
M    70.09   .OFF             - X -  OFF         PWR  - X -A  0.24    . Supply_AOPD
M    70.10   .GdO             - X -  GdO
M    70.11   .SBrk            - X -  SBrk
M    70.13   .DBrk            - X -  DBrk
M    110.01  .RLO-1           - X -  RUN
M    88.00   .TDC             - X -  CyRs
M    110.00  .RLO-0           - X -  SSeq
M    72.01   .ARSt            - X -  ARSt
M    110.00  .RLO-0           - X -  STyp
M    110.00  .RLO-0           - X -  Test
E    0.10    .Reset           - X -  RSET


Static_Enable  : Network 02

: L    M  70.00      .FG SB061
: U    M  70.01 .Stat_Enable
: U    M  70.04 .Enable_Camshaft
: =    M  70.07 .Enable_Press
```

Category 4, EN 954-1

PSS 3100 – Operating modes of a press with AOPD

Please note:
A “Minimum scan time” must be specified in the configurator of the PSS SW PG system software.

Global parameters used in administration data block DB015, DB016 and DB017

- DW1022: Minimum scan time

The global parameter may be set in OB120 using SB071.

Additional blocks required

- DB015, DB016, DB017: Administration data block
  DB015, DB016, DB017 must consist of their total length of 1024 data words and must be declared READ/WRITE.
- SB071: Initialisation of global parameters in DB015, DB016 and DB017

Notes

Contents				**Page**
Actuator applications				
PSS 3000	–	Driving/monitoring a press safety valve	Category 4, EN 954-1	5.6-2
SafetyBUS p	–	Driving/monitoring a press safety valve	Category 4, EN 954-1	5.6-6
PSS 3000	–	Monitoring the work area	Category 3, EN 954-1	5.6-10
PSS 3000	–	Monitoring contactors on frequency converters	Category 4, EN 954-1	5.6-14
PSS 300	–	Driving/monitoring a valve terminal	Category 3, EN 954-1	5.6-18
PSS 3000	–	Driving/monitoring a muting lamp	Category 4, EN 954-1	5.6-26

Category 4, EN 954-1

PSS 3000 – Driving/monitoring a press safety valve

Features

- Dual-channel redundancy
- Monitors valve position
- Open circuit detection
- Failsafe standard function block used: SB080 (PSV_1)
- Feasibility test and time monitoring of the start-up conditions, the feedback loop signals and the output statuses through standard function block SB080

Description

Driving and monitoring function

In this example the safety system drives and monitors a press safety valve (dual valve). Within the user program, the failsafe standard function block SB080 is assigned to the press safety valve.

SB080 control the valves via outputs Y1 and Y2. A separate input is available for each valve to acknowledge the valve position (S1 and S2).

If the acknowledgements from S1 and S2 come via switch contacts, these must be supplied with test pulses via the PSS. If the acknowledgements from S1 and S2 come via proximity switches, the signal lines of the proximity switches must be carried in separate cables. This will ensure that a short cannot occur between the two signal lines.

The switch-on sequence for the valve coils can be defined via input parameter OnSq. If OnSq=1, valve output Y2 is switched on one PSS cycle later than Y1. This way it is possible to detect a short between the two valve outputs Y1 and Y2. If OnSq=0, valve outputs Y1 and Y2 are switched on simultaneously. In this case, make sure Y1 and Y2 are carried in separate cables.

SB080 monitors the operating pressure of the compressed air supply via input parameter *AIR*.

Different reaction times for switching on and off can be specified on SB080 (*TOn* and *TOff*). This is necessary because the reaction time of the safety valve on switch-off is largely responsible for the press stopping time in the case of an emergency stop. The reaction time on switch-off directly determines the safety distance to the tool.

The valves are switched on via a 0/1 pulse edge at input parameter *ON* of SB080 and switched off via a 1/0 pulse edge.

SB080 has extensive fault detection features. SB080 automatically detects incorrect valve positions.

If an error occurs, the enable output *ENBL* and valve outputs Y*1* and Y2 on SB080 will immediately be reset.

The outputs are also reset by the “Switch-off” command (1/0 pulse edge at *ON*) when the PSS stops and when the PSS is switched on.

The signal at the enable output *ENBL* can be evaluated by the user program and trigger an appropriate reaction. SB080 stores a value in DB015, which can be used to determine why *ENBL* was reset.

If an error occurs, once the error has been rectified, it is necessary to reset by pressing S3 (0/1 pulse edge at *RSET*) in order to also reset enable output *ENBL* of SB080. However, for the reset to occur, the press safety valve must be in its start position.

Safety assessment

- If a contact on the acknowledgement from the valve is overridden, the standard function block will detect this as an error at the next operation.
- A short between the input circuits (acknowledgement) will be detected as an error by the programmable safety system.
- A short between 24 VDC and an input circuit (acknowledgement) will be detected as an error by the programmable safety system.
- A short between 24 VDC and a safety output will be detected as an error by the programmable safety system.
- The centralised module PSS DI2O Z will detect an open circuit in the output circuit.

Classification in accordance with EN 954-1

Depending on the application area and its respective regulations, this connection example is suitable for applications up to category 4, in accordance with EN 954-1.

Pilz products

Number	Description	Order number
1	PSS CPU 3	301 064
1	PSS BMP 4/2	301 006
1	PSS PS 24	301 051
1	PSS DI2O T	301 112
1	PSS DI2O Z	301 109
1	PSS DI 2	301 101
1	PSS-SB-EXZ2	301 172B

Drawing file

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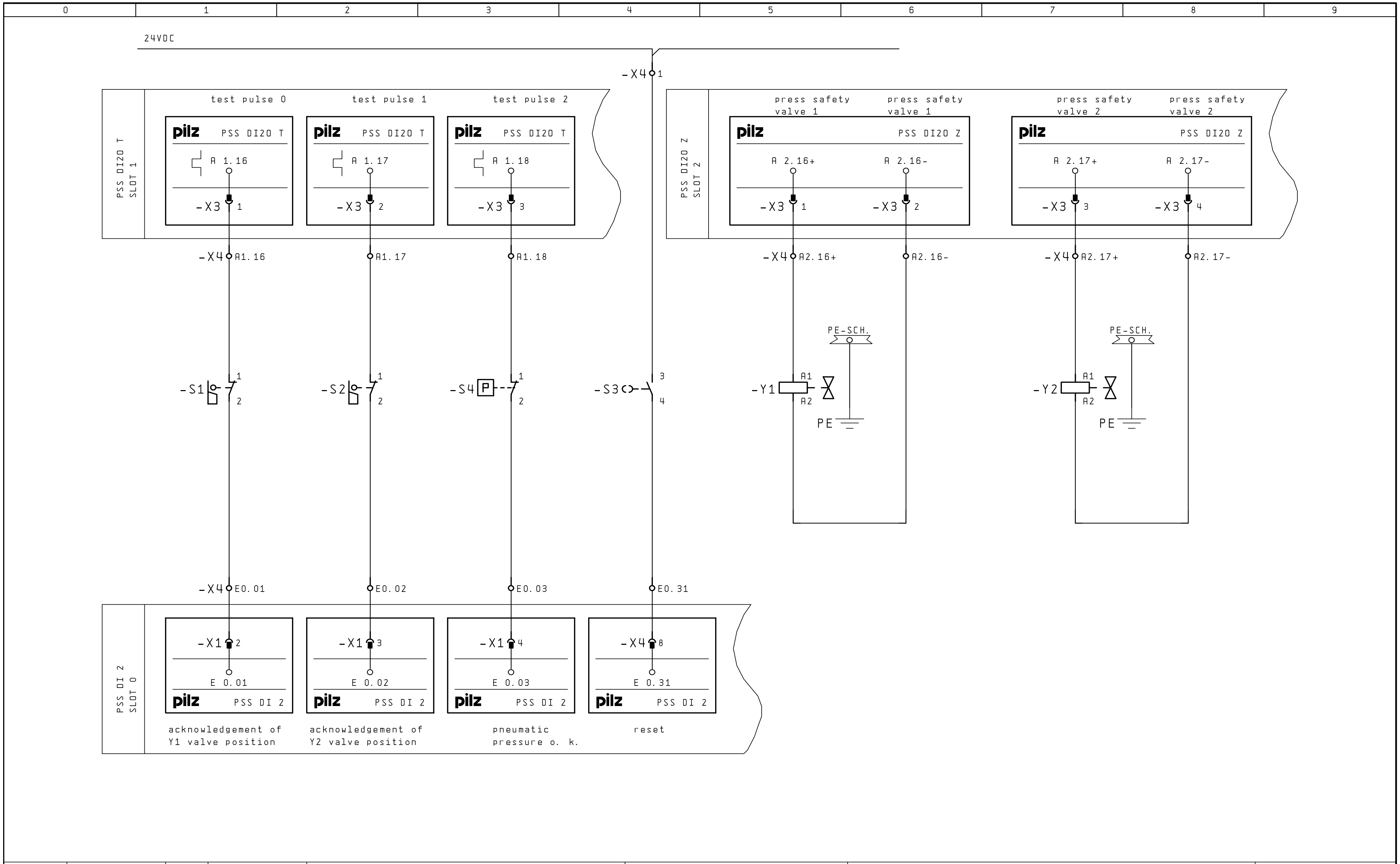
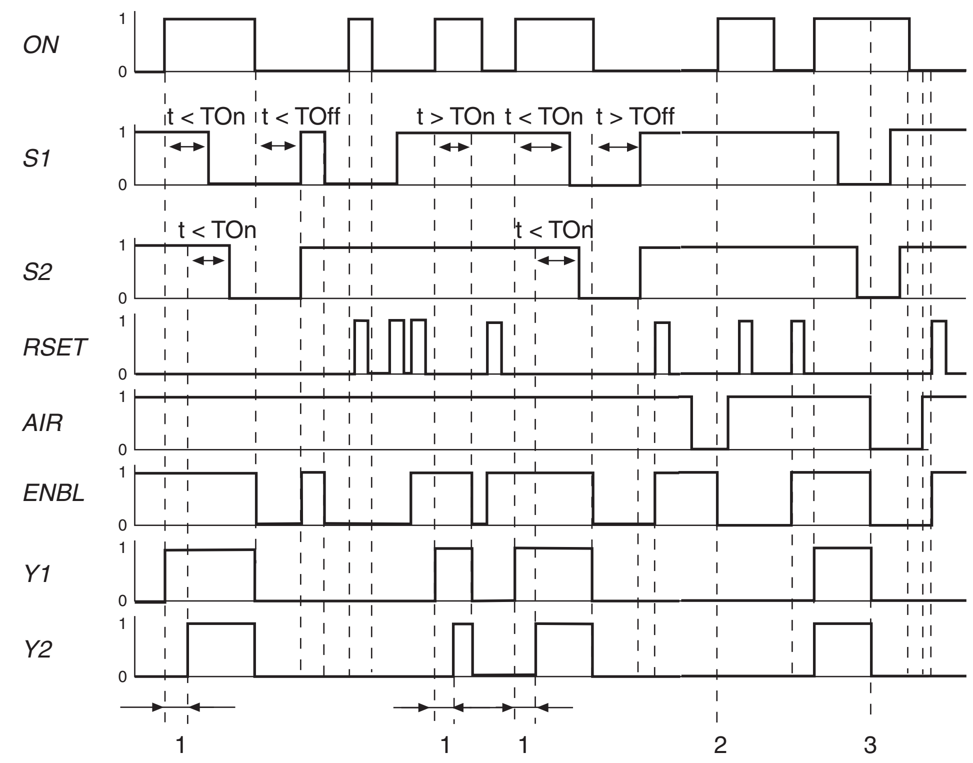

0
1
2
3
4
5
6
7
8
9
24VDC
-X4 1
PSS DI20 T
SLOT 1
test pulse 0
test pulse 1
test pulse 2
pilz PSS DI20 T
A 1.16
-X3 1
pilz PSS DI20 T
A 1.17
-X3 2
pilz PSS DI20 T
A 1.18
-X3 3
PSS DI20 Z
SLOT 2
press safety valve 1
press safety valve 1
press safety valve 2
press safety valve 2
pilz PSS DI20 Z
A 2.16+
A 2.16-
-X3 1
-X3 2
pilz PSS DI20 Z
A 2.17+
A 2.17-
-X3 3
-X3 4
-X4 A1.16
A1.17
A1.18
-X4 A2.16+
A2.16-
-X4 A2.17+
A2.17-
PE-SCH.
PE-SCH.
-S1
1
2
-S2
1
2
-S4 P
1
2
-S3
3
4
-Y1
A1
A2
PE
-Y2
A1
A2
PE
-X4 E0.01
E0.02
E0.03
E0.31
PSS DI 2
SLOT 0
-X1 2
E 0.01
pilz PSS DI 2
-X1 3
E 0.02
pilz PSS DI 2
-X1 4
E 0.03
pilz PSS DI 2
-X4 8
E 0.31
pilz PSS DI 2
acknowledgement of Y1 valve position
acknowledgement of Y2 valve position
pneumatic pressure o. k.
reset

Revision	30.Apr.2003	Date	22.Apr.2003	press safety valve	Pilz GmbH & Co. Felix-Wankel-Str.2 73760 Ostfildern	driving and monitoring a press safety valve with PSS 3000	Directory: Eplan4/Pilz/Appl0703
Name	CLE	Name	CLE				
				Category 4 EN 954-1			
		Dep.	CS				Page: 10

Category 4, EN 954-1

PSS 3000 – Driving/monitoring a press safety valve

Timing diagram



1: One PSS cycle
2: *AIR* missing on power-up
3: *AIR* missing during operation

Program

```
                                                SB080
                                                PSV_1

KB  001                              - B - SSNR         ENBL - X  - M   070.00 .Enable
M   080.00  .PSV_ON                  - X - ON             Y1 - X  - A   2.16   .Valve_Y1
E   0.03    .AIR_ON                  - X - AIR            Y2 - X  - A   2.17   .Valve_Y2
E   0.01    .PSV_FL-1                - X - S1
E   0.02    .PSV_FL-2                - X - S2
M   110.01  .RLO-1                   - X - OnSq
KF  250                              - W - TOn
KF  300                              - W - TOff
E   0.31    .Reset_button            - X - RSET
```

Please note:
A “Minimum scan time” must be specified in the configurator of the PSS SW PG system software.

Global parameters used in administration data block DB015

- DW1022: Minimum scan time

The global parameter may be set in OB120 using SB070.

Additional blocks required

- DB015: Administration data block
  DB015 must consist of its total length of 1024 data words. DB015 must be declared READ/WRITE.
- SB070: Initialisation of global parameters in DB015

Notes

Category 4, EN 954-1

SafetyBUS p – Driving/monitoring a press safety valve

Features

- Dual-channel redundancy
- Monitors valve position
- Open circuit detection
- Failsafe standard function block used: SB080 (PSV_1)
- Feasibility test and time monitoring of the start-up conditions, the feedback loop signals and the output statuses through standard function block SB080

Description

Driving and monitoring function

In this example the safety system with the safe bus system SafetyBUS p drives and monitors a press safety valve (dual valve). Within the user program, the failsafe standard function block SB080 is assigned to the press safety valve.
SB080 control the valves via outputs Y1 and Y2. A separate input is available for each valve to acknowledge the valve position (S1 and S2).
If the acknowledgements from S1 and S2 come via switch contacts, these must be supplied with test pulses via the PSS. If the acknowledgements from S1 and S2 come via proximity switches, the signal lines of the proximity switches must be carried in separate cables. This will ensure that a short cannot occur between the two signal lines.
The switch-on sequence for the valve coils can be defined via input parameter OnSq. If OnSq=1, valve output Y2 is switched on one PSS cycle later than Y1. This way it is possible to detect a short between the two valve outputs Y1 and Y2. If OnSq=0, valve outputs Y1 and Y2 are switched on simultaneously. In this case, make sure Y1 and Y2 are carried in separate cables.
SB080 monitors the operating pressure of the compressed air supply via input parameter *AIR*.
Different reaction times for switching on and off can be specified on SB080 (*TOn* and *TOff*). This is necessary because the reaction time of the safety valve on switch-off is largely responsible for the press stopping time in the case of an emergency stop. The reaction time on switch-off directly determines the safety distance to the tool.
The valves are switched on via a 0/1 pulse edge at input parameter *ON* of SB080 and switched off via a 1/0 pulse edge.
SB080 has extensive fault detection features. SB080 automatically detects incorrect valve positions.
If an error occurs, the enable output *ENBL* and valve outputs Y1 and Y2 on SB080 will immediately be reset. The outputs are also reset by the “Switch-off” command (1/0 pulse edge at *ON*) when the PSS stops and when the PSS is switched on.
The signal at the enable output *ENBL* can be evaluated by the user program and trigger an appropriate reaction. SB080 stores a value in DB015, which can be used to determine why *ENBL* was reset. If an error occurs, once the error has been rectified, it is necessary to reset by pressing S3 (0/1 pulse edge at *RSET*) in order to also reset enable output *ENBL* of SB080. However, for the reset to occur, the press safety valve must be in its start position.
The positive-switching outputs A34.04 and A34.05 are configured as dual-pole outputs.

Safety assessment

- If a contact on the acknowledgement from the valve is overridden, the standard function block will detect this as an error at the next operation.
- A short between the input circuits (acknowledgement) will be detected as an error by the programmable safety system.
- A short between 24 VDC and an input circuit (acknowledgement) will be detected as an error by the programmable safety system.
- A short between 24 VDC and a safety output will be detected as an error by the programmable safety system.

Classification in accordance with EN 954-1

Depending on the application area and its respective regulations, this connection example is suitable for applications up to category 4, in accordance with EN 954-1.

Pilz products

Number	Description	Order number	
1	PSS SB 3006 DP-S	301 460	
1	PSS SB DI8O8	301 140	
1	PSS SB screw connectors	311 060	**or**
1	PSS SB spring-loaded terminals	311 061	
2	PSS SB SUB-D1	311 051	
1	PSS SB cable	311 070	
1	PSS-SB-EXZ2	301 172B	

Drawing file

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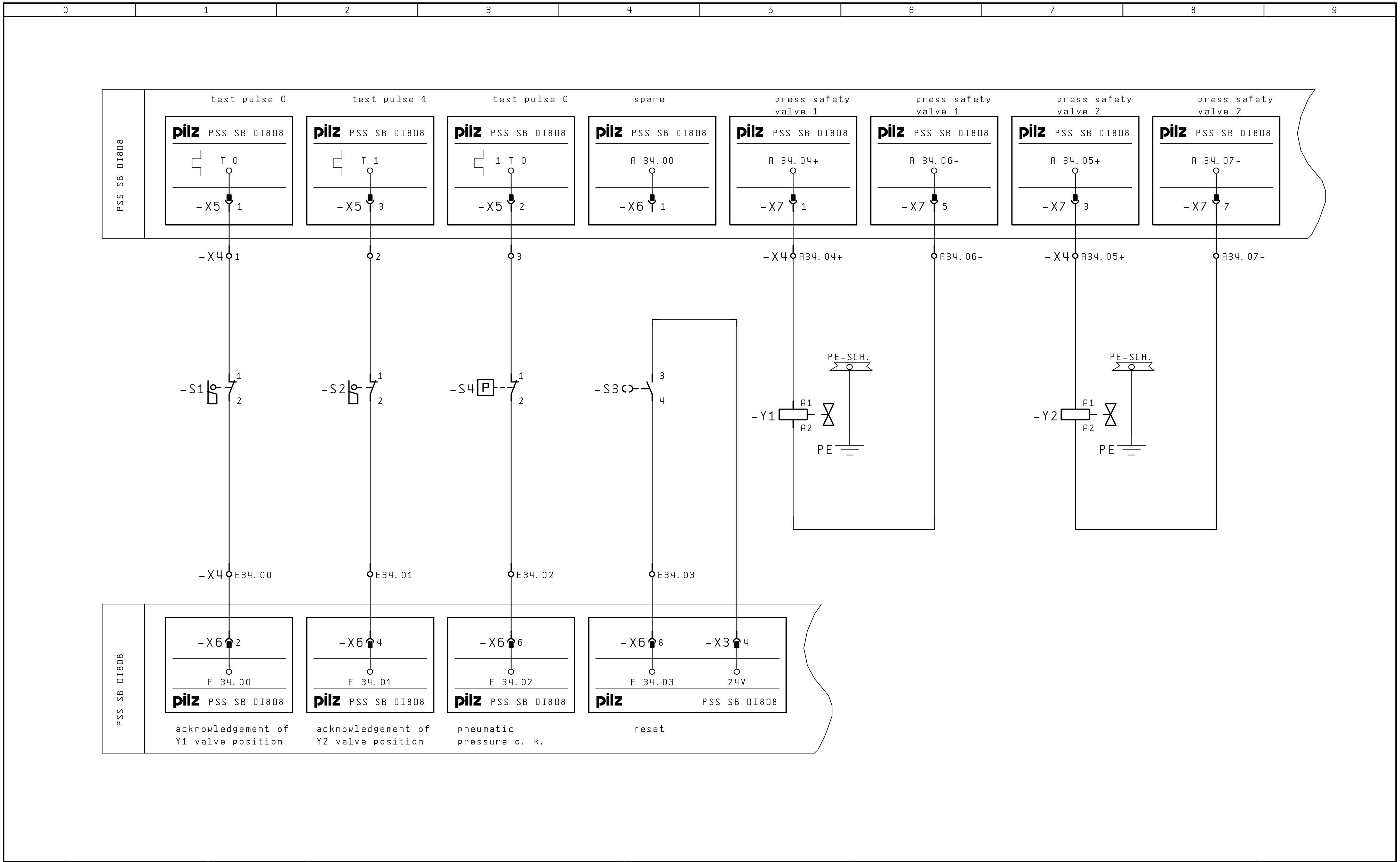
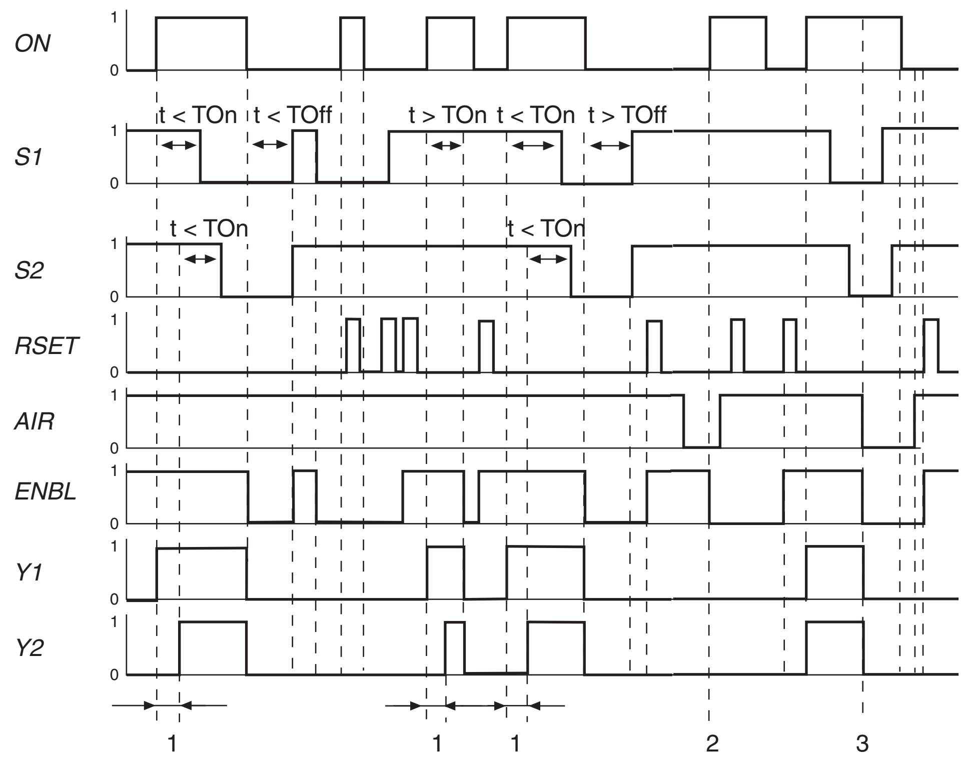

0
1
2
3
4
5
6
7
8
9
PSS SB DI808
test pulse 0
test pulse 1
test pulse 0
spare
press safety valve 1
press safety valve 1
press safety valve 2
press safety valve 2
pilz PSS SB DI808
T 0
T 1
1 T 0
A 34.00
A 34.04+
A 34.06-
A 34.05+
A 34.07-
-X5 1
-X5 3
-X5 2
-X6 1
-X7 1
-X7 5
-X7 3
-X7 7
-X4 1
2
3
-X4 A34.04+
A34.06-
-X4 A34.05+
A34.07-
-S1 1 2
-S2 1 2
-S4 P 1 2
-S3 3 4
PE-SCH.
-Y1 A1 A2
PE
-Y2 A1 A2
-X4 E34.00
E34.01
E34.02
E34.03
-X6 2
-X6 4
-X6 6
-X6 8
-X3 4
E 34.00
E 34.01
E 34.02
E 34.03
24V
acknowledgement of Y1 valve position
acknowledgement of Y2 valve position
pneumatic pressure o. k.
reset

Revision	30.Apr.2003	Date	22.Apr.2003	press safety valve	Pilz GmbH & Co. Felix-Wankel-Str.2 73760 Ostfildern	driving and monitoring a press safety valve with SafetyBUS p	Directory: Eplan4/Pilz/Appl0703
Name	CLE	Name	CLE	Category 4 EN 954-1			Page: 26
		Dep.	CS				

Category 4, EN 954-1

SafetyBUS p – Driving/monitoring a press safety valve

Timing diagram



1: One PSS cycle
2: *AIR* missing on power-up
3: *AIR* missing during operation b

Program

```
                                           SB080
                                           PSV_1

KB  001                            - B - SSNR          ENBL - X - M  070.00 .Enable
M   080.00  .PSV_ON                - X - ON              Y1 - X - A  34.04  .Valve_Y1
E   34.02   .AIR_ON                - X - AIR             Y2 - X - A  34.05  .Valve_Y2
E   34.00   .PSV_FL-1              - X - S1
E   34.01   .PSV_FL-2              - X - S2
M   110.01  .RLO-1                 - X - OnSq
KF  250                            - W - TOn
KF  300                            - W - TOff
E   34.03   .Reset_button          - X - RSET
```

Please note:
A “Minimum scan time” must be specified in the configurator of the PSS SW PG system software.

Global parameters used in administration data block DB015

- DW1022: Minimum scan time

The global parameter may be set in OB120 using SB070.

Additional blocks required

- DB015: Administration data block
  DB015 must consist of its total length of 1024 data words. DB015 must be declared READ/WRITE.
- SB070: Initialisation of global parameters in DB015

Notes

Category 3, EN 954-1

PSS 3100 – Monitoring the work area

Features

- Four-channel redundancy
- Automatic reset when the PSS is cold/warm started
- Automatic reset on leaving the protected area
- Failsafe standard function block used: SB066 (ST_K4)
- Feasibility test on the input signals through SB066

Description

Monitoring the work area

On robot cells which have manual work areas, for example, the situation must be avoided in which a person occupied in the manual work area is injured while the robot continues to work in parallel. For this reason the robot's main axis is fitted with "zone interrogators". These are generally cam tracks which are polled using end switches. These supply a 1 signal when everything is in order, i.e. the robot is outside the manual work area.

In this example the safety system monitors the two non-contact proximity switches S1 and S2. SB066 shuts down if S1 or S2 switches to "0". If one channel switches between "1-0-1" while the other channel remains constantly at "1", SB066 will detect this as an error.

The way in which the error is reset will depend on the operating mode set on SB066. In this application example, parameters for SB066 have been set for the system to reset automatically when the PSS is cold started (PSS switched from off to on), warm started (PSS transferring from STOP to RUN after an error has been rectified), or after signals at both inputs have switched to "1". The output parameter *FG* of SB066 is then reset.

As two switch contacts are replaced by single sensors in this example, the sensors use four-channels via the additional proximity switches S3 und S4.

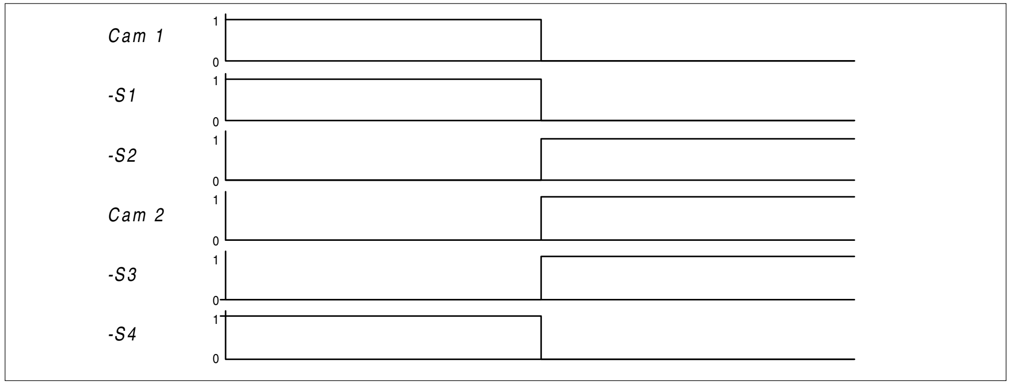
Safety assessment

- A short between 24 VDC and an input circuit will be detected as an error by standard function block SB066 at the next operation.
- A short between the input circuits will be detected as an error by standard function block SB066 at the next operation.

Classification in accordance with EN 954-1

Depending on the application area and its respective regulations, this connection example is suitable for applications up to category 3, in accordance with EN 954-1 (depending on the design of the industrial robot).

Wiring on the cam tracks



Tested proximity switches

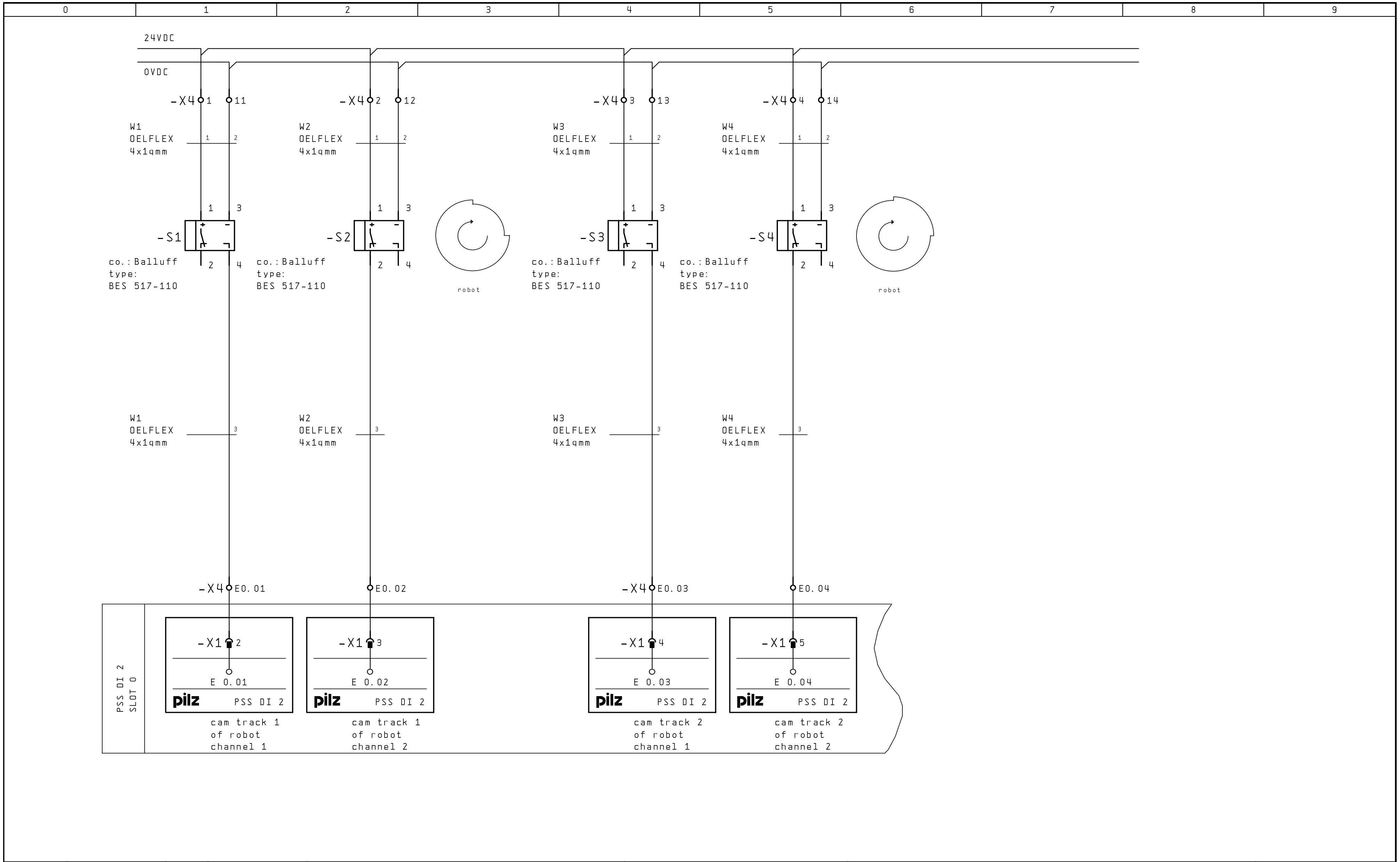
Manufacturer	Type	Contact
BALLUFF	BES 517-110	N/C / N/O
BALLUFF	BES 516-3019	N/C
BALLUFF	BES 516-356	N/O
EUCHNER	ES 781	N/C / N/O
ifm	IF5333	N/C
ifm	IF5329	N/O

Pilz products

Number	Description	Order number
1	PSS1 CPU 3	302 064
1	PSS1 BMP 3/1	302 007
1	PSS1 DI 2	302 101
1	PSS-SB-TRA	301 175B

Drawing file

Page 33 in the project "Eplan4/Pilz/APPL0703"


0
1
2
3
4
5
6
7
8
9
24VDC
0VDC
-X4 1 11
-X4 2 12
-X4 3 13
-X4 4 14
W1 OELFLEX 4x1qmm
W2 OELFLEX 4x1qmm
W3 OELFLEX 4x1qmm
W4 OELFLEX 4x1qmm
1 2
1 3
2 4
-S1
-S2
-S3
-S4
co.:Balluff
type:
BES 517-110
robot
3
-X4 E0.01
E0.02
-X4 E0.03
E0.04
PSS DI 2
SLOT 0
-X1 2
-X1 3
-X1 4
-X1 5
E 0.01
E 0.02
E 0.03
E 0.04
pilz PSS DI 2
cam track 1 of robot channel 1
cam track 1 of robot channel 2
cam track 2 of robot channel 1
cam track 2 of robot channel 2

Revision	10.Jul.2003	Date	22.Apr.2003	operating range monitoring	pilz	Pilz GmbH & Co. Felix-Wankel-Str.2 73760 Ostfildern	operating range monitoring with PSS 3000	Directory: Eplan4/Pilz/Appl0703
Name	CLE	Name	CLE	Category 3 EN 954-1				Page: 33
		Dep.	CS					

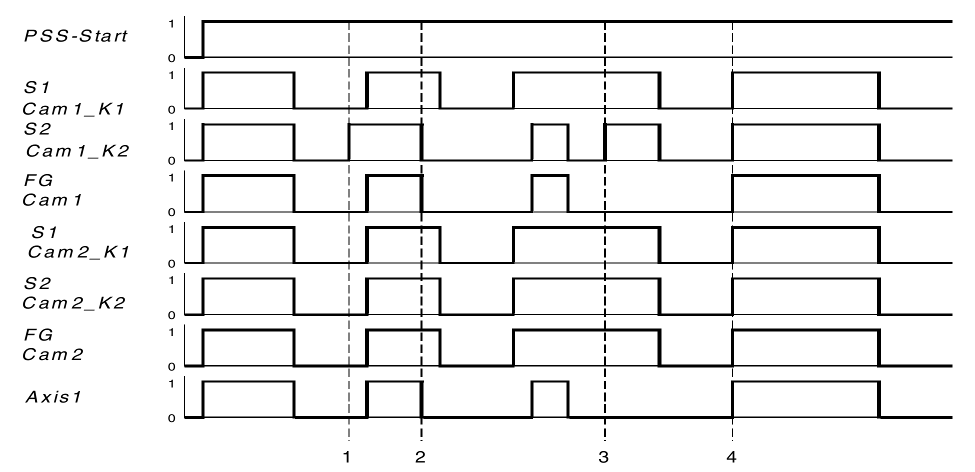
Category 3, EN 954-1

PSS 3100 – Monitoring the work area

Timing diagram

Parameters set on SB066

- Synchronisation time switched off: *SyTi* = 0
- No function test: *MEin* = 0
- No reset button connected: *Strt* = 0
- Automatic reset after PSS cold start: *ARSt* = 1
- No start-up disabler: *AuSt* = 1
- No function test: *NFkT* = 1



1: S1 and S2 can be switched on with an offset
2: S1 and S2 can be switched off with an offset
3: S1 had not switched off, SB066 detects an error
4: S1 and S2 must be switched off and on to reset

Program

```
:  LN  E  0.02     .Cam1_K2
:  =      M  80.00  .M_Cam1_K2
                                            SB066
                                            ST_K4

KB  003                          - B -  SSNR          FG  - X  - M   70.02   .Axis1_K1
E   0.01     .Cam1_K1            - X -  S1
M   80.00    .M_Cam1_K2          - X -  S2
KF  00000    .Syn.Time           - W -  SyTi
M   110.00   .RLO-0              - X -  MEin
E   110.00   .RLO-0              - X -  Strt
M   110.01   .RLO-1              - X -  ARSt
M   110.01   .RLO-1              - X -  AuSt
M   110.01   .RLO-1              - X -  NFkT


:  LN  E  0.03     .Cam2_K1
:  =      M  80.01  .M_Cam2_K1
                                            SB066
                                            ST_K4

KB  004                          - B -  SSNR          FG  - X  - M   70.03   .Axis1_K2
M   80.01    .M_Cam2_K1          - X -  S1
E   0.04     .Cam2_K2            - X -  S2
KF  00000    .Syn.Time           - W -  SyTi
M   110.00   .RLO-0              - X -  MEin
E   110.00   .RLO-0              - X -  Strt
M   110.01   .RLO-1              - X -  ARSt
M   110.01   .RLO-1              - X -  AuSt
M   110.01   .RLO-1              - X -  NFkT


:  L      M 70.02  .Axis1_K1
:  U      M 70.03  .Axis1_K2
:  =      M  88.31 .Axis1
```

Category 3, EN 954-1

PSS 3100 – Monitoring the work area

Please note:
A “Minimum scan time” must be specified in the configurator of the PSS SW PG system software.

Global parameters used in administration data block DB015

- DW1022: Minimum scan time

The global parameter may be set in OB120 using SB070.

Additional blocks required

- DB015: Administration data block
  DB015 must consist of its total length of 1024 data words. DB015 must be declared READ/WRITE.
- SB070: Initialisation of global parameters in DB015

Category 4, EN 954-1; stop category 1, EN 60204-1

PSS 3000 – Monitoring contactors on frequency converters

Features

- Dual-channel
- Failsafe standard function block used: SB067 (RFK_K4)

Description

Frequency converter monitoring function
In this example the safety system monitors the two main contactors separating the frequency converter from the drive. In stop category 1, the potentially hazardous movements must be brought to a halt before the hazardous area can be reached. By opening a safety gate or activating another safety device, auxiliary contactor K25 is used to control drive M1 down to standstill via the frequency converter A1. The drive is then separated from the frequency converter. If there is a long overrun it may be necessary to use a brake. The safety system monitors the contacts on the two contactors K26 and K27. Within the user program, the failsafe standard function block SB067 is assigned to the N/C contacts K26 and K27. SB067 drives the contactors as well as monitoring the feedback loop. A 0/1 pulse edge at input parameter *Ein* of SB067 (flag M82.02, enable delay) sets the output that drives the contactors, *K*, to “1”; a 1/0 pulse edge sets it to “0”.
SB067 has extensive fault detection features. For example, SB067 automatically detects errors such as “FL remains open” or “FL remains closed”.
If an error occurs, the enable output *FG* on SB067 will immediately be reset, along with *K*, the output that drives the contactors. Both outputs are also reset when the PSS is stopped and when the PSS is switched on. The signal at the enable output *FG* can be evaluated by the user program and trigger an appropriate reaction. SB067 stores a value in DB015, which can be used to determine why *FG* was reset.
If an error occurs, once the error has been rectified, it is necessary to reset by pressing S1 (0/1 pulse edge at *RSet*) in order to also reset enable output *FG* of SB067. Output *K* can then also be reset by enabling the E-STOP flag.

Safety assessment

- A short between 24 VDC and a safety output or a feedback loop input will be detected as an error by the programmable safety system.

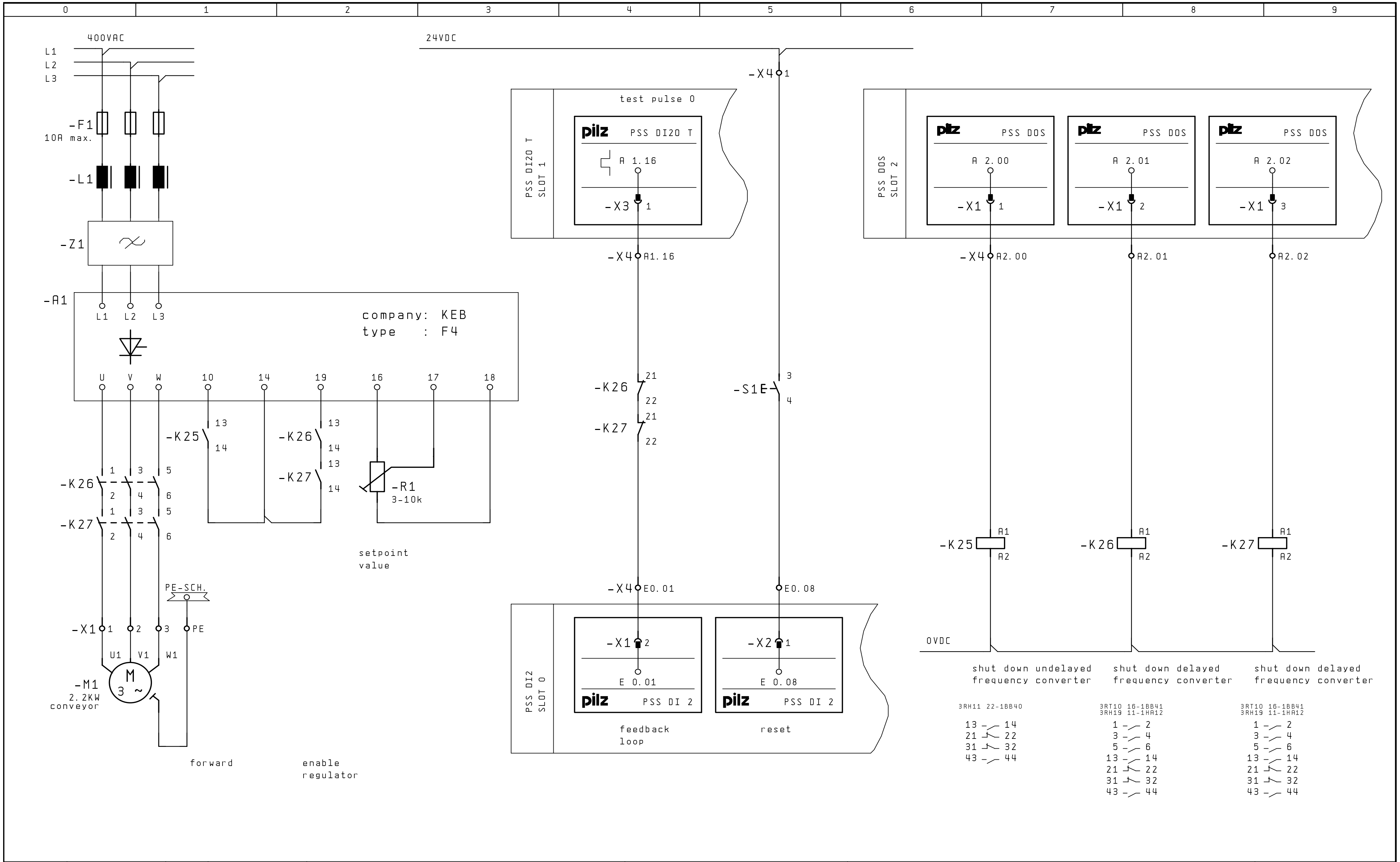
Classification in accordance with EN 954-1
Depending on the application area and its respective regulations, this connection example is suitable for applications up to category 4, in accordance with EN 954-1.

Pilz products

Number	Description	Order number
1	PSS CPU 3	301 064
1	PSS BMP 4/2	301 006
1	PSS PS 24	301 051
1	PSS DI 2	301 101
1	PSS DOS	301 111
1	PSS DI2O T	301 112
1	PSS-SB-NOT	301 176B

Drawing file

Page 40 in the project “Eplan4/Pilz/APPL0703”

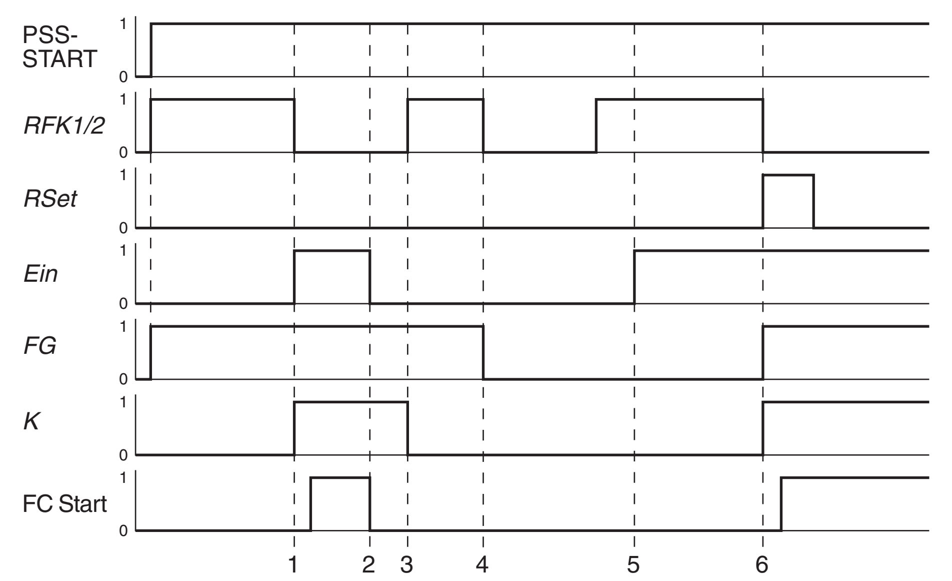

0
1
2
3
4
5
6
7
8
9
400VAC
L1
L2
L3
-F1
10A max.
-L1
-Z1
-A1
L1 L2 L3
company: KEB
type : F4
U V W 10 14 19 16 17 18
-K25
13
14
-K26
13
14
-K27
13
14
-R1
3-10k
setpoint value
-K26
1 3 5
2 4 6
-K27
1 3 5
2 4 6
PE-SCH.
-X1 1 2 3 PE
U1 V1 W1
-M1
2.2KW
conveyor
M
3 ~
forward
enable regulator
24VDC
-X4 1
PSS DI20 T
SLOT 1
test pulse 0
pilz
PSS DI20 T
A 1.16
-X3 1
-X4 A1.16
-K26
21
22
-K27
21
22
-S1E
3
4
-X4 E0.01
E0.08
PSS DI 2
SLOT 0
-X1 2
E 0.01
pilz
PSS DI 2
-X2 1
E 0.08
pilz
PSS DI 2
feedback loop
reset
PSS DOS
SLOT 2
pilz
PSS DOS
A 2.00
-X1 1
pilz
PSS DOS
A 2.01
-X1 2
pilz
PSS DOS
A 2.02
-X1 3
-X4 A2.00
A2.01
A2.02
-K25
A1
A2
-K26
A1
A2
-K27
A1
A2
0VDC
shut down undelayed frequency converter
shut down delayed frequency converter
shut down delayed frequency converter
3RH11 22-1BB40
13 14
21 22
31 32
43 44
3RT10 16-1BB41
3RH19 11-1HA12
1 2
3 4
5 6
13 14
21 22
31 32
43 44
3RT10 16-1BB41
3RH19 11-1HA12
1 2
3 4
5 6
13 14
21 22
31 32
43 44

Revision	10.Jul.2003	Date	22.Apr.2003	e-stop category 1 application	Pilz GmbH & Co. Felix-Wankel-Str.2 73760 Ostfildern	emergency stop categorie 1 with PSS 3000	Directory: Eplan4/Pilz/Appl0703
Name	CLE	Name	CLE	Category 4 EN 954-1			Page: 40
		Dep.	CS				

Category 4, EN 954-1; stop category 1, EN 60204-1

PSS 3000 – Monitoring contactors on frequency converters

Timing diagram



1: Output *K* = 1
2: Instantaneous shutdown of frequency converter
3: Delayed shutdown of frequency converter
4: Error in the feedback loop -> FG = 0
5: Reset lock after error
6: Error reset *Rset* = 0/1 -> *FG* = 1

Program

```
: L    M 071.00   Enable E-STOP
: S    M 082.00   HM 1 (FG was on)

: LN   M 071.00   Enable E-STOP
: U    M 082.00   HM 1 (FG was on)
: S    M 082.01   HM 2 (start time)
:
: L    KF 00002   TIMEVALUE “set to suit the application”
: L    M 082.01   HM 2 (start time)
: SE   T64.1      TIMER LEVEL

: L    T 64       TIMER
: R    M 082.00   HM 1 (FG was on)
: R    M 082.01   HM 2 (start time)

: L    M 082.01   HM 2 (start time)
: O    M 071.00   Enable E-STOP
: =    M 082.02   Enable delay (controlled shutdown)

: L    M 071.00   Enable E-STOP
: U    M 082.03   StartCond.FC (incl. reset button, “no error present”...)
: U    M 070.00   Enable FL
: =    A  2.00    Start FC

: CAL SB 067

                                        SB067
                                        RFK_K4

KB  001                      - B -  SSNR          FG  - X  - M   070.00 .Enable FL
E   0.01    .FL-K26/27       - X -  RFK1           K   - X  - M   081.00 .K26/27
E   0.01    .FL-K26/27       - X -  RFK2
E   0.08    .Reset           - X -  RSet
M   082.02  .Enable_delay    - X -  Ein
```

Category 4, EN 954-1; stop category 1, EN 60204-1

PSS 3000 – Monitoring contactors on frequency converters

```
:  L    M81.00    K26/27
:  =    A2.01     K26
:  =    A2.02     K27
```

Please note:
A “Minimum scan time” must be specified in the configurator of the PSS SW PG system software.

Global parameters used in administration data block DB015

- DW1002: Number of cycles for the reaction time of the feedback loop

The global parameter may be set in OB120 using SB070.

Additional blocks required

- DB015: Administration data block
  DB015 must consist of its total length of 1024 data words. DB015 must be declared READ/WRITE.
- SB070: Initialisation of global parameters in DB015

Category 3, EN 954-1

PSS 3000 – Driving/monitoring a valve terminal

Features

- Redundant, electrical (contactor) and pneumatic shutdown
- Monitors the pneumatic pressure on the closing valve
- Uses pneumatic components which do not permit any hazardous movements in the case of danger (piston rod clamps, spring return valve, valve in central position)
- Failsafe standard function block used: SB067 (RFK_K4)
- Feasibility test and time monitoring of the start-up condition, the feedback loop signal and the output status through standard function block SB067

Description

Driving and monitoring function
In this example the safety system monitors the electrical and pneumatic shutdown of a Festo 03 type valve terminal. The PSS switches the valve terminal's air intake via closing valve Y10 and it's load voltage via contactor K33.
The closing valve (ELD) ensures a slow build up of pressure, so that the cylinders that are not in a defined end position move at reduced speed. The pressure switch S10 is closed when the pressure builds up. If the closing valve is shut down, the pressure switch must open after a delay time. If an error occurs, enable flag M81.00 is set. The enable flag is reset again once the error has been rectified and the S5 button has been operated.
When all the start-up conditions have been met (pressure switch S10 and contactor's feedback loop closed, enable flag *FG* set on SB067), the compressed air can be built up by pressing S3. When enough pressure has built up, pressure switch S10 closes after a delay time and the valve terminal can be switched on by pressing S1.
If the pressure drops over a defined period during operation, the closing valve will close and the pressure is reduced. When the error has been rectified and the start-up conditions are met, the system can be restarted by pressing S5.
SB067 controls and monitors the contactor K33 and the feedback loop. A 0/1 pulse edge at input parameter *Ein* sets output parameter *K* to 1, thereby switching on contactor K33. A 1/0 pulse edge at *Ein* switches off the contactor.
If an error occurs, e.g. the feedback loop remains open, SB067 resets the enable output *FG* and output *K*. The output is also reset when the PSS is stopped and when the PSS is switched on.
Once the error has been rectified, it is necessary to reset by pressing S5 (0/1 pulse edge at RSet) in order to also reset enable output *FG* of SB067. When all the start-up conditions have been met, output *K* is reset.
If the valve terminal is shut down through the PSS, the signals for driving the valves on the valve terminal should be reset via Interbus.

Safety assessment:

- If the contacts on the pressure switch S10 are overridden, this will be detected as an error at the next operation.
- A short between 24 VDC and the input circuit of the pressure switch S10 will be detected as an error by the programmable safety system.
- If the feedback signal K33 is overridden, standard function block SB097 will detect this as an error at the next operation.
- A short between 24 VDC and the feedback input K33 will be detected as an error by the programmable safety system.
- A short between 24 VDC and a safety output will be detected as an error by the programmable safety system and will cause a dual-channel shutdown of the load.
- The centralised module DI2OZ will detect an open circuit in the output circuits.
- An internal short circuit at the valve outputs in the electronics of the valve terminal cannot be excluded. This error will not be detected because the outputs are not uploaded.
- A short circuit between the supply voltage and the load voltage on the valve terminal cannot be excluded as there is no galvanic isolation.

Classification in accordance with EN 954-1:
Depending on the application area and its respective regulations, this connection example is suitable for applications up to category 3, in accordance with EN 954-1.

Category 3, EN 954-1

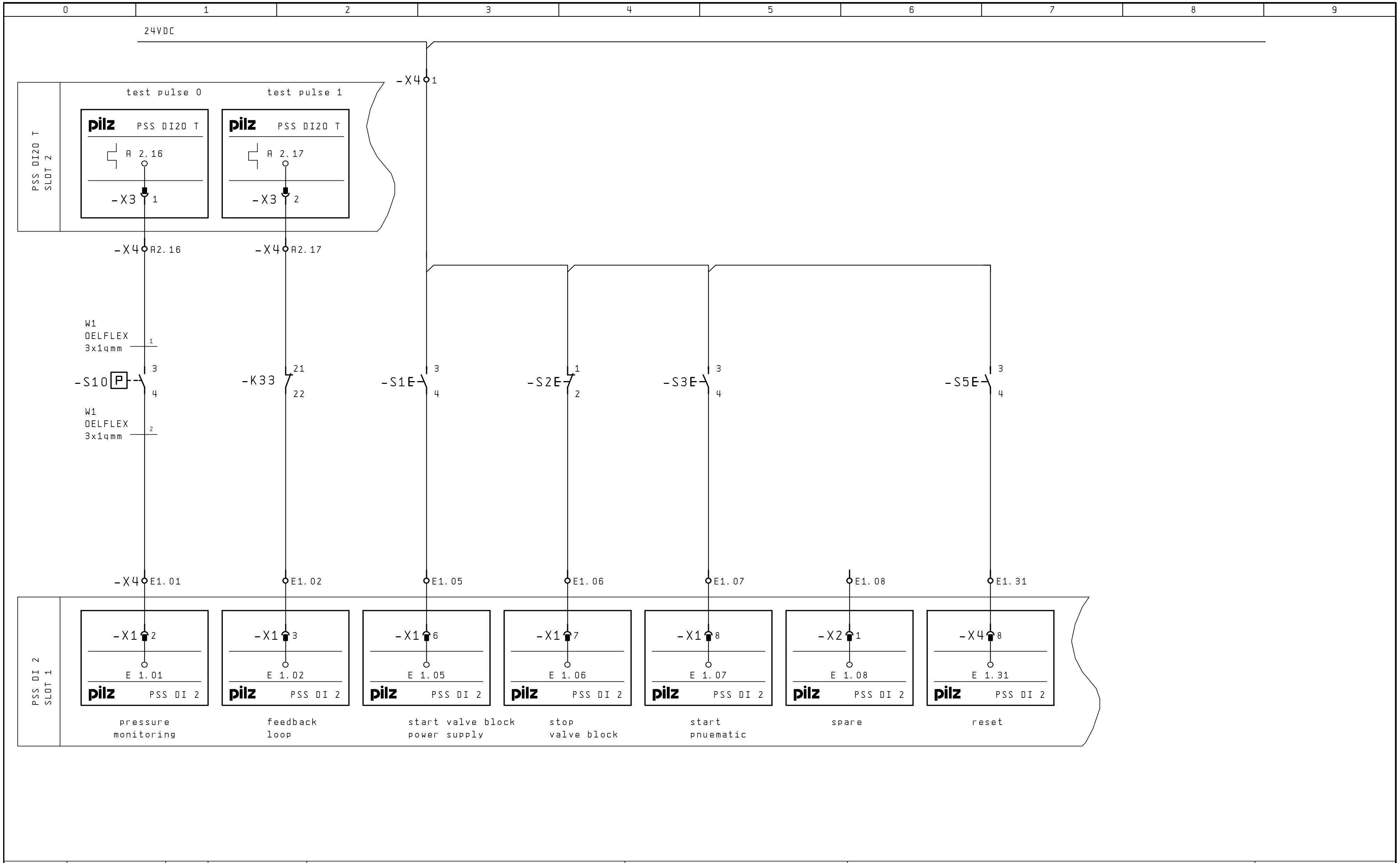
PSS 3000 – Driving/monitoring a valve terminal

Pilz products

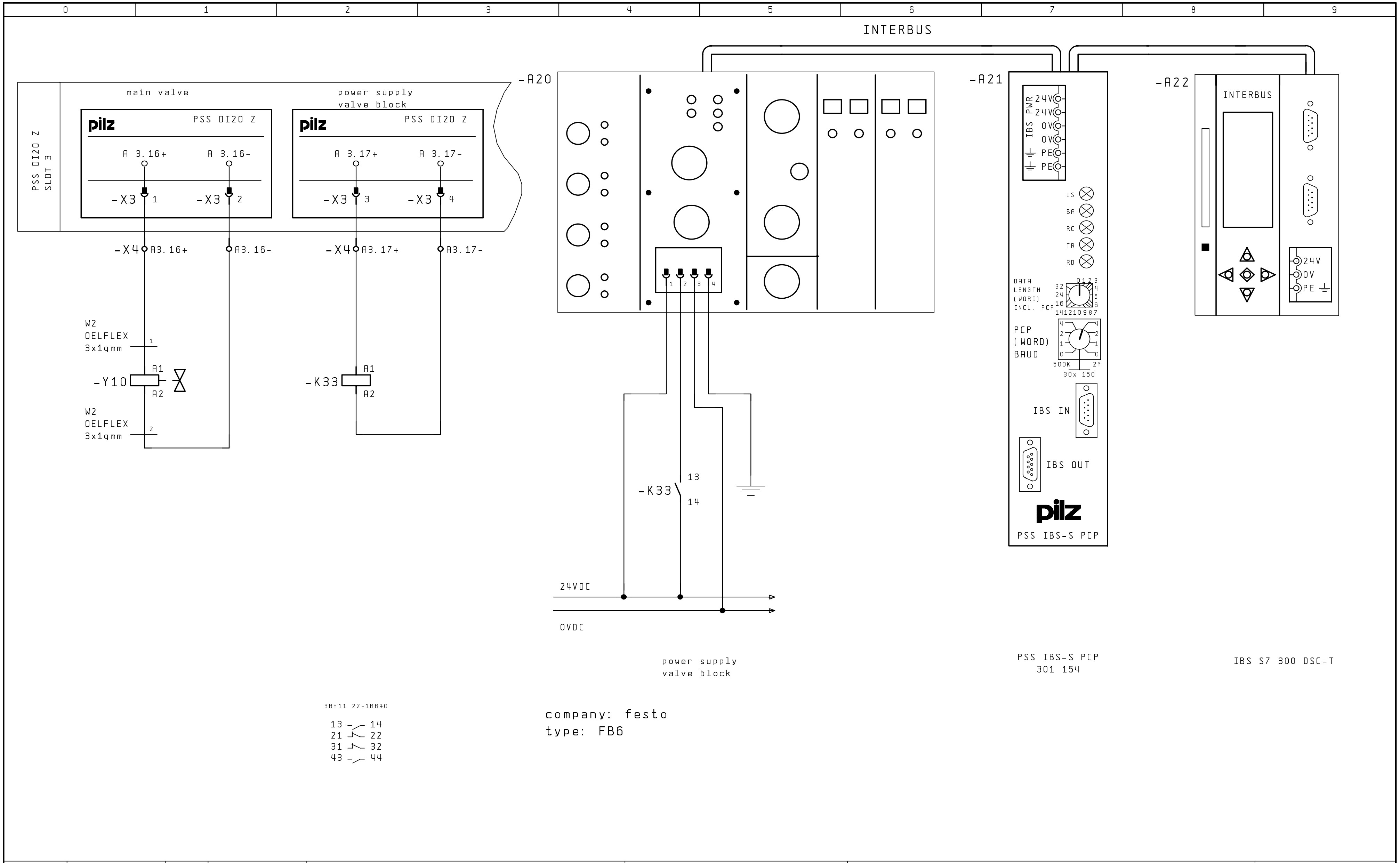
Number	Description	Order number
1	PSS CPU 3	301 064
1	PSS BMP 8	301 005
1	PSS PS 24	301 051
	PSS IBS-S PCP	301 154
1	PSS DI 2	301 101
1	PSS DI2O T	301 112
1	PSS DI2O Z	301 109
1	PSS-SB-NOT	301 176B

Drawing file

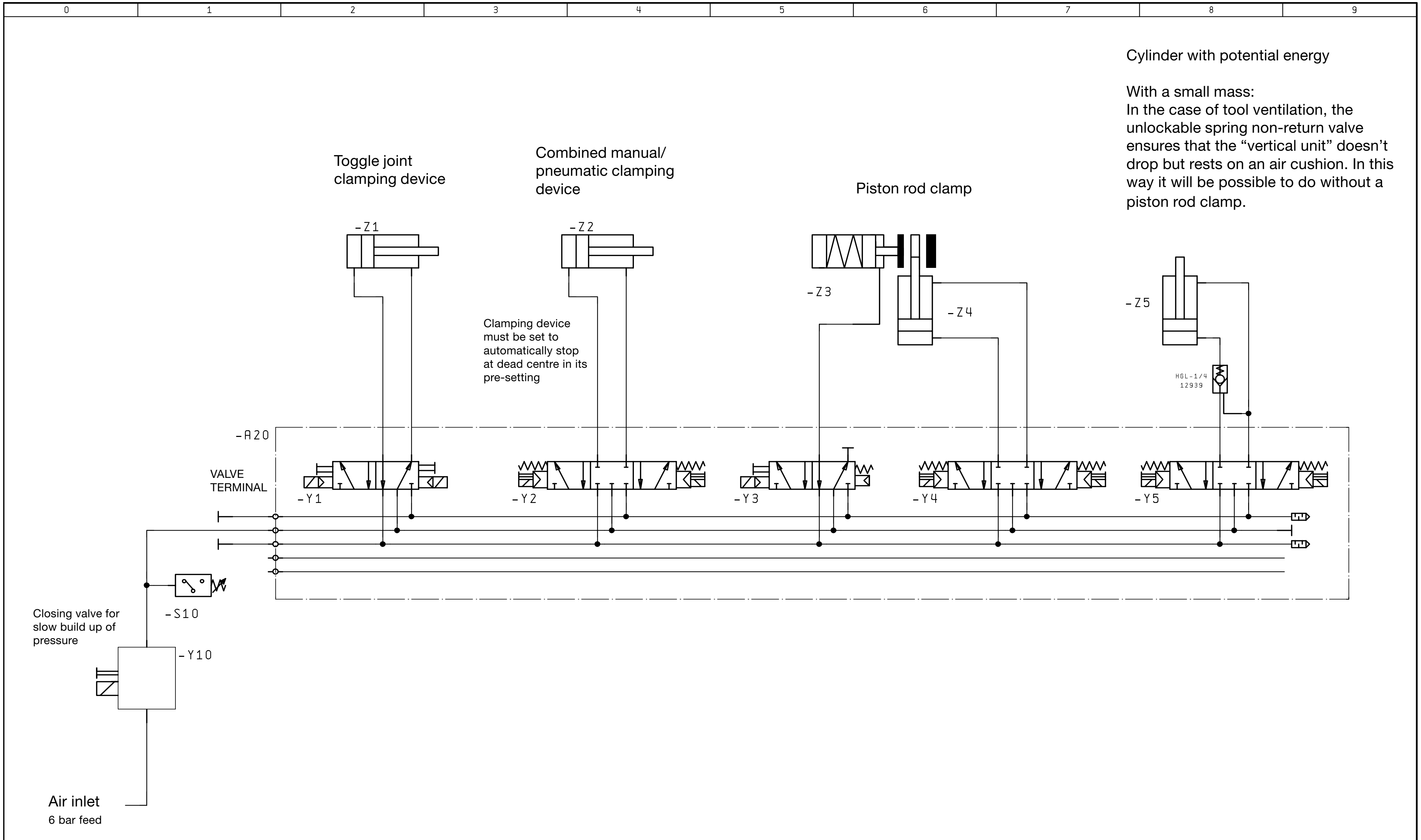
Pages 42, 43 and 44 in the project “Eplan4/Pilz/APPL0703”


0
1
2
3
4
5
6
7
8
9
24VDC
-X4 1
PSS DI20 T
SLOT 2
test pulse 0
test pulse 1
pilz PSS DI20 T
A 2.16
-X3 1
pilz PSS DI20 T
A 2.17
-X3 2
-X4 A2.16
-X4 A2.17
W1
OELFLEX
3x1qmm
1
-S10 P 3 4
W1
OELFLEX
3x1qmm
2
-K33 21 22
-S1E 3 4
-S2E 1 2
-S3E 3 4
-S5E 3 4
-X4 E1.01
E1.02
E1.05
E1.06
E1.07
E1.08
E1.31
PSS DI 2
SLOT 1
-X1 2
E 1.01
pilz PSS DI 2
-X1 3
E 1.02
pilz PSS DI 2
-X1 6
E 1.05
pilz PSS DI 2
-X1 7
E 1.06
pilz PSS DI 2
-X1 8
E 1.07
pilz PSS DI 2
-X2 1
E 1.08
pilz PSS DI 2
-X4 8
E 1.31
pilz PSS DI 2
pressure monitoring
feedback loop
start valve block power supply
stop valve block
start pnuematic
spare
reset

Revision	30.Apr.2003	Date	22.Apr.2003	plc output modul application	pilz Pilz GmbH & Co. Felix-Wankel-Str.2 73760 Ostfildern	valve block application with PSS 3000	Directory: Eplan4/Pilz/Appl0703
Name	CLE	Name	CLE				
				Category 3 EN 954-1			Page: 42
		Dep.	CS				


0
1
2
3
4
5
6
7
8
9
INTERBUS
PSS DI20 Z SLOT 3
main valve
power supply valve block
pilz
PSS DI20 Z
A 3.16+
A 3.16-
A 3.17+
A 3.17-
-X3 1
-X3 2
-X3 3
-X3 4
-X4 A3.16+
A3.16-
-X4 A3.17+
A3.17-
W2 OELFLEX 3x1qmm
1
A1
-Y10
A2
W2 OELFLEX 3x1qmm
2
-K33
A1
A2
-A20
1 2 3 4
-K33
13
14
24VDC
0VDC
power supply valve block
-A21
IBS PWR
24V
24V
0V
0V
PE
PE
US
BA
RC
TR
RD
DATA LENGTH (WORD) INCL. PCP
0 1 2 3 4 5 6 7 8 9 10 12 14 16 24 32
PCP (WORD) BAUD
500K
2M
30x 150
IBS IN
IBS OUT
pilz
PSS IBS-S PCP
PSS IBS-S PCP 301 154
-A22
INTERBUS
24V
0V
PE
IBS S7 300 DSC-T
3RH11 22-1BB40
13 14
21 22
31 32
43 44
company: festo
type: FB6

Revision	30. Apr. 2003	Date	22. Apr. 2003	plc output modul application	Pilz GmbH & Co. Felix-Wankel-Str. 2 73760 Ostfildern	valve block application with PSS 3000	Directory: Eplan4/Pilz/Appl0703
Name	CLE	Name	CLE				
				Category 3 EN 954-1			Page: 43
		Dep.	CS				


0
1
2
3
4
5
6
7
8
9
Toggle joint clamping device
Combined manual/ pneumatic clamping device
Piston rod clamp
-Z1
-Z2
-Z3
-Z4
-Z5
HGL-1/4
12939
-A20
VALVE TERMINAL
-Y1
-Y2
-Y3
-Y4
-Y5
-S10
-Y10

Cylinder with potential energy

With a small mass:
In the case of tool ventilation, the unlockable spring non-return valve ensures that the “vertical unit” doesn’t drop but rests on an air cushion. In this way it will be possible to do without a piston rod clamp.

Clamping device must be set to automatically stop at dead centre in its pre-setting

Closing valve for slow build up of pressure

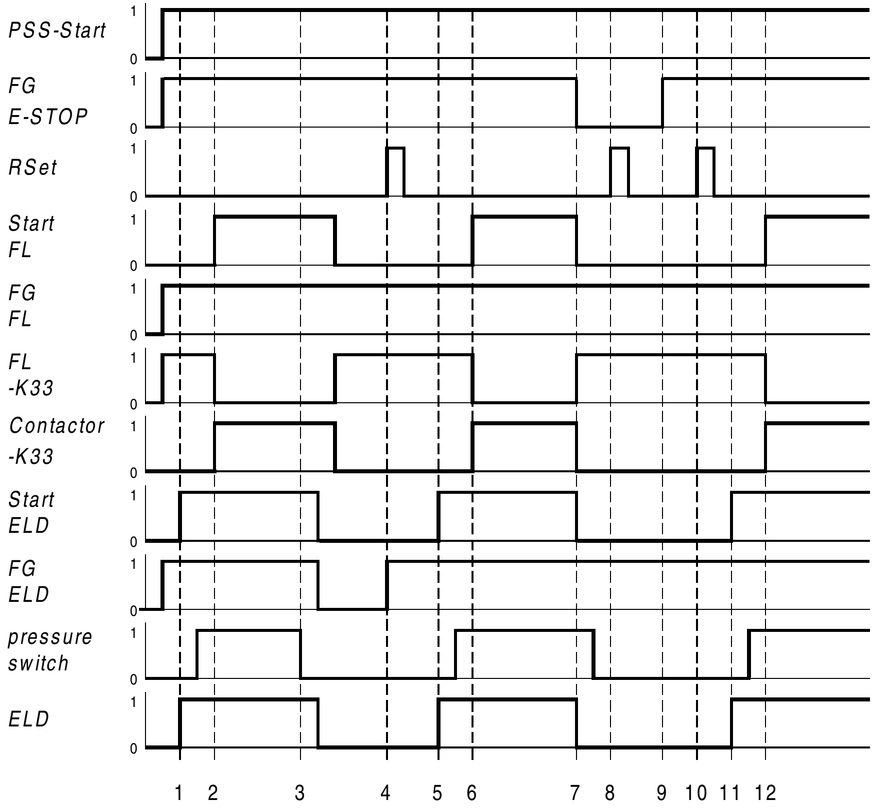
Air inlet
6 bar feed

Revision	30.Apr.2003	Date	22.Apr.2003	plc output modul application	Pilz GmbH & Co. Felix-Wankel-Str.2 73760 Ostfildern	valve block application with PSS 3000	Directory: Eplan4/Pilz/Appl0703
Name	CLE	Name	CLE				
				Category 3 EN 954-1			Page: 44
		Dep.	CS				

Category 3, EN 954-1

PSS 3000 – Driving/monitoring a valve terminal

Timing diagram



1: Start ELD
2: Start valve voltage
3: Error, pressure switch dropped out
4: Rectify error and reset
5: Start ELD
6: Start valve voltage
7: Enable for E-STOP missing
8: Reset (error was not rectified)
9: Enable for E-STOP restored
10: Reset
11: Start ELD
12: Start valve voltage

Category 3, EN 954-1

PSS 3000 – Driving/monitoring a valve terminal

Program

```
:
:
: L      E  1.07    Button start pressure build up -S3
: O     M  83.00    Start closing valve (ELD)
: U     E  1.06     Button stop valve terminal -S2
: U     M  70.00    Enable E-STOP
: U     M  70.01    Enable feedback loop
: U     M  81.00    Enable ELD
: =     M  83.00    Start ELD

: L     KF 000001   Time value pressure established
: L     E  1.01     Pressure switch –S10
: U     M  83.00    Start ELD
: SE    T 66.2      Timer level 3


: L     E   1.05    Button start valve terminal -S1
: U     T 66        Pneumatic pressure available
: O     M  85.00    Start load voltage valve terminal
: U     E  1.06     Button stop valve terminal -S2
: U     M  70.00    Enable E-STOP
: U     M  70.01    Enable feedback loop
: U     M  81.00    Enable ELD
: U     M  83.00    Start ELD
: U     A   3.16    Pneumatic closing valve
: =     M  85.00    Start load voltage valve terminal
```

```
CAL   SB 067

                                      +---------------------+
                                      |        SB067        |
                                      |        RFK_K4       |
                                      |                     |
KB  002                          - B -| SSNR             FG |- X  - M   70.01  .Enable
E    1.02     .FL                - X -| RFK1              K |- X  - M   2.17   .K33
E    1.02     .FL                - X -| RFK2                |
E    1.31     .Reset             - X -| RSet                |
M    85.00    .LoadV.valve.term  - X -| Ein                 |
                                      +---------------------+

:
DS_Poll             :Network 00
:
: L     KF 000002   Time value reduce pressure
: LN    A  3.16     Pneumatic closing valve
: SE    T 64.2      Timer level 1
:
: L     T64         Timer level 1
: U     E  1.01     Pressure switch –S10
: S     M  80.00    Pressure switch closed, but valve off
:
: L     KF 000001   Time value pressure drop
: L     A  3.16     Pneumatic closing valve
: UN    E  1.01     Pressure switch -S10
: SE    T65.2       Timer level 2
:
: L     T 65        Timer level 2
: S     M  80.01    Pressure switch open, but valve on
:
StartCond.          :Network 01
:
: L     M  110.01   RLO-1
: R     M  81.00    Enable ELD
:
```

Category 3, EN 954-1

PSS 3000 – Driving/monitoring a valve terminal

```
: LN   M  83.00     Start ELD
: SPB = Reset_Valve
:
Request_Valve        :Network 02
:
: L    M  80.00     Pressure switch closed, but valve off
: O    M  80.01     Pressure switch open, but valve on
: SPB = Reset_Valve
: S    A  3.16      Pneumatic closing valve
: S    M  81.00     Enable ELD
: SPA = PulseEdge_Reset
:
Reset_Valve         :Network 03
: R    A  3.16      Pneumatic closing valve
:
: L    M  80.00     Pressure switch closed, but valve off
: O    M  80.01     Pressure switch open, but valve on
: SPB = PulseEdge_Reset
: S    M  81.00     Enable ELD

PulseEdge_Reset  :Network 4

: L    E  1.31      Reset
: UN   M  82.01     HM_PulseEdge Reset
: =    M  82.00     Reset PulseEdge flag
: L    E  1.31      Reset
: =    M  82.01     HM_PulseEdge Reset

: LN   M  82.00     Reset PulseEdge
: O    M  83.00     Start ELD
: SPB = Block End
: R    M  80.00     Pressure switch closed, but valve off
: R    M  80.01     Pressure switch open, but valve on
:
Block end           :Network 05:
: BE
```

Please note:
A “Minimum scan time” must be specified in the configurator of the PSS SW PG system software.

Global parameters used in administration data block DB015

- DW1002: Number of cycles for the reaction time of the feedback loop

The global parameter may be set in OB120 using SB070.

Additional blocks required

- DB015: Administration data block
  DB015 must consist of its total length of 1024 data words. DB015 must be declared READ/WRITE.
- SB070: Initialisation of global parameters in DB015

Category 4, EN 954-1

PSS 3000 – Driving/monitoring a muting lamp

Features

- Dual-channel redundancy
- Lamp on which the filament is monitored
- Failsafe standard function block used: SB065 (FBL)
- Feasibility test and time monitoring of the start-up condition, the feedback loop signals and the output status through standard function block SB065

Description

Driving and monitoring function

The plant conditions are logically connected within the user program through various SBs. Flag M70.00 contains the static enable and is linked with the muting block SB095, for example.

The safety system monitors the two semiconductor outputs on the muting lamp. Within the user program, the failsafe standard function block SB065 is assigned to the semiconductor outputs. SB065 drives the muting lamp as well as monitoring the semiconductor outputs. A 0/1 pulse edge at input parameter *ON* of SB065 (through S1 switch) sets the outputs that drive the lamp, *K1* and *K2*, to “1”; a 1/0 pulse edge sets them to “0”.

The muting lamp has built-in monitoring, which registers the current flow on the filament at two galvanically isolated, volt-free semiconductor outputs. If the lamp is not being driven, both semiconductor outputs are switched off. SB065 checks:

- on a lamp that is switched on, that the semiconductor outputs are switched on
- on a lamp that is switched off, that the semiconductor outputs are switched off.

If an error occurs, the enable output *ENBL* on SB065 will immediately be reset, along with the outputs that drive the lamp, *K1 and K2*. Both outputs are also reset when the PSS is stopped and when the PSS is switched on. The signal at the enable output *ENBL* can be evaluated by the user program and trigger an appropriate reaction. SB065 stores a value in DB015 (DB016 or DB017); this can be used to determine why *ENBL* was reset. If an error occurs, once the error has been rectified, a reset must be performed by pressing S1 (0/1 pulse edge at *RSET*) in order to also reset the enable output *ENBL* on SB065. Outputs *K1* and *K2* can then also be reset.

Safety assessment

- A short between 24 VDC and a safety output or a feedback loop input will be detected as an error by the programmable safety system.
- A short between the input circuits within a multicore cable will be detected as an error by the programmable safety system.
- To achieve category 4, both semiconductor outputs must be monitored.

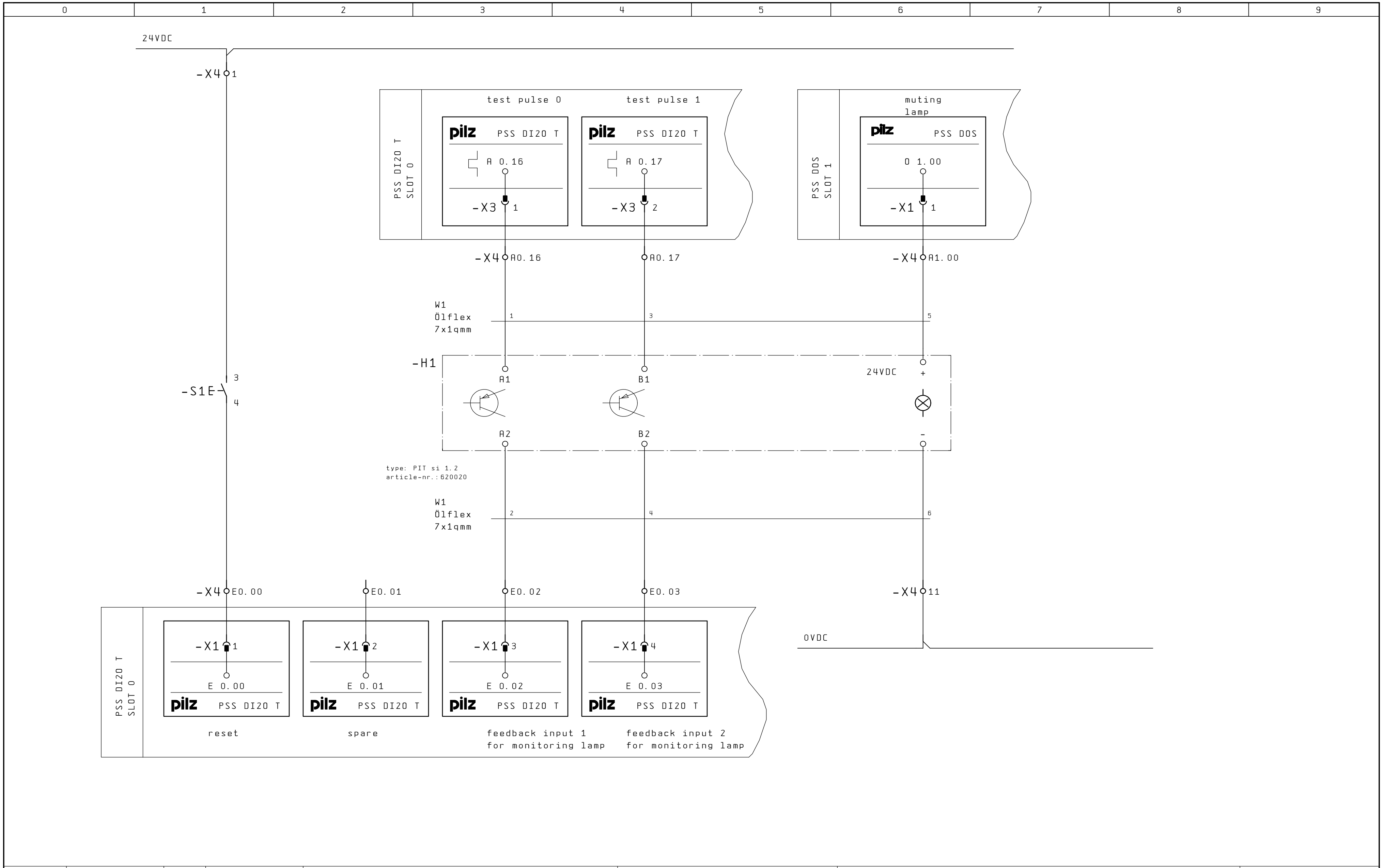
Pilz products

Number	Description	Order number
1	PSS CPU 3	301 064
1	PSS BMP 4/2	301 006
1	PSS PS 24	301 051
1	PSS DI2O T	301 112
1	PSS DOS	301 111
1	PSS-SB-NOT	301 176B
1	PIT si 1.2	620 020

Drawing file

Pages 55 in the project “Eplan4/Pilz/APPL0703”

Classification in accordance with EN 954-1:
Depending on the application area and its respective regulations, this connection example is suitable for applications up to category 4, in accordance with EN 954-1.

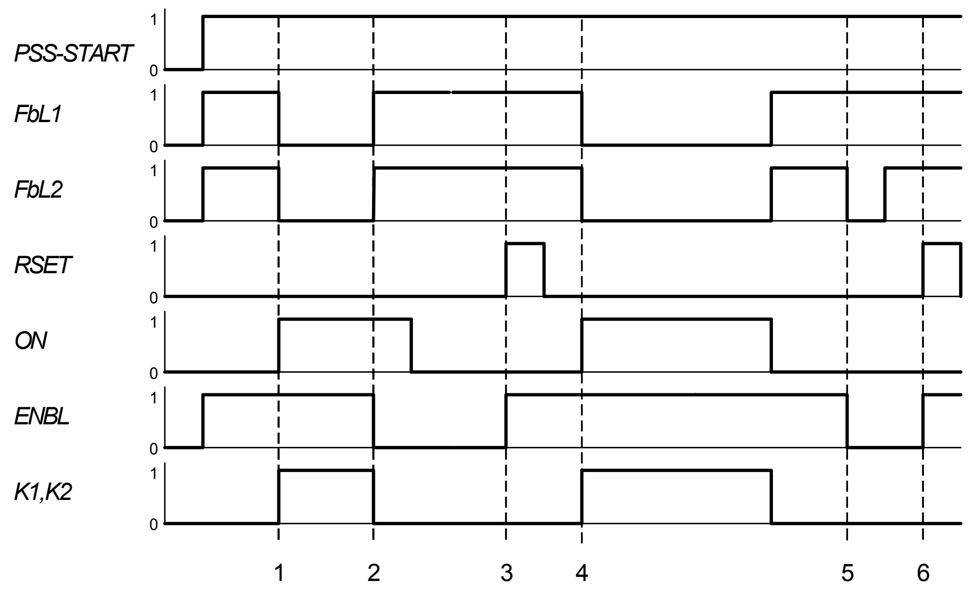

0
1
2
3
4
5
6
7
8
9
24VDC
-X4 1
test pulse 0
test pulse 1
muting lamp
PSS DI20 T
SLOT 0
pilz PSS DI20 T
A 0.16
-X3 1
pilz PSS DI20 T
A 0.17
-X3 2
PSS DOS
SLOT 1
pilz PSS DOS
O 1.00
-X1 1
-X4 A0.16
A0.17
-X4 A1.00
W1
Ölflex
7x1qmm
1
3
5
-H1
A1
B1
24VDC
+
A2
B2
-
type: PIT si 1.2
article-nr.:620020
-S1E
3
4
W1
Ölflex
7x1qmm
2
4
6
-X4 E0.00
E0.01
E0.02
E0.03
-X4 11
0VDC
PSS DI20 T
SLOT 0
-X1 1
E 0.00
pilz PSS DI20 T
-X1 2
E 0.01
pilz PSS DI20 T
-X1 3
E 0.02
pilz PSS DI20 T
-X1 4
E 0.03
pilz PSS DI20 T
reset
spare
feedback input 1
for monitoring lamp
feedback input 2
for monitoring lamp

Revision	27.Apr.2004	Date	22.Apr.2003	monitoring muting lamp	Pilz GmbH & Co.KG Felix-Wankel-Str.2 73760 Ostfildern	monitoring muting lamp with PSS 3000	Directory: Eplan4/Pilz/App10703
Name	CLE	Name	CLE				
				Category 4 EN 954-1			Page: 55
		Dep.	CS				

Category 4, EN 954-1

PSS 3000 – Driving/monitoring a muting lamp

Timing diagram



1: Muting lamp on: *K1*, *K2* = 1
2: Error in the feedback loop when the muting lamp is on: *ENBL* = 0 (filament broken)
3: Error reset *RSET* = 0/1: *ENBL* = 1
4: Muting lamp on: *K1*, *K2* = 1
5: Error in the feedback loop when the muting lamp is off: *ENBL* = 0 (A1 – A2 overriden)
6: Error reset *RSET* = 0/1: *ENBL* = 1

Program:

```
: LN  E 00.02     .FL1-LAMP
: =   M 99.00     .M_FL1
: LN  E 00.03     .FL2-LAMP
: =   M 99.01     .M_FL2
:
: CAL SB 065

                                        SB065
                                         FBL

KF  000001                   - W -  SSNR        ENBL  - X  - M   70.00  ST_EN
M   110.01  .RLO-1           -  X - GRP           K1  - X  - A   1.00   LAMP
M   99.02   .Muting active   -  X - ON            K2  - X  - A   1.00   LAMP
M   99.00   .M_FL1           -  X - FbL1
M   99.01   .M_FL2           -  X - FbL2
KF  000250                   - W -  TFbL
E   0.00    .Reset           -  X - RSET
```

Please note:
A “Minimum scan time” must be specified in the configurator of the PSS SW PG system software.

Global parameters used in administration data block DB015, DB016, DB017

- DW1022: Global parameters must be set in OB120 using SB071.

Additional blocks required

- DB015, DB016, DB017: Administration data block
  DB015, DB016 and DB017 must consist of their total length of 1024 data words. DB015, DB016 and DB017 must be declared READ/WRITE.
- SB071: Initialisation of global parameters in DB015, DB016, DB017
- SB255: Operating system call

Notes

Further Applications

Contents **Page**

Further Applications

PSS 3000	–	Monitoring an enable switch	Category 4, EN 954-1	5.7-2
PSS 3000	–	Monitoring an enable switch	Category 4, EN 954-1	5.7-6
PSS 3000	–	Monitoring an enable switch	Category 2, EN 954-1	5.7-10
SafetyBUS p	–	PSS connection	Category 4, EN 954-1	5.7-14
SafetyBUS p	–	FO connection	Category 4, EN 954-1	5.7-20

Category 4, EN 954-1

PSS 3000 – Monitoring an enable switch

Features

- Dual-channel
- Two N/O contacts, two positive-guided N/C contacts
- Failsafe standard function block used: SB063 (E-STOP), SB064 (S-GATE), SB092 (ENBL_DEV)

Description

Enable switch monitoring function
In this example the safety system monitors the dual-channel, three-stage enable switch A1, which has two N/O contacts and two positive-guided N/C contacts. Within the user program, the failsafe standard function blocks SB063, SB064 and SB092 are assigned to the enable switch. SB092 evaluates SB062 and SB063 and detects any defect on the N/O or N/C contact of the enable switch. SB069 also detects invalid input signals, such as a reset button that is constantly operated. If the enable switch is fully depressed (E-STOP) or an error occurs, the enable output *ENBL* on SB092 will immediately be reset. If the enable switch is fed back from stage 3 through stage 2 to stage 1, SB092 will prevent an enable function in stage 2.
The signal at the enable output *ENBL* can be evaluated by the user program and trigger an appropriate reaction. SB092 stores a value in DB015 (DB016 or DB017); this can be used to determine why *ENBL* was reset. The way in which the error is reset will depend on the operating mode set on SB092. In this application example, parameters for SB092 have been set in such a way that it is necessary to reset by pressing S2 (0/1 pulse edge at *RSET*) in order to reset enable output *ENBL* on SB092 when the PSS is cold started (PSS switched from off to on), warm started (PSS transferring from STOP to RUN) or after the enable switch has been fully depressed (stop function) and then released.

Safety assessment

- If a contact on the N/O or N/C circuit of the enable switch is overridden, standard function block SB063 or SB064 will detect this at the next operation.
- A short between the input circuits on the enable switch will be detected as an error by the programmable safety system.
- A short between 24 VDC and an input circuit on the enable switch will be detected as an error by the programmable safety system.
- If the enable switch is fed back from stage 3 to stage 1, the enable will be suppressed through SB092.

Classification in accordance with EN 954-1

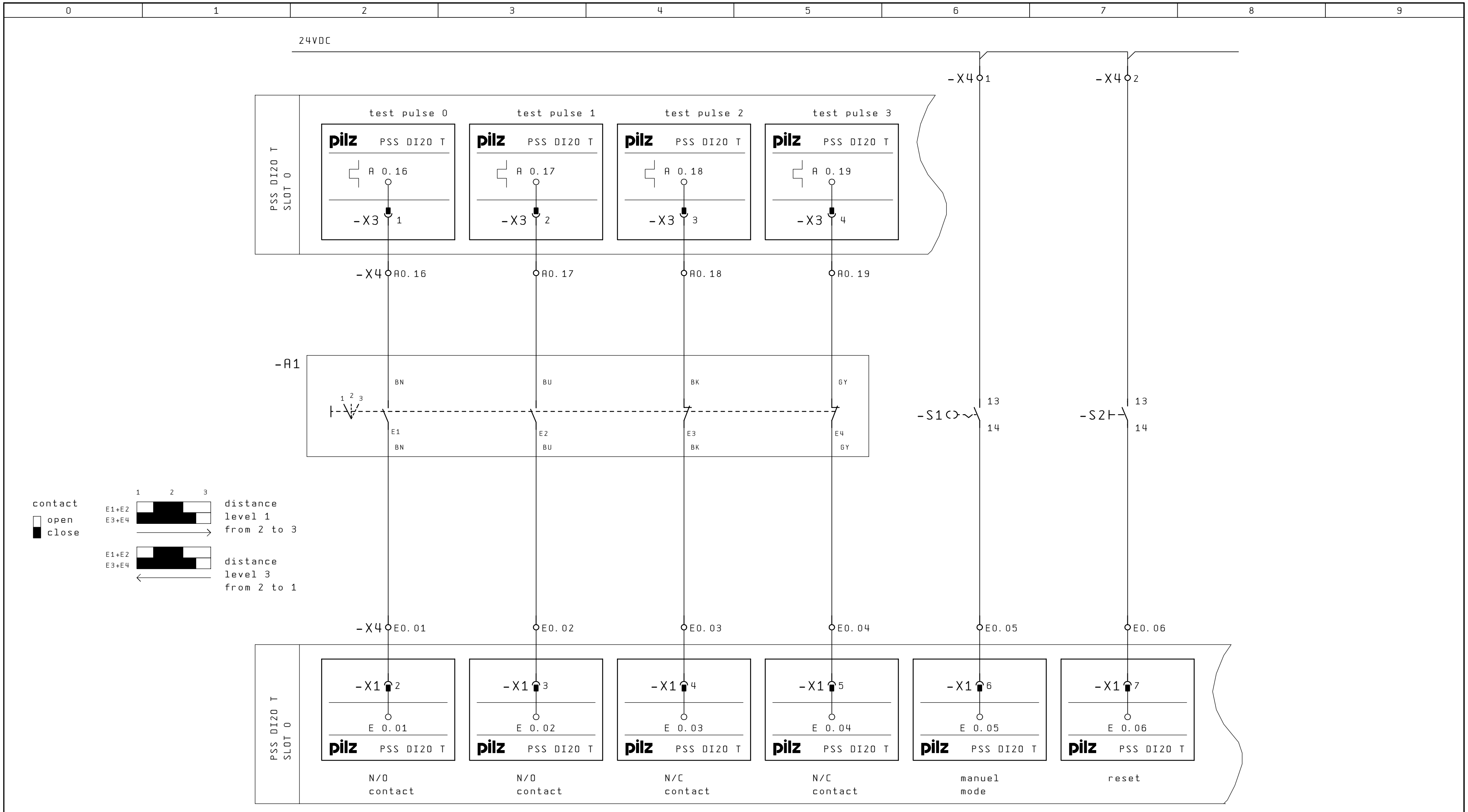
Depending on the application area and its respective regulations, this connection example is suitable for applications up to category 4, in accordance with EN 954-1.

Pilz products

Number	Description	Order number
1	PSS CPU 3	301 064
1	PSS BMP 4/2	301 006
1	PSS PS 24	301 051
1	PSS DI2O T	301 112
1	PSS-SB-TRA	301 175B

Drawing file

Page 51 in the project “Eplan4/Pilz/APPL0703”


0
1
2
3
4
5
6
7
8
9
24VDC
-X4 1
-X4 2
PSS DI20 T
SLOT 0
test pulse 0
test pulse 1
test pulse 2
test pulse 3
pilz PSS DI20 T
A 0.16
A 0.17
A 0.18
A 0.19
-X3 1
-X3 2
-X3 3
-X3 4
-X4 A0.16
A0.17
A0.18
A0.19
-A1
BN
BU
BK
GY
1 2 3
E1
E2
E3
E4
-S1
-S2
13
14
contact
open
close
E1+E2
E3+E4
distance level 1 from 2 to 3
distance level 3 from 2 to 1
-X4 E0.01
E0.02
E0.03
E0.04
E0.05
E0.06
-X1 2
-X1 3
-X1 4
-X1 5
-X1 6
-X1 7
E 0.01
E 0.02
E 0.03
E 0.04
E 0.05
E 0.06
N/O contact
N/O contact
N/C contact
N/C contact
manuel mode
reset

Revision	18. Mai. 2004	Date	22. Apr. 2003	Enable switch application	pilz	Pilz GmbH & Co.KG Felix-Wankel-Str. 2 73760 Ostfildern	Enable switch with PSS 3000	Directory: Eplan4/Pilz/App10703
Name	CLE	Name	CLE					
		Dep.	CS	Category 4 EN 954-1				Page: 51

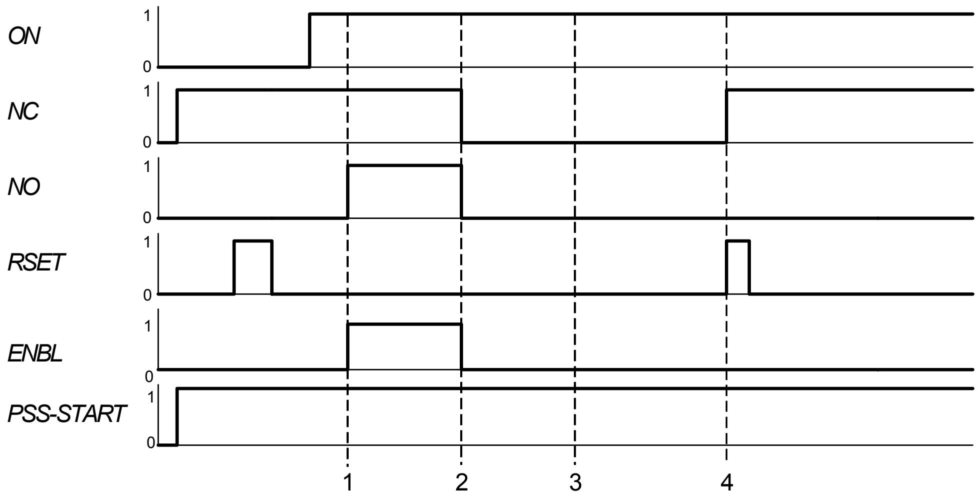
Category 4, EN 954-1

PSS 3000 – Monitoring an enable switch

Timing diagram

Parameters set on SB092

- Switch on special mode
  ON = 0/1 pulse edge
- Reset button/acknowledgement
  RSET = 0/1 pulse edge
- No automatic reset/start-up disabler when PSS is warm started
  AuSt = 0
- No automatic restart/reset lock after an error
  ARst = 0



1: Enable (*NC* & *NO*) = 1 -> *ENBL* = 1.
2: Enable switch fully depressed (*NC* & *NO*) = 0.
3: Reset lock activated (released)
4: Reset lock reset (acknowledged)

Program

```
:  CAL SB 064
                                   SB064
                                   S-GATE
KF  000001                 - W -  SSNR        ENBL  - X  - M  70.00  .Enable
M   110.01  .RLO-1         -  X -  GRP
E   0.01    .ENABLE_1      -  X -  S1
E   0.02    .ENABLE_2      -  X -  S2
KF  001000                 - W -  SyTi
M   110.00  .RLO-0         -  X -  MRun
M   110.01  .RLO-1         -  X -  AuSt
M   110.01  .RLO-1         -  X -  ARSt
M   110.01  .RLO-1         -  X -  NoFT
E   0.06    .Reset         -  X -  RSET

: CAL SB 063
                                   SB063
                                   E-STOP
KF  000002                 - W -  SSNR        ENBL  -  X -  M     70.01  .STOP
M   110.01  .RLO-1         -  X -  GRP
E   0.03    .STOP_1        -  X -  NC_1
E   0.04    .STOP_2        -  X -  NC_2
M   110.01  .RLO-1         -  X -  AuSt
M   110.00  .RLO-1         -  X -  ARst
M   110.00  .RLO-0         -  X -  FTST
E   0.06    .Reset         -  X -  RSET
```

Category 4, EN 954-1

PSS 3000 – Monitoring an enable switch

```
: CAL SB 092
                                    +-------------------+
                                    |       SB092       |
                                    |     ENBL_DEV      |
                                    |                   |
KB  003                       - B - | SSNR        ENBL  |- X  - M   070.02      .EN_SWITCH
E   0.05     .On              - X - | ON                |
M   70.01    .STOP            - X - | NC                |
E   70.00    .Enable          - X - | NO                |
M   110.00   .RLO-0           - X - | AuSt              |
M   110.00   .RLO-0           - W - | ARst              |
E   0.06     .Reset           - X - | RSET              |
                                    +-------------------+
```

Please note:
A “Minimum scan time” must be specified in the configurator of the PSS SW PG system software.

Global parameters used in administration data block DB015, DB016, DB017

- DW1001: Number of cycles in the contact synchronisation time between the N/C contacts on the off function
- DW1022: Minimum scan time

Global parameters must be set in OB120 using SB071.

Additional blocks required

- DB015, DB016, DB017: Administration data block
  DB015, DB016 and DB017 must consist of their total length of 1024 data words. DB015, DB016 and DB017 must be declared READ/WRITE.
- SB071: Initialisation of global parameters in DB015, DB016, DB017
- SB255: Operating system call

Category 4, EN 954-1

PSS 3000 – Monitoring an enable switch

Features

- Dual-channel
- Two N/O contacts, two positive-guided N/C contacts
- Enable switch with integral suppression of enable in the case of feedback from stage 3 to stage 1
- Failsafe standard function blocks used: SB063 (E-STOP), SB064 (S-GATE)

Description

Enable switch monitoring function
In this example the safety system monitors the dual-channel, three-stage enable switch A1 from Euchner, which has two N/O contacts and two positive-guided N/C contacts.
Within the user program, the stop function with positive separation in stage 3 of the enable switch is assigned to SB063. SB063 detects whether the stop function has been operated, as well as detecting invalid input signals, such as the contact synchronisation time being exceeded.
Within the user program, the enable function on the enable switch is assigned to SB064. SB064 detects whether the enable switch has been operated, as well as detecting invalid input signals, such as the contact synchronisation time being exceeded.
If the enable switch is fully depressed (stop function) or an error occurs, the enable flag *ENBL* will immediately be reset.
Patented mechanics on the Euchner enable switch prevent the enable coming into effect in the case of feedback from stage 3 to stage 1. This is a requirement for this application.
The signal at the enable output *ENBL* can be evaluated by the user program and trigger an appropriate reaction. SB063 and SB064 store a value in DB015 (DB016 or DB017); this can be used to determine why *ENBL* was reset. The way in which the error is reset will depend on the operating mode set on SB063 and SB064. In this application example, parameters for SB063 have been set so that no reset is required for the enable output *ENBL* to be set when the PSS is cold started (PSS switched from off to on) or warm started (PSS transferring from STOP to RUN). After the enable switch has been fully depressed (stop function) and then released, a reset must be performed by pressing S2 (0/1 pulse edge at *RSET*) in order to reset enable output *ENBL* on SB063. In this application example, parameters for SB064 have been set so that no reset is required when the PSS is cold started (PSS switched from off to on), warm started (PSS transferring from STOP to RUN) or after an enable function (restart). There is no need to test the function of the enable switch during a cold/warm start.
After the enable switch has been operated (stage 2), the enable output *ENBL* is set. If an error occurs, the enable output *ENBL* on SB064 will automatically be reset once the error has been rectified.

Safety assessment

- If a contact on the N/O or N/C circuit of the enable switch is overridden, standard function block SB063 or SB064 will detect this at the next operation.
- A short between the input circuits on the enable switch will be detected as an error by the programmable safety system.
- A short between 24 VDC and an input circuit on the enable switch will be detected as an error by the programmable safety system.

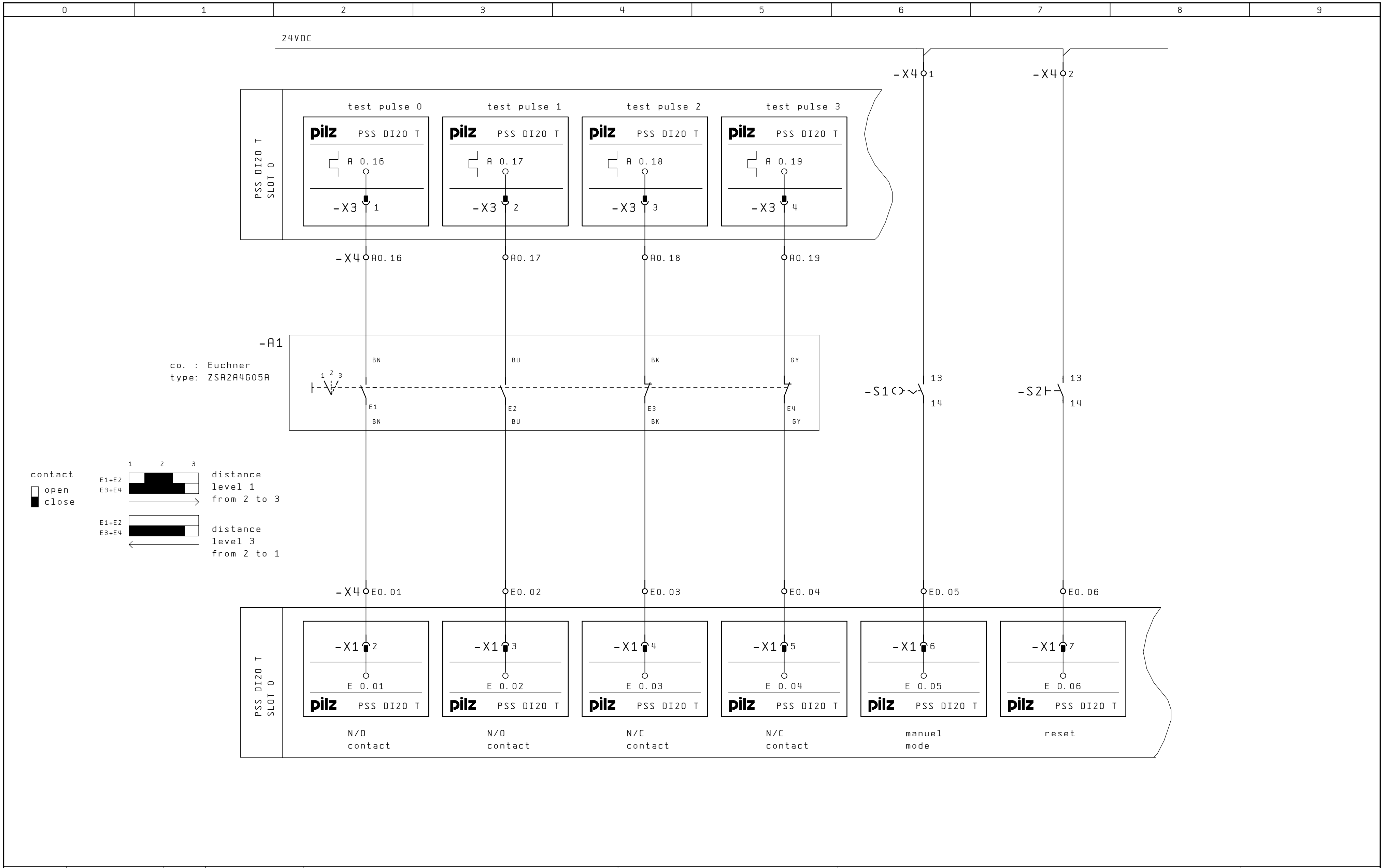
Classification in accordance with EN 954-1
Depending on the application area and its respective regulations, this connection example is suitable for applications up to category 4, in accordance with EN 954-1.

Pilz products

Number	Description	Order number
1	PSS CPU 3	301 064
1	PSS BMP 4/2	301 006
1	PSS PS 24	301 051
1	PSS DI2O T	301 112
1	PSS-SB-TRA	301 175B

Drawing file

Page 52 in the project “Eplan4/Pilz/APPL0703”


0
1
2
3
4
5
6
7
8
9
24VDC
-X4 1
-X4 2
PSS DI20 T
SLOT 0
test pulse 0
test pulse 1
test pulse 2
test pulse 3
pilz PSS DI20 T
A 0.16
A 0.17
A 0.18
A 0.19
-X3 1
-X3 2
-X3 3
-X3 4
-X4 A0.16
A0.17
A0.18
A0.19
-A1
co. : Euchner
type: ZSA2A4G05A
BN
BU
BK
GY
E1
E2
E3
E4
13
14
-S1
-S2
contact
open
close
E1+E2
E3+E4
distance
level 1
from 2 to 3
distance
level 3
from 2 to 1
-X4 E0.01
E0.02
E0.03
E0.04
E0.05
E0.06
-X1 2
-X1 3
-X1 4
-X1 5
-X1 6
-X1 7
E 0.01
E 0.02
E 0.03
E 0.04
E 0.05
E 0.06
N/O contact
N/O contact
N/C contact
N/C contact
manuel mode
reset

Revision	18.Mai.2004	Date	22.Apr.2003	Enable switch application	Pilz GmbH & Co.KG Felix-Wankel-Str.2 73760 Ostfildern	Enable switch with PSS 3000	Directory: Eplan4/Pilz/Appl0703
Name	CLE	Name	CLE				
		Dep.	CS	Category 4 EN 954-1			Page: 52

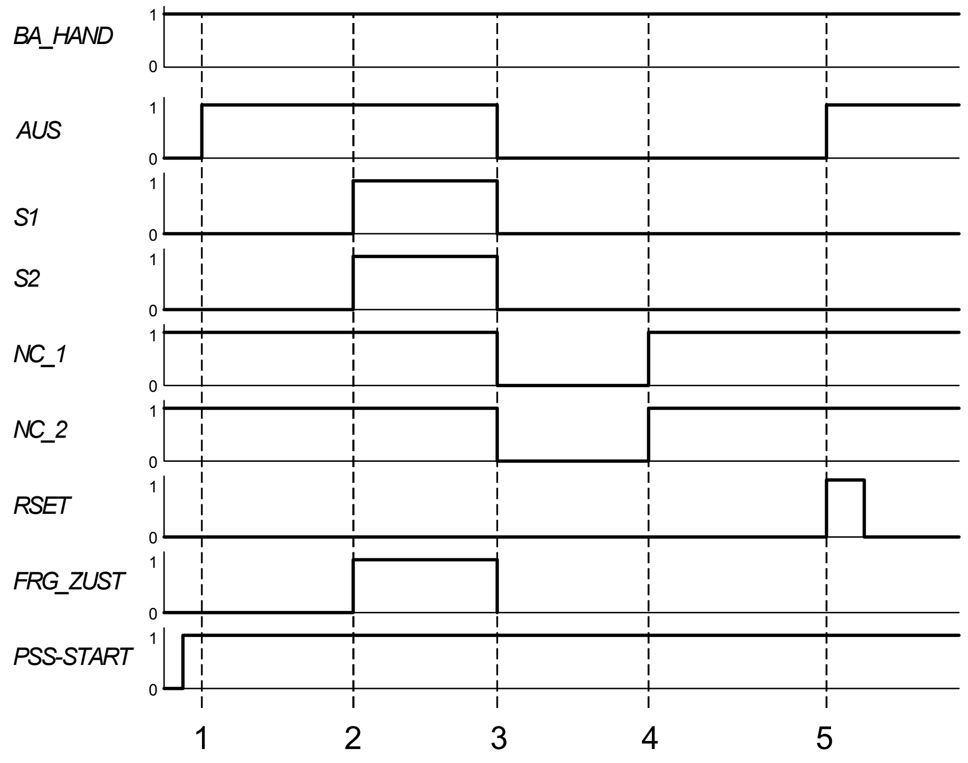
Category 4, EN 954-1

PSS 3000 – Monitoring an enable switch

Timing diagram

Parameters set on SB063
- Without SafetyBUS p connection
  GRP = 1
- No start-up disabler
  AuST = 1
- Reset lock
  ARSt = 0
- No function test after error on release
  FTST = 0
- Reset button/acknowledgement
  RSET = 0/1 pulse edge

Parameters set on SB064
- Without SafetyBUS p connection
  GRP = 1
- Synchronisation time monitoring on
  SyTi = 001000 (ms)
- No start-up disabler
  AuSt = 1
- No reset lock
  ARSt = 1
- No function test when the PSS is cold and warm started
  NoFT = 1
- Reset button/acknowledgement
  RSET = 0/1 pulse edge



1: PSS start
2: Enable (*S1* & *S2*) = 1
3: Enable switch fully depressed (*NC_1* & *NC_2*) = 0.
4: Enable switch released
5: Reset lock reset (*Reset* = 1)

Category 4, EN 954-1

PSS 3000 – Monitoring an enable switch

Program

```
:  CAL SB 064
                                     SB064
                                    S-GATE

KF  000001                 - W -  SSNR        ENBL  - X  - M  70.00  .Enable
M   110.01  .RLO-1         - X -  GRP
E   0.01    .ENABLE_1      - X -  S1
E   0.02    .ENABLE_2      - X -  S2
KF  001000                 - W -  SyTi
M   110.00  .RLO-0         - X -  MRun
M   110.01  .RLO-1         - X -  AuSt
M   110.01  .RLO-1         - X -  ARSt
M   110.01  .RLO-1         - X -  NoFT
E   0.06    .Reset         - X -  RSET

: CAL SB 063
                                     SB063
                                    E-STOP

KF  000002                 - W -  SSNR        ENBL  -  X-   M      70.01  .STOP
M   110.01  .RLO-1         - X -  GRP
E   0.03    .STOP_1        - X -  NC_1
E   0.04    .STOP_2        - X -  NC_2
M   110.01  .RLO-1         - X -  AuSt
M   110.00  .RLO-1         - X -  ARst
M   110.00  .RLO-0         - X -  FTST
E   0.06    .Reset         - X -  RSET

:  L    M 70.00    .Enable       Enable function
:  U    M 70.01    .STOP         Stop function
:  U    E  0.05    .BA_HAND      Manual mode
:  =    M 80.00    .FRG_ZUST     Enable switch enabled
```

Please note:
A “Minimum scan time” must be specified in the configurator of the PSS SW PG system software.

Global parameters used in administration data block DB015, DB016, DB017

- DW1001: Number of cycles in the contact synchronisation time between the N/C contacts on the Stop function
- DW1022: Minimum scan time

Global parameters must be set in OB120 using SB071.

Additional blocks required

- DB015, DB016, DB017: Administration data block
  DB015, DB016 and DB017 must consist of their total length of 1024 data words. DB015, DB016 and DB017 must be declared READ/WRITE.
- SB071: Initialisation of global parameters in DB015, DB016, DB017
- SB255: Operating system call

Category 2, EN 954-1

PSS 3000 – Monitoring an enable switch

Features

- Single-channel
- One N/O contact, one positive-guided N/C contact
- Failsafe standard function block used: SB092 (ENBL_DEV)

Description

Enable switch monitoring function
In this example the safety system monitors the single-channel, three-stage enable switch A1, which has one N/O contact and one positive-guided N/C contact. Within the user program, the failsafe standard function block SB092 is assigned to the enable switch. SB092 detects whether the N/O contact on the enable switch is defective, as well as detecting incorrect input signals, such as a reset button that is constantly operated. If the enable switch is fully depressed (E-STOP) or an error occurs, the enable output *ENBL* on SB092 will immediately be reset. If the enable switch is fed back from stage 3 through stage 2 to stage 1, SB092 will prevent an enable function in stage 2.
The signal at the enable output *ENBL* can be evaluated by the user program and trigger an appropriate reaction. SB092 stores a value in DB015, which can be used to determine why *ENBL* was reset. The way in which the error is reset will depend on the operating mode set on SB092. In this application example, parameters for SB092 have been set in such a way that it is necessary to reset by pressing S2 (0/1 pulse edge at *RSET*) in order to reset enable output *ENBL* on SB092 when the PSS is cold started (PSS switched from off to on), warm started (PSS transferring from STOP to RUN) or after the enable switch has been fully depressed (E-STOP) and then released.

Safety assessment

- If a contact on the E-STOP button is overridden, the standard function block will detect this as an error at the next operation.
- A short between the input circuits on the enable switch will be detected as an error by the programmable safety system.
- A short between 24 VDC and an input circuit on the enable switch will be detected as an error by the programmable safety system.
- The switching function must be tested at appropriate intervals.

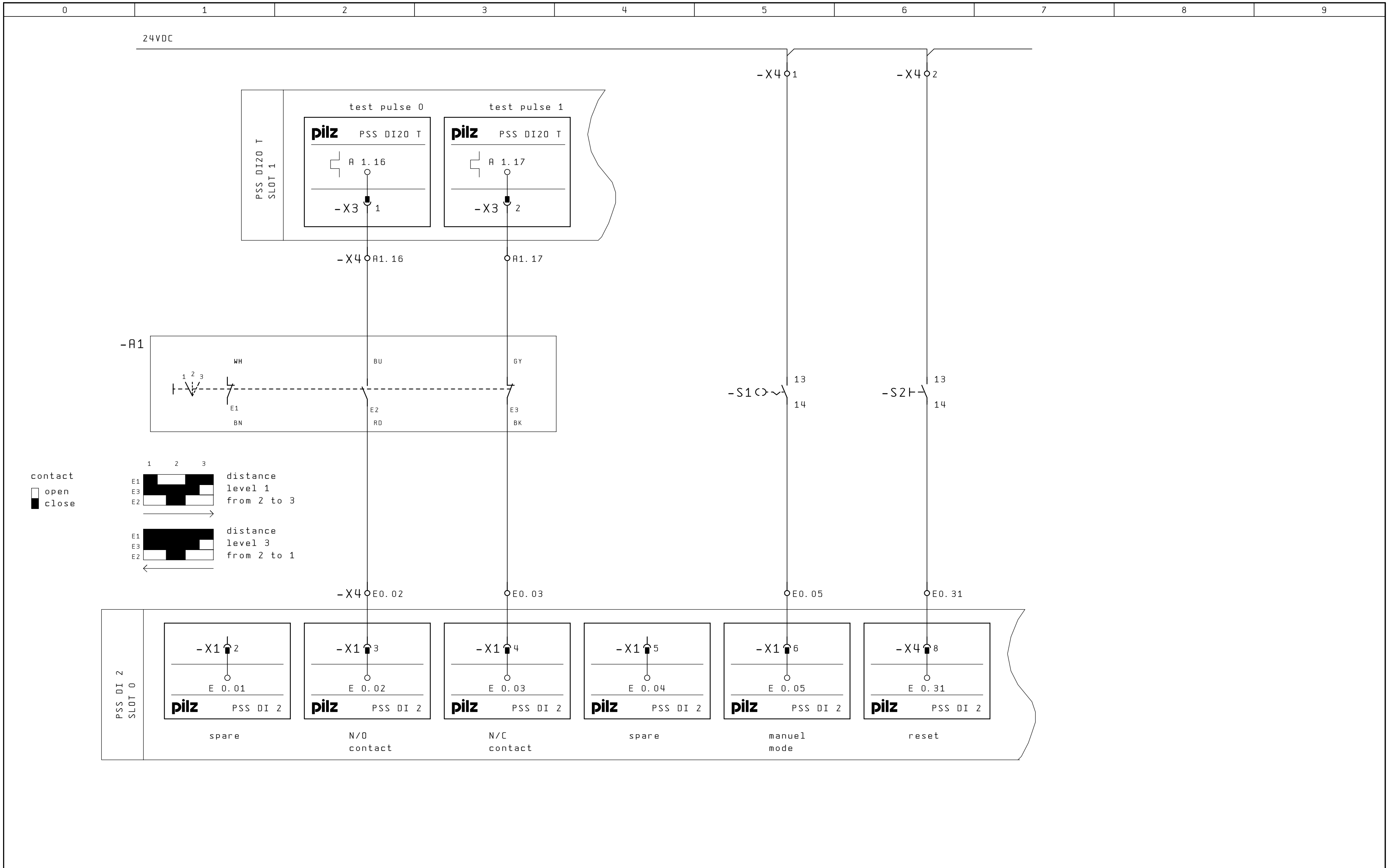
Classification in accordance with EN 954-1
Depending on the application area and its respective regulations, this connection example is suitable for applications up to category 2, in accordance with EN 954-1.

Pilz products

Number	Description	Order number
1	PSS CPU 3	301 064
1	PSS BMP 4/2	301 006
1	PSS PS 24	301 051
1	PSS DI 2	301 101
1	PSS DI2O T	301 112
1	PSS-SB-TRA	301 175B

Drawing file

Page 35 in the project “Eplan4/Pilz/APPL0703”


0
1
2
3
4
5
6
7
8
9
24VDC
-X4 1
-X4 2
PSS DI20 T
SLOT 1
test pulse 0
test pulse 1
pilz PSS DI20 T
A 1.16
-X3 1
pilz PSS DI20 T
A 1.17
-X3 2
-X4 A1.16
A1.17
-A1
WH
BU
GY
1 2 3
E1
E2
E3
BN
RD
BK
13
14
-S1
-S2
contact
open
close
E1
E3
E2
distance
level 1
from 2 to 3
distance
level 3
from 2 to 1
-X4 E0.02
E0.03
E0.05
E0.31
PSS DI 2
SLOT 0
-X1 2
E 0.01
pilz PSS DI 2
spare
-X1 3
E 0.02
N/O
contact
-X1 4
E 0.03
N/C
contact
-X1 5
E 0.04
spare
-X1 6
E 0.05
manuel
mode
-X4 8
E 0.31
reset

Revision	29.Apr.2004	Date	22.Apr.2003	Enable switch application	pilz	Pilz GmbH & Co.KG Felix-Wankel-Str.2 73760 Ostfildern	Enable switch with PSS 3000	Directory: Eplan4/Pilz/App10703
Name	CLE	Name	CLE					
				Category 2 EN 954-1				
		Dep.	CS					Page: 35

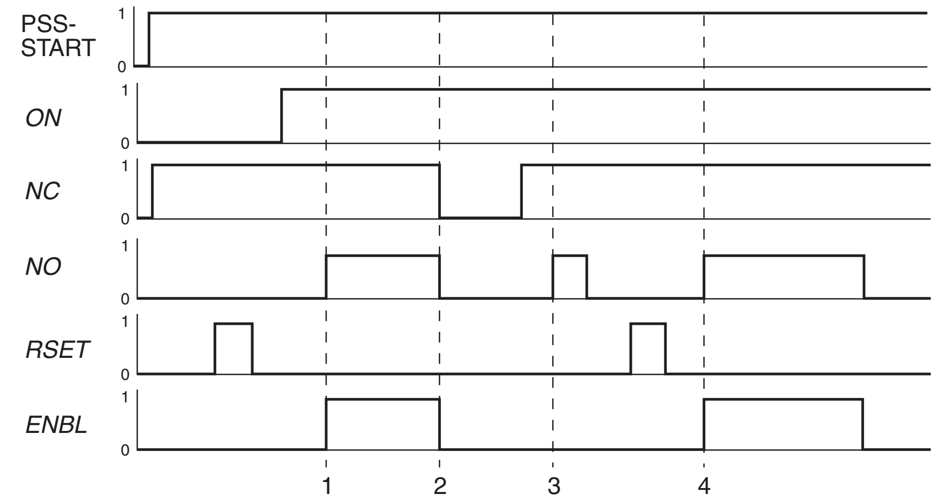
Category 2, EN 954-1

PSS 3000 – Monitoring an enable switch

Timing diagram

Parameters set on SB092

- Switch on special mode
  ON = 0/1 pulse edge
- Reset button/acknowledgement
  RSET = 0/1 pulse edge
- Manual reset when PSS is cold/warm started
  AuSt = 0
- Manual reset after releasing the enable switch
  ARst = 0



1: Enable (*NC* & *NO*) = 1 -> *ENBL* = 1.
2: Enable switch fully depressed (*NC* & *NO*) = 0.
3: Reset lock activated
4: Reset lock reset

Program

```
                                          SB092
                                        ENBL_DEV

KB  010                      - B -  SSNR       ENBL  - X  - M   70.09
E   00.05   .On              - X -  ON
E   00.03   .ENABLE_NC       - X -  NC
E   00.02   .ENABLE_NO       - X -  NO
M   110.00  .RLO-0           - X -  AuSt
M   110.00  .RLO-0           - W -  ARst
E   0.31    .Reset_button    - X -  RSET
```

Please note:
A “Minimum scan time” must be specified in the configurator of the PSS SW PG system software.

Global parameters used in administration data block DB015

- None

Additional blocks required

- DB015: Administration data block
  DB015 must consist of its total length of 1024 data words.
  DB015 must be declared READ/WRITE.

Notes

Category 4, EN 954-1

SafetyBUS p – PSS connection

Features

- Dual-channel redundancy with detection of shorts across contacts
- I/O-Group 1 configured:
- PLC 1: Master LD of Group 1, read/write access to all I/ODs
- PLC 2-4: Slave LD of Group 1, read-only access to IODs
- Failsafe standard function blocks used: SB063 (E-STOP), SB065 (FBL)

Description

Data exchange between PSS systems in the case of an emergency stop

In this example, four programmable safety systems (PLCs 1-4) are interconnected via SafetyBUS p. Each SafetyBUS p must have a Management Device (MD). It is defined in the programming device configurator that PLC 1 will undertake the management of SafetyBUS p. PLCs 2-4 will be configured as Logic Devices (LD). The Management Device manages the bus, the Logic Device processes the information provided by one or more systems. In the configurator, the bus subscribers have been assigned as bus subscribers in Group 1. Groups are formed in order to physically or functionally restrict errors and in order to grade error reactions.
If the E-STOP button S1 is operated, the enable output *ENBL* on SB063 will immediately be reset. The enable output *ENBL* will be evaluated by the user program and transmitted to the virtual I/ODs on PLCs 2-4 via a flag word.
The virtual I/ODs on the Logic Devices are configured (activated). These are used for rapid data exchange between the PSS systems. The virtual I/ODs on a PSS automatically receive the Device Address of the PSS. The data length of the virtual I/ODs is 2 Bytes each.
The E-STOP and safety gate signals represent process data, which needs to be transmitted quickly and with high priority. To do this the PSS requires a single data telegram. The process data is read in via the process image of PLCs 2-4 at the start of a program cycle and is stored in the process image of inputs. The user program is then called up and processed with the values from the process image of the failsafe section.
In this application example, parameters for SB063 have been set so that after the emergency stop button S1 has been released, a reset must be performed by pressing S2 (0/1 pulse edge at *RSET*) in order to reset enable output *ENBL* on SB063.
PLCs 2-4 will then process enable output *ENBL* on SB063, which is transmitted via the PSS connection. For this the enable output is connected to input parameter *ON* of SB065 (feedback loop monitoring). SB065 then drives the contactors that shut down a dangerous movement, for example.

Safety assessment

- If a contact on the E-STOP button is overridden, the standard function block will detect this as an error at the next operation.
- A short between 24 VDC and an input circuit will be detected as an error by the standard function block at the next operation.
- A short between the input circuits within a multicore cable will be detected by the programmable safety system.
- Data exchange via SafetyBUS p is safe.
- A short between 24 VDC and an input circuit will be detected as an error by the programmable safety system.

Classification in accordance with EN 954-1

Depending on the application area and its respective regulations, this connection example is suitable for applications up to category 4, in accordance with EN 954-1.

Pilz products

Number	Description	Order number
4	PSS SB CPU 3	301 071
4	PSS BMP 4/2	301 006
4	PSS PS 24	301 051
4	PSS DI2O T	301 121
4	PSS DOS	301 111
4	PSS SB SUB D4	311 040
100m	PSS SB BUSCABLE0	311 070
1	PSS-SB-TRA	301 175B

Drawing file

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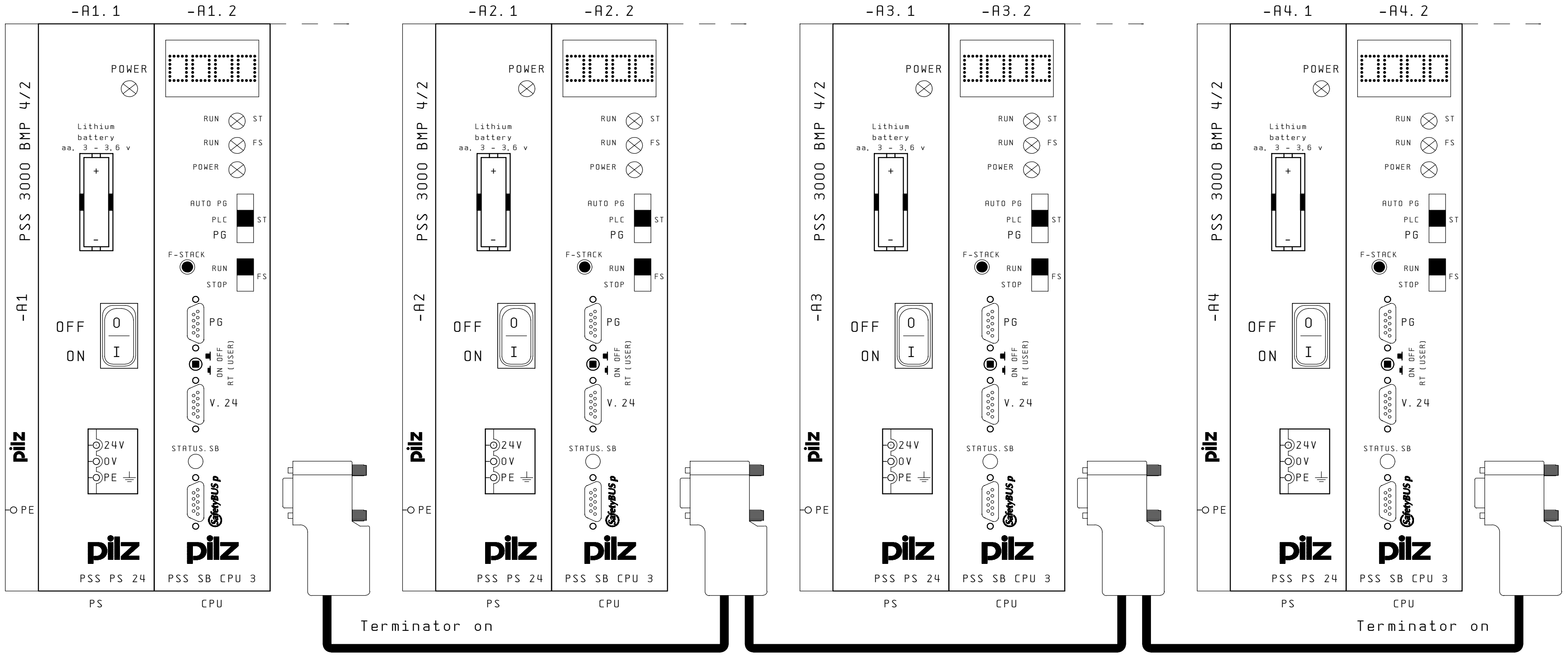
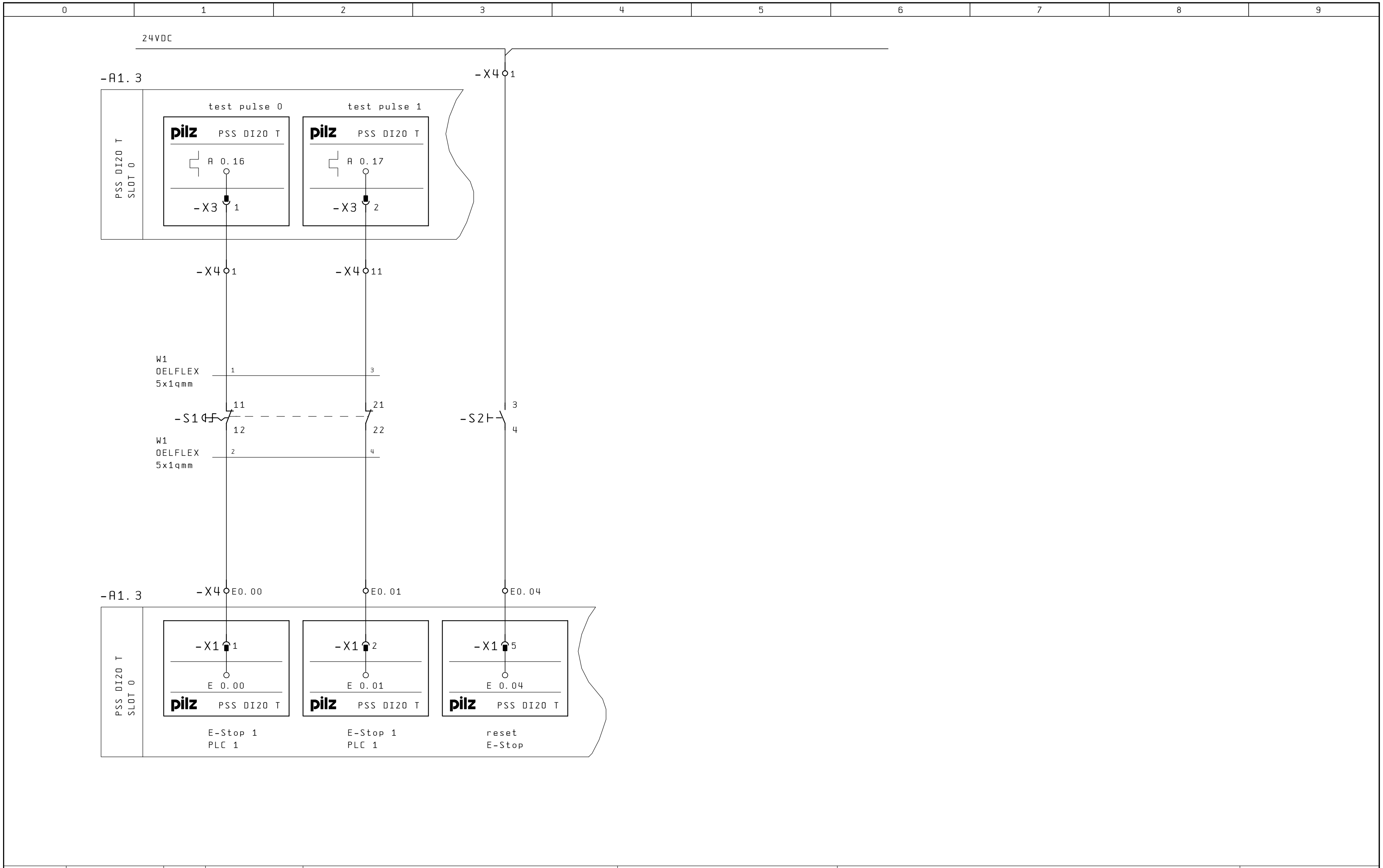

-A1.1
-A1.2
-A2.1
-A2.2
-A3.1
-A3.2
-A4.1
-A4.2
PSS 3000 BMP 4/2
-A1
-A2
-A3
-A4
pilz
PE
POWER
Lithium battery aa, 3 - 3,6 v
OFF
ON
0
I
24V
0V
PE
PSS PS 24
PSS SB CPU 3
RUN ST
RUN FS
POWER
AUTO PG
PLC
PG
ST
F-STACK
RUN
STOP
FS
PG
ON OFF
RT (USER)
V.24
STATUS. SB
SafetyBUS p
PS
CPU
Terminator on
Terminator on

PLC 1	PLC 2	PLC 3	PLC 4
Management Device	Logic Device	Logic Device	Logic Device
Group: 1	Group: 1	Group: 1	Group: 1
32: LD	33: LD	34: LD	35: LD
Master	Slave	Slave	Slave

Revision	29. Apr. 2004	Date	22. Apr. 2003	data transfer SafetyBUS p	pilz Pilz GmbH & Co. KG Felix-Wankel-Str. 2 73760 Ostfildern	Safety BUS p connection with PSS 3000	Directory: Eplan4/Pilz/Appl0703
Name	CLE	Name	CLE				
		Dep.	CS	Category 4 EN 954-1			Page: 62


0
1
2
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4
5
6
7
8
9
24VDC
-A1.3
PSS DI20 T
SLOT 0
test pulse 0
test pulse 1
pilz PSS DI20 T
A 0.16
A 0.17
-X3 1
-X3 2
-X4 1
-X4 1
-X4 11
W1
OELFLEX
5x1qmm
1
3
-S1
11
12
21
22
-S2
3
4
2
4
-A1.3
-X4 E0.00
E0.01
E0.04
-X1 1
-X1 2
-X1 5
E 0.00
E 0.01
E 0.04
E-Stop 1
PLC 1
reset
E-Stop

Revision	29. Apr. 2004	Date	22. Apr. 2003
Name	CLE	Name	CLE
		Dep.	CS

data transfer SafetyBUS p

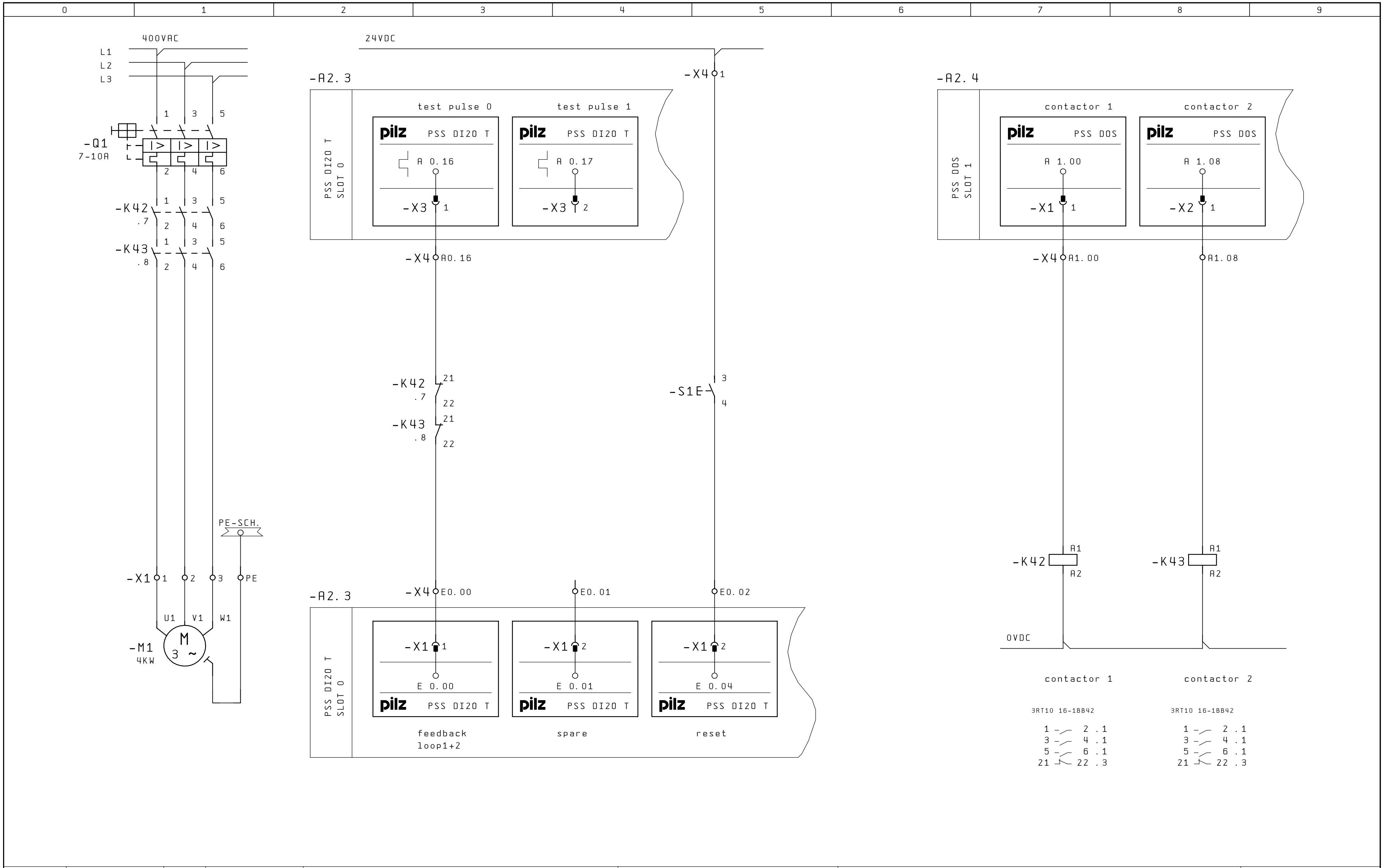
Category 4 EN 954-1

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

Safety BUS p connection with PSS 3000

Directory:
Eplan4/Pilz/App10703

Page: 63


0
1
2
3
4
5
6
7
8
9
400VAC
L1
L2
L3
1
3
5
-Q1
7-10A
2
4
6
-K42
.7
-K43
.8
PE-SCH.
-X1
PE
U1
V1
W1
-M1
4KW
M
3 ~
24VDC
-X4
-A2.3
PSS DI20 T
SLOT 0
test pulse 0
test pulse 1
pilz
PSS DI20 T
A 0.16
A 0.17
-X3
-X4
A0.16
-K42
.7
21
22
-K43
.8
-S1E
3
4
E0.00
E0.01
E0.02
-X1
E 0.00
E 0.01
E 0.04
feedback
loop1+2
spare
reset
-A2.4
PSS DOS
SLOT 1
contactor 1
contactor 2
PSS DOS
A 1.00
A 1.08
-X1
-X2
-X4
A1.00
A1.08
-K42
-K43
A1
A2
0VDC
contactor 1
contactor 2
3RT10 16-1BB42
1 - 2 .1
3 - 4 .1
5 - 6 .1
21 - 22 .3

Revision	29. Apr. 2004	Date	22. Apr. 2003	data transfer SafetyBUS p	Pilz GmbH & Co.KG Felix-Wankel-Str. 2 73760 Ostfildern	Safety BUS p connection with PSS 3000	Directory: Eplan4/Pilz/App10703
Name	CLE	Name	CLE				
				Category 4 EN 954-1			Page: 64
		Dep.	CS				

Category 4, EN 954-1

SafetyBUS p – PSS connection

Program

PLC 1

```
                                    SB063
                                    E-STOP

KF  000001                   - W - SSNR       ENBL - X -  M    70.00  .ES_ALL_1
M   116.01  .SBUS_Grp_01     - X - GRP
E   0.00    .E-STOP_NC1      - X - NC_1
E   0.01    .E-STOP_NC2      - X - NC_2
M   110.01  .RLO-1           - X - AuSt
M   110.00  .RLO-0           - W - ARst
M   110.01  .RLO-1           - X - FTST
E   0.04    .Reset           - X - RSET
```

```
:  L    MW 70.00    Enable
:  T    AW 33.00    Virtual I/ODs on PLC 2
:  T    AW 34.00    Virtual I/ODs on PLC 3
:  T    AW 35.00    Virtual I/ODs on PLC 4
```

PLC 2

```
:  L    EW 33.00    Virtual I/ODs on PLC 2
:  T    MW 90.00
```

```
                                      SB065
                                       FBL

KF  000001                     - W - SSNR       ENBL - X  - M   70.00   .Enable
M   116.01  .I/O-Group 01      - X - GRP          K1 - X  - A   1.00    .Contactor 1
M   90.00   .ON                - X - ON           K2 - X  - A   1.08    .Contactor 2
E   0.00    .FbL-Contactor 1   - X - FbL1
E   0.00    .FbL-Contactor 2   - X - FbL2
KF  000150                     - W - TFbL
E   0.04    .Reset             - X - RSET
```

PLC 3

```
:  L    EW 34.00    Virtual I/ODs on PLC 3
:  T    MW 90.00
```

```
                                      SB065
                                       FBL

KF  000001                     - W - SSNR       ENBL - X  - M   70.00   .Enable
M   116.01  .I/O-Group 01      - X - GRP          K1 - X  - A   1.00    .Contactor 1
M   90.00   .EIN               - X - ON           K2 - X  - A   1.08    .Contactor 2
E   0.00    .FbL-Contactor 1   - X - FbL1
E   0.00    .FbL-Contactor 2   - X - FbL2
KF  000150                     - W - TFbL
E   0.04    .Reset             - X - RSET
```

PLC 4

```
:  L    EW 35.00    Virtual I/ODs on PLC 4
:  T    MW 90.00
```

```
                                      SB065
                                       FBL

KF  000001                     - W - SSNR       ENBL - X  - M   70.00   .Enable
M   116.01  .I/O-Group 01      - X - GRP          K1 - X  - A   1.00    .Contactor 1
M   90.00   .ON                - X - ON           K2 - X  - A   1.08    .Contactor 2
E   0.00    .FbL-Contactor 1   - X - FbL1
E   0.00    .FbL-Contactor 2   - X - FbL2
KF  000150                     - W - TFbL
E   0.04    .Reset             - X - RSET
```

Category 4, EN 954-1

SafetyBUS p – PSS connection

Please note:
A “Minimum scan time” must be specified in the configurator of the PSS SW PG system software.

Global parameters used in administration data block DB015, DB016, DB017

- DW1022: Minimum scan time

Global parameters must be set in OB120 using SB071.

Additional blocks required

- DB015, DB016, DB017: Administration data block
  DB015, DB016 and DB017 must consist of their total length of 1024 data words. DB015, DB016 and DB017 must be declared READ/WRITE.
- SB071: Initialisation of global parameters in DB015, DB016, DB017
- SB255: Operating system call

Category 4, EN 954-1
SafetyBUS p – FO connection

Features:
- Dual-channel redundancy with detection of shorts across contacts
- Automatic reset when the PSS is cold/warm started
- No automatic reset after the emergency stop button is released
- Failsafe standard function block used: SB063 (E-STOP)
- Feasibility test on the input signals and monitoring of the contact synchronisation time

Description

It is preferable to transfer data via fibre-optic cables once the physical limits of copper-based data communication have been reached, i.e.
- Larger operating range
- Increased transmission speed
- Absolute noise immunity

Emergency stop function
In this example the safety system with the safe bus system SafetyBUS p is monitoring the E-STOP button S1. The SafetyBUS p fibre-optic coupler converts the electrical signals of the SafetyBUS p interface into optical signals. Data transfer is two-way, with data transparency and in half duplex mode. The SafetyBUS p fibre-optic coupler is used with 50/125µm or 62.5/125µm graded index glass fibre at a wavelength of 850 nm and an ST connection.
Within the user program, failsafe standard function block SB063 is assigned to the E-STOP button. SB063 detects whether the assigned E-STOP button has been operated. SB063 also detects invalid input signals, whether the contact synchronisation time has been exceeded, etc..
If the E-STOP button is operated or an error occurs, the enable output *ENBL* on the relevant SB063 will be reset.
The enable output *ENBL* is also reset when the PSS is stopped and when the PSS is switched on.
The signal at the enable output *ENBL* must be evaluated by the user program and trigger an appropriate reaction. SB063 stores a value in DB015 (DB016 or DB017); this can be used to determine why *ENBL* was reset.
The way in which the error is reset will depend on the operating mode set on SB063. In this application example, parameters for SB063 have been set so that no reset is required when the PSS is cold started (PSS switched from off to on), warm started (PSS transferring from STOP to RUN) or when starting the SafetyBUS p I/O-Groups. When the E-STOP button is released or after a function test, a reset is required by pressing S2, in order to reset output parameter *ENBL* on SB063.
Although the emergency stop function is configured to reset itself, a PSS cold start and a SafetyBUS p I/O-Group start may not directly enable a machine to start up without further conditions being met.

Safety assessment
- If a contact on the E-STOP button is overridden, the standard function block will detect this as an error at the next operation.
- A short between the input circuits within a multicore cable will be detected as an error by the programmable safety system.
- A short between 24 VDC and an input circuit will be detected as an error by the programmable safety system.

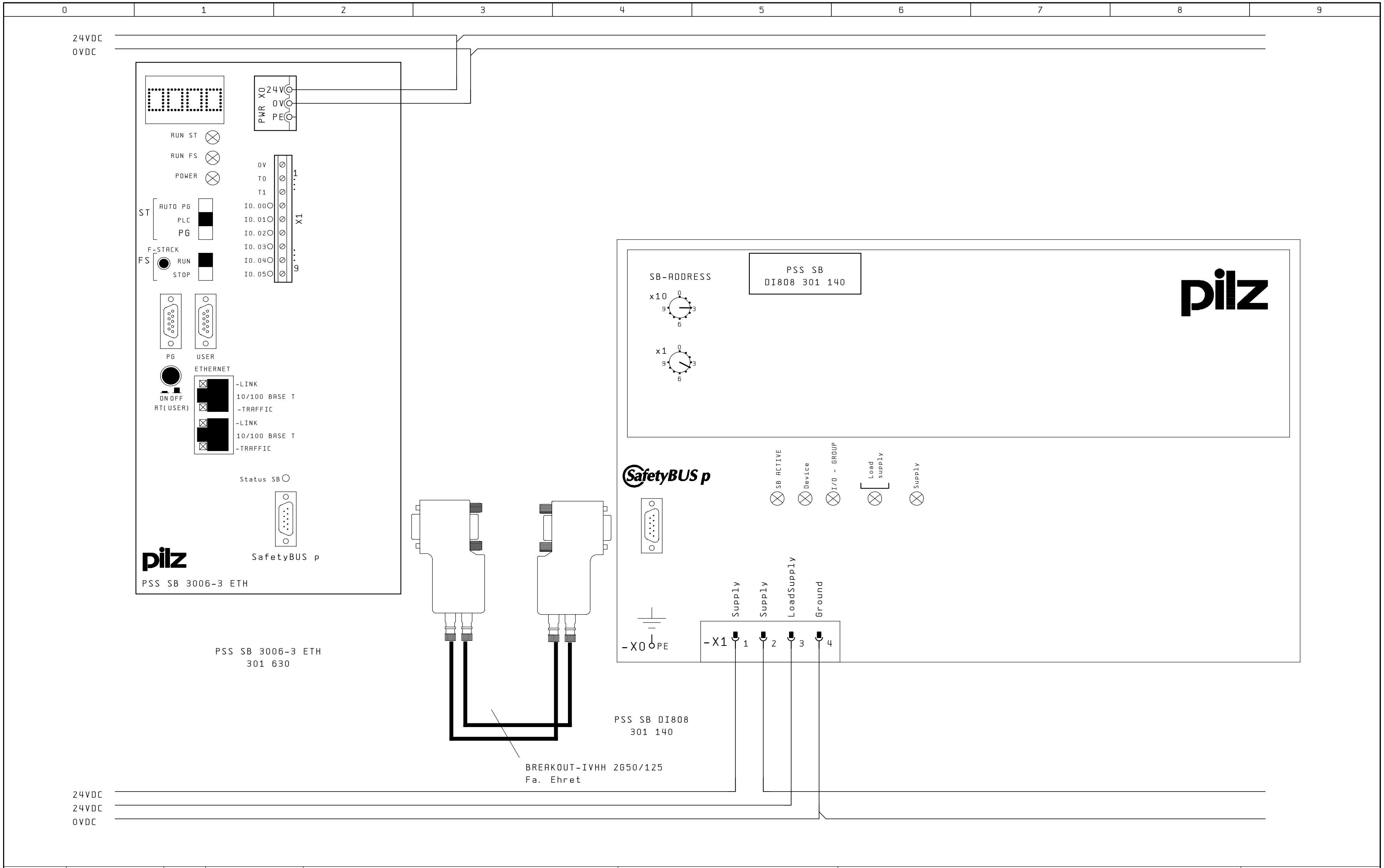
Pilz products

Number	Description	Order number
1	PSS SB 3006-3 ETH	301 630
1	PSS SB DI8O8	301 140
1	PSS SB screw connectors	311 060 or
1	PSS SB spring-loaded terminals	311 061
2	PSS SB SUB-D-F01	311 053
1	PSS-SB-NOT	301 176B

Drawing file

Page 56, 57 in the project “Eplan4/Pilz/APPL0703”

Classification in accordance with EN 954-1
Depending on the application area and its respective regulations, this connection example is suitable for applications up to category 4, in accordance with EN 954-1.


0
1
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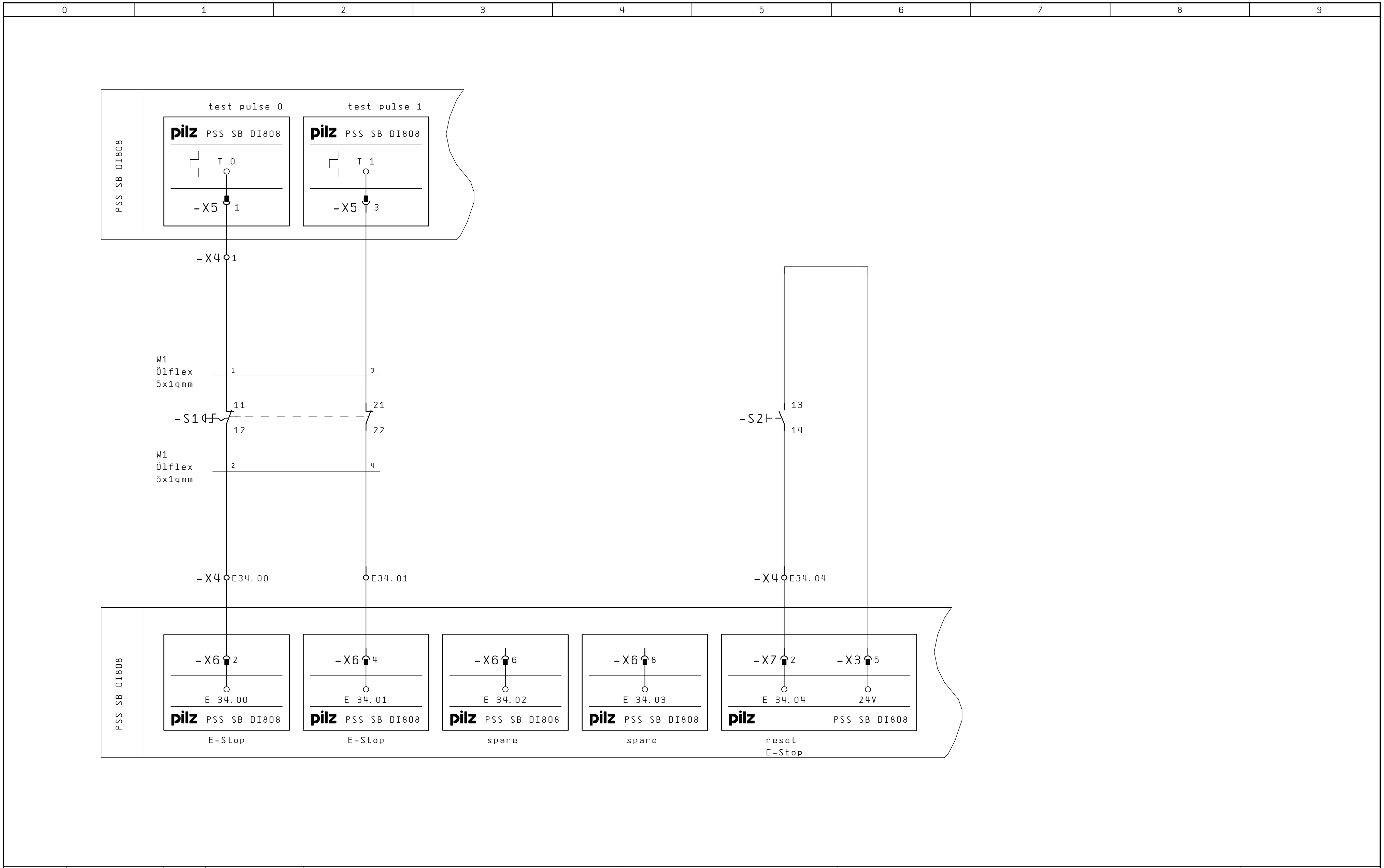
4
5
6
7
8
9
24VDC
0VDC
PWR X0
24V
0V
PE
RUN ST
RUN FS
POWER
ST
AUTO PG
PLC
PG
F-STACK
FS
RUN
STOP
0V
T0
T1
I0.00
I0.01
I0.02
I0.03
I0.04
I0.05
1
X1
9
PG
USER
ETHERNET
ON OFF
RT(USER)
-LINK
10/100 BASE T
-TRAFFIC
-LINK
10/100 BASE T
-TRAFFIC
Status SB
pilz
SafetyBUS p
PSS SB 3006-3 ETH
PSS SB 3006-3 ETH
301 630
SB-ADDRESS
x10
x1
0
3
6
9
PSS SB
DI808 301 140
pilz
SafetyBUS p
SB ACTIVE
Device
I/O - GROUP
Load supply
Supply
Supply
Supply
LoadSupply
Ground
-X0
PE
-X1
1
2
3
4
PSS SB DI808
301 140
BREAKOUT-IVHH 2G50/125
Fa. Ehret
24VDC
24VDC
0VDC

Revision	27.Apr.2004	Date	22.Apr.2003	optical fiber connection	pilz Pilz GmbH & Co.KG Felix-Wankel-Str.2 73760 Ostfildern	SafetyBUS p optical fiber connection	Directory: Eplan4/Pilz/Appl0703
Name	CLE	Name	CLE				
				Category 4 EN 954-1			Page: 56
		Dep.	CS				


0
1
2
3
4
5
6
7
8
9
PSS SB DI808
test pulse 0
test pulse 1
pilz PSS SB DI808
pilz PSS SB DI808
T 0
T 1
-X5 1
-X5 3
-X4 1
W1
Ölflex
5x1qmm
1
3
11
21
-S1
12
22
W1
Ölflex
5x1qmm
2
4
13
-S2
14
-X4 E34.00
E34.01
-X4 E34.04
PSS SB DI808
-X6 2
-X6 4
-X6 6
-X6 8
-X7 2
-X3 5
E 34.00
E 34.01
E 34.02
E 34.03
E 34.04
24V
pilz PSS SB DI808
pilz PSS SB DI808
pilz PSS SB DI808
pilz PSS SB DI808
pilz PSS SB DI808
E-Stop
E-Stop
spare
spare
reset
E-Stop

Revision	18.Mai.2004	Date	22.Apr.2003
Name	CLE	Name	CLE
		Dep.	CS

E-Stop applications

Category 4 EN 954-1

pilz

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

SafetyBUS p optical fiber connection

Directory:
Eplan4/Pilz/Appl0703

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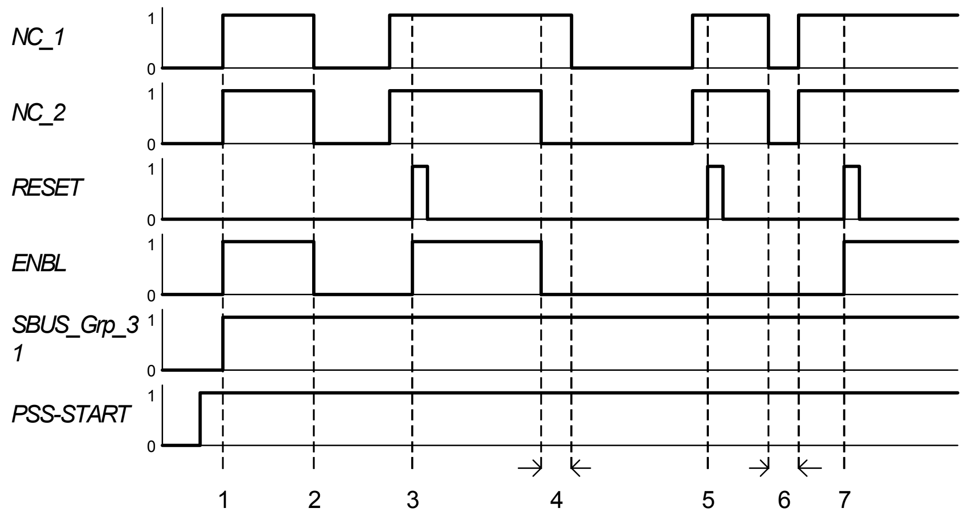
Category 4, EN 954-1

SafetyBUS p – FO connection

Timing diagram

Parameters set on SB063

- With SafetyBUS p connection:
  GRP = M116.31 for I/O-Group 31
- Automatic reset after the PSS is cold/warm started:
  AuSt = 1
- No automatic reset after the emergency stop button is released:
  ARSt = 0
- A function test must be performed if a synchronisation error occurs when the E-STOP button is released:
  FTST = 1



1: Automatic start-up
2: E-STOP button operated
3: E-STOP reset
4: E-STOP button synchronisation error
5: Reset lock
6: Function test E-STOP button
7: Function test reset

Program

```
: CAL SB 063

                                         SB063
                                         E-STOP

KF  000234                   - W -  SSNR        ENBL - X -  M     77.09  .ES-ALL
M   116.31  .SBUS_Grp_31     - X -  GRP
E   34.00   .E-STOP_T0       - X -  NC_1
E   34.01   .E-STOP_T1       - X -  NC_2
M   110.01  .RLO-1           - X -  AuSt
M   110.00  .RLO-0           - X -  ARst
M   110.01  .RLO-1           - X -  FTST
E   34.04   .Reset           - X -  RSET
```

Please note:
A “Minimum scan time” must be specified in the configurator of the PSS SW PG system software.

Global parameters used in administration data block DB015, DB016, DB017

- DW1001: Number of cycles in the contact synchronisation time between the N/C contacts on the E-STOP button

Global parameters must be set in OB120 using SB071.

Additional blocks required

- DB015, DB016, DB017: Administration data block
  DB015, DB016 and DB017 must consist of their total length of 1024 data words. DB015, DB016 and DB017 must be declared READ/WRITE.
- SB071: Initialisation of global parameters in DB015, DB016, DB017
- SB255: Operating system call

Pilz – Your Partner For Practical Training

6

Pilz – Your Partner For Practical Training

Contents **Seite**

Pilz – Your Partner For Practical Training

Introduction 6-2

Scheduled dates for seminars and courses 2005 6-3

Introduction
Customised training concepts

Benefit from the expertise of one of the leading brands in automation technology

As a result of many years' experience, work with the standards' committees and thorough expertise in the area of safe automation technology, Pilz is the ideal partner for practical training. Pilz offers a large number of seminars and courses on the widest range of subjects to both manufacturers and users alike – worldwide, in various languages, to the samed standard. For example:

- General safety-related issues
- New machinery safety standards, programming and maintenance
- Error evaluation and diagnostics.

Whether you need a basic seminar or an advanced course, we can help to prepare you individually in the best way possible for everyday work situations. We will happily do this at your premises, directly on the machine.

More information on our complete seminar program, conditions of registration and seminar venues can be found on the Internet, where you also have the opportunity to register directly online:

- www.pilz.de/kurse

Why not find out more about our attractive range of training courses!

Scheduled dates

Seminars and courses 2005

	January	February	March	April	May	June	July	August	September	October	November	December
Seminars on safety technology												
Safety technology basics – An overview		24.02.				09.06.				11.10.		06.12.
Safe electrical design – A practical seminar	27.01.		10.03.			06.06.			19.09.		25.11.	
Plant and machinery in the internal EU market – Current changes for purchases/sales							07.07.				24.11.	
Safety-related upgrade of plant and machinery	26.01.		09.03.			07.06.			20.09.			
CE-marking – Legal principles and practical implementation			02.-03.03.							12.-13.10.		
New machinery safety standards	25.01.		08.03.			08.06.						07.12.
CCC certification, norms and standardisation in China			22.03.				15.07.				23.11.	
Ethernet basics for maintenance staff			21.03.				14.07.		23.09.			05.12.
Product courses for PSS programmable safety systems and safe bus systems SafetyBUS p												
Basic course		21.-22.02.		05.-06.04.			05.-06.07.		13.-14.09.		29.-30.11.	
Intermediate programming course				07.-08.04.					15.-16.09.			01.-02.12.
Service course	19.-20.01.		16.-17.03.		10.-11.05.		20.-21.07.		27.-28.09.		08.-09.11.	
Service and programming course	19.-21.01.		16.-18.03.		10.-12.05.		20.-22.07.		27.-29.09.		08.-10.11.	
Intensive configuration course	31.01.-02.02.			27.-29.04.		28.-30.06.				05.-07.10.		13.-15.12.
Intensive programming and maintenance course		14.-17.02.		11.-14.04.		21.-24.06.			06.-09.09.		15.-18.11.	
Programming software PSS WIN-PRO – Upgrade course	12.01.				23.05.					19.10.		
PSS Ethernet module									12.09.		22.11.	

Service

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Service

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Pre-sales/after sales

Services, concepts and solutions

We are happy to advise you, in the configuration phase or during commissioning.

Plant assessment

Analysis and assessment of the safety-related condition of your plant and machinery. Presentation of basic proposals for improvement.

Risk assessment

Assessment of the hazards and risks on plant and machinery, based on standards and norms.

Safety concept

Based on the risk assessment, appropriate protective measures can be selected and a safety concept drawn up.

Safety design

Pilz can undertake all the tasks required to implement a project: component selection, preparation of circuit diagrams, programming, control cabinet, installation, commissioning.

CE services

Co-ordination and implementation of all the activities necessary for the “CE conformity” of plant and machinery.

Safety sign-off

Check of all the relevant safety-related documents, creation of check lists and examination of plant and machinery.

Technical support

Our engineers can support you in the selection, use and application of our products. They are in constant contact with customers from the widest range of industries and industrial sectors and are happy to answer your queries at any time.

E-Mail:
techsupport@pilz.de

24-hour hotline:
+49 711 3409-444

Training and education

A wide range of seminars and courses help to pass on the basics to minimise risks and safeguard your success.

Worldwide representatives

Our worldwide network of subsidiaries and sales partners ensures comprehensive support and assistance with your questions and problems.

Internet

Our homepage at www.pilz.com provides the latest information, electronic shopping, direct dialogue and enquiry functions, as well as extensive download options.

E-Business

The focus of Pilz’s E-Business activities is to strengthen customer orientation through the use of new media and to increase added value via a supplementary business model for Business-to-Business.

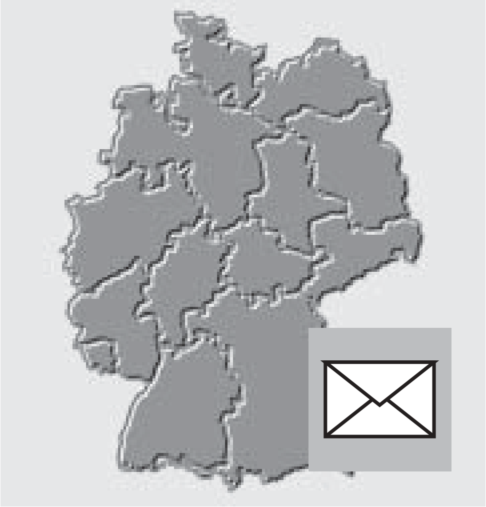
Supply and repair service

From a fast, economical repair through to a long supply guarantee to safeguard your investment – always expect more from Pilz.

Certificates and approvals

Pilz is certified to DIN ISO 9001. International approvals and certification from recognised test bodies confirm our products’ suitability for worldwide use.

Addresses
Technical offices in Germany



BI
Pilz GmbH & Co. KG
Sichere Automation
Technisches Büro Bielefeld
Mackenbrucher Straße 35 a
33813 Oerlinghausen
Telephone: 05202 926012
Telefax: 05202 926013

BN
Pilz GmbH & Co. KG
Sichere Automation
Technisches Büro Bonn
Cimbernstraße 3
53859 Niederkassel
Telephone: 02208 914128
Telefax: 02208 914129

DD
Pilz GmbH & Co. KG
Sichere Automation
Technisches Büro Dresden
Hauptstraße 32
01445 Radebeul
Telephone: 0351 83639-96/-97
Telefax: 0351 83639-98

Field office in Berlin,
Telephone: 030 4408987
Telefax: 030 44359047

F
Pilz GmbH & Co. KG
Sichere Automation
Technisches Büro Frankfurt
Heinrich-Böll-Str. 27
63110 Rodgau
Telephone: 06106 624641
Telefax: 06106 624677

GI
Pilz GmbH & Co. KG
Sichere Automation
Technisches Büro Gießen
Waldstraße 26
35452 Heuchelheim
Telephone: 0641 9661788
Telefax: 0641 9661789

H
Pilz GmbH & Co. KG
Sichere Automation
Technisches Büro Hannover
Osterwalder Straße 8
30827 Garbsen
Telephone: 05131 4918-0
Telefax: 05131 4918-10

M
Pilz GmbH & Co. KG
Sichere Automation
Technisches Büro München
Industriestraße 44 b
82194 Gröbenzell
Telephone: 08142 4670-0
Telefax: 08142 54541

MG
Pilz GmbH & Co. KG
Sichere Automation
Technisches Büro Mönchengladbach
Girmen 32
52525 Heinsberg
Telephone: 02452 939-877
Telefax: 02452 939-878

N
Pilz GmbH & Co. KG
Sichere Automation
Technisches Büro Nürnberg
Poppenleite 6
96152 Burghaslach
Telephone: 09552 980568
Telefax: 09552 980569

PS
Pilz GmbH & Co. KG
Sichere Automation
Technisches Büro Pirmasens
Karlstraße 22
66969 Lemberg
Telephone: 06331 6981-11
Telefax: 06331 6981-61

RT
Pilz GmbH & Co. KG
Sichere Automation
Technisches Büro Reutlingen
Lichtensteinstraße 38
72124 Pliezhausen
Telephone: 07127 8905-10
Telefax: 07127 8905-11

S
Pilz GmbH & Co. KG
Sichere Automation
Technisches Büro Stuttgart
Felix-Wankel-Straße 2
73760 Ostfildern
Telephone: 0711 3409-117/-129/-136
Telefax: 0711 3409-132

SU
Pilz GmbH & Co. KG
Sichere Automation
Technisches Büro Siegburg
Adolf-Kolping-Platz 12
53721 Siegburg
Telephone: 02241 57160
Telefax: 02241 57076

A
Pilz Ges.m.b.H.
Sichere Automation
Modecenterstraße 14
1030 Wien
Austria
Telephone: 01 7986263-0
Telefax: 01 7986264
E-Mail: pilz@pilz.at

AUS
Pilz Australia
Safe Automation
Suite C1, 756 Blackburn Road
Clayton, Melbourne VIC 3168
Australia
Telephone: 03 95446300
Telefax: 03 95446311
E-Mail: safety@pilz.com.au

B L
Pilz Belgium
Safe Automation
Bijenstraat 4
9051 Gent (Sint-Denijs-Westrem)
Belgium
Telephone: 09 3217570
Telefax: 09 3217571
E-Mail: info@pilz.be

BR
Pilz do Brasil
Automação Segura
Rua Ártico, 123 - Jd. do Mar
09726-300
São Bernardo do Campo - SP
Brazil
Telephone: 11 4337-1241
Telefax: 11 4337-1242
E-Mail: pilz@pilzbr.com.br

CH
Pilz Industrieelektronik GmbH
Gewerbepark Hintermättli
Postfach 6
5506 Mägenwil
Switzerland
Telephone: 062 88979-30
Telefax: 062 88979-40
E-Mail: pilz@pilz.ch

D
Pilz GmbH & Co. KG
Sichere Automation
Felix-Wankel-Straße 2
73760 Ostfildern
Germany
Telephone: 0711 3409-0
Telefax: 0711 3409-133
E-Mail: pilz.gmbh@pilz.de

DK
Pilz Skandinavien K/S
Safe Automation
Ellegaardvej 25 L
6400 Sonderborg
Denmark
Telephone: 74436332
Telefax: 74436342
E-Mail: pilz@pilz.dk

E
Pilz Industrieelektronik S.L.
Camí Ral, 130
Polígono Industrial Palou Nord
08400 Granollers
Spain
Telephone: 938497433
Telefax: 938497544
E-Mail: pilz@pilz.es

F
Pilz France Electronic
1, rue Jacob Mayer
BP 12
67037 Strasbourg Cedex
France
Telephone: 03 88104000
Telefax: 03 88108000
E-Mail: siege@pilz-france.fr

FIN
Pilz Skandinavien K/S
Safe Automation
Nuijamiestentie 5 A
00400 Helsinki
Finland
Telephone: 09 27093700
Telefax: 09 27093709
E-Mail: pilz.fi@pilz.dk

GB
Pilz Automation Technology
Safe Automation
Willow House, Medlicott Close
Oakley Hay Business Park
Corby
Northants NN18 9NF
United Kingdom
Telephone: 01536 460766
Telefax: 01536 460866
E-Mail: sales@pilz.co.uk

I
Pilz Italia Srl
Automazione sicura
Via Meda 2/A
22060 Novedrate (CO)
Italy
Telephone: 031 789511
Telefax: 031 789555
E-Mail: info@pilz.it

IRL
Pilz Ireland Industrial Automation
Cork Business and Technology Park
Model Farm Road
Cork
Ireland
Telephone: 021 4346535
Telefax: 021 4804994
E-Mail: sales@pilz.ie

J
Pilz Japan Co., Ltd.
Safe Automation
Shin-Yokohama Fujika Building 5F
2-5-9 Shin-Yokohama
Kohoku-ku
Yokohama 222-0033
Japan
Telephone: 045 471-2281
Telefax: 045 471-2283
E-Mail: pilz@pilz.co.jp

MEX
Pilz de Mexico, S. de R.L. de C.V.
Automatización Segura
Circuito Pintores # 170
Cd. Satelite
C.P. 53100
Naucalpan de Juarez, Edo. de Mexico
Mexico
Telephone: 55 5572 1300
Telefax: 55 5572 4194
E-Mail: info@mx.pilz.com

NL
Pilz Nederland
Veilige automatisering
Postbus 186
4130 ED Vianen
Netherlands
Telephone: 0347 320477
Telefax: 0347 320485
E-Mail: info@pilz.nl

NZ
Pilz New Zealand
Safe Automation
5 Nixon Road
Mangere
Auckland
New Zealand
Telephone: 09-6345350
Telefax: 09-6345352
E-Mail: t.catterson@pilz.co.nz

P
Pilz Industrieelektronik S.L.
R. Eng Duarte Pacheco, 120
4 Andar Sala 21
4470-174 Maia
Portugal
Telephone: 229407594
Telefax: 229407595
E-Mail: pilz@pilz.es

PRC
Pilz China Representative Office
Safe Automation
Rm. 704-706
No. 457 Wu Lu Mu Qi (N) Road
Shanghai 200040
China
Telephone: 021 62494658
Telefax: 021 62491300
E-Mail: sales@pilz.com.cn

ROK
Pilz Korea
Safe Automation
#428 Midas Venture Tower
775-1 Janghang-Dong
Ilsan-Gu, Goyang-City
Kyungki-Do 411-837
Korea
Telephone: 031 8159541
Telefax: 031 8159542
E-Mail: info@pilzkorea.co.kr

SE
Pilz Skandinavien K/S
Safe Automation
Energigatan 10 B
43437 Kungsbacka
Sweden
Telephone: 0300 13990
Telefax: 0300 30740
E-Mail: pilz.se@pilz.dk

TR
Pilz Elektronik Güvenlik Ürünleri
ve Hizmetleri Tic. Ltd. Şti.
Tan iş Merkezi
Kükürtlü Caddesi No: 67
C-Blok Daire: 1
16080 Bursa
Turkey
Telephone: 0224 2360180
Telefax: 0224 2360184
E-Mail: pilz.tr@pilz.de

USA
Pilz Automation Safety L.P.
7150 Commerce Boulevard
Canton
Michigan 48187
USA
Telephone: 734 354-0272
Telefax: 734 354-3355
E-Mail: info@pilzusa.com

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www.pilz.com

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

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