Chipsmall Limited consists of a professional team with an average of over 10 year of expertise in the distribution of electronic components. Based in Hongkong, we have already established firm and mutual-benefit business relationships with customers from,Europe,America and south Asia,supplying obsolete and hard-to-find components to meet their specific needs.

With the principle of “Quality Parts,Customers Priority,Honest Operation,and Considerate Service”,our business mainly focus on the distribution of electronic components. Line cards we deal with include Microchip,ALPS,ROHM,Xilinx,Pulse,ON,Everlight and Freescale. Main products comprise IC,Modules,Potentiometer,IC Socket,Relay,Connector.Our parts cover such applications as commercial,industrial, and automotives areas.

We are looking forward to setting up business relationship with you and hope to provide you with the best service and solution. Let us make a better world for our industry!

Contact us

Tel: +86-755-8981 8866 Fax: +86-755-8427 6832
Email & Skype: info@chipsmall.com Web: www.chipsmall.com
Address: A1208, Overseas Decoration Building, #122 Zhenhua RD., Futian, Shenzhen, China

Parameterization and installation of the PSR-RSM4 safe speed monitor

User manual

UM EN PSR-CONF-WIN
Order No. 2888107

PHOENIX CONTACT
INSPIRING INNOVATIONS

User manual

Parameterization and installation of the PSR-RSM4 safe speed monitor

2014-10-02

Designation: UM EN PSR-CONF-WIN

Revision: 03

Order No.: 2888107

This user manual is valid for:

Designation	Revision	Order No.
PSR-CONF-WIN1.0	1.0	2981554
PSR-SCP-24DC/RSM4/4X1		2981538
PSR-SPP-24DC/RSM4/4X1		2981541

Please observe the following notes

User group of this manual

The use of products described in this manual is oriented exclusively to:

- Qualified electricians or persons instructed by them, who are familiar with applicable standards and other regulations regarding electrical engineering and, in particular, the relevant safety concepts.
- Qualified application programmers and software engineers, who are familiar with the safety concepts of automation technology and applicable standards.

Explanation of symbols used and signal words

This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety measures that follow this symbol to avoid possible injury or death.

There are three different categories of personal injury that are indicated with a signal word.

DANGER This indicates a hazardous situation which, if not avoided, will result in death or serious injury.

WARNING This indicates a hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION This indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

This symbol together with the signal word **NOTE** and the accompanying text alert the reader to a situation which may cause damage or malfunction to the device, hardware/software, or surrounding property.

This symbol and the accompanying text provide the reader with additional information or refer to detailed sources of information.

How to contact us

Internet

Up-to-date information on Phoenix Contact products and our Terms and Conditions can be found on the Internet at:
phoenixcontact.com

Make sure you always use the latest documentation.
It can be downloaded at:
phoenixcontact.net/products

Subsidiaries

If there are any problems that cannot be solved using the documentation, please contact your Phoenix Contact subsidiary.
Subsidiary contact information is available at phoenixcontact.com.

Published by

PHOENIX CONTACT GmbH & Co. KG
Flachsmarktstraße 8
32825 Blomberg
GERMANY

Should you have any suggestions or recommendations for improvement of the contents and layout of our manuals, please send your comments to:
tecdoc@phoenixcontact.com

General terms and conditions of use for technical documentation

Phoenix Contact reserves the right to alter, correct, and/or improve the technical documentation and the products described in the technical documentation at its own discretion and without giving prior notice, insofar as this is reasonable for the user. The same applies to any technical changes that serve the purpose of technical progress.

The receipt of technical documentation (in particular user documentation) does not constitute any further duty on the part of Phoenix Contact to furnish information on modifications to products and/or technical documentation. You are responsible to verify the suitability and intended use of the products in your specific application, in particular with regard to observing the applicable standards and regulations. All information made available in the technical data is supplied without any accompanying guarantee, whether expressly mentioned, implied or tacitly assumed.

In general, the provisions of the current standard Terms and Conditions of Phoenix Contact apply exclusively, in particular as concerns any warranty liability.

This manual, including all illustrations contained herein, is copyright protected. Any changes to the contents or the publication of extracts of this document is prohibited.

Phoenix Contact reserves the right to register its own intellectual property rights for the product identifications of Phoenix Contact products that are used here. Registration of such intellectual property rights by third parties is prohibited.

Other product identifications may be afforded legal protection, even where they may not be indicated as such.

Table of contents

1 For your safety 9

1.1 General safety notes 9
1.2 Electrical safety 10
1.3 Correct usage 11
1.4 Safety of the machine or system 12
1.5 Safety when starting applications 12
1.6 Directives and standards 13
1.7 Documentation 13
1.8 Safety hotline 13

2 Product description 15

2.1 Structure of the PSR-RSM4 15
2.1.1 Operating elements 16
2.1.2 LEDs 16
2.2 Function description 17

3 Mounting 19

3.1 General 19
3.2 Mounting the PSR-RSM4 19

4 Connection and wiring 21

4.1 General 21
4.2 RJ45 programming and encoder connection 21
4.2.1 Signal conditioning for HTL encoders 22
4.3 Initiator connection 23
4.4 Adaptation to existing drive systems 25
4.5 Connection for the supply voltage 26
4.6 Start circuit connection 26
4.7 Operating mode selection 27
4.8 Switching outputs 27
4.8.1 Signal outputs 29

5 Software installation 31

5.1 System requirements 31
5.2 Installation instructions 31
5.3 Program startup 34

6 Parameterization 35
6.1 Toolbar for parameterization 35
6.1.1 Language selection 37
6.1.2 Refresh button 37
6.2 Input fields for the parameterization 38
6.2.1 Axis/Spindle 38
6.2.2 Machine 38
6.2.3 Axial pitch/Ratio 39
6.2.4 Encoder 39
6.2.5 Automatic operation 40
6.2.6 Special operation mode 40
6.2.7 Set mode 40
6.2.8 Stop mode 40
6.2.9 Error message output FO 41
6.2.10 Signal output MO1 41
6.2.11 Signal output MO2 41
6.2.12 IN/RJ45 42
6.2.13 Encoder type 42
6.3 Parameterization of shaft break monitoring 43

7 Startup 45
7.1 Communication with the module 45
7.2 Hardware connection 45

8 System response times 47

9 Safety evaluation of connected measuring systems 49
9.1 Requirements for subsystems when using different sensors 50

10 Error detection 51
10.1 Initiator errors, data errors 51
10.2 Encoder errors 51
10.3 Error list 52

11 Application examples 53
11.1 Application 1: basic machine 53
11.2 Application 2: basic machine with a monitored drive 54
11.3 Application 3: machine tool with several drives and differentiated operating modes 55
11.4 Application 4: basic machine with monitored drive and additional drive shaft monitoring 56

12 Technical data and ordering data 57
12.1 Technical data 57
12.2 Ordering data 59

A Appendix for document lists 61
A 1 List of figures 61
A 2 List of tables 63

B Revision history 65

1 For your safety

Purpose of this user manual

The information in this document is designed to familiarize you with how the PSR-RSM4 safety module works, its operating and connection elements, and its parameter settings. This information will enable you to use the safety module according to your requirements.

Validity of the user manual

This user manual is only valid for the safety modules indicated on the inner cover page.

1.1 General safety notes

WARNING: Incorrect handling can pose serious risks for the user

Depending on the application, incorrect handling of the safety module can pose serious risks for the user.

- When working with the safety module, please observe all the safety notes included in this section.

Qualified personnel

In terms of this user manual, qualified personnel are persons who, because of their education, experience and instruction, and their knowledge of relevant standards, regulations, accident prevention, and service conditions, have been authorized to carry out any required operations, and who are able to recognize and avoid any possible dangers.

Safety of personnel and equipment

The safety of personnel and equipment can only be assured if the safety module is used correctly (see “Correct usage” on page 11).

Error detection

Depending on the wiring and the corresponding setting of the parameters, the PSR-RSM4 can detect various errors.

Ground contact

Please ensure that all inputs and outputs and the safety switching device are connected to the same ground.

Do not carry out any repairs

Repair work may not be carried out on the safety module.

In the event that an error cannot be removed, please contact Phoenix Contact immediately, engage a service engineer or send the faulty module directly to Phoenix Contact.

Do not open the housing/security seal

It is strictly prohibited to open the safety module housing. In order to prevent the manipulation of the safety module and to detect the unauthorized opening of the safety module, a security seal is applied to the module. This security seal is damaged in the event of unauthorized opening. In this case, the correct operation of the safety module can no longer be ensured.

Measures to prevent mismatching and polarity reversal

Take measures to prevent the mismatching, polarity reversal, and manipulation of connections.

1.2 Electrical safety

WARNING: Hazardous shock currents and the loss of Functional Safety

Disregarding instructions for electrical safety may result in hazardous shock currents and the loss of Functional Safety.

- In order to ensure electrical safety, please observe the following points.

Direct/indirect contact

Protection against direct and indirect contact according to VDE 0100 Part 410 must be ensured for all components connected to the system. In the event of an error, parasitic voltages must not occur (single-fault tolerance).

This can be achieved by:

– Using power supply units with safe isolation (PELV)

– Decoupling circuits, which are not PELV systems, using optocouplers, relays, and other components which meet the requirements of safe isolation

Power supply unit for 24 V supply

Only use power supply units with safe isolation and PELV according to EN 50178/VDE 0160. This prevents short-circuits between primary and secondary sides.

Make sure that the output voltage of the power supply does not exceed 32 V even in the event of an error.

PELV

PELV = Protective extra-low voltage according to EN 50178/VDE 0160

Insulation rating

When selecting the equipment, please take into consideration the dirt and surge voltages which may occur during operation.

The PSR-RSM4 safety module is designed for surge voltage category II (according to DIN EN 60664-1). If you expect surge voltages in the system, which exceed the values defined in surge voltage category II, take into consideration additional measures for voltage limitation.

WARNING: Incorrect installation and upgrades can pose serious risks for the user

Depending on the application, incorrect installation and upgrades can pose serious risks for the user.

The user is obliged to design the devices used and their installation in the system according to these requirements.

- Check plants and systems retrofitted with the PSR-RSM4 safety module in this respect.

1.3 Correct usage

Only use the PSR-RSM4 safety module in accordance with the instructions in this section.

The PSR-RSM4 safety module is designed exclusively for downtime and speed monitoring on machines and systems.

The safety module can only perform its safety-related tasks within the system if it has been integrated into the execution process correctly and in such a way as to avoid errors.

Within a system, the PSR-RSM4 safety module can be used to achieve safety functions with the following requirements depending on the conditions of use:

– Up to SIL 3 according to EN 61508
– Up to SILCL 3 according to EN 62061
– Up to Cat. 4/PL e according to EN ISO 13849-1

Key

SIL	Safety integrity level
SILCL	SIL claim limit
Cat.	Category
PL	Performance level

The PSR-RSM4 safety module can be used, for example, in the following applications:

– Safety circuits according to EN 60204 Part 1
– Safe shutdown of contactors, motors (24 V DC), valves, ohmic, inductive, and capacitive loads

Before startup, configure the safety module according to your application.
To do this, you will require the PSR-CONF-WIN parameterization software that is described in this user manual.

1.4 Safety of the machine or system

The machine/system manufacturer and the operator are solely responsible for the safety of the machine or system and the implemented application in which the machine or system is used. The Machinery Directive must therefore be observed.

Draw up and implement a safety concept

In order to use the safety module described in this document, you must have drawn up an appropriate safety concept for your machine or system. This includes a hazard and risk analysis according to the directives and standards specified in “Directives and standards” on page 13.

The target safety integrity level (SIL according to IEC 61508, SILCL according to EN 62061 or performance level and category according to EN ISO 13849-1) is ascertained on the basis of the risk analysis. The safety integrity level ascertained determines how to connect and parameterize the safety module within the overall safety function.

Safety-related equipment

In order to use the PSR-RSM4 properly, safety-related equipment must be provided on the machine.

This includes protective cover switches, enable switches, mode selector switches, and essential sensors for motion detection (e.g., rotary impulse encoders, length measuring systems, initiators, and Hall sensors).

The limit values may not be switched by the control circuit, as control circuits are generally not safety-related.

Check hardware and parameterization

Carry out a **validation** every time you make a safety-related modification to your overall system.

Use your test report to ensure that the following conditions are met:

- The safe devices are connected to the correct sensors and actuators.
- The safety functions have been wired correctly.
- The parameter settings have been correctly calculated and set according to the safety function.

1.5 Safety when starting applications

Take the following into consideration when determining the start conditions for your machine or system:

- The machine or system may only be started if it has been ensured that no one is present in the danger zone.
- Meet the requirements of EN ISO 13849-1 with regard to the manual reset function.

This applies to:

- Switching on safe devices
- Acknowledging device error messages
- Removing startup inhibits for safety functions

1.6 Directives and standards

The manufacturers and operators of machines and systems in which the PSR-RSM4 module is used are responsible for adhering to all applicable directives and legislation.

For the standards observed by the safety module, please refer to the certificate issued by the approval body and the EC declaration of conformity. These documents are available on the Internet at phoenixcontact.net/products.

1.7 Documentation

Latest documentation

Make sure you always use the latest documentation. Changes or additions to this document can be found on the Internet at phoenixcontact.net/products.

1.8 Safety hotline

24-hour hotline

Should you have any technical questions, please contact our 24-hour hotline.

Phone: + 49 5281 9-462777

E-mail: safety-service@phoenixcontact.com

2 Product description

2.1 Structure of the PSR-RSM4

Product image

Figure 2-1 Product image for the PSR-RSM4

Connection versions

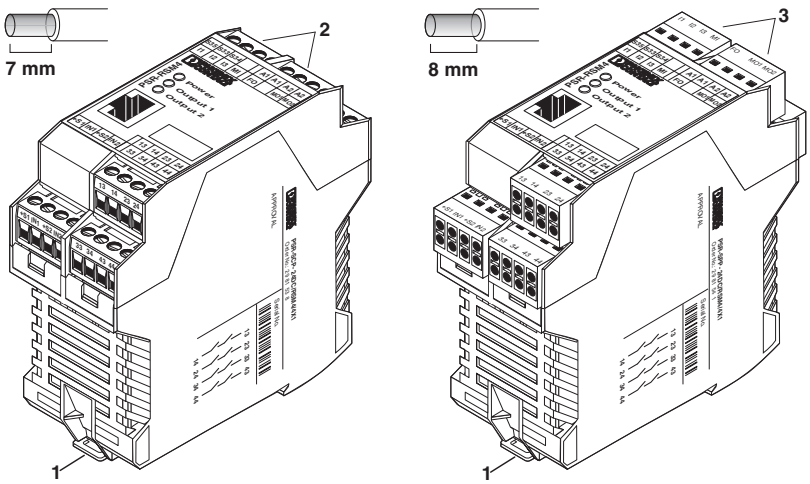

Figure 2-2 Connection versions for the PSR-RSM4

1 Metal lock for fixing to the DIN rail
2 COMBICON plug-in screw terminal block
3 COMBICON plug-in spring-cage terminal block

2.1.1 Operating elements

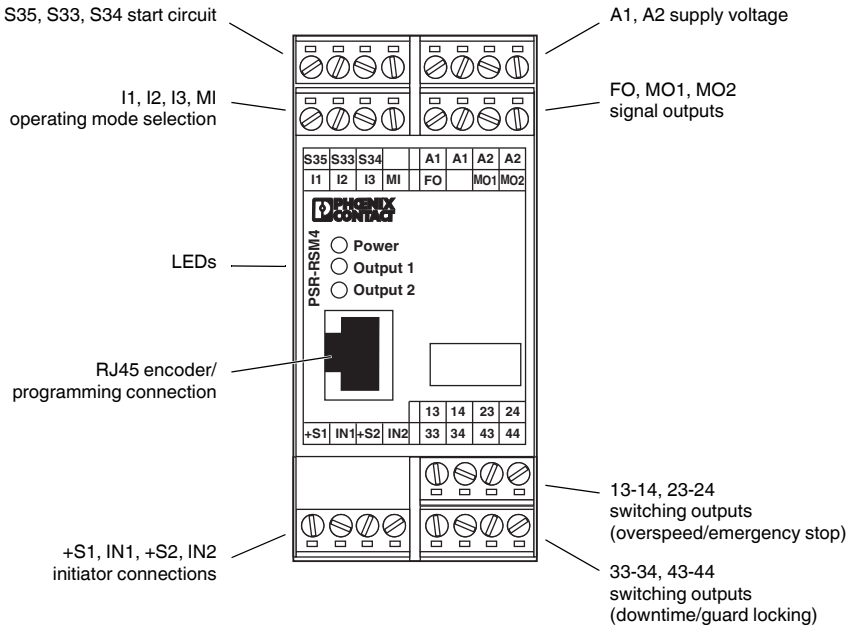

Figure 2-3 Operating elements of the PSR-RSM4

2.1.2 LEDs

Power	**Supply voltage**
	ON: speed monitor is ready
	Flashing: an error has occurred (“Error list” on page 52)
Output 1	**Overspeed (emergency stop)**
	ON: actual speed (speed) < parameterized overspeed threshold
Output 2	**Downtime detection**
	ON: actual speed (speed) < parameterized downtime threshold

2.2 Function description

Block diagram

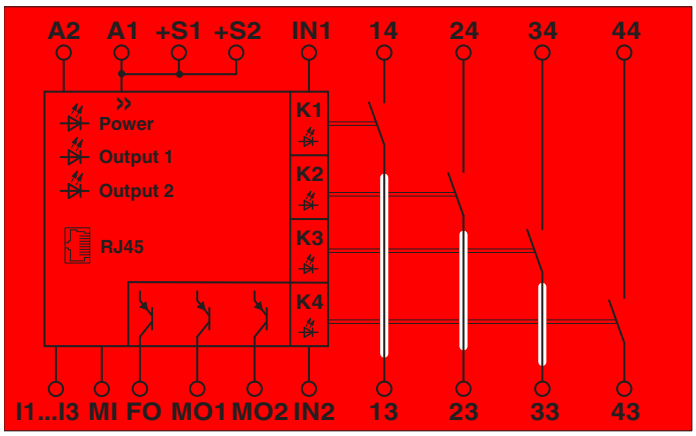

Figure 2-4 Block diagram for the PSR-RSM4

Key

Designation	Explanation
A1, A2	Supply voltage connection
+S1, IN1	Initiator connections
+S2, IN2	
I1 ... I3, MI	Operating mode selection
FO	Error message output
MO1	Signal output (emergency stop)
MO2	Signal output (guard locking)
13-14, 23-14	Switching outputs (overspeed/emergency stop)
33-34, 43-44	Switching outputs (downtime/guard locking)
RJ45	Encoder input

Method of operation

The speed monitor is used to monitor movement on all types of machines, assuming that the required equipment is present on the machine.

Motion detection is performed by two proximity switches which switch with an overlap or by an encoder (incremental or sin/cos encoder) that can be connected via a cable adapter.

The frequency comparator uses the actual value for speed detection and the setpoint for operating mode selection at I1, I2, I3 or MI to update the downtime contact and the speed/emergency stop contact (see Figure 2-5 “Function diagram”).

Function diagram

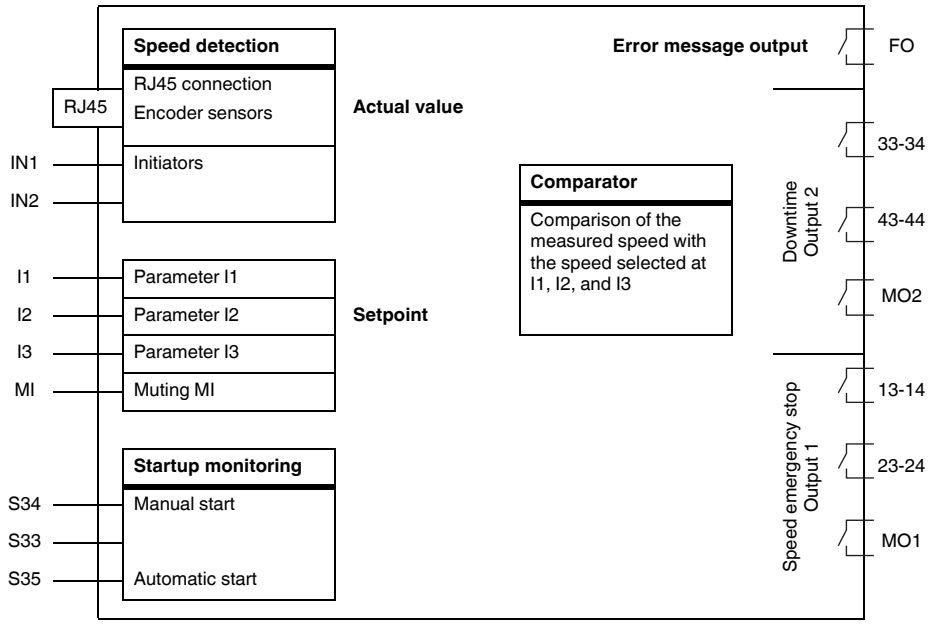

Figure 2-5 Function diagram

Function description

Once the operating voltage (24 V DC) has been applied at terminal blocks A1 and A2, the electronics (during downtime) check whether at least one proximity switch is supplying a signal to input IN1 or IN2 or whether a valid signal is present at the encoder input. If so, all the output relays switch to the operated condition, according to terminal blocks S33, S34, and S35. N/O contacts 13-14, 23-24 (emergency stop), and 33-34, 43-44 (guard locking) are closed, signal outputs MO1 (emergency stop) and MO2 (guard locking) supply 24 V DC. Error message output FO is in a high-resistance state.

Outputs 33-34 and 43-44 (guard locking) remain active in their switch position as long as no signal change is generated at the inputs (IN1 and IN2 or at the encoder input) by a movement greater than the parameterized downtime frequency. As soon as the downtime frequency is exceeded, outputs 33-34 and 43-44 return to the idle position and signal output MO2 switches to a high-resistance state.

Outputs 13-14 and 23-24 (emergency stop) remain active in their switch position as long as the parameterized and preselected desired speed value is not exceeded at the inputs (IN1 and IN2 or at the encoder input). As soon as the desired speed value is exceeded, outputs 13-14 and 23-24 return to the idle position and signal output MO1 switches to a high-resistance state.

If an initiator or encoder error is detected, all the output relays shut down, the “Power” LED flashes, and error message output FO supplies 24 V.

Signal outputs MO1 and MO2 and error message output FO can be inverted via the PSR-CONF-WIN software.

3 Mounting

3.1 General

The module is supplied in an ESD box together with a package slip with installation instructions.

Please read the complete package slip carefully.

NOTE: Electrostatic discharge

The module contains components that can be damaged or destroyed by electrostatic discharge. When handling the module, observe the necessary safety precautions against electrostatic discharge (ESD) according to EN 61340-5-1 and IEC 61340-5-1.

Qualified personnel

The safety module may only be installed and removed by qualified personnel.

WARNING: Unintentional machine startup

The system may only be started provided neither the station nor the system poses a hazard.

- Do not mount or remove the module while the power is connected.
- Before mounting or removing the safety module, disconnect the power to the module and ensure that it cannot be switched on again.
- Make sure the entire system is reassembled before switching the power back on.
- Observe the diagnostics indicators and any diagnostic messages.

Installation space

To ensure reliable operation, install the safety module in housing protected from dust and humidity (IP54 or higher).

In order to prevent manipulation, secure the housing (control cabinet/control box) against being opened by unauthorized persons.

Mount the safety module on a 35 mm DIN rail.

3.2 Mounting the PSR-RSM4

- Disconnect the power to the station.
- Hold the safety module perpendicular and snap it onto the DIN rail (7.5 mm in height).

Observe a mounting distance of 30 mm above and 40 mm below the safety module. Shorter distances may inhibit proper handling during installation.

- Check that all the snap-on mechanisms are securely snapped into place.

Make sure that all featherkeys and keyways on adjacent terminals are securely interlocked.

4 Connection and wiring

4.1 General

Qualified personnel

The electrical connection, startup, and operation of this device may only be performed by qualified personnel.

WARNING: Unintentional machine startup

The system may only be started provided neither the station nor the system poses a hazard.

- Make sure the entire system is reassembled before switching the power back on.
- Observe the diagnostics indicators and any diagnostic messages.

4.2 RJ45 programming and encoder connection

The RJ45 input is only designed for programming and for TTL, HTL, and sine/cosine encoders.

Resolver encoder, Ethernet or ISDN signals will not be processed.

Programming

The safety module is connected to the computer for configuration via the RS-232 programming cable. The cable is a passive interface cable with RJ45 and D9-SUB connector plug.

- Use this interface cable to connect the speed monitor to a free COM interface on the PC.

Signal	D9-SUB RS-232 PIN
–	1
TX	2
RX	3
–	4
GND	5
–	6
–	7
–	8
–	9

Signal	RJ45 PIN
GND	1
–	2
–	3
–	4
RX	5
–	6
TX	7
–	8

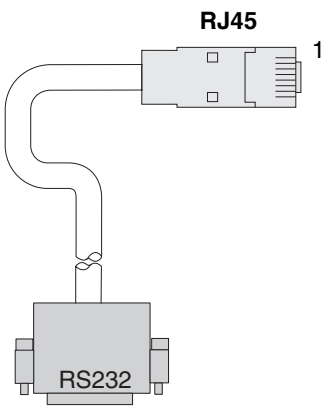

Figure 4-1 Interface cable with RJ45 and D9-SUB connector plug

Encoder connection

- Connect the encoder to the front of the device using an RJ45 adapter cable (accessory).

Cut-off frequency: 400 kHz
Nominal input voltage: 1 V_{PP}, 5 V TTL, and 24 V HTL

The supply voltage of the encoder is not provided by the PSR-RSM4 and must therefore be supplied separately.

NOTE: Errors

The GND connection of the encoder must be connected to the GND connection (pin 1 of the RJ45 connector).

- Follow the encoder manufacturer's recommendations to ensure correct shielding of the sensor cable.

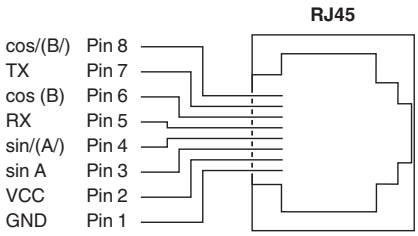

Figure 4-2 Connection with RJ45 connector

The Sin(A), Sin/(A/), Cos(B), and Cos/(B/) signals must be present. Encoders without negated tracks cannot be used.

4.2.1 Signal conditioning for HTL encoders

Signal conditioning is required if the permissible low level of the encoder signals of 0.8 V is exceeded.

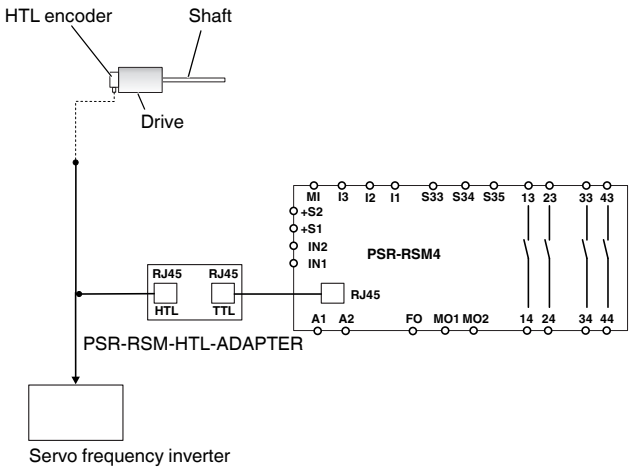

Figure 4-3 Connection example

Signal conditioning may be required if HTL encoders are used. Use the PSR-HTL adapter from Phoenix Contact for this (Order No. 2981897).

4.3 Initiator connection

IN1, IN2

24 V two or three-wire sensors can be connected directly to the plug-in connection terminal blocks.

WARNING: Loss of Functional Safety
Cross-circuits between the initiators can result in the loss of Functional Safety.
- Prevent cross-circuits between the initiators by using a suitable cable installation.

Cut-off frequency: 2 kHz
Nominal input voltage: 24 V HTL

Single-channel operation

- In single-channel operation, jumper IN1 and IN2.

WARNING: Loss of Functional Safety
In single-channel operation, sensor errors and an open circuit or short-circuit of the sensor cable are not detected by the safety module.

+S1, +S2

Two and three-wire sensors can be supplied directly by the safety module via terminal blocks +S1 and +S2 (U_N = 24 V DC).

For three-wire sensors, please note that the GND potential of the sensors is the same as the device potential of the PSR-RSM4.

To prevent electromagnetic interference, the initiator cables that are installed must be shielded.

Requirements for a gear wheel or gear rack

The design of the gear wheel or the gear rack is an important factor for safe operation.

The gear wheel surface must always be larger than the gap between the teeth. This ensures that at least one initiator is dampened.

Requirements for the initiators

– Tooth > tooth gap
– Tooth > switch diameter
– Gap depth > switch operating distance
– a ≤ (switch operating distance/2 (as per manufacturer's information))

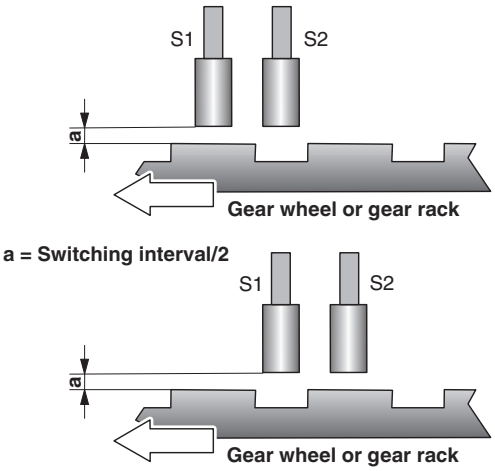

Figure 4-4 Mounting initiators

4.4 Adaptation to existing drive systems

Prefabricated Y cable adapters can be used on existing drive systems for quick and easy connection. Phoenix Contact offers an appropriate solution for all popular systems (see Table 4-1).

The Y adapter is inserted directly into the motor feedback interface (D-SUB or other) and connects the encoder (or sin/cos encoder) to the drive and the PSR-RSM4 (Figure 22).

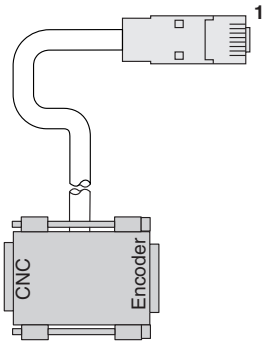

Figure 4-5 Y adapter

Table 4-1 Adaptation to existing drive systems

Order No.	Designation	D-SUB	Controller type	Motor feedback - interface (D-SUB) assignment						RJ45 assignment					
				UB	0V	A	A/	B	B/	UB	0V	A	A/	B	B/
2981583	CABLE-25/8/250/RSM/SIMO611D	D-SUB 25	Siemens, Heidenhain	1	2	3	4	6	7	2	1	3	4	6	8
2981596	CABLE-25/8/250/RSM/ARADEX		Aradex	1	12	2	3	4	5						
2981606	CABLE-15/8/250/RSM/SIMO611D		Siemens, Heidenhain	1	2	3	4	6	7						
2981619	CABLE-15/8/250/RSM/MHD/G	D-SUB 15	Indramat	12	4	2	9	3	10						
2981622	CABLE-15/8/250/RSM/SIN800		Siemens	14	11	1	9	10	3						
2981635	CABLE-15/8/250/RSM/FM-NC		Siemens	4	9	15	14	13	12						
2981648	CABLE-15/8/250/RSM/DKC		Indramat	12	10	7	8	6	5						
2981651	CABLE-15/8/250/RSM/AMK		AMK	7	8	4	3	6	5						
2981664	CABLE-15/8/250/RSM/SWE-X15		SEW	15	8	2	10	1	9						
2981758	CABLE-15/8/250/RSM/PD		Parker Drives	4	2	1	9	3	11						
2981826	CABLE-9/8/250/RSM/LENZE	D-SUB 9	LENZE	4	5	3	2	1	9						
2986698	CABLE-15/8/250/RSM/KINETIX	D-SUB 15	AB KINETIX	14	6	1	2	3	4						
2986973	CABLE-15/8/250/RSM/IHDUNI-SP		Unidrive SP	-	14	1	2	3	4						
2986986	CABLE-15/8/250/RSM/INDRADYN-2		Rexroth	-	4	2	3	5	6						
2986999	CABLE-20/8/250/RSM/FANUC	FANUC	GE FANUC	20	12	5	6	7	8						
2901746	CABLE-25/8/250/RSM/E-SIMO611D	D-SUB 25	Siemens, Heidenhain	1	2	3	4	6	7						
2902338	CABLE-15/8/250/RSM/INDEL	D-SUB 15	INDEL	12	10	1	9	3	11						
2902984	CABLE-9/8/250/RSM/ELAU	D-SUB 9	ELAU	-	9	1	2	3	4						
2904108	CABLE-15/8/100/RSM/BM	D-SUB 15	Baumüller	-	1	8	7	5	9						
Further types available on request at phoenixcontact.net/products.															