

Parker Servo Drive

Servo drives

Installation instructions

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German Master created.

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1. What is necessary and where to find it?

Software Tool, PSD ServoManager
Field Bus Files, **Downloads under http://solutions.parker.com/psd_support**
CE declaration of compliance **http://solutions.parker.com/psd_support**

2. Introduction

In this chapter you can read about:

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- Scope of delivery 8
- Type identification plate PSD1-S and PSD1-M with Safety Option Board 9
- Type identification plate PSD1-M 9
- Order/type code PSD 9
- Designated use 11
- Packaging, transport, storage 11
- For Safety Use 12
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- Conditions of utilization 15
- Before commissioning the drive, please observe the following: 28

2.1 Device assignment

This manual is valid for the following devices:

- PSD1-SW1200 (2 A)
- PSD1-SW1300 (5 A)
- PSD1-SW1400 (7.5 A)
- PSD1-M_1300 (5 A)
- PSD1-M_1400 (8 A)
- PSD1-M_1600 (15 A)
- PSD1-M_1800 (30A)
- PSD1-M_2220 (2 A + 2 A)
- PSD1-M_2330 (5 A + 5 A)
- PSD1-M_2440 (8 A + 8 A)
- PSD1-M_2630 (15 A + 5 A)
- PSD1-M_3222 (2 A + 2 A + 2 A)
- PSD1-M_3433 (8 A + 5 A + 5 A)
- PSD1-MWP010 (Mains module 10 kW)
- PSD1-MWP020 (Mains module 20 kW)

2.2 Scope of delivery

Included in delivery are mating connectors for:

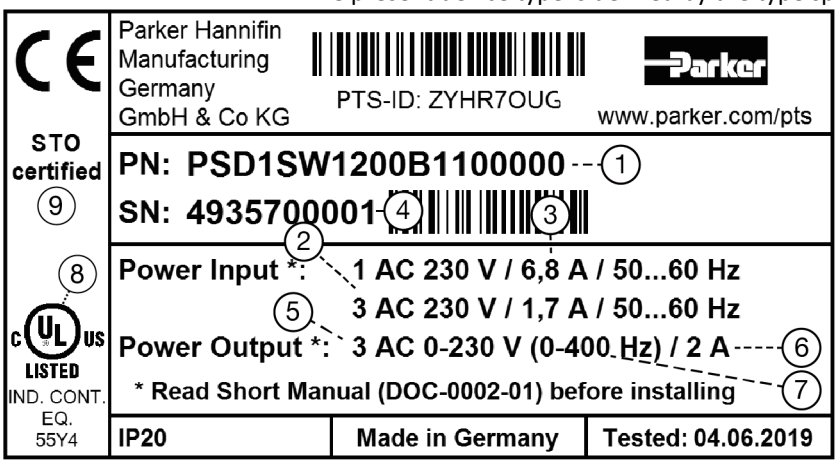
PSD1-S X17 (Push-in)
X51, X52, X63
X64 for PSD1SW1400
Cable clamps for the motor cable in sizes
D=7.9/9.5/11.1/12.7mm

PSD1-M: X17 / X21 (Push-in)
X45, X46, X48
Tin angle with screw terminals for motor and feedback cable (see page 60)

PSD1-M_P: X4 (Push-in)
X9, X40, X41

2.3 Type identification plate PSD1-S and PSD1-M with Safety Option Board

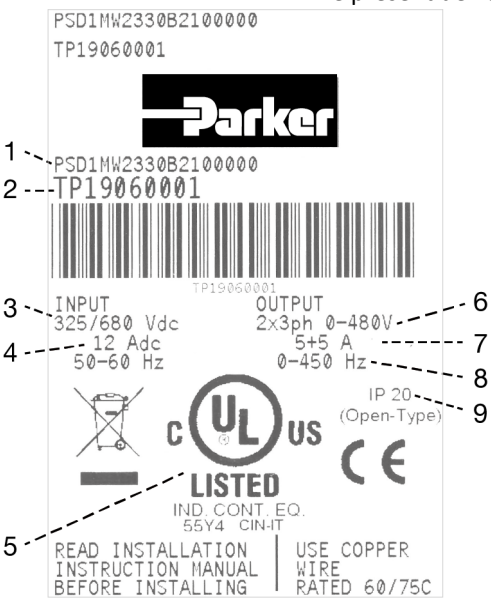
The present device type is defined by the type specification plate (on the housing):



1	Order code of the device
2	Input voltage
3	Input Current
4	Serial Number
5	Output voltage
6	Output current
7	Output frequency
8	UL certification (corresponding to the existing logo)
9	Type of safety certification

2.4 Type identification plate PSD1-M

The present device type is defined by the type specification plate (on the housing):



1	Order code of the device
2	Serial Number
3	Input voltage
4	Input Current
5	UL certification
6	Output voltage
7	Output current
8	Output frequency
9	IP Rating

2.5 Order/type code PSD

	1	2	3	4	5	6	7	8	9	10	11
Ordering example	**PSD1**	**M**	**W**	**3**	**433**	**B**	**1**	**1**	**0**	**0**	**000**

1	**Drive family**	
	PSD1	**Parker Servo Drive**
2	**Device type**	
	S	**Stand-Alone 230 VAC**
	M	**Multi-axis 400 VAC**
3	**Mounting type**	
	W	**Wall mounting**
4	**Device type**	
	1	**1 performance level**
	2	**2 performance levels**
	3	**3 performance levels**
	P	**Mains modules**

5	**Device type**	
	PSD1SW1 Stand-Alone	
	200	**2 A**
	300	**5 A**
	400	**7.5 A**
	PSD1MW1: 1 performance level	
	300	**5 A**
	400	**8 A**
	600	**15 A**
	800	**30 A**
	PSD1MW2: 2 performance levels	
	220	**2 + 2 A**
	330	**5 + 5 A**
	440	**8 + 8 A**
	PSD1MW3: 3 performance levels	
	222	**2 + 2 + 2 A**
	433	**8 + 5 + 5 A**
	PSD1MWP	
	010	**10 kVA**
	020	**20 kVA**
6	**Technology**	
	B	**Basis**
	C	**Programmable based on IEC 61131-3 with PLCopen function modules**
7	**Interface**	
	1	**EtherCAT** (standard, also for technology C applications "without fieldbus")
	2	**Multi-fieldbus** Fieldbus configurable (for the device):[1)] **PROFINET** **EtherCAT** **EtherNet/IP**
8	**Feedback**	
	1	**Hiperface DSL®**
	2	**Multi-Feedback** Feedback configurable (for the device):[1)] **Generally available 2)** ***Hiperface DSL®** ***Resolver** **Conditionally available 3)** *** Encoder (1 V_{ss})** *** Encoder A/B (TTL (RS422))** *** Analog Hall (1 V_{ss})** **Future/planned 3)** *** EnDat 2.2 (fully digital) [4)]** *** BISS_C [4)]**
9	**Option 1**	
	0	**No option**
	1	**Functional Safety over EtherCAT** (only for ...B11... devices possible) ...B11...: Technology B: Basis Interface 1: EtherCAT Feedback 1: Hiperface DSL®
	2	**IO option card Slot1, only available in combination with Slot2 option**
10	**Option 2**	
	0	
	2	**IO option card Slot2**
11	**Customized**	
	000	**Non customized**

[1)] Configurable in PSD ServoManager

[2)] With PSD1**M**W**2** and PSD1**M**W**3** all axes must be configured on the same feedback system

[3)] in the 1st setup level only for PSD1-S and PSD1MW1**1** (multi-axis devices with only **one possible** axis)

[4)] in development

2.6 Designated use

The device is designed for operation in electric power drive systems (EN 50178). Motion sequences can be automated with this device. Several motion sequences can be can combined by interconnecting several of these devices. Mutual interlocking functions must be incorporated for this purpose.

Please respect the **technical data** (see page 52)!

Exceeding / not respecting its intended use or its limits may cause danger.

- Motion sequence may not be carried out correctly which can cause personal injuries or material damages.
- The device might be destroyed what could result in fire.
- The device corresponds to EN 61800-3, i.e. it is subject to limited sale. The device can emit disturbances in certain local environments. In this case, the user is liable to take suitable measures.

2.7 Packaging, transport, storage

Packaging material and transport

⚠CAUTION **Caution!**

The packaging material is inflammable, if it is disposed of improperly by burning, lethal fumes may develop.

The packaging material must be kept and reused in the case of a return shipment. Improper or faulty packaging may lead to transport damages.

Make sure to transport the drive always in a safe manner and with the aid of suitable lifting equipment (**Weight** (see page 52)). Do never use the electric connections for lifting. Before the transport, a clean, level surface should be prepared to place the device on. The electric connections may not be damaged when placing the device.

First device checkup

- Check the device for signs of transport damages.
- Please verify, if the indications on the Type identification plate correspond to your requirements.
- Check if the consignment is complete.

Disposal

This product contains materials that fall under the special disposal regulation from 2010, which corresponds to the EC directory 2008/98/EC for dangerous disposal material. We recommend to dispose of the respective materials in accordance with the respectively valid environmental laws. The following table states the materials suitable for recycling and the materials which have to be disposed of separately.

Material	suitable for recycling	Disposal
metal	yes	No
Plastics	yes	No
Circuit boards	no	Yes

Please dispose of the circuit boards according to one of the following methods:

- Burning at high temperatures (at least 1200°C) in an incineration plant licensed in accordance with part A or B of the environmental protection act.
- Disposal via a technical waste dump which is allowed to take on electrolytic aluminium condensers. Do under no circumstances dump the circuit boards at a place near a normal waste dump.

Storage

If you do not wish to mount and install the device immediately, make sure to store it in a dry and clean environment. Make sure that the device is not stored near strong heat sources and that no metal chippings can get into the device.

Please note in the event of storage >1 year: **Forming the capacitors**

Forming the capacitors only required with 400 VAC axis controllers and mains module PSD1-M_P

If the device was stored longer than one year, the intermediate capacitors must be re-formed!

Forming sequence:

- Remove all electric connections
- Supply the device with 230VAC single phase for 30 minutes
  - ♦ via the L1 and L2 terminals on the device or
  - ♦ with multi axis devices via L1 and L2 on the mains module PSD1-M_P.

2.8 For Safety Use

In this chapter you can read about:

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- Working safely / qualification 12
- General hazards 13
- Special dangers 13
- Cautionary Markings 14
- Responsibility 14

2.8.1. Explanation of the safety instructions

⚠DANGER Indicates a potential risk that may result in death or severe injury.

⚠WARNING Indicates a potential medium risk with that may result in death or severe injury.

⚠CAUTION Indicates a potential low risk with that may result in minor or moderate injury.

NOTICE Alerts you to situations that may damage this product or other products.

2.8.2. Working safely / qualification

This device may be operated only by qualified personnel.
Qualified personnel in the sense of these operating instructions consists of:

- Persons who, by virtue to their training, experience and instruction, and their knowledge of pertinent norms, specifications, accident prevention regulations and operational relationships, have been authorized by the officer responsible for the safety of the system to perform the required task and in the process are capable of recognizing potential hazards and avoiding them (definition of technical personnel according to VDE105 or IEC364),
- who have a knowledge of first-aid techniques and the local emergency rescue services,
- who have read and will observe the safety instructions,
- who have read and observe the manual or help (or the sections pertinent to the work to be carried out).

This applies to all work relating to setting up, commissioning, configuring, programming, modifying the conditions of utilization and operating modes, and to maintenance work.
This manual and the help information must be available close to the device during the performance of all tasks.

2.8.3. General hazards

General Hazards on Non-Compliance with the Safety Instructions
The device described in this manual is designed in accordance with the latest technology and is safe in operation. Nevertheless, the device can entail certain hazards if used improperly or for purposes other than those explicitly intended.
Electronic, moving and rotating components can

- constitute a hazard for body and life of the user, and
- cause material damage

2.8.4. Special dangers



Danger!
Due to movable machine parts and high voltages, the device can pose a lethal danger. Danger of electric shock in the case of non-respect of the following instructions. The device corresponds to DIN EN 61800-3, i.e. it is subject to limited sale. The device can emit disturbances in certain local environments. In this case, the user is liable to take suitable measures.

- Check that all live terminals are secured against contact. Dangerous voltages up to 850V occur.
- Do not short-circuit the DC power voltage.

CAUTION: Risk of electric shock



Caution - Risk of electric shock!



Before wiring or loosening electrical connections please observe the following:

- Risk of electric shock, disconnect power before removing cover resp. disconnect the devices from the mains supply.
- **Caution!** Dangerous electrical voltage even after turning off the intermediate capacitors:
  Up to 3 minutes with PSD1-S and 10 minutes with PSD1-M **after switching off mains supply, dangerous voltages may still be present.**
  Please check that no voltages are present (<50 V) at the output terminals DC+ and DC- with PSD1-SW1200/1300: X63/4 & X63/5, PSD1-SW1400: X63/3 & X63/2 and with PSD1-M: Bus rail 5 (+HV DC) & 3 (-HV DC).

- The device must be permanently grounded due to high earth leakage currents. The leakage current is greater than 3.5 mA.
- The drive motor must be grounded with a suitable protective lead.

⚠DANGER



- The devices are equipped with high voltage DC capacitor. Before removing the protective cover, the discharging time must be awaited. After switching off the supply voltage, it may take up to 3 minutes with PSD1-S and 10 minutes with PSD1-M (up to 30 minutes with additional capacitor modules) to discharge the capacitors. Danger of electric shock in case of non respect.
- Do never perform resistance tests with elevated voltages (over 690V) on the wiring without separating the circuit to be tested from the drive.
- Please exchange devices only in currentless state and, in an axis system, only in a defined original state.
- If the axis controller is replaced, it is absolutely necessary to transfer the configuration determining the correct operation of the drive to the device before the device is put into operation. Depending on the operation mode, a machine zero run will be necessary.
- The device contains electrostatically sensitive components. Please observe the electrostatic protection measures while working at/with the device as well as during installation and maintenance.

2.8.5. Cautionary Markings

⚠WARNING Ignoring of the following instructions will result in personal injury or material damage.

- The heat disispator can reach very high temperatures (>70°C)
- Do never perform resistance tests with elevated voltages (over 690V) on the wiring without separating the circuit to be tested from the drive.
- Please exchange devices only in currentless state and, in an axis system, only in a defined original state.
- If the axis controller is replaced, it is absolutely necessary to transfer the configuration determining the correct operation of the drive to the device before the device is put into operation. Depending on the operation mode, a machine zero run will be necessary.
- The device contains electrostatically sensitive components. Please heed the electrostatic protection measures while working at/with the device as well as during installation and maintenance.
- Never carry out high voltage resistance tests at lines without disconnecting the drive from the power supply you need to check.
- Provide protection and/or additional safety systems in order to prevent personal injury and material damage. Always care for sufficient ventilation.
- All control and signal terminals guaranty safe extra-low voltages (SELV), i.e. they are protected by a double isolation. Make sure the complete external wiring is approved for the highest system voltage.
- The user is responsible for protective covers and/or additional safety measures in order to prevent damages to persons and electric accidents.

2.8.6. Responsibility

Fitters and operators of any machine or systems are responsible for ensuring that, in case of failure of a device or component, the drive and therefore the machine or system is rendered safe. In doing so, people must not be endangered.
The here-in described technical data, processes and circuits are merely a general guidance and may not be suitable for the user's specified application. We cannot guaranty the suitability for certain applications of the device described in this manual.

2.9 Warranty conditions

- The device must not be opened.
- No changes may be made to the device; except for the changes described in the manual.
- Make connections to the inputs, outputs and interfaces only in the manner described in the manual.
- Fix the devices according to the **mounting instructions.** (see page 31)
  We cannot provide any guarantee for other mounting methods.

Note on exchange of options

Device options must be exchanged in the factory to ensure hardware and software compatibility.

- When installing the device, make sure the heat dissipators of the device receive sufficient air and respect the recommended mounting distances of the devices with integrated ventilator fans in order to ensure free circulation of the cooling air.
- Make sure that the mounting plate is not exposed to external temperature influences.

2.10 Conditions of utilization

In this chapter you can read about:

- Conditions of utilization for CE-conform operation 15
- CE declaration of conformity PSD1-M 19
- CE declaration of conformity PSD1-S 19
- Conditions of utilization for the cUL certification of PSD1-M 19
- Conditions of utilization for the cUL certification of PSD1-S 23
- Current on the mains PE (leakage current) 27
- Supply networks 27

2.10.1. Conditions of utilization for CE-conform operation

2.10.1.1 - Industry and trade -

- Industry and trade -

The EC guidelines for electromagnetic compatibility 2014/30/EU and for electrical operating devices for utilization within certain voltage limits 2014/35/EU are fulfilled when the following boundary conditions are observed:

Operation of devices only in the state in which they are delivered.

Contact protection mating plug

In order to ensure contact protection, all mating plugs must be present on the device connections even if they are not wired.

Instructions for this manual

Please respect the specifications of the manual resp. of the help function, especially the technical characteristics (mains connection, circuit breakers, output data, ambient conditions,...).

2.10.1.2 Mains filter for use in industrial areas

The mains supply line requires a mains filter for the PSD1-M in general and for the PSD1-S from a specific motor cable length. Filtering can be provided plant specifically or separately for each device respectively for each axis combination.

Use of the devices in the industrial area (limit values class C3 in accordance with EN 61800-3)

The following mains filters are available for self-sufficient utilization:

Device:	Limit value class	Axis system with motor cable / Single-axis	Mains filter Order No.:
PSD1-M_P010	C3	< 6 x 10 m	**ECP-0003-01** (see page 118)
PSD1-M_P010	C3	< 6 x 50 m	**ECP-0003-02** (see page 118)
PSD1-M_P020	C3	< 6 x 50 m	**ECP-0003-03** (see page 118)
PSD1-SW1200 PSD1-SW1300	C3	< 10 m	no mains filter
PSD1-SW1400	C3	< 5 m	no mains filter
PSD1-SW1200 PSD1-SW1300 (single-phase supply)	C3	> 10 m	**ECP-0001-01** (see page 115)
PSD1-SW1400 (Single-phase supply)	C3	> 5m	**ECP-0001-03** (see page 116)
PSD1-SW1200 PSD1-SW1300 (3-phase supply)	C3	> 10 m	**ECP-0002-01** (see page 116)
PSD1-SW1400 (3-phase supply)	C3	> 5m	**ECP-0002-02** (see page 117)

2.10.1.3 Connection length in-between mains filters & device

In general, the connection mains filter - device shall be as short as possible.

unshielded: < 0.5 m

shielded: < 5 m (screen must be connected to ground - e.g. ground - control cabinet)

2.10.1.4 Operating conditions motor and feedback cable

- Operation of the devices only with motor and feedback cables containing a flat shielding.
- Maintain the shielding as close as possible to the cable-end (max distance 8 cm).
- Ground empty wires in the cable on both sides.
- Follow the notes for the **connector descriptions** (see page 43, see page 38, see page 68, see page 66, see page 71)

2.10.1.5 Requirements for motor cable PSD / motor output chokes

<100 m per axis (the cable must not be rolled up!).
The entire length of the motor cable per axis system must not exceed 300 m .

PSD1-M

For the PSD1-M device series with motor cables >20 m , the use of a motor output choke is required:

- **ECM-0004-01** (see page 120) (max. 6.3 A rated motor current)
- **ECM-0001-01** (see page 121) (max. 16 A rated motor current)
- **ECM-0002-01** (see page 121) (max. 30 A rated motor current)

PSD1-S

For the PSD1-S device series with motor cables >50 m , the use of a motor output choke is required:

- **ECM-0005-01** (see page 119) (max. 7 A rated motor current)
- **ECM-0005-02** (see page 120) (max. 8 A rated motor current)

2.10.1.6 Shielding connection of the PSD motor cable

Shielding connection of the motor cable

The external shield of the motor cable must be properly (=over a large area!) connected to the PE both on the **drive side** (see page 60, see page 86, see page 33) (on the device housing or on the rear wall of the control cabinet) as well as on the motor side (motor housing e.g. via the motor cable plug connector).
The outer and any existing additional inner shielding for the DSL or motor holding brake must not be interrupted.

2.10.1.7 Cable installation

General rules:

- Signal lines and power lines should be installed as far apart as possible; cross points 90°.
- Ideally, power electronics/drive technology and control technology should be placed separately in the control cabinet.
- **Signal lines** and other **clean power lines** must

  * never be routed at a short distance (< approx. 20 cm) or unshielded past strong **sources of interference** .
  * never be laid in parallel with interfering cables ('dirty lines') (e.g. in a cable duct in the control cabinet).

  Examples of signal lines: 24 V supply in general (for the PSD: device supply, supply for the digital outputs, supply for the motor brake), 24V input/output signals, bus cables, encoder interface cable, cable for analog inputs/outputs, ...

  Clean power lines: AC power supply cable before the mains filter input

  Examples of sources of interference: Motors, motor cables, supply cable to the braking resistor, connecting cable mains filter to the AC mains input of the device, transformers, contactors, ...

- The mains filter output cable must not be routed parallel to the power cables.
- All cables must be routed as closely as possible along conductive, earthed metal surfaces.

Special additional note on bus connections:

Use a **shielded bus cable** (at least Cat5e):

- **SF/UTP:**: Overall cable shielded (shield + foil), the 4 twisted pairs of conductors inside are unshielded.

or

- **S/STP** respectively **S/FTP**: Overall cable shielded and additional shielding (foil or shield) around each of the 4 twisted pairs of conductors on the inside.

For connection cables manufactured in-house, the shield must be connected to the connector over a large area; **the RJ45 connector itself must be metallized** !

2.10.1.8 Motors

Operation with standard motors.

2.10.1.9 Connecting protective earth

⚠WARNING

Additionally to the ground connection at the power mains connection, establish a ground connection via the **grounding screw** (see page 60, see page 86, see page 33) on the device bottom by means of a copper cable with the same section.
In case there is not earth connection at the mains connection, the wire used must have a minimum diameter of 10 mm².

The connection to the central earth rail should be as short as possible. The minimum required width of the central earth rail depends on the length of the grounding cable:

Length [m]	Width [mm]	Strength [mm]
0.5	20	6
1	40	6
1.5	50	6

- Pay close attention to the overall grounding of the complete system.
- With several mounting plates: Ground connection by copper rails or copper strip.
- Ensure ground connection between the control cabinet and machine.
- Earth control transformer thoroughly (for 24 VDC). Use a transformer with tin angles and make conductive contact with the mounting plate.

2.10.1.10 Grounding request

Connect the filter housing and the device to the cabinet frame, making sure that the contact area is adequate and that the connection has low resistance and low inductance by using an 3 mm steel plate (galvanized).
Never mount the filter housing and the device on paint-coated surfaces!

2.10.1.11 Control requirements

Use only with aligned controller (to avoid control loop oscillation).

2.10.1.12 Accessories

Make sure to use only the accessories recommended by Parker.

2.10.1.13 Notes on the use in domestic environments

NOTICE

This is restricted operation category product according to EN 61800-3. This product can cause high-frequency disturbance in domestic areas. Users are asked to take suitable action if this proves to be the case.

2.10.2. CE declaration of conformity PSD1-M

CE declaration of conformity PSD1-M
https://www.parker.com/content/dam/Parker-com/Literature/Electromechanical-Europe/Certificates/Conformity%20PSD1M.pdf

2.10.3. CE declaration of conformity PSD1-S

CE declaration of conformity PSD1-SW1200 / PSD1-SW1300
https://www.parker.com/content/dam/Parker-com/Literature/Electromechanical-Europe/Certificates/Conformity%20PSD1S.pdf

CE declaration of conformity PSD1-SW1400
https://www.parker.com/content/dam/Parker-com/Literature/Electromechanical-Europe/Certificates/Conformity_PSD1SW1400.pdf

2.10.4. Conditions of utilization for the cUL certification of PSD1-M

In this chapter you can read about:

- UL certification 20
- Installations- & Environmental Characteristics PSD1-M 20
- PSD1-M Installations- & Environmental Characteristics 20
- Conditions of utilization for CSA certification 22

2.10.4.1 UL certification

Category	Specifications
Certified	E-File_No.: E142140 The UL certification is only valid if the type plate of the device shows the "UL" -sign. c UL US LISTED
PSD1-M:	UL508C, 3rd Edition, power supply load revision November 9th, 2010. C22.2 No.274-13, 1st Edition, issued March, 2013

2.10.4.2 Installations- & Environmental Characteristics PSD1-M

- The devices are only to be installed in a pollution degree 2 environment (maximum).
- Maximum Surrounding Air Temperature 40 °C.
- The devices must be appropriately protected (e.g. by a switching cabinet). - Open type equipment.
- Temperature rating of field installed conductors shall be at least 60°C. Do only use copper lines.
  Do only use the Parker cables available under **Accessories** (see page 113) or assemble the cables according to the specified regulations.
- Control voltage supply (24 VDC) only permissible with "class 2" power supply.
- The devices are internally protected against overvoltage in compliance with UL508C.
- The drive modules are equipped with a current limit. Values for maximum device current and maximum motor current can be set via PSD ServoManager (Chapter resp. Menu Limit values & Motor Characteristics).
- The drive does not support an internal motor overload protection as specified in UL508C, chapter 20.1.10.
- The overload protection must be implemented externally in the application, if required.
- The drive does not support an internal motor over temperature protection as specified in UL508C, chapter 20.1.10
- Integral solid state short circuit protection does not provide branch circuit protection. Branch circuit protection must be provided in accordance with the Manufacturer Instructions, National Electrical Code and any additional local codes
- Protective earth of the motor must be connected to protective earth of the device. Please observe that ground on PSD1 - motor connector is, according to NEC NFPA 70, a functional earth and not a protective earth.

2.10.4.3 PSD1-M Installations- & Environmental Characteristics

- Please observe that the operation of the PSD1-M axis modules is only permitted via the Parker Power Module PSD1-M_P. Furthermore Power Modules PSD1-M_P must only be used with PSD1-M axis modules.
  The UL certification does not cover individual devices but only the axis system of the PSD1-M_P and PSD1-M_P mains module.
- Dynamic braking unit

Data of the integrated dynamic brake module PSD1-M_P

Category	Specifications			
Mains module	Maximum current		Max. Duty Cycle	Minimum resistance value
	Peak	Duration		
PSD1-M_P010	28.8 A	4.27 A (500 W)	2.2 % (@60 s)	27 Ω
		7.5 A (1500 W)	6.7 % (@60 s)	
PSD1-M_P020	78.0 A	7.06 A (500 W)	0.82 % (@60 s)	10 Ω
		22.3 A (5000 W)	8.2 % (@60 s)	

- Suitable for use on a circuit capable of delivering not more than 5000 rms Symmetrical Amperes, 480 V ac +10 % maximum, when protected by Listed
  ♦DIVQ Circuit Breakers manufactured by ABB, Stotz-Kontakt GmbH, Mod. No. S203UP-K / 480 Vac, 25 A for PSD1-M_P010
  or
  ♦R/C (JFHR2/8) Semiconductor Fuse type manufactured by Cooper Bussmann LLC, Mod. No. 170M1366 oder 170M1566D, 690 VAC, 80 A, 200 kA RMS Sym for PSD1-M_P020..
- Power supply units PSD1-M_P need a fusing on the main site (branch circuit protection) as stated below.

PSD1-M_P010

Maximum fuse rating per device	Measure for line and device protection: UL listing (DIVQ) circuit breakers Manufacturer: ABB, Stotz-Kontakt GmbH (E212323) Model no.: S203UP-K, 1 circuit breaker 480 VAC, 3-phase, 25 A, operating temperature 55 °C

PSD1-M_P020

Maximum fuse rating per device **2 special purpose fuses in line are required**	**Cable protection measure:** MCB (K characteristic) with a rating of 50A / 4xxVAC (depending on the input voltage). Recommendation: (ABB) S203U-K50 (440VAC) **Device protection measure:** Fuses 80A / 700VAC per supply leg in accordance with UL category JFHR2: Required: Bussmann 170M1366 or 170M1566D

Tightening torque of the wiring terminals

⚠CAUTION Risk of Electric Shock, wait at least 10 minutes before removing cover.

The field wiring terminals should be tightened with the torques mentioned below.
Only the supplied mating connectors must be used.

PSD1-M		2 A ... 15 A
X45 Motor	UL	up to AWG10
	CE	up up 4 mm²
	Tightening torque	0.8 Nm 7 Lb.in
❖	❖	
X46 motor brake	UL	up up AWG14
	CE	up up 1.5 mm²
	Tightening torque	0.22 ... 0.25 Nm 1.95 ... 2.21 Lb.in
PSD1M_1800		**2 A ... 30 A**
X43 Motor	UL	up up AWG20-8
	CE	up up 6 mm²
	Tightening torque	1.1 ... 1.7 Nm 11 ... 15 Lb.in
❖	❖	

X44 motor brake	**UL**	up up AWG30-14
	CE	up up 1.5 mm²*
	Tightening torque	0.22 ... 0.25 Nm 1.95 ... 2.21 Lb.in
Mains module		
X40: Ballast resistor	**UL**	up up AWG10
	CE	up up 6 mm²
	Tightening torque	0.46 ... 0.57 Nm (M3) 4 ... 5 Lb.in
❖	❖	
X41: Mains connector PSD1-M_P010	**UL**	up up AWG10
	CE	up up 6 mm²
	Tightening torque	1,1 ... 1.7 Nm 11 ... 15 Lb.in
❖	❖	
X41: Mains connector PSD1-M_P020	**UL**	up up AWG6
	CE	up up 16 mm²
	Tightening torque	1.7 Nm 15 Lb.in
❖	❖	
X9: 24 VDC control voltage	**UL**	up up AWG10
	CE	up up 6 mm²
	Tightening torque	1.1 ... 1.7 Nm 11 ... 15 Lb.in
❖	❖	
DC Bus	**UL**	-
	CE	-
	Tightening torque	0.8 Nm 7 Lb.in

* max 0.5mm² ferrule with plastic sleeve

2.10.4.4 Conditions of utilization for CSA certification

External Overvoltage Protection

External overvoltage protection in accordance with Canadian Standards C22.2-No.274-13 with over-voltage protection device (VZCA2) CSA-certified.

Note the following table:

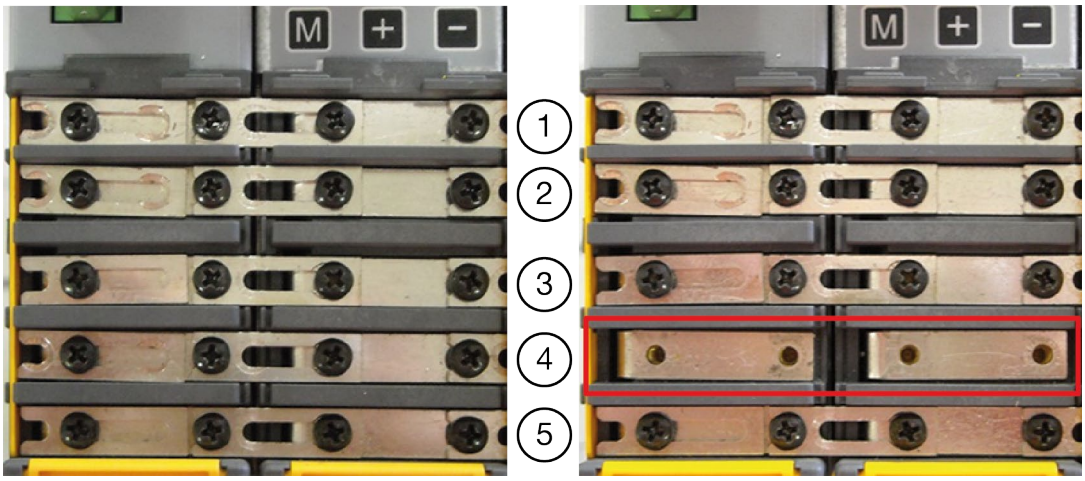
Mains module	**Manufacturer**	**Model No** (Quantity 1)	**Maximum Continuous Operating Voltage (Vac)**	**Voltage Protection Rating (VPR)(Vpk)**	**Category / Nominal earth leakage current**
PSD1-M_P010	ABB Frankreich (E322885)	OVR T2 3N 40-440 P(TS)U	L-GND 420 Veff Max L-L 840 Veff Max	L-GND 1500 V Max L-L 3000 V Max	1 / 10 kA
PSD1-M_P020	Cooper Bussmann LLC (E340782)	BSPM 4480 WY NGR	L-GND 660 Veff Max L-L 770 Veff Max	L-GND 2500 V Max L-L 2500 V Max	1 / 20 kA
	DEHN + SOEHNE GmbH + Co. KG. (E319777)	904 346			

Ground rail not sufficient

For CSA approval, earth rail must be replaced by a direct earth connection.

⚠CAUTION Risk of Electric Shock, wait at least 10 minutes before removing cover.

Removing the earth rail (4) (Right):



1	24 VDC
2	GND 24 VDC
3	DC power supply bus -
4	Protective earth
5	DC power supply bus +

⚠WARNING

Connecting protective earth
Connect protective earth via a copper wire of minimum 10 mm² by means of the provided screws at the bottom of the PSD1M (axis controller) and of the mains module PSD1-M_P:



2.10.5. Conditions of utilization for the cUL certification of PSD1-S

In this chapter you can read about:

- UL certification 23
- Installations- & Environmental Characteristics PSD1-S 24
- Tightening torque of the wiring terminals 25
- Auxiliary connection – electrical ratings 25
- Data of integrated dynamic brake unit 25
- In- / Output Ratings 26

2.10.5.1 UL certification

Category	Specifications
Certified	E-File_No.: E142140 The UL certification is only valid if the type plate of the device shows the "UL" -sign. c UL US LISTED
PSD1-SW1200/ PSD1-SW1300:	UL61800-5-1 1st Edition, issued June, 8th, 2012 C22.2 No.274-13, 1st Edition, issued March, 2013
PSD1-SW1400	

2.10.5.2 Installations- & Environmental Characteristics PSD1-S

⚠CAUTION Risk of Electric Shock, wait at least 3 minutes with PSD1-S and 10 minutes with PSD1-M before removing cover

- Use in Pollution degree 2 Environment.
- Maximum Surrounding Air Temperature 40 °C.
- The devices must be appropriately protected (e.g. by a switching cabinet). - Open type equipment.
- Use 60/75°C wires only
  Use Copper Conductors Only
  Do only use the Parker cables available under **Accessories** (see page 113) or assemble the cables according to the specified regulations.
- Control voltage supply (24 VDC) only permissible with "class 2" power supply.
- Grounding Terminals - the screw terminals are suitable for Field Wiring Connection only when the wire is provided with Eyelet Tube Terminal.
- Overvoltage category III.
- Short circuit ratings SCCR = 5000 Arms
- The drive modules are equipped with a current limit. Values for maximum device current and maximum motor current can be set via PSD ServoManager (Chapter resp. Menu Limit values & Motor Characteristics).
- The drive does not support an internal motor overload protection as specified in UL508C, chapter 20.1.10.
- The overload protection must be implemented externally in the application, if required.
- The drive does not support an internal motor over temperature protection as specified in UL508C, chapter 20.1.10.
- Integral solid state short circuit protection does not provide branch circuit protection. Branch circuit protection must be provided in accordance with the Manufacturer Instructions, National Electrical Code and any additional local codes
- Suitable for use on a circuit capable of delivering not more than 5000 rms Symmetrical Amperes, 240 Vac maximum. When protected by Listed – Cartridge Fuses, Non-Renewable (JDDZ), Time-Delay Class-CC Fuses, rated 600 Vac, 3 A or 8A (for model No. PSD1SW1200) / 6 A or 12A (for model No. PSD1SW1300). See table below for the manufacturers, model number and electrical ratings.

External Branch Circuit Protection

Device	Spezification			
	Time-Delay "Class-CC" Fuses Listed – Cartridge Fuses, Non-Renewable manufactured by Cooper Bussmann LLC (E4273) (200 kARMS Symmetrical A.I.C.)			
	Model No.	**Current [Arms]**	**Voltage [VAC]**	**Quantity Phase**
PSD1-S_1200	LP-CC-8	8	600	1 phase
	LP-CC-3	3	600	3 phases
PSD1-S_1300	LP-CC-12	12	600	1 phase
	LP-CC-6	6	600	3 phases
PSD1-S_1400	LP-CC-15	15	600	1 phase
	LP-CC-8	8	600	3 phases

Alternate External Branch Circuit Protection

Device	Spezification			
	Time-Delay "Class-CC" Fuses Listed – Cartridge Fuses, Non-Renewable manufactured by Mersen USA Newburyport-MA LLC (E2137) (200 kARMS Symmetrical A.I.C.)			
	Model No.	**Current [Arms]**	**Voltage [VAC]**	**Quantity Phase**
PSD1-S_1200	ATDR8	8	600	1 phase
	ATDR3	3	600	3 phases
PSD1-S_1300	ATDR12	12	600	1 phase
	ATDR6	6	600	3 phases
PSD1-S_1400	ATDR15	15	600	1 phase
	ATDR8	8	600	3 phases

For use in Canada:

- External Surge Protection devices (required in the end use instalation) - According to the Canadian Standard C22.2-No.274-13.
- R/C Surge-Protective Device (VZCA2/8) and CSA-Certified transient surge suppression shall be installed on the line side of this equipment and shall be rated minimum 240 V (phase to ground), suitable for “Overvoltage Category III”, and shall provide protection for a rated Impulse withstand Voltage peak of 4 kV.

2.10.5.3 Tightening torque of the wiring terminals

Connector		Torque	mm²	AWG
X17	Digital I/Os	Push-In	0,2 ... 1,5*	24-16
X51	DSL® feedback / motor brake	Push-In	0,2 ... 1,5*	24-16
X52	Motor	Push-In	0,2 ... 2,5**	26-12
X63	PSD1-S1200: Mains supply / DC power PSD1-S1300: Mains supply / DC power PSD1-S1400: DC power	Push-In	0,2 ... 2,5**	26-12
X64	PSD1-S1400: Mains supply	Push-In	0,2 ... 2,5**	26-12

* max 0,75mm² ferrule with plastic sleeve

** max 1,5mm² ferrule with plastic sleeve

2.10.5.4 Auxiliary connection – electrical ratings

DC Bus Input / Output – X63

400 VDC / D.C. / 7 A (PSD1SW1200/1300), 10.6 A (PSD1SW1400)

Auxiliary Input Supply – X17

Control Supply - Max 24 VDC ±10% / max 0.5 ADC

Signal I/O’s Ports (PELV circuit) – X51

Signal I/O’s / Communication Ports - max 24 VDC / max 100 mA

2.10.5.5 Data of integrated dynamic brake unit

Internal DBU Ratings

Servo-Drive Model Nos.	Max Current - Amps		Max Duty Cycle - per cent	Internal D.B.U. Resistor Ratings (Ohm)
	Peak	rms		
PSD1SW1200 PSD1SW1300	7.84 A	0.1 A	1.27 % (@60s)	51 Ω (40 W)

For PSD1SW1400 there is no integrated brake resistor available.

External DBU Ratings

Servo-Drive Model Nos.	Max Current - Amps		Max Duty Cycle - per cent	Min Resistance D.B.U. Resistor (Ohm)
	Peak	rms		
PSD1SW1200	7.84 A	0.15 A	1.91 % (@60s)	51 Ω (60 W)
PSD1SW1300	7.84 A	0.45 A	5.73 % (@60s)	51 Ω (180 W)
PSD1SW1400	13.33 A	1.0 A	7.5 % (@60s)	30 Ω (400 W)

2.10.5.6 In- / Output Ratings

Input Ratings

Servo-Drive Model Nos.	Input Voltage V AC	Frequency Phase	Maximum Input Current A rms
PSD1SW1200	3AC230 VAC ±10 %	50/60 Hz	1.7
PSD1SW1300			4.2
PSD1SW1400			6.7
PSD1SW1200	1AC230 VAC ±10 %	50/60 Hz	6.8
PSD1SW1300			11.0
PSD1SW1400			13.2

Output ratings

Device	Range of Output Voltage VAC	Range of Frequency / Phase	Output Current		Max. Continuous Output Power kW
			Nominal A rms (Continuous)	Maximum A rms (Duty Cycle)*	
PSD1SW1200	0-230 VAC	0-590 Hz / Three-Phase	2	6	0.64
PSD1SW1300			5	15	1.6
PSD1SW1400			7.5	20	2.5

Note:
* "Duty Cycle": 10% @10 s (ON=1.0 s - OFF=9.0 s)

2.10.6. Current on the mains PE (leakage current)

⚠WARNING This product can cause a direct current in the protective lead. If a residual current device (RCD) is used for protection in the event of direct or indirect contact, only a type B (all current sensitive) RCD is permitted on the current supply side of this product .
Otherwise, a different protective measure must be taken, such as separation from the environment by doubled or enforced insulation or separation from the mains power supply by means of a transformer. Respect the supplier's instructions.

Mains filters do have high leakage currents due to their internal capacity. An internal mains filter is usually integrated into the servo controllers. Additional discharge currents are caused by the capacities of the motor cable and the motor winding. Due to the high clock frequency of the power output stage, the leakage currents do have high-frequency components. Please check if the FI protection switch is suitable for the individual application.
If an external mains filter is used, an additional leakage current will be produced.
The figure of the leakage current depends on the following factors:

- Length and properties of the motor cable
- Switching frequency
- Operation with or without external mains filter
- Motor cable with or without shield network
- Motor housing grounding (how and where)

Remark:

- The leakage current is important with respect to the handling and usage safety of the device.
- A pulsing leakage current occurs if the supply voltage is switched on.

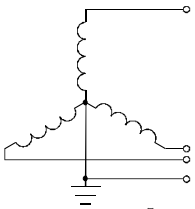
Please note:

The device must be operated with effective grounding connection, which must comply with the local regulations for high leakage currents (>3.5 mA).
Due to the high leakage currents it is not advisable to operate the servo drive with an earth leakage circuit breaker.

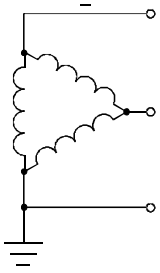
2.10.7. Supply networks

This product is designed for fixed connection to TN networks (TN-C, TN-C-S or TN-S).
Please note that the line-earth voltage may not exceed 300VAC.

- When grounding the neutral conductor, mains voltages of up to 480VAC are permitted.



- When grounding an external conductor (delta mains, two-phase mains), mains voltages (external conductor voltages) of up to 240VAC are permitted.



Devices which are to be connected to an IT network must be provided with a separating transformer. Then the devices are operated locally as in a TN network. The secondary sided center of the separating transformer must be grounded and connected to the PE connector of the device.

2.11 Before commissioning the drive, please observe the following:

- Read the safety instructions.
- Make sure that all local electrical regulations are adhered to.
- Inspect the device for any damages.
- Inspect the device within the drive and system for loose ends, blends, grinding- or drilling chips, etc.
- Check all external power circuits of the system: Power supply, control, motor and ground connections.
- Make sure no damages or injuries may occur by a rotating motor. Uncouple the load from the motor shaft.
- Check the condition of the motor thermistor- and brake resistance connections. Make sure that all external set speeds are zero.
- Make sure nobody works with another part of the system which may affect switch-on.
- Make sure that switch-on does not negatively influence other devices.
- Verify if the motor connections are correctly wired.
- Ensure that the STO function is not activated.

3. PSD: Parker Servo Drive - Overview

Description

The PSD1 is Parker Servo Drive family, available with different power rating from 2 to 30A and form factors. Today the offering contains:

- The PSD1-S is a standalone drive which can be connected directly to the main supply.
- The PSD1-M is a multi-axis servo system where each axis module can supply up to three servo motors.

The base configuration consists of a common DC bus supply and multiples PSD1-M modules, connected through DC bus bars. The modules are available as one, two or three axis versions. This makes the system highly flexible. PSD1-M servo system is particularly suitable for all centralised automation systems, such as those found in many packaging machines, where large numbers of drives are often required offering significant advantages.

The PSD servo drive is available in two versions:

- **Basic: Used as fieldbus slave**
- **Programmable:**
  - Intelligent standalone drive
  - Runtime based on CODESYS V3
  - IEC 61131-3
  - PLCopen function blocks

Common Features

The PSD servo drives support the following feedback systems (choosen by configuration):

- DSL (Single or Multiturn) Single cable solution
- Resolver
- 1 Vpp Rotary and Linear Encoders
- Incremental TTL Encoders

- EtherCAT / PROFINET / Ethernet/IP
- Quick and simple wiring
- Removable SD card
- Same software functionalities for standalone drive and multi-axis servo system

Applications

- Packaging machines
- Material forming machines
- Handling machines
- General automation



PSD1-S unique features

- Single or three phases power supply
- Compact housing
- Particularly suitable for small machines

Standalone axis PSD1 S	Continuous current [A_{rms}]	Peak current A (⩽ 2 s)
PSD1 SW1200	2	6
PSD1 SW1300	5	15
PSD1 SW1400	7.5	20



PSD1-M unique features

- The most compact multi-axis servo system on the market
- One, two or three axis versions combined in one housing
- Common DC bus connection for energy exchange between drives

Multi axis PSD1 M	Continuous current [A_{rms}]	Peak current A (⩽ 2 s)
PSD1 MW1300	5	10
PSD1 MW1400	8	16
PSD1 MW1600	15	30
PSD1 MW1800	30	60
PSD1 MW2220	2 + 2	4 + 4
PSD1 MW2330	5 + 5	10 + 10
PSD1 MW2440	8 + 8	16 + 16
PSD1 MW3222	2 + 2 + 2	4 + 4 + 4
PSD1 MW3433	8 + 5 + 5	16 + 10 + 10

(additional module on request)

4. Installation PSD1-S (Single-axis drive)

In this chapter you can read about:

- Before installation, please observe the following safety instructions 30
- Mounting and dimensions 31
- Plug and device overview PSD1-S 32
- P14: Status LED (PSD1-S) 35
- X17: control voltage 24V, STO, digital inputs/outputs (PSD1-S) 36
- X51, X18 Motor Feedback 37
- X52: Motor connection (PSD1-S) 43
- X60...X62 Communication interfaces 44
- X63: AC Mains Supply, DC voltage supply & Connection of braking resistor (PSD1-SW1200 / PSD1-SW1300) 47
- X63 / X64: DC voltage supply, braking resistor connection & AC mains supply (PSD1-SW1400) 48
- Signal interfaces IO option board 49
- Technical data 52

4.1 Before installation, please observe the following safety instructions

Danger: Risk of electric shock

⚠DANGER

Caution—Risk of electric shock!



Before wiring or loosening electrical connections please observe the following:

- Risk of electric shock—turn off the devices or disconnect them from the power supply.
- **Caution!** Dangerous electrical voltage even after turning off the intermediate capacitors:
  Up to 10 minutes Dangerous voltages may still be present after switching off the power supply.
  Please check that no voltages are present (<50 V) at the output terminals DC+ and DC- of PSD1-SW1200/1300: X63/4 & X63/5, PSD1-SW1400: X63/3 & X63/2.

⚠CAUTION Installation may only be carried out by qualified electricians. Accident prevention measures must be observed.

⚠CAUTION Please make sure that no small parts (screws, cable remnants, etc.) enter the devices.

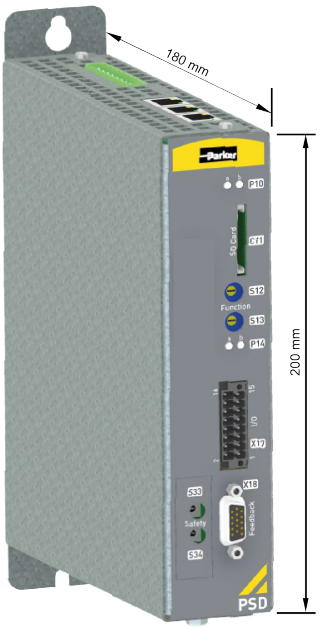
⚠CAUTION **Feedback system can be destroyed if configured incorrectly!**
If you connect a PSD that has already been configured for a specific feedback system to another feedback system, it can be destroyed by too high a voltage.
Procedure when changing the feedback system.

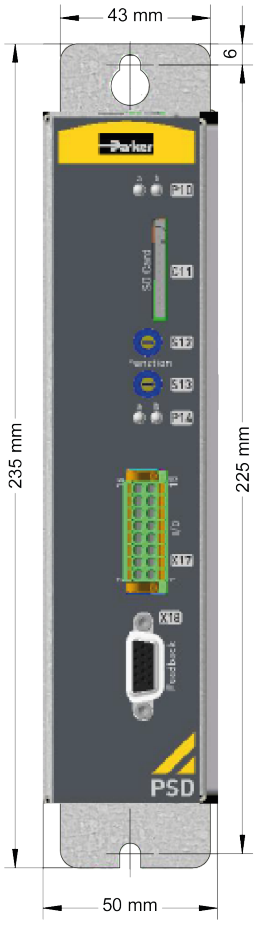
4.2 Mounting and dimensions

⚠CAUTION **Ventilation:**

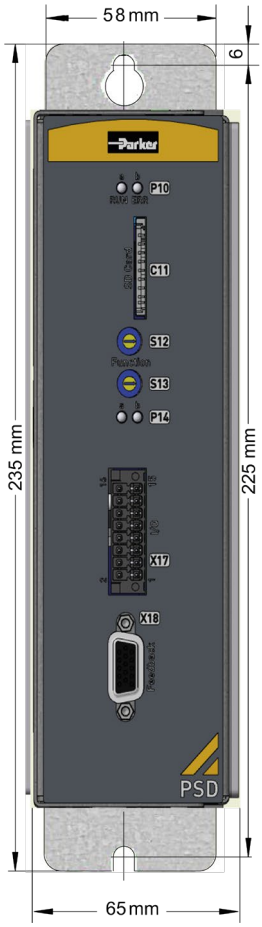
- During operation, the device radiates heat (heat dissipation). Please provide for a sufficient mounting distance below and above the device (at least 100 mm) in order to ensure free circulation of the cooling air.
- Please do also respect the recommended distances of other devices.
- Make sure that the mounting plate is not exhibited to other temperature influences than that of the devices mounted on this very plate.
- The devices must be mounted vertically on a level surface. Make sure that all devices are sufficiently fixed.

4.2.1. Mounting and dimensions PSD1-S





PSD1SW1200
PSD1SW1300



PSD1SW1400

Mounting:

2 socket head screws M6
Lateral distance of fixing of mounting holes: 50.5 mm
Required mounting distance for heat regulation at the top and bottom: At least 100mm

NOTICE For the PSD1SW1400, lateral mounting spacing of 15mm must be ensured. If the device is installed without spacing, the rated current is reduced to 6.5A.

⚠CAUTION Please check regularly the firmness of the screw connection!

4.3 Plug and device overview PSD1-S

In this chapter you can read about:

- Front view (PSD1-S) 32
- View from below (PSD1-S) 33
- View from above (PSD1-S) 34

4.3.1. Front view (PSD1-S)

Danger: Risk of electric shock

DANGER

Caution—Risk of electric shock!

Before wiring or loosening electrical connections please observe the following:

- Risk of electric shock—turn off the devices or disconnect them from the power supply.
- **Caution!** Dangerous electrical voltage even after turning off the intermediate capacitors:
  Up to 10 minutes Dangerous voltages may still be present after switching off the power supply.
  Please check that no voltages are present (<50 V) at the output terminals DC+ and DC- (PSD1-SW1200/1300: X63/4 & X63/5, PSD1-SW1400: X63/3 & X63/2).



Above
Fieldbus &
Config Interface

P10: Fieldbus LED
X30: IO Option2 Dig I/O
X31: IO Option2 An Input
C11: SD-Slot

Address:
S12: high half byte
S13: low half byte

P14: LED Status Axis

X17: I/Os

X18: Feedback

S33: Safety
S34: Safety

Below
Motor, Brake & DSL

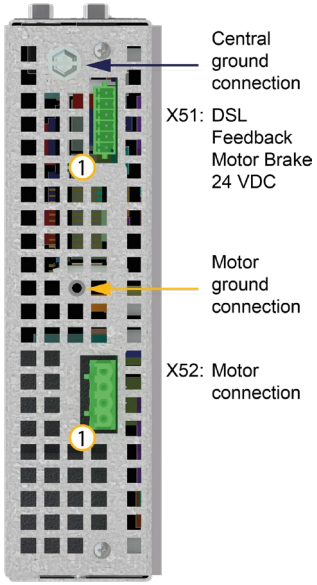
View from above (see page 34)	
P10	Status LEDs for the fieldbus
X30 **(see page 49)**	Digital inputs / outputs IO option board2
X31 **(see page 51)**	Analog inputs and encoder input IO option board2
C11	Slot for SD card (SD card not included in delivery)
S12 **(see page 45)**	Device address higher value half-byte (accept with power ON)
S13 **(see page 45)**	Device address low value half-byte (accept with power ON)
P14 **(see page 35)**	Status LED device
X17 **(see page 36)**	Digital inputs/outputs
X18 *	Feedback connector (**Resolver** (see page 141), **Encoder/Hall** (see page 41))
S33	For safety option
S34	For safety option
View from below (see page 33)	

*

NOTICE

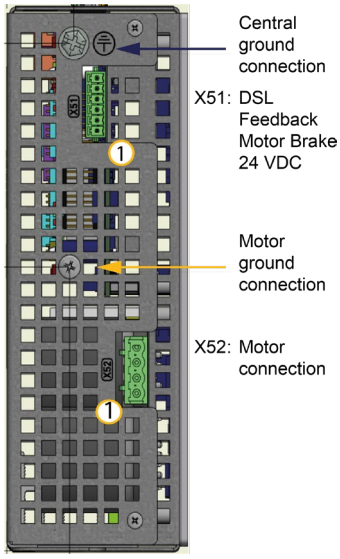
Before connecting a feedback cable, check that the correct feedback system is configured in the device.
Otherwise, destruction of the feedback system is threatened by overvoltage!

4.3.2. View from below (PSD1-S)



PSD1SW1200

PSD1SW1300



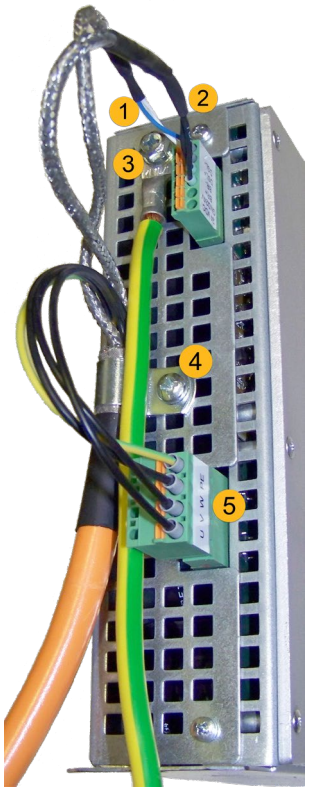
PSD1SW1400

View from above (see page 34)	
Central ground connection	Connect ground via ring cable lug with a 10 mm² copper cable to central ground
X51 **(see page 38)**	To motor • HIPERFACE DSL® Motor feedback • Motor holding brake and 24VDC feed for the brake
Motor ground connection	Connecting screw for motor earth/the shielding of the motor cable (see image below)
X52 **(see page 43)**	Connection of motor
Front view (see page 32)	
① Shows pin 1 of the connector	

NOTICE

The **24V supply inputs** of the PSD Servo Drive controller (also for the digital outputs and especially **also for the motor holding brake**) are **signal inputs**. **The notes on CE-compliant and EMC-compliant cable routing must be observed!** (see page 17)

Wiring



Explanation

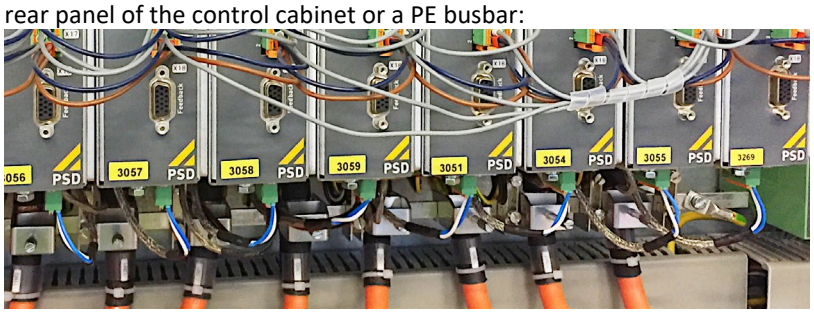
1 DSL connection
2 Motor brake connection
3 Connect ground via ring cable lug with a 10 mm² copper cable to central ground
4 Fixing the *shield terminal* [1] with a flat connection to the motor cable shield
5 Motor connection [1]

[1] The *shield terminal* is supplied with the Parker motor cables.

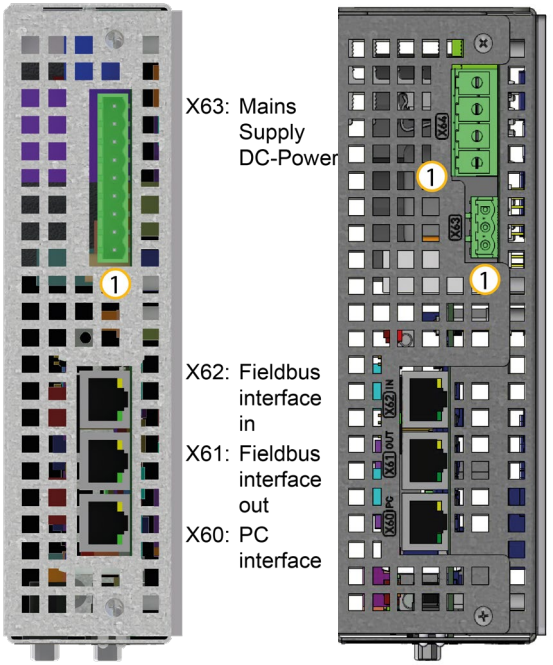
An optional accessory set with several terminals for the various possible cable cross-sections is available for motor cables manufactured in-house.

Wiring

Alternatively, the motor shield can also be connected to earth via the rear panel of the control cabinet or a PE busbar:



4.3.3. View from above (PSD1-S)



PSD1SW1200

PSD1SW1300

PSD1SW1400

Front view (see page 32)	
X60 **(see page 45)**	PC interface to configure and program servo axes
X61 **(see page 46)**	Fieldbus Interface output
X62 **(see page 46)**	Fieldbus Interface input
X63 **(see page 47)** X63 **(PSD1SW1400)**	Connections • AC mains supply (for PSD1SW1400 on a separate connector X64) • DC voltage supply • Connection of braking resistor or **bridge** for activating the internal braking resistor (not for PSD1SW1400)
X64	only with PSD1SW1400 • AC Mains Supply
View from below (see page 33)	
① Shows pin 1 of the connector	

4.4 P14: Status LED (PSD1-S)

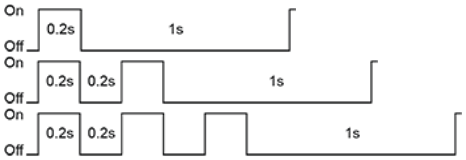
Status No.	Status of axis	Left LED a (green) (ready)	Right LED b (red) (error)
0	No voltage	off	off
1	Booting of axis, firmware is missing	alternate quick flashing (LEDa green, LEDb rot)	
2	Axis not ready: • Booting of axis • No feedback detected. • IEC61131-3 program not compatible with firmware. • no IEC61131-3 program • Hall signals invalid.	off	flashes quickly (5 HZ)
3	Axis de-energized	flashes slowly	off
4	Axis energized; commutation calibration running	flashes quickly	off
5	Axis energized	on	off
6	Axis in error state / error present / axis energized (error reaction 1)	on	flashes quickly (5 HZ)
7	Axis in error state / error present / axis de-energized (error reaction 2)	off	on
8	Axis faulty: Please contact us	on	on
9	STO active	off	flashes slowly (1 HZ)
10	reserved	flashes quickly	flashes quickly (5 HZ)
11	SD Card detected or restoring from SD card successfully terminated	alternate quick flashing (LEDa green, LEDb green)	
12	SD card not detected or restoring from SD card interrupted	alternate quick flashing (LEDa red, LEDb red)	
13	Axis de-energized	off	Single flash
14	Axis energized	on	Single flash
15	Axis de-energized HEDA3 slave not ready	off	Double flash
16	Axis energized HEDA3 Slave not ready	on	Double flash
17	Axis de-energized HEDA3 Master not ready	off	Triple flash
18	Axis energized HEDA3 Master not ready	on	Triple flash
19	Axis de-energized	off	Jitter (10 HZ)
20	Axis energized	on	Jitter (10 HZ)

Error response 1: Ramping with slow ramp; then deactivate control loops.
Error response 2: Ramping with "Stop" ramp, then deactivate control loops.
For the meaning of individuals errors please go to Error list.

Single flash

Double flash

Triple flash

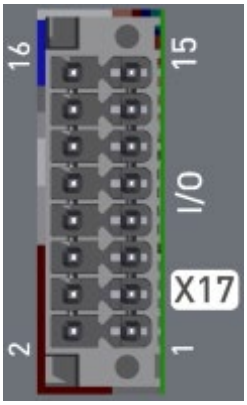


DANGER

Caution - Risk of electric shock!

High voltage supply may be present even with missing voltage supply (both LEDs off)!

4.5 X17: control voltage 24V, STO, digital inputs/outputs (PSD1-S)



Pin X17	Input / Output	
1	Input	+24 VDC devices control voltage
2	Input	GND24V
3	Input	+24 VDC for digital outputs
4	I0	Input 0
5	I1	Input 1
6	I2	Input 2
7	I3	Input 3
8	GND24V	
9	O0	Output 0
10	GND24V	
11	O1	Output 1
12	STOA/	STO Channel A input
13	reserved	
14	STOGND	STO Ground
15	reserved	
16	STOB/	STO Channel B input

Loading of the outputs: maximum 200 mA
In case of output overload / over-temperature, a device error is reported. In addition, this output is deactivated and reactivated automatically after cooling.
All inputs and outputs do have 24 V level.
Input level:
"0" (low) = Rated Input Voltage ≤ 12.5 V
"1" (high= Rated Input Voltage ≥ 13.5 V
The digital outputs are free for writing via object 0x2079.0x01 or 0x60FE.0x01 via fieldbus.
The status of digital inputs can be read via object 0x2070.0x00 or 0x60FD.0x00 .

NOTICE

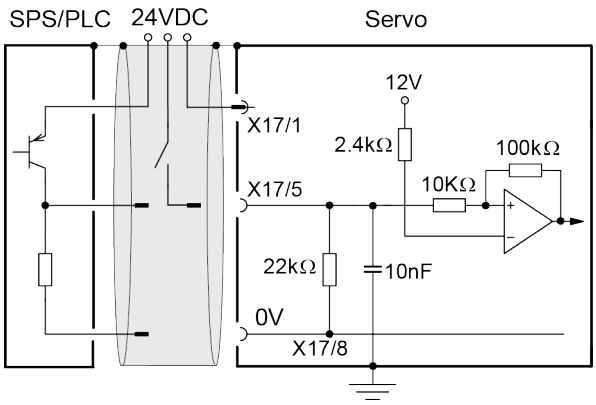
The **24V supply inputs** of the PSD Servo Drive controller (also for the digital outputs and especially **also for the motor holding brake**) are **signal inputs**. **The notes on CE-compliant and EMC-compliant cable routing must be observed!** (see page 17)

4.5.1. Control Voltage 24 VDC PSD1-S

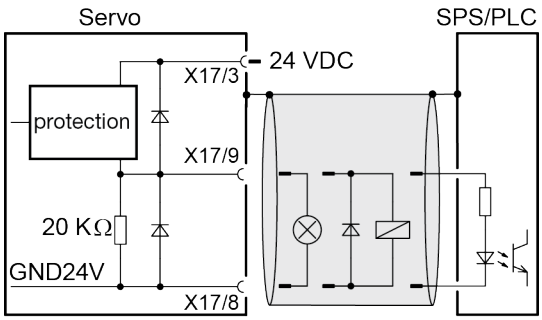
Category	Specifications
Voltage operating range	21.6 - 27.0 VDC (24 VDC -10% +12.5%)
Ripple	0.5 Vpp
Requirement according to safe extra low voltage (PELV)	yes (class 2 mains module)
Electric current drain	0.5 A + Output current of digital output currents (fed via connectors X17/2, 3) + Output current of motor brakes (fed via connectors X51/1 & 2)) + Current requirements of optional boards

4.5.2. Wiring of the digital inputs and outputs

Wiring of digital inputs



Wiring of digital outputs



4.6 X51, X18 Motor Feedback

In this chapter you can read about:

- X51: Motor holding brake and HIPERFACE DSL® connection 38
- X18: Connector assignment with configured resolver feedback 39
- X18: Assignment with configured incremental encoder or analog Hall 41

⚠CAUTION **Feedback system can be destroyed if configured incorrectly!**

If you connect a PSD that has already been configured for a specific feedback system to another feedback system, it can be destroyed by too high a voltage.

Procedure when changing the feedback system.

4.6.1. X51: Motor holding brake and HIPERFACE DSL® connection

Pin	Designation	Description
1	24 VDC	Input power supply brake 24 VDC
2	GND24V	Input power supply brake GND24V
3	Br +	Output of motor holding brake + (max 1.0 A)
4	Br -	Motor holding brake output - (connected with GND24V)
5	DSL+	Feedback
6	DSL-	Feedback

NOTICE

The **24V supply inputs** of the PSD Servo Drive controller (also for the digital outputs and especially **also for the motor holding brake**) are **signal inputs**. **The notes on CE-compliant and EMC-compliant cable routing must be observed!** (see page 17)

Electrical connection on device (see page 60, see page 86, see page 33)

NOTICE

Operation with Parker **HIPERFACE DSL® cables recommended!** (see page 114)

Note the following, if **no Parker PSD DSL motor cable** is used **or** this **is shortened** :

The internal shield of the twisted Hiperface DSL® signal cables must be connected on the **drive side** (see page 60, see page 33) to the outer motor cable shield (and thus PE) (braided, soldered or connected using self-adhesive EMC copper tape). Up from this connection point, the internal shielding of the Hiperface DSL® line (with the wire pair still twisted in it) must be guided up to the PSD servo amplifier Hiperface DSL® connection terminal.

The same applies on the motor side when connecting the Hiperface DSL® cables in a motor terminal box. Here too, the Hiperface DSL® cable shield must be connected to the outer cable shield and the Hiperface DSL® cable pair must continue to be routed, twisted and shielded, from there to its connection terminal.

NOTICE

Please observe the following if you want to disconnect the DSL lines with an **additional plug** :

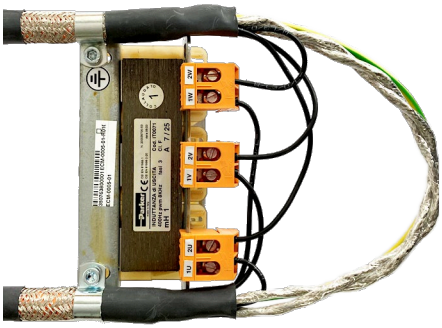
- No other lines must be wired between DSL+ and DSL-.
- The DSL lines must be twisted and separately shielded.
- A flat shielding must be guaranteed across the plug connection (recommendation: Harting Han-Modular plug with “Han Quintax” or “Hand MegaBit” module).
- The shield of the DSL lines must be connected to PE/earth with low impedance. In the simplest case, this can be done by connecting the DSL shield with the overall shield of the cable at the cable end (on the controller side).

NOTICE

Please note the following instructions if you are using the hybrid cable with DSL lines with a **motor choke**:

- The DSL cable must not be cut (also or especially the DSL cable shield must remain intact).
  In case of a motor with brake, the same applies to the brake control line in the hybrid cable.
- A shield connection of the complete outer shield and DSL shield must be ensured at the input and the output side of the motor choke (e.g. braiding the cable, soldering or connecting by using self-adhesive EMC copper tape).
- The motor cable shield must not be interrupted at the motor choke. This is ensured by using the ground cable shield clamps of the motor choke at the input and the output side.
- Make sure that the shielding is carried out over a large area!
- The overall connection between choke & motor has to be done by a modified **DSL motor cable** (see page 114) (CBMxxxH...).

Example of a possible wiring of a hybrid cable using a motor choke:



4.6.2. X18: Connector assignment with configured resolver feedback



Assignment with multi feedback option with configured resolver

Pin	Feedback High Density /Sub D
1	reserved
2	reserved
3	reserved
4	REF-Resolver+ (8 kHz / max. 9.5 V_{ss})
5	+3.3 V (for temperature sensor)
6	reserved
7	SIN- (max. 4.7 V_{ss} differential)
8	SIN+ (max. 4.7 V_{ss} differential)
9	reserved
10	Tmot*
11	COS- (max. 4.7 V_{ss} differential)
12	COS+ (max. 4.7 V_{ss} differential)
13	reserved
14	reserved
15	REF-Resolver-

* Pin10 Tmot may not be simultaneously connected to the axis of the associated temperature sensor entry of **X48** (see page 71) (PSD1-M).

Category	Specifications
Resolution of the motor position	• Position resolution: 16.6 Bits (= 0.005°) • Absolute accuracy: ±0.167°
Resolver supported	• **LTN**: RE-21-1-A05, RE-15-1-B04 • **Tamagawa:** TS2610N171E64, TS2620N21E11, TS2640N321E64, TS2660N31E64 • **Tyco (AMP):** V23401-T2009-B202
Resolver data supported	• Transformation ratio: 0.25... 1 (typical 0.5) • Excitation frequency 8 Hz • Amplitude of the excitation signal: max. 9.5 V_{pp}. (The resolver must be approved for at least this value).

Accuracy

The precision of the position signal is above all determined by the exactitude of the feedback system used.

4.6.3. X18: Assignment with configured incremental encoder or analog Hall

Incremental encoder / analog & digital Hall sensor with analog sin/cos signals with $1V_{ss}$



Pin	Feedback option / high density / sub D		
	Encoder 1 V_{ss}	Encoder A/B	Analog Hall sensor
1	Sense -*		
2	Sense +*		
3	Hall 1 (digital)		reserved
4	Vcc (+5 V) max. 350 mA load		
5	+3.3 V (for temperature sensors)		
6	Hall 2 (digital)		reserved
7	Sine -	A-	Sine -
8	Sine +	A+	Sine +
9	Hall 3 (digital)		reserved
10	Tmot**		
11	Cosine -	B-	Cosine -
12	Cosine +	B+	Cosine +
13	N+, Z+, Ref + (encoder reference mark or index pulse +)		reserved
14	N-, Z-, Ref - (encoder reference mark or index pulse -)		reserved
15	GND (Vcc)		

*+5V (Pin 4) is measured and controlled directly at the end of the line via Sense+ and Sense-.
Maximum cable length: 100 m with 0.5 mm^2.
* Pin10 Tmot may not be simultaneously connected to the axis of the associated temperature sensor entry of **X48** (see page 71) (PSD1-M).

Category	Specification
Incremental encoder **(see page 41) * (Sine / Cosine or A/B square wave signal)**	• Linear or rotary • 5V power supply voltage (optionally controlled on the encoder side by voltage feedback via sense measuring lines) • **Supported signals**: ♦**Sin/Cos** Signal: Differential with 2.5V reference voltage, typically 1 Vss (max. 4.7 Vss), sine/cosine 90° phase-shifted, max. frequency 400 kHz (an existing reference mark (ref signal) is evaluated (if the machine zero mode is set accordingly) during the machine zero run) **Position resolution:** 14 bits per sine/cosine period (at 1Vpp) -> for rotary encoder, unit incr./rev: Encoder line number [periods/rev.]*16384[incr./period] -> for linear encoder, unit e.g. incr./mm: 16384[incr./period]*1000[um/mm]/encoder_period length[um] or ♦**A/B pulses**: Physical RS422 (differential), A/B 90° phase-shifted, max. 5 MHz (an existing reference mark (Z-track) is evaluated (if the machine zero mode is set accordingly) during the machine zero run) with the following **commutation options**: • Auto commutation or • U, V, W or R, S, T commutation signals (NPN open collector) e.g. digital Hall sensors**, incremental encoders with commutation track (such as Hengstler F series with electrical ordering variant 6)
Analog Hall sensor **(see page 41) ***	• Linear or rotary • 5V power supply voltage (optionally controlled on the encoder side by voltage feedback via sense measuring lines) • Sine/cosine signal: Differential with 2.5V reference voltage, typically 1 Vss (max. 4.7 Vss), sine/cosine 90° phase-shifted, max. frequency 400 kHz • **Position resolution:** 14 bits (at 1Vpp) per sine/cosine period (= 14 bits per motor magnetic period) -> for rotary motor, unit incr./rev: number of motor pole pairs [1/rev]*16384 incr. -> for linear motor: 16384 [incr./pitch] for unit e.g. incr./mm: 16384[incr.]/MotorPitch[mm]

* in the first expansion stage only for PSD1S and PSD1MW**1**...: multi-axis device with **one** performance level.
** the digital Hall sensors must be supplied via the encoder supply pin Vcc (5V nominal, higher voltage possible with connected sense measuring lines).

4.7 X52: Motor connection (PSD1-S)

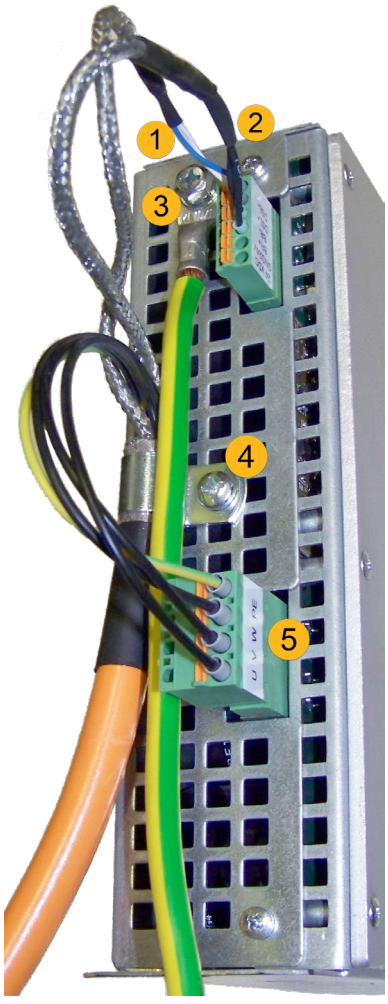
Pin	Description	Motor cable lead designation*		
1	U	U / L1	1	U1
2	V	V / L2	2	U2
3	W	W / L3	3	U3
4	FE & PE	YE / GN		

* Depending on cable type.
FE: Functional ground
PE: Protective earth

Shielding connection of the motor cable

The external shield of the motor cable must be properly (=over a large area!) connected to the PE both on the **drive side** (see page 60, see page 86, see page 33) (on the device housing or on the rear wall of the control cabinet) as well as on the motor side (motor housing e.g. via the motor cable plug connector).
The outer and any existing additional inner shielding for the DSL or motor holding brake must not be interrupted.

Also observe **the tips on connecting a Hiperface DSL encoder** (see page 38) (via hybrid cable).



Explanation

1 DSL connection
2 Connection of motor brake
3 Connect ground via ring cable lug with a 10 mm2 copper cable to central ground
4 Mounting the *shield clamp* [1] with flat connection to the motor cable shielding
5 Motor Connection

[1] The *shield clamp* is supplied with the Parker motor cables.

An accessory set with several clamps for various possible cable diameters is optionally available for in-house manufactured motor cables

Please observe the notes in chapter "**Operating conditions for CE-conform operation** (see page 15)".

4.7.1. Motor connection with self-made motor cable

NOTICE

Please consider the special features of the **DSL** Motor connection with:

- EX motors,
- EY motors,
- NK motors,
- NV motors and
- NX motors!

For these motors with DSL feedback the outputs V & W are reversed in the PSD via the motor configuration (**this has no influence on the wiring with Parker motor cables)!**

You must connect these motors with a self-made cable in accordance with the following table:

For EX motors, EY motors, NK motors, NV motors and NX motors:

Pin	Designation	Motor cable lead designation*			Motor side for: EX, EY, NK, NV, NX (as per motor data sheet)
1	U	U / L1	1	U1	U
2	**V**	V / L2	2	U2	W
3	W	W / L3	3	U3	**V**
4	FE & PE	YE / GN			Ground

* Depending on cable type.

FE: Functional ground

PE Protective earth

4.8 X60...X62 Communication interfaces

In this chapter you can read about:

- X60: PC-/Diagnostic interface 45
- X61, X62 connection fieldbuses (Ethernet) 46

4.8.1. X60: PC-/Diagnostic interface

Wiring with Ethernet Crossover cable Cat5e; for this, we offer our interface cable **CBD000C0-T00-T0** (see page 132) .
Standard Ethernet Address of the PSD:192.168.10.x
The final position (x) is set via the address adder S12 (higher value byte) & S13 (low value byte) and accepted by Power On.

Address setting

Settings:
S12: Device address higher value half-byte (accept with power ON)
S13: Device address low value half-byte (accept with power ON)
Address 1 ... 240 (0x01 ... 0xF0) is possible; the range 241 ... 255 (0xF1 ... 0xFF) is reserved for special functions!

Example: S12=2, S13=1
Address= 0x21: S12*16 + S13 = 2*16 + 1 = 33

After switching on PSD, the IP address is set to the value
- "192.168.10.S12_S13" (X60 PC interface) e.g. "192.168.10.33"

respectively
- "192.168.100.S12_S13" (X61/X62 fieldbus interface) e.g. "192.168.100.33"

.

In addition, the set address becomes part of the host name. The address set via S12_S13 is appended to the prefix "PSD1-" as a string with 3 digits:
- Host name= "PSD1-" followed by "S12_S13_3digit_String"

For example:
- Host name=PSD1-033

If the IP address has been changed and is no longer known, it can be reset to the default setting with S12_S13 = 249 (0xF9):
- IP address = 192.168.10.2 (X60 PC) / 192.168.100.2 (X61/X62 fieldbus)
- SubNetmask = 255.255.0.0
- Gateway_IP = 192.168.10.254 (X60 PC) / 192.168.100.254 (X61/X62 fieldbus)
- Host name = PSD1-002

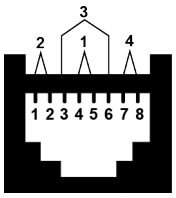
Afterwards or in general, the complete IP address (not just the last part) can then be redefined as follows:
- For X60 via the objects 0x2500.0x04 & 0x2500.0x01 (Bit 12)
- For X61/X62 via the objects 0x2605.0x04 & 0x2605.0x01 (Bit 12)

The default address 192.168.10.xx for the configuration interface can be set with object 0x2500.4.
The default address 192.168.100.xx for the fieldbus device address can be set with object 0x2605.4.
This is also possible via the ServoManager Wizard .

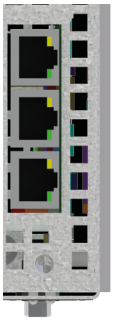
Addresses 0 and 241 … 255 are not possible.
The connection is configured in the PSD ServoManager.

4.8.2. X61, X62 connection fieldbuses (Ethernet)

RJ45 socket: assignment



Pin	Wire pair no.	RJ45 (X61) out	RJ45 (X62) in
1	2	Tx +	Tx +
2	2	Tx -	Tx -
3	3	Rx +	Rx +
4	1	-	reserved
5	1	-	reserved
6	3	Rx -	Rx -
7	4	-	reserved
8	4	-	reserved



X62: Fieldbus interface in
X61: Fieldbus interface out
X60: PC interface

Wiring with Ethernet Crossover cable Cat5e (from X61 to X62 of the next device without termination); for this, we offer our interface cable **CBD000C0-T00-T0** (see page 132) .

NOTICE

Use a **shielded bus cable** (at least Cat5e):

- **SF/UTP:**: Overall cable shielded (shield + foil), the 4 twisted pairs of conductors inside are unshielded.

or

- **S/STP** respectively **S/FTP**: Overall cable shielded and additional shielding (foil or shield) around each of the 4 twisted pairs of conductors on the inside.

For connection cables manufactured in-house, the shield must be connected to the connector over a large area; **the RJ45 connector itself must be metallized** !

4.8.3. Reference to the meaning of LEDs X60, X61, X62

The meaning of the LEDs depends on the fieldbus:

EtherCAT

LED green: Connection/activity indicator (X61 & X62)

Off	No connection
On	Connected, no activity
Flickering	Connected, activity

LED yellow: Activity indicator (X61 & X62)

Off	No activity
Flickering	Activity

LED green: Connection/activity indicator (X60)

Off	No connection
On	Connected, no activity
Flickering	Connected, activity

LED yellow: Speed indicator (X60)

Off	10Base-T
On	100Base-TX

PROFINET / Ethernet/IP:

LED green: Connection/activity indicator (X61 & X62)

Off	No connection
On	Connected, no activity
Flickering	Connected, activity

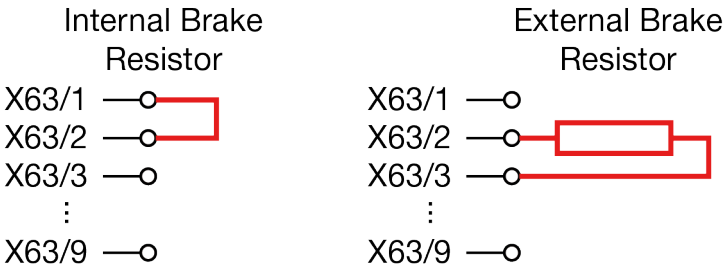
LED yellow: Speed indicator (X61 & X62)

Off	10Base-T
Flickering	100Base-TX

4.9 X63: AC Mains Supply, DC voltage supply & Connection of braking resistor (PSD1-SW1200 / PSD1-SW1300)

Pin	Designation	Description	
1	Rin	Internal Braking Resistor [1]	
2	-R	Output for connection of the **braking resistor** (see page 126) -	
3	+R	Output for braking resistor connection +	
4	DC+	Power direct current + [2]	
5	DC-	Power direct current - [2]	
6	L3	Phase 3 (Mains Supply)	reserved
7	L2	Phase 2 (mains supply)	N (Single Phase)
8	L1	Phase 1 (Mains Supply)	L (single-phase)
9	PE	Earth conductor	

[1] The internal braking resistor is connected via bridge X63/1 and X63/2:



- All shields must be connected via a cable joint to the cable feed through plate.
- Braking resistor and cable must be shielded if they are not installed in a control cabinet.
- The connecting cables of the external braking resistor and the mains supply must be routed separately from the signal cables, see **Cable installation** (see page 17).

⚠WARNING

Device protection

By cyclically switching on and off the power voltage, the input current limitation can be overloaded, which may cause damage to the device.
Wait at least one minute between two switching on processes!

NOTICE

Please note!

If neither a braking resistor nor a bridge are connected, the intermediate circuit voltage is 0.

[2] **Connection of the power voltage of 2 PSDs**

In order to improve the conditions during brake operation, the DC power voltage of 2 servo axes may be connected.
The capacity as well as the storable energy are increased; furthermore, the braking energy of one servo axis may be utilized by a second servo axis, depending on the application
Please connect as follows:

- PSD 1 X63/4 with PSD 2 X63/4
- PSD 1 X63/5 with PSD 2 X63/5



Caution - Risk of electric shock!
Always switch off devices before wiring them! Dangerous voltages are still present until 10min. after switching off the power supply. Please check that no voltages are present (<50 V) at the output terminals DC+ and DC- (PSD1-SW1200/1300: X63/4 & X63/5, PSD1-SW1400: X63/3 & X63/2).

⚠WARNING

Only devices with the same power supply may be connected to each other.

- 3-phase supplied PSD only with 3-phase supplied PSD in the same network
- 1-phase supplied PSD only with 1-phase supplied PSD with same phase

4.10 X63 / X64: DC voltage supply, braking resistor connection & AC mains supply (PSD1-SW1400)

Mains supply for plug X64

Pin	Designation	Description	
1	L3	Phase 3 (mains supply)	reserved
2	L2	Phase 2 (mains supply)	N (Single Phase)
3	L1	Phase 1 (mains supply)	L (single-phase)
4	PE	Earth conductor	

DC power voltage and connection of braking resistor plug X63

Pin	Designation	Description
1	-R	Output for connection of the **braking resistor** (see page 126) -
2	DC-	DC link voltage -
3	+R	Output for braking resistor connection + DC link voltage +

- All shields must be connected via a cable joint to the cable feed through plate.
- Braking resistor and cable must be shielded if they are not installed in a control cabinet.
- The connecting cables of the external braking resistor and the mains supply must be routed separately from the signal cables, see **Cable installation** (see page 17).

⚠WARNING

Device protection
By cyclically switching on and off the power voltage, the input current limitation can be overloaded, which may cause damage to the device.
Wait at least one minute between two switching on processes!

4.11 Signal interfaces IO option board

In this chapter you can read about:

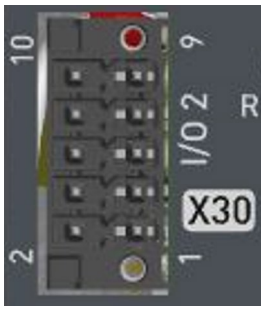
- X30, X37 digital inputs/outputs / 24V power supply 49
- X31, X38 analog inputs / encoder 51

This function is only supported by a PSD1 with IO option card (see **Order code** (see page 9))

4.11.1. X30, X37 digital inputs/outputs / 24V power supply

In this chapter you can read about:

- Wiring of digital I/Os 50
- Logic proximity switch types 50



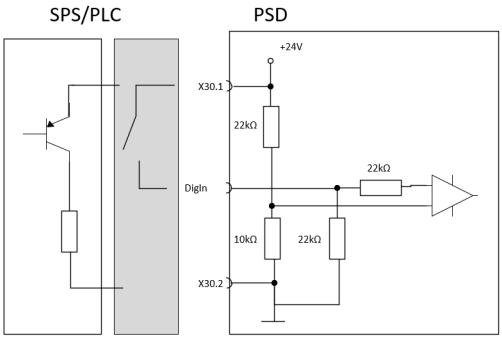
Pin X30 / X37		
1	+24V DC external	24V for the digital outputs and encoder supply
2	GND	GND24V
3	Digital I/O0	Combined inputs/outputs. When the output is set, the high signal is also read in at the input. The outputs are short circuit proof and can be loaded with a maximum of 70mA.
4	Digital I/O1	
5	Digital I/O2	
6	Digital I/O3	
7	Digital I/O4	
8	Digital I/O5	
9	Digital I/O6	
10	Digital I/O7	

8 combined inputs/outputs can be set. If an output is set to high, the corresponding input also reports a high signal.
Please note that the 24V supply voltage must be fed in externally to operate the digital inputs/outputs and to connect an encoder to X31 / X38.

Technical data X30, X37 (see page 143)

4.11.1.1 Wiring of digital I/Os

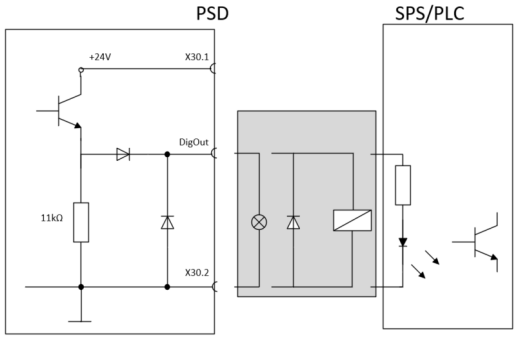
Wiring of digital inputs



The circuit example is valid for all digital inputs!
Signal level:

- > 9.15V = "1" (38.2% of the control voltage applied)
- < 8.05V = "0" (33.5% of the control voltage applied)

Wiring of digital outputs



The circuit example is valid for all digital outputs!
The outputs are short circuit proof; a short circuit generates an error.

4.11.1.2 Logic proximity switch types

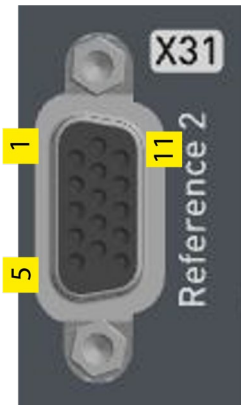
Type	1	2	3	4
Transistor switch	PNP	NPN	NPN	NPN
Logic	(N.O.) "active high"	(N.O.) "active low"	Schließer (N.O.) „Aktiv Low"	(N.C) "active high"
Description of logic	When damping, the PSD sees a logical "1"	When damping, the PSD sees a logical "0"	Beim Bedämpfen sieht das PSD eine logische „0"	When damping, the PSD sees a logical "1"
Fail safe logic	No	Only conditional 1)	nur bedingt 1)	No
Instruction for pull up resistor in the initiator	-	Rmin=3k3 Rmax=10k 2)	Rmin=3k3 Rmax=10k 2)	Rmin=3k3 Rmax=10k 2)
Wiring				

1) When the connection between transistor emitter of the initiator and X30/37 (GND24V of the PSD) is lost, it can not be guaranteed that the PSD detects a logical "0".
2) The INSOR NPN types INHE5212 and INHE5213 manufactured by Schönbuch Electronic do correspond to this specification.

4.11.2. X31, X38 analog inputs / encoder

In this chapter you can read about:

- Wiring of analog interface 51
- Connections of the encoder interface 52



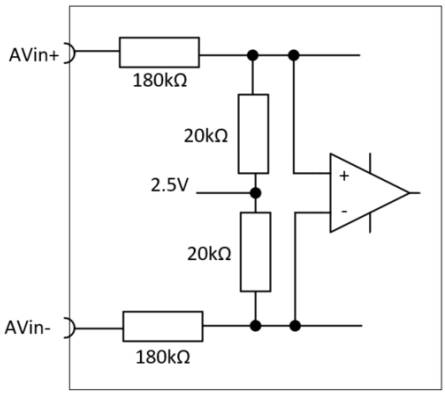
Reference 1 (X38) Reference 2 (X31)		Description	
Pin	**Signal**	**A/B Encoder**	**Step/Dir Encoder**
1	Vcc +24V	Output for encoder power supply max. 70mA	
2	Vin 1-	Vin1-: diff. analog input +/-10V	
3	Iin0	Iin0: analog input: 0..20mA	
4	Iin 1	Iin1: analog input: 0..20mA	
5	Vcc +5V	Output encoder supply max. 150mA	
6	RS422 (A-)	A- Encoder (In/Out)	Step- Encoder (In/Out)
7	RS422 (A+)	A+ Encoder (In/Out)	Step+ Encoder (In/Out)
8	RS422 (B+)	B+ Encoder (In/Out)	Dir+ Encoder (In/Out)
9	Vin 0+	Vin0+: diff. analog input +/-10V	
10	Vin 1+	Vin1+: diff. analog input +/-10V	
11	Vin 0-	Vin0-: diff. analog input +/-10V	
12	RS422 (B-)	B- Encoder (In/Out)	Dir- Encoder (In/Out)
13	RS422 (N-)	N- Encoder (In/Out)	
14	RS422 (N+)	N+ Encoder (In/Out)	
15	GND	GND	

The encoder signals are used for both encoder input and encoder simulation.

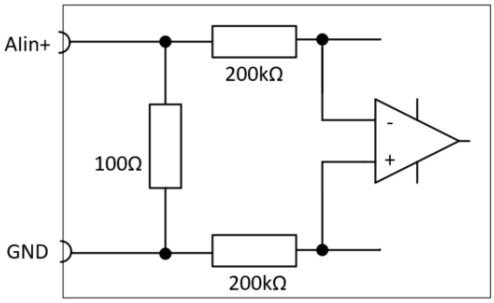
Technical data X31, X38 (see page 143)

4.11.2.1 Wiring of analog interface

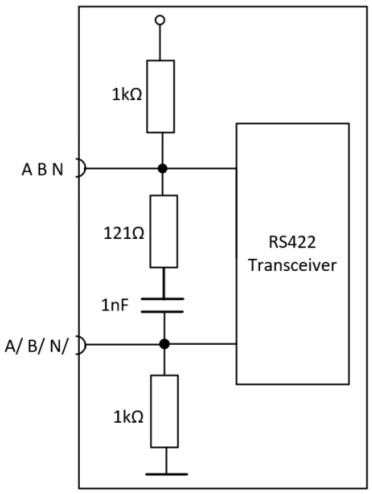
Structure image of the internal signal processing of the analog voltage inputs



Structure image of the internal signal processing of the analog current inputs



4.11.2.2 Connections of the encoder interface



The input connection is available in triple (for A & /A, B & /B, N & /N)

4.12 Technical data

In this chapter you can read about:

- Mains connection PSD1-S 52
- Braking operation PSD1-S 53
- Output data PSD1-S 1/3*230 VAC 53

4.12.1. Mains connection PSD1-S

Category	Specification		
PSD1-S	**PSD1-S_1200**	**PSD1-S_1300**	**PSD1-S_1400**
Mains voltage	AC single-phase (1 AC) or AC three-phase (3 AC) Technically permissible voltage range: 30 ... 253 VAC / 50-60 Hz Voltages previously supported in ServoManager: 1* or 3* 230 VAC ±10% 1* or 3* 208 VAC ±10% 1* or 3* 110/115 VAC ±10% (Operation on DC direct voltage may be possible after checking the technical details with Parker Support)		
Input current	1AC230V: 6.8 Arms 3AC230V: 1.7 Arms	1AC230V: 11 Arms 3AC230V: 4.2 Arms	1AC230V: 13.2 Arms 3AC230V: 6.7 Arms
Maximum fuse per device*	Single phase: 8 A Device protection: fuse 8A gS (gRL), time delay Line protection: S202U-K8 (ABB) / 5SJ4208-8HG42 (SIEMENS)	Single-phase: 12 A Device protection: fuse 12A gS (gRL), time delay Line protection: S202U-K16 (ABB) / 5SJ4216-8HG42 (SIEMENS)	Single-phase: 16 A Device protection: fuse 16A gS (gRL), time delay Line protection: S202U-K16 (ABB) / 5SJ4216-8HG42 (SIEMENS)
	3-phase: 3 A Device protection: fuse 3A gS (gRL), time delay Line protection: S202U-K4 (ABB) / 5SJ4304-8HG42 (SIEMENS)	3-phase: 6 A Device protection: fuse 6A gS (gRL), time delay Line protection: S202U-K10 (ABB) / 5SJ4308-8HG42 (SIEMENS)	3-phase: 8 A Device protection: fuse 8A gS (gRL), time delay Line protection: S202U-K10 (ABB) / 5SJ4310-8HG42 (SIEMENS)
Earth leakage current	**Current on the mains PE** (see page 27) (>3.5 mA)		
Supply networks	**Possible supply networks** (see page 27): TN		

* Fuses for operation in accordance with CE.
Fuses for UL and CSA in the **UL chapter** (see page 19, see page 23).

Please observe the notes in chapter "Operating conditions for CE-conform operation **(see page 15)".**

4.12.2. Braking operation PSD1-S

Category	Specification		
Controller type	**PSD1-S_1200 (2 A)**	**PSD1-S_1300 (5 A)**	**PSD1-S_1400 (7.5 A)**
Capacity / storable energy	760 µF / 15 Ws	1140 µF / 23 Ws	1680 µF / 33 Ws
Minimum braking resistance	51 Ω	51 Ω	30 Ω
Maximum current	7.84 A	7.84 A	13.33 A

Data of the integrated braking resistor PSD1-S

Category	Specification			
Device	**Maximum current**		**Max. duty cycle**	**Resistance value, Nominal power rating**
	Peak	**Duration**		
PSD1-SW1200 PSD1-SW1300	7.84 A	0.1 A	1.27% @ 60 s	51 Ω, 40 W

No internal braking resistor is integrated in the PSD1-SW1400.

External ballast resistors from Parker **(see page *126*).**

4.12.3. Output data PSD1-S 1/3*230 VAC

Category		Specification		
Device type		**PSD1-S_1200 (2 A)**	**PSD1-S_1300 (5 A)**	**PSD1-S_1400 (7.5A)**
Output voltage		3 x 0 ... 230 V ±10 %		
Output current [1]:				
$I_{Nominal}$ [Arms]	**4 kHz**	2	5	7.5
I_{Peak} (2 s) [Arms] [2]	**4 kHz**	6	15	20
$I_{Nominal}$ [Arms]	**8 kHz**	**2**	**5**	**7.5**
I_{Peak} (2 s) [Arms] [2]	**8 kHz**	**6**	**15**	**20**
$I_{Nominal}$ [Arms]	**16 kHz**	1.332	3.33	5.62
I_{Peak} (2 s) [Arms] [2]	**16 kHz**	3.996	9.99	15
Power at continuous operation		0.64 kW (3-phase mains supply) 0.64 kW (single-phase mains supply)	1.6 kW (3-phase mains supply) 1.6 kW (single-phase mains supply)	2.5 kW (3-phase mains supply) 2.5 kW (single-phase mains supply)
Switching frequency of the motor current		8 kHz	8 kHz	8 kHz
Heat dissipation for In		13 W	35 W	260W

[1] Output current bei verschiedenen switching frequency. The default settings of the currents und switching frequencies are grayed out & in bold.

[2] "Duty Cycle": 10% @10 s (ON=1.0 s - OFF=9.0 s)

5. Installation PSD1-M (multi-axis system)

The PSD1 multi-axis system consist of a mains module (PSD1-M_P) and the axis modules (PSD1-M_x).
The axis module drives 1 to 3 motors, depending on the type (x=1, 2 or 3).
Please observe that the operation of the axis modules is only permitted via the Parker mains Module PSD1-M_P.



In this chapter you can read about:

- Before installation, please observe the following safety instructions 55
- Mounting and dimensions 55
- Plug and device overview PSD1-M 58
- P14 ... P16: Status LEDs of the individual axes (PSD1-M) 63
- X17, X21 STO, digital inputs/outputs PSD1-M 64
- X43, X45 motor connection 66
- X44, X46 Connecting the motor brake PSD1-M 69
- X48, X18...X20 Motor Feedback 70
- X60...X62 Communication interfaces 75
- Signal interfaces IO option board 78
- Connections of the axis system 81
- Technical data 83
- Mains module PSD1-M_P 84

5.1 Before installation, please observe the following safety instructions

Danger: Risk of electric shock

⚠DANGER

Caution—Risk of electric shock!



Before wiring or loosening electrical connections please observe the following:

- Risk of electric shock—turn off the devices or disconnect them from the power supply.
- **Caution!** Dangerous electrical voltage even after turning off the intermediate capacitors:
  Up to 10 minutes Dangerous voltages may still be present after switching off the power supply.
  Please check that no voltages are present (<50 V) at the output terminals DC+ and DC- (bus bars 5(+HV DC) & 3(-HV DC)).

⚠CAUTION Installation may only be carried out by qualified electricians. Accident prevention measures must be observed.

⚠CAUTION Please make sure that no small parts (screws, cable remnants, etc.) enter the devices.

⚠CAUTION **Feedback system can be destroyed if configured incorrectly!**
If you connect a PSD that has already been configured for a specific feedback system to another feedback system, it can be destroyed by too high a voltage.
Procedure when changing the feedback system.

5.2 Mounting and dimensions

⚠CAUTION **Ventilation:**

- During operation, the device radiates heat (heat dissipation). Please provide for a sufficient mounting distance below and above the device (at least 100 mm) in order to ensure free circulation of the cooling air.
- Please do also respect the recommended distances of other devices.
- Make sure that the mounting plate is not exhibited to other temperature influences than that of the devices mounted on this very plate.
- The devices must be mounted vertically on a level surface. Make sure that all devices are sufficiently fixed.

5.2.1. Mounting and dimensions PSD1-M size 1

The devices are force-ventilated via a ventilator fan fixed to the lower part of the heat dissipator!

Mounting spacing: At the top and below: at least 100mm

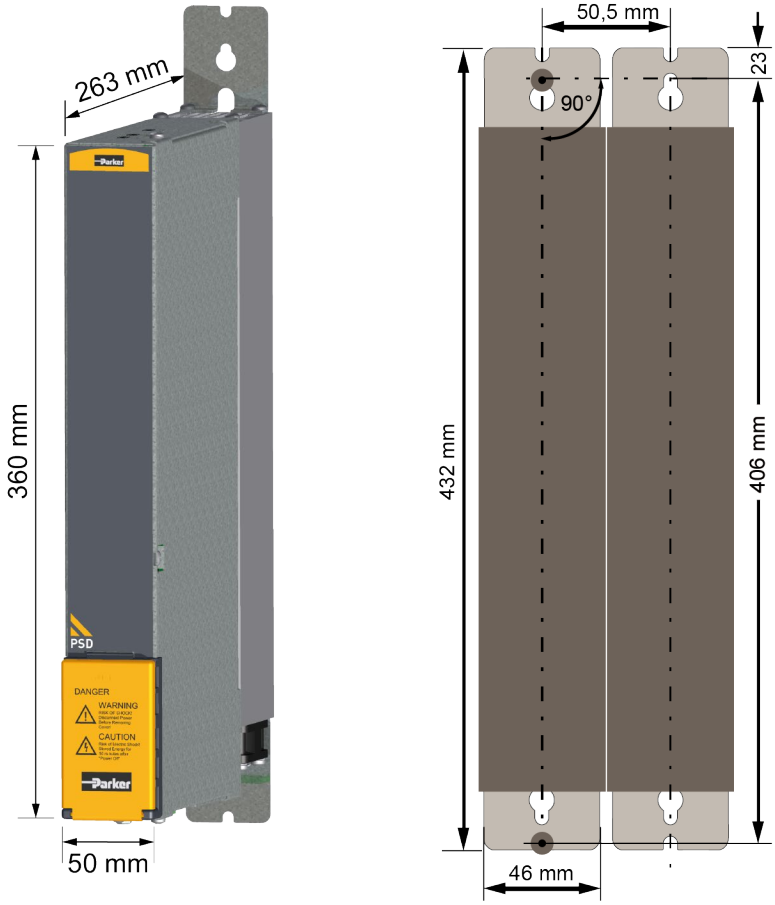
Information on

PSD1-M Size 1
- Multi axes servo drives and
- Mains Module PSD1-M_P010

Mounting:

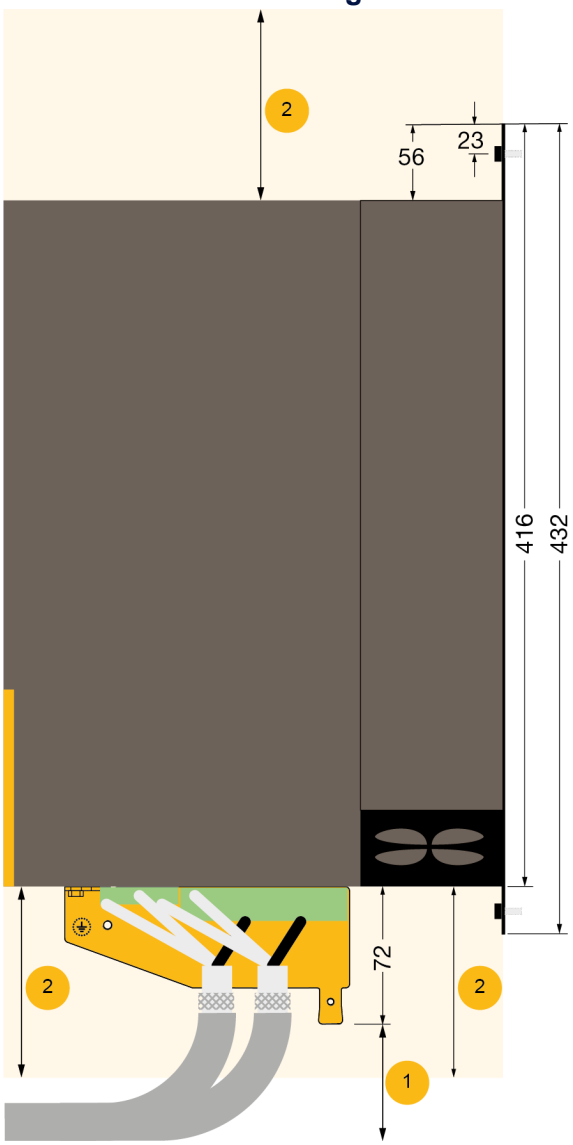
2 socket head screws M6
Lateral distance of fixing of mounting holes: 50.5 mm
Required mounting distance for heat regulation at the top and bottom: At least 100 mm

⚠CAUTION Please check regularly the firmness of the screw connection!



Tolerances: DIN ISO 2768-f

5.2.1.1 Mounting distances PSD1-M size 1



1	Additional mounting distance corresponding to the minimum bending radius of the cables
2	At least 100mm distance for free circulation of cooling air.

5.2.2. Mounting and dimensions PSD1-M size 2

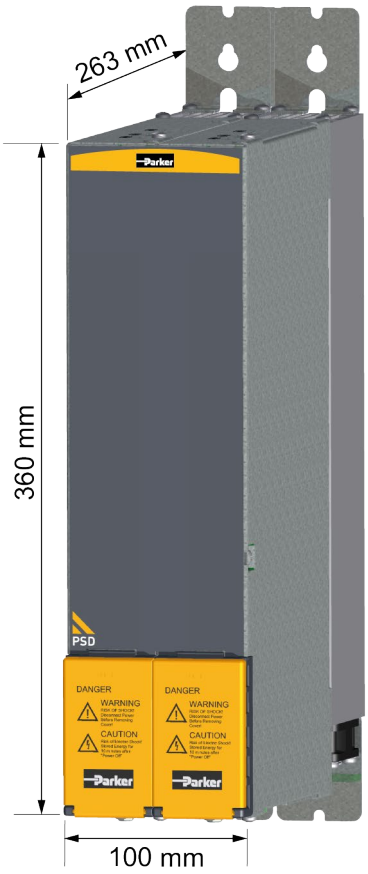
Information on

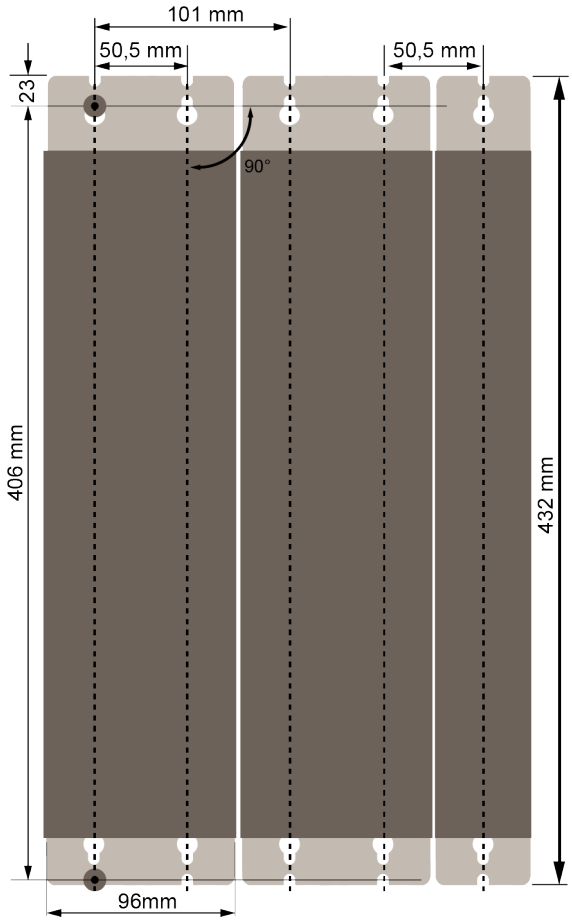
PSD1-M Size 2
Multi axis Servo Drives (30 A) and
Mains Module PSD1-M_P020

Required mounting distance for heat regulation at the top and below: At least 100mm

Mounting:

4 socket head screws M5





Tolerances: DIN ISO 2768-f

5.3 Plug and device overview PSD1-M

In this chapter you can read about:

- Front view (PSD1-M) 59
- View from below (PSD1-M) 60
- View from above (PSD1-M) 62

5.3.1. Front view (PSD1-M)

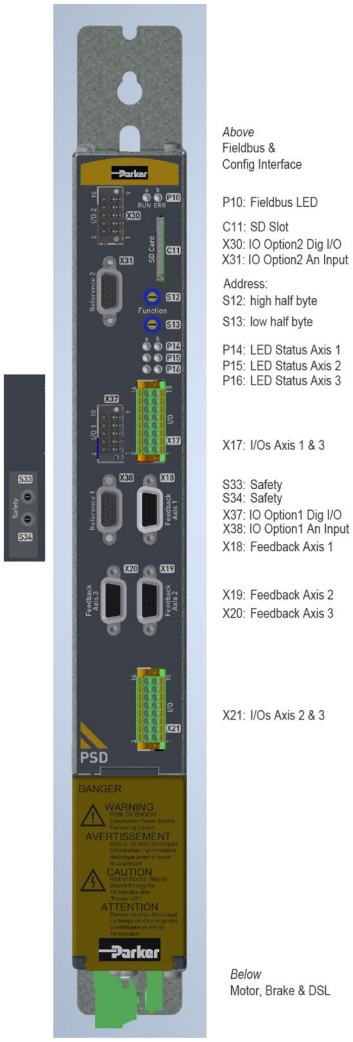
Danger: Risk of electric shock

DANGER

Caution—Risk of electric shock!

Before wiring or loosening electrical connections please observe the following:

- Risk of electric shock—turn off the devices or disconnect them from the power supply.
- **Caution!** Dangerous electrical voltage even after turning off the intermediate capacitors:
  Up to 10 minutes Dangerous voltages may still be present after switching off the power supply.
  Please check that no voltages are present (<50 V) at the output terminals DC+ and DC- (bus bars 5(+HV DC) & 3(-HV DC)).



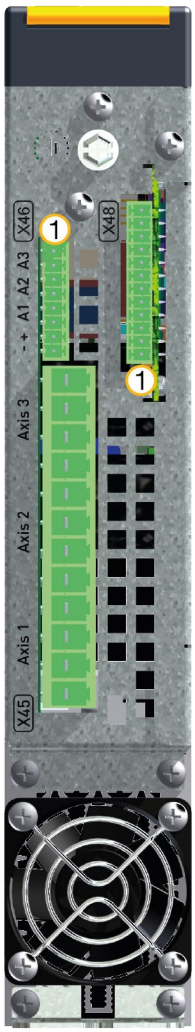
View from above (see page 62)	
P10	Status LEDs for the fieldbus
C11	Slot for SD card (SD card not included in delivery)
X30 **(see page 49)**	Digital inputs / outputs IO option board2
X31 **(see page 51)**	Analog inputs and encoder input IO option board2
S12 **(see page 45)**	Device address higher value half-byte (accept with power ON)
S13 **(see page 45)**	Device address low value half-byte (accept with power ON)
P14 **(see page 63)**	Status LED axis 1
P15 **(see page 63)**	Status LED axis 2
P16 **(see page 63)**	Status LED axis 3
X17 **(see page 64)**	Digital inputs/outputs axis 1 & 3
X18 *	Feedback sensor Axis 1: **Resolver** (see page 72), **Encoder/Hall** (see page 74)
X19 *	Feedback sensor Axis 2: **Resolver** (see page 72), **Encoder/Hall** (see page 74)
X20 *	Feedback sensor Axis 3: **Resolver** (see page 72), **Encoder/Hall** (see page 74)
S33	For safety option
S34	For safety option
X37 **(see page 49)**	Digital inputs / outputs IO option board1
X38 **(see page 51)**	Analog inputs and encoder input IO option board2
X21 **(see page 65)**	Digital inputs/outputs axis 2 & 3
24 VDC & DC power **(see page 89)**	Behind the yellow protective covers you can find the rails for connecting the supply voltage to the **Mains module PSD1-M_P**. • 24 V DC power supply • DC power voltage supply
View from below (see page 60)	

*

NOTICE

Before connecting a feedback cable, check that the correct feedback system is configured in the device.
Otherwise, destruction of the feedback system is threatened by overvoltage!

5.3.2. View from below (PSD1-M)



X46: Mechanical Motorbrake Axis 1 ... 3

X48: DSL Feedback Axis 1 ... 3

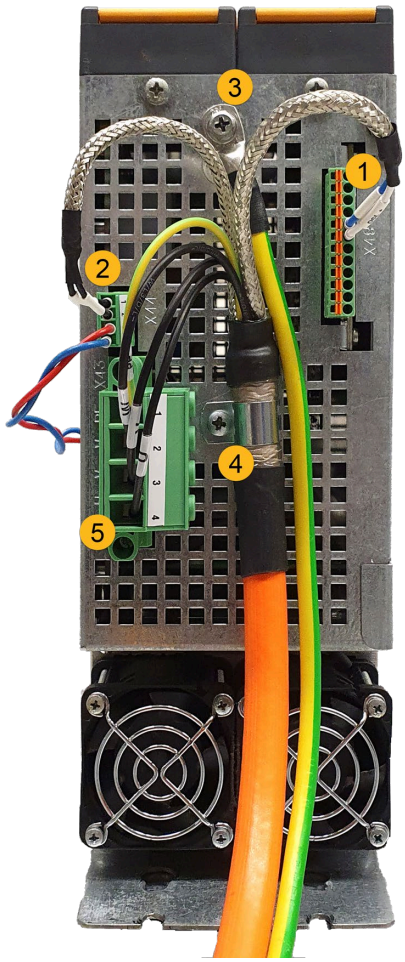
X45: Motor connection Axis 1 ... 3

View from above (see page 62)	
X45 **(see page 68)** X43 **(see page 66) for PSD1-M_1800**	Connection of motors axis 1 ... 3 (depending on the devices)
X46 **(see page 70)** X44 **(see page 69) for PSD1-M_1800**	Connection of motor brakes: axis 1 ... 3 (depending on the devices)
X48 **(see page 71)**	Connection of HIPERFACE DSL® motor feedback systems and motor temperature sensor Axis 1 ... 3 (depending on the devices)
Front view (see page 59)	
① Shows pin 1 of the connector	

NOTICE

The **24V supply inputs** of the PSD Servo Drive controller (also for the digital outputs and especially **also for the motor holding brake**) are **signal inputs**. **The notes on CE-compliant and EMC-compliant cable routing must be observed!** (see page 17)

Earthing PSD1M_1800:



Explanation

1 DSL connection
2 Motor brake connection
3 Connect ground via ring cable lug with a 10 mm² copper cable to central ground
4 Fixing the *shield terminal* [1] with a flat connection to the motor cable shield
5 Motor connection

[1] The *shield terminal* is supplied with the Parker motor cables.

An optional accessory set with several terminals for the various possible cable cross-sections is available for motor cables manufactured in-house.

Earthing of all other PSD1M devices:

The earth connection of the motor (and feedback) cable(s) is made using the tin angle supplied:



Mounting:

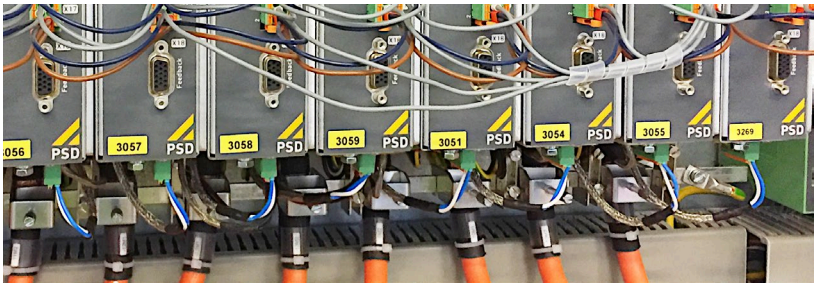
- Fix cables with clamp collars on the corresponding tin bar (3)
- Connect plug
- Screw on tin angle

Explanation

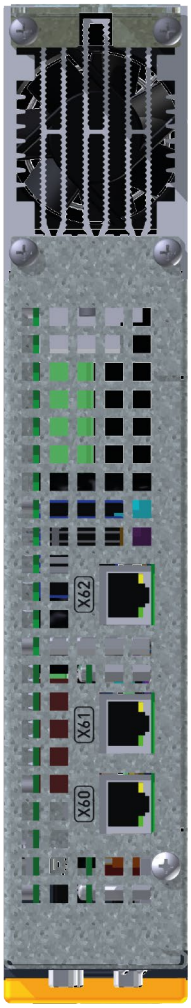
1	Fixing screw for tin angle (included with delivery)
2	Tin angle for cable guiding with earthing screw
3	Mounting of cable, flat shielding
4	Central ground connection

Tin angles and clamp collars are all included.

Alternatively, the motor shield can also be connected to earth via the rear panel of the control cabinet or a PE busbar:



5.3.3. View from above (PSD1-M)



X62: Fieldbus interface in

X61: Fieldbus interface out

X60: PC interface

Front view (see page 59)	
X60	PC Interface to configure and program servo axes
X61 **(see page 46)**	Fieldbus Interface output
X62 **(see page 46)**	Fieldbus Interface input
View from below (see page 60)	

5.4 P14 ... P16: Status LEDs of the individual axes (PSD1-M)

- P14: Status Axis 1
- LEDs P15: Status Axis 2
- LEDs P16: Status Axis 3

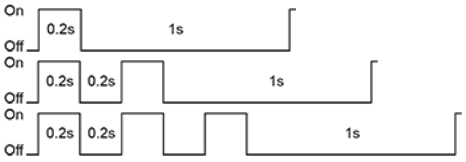
Status No.	Status of axis	Left LED a (green) (ready)	Right LED b (red) (error)
0	No voltage	off	off
1	Booting of axis, firmware is missing	alternate quick flashing (LEDa green, LEDb rot)	
2	Axis not ready: • Booting of axis • No feedback detected. • IEC61131-3 program not compatible with firmware. • no IEC61131-3 program • Hall signals invalid.	off	flashes quickly (5 HZ)
3	Axis de-energized	flashes slowly	off
4	Axis energized; commutation calibration running	flashes quickly	off
5	Axis energized	on	off
6	Axis in error state / error present / axis energized (error reaction 1)	on	flashes quickly (5 HZ)
7	Axis in error state / error present / axis de-energized (error reaction 2)	off	on
8	Axis faulty: Please contact us	on	on
9	STO active	off	flashes slowly (1 HZ)
10	reserved	flashes quickly	flashes quickly (5 HZ)
11	SD Card detected or restoring from SD card successfully terminated	alternate quick flashing (LEDa green, LEDb green)	
12	SD card not detected or restoring from SD card interrupted	alternate quick flashing (LEDa red, LEDb red)	
13	Axis de-energized	off	Single flash
14	Axis energized	on	Single flash
15	Axis de-energized HEDA3 slave not ready	off	Double flash
16	Axis energized HEDA3 Slave not ready	on	Double flash
17	Axis de-energized HEDA3 Master not ready	off	Triple flash
18	Axis energized HEDA3 Master not ready	on	Triple flash
19	Axis de-energized	off	Jitter (10 HZ)
20	Axis energized	on	Jitter (10 HZ)

Error response 1: Ramping with slow ramp; then deactivate control loops.
Error response 2: Ramping with "Stop" ramp, then deactivate control loops.
For the meaning of individuals errors please go to Error list.

Single flash

Double flash

Triple flash



DANGER **Caution - Risk of electric shock!**

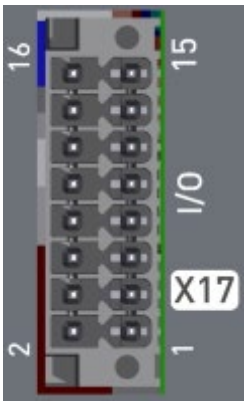
High voltage supply may be present even with missing voltage supply (both LEDs off)!

5.5 X17, X21 STO, digital inputs/outputs PSD1-M

In this chapter you can read about:

- X17: Digital inputs / outputs axis 1 & 3 (PSD1-M) 64
- X21: Digital inputs / outputs Axis 2 & 3 (PSD1-M) 65
- Wiring of the digital inputs and outputs 65

5.5.1. X17: Digital inputs / outputs axis 1 & 3 (PSD1-M)



Pin X17	Input / Output	Axis	
1	Output	1 ... 3	+24 VDC
2	Output	1 ... 3	GND24V
3	Input	1 ... 3	+24 VDC power supply voltage for digital outputs
4	I0_1	1	Input 0 Axis 1
5	I1_1	1	Input 1 Axis 1
6	I2_1	1	Input 2 Axis 1
7	I3_1	1	Input 3 Axis 1
8	GND24V	1 ... 3	
9	O0_1	1	Output 0 Axis 1
10	GND24V	1 ... 3	
11	O1_1	1	Output 1 Axis 1
12	STOA1/	1	STO input A Axis 1
13	I0_3	3	Input 0 Axis 3
14	STOGND1	1	STO Ground
15	I1_3	3	Input 1 Axis 3
16	STOB1/	1	STO input B Axis 1

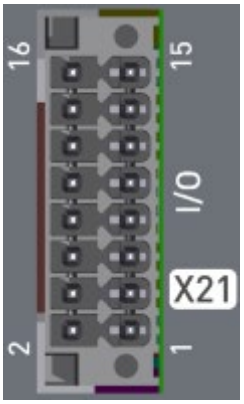
Loading of the outputs: maximum 350 mA
In case of overload / overtemperature of an output, a device error is output and all outputs are deactivated and reactivated automatically after cooling.

All inputs and outputs do have 24 V level.
Input level:
"0" (low) = Rated Input Voltage ≤ 12.5 V
"1" (high= Rated Input Voltage ≥ 13.5 V
The digital outputs are free for writing via object 0x2079.0x01 or 0x60FE.0x01 via fieldbus.
The status of digital inputs can be read via object 0x2070.0x00 or 0x60FD.0x00 .

NOTICE

The **24V supply inputs** of the PSD Servo Drive controller (also for the digital outputs and especially **also for the motor holding brake**) are **signal inputs**. **The notes on CE-compliant and EMC-compliant cable routing must be observed!** (see page 17)

5.5.2. X21: Digital inputs / outputs Axis 2 & 3 (PSD1-M)



Pin X21	Input / Output	Axis	
1	I2_3	3	Input 2 Axis 3
2	GND24V	1...3	
3	I3_3	3	Input 3 Axis 3
4	I0_2	2	Input 0 Axis 2
5	I1_2	2	Input 1 Axis 2
6	I2_2	2	Input 2 Axis 2
7	I3_2	2	Input 3 Axis 2
8	GND24V	1...3	
9	O0_2	2	Output 0 Axis 2
10	GND24V	1...3	
11	O1_2	2	Output 1 Axis 2
12	STOA2/		STO input A Axis 2/3
13	O0_3	3	Output 0 Axis 3
14	STOGND2	1...3	STO Ground
15	O1_3	3	Output 1 Axis 3
16	STOB2/		STO Input B axis 2/3

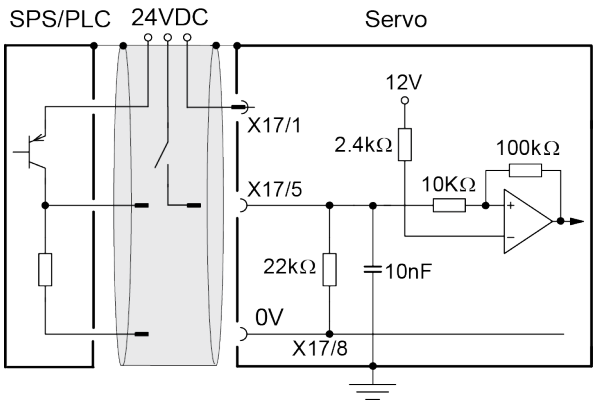
Loading of the outputs: maximum 350 mA
In case of overload / overtemperature of an output, a device error is output and all outputs are deactivated and reactivated automatically after cooling.
All inputs and outputs do have 24 V level.
Input level:
"0" (low) = Rated Input Voltage ≤ 12.5 V
"1" (high= Rated Input Voltage ≥ 13.5 V
The digital outputs are free for writing via object 0x2079.0x01 or 0x60FE.0x01 via fieldbus.
The status of digital inputs can be read via object 0x2070.0x00 or 0x60FD.0x00 .

NOTICE

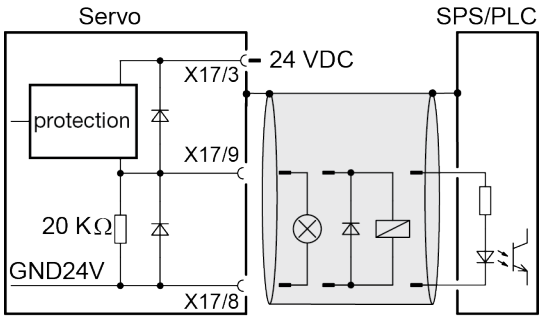
The **24V supply inputs** of the PSD Servo Drive controller (also for the digital outputs and especially **also for the motor holding brake**) are **signal inputs**. **The notes on CE-compliant and EMC-compliant cable routing must be observed!** (see page 17)

5.5.3. Wiring of the digital inputs and outputs

Wiring of digital inputs



Wiring of digital outputs



5.6 X43, X45 motor connection

In this chapter you can read about:

- X43: Motor connection (PSD1M_1800) 66
- X45: Motor connection (PSD1-M) 68

5.6.1. X43: Motor connection (PSD1M_1800)

Motor connection for PSD1M_1800 (30 A)

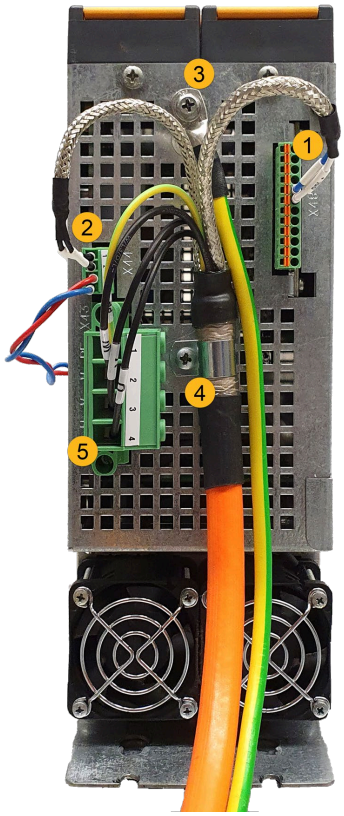


Designation	Axis	Motor cable lead designation*		
U	1	U / L1	1	U1
V	1	V / L2	2	U2
W	1	W / L3	3	U3
FE & PE	1	YE / GN		

* Depending on cable type.
FE: Functional ground
PE: Protective earth

Shielding connection of the motor cable

The external shield of the motor cable must be properly (=over a large area!) connected to the PE both on the **drive side** (see page 60, see page 86, see page 33) (on the device housing or on the rear wall of the control cabinet) as well as on the motor side (motor housing e.g. via the motor cable plug connector).
The outer and any existing additional inner shielding for the DSL or motor holding brake must not be interrupted.
Please also observe the **notes regarding the connection of a Hiperface DSL encoder** (see page 71) (via hybrid cable).
The PSD1M_1800 is wired differently to the other PSD1M devices:



Explanation

1 DSL connection
2 Motor brake connection
3 Connect ground via ring cable lug with a 10 mm² copper cable to central ground
4 Fixing the *shield terminal* [1] with a flat connection to the motor cable shield
5 Motor connection

[1] The *shield terminal* is supplied with the Parker motor cables.

An optional accessory set with several terminals for the various possible cable cross-sections is available for motor cables manufactured in-house.

Please observe the notes in chapter "**Operating conditions for CE-conform operation** (see page 15)".

5.6.1.1 Motor connection with self-made motor cable

NOTICE

Please consider the special features of the **DSL** Motor connection with:

- EX motors,
- EY motors,
- NK motors,
- NV motors and
- NX motors!

For these motors with DSL feedback the outputs V & W are reversed in the PSD via the motor configuration (**this has no influence on the wiring with Parker motor cables)!**

You must connect these motors with a self-made cable in accordance with the following table:

For EX motors, EY motors, NK motors, NV motors and NX motors:

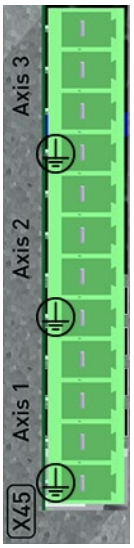
Axis	Designation	Motor cable lead designation*			Motor side EX, EY, NK, NV, NX (as per motor data sheet)
1	U	U / L1	1	U1	U
	V	V / L2	2	U2	W
	W	W / L3	3	U3	**V**
	FE & PE	YE / GN			Ground

* Depending on cable type.
FE: Functional ground
PE Protective earth

5.6.2. X45: Motor connection (PSD1-M)

Motor connection for 3 axes

The respective pins are not assigned with 1- or 2-axis devices!



Designation	Axis	Motor cable lead designation*		
CU	3	U / L1	1	U1
CV	3	V / L2	2	U2
STW	3	W / L3	3	U3
FE & PE	3	YE / GN		
BU	2	U / L1	1	U1
BV	2	V / L2	2	U2
BW	2	W / L3	3	U3
FE & PE	2	YE / GN		
AU	1	U / L1	1	U1
AV	1	V / L2	2	U2
AW	1	W / L3	3	U3
FE & PE	1	YE / GN		

* Depending on cable type.
FE: Functional ground
PE Protective earth

Shielding connection of the motor cable

The external shield of the motor cable must be properly (=over a large area!) connected to the PE both on the **drive side** (see page 60, see page 86, see page 33) (on the device housing or on the rear wall of the control cabinet) as well as on the motor side (motor housing e.g. via the motor cable plug connector).

The outer and any existing additional inner shielding for the DSL or motor holding brake must not be interrupted.

Please also observe the **notes regarding the connection of a Hiperface DSL encoder** (see page 71) (via hybrid cable).



Mounting:

- Fix cables with clamp collars on the corresponding tin bar (3)
- Connect plug
- Screw on tin angle

Explanation

1 Fixing screw for tin angle (included with delivery)
2 Tin angle for cable guiding with earthing screw
3 Mounting of cable, flat shielding
4 Central ground connection

Tin angles and clamp collars are all included.

Please observe the notes in chapter "**Operating conditions for CE-conform operation** (see page 15)".

5.6.2.1 Motor connection with self-made motor cable

Motor connection with self-made motor cable PSD-M

NOTICE

Please consider the special features of the **DSL** Motor connection with:

- EX motors,
- EY motors,
- NK motors,
- NV motors and
- NX motors!

For these motors with DSL feedback the outputs V & W are reversed in the PSD via the motor configuration (**this has no influence on the wiring with Parker motor cables)!**

You must connect these motors with a self-made cable in accordance with the following table:

For EX motors, EY motors, NK motors, NV motors and NX motors:

Axis	Designation	Motor cable lead designation*			Motor side: EX, EY, NK, NV, NX (as per motor data sheet)
3	CU	U / L1	1	U1	U
	C**V**	V / L2	2	U2	W
	STW	W / L3	3	U3	**V**
	FE & PE	YE / GN			Ground
2	BU	U / L1	1	U1	U
	B**V**	V / L2	2	U2	W
	BW	W / L3	3	U3	**V**
	FE & PE	YE / GN			Ground
1	AU	U / L1	1	U1	U
	A**V**	V / L2	2	U2	W
	AW	W / L3	3	U3	**V**
	FE & PE	YE / GN			Ground

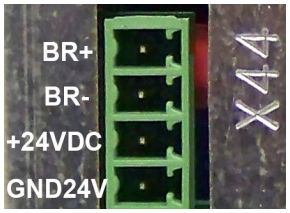
* Depending on cable type.
FE: Functional ground
PE: Protective earth

5.7 X44, X46 Connecting the motor brake PSD1-M

In this chapter you can read about:

- X44: Connection of motor brake (PSD1M_1800) 69
- X46: Connection of motor brake (PSD1-M) 70

5.7.1. X44: Connection of motor brake (PSD1M_1800)



Pin		Designation	Motor cable lead designation*		
1	A1	Motor holding brake +**	WH	4	Br1
2	A1	Motor holding brake -**	BK	5	Br2
3	+	Brake power supply voltage 24 VDC			
4	-	GND24 VDC			

* Depending on cable type.
** max. 1.6 A.

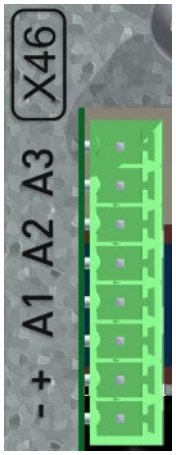
NOTICE

The **24V supply inputs** of the PSD Servo Drive controller (also for the digital outputs and especially **also for the motor holding brake**) are **signal inputs**. **The notes on CE-compliant and EMC-compliant cable routing must be observed!** (see page 17)

5.7.2. X46: Connection of motor brake (PSD1-M)

Connection for 3 axes

The respective pins are not assigned with 1- or 2-axis devices!



Pin		Designation	Axis	Motor cable lead designation*		
1	A3	Motor holding brake +**	3	WH	4	Br1
2	A3	Motor holding brake -**	3	BK	5	Br2
3	A2	Motor holding brake +**	2	WH	4	Br1
4	A2	Motor holding brake -**	2	BK	5	Br2
5	A1	Motor holding brake +**	1	WH	4	Br1
6	A1	Motor holding brake -**	1	BK	5	Br2
7	+	Brake power supply voltage 24 VDC	1 ... 3			
8	-	GND24 VDC	1 ... 3			

* Depending on cable type.

** max. 1.6 A.

NOTICE

The **24V supply inputs** of the PSD Servo Drive controller (also for the digital outputs and especially **also for the motor holding brake**) are **signal inputs**. **The notes on CE-compliant and EMC-compliant cable routing must be observed!** (see page 17)

5.8 X48, X18...X20 Motor Feedback

In this chapter you can read about:

- X48: HIPERFACE DSL® & motor temperature sensor (PSD1-M) 71
- X18, X19, X20 Connector assignment with configured resolver 72
- X18, X19, X20: Assignment with configured incremental encoder or analogue Hall 74

⚠CAUTION

Feedback system can be destroyed if configured incorrectly!

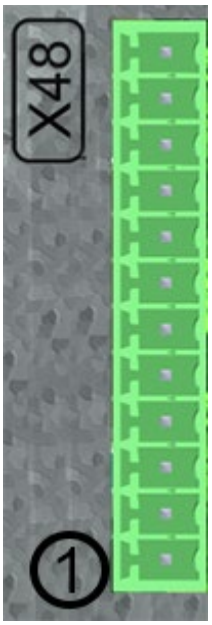
If you connect a PSD that has already been configured for a specific feedback system to another feedback system, it can be destroyed by too high a voltage.

Procedure when changing the feedback system.

5.8.1. X48: HIPERFACE DSL® & motor temperature sensor (PSD1-M)

HIPERFACE DSL® feedback and motor temperature sensor connection for 3 axes

The respective pins are not assigned with 1- or 2-axis devices!



Pin	Designation	Axis	
1	PTC+	1	Temperature sensor + motor 1
2	PTC-	1	Temperature sensor - motor 1
3	PTC+	2	Temperature sensor + motor 2
4	PTC-	2	Temperature sensor - motor 2
5	PTC+	3	Temperature sensor + motor 3
6	PTC-	3	Temperature sensor - motor 3
7	DSL+	1	
8	DSL-	1	
9	DSL+	2	
10	DSL-	2	
11	DSL+	3	
12	DSL-	3	

Connection on the device (see page 60, see page 86, see page 33).

NOTICE

Operation with Parker **HIPERFACE DSL® cables recommended!** (see page 114)
Note the following, if **no Parker PSD DSL motor cable** is used **or** this **is shortened** :
The internal shield of the twisted Hiperface DSL® signal cables must be connected on the **drive side** (see page 60, see page 33) to the outer motor cable shield (and thus PE) (braided, soldered or connected using self-adhesive EMC copper tape). Up from this connection point, the internal shielding of the Hiperface DSL® line (with the wire pair still twisted in it) must be guided up to the PSD servo amplifier Hiperface DSL® connection terminal.
The same applies on the motor side when connecting the Hiperface DSL® cables in a motor terminal box. Here too, the Hiperface DSL® cable shield must be connected to the outer cable shield and the Hiperface DSL® cable pair must continue to be routed, twisted and shielded, from there to its connection terminal.

NOTICE

Please observe the following if you want to disconnect the DSL lines with an **additional plug** :

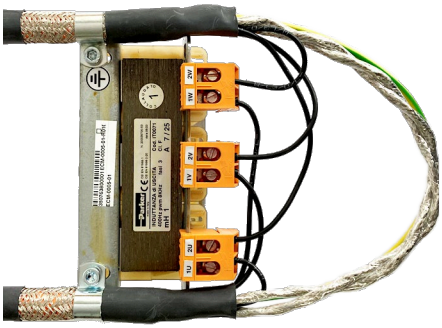
- No other lines must be wired between DSL+ and DSL-.
- The DSL lines must be twisted and separately shielded.
- A flat shielding must be guaranteed across the plug connection (recommendation: Harting Han-Modular plug with “Han Quintax” or “Hand MegaBit” module).
- The shield of the DSL lines must be connected to PE/earth with low impedance. In the simplest case, this can be done by connecting the DSL shield with the overall shield of the cable at the cable end (on the controller side).

NOTICE

Please note the following instructions if you are using the hybrid cable with DSL lines with a **motor choke**:

- The DSL cable must not be cut (also or especially the DSL cable shield must remain intact).
  In case of a motor with brake, the same applies to the brake control line in the hybrid cable.
- A shield connection of the complete outer shield and DSL shield must be ensured at the input and the output side of the motor choke (e.g. braiding the cable, soldering or connecting by using self-adhesive EMC copper tape).
- The motor cable shield must not be interrupted at the motor choke. This is ensured by using the ground cable shield clamps of the motor choke at the input and the output side.
- Make sure that the shielding is carried out over a large area!
- The overall connection between choke & motor has to be done by a modified **DSL motor cable** (see page 114) (CBMxxxH...).

Example of a possible wiring of a hybrid cable using a motor choke:



5.8.2. X18, X19, X20 Connector assignment with configured resolver



Assignment with multi feedback option with configured resolver

Pin	Feedback High Density /Sub D
1	reserved
2	reserved
3	reserved
4	REF-Resolver+ (8 kHz / max. 9.5 V_{ss})
5	+3.3 V (for temperature sensor)
6	reserved
7	SIN- (max. 4.7 V_{ss} differential)
8	SIN+ (max. 4.7 V_{ss} differential)
9	reserved
10	Tmot*
11	COS- (max. 4.7 V_{ss} differential)
12	COS+ (max. 4.7 V_{ss} differential)
13	reserved
14	reserved
15	REF-Resolver-

* Pin10 Tmot may not be simultaneously connected to the axis of the associated temperature sensor entry of **X48** (see page 71) (PSD1-M).

Category	Specifications
Resolution of the motor position	• Position resolution: 16.6 Bits (= 0.005°) • Absolute accuracy: ±0.167°
Resolver supported	• **LTN**: RE-21-1-A05, RE-15-1-B04 • **Tamagawa:** TS2610N171E64, TS2620N21E11, TS2640N321E64, TS2660N31E64 • **Tyco (AMP):** V23401-T2009-B202
Resolver data supported	• Transformation ratio: 0.25... 1 (typical 0.5) • Excitation frequency 8 Hz • Amplitude of the excitation signal: max. 9.5 V_{pp}. (The resolver must be approved for at least this value).

Accuracy

The precision of the position signal is above all determined by the exactitude of the feedback system used.

5.8.3. X18, X19, X20: Assignment with configured incremental encoder or analogue Hall

X18: Axis 1/ single axis devices
X19: Axis 2: not implemented
X20: Axis 3: not implemented

Incremental encoder / analog & digital Hall sensor with analog sin/cos signals with $1V_{ss}$



Pin	Feedback option / high density / sub D		
	Encoder 1 V_{ss}	Encoder A/B	Analog Hall sensor
1	Sense -*		
2	Sense +*		
3	Hall 1 (digital)		reserved
4	Vcc (+5 V) max. 350 mA load		
5	+3.3 V (for temperature sensors)		
6	Hall 2 (digital)		reserved
7	Sine -	A-	Sine -
8	Sine +	A+	Sine +
9	Hall 3 (digital)		reserved
10	Tmot**		
11	Cosine -	B-	Cosine -
12	Cosine +	B+	Cosine +
13	N+, Z+, Ref + (encoder reference mark or index pulse +)		reserved
14	N-, Z-, Ref - (encoder reference mark or index pulse -)		reserved
15	GND (Vcc)		

*+5V (Pin 4) is measured and controlled directly at the end of the line via Sense+ and Sense-.
Maximum cable length: 100 m with 0.5 mm^2.
* Pin10 Tmot may not be simultaneously connected to the axis of the associated temperature sensor entry of **X48** (see page 71) (PSD1-M).

Category	Specification
Incremental encoder **(see page 41) * (Sine / Cosine or A/B square wave signal)**	• Linear or rotary • 5V power supply voltage (optionally controlled on the encoder side by voltage feedback via sense measuring lines) • **Supported signals**: ♦**Sin/Cos** Signal: Differential with 2.5V reference voltage, typically 1 Vss (max. 4.7 Vss), sine/cosine 90° phase-shifted, max. frequency 400 kHz (an existing reference mark (ref signal) is evaluated (if the machine zero mode is set accordingly) during the machine zero run) **Position resolution:** 14 bits per sine/cosine period (at 1Vpp) -> for rotary encoder, unit incr./rev: Encoder line number [periods/rev.]*16384[incr./period] -> for linear encoder, unit e.g. incr./mm: 16384[incr./period]*1000[um/mm]/encoder_period length[um] or ♦**A/B pulses**: Physical RS422 (differential), A/B 90° phase-shifted, max. 5 MHz (an existing reference mark (Z-track) is evaluated (if the machine zero mode is set accordingly) during the machine zero run) with the following **commutation options**: • Auto commutation or • U, V, W or R, S, T commutation signals (NPN open collector) e.g. digital Hall sensors**, incremental encoders with commutation track (such as Hengstler F series with electrical ordering variant 6)
Analog Hall sensor **(see page 41) ***	• Linear or rotary • 5V power supply voltage (optionally controlled on the encoder side by voltage feedback via sense measuring lines) • Sine/cosine signal: Differential with 2.5V reference voltage, typically 1 Vss (max. 4.7 Vss), sine/cosine 90° phase-shifted, max. frequency 400 kHz • **Position resolution:** 14 bits (at 1Vpp) per sine/cosine period (= 14 bits per motor magnetic period) -> for rotary motor, unit incr./rev: number of motor pole pairs [1/rev]*16384 incr. -> for linear motor: 16384 [incr./pitch] for unit e.g. incr./mm: 16384[incr.]/MotorPitch[mm]

* in the first expansion stage only for PSD1S and PSD1MW**1**...: multi-axis device with **one** performance level.

** the digital Hall sensors must be supplied via the encoder supply pin Vcc (5V nominal, higher voltage possible with connected sense measuring lines).

5.9 X60...X62 Communication interfaces

5.9.1. X60: PC-/Diagnostic interface

Wiring with Ethernet Crossover cable Cat5e; for this, we offer our interface cable **CBD000C0-T00-T0** (see page 132) .
Standard Ethernet Address of the PSD:192.168.10.x
The final position (x) is set via the address adder S12 (higher value byte) & S13 (low value byte) and accepted by Power On.

Address setting

Settings:
S12: Device address higher value half-byte (accept with power ON)
S13: Device address low value half-byte (accept with power ON)
Address 1 ... 240 (0x01 ... 0xF0) is possible; the range 241 ... 255 (0xF1 ... 0xFF) is reserved for special functions!

Example: S12=2, S13=1
Address= 0x21: S12*16 + S13 = 2*16 + 1 = 33

After switching on PSD, the IP address is set to the value
- "192.168.10.S12_S13" (X60 PC interface) e.g. "192.168.10.33"

respectively
- "192.168.100.S12_S13" (X61/X62 fieldbus interface) e.g. "192.168.100.33"

.

In addition, the set address becomes part of the host name. The address set via S12_S13 is appended to the prefix "PSD1-" as a string with 3 digits:
- Host name= "PSD1-" followed by "S12_S13_3digit_String"

For example:
- Host name=PSD1-033

If the IP address has been changed and is no longer known, it can be reset to the default setting with S12_S13 = 249 (0xF9):
- IP address = 192.168.10.2 (X60 PC) / 192.168.100.2 (X61/X62 fieldbus)
- SubNetmask = 255.255.0.0
- Gateway_IP = 192.168.10.254 (X60 PC) / 192.168.100.254 (X61/X62 fieldbus)
- Host name = PSD1-002

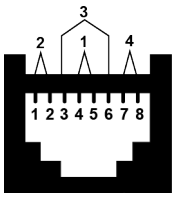
Afterwards or in general, the complete IP address (not just the last part) can then be redefined as follows:
- For X60 via the objects 0x2500.0x04 & 0x2500.0x01 (Bit 12)
- For X61/X62 via the objects 0x2605.0x04 & 0x2605.0x01 (Bit 12)

The default address 192.168.10.xx for the configuration interface can be set with object 0x2500.4.
The default address 192.168.100.xx for the fieldbus device address can be set with object 0x2605.4.
This is also possible via the ServoManager Wizard .

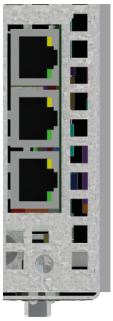
Addresses 0 and 241 … 255 are not possible.
The connection is configured in the PSD ServoManager.

5.9.2. X61, X62 connection fieldbuses (Ethernet)

RJ45 socket: assignment



Pin	Wire pair no.	RJ45 (X61) out	RJ45 (X62) in
1	2	Tx +	Tx +
2	2	Tx -	Tx -
3	3	Rx +	Rx +
4	1	-	reserved
5	1	-	reserved
6	3	Rx -	Rx -
7	4	-	reserved
8	4	-	reserved



X62: Fieldbus interface in
X61: Fieldbus interface out
X60: PC interface

Wiring with Ethernet Crossover cable Cat5e (from X61 to X62 of the next device without termination); for this, we offer our interface cable **CBD000C0-T00-T0** (see page 132) .

NOTICE

Use a **shielded bus cable** (at least Cat5e):

- **SF/UTP:**: Overall cable shielded (shield + foil), the 4 twisted pairs of conductors inside are unshielded.

or

- **S/STP** respectively **S/FTP**: Overall cable shielded and additional shielding (foil or shield) around each of the 4 twisted pairs of conductors on the inside.

For connection cables manufactured in-house, the shield must be connected to the connector over a large area; **the RJ45 connector itself must be metallized** !

5.9.2.1 Reference to the meaning of LEDs X60, X61, X62

The meaning of the LEDs depends on the fieldbus:

EtherCAT

LED green: Connection/activity indicator (X61 & X62)

Off	No connection
On	Connected, no activity
Flickering	Connected, activity

LED yellow: Activity indicator (X61 & X62)

Off	No activity
Flickering	Activity

LED green: Connection/activity indicator (X60)

Off	No connection
On	Connected, no activity
Flickering	Connected, activity

LED yellow: Speed indicator (X60)

Off	10Base-T
On	100Base-TX

PROFINET / Ethernet/IP:

LED green: Connection/activity indicator (X61 & X62)

Off	No connection
On	Connected, no activity
Flickering	Connected, activity

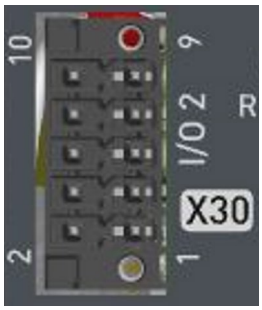
LED yellow: Speed indicator (X61 & X62)

Off	10Base-T
Flickering	100Base-TX

5.10 Signal interfaces IO option board

This function is only supported by a PSD1 with IO option card (see **Order code** (see page 9))

5.10.1. X30, X37 digital inputs/outputs / 24V power supply



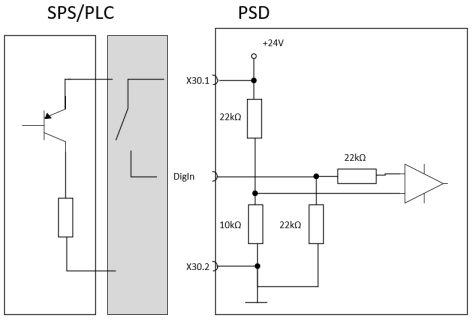
Pin X30 / X37		
1	+24V DC external	24V for the digital outputs and encoder supply
2	GND	GND24V
3	Digital I/O0	Combined inputs/outputs. When the output is set, the high signal is also read in at the input. The outputs are short circuit proof and can be loaded with a maximum of 70mA.
4	Digital I/O1	
5	Digital I/O2	
6	Digital I/O3	
7	Digital I/O4	
8	Digital I/O5	
9	Digital I/O6	
10	Digital I/O7	

8 combined inputs/outputs can be set. If an output is set to high, the corresponding input also reports a high signal.
Please note that the 24V supply voltage must be fed in externally to operate the digital inputs/outputs and to connect an encoder to X31 / X38.

Technical data X30, X37 (see page 143)

5.10.1.1 Wiring of digital I/Os

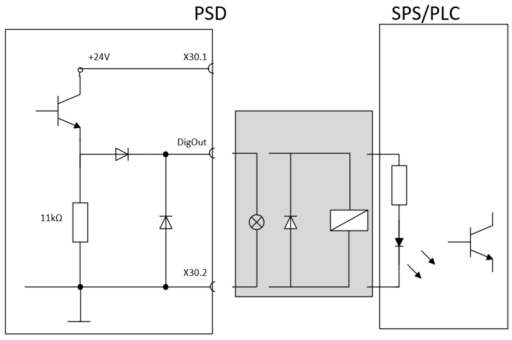
Wiring of digital inputs



The circuit example is valid for all digital inputs!
Signal level:

- > 9.15V = "1" (38.2% of the control voltage applied)
- < 8.05V = "0" (33.5% of the control voltage applied)

Wiring of digital outputs



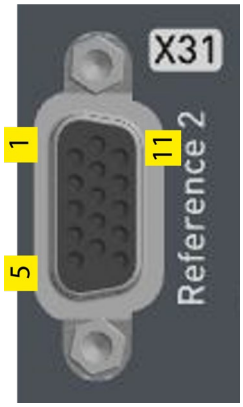
The circuit example is valid for all digital outputs!
The outputs are short circuit proof; a short circuit generates an error.

5.10.1.2 Logic proximity switch types

Type	1	2	3	4
Transistor switch	PNP	NPN	NPN	NPN
Logic	(N.O.) "active high"	(N.O.) "active low"	Schließer (N.O.) „Aktiv Low"	(N.C) "active high"
Description of logic	When damping, the PSD sees a logical "1"	When damping, the PSD sees a logical "0"	Beim Bedämpfen sieht das PSD eine logische „0"	When damping, the PSD sees a logical "1"
Fail safe logic	No	Only conditional 1)	nur bedingt 1)	No
Instruction for pull up resistor in the initiator	-	Rmin=3k3 Rmax=10k 2)	Rmin=3k3 Rmax=10k 2)	Rmin=3k3 Rmax=10k 2)
Wiring				

1) When the connection between transistor emitter of the initiator and X30/37 (GND24V of the PSD) is lost, it can not be guaranteed that the PSD detects a logical "0".
2) The INSOR NPN types INHE5212 and INHE5213 manufactured by Schönbuch Electronic do correspond to this specification.

5.10.2. X31, X38 analog inputs / encoder



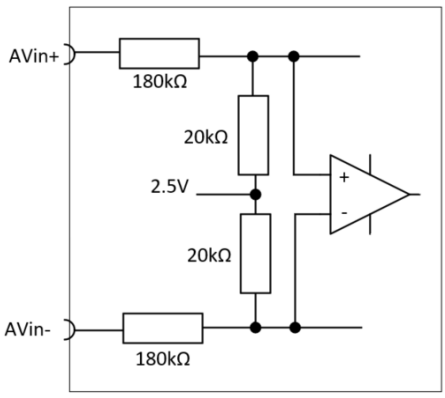
Reference 1 (X38) Reference 2 (X31)		Description	
Pin	**Signal**	**A/B Encoder**	**Step/Dir Encoder**
1	Vcc +24V	Output for encoder power supply max. 70mA	
2	Vin 1-	Vin1-: diff. analog input +/-10V	
3	Iin0	Iin0: analog input: 0..20mA	
4	Iin 1	Iin1: analog input: 0..20mA	
5	Vcc +5V	Output encoder supply max. 150mA	
6	RS422 (A-)	A- Encoder (In/Out)	Step- Encoder (In/Out)
7	RS422 (A+)	A+ Encoder (In/Out)	Step+ Encoder (In/Out)
8	RS422 (B+)	B+ Encoder (In/Out)	Dir+ Encoder (In/Out)
9	Vin 0+	Vin0+: diff. analog input +/-10V	
10	Vin 1+	Vin1+: diff. analog input +/-10V	
11	Vin 0-	Vin0-: diff. analog input +/-10V	
12	RS422 (B-)	B- Encoder (In/Out)	Dir- Encoder (In/Out)
13	RS422 (N-)	N- Encoder (In/Out)	
14	RS422 (N+)	N+ Encoder (In/Out)	
15	GND	GND	

The encoder signals are used for both encoder input and encoder simulation.

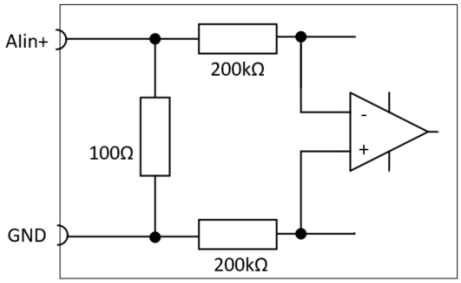
Technical data X31, X38 (see page 143)

5.10.2.1 Wiring of analog interface

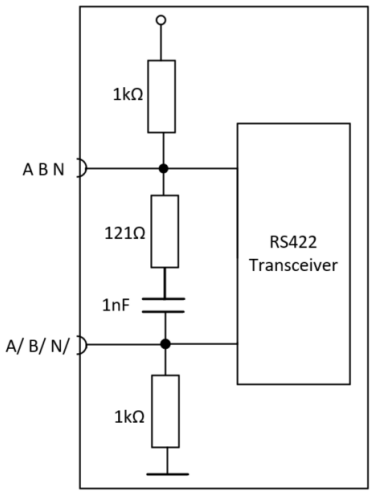
Structure image of the internal signal processing of the analog voltage inputs



Structure image of the internal signal processing of the analog current inputs



5.10.2.2 Connections of the encoder interface



The input connection is available in triple (for A & /A, B & /B, N & /N)

5.11 Connections of the axis system

The axis controllers are connected to the supply voltages via rails.

- Supply voltage 24VDC
- DC power voltage supply

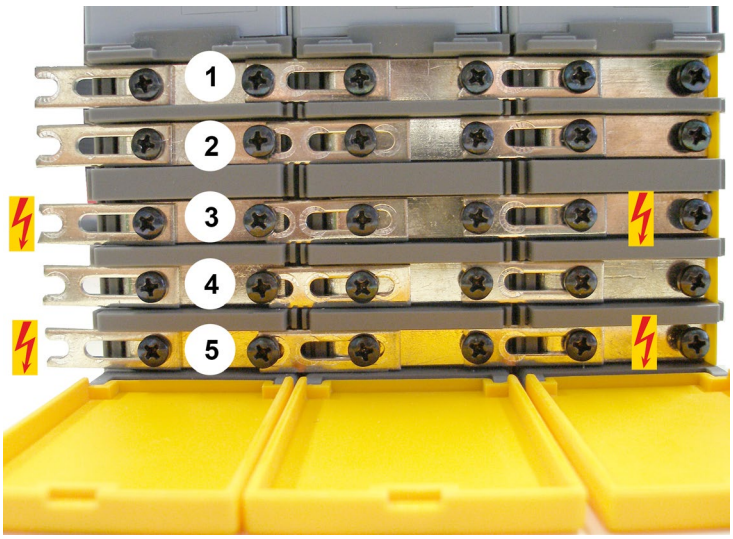
The rails can be found behind the yellow protective covers. In order to connect the rails of the devices, you may have to remove the yellow plastic device inserted at the side.

DANGER **Caution - Risk of electric shock!**

Always switch off devices before wiring them!

Dangerous voltages are still present until 10min. after switching off the power supply.

Please check that no voltages are present (<50 V) at the output terminals DC+ and DC- (PSD1-SW1200/1300: X63/4 & X63/5, PSD1-SW1400: X63/3 & X63/2).



1	24VDC
2	GND24V
3	-HV DC
4	PE
5	+HV DC

Protective seals

⚠DANGER

Caution - Risk of electric shock!

In order to secure the contact protection against the alive rails, it is absolutely necessary to respect the following:

- Insert the yellow plastic comb at the left and right of the rails.
  Make sure that the yellow plastic combs are placed at the left of the first device and at the right of the last device in the system and have not been removed.
- Setup of the devices only with closed protective covers.

⚠CAUTION

External components **may not** be connected to the rail system.

Protective seals

⚠WARNING

Caution!

The user is responsible for protective covers and/or additional safety measures in order to prevent damages to persons and electric accidents.

5.12 Technical Data

5.12.1. Output data servo modules PSD1-M (3*400 VAC)

Category	Specification [1]		
Controller type	Number of power output stage	Output nominal current [A_{rms}]	Pulse current for 2 s [A_{rms}] [4]
PSD1-M_1300	1	5	10
PSD1-M_1400	1	8	16
PSD1-M_1600	1	15	30 [2]
PSD1-M_1800	1	30	60 [2]
PSD1-M_2220	2	2 + 2	4 + 4
PSD1-M_2330	2	5 + 5	10 + 10
PSD1-M_2440	2	8 + 8	16 + 16
PSD1-M_2630	2	15 + 5 [3]	30 [2] 10
PSD1-M_3222	3	2 + 2 + 2	4 + 4 + 4
PSD1-M_3433	3	8 + 5 + 5 [3]	16 + 10 + 10

[1] At the **default setting of the switching frequency** (see page 83).

[2] **Minimum rotating field frequency for peak current at 15 A & 30 A output stages: f > 3 Hz; with a rotating field frequency of f <3 Hz the maximum peak current duration is 100 ms**

[3] Maximum total output current per device: 16 A.

[4] "Duty Cycle": 20% @10 s (ON=2.0 s - OFF=8.0 s)

5.12.2. Detailed output data for PSD1-M servo modules

Category		Specification				
Power output stage		2 A	5 A	8 A	15 A [2]	30 A [2]
Input Voltage				300 ... 750 VDC		
Output voltage		3x 0-400 V (0...590 Hz)				
Power at continuous operation[1]		1.2 kVA	3 kVA	4.8 kVA	9 kVA	18 kVA
Heat dissipation [1]		20 W	45 W	75 W	105 W	220 W
Output currents [3]		With 400 VAC at the mains module				
$I_{Nominal}$ [Arms]	4 kHz	2	5	8	**15**	**30**
I_{Peak} (2 s) [Arms] [4]	4 kHz	4	10	16	**30**	**60**
$I_{nominal}$ [Arms]	8 kHz	**2**	**5**	**8**	10	20
I_{peak} (2 s) [Arms] [4]	8 kHz	**4**	**10**	**16**	20	40
$I_{nominal}$ [Arms]	16 kHz	1.33	3.33	5.33	5	11
I_{peak} (2 s) [Arms] [4]	16 kHz	2.67	6.66	10.66	10	22
Output currents [3]		With 480 VAC at the mains module				
$I_{Nominal}$ [Arms]	4 kHz	2	5	8	**12.5**	**25**
I_{Peak} (2 s) [Arms] [4]	4 kHz	4	10	16	**25**	**50**
$I_{Nominal}$ [Arms]	8 kHz	**1.8**	**4.5**	**7.2**	8	15
I_{Peak} (2 s) [Arms] [4]	8 kHz	**3.6**	**10**	**14.4**	16	30
$I_{Nominal}$ [Arms]	16 kHz	1.07	2.67	4.27	4	8.5
I_{Peak} (2 s) [Arms] [4]	16 kHz	2.13	5.33	8.53	8	17

[1] For continuous operation with a mains supply of 400 VAC at the mains module

[2] **Minimum rotating field frequency for peak current at 15 A & 30 A output stages: f > 3 Hz; with a rotating field frequency of f <3 Hz the maximum peak current duration is 100 ms**

[3] Output current at different switching frequencies. The default settings of the currents und switching frequencies are grayed out & in bold.

[4] "Duty Cycle": 20% @10 s (ON=2.0 s - OFF=8.0 s)

5.13 Mains module PSD1-M_P

In this chapter you can read about:

- Plug and device overview PSD1-M_P (mains module) 84
- P1: Status - LEDs - indication (mains module) 87
- S2: Modes switch (Power module) 89
- S3: Voltage switch (mains module) 89
- Connections of the axis system 89
- X4: Inputs/outputs of the mains module 90
- X9: Control voltage 24 VDC mains module 91
- X40: Braking resistor / Temperature switch PSD1-M_P (Power supply) 91
- X41 Mains supply (mains module PSD1-M_P) 92

5.13.1. Plug and device overview PSD1-M_P (mains module)

In this chapter you can read about:

- Front view (PSD1-M_P Mains Module) 84
- View from below (PSD1-M_P mains module) 86

5.13.1.1 Front view (PSD1-M_P Mains Module)

Danger: Risk of electric shock



Caution—Risk of electric shock!



Before wiring or loosening electrical connections please observe the following:

- Risk of electric shock—turn off the devices or disconnect them from the power supply.
- **Caution!** Dangerous electrical voltage even after turning off the intermediate capacitors:
  Up to 10 minutes Dangerous voltages may still be present after switching off the power supply.
  Please check that no voltages are present (<50 V) at the output terminals DC+ and DC- (bus bars 5(+HV DC) & 3(-HV DC)).



P1: Device Status LED

S2: Operation Mode

S3: Power Voltage

X4: Inputs / Outputs

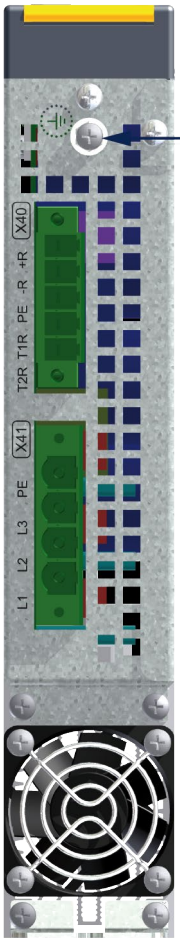
X9: 24 VDC Control Voltage

24 VDC & DC Power

Below
Mains supply, Ballast Resistor, Central Ground

P1	Status LEDs
S2 **(see page 89)**	Modes switch
S3 **(see page 89)**	Power supply requirements setting
X4 **(see page 90)**	Digital Inputs / Outputs
X9 **(see page 91)**	Control Voltage supply 24 VDC
24 VDC & DC power **(see page 89)**	Behind the yellow protective covers you can find the rails for the supply voltage connection. • 24 V DC power supply • DC power voltage supply
View from below (see page 86)	

5.13.1.2 View from below (PSD1-M_P mains module)



Front view (see page 84)	
X40 **(see page 91)**	Ballast resistor
X41 **(see page 92)**	Power supply
Central ground connection	Connect ground via ring cable lug with a 10 mm² copper cable to central ground

5.13.2. P1: Status - LEDs - indication (mains module)

Mains module status		P1 green LED a (left)	P1 red LED b (right)	Status of digital outputs (Terminal X4)
Switched off 24 VDC control voltage missing or out of range		off	off	All Outputs = Low
Pre-Charge *	The DC link is being charged or the AC power voltage is being waited for (control voltage OK, no error)	flashes quickly	off	Ready A0 = Low Warning A1 = High
	Pre-warning still active; the DC link is being charged or the AC power voltage is being waited for (control voltage OK, no error)	flashes quickly	flashes slowly	Ready A0 = Low Warning A1 = Low ****
Device ready	Not yet enabled by input E0 = High ("Enable" X4 pin 5) and no pre-warning	flashes slowly	off	Ready A0 = Input E0 ("Enable" X4 Pin 5) = Low Warning A1 = High
	No longer enabled by input E0 = High ("Enable" X4 pin 5) but pre-warning still active	flashes slowly	flashes slowly	Ready A0 = Input E0 ("Enable" X4 Pin 5) = Low Warning A1 = Low ****
	Enable granted (no warning, no error, E0 = High)	on	off	Ready A0 = Input E0 ("Enable" X4 pin 5) = High Warning A1 = High
	Pre-warning active and enable granted (Device still ready, warning present, no error yet, E0 = High)	on	flashes slowly	Ready A0 = Input E0 ("Enable" X4 pin 5) = High Warning A1 = Low ****
Device in Error **	with overtemperature or overload	off	flashes slowly	Ready A0 = Low Warning A1 = Low
	with "Error digital outputs"	off	flashes quickly	Ready A0 = Low Warning A1 = High
	One or more other errors 1) with display of the error number after 5s*** 1) other errors = not overtemperature, not overload, not "digital output error"	off	on (5s) ***	Ready A0 = Low Warning A1 = High
Device in "Bootloader" status (short start-up phase before the device is switched on via 24V)		flashes slowly	flashes slowly	All Outputs = Low

See also **X4: Inputs/outputs of the mains module**

*** Low voltage error/switch on AC voltage**

A low voltage error will be issued at the earliest 8s after switching on the 24VDC (**control voltage 24VDC PSD1-M_P (mains module) X9** (see page 91)).
If there is a (significant) delay (after the 24 VDC) in switching on the AC voltage, the device will enter an error state after 8s.

After switching on the AC power supply, this low voltage error must first be acknowledged in order to switch to the normal operating state.
To avoid another error, a waiting time must be implemented between switching on the AC voltage and the "Quit" ** (approx. 5s). Alternatively, the "Quit" (new rising edge) for the set input 0 "Enable" (X4 Pin 5) can be re-triggered until the device reports it is ready via the digital output 0 X4 Pin 9.

**** Acknowledgment of errors**

The error cancellation is carried out via a rising edge (Low -> High) on the E1 input ("Quit" X4 Pin 6)

*****Display of error numbers by flash sequences**

Green LED: in tens
1 flash = 10; 2 flashes = 20; 3 flashes = 30; ...

Red LED: in single figures
1 flash = 1; 2 flashes = 2; 3 flashes = 3; ...
Adding both values results in the error number.

Display sequence:
- Green LED = OFF, red LED on for 5 s
- Green LED 1 … 9 flashes, depending on the error number.
- Red LED 1 … 9 flashes, depending on the error number.
- Green LED off and red LED off for 1 s.

This sequence repeats until the error is reset.

Meaning of the error numbers

11	Phase error
12	Voltage DC bus too low *
13	Voltage DC bus too high
21	Temperature in the rectifier too high
22	Braking circuit overloaded
23	Temperature in the braking resistor too high
24	Short-circuit in the braking circuit
25	Rectifier overloaded
31	Current DC bus too high
32	Current offset DC bus too high
41	Overcurrent at digital output
51	None or wrong EEPROM - Data

******Warning**

There are the following two conditions for the "Pre-warning active" status (setting output A1):

- Utilization warning: DC bus utilization >= 90 %

or

- Temperature warning: rectifier <=5°K before the switch-off threshold

The warning status is automatically exited again (output 1 "Warning" = High) if the cause is no longer present.

DANGER **Caution - Risk of electric shock!**
High voltage supply may be present even with missing voltage supply (both LEDs off)!

5.13.3. S2: Modes switch (Power module)

Switch position	Operating mode
0	standard
1	Increased performance by line choke mode **Warning!** Operating without line choke can destroy the device.
2 ... F	Not defined

Acceptance of the switch position when switching on 24 VDC Control voltage.

5.13.4. S3: Voltage switch (mains module)

Switch position	Supply-voltage	Ballast circuit		Umax [VDC]	Charging circuit delay
		Switch-on threshold [VDC]	Switch-off threshold [VDC]		
0	3AC400V	780	770	810	2.0s
1	3AC110V/115V	780	770	810	
2	3AC230V	780	770	810	
3	3AC380V	780	770	810	
4	3AC480V	780	770	810	
5	3AC230V	390	380	410	
6	3AC110V/115V	390	380	410	
7	1AC230V*	390	380	410	
8	1AC110V/115V*	390	380	410	
9 ..C	reserved				
D**	3AC200V	780	770	810	2.5s
E**	3AC200V	390	380	410	
F**	1AC200V*	390	380	410	

The acceptance of the switch position occurs when switching on 24 VDC control voltage.

With 3x110V/115VAC, the internal phase failure monitoring is inactive.

NOTICE

- Operation with switch positions 9 ... C can lead to destruction of the device (in this case, the mains module reports an EEPROM error).
- ** Switch positions D ... F (200VAC) are only possible from mains module firmware 1.33 (approx. from date of manufacture May 2021)

⚠WARNING

- * Switch positions 7, 8 and F are intended solely for commissioning! Continuous mode in this switch position is not allowed.
- The power supply voltage in the PSD device configuration must be identical to the selected mains module voltage selection (via S3 switch position). 200VAC is only supported from release 1.11.1.

5.13.5. X4: Inputs/outputs of the mains module

Pin	Name	Function
1	24 VDC (output)	+24 VDC output (max. 340 mA)
2	GND24V	GND24V
3	24 VDC Dout (input)	24 VDC supply for outputs 0 ... 3
4	Nc	-
5	Input 0	Enable (High=Enable, Low=Disable)
6	Input 1	Quit (positive edge) *, **
7	Input 2	Not defined
8	Input 3	Not defined
9	Output 0	Ready (High=ready, Low=not ready) *, ** Note: The output can be regarded as the logical AND operation of the internal status "Device ready" with digital input 0 "Enable" (X4 pin 5) - see also **Status LEDs PSD1-M mains module**
10	Output 1	Warning (High = no warning, low = warning)***
11	Output 2	Not defined
12	Output 3	Not defined
13	reserved	-
14	reserved	-

*** Low voltage error/switch on AC voltage**

A low voltage error will be issued at the earliest 8s after switching on the 24VDC (**control voltage 24VDC PSD1-M_P (mains module) X9** (see page 91)).
If there is a (significant) delay (after the 24 VDC) in switching on the AC voltage, the device will enter an error state after 8s.
After switching on the AC power supply, this low voltage error must first be acknowledged in order to switch to the normal operating state.
To avoid another error, a waiting time must be implemented between switching on the AC voltage and the "Quit" ** (approx. 5s). Alternatively, the "Quit" (new rising edge) for the set input 0 "Enable" (X4 Pin 5) can be re-triggered until the device reports it is ready via the digital output 0 X4 Pin 9.

**** Acknowledgment of errors**

The error cancellation is carried out via a rising edge (Low -> High) on the E1 input ("Quit" X4 Pin 6)

*** Warning**

There are the following two conditions for deleting output 1 "Warning":

- Utilization warning: DC bus utilization >= 90 %

or

- Temperature warning: rectifier <=5°K before the switch-off threshold

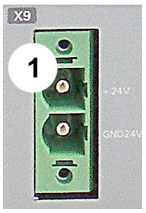
The warning is automatically deleted again (output 1 "Warning" = High) if the cause is no longer present.

NOTICE

The connected axes may only be energized when output 0 = Ready = High!
Otherwise the mains module may become damaged.

5.13.6. X9: Control voltage 24 VDC mains module

Connector X9



Pin	Designation
1	+24V
2	GND24V

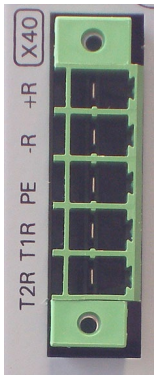
Line cross sections:
minimum: 0.5mm² with conductor sleeve
maximum: 6mm² with conductor sleeve
(AWG: 20 ... 10)

Category	Specification
Voltage range	21.6 - 27.0 VDC (24 VDC -10 % +12.5 %)
Ripple	0.5 Vpp
Requirement according to safe extra low voltage (PELV)	Yes
Electric current drain	PSD1-M_P010: 0.2 A PSD1-M_P020: 0.3 A ea. PSD1-M Axis: 1.0 A + Output current of digital outputs (fed via connectors X17/2, 3) + Output current of motor brakes (fed via connectors X46/7 & 8; PSD1M_1800 X44/3 & 4) + Current requirements of optional boards

NOTICE The **24V supply inputs** of the PSD Servo Drive controller (also for the digital outputs and especially **also for the motor holding brake**) are **signal inputs**. **The notes on CE-compliant and EMC-compliant cable routing must be observed!** (see page 17)

5.13.7. X40: Braking resistor / Temperature switch PSD1-M_P (Power supply)

The energy generated during braking operation must be dissipated via a **braking resistor** (see page 126).



Pin	Description	
+R	+ Braking resistor	short circuit proof!
-R	- Braking resistor	
PE	PE	
T1R	Temperature switch	
T2R	Temperature switch	

Device type	PSD1-M_P010	PSD1-M_P020
Capacity/ storable energy	550 µF/ 92 Ws at 400 V 53 Ws at 480 V	1175 µF/ 197 Ws at 400 V 114 Ws at 480 V
Minimum braking resistance	27 Ω	10 Ω
Recommended nominal power rating	500 ... 1500 W	500...5000 W
Pulse power for 1s	22 kW	60 kW
Maximum permissible continuous current	13 A	25 A

Maximum capacity in the axis system:

- PSD1-M_P010: 2400 µF
- PSD1-M_P020: 5000 µF

Reference value for the required capacity in an axis system

100 µF per kW of the temporal medium value of the total power (transmissions + power dissipation) in the axis system.

Example: PSD1-M_P020 (1175 µF) with one axis controller (440 µF)
Total power 15 kW, 100 µF/kW => 1500 µF required in the axis system.
Axis system: 1615 µF are sufficient.

Connection of a braking resistor on PSD1-M_P (mains module)

Minimum line cross section:	1.5 mm²
Maximum line length:	2 m
Maximum intermediate circuit voltage:	Depending on the **position of the switches on the power module** (see page 89)
Switch-on threshold:	
Hysteresis:	

5.13.7.1 Temperature switch mains module X40

Connector X40 Pin T1R, T2R

Temperature monitoring:
The temperature switch (normally closed contact) must be connected, unless an error message will be issued.

Temperature switch/relay

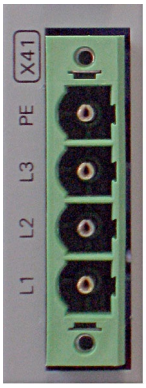
No galvanic separation, the temperature sensor (normally closed contact) must comply with the safe separation according to EN 60664.
If there is no temperature monitoring due to the connected braking resistor, the T1R and T2R connections must be connected by a jumper.

⚠CAUTION **Caution!**
Without temperature monitoring, the braking resistor might be destroyed.

5.13.8. X41 Mains supply (mains module PSD1-M_P)

⚠WARNING **Device protection**
By cyclically switching on and off the power voltage, the input current limitation can be overloaded, which may cause damage to the device.
Wait at least one minute between two switching on processes!

5.13.8.1 X41 Mains supply PSD1-M_P connector assignment



Pin	Designation
PE	Earth conductor
L3	Phase 3
L2	Phase 2
L1	Phase 1

⚠WARNING Only three-phase operation of the PSD1-M_P devices is permitted!

Please observe the notes in chapter "**Operating conditions for CE-conform operation** (see page 15)".

Fuse PSD1-M_P010:

Maximum fuse rating per device	Measure for line and device protection: UL listing (DIVQ) circuit breakers Manufacturer: ABB, Stotz-Kontakt GmbH (E212323) Model no.: S203UP-K, 1 circuit breaker 480 VAC, 3-phase, 25 A, operating temperature 55 °C

Fuse PSD1-M_P020:

Maximum fuse rating per device **2 special purpose fuses in line are required**	**Cable protection measure:** MCB (K characteristic) with a rating of 50A / 4xxVAC (depending on the input voltage). Recommendation: (ABB) S203U-K50 (440VAC) **Device protection measure:** Fuses 80A / 700VAC per supply leg in accordance with UL category JFHR2: Required: Bussmann 170M1366 or 170M1566D

DANGER **Caution - Risk of electric shock!**
Always switch off devices before wiring them!
Dangerous voltages are still present until 10min. after switching off the power supply.
Please check that no voltages are present (<50 V) at the output terminals DC+ and DC- (PSD1-SW1200/1300: X63/4 & X63/5, PSD1-SW1400: X63/3 & X63/2).

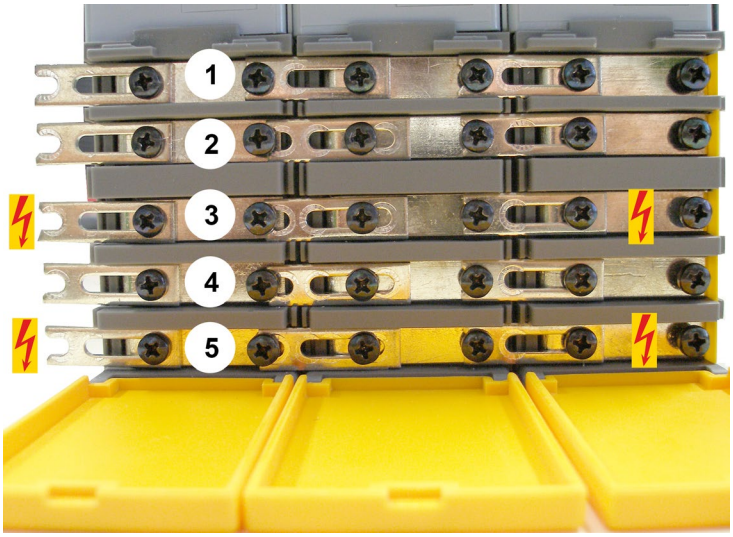
5.13.9. Connections of the axis system

The axis controllers are connected to the supply voltages via rails.

- Supply voltage 24VDC
- DC power voltage supply

The rails can be found behind the yellow protective covers. In order to connect the rails of the devices, you may have to remove the yellow plastic device inserted at the side.

DANGER **Caution - Risk of electric shock!**
Always switch off devices before wiring them!
Dangerous voltages are still present until 10min. after switching off the power supply.
Please check that no voltages are present (<50 V) at the output terminals DC+ and DC- (PSD1-SW1200/1300: X63/4 & X63/5, PSD1-SW1400: X63/3 & X63/2).



1 24VDC
2 GND24V
3 -HV DC
4 PE
5 +HV DC

Protective seals

⚠DANGER

Caution - Risk of electric shock!

In order to secure the contact protection against the alive rails, it is absolutely necessary to respect the following:

- Insert the yellow plastic comb at the left and right of the rails.
  Make sure that the yellow plastic combs are placed at the left of the first device and at the right of the last device in the system and have not been removed.
- Setup of the devices only with closed protective covers.

⚠CAUTION

External components **may not** be connected to the rail system.

Protective seals

⚠WARNING

Caution!

The user is responsible for protective covers and/or additional safety measures in order to prevent damages to persons and electric accidents.

5.13.10. Technical Data

5.13.10.1 Mains Connection Power module PSD1-M_P010 with line choke

Category	Specification				
PSD1-M_P010	**110 V**	**200 V**	**230 V**	**400 V**	**480 V**
Mains voltage	110 VAC ±10 % 50-60 Hz	200 VAC ±10 % 50-60 Hz	230 VAC ±10 % 50-60 Hz	400 VAC ±10 % 50-60 Hz	480VAC ±10% 50-60Hz
Rated voltage	3AC 110 V	3AC 200 V	3AC 230 V	3AC 400 V	3AC 480 V
Input current	22 Arms	22 Arms	22 Arms	22 Arms	18 Arms
Output voltage	156 VDC ±10 %	283 VDC ±10 %	325 VDC ±10 %	565 VDC ±10 %	680 VDC ±10 %
Output power	2.8 kW	5.1 kW	6 kW	10 kW	10 kW
Pulse power (<5 s)	4.6 kW	10.2 kW	12 kW	20 kW	20 kW
Heat dissipation	60 W	60 W	60 W	60 W	60 W
Maximum fuse rating per device	Measure for line and device protection: UL listing (DIVQ) circuit breakers Manufacturer: ABB, Stotz-Kontakt GmbH (E212323) Model no.: S203UP-K, 1 circuit breaker 480 VAC, 3-phase, 25 A, operating temperature 55 °C				

5.13.10.2 Mains connection power module PSD1-M_P010 with line choke

Increased power by means of a Line choke **(see page *124*)**

Category	Specification				
PSD1-M_P010 with line choke	**110 V**	**200 V**	**230 V**	**400 V**	**480 V**
Mains voltage	110 VAC ±10 % 50-60 Hz	200 VAC ±10 % 50-60 Hz	230 VAC ±10 % 50-60 Hz	400 VAC ±10 % 50-60 Hz	480VAC ±10% 50-60Hz
Rated voltage	3AC 110 V	3AC 200 V	3AC 230 V	3AC 400 V	3AC 480 V
Input current	24.5 Arms	24.5 Arms	24.5 Arms	24.5 Arms	20.4 Arms
Output voltage	156 VDC ±10 %	283 VDC ±10 %	325 VDC ±10 %	565 VDC ±10 %	680 VDC ±10 %
Output power	3.9 kW	7.1 kW	9 kW	15 kW	15 kW
Pulse power (<5 s)	7.8 kW	14.2 kW	18 kW	30 kW	30 kW
Heat dissipation	60 W	60 W	70 W	70 W	70 W
Maximum fuse rating per device	Measure for line and device protection: UL listing (DIVQ) circuit breakers Manufacturer: ABB, Stotz-Kontakt GmbH (E212323) Model no.: S203UP-K, 1 circuit breaker 480 VAC, 3-phase, 25 A, operating temperature 55 °C				
Earth leakage current	**Current on the mains PE** (see page 27) (>3.5 mA)				
Supply networks	**Possible supply networks** (see page 27): TN				

⚠WARNING The specified performance data are only valid in connection with line choke **IND-0001-02** (see page 124) .

5.13.10.3 Mains Connection Power module PSD1-M_P020 without line choke

Category	Specification				
PSD1-M_P020	**110 V**	**200 V**	**230 V**	**400 V**	**480 V**
Mains voltage	110 VAC ±10 % 50-60 Hz	200 VAC ±10 % 50-60 Hz	230 VAC ±10 % 50-60 Hz	400 VAC ±10 % 50-60 Hz	480VAC ±10% 50-60Hz
Rated voltage	3AC 110 V	3AC 200 V	3AC 230 V	3AC 400 V	3AC 480 V
Input current	44 Arms	44 Arms	44 Arms	44 Arms	35 Arms
Output voltage	156 VDC ±10 %	283 VDC ±10 %	325 VDC ±10 %	565 VDC ±10 %	680 VDC ±10 %
Output power	5.7 kW	10.5 kW	12 kW	20 kW	20 kW
Pulse power (<5 s)	11.4 kW	21 kW	24 kW	40 kW	40 kW
Heat dissipation	120 W	120 W	120 W	120 W	120 W

Maximum fuse rating per device 2 special purpose fuses in line are required	**Cable protection measure:** MCB (K characteristic) with a rating of 50A / 4xxVAC (depending on the input voltage). Recommendation: (ABB) S203U-K50 (440VAC) **Device protection measure:** Fuses 80A / 700VAC per supply leg in accordance with UL category JFHR2: Required: Bussmann 170M1366 or 170M1566D

5.13.10.4 Mains connection Power module PSD1-M_P020 with line choke

Increased power by means of a Line choke **(see page *124*)**

Category	Specification				
PSD1-M_P020 with line choke	**110 V**	**200 V**	**230 V**	**400 V**	**480 V**
Mains voltage	110 VAC ±10 % 50-60 Hz	200 VAC ±10 % 50-60 Hz	230 VAC ±10 % 50-60 Hz	400 VAC ±10 % 50-60 Hz	480VAC ±10% 50-60Hz
Rated voltage	3AC 110 V	3AC 200 V	3AC 230 V	3AC 400 V	3AC 480 V
Input Current [rms]	44 Arms	44 Arms	44 Arms	44 Arms	40 Arms
Output voltage	156 VDC ±10 %	283 VDC ±10 %	325 VDC ±10 %	565 VDC ±10 %	680 VDC ±10 %
Output power	7.5 kW	13.5 kW	15.5 kW	27 kW	30 kW
Pulse power (<5 s)	15 kW	27 kW	31 kW	54 kW	60 kW
Heat dissipation	120 W	120 W	140 W	140 W	140 W

Maximum fuse rating per device **2 special purpose fuses in line are required**	**Cable protection measure:** MCB (K characteristic) with a rating of 50A / 4xxVAC (depending on the input voltage). Recommendation: (ABB) S203U-K50 (440VAC) **Device protection measure:** Fuses 80A / 700VAC per supply leg in accordance with UL category JFHR2: Required: Bussmann 170M1366 or 170M1566D
Earth leakage current	**Current on the mains PE** (see page 27) (>3.5 mA)
Supply networks	**Possible supply networks** (see page 27): TN

⚠WARNING The specified performance data are only valid in connection with a **Line choke** (see page 124) IND-0002-01 or IND-0002-02 (UL).

6. Safe Torque Off (STO) with PSD1

In this chapter you can read about:

- General Description ... 97
- STO Operating Principle ... 99
- Notes on the STO function ... 103
- Conditions of utilization for the STO function ... 104
- STO delay times ... 105
- STO Application examples ... 106
- STO function test ... 110
- Technical data STO ... 112

6.1 General Description

In this chapter you can read about:

- Important Technical Terms and Explanations ... 97
- Applications in accordance with the regulations ... 98
- Qualified Personnel ... 98
- Advantages of using the "safe torque off" safety function" STO ... 99

The following documentation is meant to provide the basic information concerning our drive controller and an understanding about the advanced, safety oriented machine construction. References to standards or other regulations are made in a general overview manner. The specific standards or regulations for your installation will vary depending upon the equipment employed and the specifics of your application.
For complementary information, we recommend the respective technical literature.

6.1.1. Important Technical Terms and Explanations

Term	Explanation
Safety category 3 in accordance with EN ISO 13849-1	Definition according to standard: Circuit with built-in protective functions for individual fault conditions. Some, but not all faults will be recognized. The frequent occurrence of fault conditions can lead to a loss of the safety functions. The remainder of the risk must be understood and accepted. The determination for the application of the appropriate safety category requirements, (risk analysis), lies with the installer and operator of the equipment. It can take place according to the method described in EN ISO 13849-1, appendix A.
"Safe torque off" **or abbreviated:** **STO=Safe torque off**	With the "safe torque off", the energy supply of the drive is safely interrupted according to EN 14118, paragraph 4.1. The drive is not to be able to produce a torque and thus dangerous movements (see EN 14118, paragraph 5.3.1.3). The standstill position must not be monitored. If an external force effect, e.g. a drop of hanging loads, is possible with the "safe torque off", additional measures to safely prevent those must be provided (e.g. additional mechanical brakes). The following measures are appropriate for a "safe torque off": Contactor between mains and drive system (mains contactor) Contactor between power section and motor (motor contactor) Safe blocking of the power semiconductor control (start inhibitor)
Start-Up Lockout	Safe blocking of the power semiconductor control. With the aid of this function, you can obtain a "safe torque off".

Stop categories according to EN60204-1 (9.2.2)

Stop-Category	Safety function	Requirement	System Behaviour	Remark
0	Safe Torque Off (STO)	Stopping by immediately switching off the energy supply of the machine drive elements	Uncontrolled stop	Uncontrolled stop is the stopping of a machine movement by switching off the energy of the machine drive elements. Available brakes and/or other mechanical stopping components are applied.
1	Safe stop 1 (SS1)	Stop where the energy of the machine drive elements is maintained in order to reach a stop. The energy supply is only interrupted, if the standstill is attained.	Controlled stop	Controlled stop is the stopping of a machine movement by for instance resetting the electrical command signal to zero, as soon as the stop signal has been detected by the controller, the electrical energy for the machine drive elements remains however during the stopping procedure.
2	Safe stop 2 (SS2)	Stop where the energy to the machine drive elements is maintained.	Controlled stop	This category is not covered.

6.1.2. Applications in accordance with the regulations

The Servo Drive PSD supports the "safe torque off" (STO) safety function, with protection against unexpected startup according to the requirements of EN ISO 13849-1, category 3 to PLe and EN 14118.
Together with the external safety control device, the "safe stop 1" (SS1) safety function according to the requirements of DIN EN 61800-5-2:2008 category 3 can be used. As the function is however realized with the aid of an individually settable time delay on the safety control, it must be taken into account that, due to an error in the drive system during the active braking phase, the motor coasts uncontrolled or may even accelerate actively in the worst case until the expiry of the preset switch-off time.

A risk evaluation which must be carried out according to the machine standard 2006/42/EG resp. EN ISO 12100 and EN ISO 13849-1, the machine manufacturer must project the safety system for the entire machine including all integrated components. This does also include the electrical drives.

6.1.3. Qualified Personnel

Planning, installation and initial system commissioning require a detailed understanding of this description.
Standards and accident prevention regulation associated with the application must be known and respected as well as risks, protective and emergency measures.
The implementation of the safety functions as well as maintenance and service can only be carried out by suitably qualified personnel with many years of experience in the field of machine safety with drives.
We assume that these specialists have a good knowledge of English.
In the case of deviating regulations (in particular work by persons who do not speak English), the machine manufacturer must provide these persons with the necessary information in the national language.

6.1.4. Advantages of using the "safe torque off" safety function" STO

Safety category 3 in accordance with EN ISO 13849-1

Requirements performance features	Use of the safe torque off function	Conventional solution: Use of external switching elements
Reduced switching overhead	Simple wiring, certified application examples Grouping of drive controllers on a mains contactor is possible.	Two safety-oriented power contactors in series connection are required.
Use in the production process High operating cycles, high reliability, low wear	Extremely high operating cycles thanks to almost wear-free technology (low-voltage relay and electronic switch). The "safe torque off" status is attained due to the use of wear-free electronic switches (IGBTs).	This performance feature cannot be reached with conventional technology.
Use in the production process High reaction speed, fast restart	Drive controller remains performance- and control-oriented in connected state. No significant waiting times due to restart.	When using power contactors in the supply, a long waiting time for the energy discharge of the DC link circuit is required. When using two power contactors on the motor side, the reaction times may increase, you must however take into consideration other disadvantages: a) Securing that switching takes only place in powerless state (Direct current! Constant electric arcs must be prevented). b) Increased overhead for EMC conform wiring.
Emergency-stop function	Allowed	Allowed

6.2 STO Operating Principle

In this chapter you can read about:

- STO principle with PSD1-S 100
- STO principle of PSD1-S with one axis module 100
- STO principle of PSD1-M with two axis modules 101
- STO principle of PSD1-M with three axis modules 102

Principle

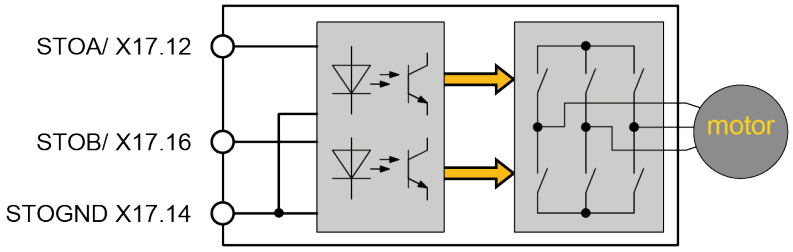
The current flow in the motor windings is controlled by a power semiconductor bridge (6-fold IGBT).
A rotating field is created via the processor by means of the power output stage. Between control logic and power module, optocouplers are used for potential separation.
The STO input are on the front panel. 2 optocouplers are controlled via 2 STO channels (STOA/ & STOB/). At a STO via external safety control both auxiliary power supplies of the power output stage are switched off via 2 channels. Due to this fact the power semiconductor bridge is blocked and there is no motor current.
The reset procedure of the Safe Torque Off depends on the configurated settings of the object STO_Setup.
At standard settings STO_Setup=0 the motor may be powered as soon as STOA/ and STOB/ inputs are reset to high level.
At settings STO_Setup=1 the generated error 0x5492 needs be acknowledged before the motor can be powered again.

Detection of hardware failure

An internal Hardware monitoring recognizes the failure of the optocoupler by continuously comparing both channels. If the monitoring system recognizes a discrepancy for a defined time (approx. 10 s) the fault is stored in the hardware. This is reported via the error code 0x5493 ?.
The error can only be reset by a hardware reset (switching off and on the servo drive). But before the error must be found and solved by the user.

6.2.1. STO principle with PSD1-S

With the single axis drive PSD1-S STO is activated via 2 channels (STOA/ and STOB/).

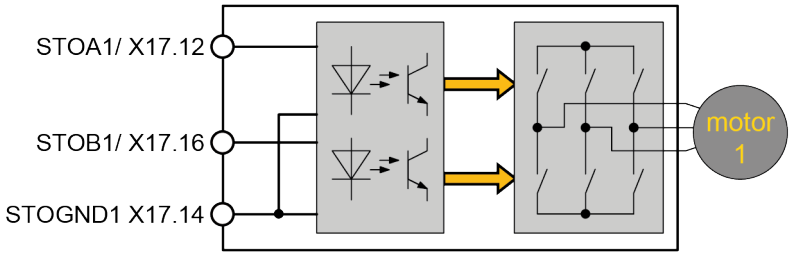


Pin	Name		Description	
X17.12	STOA/*	Input	STOA/ = 0 V	Motor deactivated
X17.16 (see page 36)	STOB/*	Input	STOB/ = 0 V	Motor deactivated
			STOA/ = 24 VDC and STOB/ = 24 VDC	Motor released
X17.14	STOGND*	Input	STO Ground. Ground of the external 24 VDC must be connected to the central ground connection (bottom of the device).	

* The inputs are optically isolated.

6.2.2. STO principle of PSD1-S with one axis module

At the PSD1-M with one axis module, STO is activated via 2 channels (STOA1/ und STOB1/).

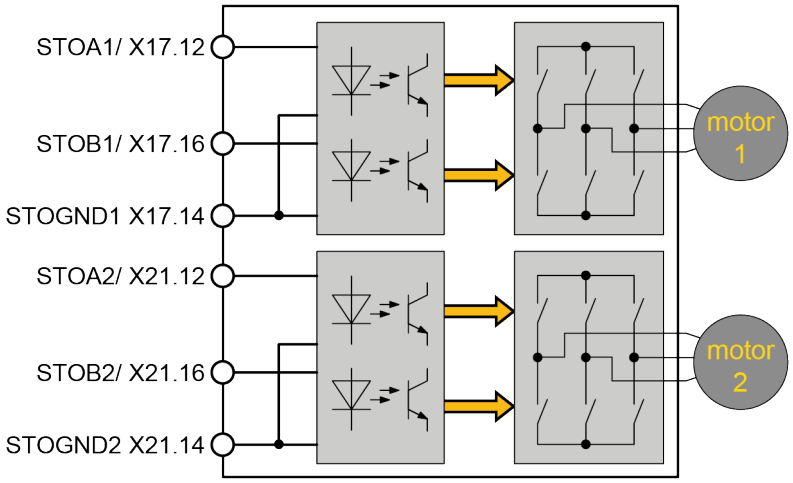


Pin	Name		Description	
X17.12	STOA1/*	Input	STOA1/ = 0 V	Motor deactivated
X17.16 (see page 64)	STOB1/*	Input	STOB1/ = 0 V	Motor deactivated
			STOA1/ = 24 VDC and STOB1/ = 24 VDC	Motor released
X17.14	STOGND1*	input	STO Ground. Ground of the external 24 VDC must be connected to the central ground connection (bottom of the device).	

* The inputs are optically isolated.

6.2.3. STO principle of PSD1-M with two axis modules

At the PSD1-M drive with two axis modules, STO is activated via 2 channels for each motor (STOA1/ and STOB1/ for motor 1 and STOA2/ and STOB2/ for motor 2).

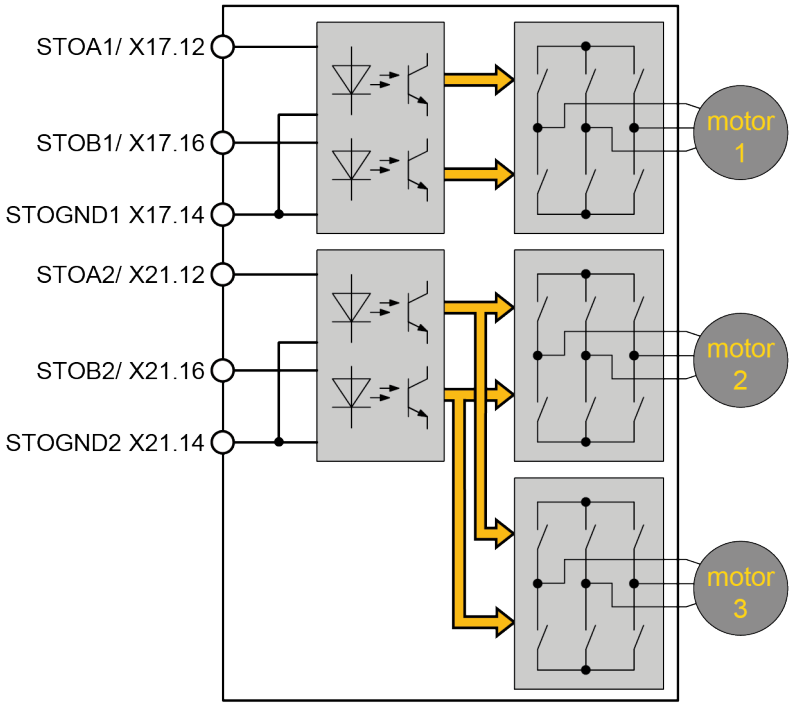


Pin	Name		Description
X17.12 (see page 64)	STOA1/*	Input	STOA1/ = 0 V — Motor 1 deactivated STOB1/ = 0 V — Motor 1 deactivated STOA1/ = 24 VDC and STOB1/ = 24 VDC — Motor 1 released
X17.16	STOB1/*	Input	
X17.14	STOGND1*	Input	STO Ground. Ground of the external 24 VDC must be connected to the central ground connection (bottom of the device).
X21.12 (see page 65)	STOA2/*	Input	STOA2/ = 0 V — Motor 2 deactivated STOB2/ = 0 V — Motor 2 deactivated STOA2/ = 24 VDC and STOB2/ = 24 VDC — Motor 2 released
X21.16	STOB2/*	Input	
X21.14	STOGND2*	input	STO Ground. Ground of the external 24 VDC must be connected to the central ground connection (bottom of the device).

* The inputs are optically isolated.

6.2.4. STO principle of PSD1-M with three axis modules

At the PSD1-M drive with three axis modules, STO for motor 1 is activated via 2 channels (STOA1/ and STOB1/ and for the motors 2 & 3 via two further channels (STOA2/ & STOB2/).



Pin	Name		Description	
X17.12	STOA1/*	Input	STOA1/ = 0 V	Motor 1 deactivated
			STOB1/ = 0 V	Motor 1 deactivated
X17.16 (see page 64)	STOB1/*	Input	STOA1/ = 24 VDC and STOB1/ = 24 VDC	Motor 1 released
X17.14	STOGND1*	Input	STO Ground. Ground of the external 24 VDC must be connected to the central ground connection (bottom of the device).	
X21.12	STOA2/*	Input	STOA2/ = 0 V	Motor 2 & 3 deactivated
			STOB2/ = 0 V	Motor 2 & 3 deactivated
X21.16 (see page 65)	STOB2/*	Input	STOA2/ = 24 VDC and STOB2/ = 24 VDC	Motor 2 & 3 released
X21.14	STOGND2*	Input	STO Ground. Ground of the external 24 VDC must be connected to the central ground connection (bottom of the device).	

* The inputs are optically isolated.

6.3 Notes on the STO function

DANGER

- It should be noted in connection with the STO application examples illustrated here that after the Emergency stop switch has been activated, no galvanic isolation in accordance with EN 60204-1 Section 5.5 is guaranteed. This means that the entire system must be disconnected from the mains power supply with an additional main switch or mains power contactor for repair jobs. Please note in this context, that even after the power is disconnected, dangerous electrical voltages may still be present in the drive for about 10 minutes.
- During the active braking phase of Stop category 1 (controlled bringing to a stop with safely monitored delay time according to EN60204-1) or safe stop 1, faulty function must be expected. If an error in the drive system occurs during the active braking phase, the axis may trundle to an unguided stop or might even actively accelerate until the expiry of the defined switch-off time.
- As soon as Setup-mode is activated in the PSD ServoManager, the Fieldbus - Interface is deactivated. Then it is not possible to set a braking ramp via fieldbus.

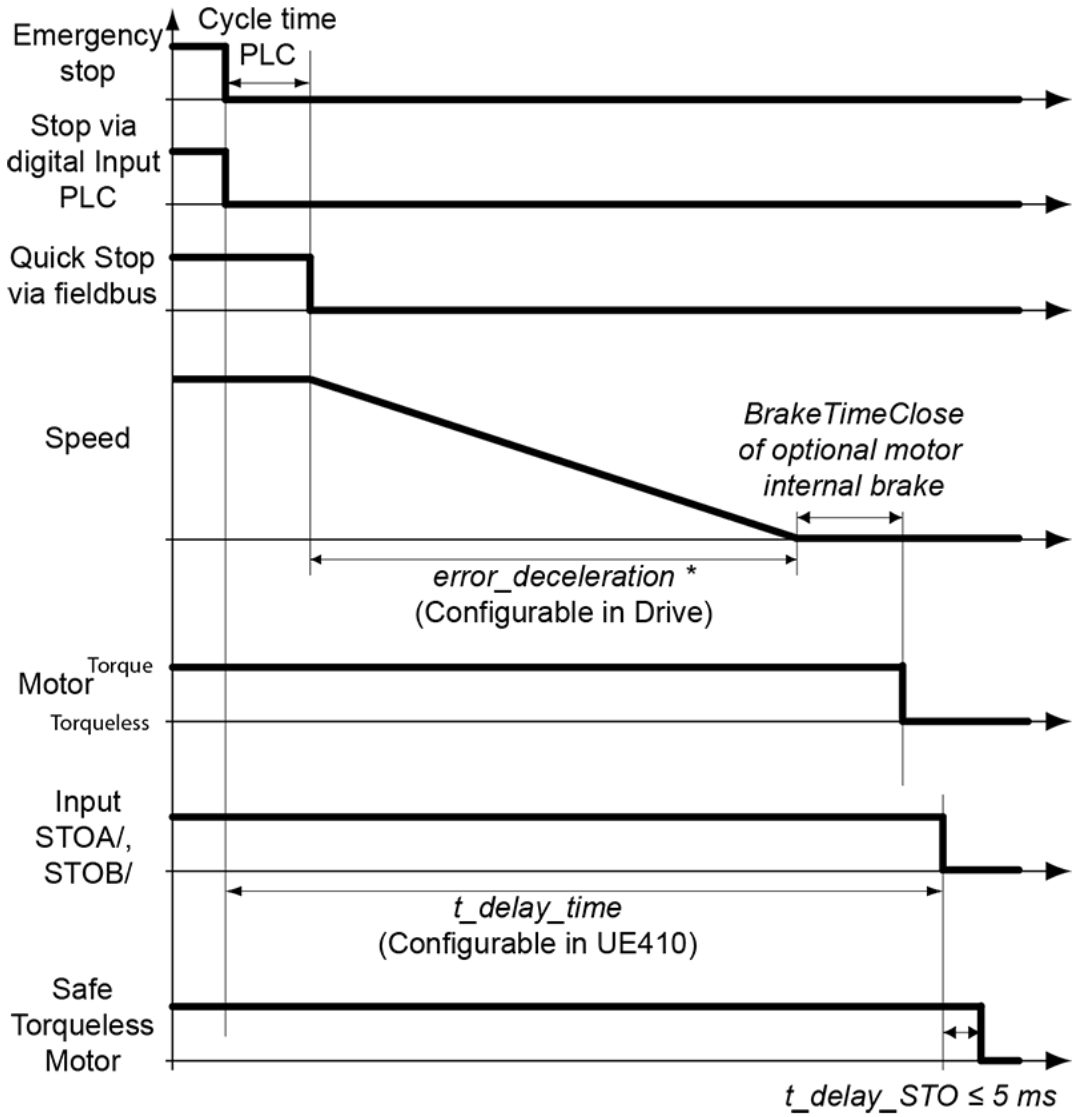
Maintenance

- When using STO a **recorded STO - function test** (see page 110) must be carried out:
  - ♦ After commissioning and
  - ♦ in defined maintenance intervals.

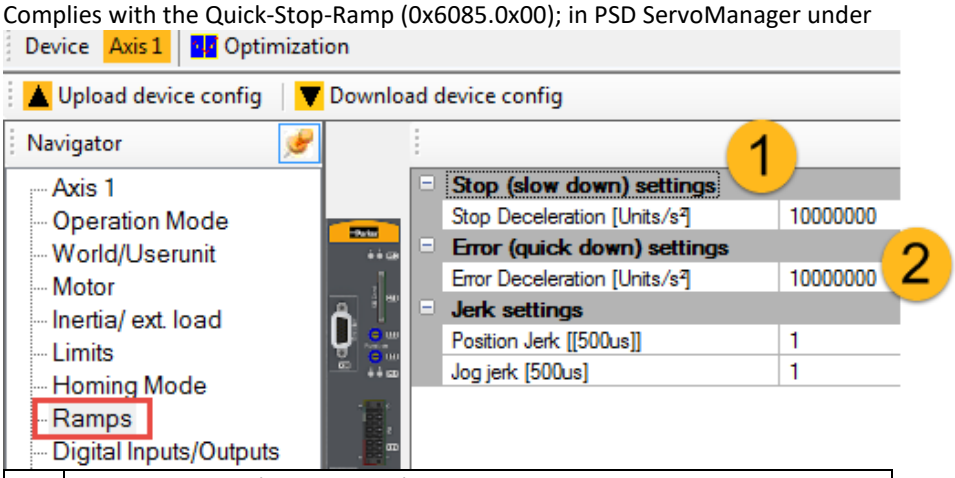
6.4 Conditions of utilization for the STO function

- The STO safety function must be tested and protocoled **as described** (see page 110). The safety function must be requested at least once a week. In safety door applications, the weekly testing interval must not be observed, as you can assume that the safety doors will be opened several times during the operation of the machine.
- The PSD1 with integrated STO safety function as well as the utilized safety switching devices must be mounted protected (IP54 control cabinet).
- Basically there is only a maximum cable lenght of 30 m of STO inputs (X17, X21) alllowed. It's not permitted to route the cables outside.
- Only qualified staff members are permitted to install the STO function and place it in service.
- The X9/2 (GND24V) terminal on the PSD1-M_P mains module respectively the X17.12 (GND24V) terminal on the PSD1-S single device must be connected to the PE protective lead. This is the only way to ensure protection against incorrect operation through earth faults (EN60204-1 Section 9.4.3)!
- When using an external safety control with adjustable delay time, (as illustrated in the STO application example), it must be ensured that the delay time cannot be adjusted by persons not authorized to do so (for example by applying a lead seal). With the UE410-MU safety control, this is not necessary, if the anti manipulation measures are respected.
- The adjustable delay time on the safety control must be set to a value greater than the duration of the braking ramp controlled by the PSD1 with maximum load and maximum speed.
  Otherwise fault 0x5495 may occur.
- All conditions necessary for CE-conform operation must be observed.
- When external forces are applied to the drive axes, additional measures (e.g. additional brakes) are to be taken. Please note in particular the effects of gravity on suspended loads! This must be respected above all for vertical axes without self-locking mechanical devices or weight balance.
- When using synchronous motors, a short movement over a small angle is possible, if two errors occur simultaneously in the power section. This depends on the number of pole pairs of the motor (rotary types: 2 poles = 180°, 4 poles = 90°, 6 poles = 60°, 8 poles = 45 °, Linear motors: 180 ° electric).

6.5 STO delay times



* Complies with the Quick-Stop-Ramp (0x6085.0x00); in PSD ServoManager under



1	= MinSlowDown (0x3428.0x00)
2	= QuickStopDecel (0x6085.0x00)

.

With DS402, QuickStopOptionCode (0x605A.0x00) should be set to standard value 2 so that the motor can be disconnected from the power supply.

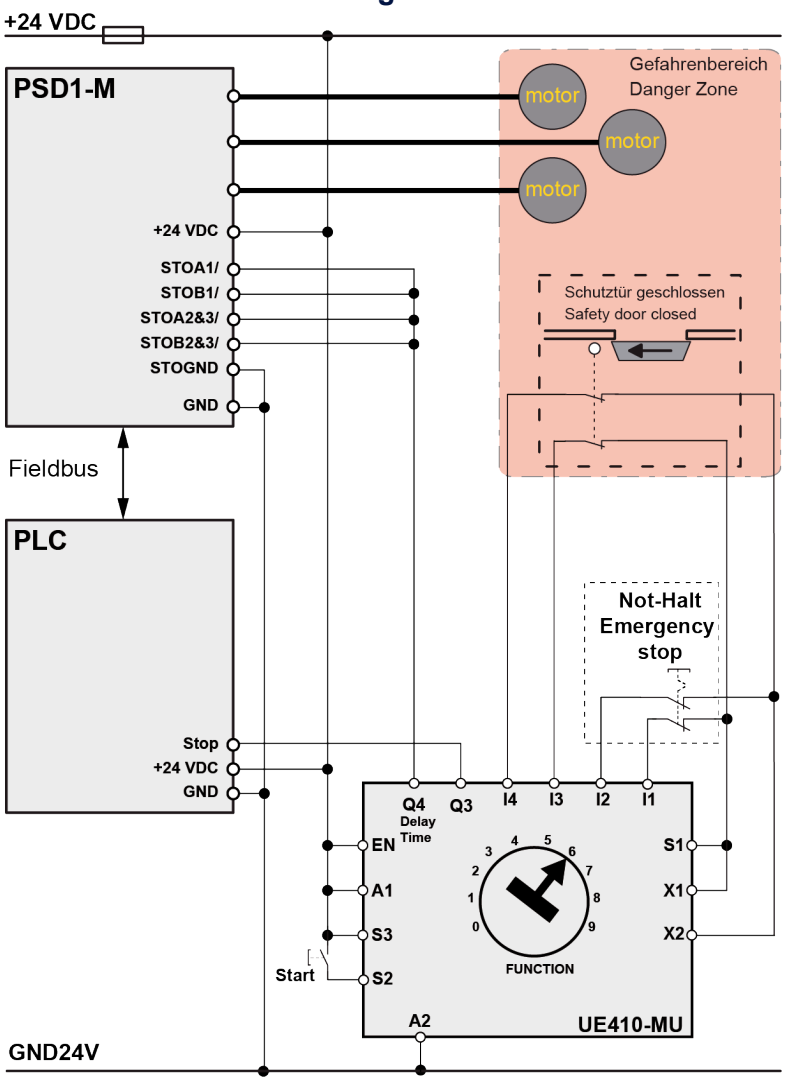
6.6 STO Application examples

6.6.1. STO and SS1 function with external safety control

In this chapter you can read about:

- Circuit Diagram 106
- Description 107
- Functional description 107
- Design Features 107
- Calculation of the total failure probability 108

6.6.1.1 Circuit Diagram



6.6.1.2 Description

The application example demonstrate how a 3-axis PSD1-M servo drive cooperates with the safety control UE410-MU of Sick and with a PLC.
The STO circuit of the 3-axis PSD1-M must support a safe stop 1 of the control with emergency stop (category 3 - PL e). The application example described here corresponds to Stop Category 1 as defined by EN60204-1.
Together with the external safety switching device, the "Safe Stop 1"(SS1) safety function can also be implemented.
A Stop Category 0 in accordance with EN 60204-1 can be implemented, for example by setting the delay time on the safety switching device to 0. The motor torque will then be turned off immediately in 2 channels and will not be able to generate any more torque. Please take into consideration that the motor will not brake and a coasting down of the motor (trundling) may result in hazards. Additionally the motor fixing brake can be damaged at braking. If this is the case, the STO function in stop category 0 is not permitted.

6.6.1.3 Functional description

- Shut-down of the motor is initiated by:
  - ♦ Activating emergency-stop or
  - ♦ Opening the safety door
- The safety control UE410-MU requires a stop from PLC via output Q3.
- Via fieldbus the PLC sends a braking ramp/ stop command to the PSD1-M for all 3 motors.
- After a delay time set in the safety control UE410-MU, STO (channel 1 & 2) is released via output Q4.
- Thus all 3 motors are placed in a moment-free condition (STO). Please take care that object STO_Setup=0 (standard settings) in order to prevent that STO is recognized as fault.
- In the Fieldbus, Status Word Bit 15 STO status is displayed as slowly flashing LED.
- The delay time in the safety control must increased in such a way that, as soon as STO is released, the motors stand still by the braking ramp configured in the drive.
- The acknowledgement (start button) via the safety control UE410-MU is only necessary, if after the disabling of the STO function, a danger to any person or to the machine could arise due to automatic start-up.

6.6.1.4 Design Features

- The contacts of the emergency stop buttons and the safety door need to be designed mechanically in accordance with EN 60947-5-1 appendix K.
- Concerning the delayed STO procedure, the risk must be considered by the machine designer.
- Drive and safety control must be wired in the same control cabinet. Wiring must be in accordance with EN 60204-1.
- The operating instructions of the UE410-MU3T5 safety control must be observed.
- We recommend to use a filter > 3 ms for the signal Q3 in the PLC (stop input) as the safety control UET410-MU regularly modulates test signals on the outputs Q3 and Q4.
- Other safety controls may be used if they fulfill all requirements for category 3 PL=e and dispose of a high-quality error detection with dynamic test pulse. The max. test pulse must be <1 ms / actively low.

6.6.1.5 Calculation of the total failure probability

The failure probability of each of the two STO circuits of the servo drive is 1.0E-09 per hour. Thus the probability of a failure of the entire 3-axis servo drive is 2.0E-09 per hour. The safety control UE410.MU is a certified component. Its failure probability is 6.0E-09 per hour.
At this calculation only the probability of a failure of the emergency stop is considered, not the contact of the safety door. With a B10d value of 100.000 cycles at 240 working days, 16 working hours and at a cycle time of 1 hour, the result for n_{op} is 3840 cycles per year and 260 years for MTTFd. As the safety control disposes of a high-quality error detection with dynamic test pulse for the input signal, a high diagnostic coverage DC for the switches can be set.

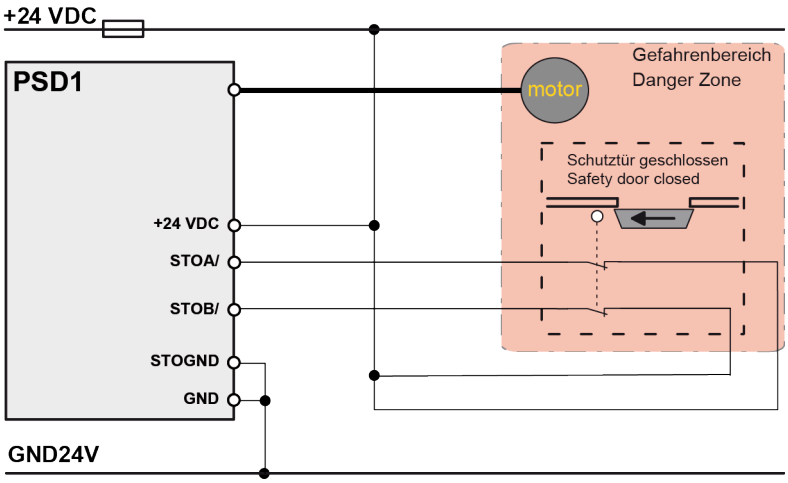
According to Sistema the total failure probability is 3.27E-8 per hour (PL=e).

6.6.2. STO function without external safety control

In this chapter you can read about:

- Circuit Diagram 108
- Functional description 109
- Design Features 109
- Calculation of the total failure probability 109

6.6.2.1 Circuit Diagram



In this example we show how the contacts of the safety door can be wired to the 1-axis PSD1 without the use of a safety control.
A double-channel safety door monitoring or a double-channel emergency stop can be directly wired to the PSD1.
We do not recommend this type of wiring for vertical axes without self-locking mechanics as it may be damaged at braking with the motor holding brake by motor coasting. If this is the case we recommend to use the previous wiring type with safety control.

6.6.2.2 Functional description

- When opening the safety door, the motor is immediately switched to double-channel, moment-free mode; this complies with Stop Category 0 In accordance with EN 60204-1. In case the motor axis is still energized or moving during the triggering of the STO, error 0x5495 is triggered simultaneously. If not, no error is triggered; unless error 0x5492 is triggered at setting STO_Setup=1.
  Basically STO status is displayed in the Fieldbus Status Word Bit 15 and as slowly flashing LED.
- During trundling of the motor the motor brakes of the Parker motor must not be activated as otherwise they can be damaged.
- In case error 0x5492 or 0x5495 are triggered then error must be acknowledged in order to reactivate the drive. The acknowledgement is only permissible with category B. It shouldn't been used if there is a possibility to enter the dangerous area. In this case an external acknowledgement device must be used.

6.6.2.3 Design Features

- The contacts of the emergency stop buttons and the safety door need to be designed mechanically in accordance with EN 60947-5-1 appendix K.
- PSD must be located in a protected area (IP54 control cabinet). Outside this protected area, the line guiding to the external switches must be separated channelwise or must be especially protected.

6.6.2.4 Calculation of the total failure probability

The failure probability of each of the two STO circuits of the servo drive is 1.0E-09 per hour. When calculation the overall failure probability further components of the complete machine such as contacts of the safety door must be considered.
Due to the hardware monitoring in the PSD servo drive, only a medium level of diagnostic coverage DC for the external contacts can be set.

6.7 STO function test

The STO function must be checked in the event of:

- Commissioning
- After each exchange of any equipment within the system
- After each intervention into the system wiring
- In defined maintenance intervals (at least once per week) and after a longer standstill of the machine
  If the STO function was triggered by opening a protective door and if this door is opened several times a week, the weekly testing interval is not required.

The check must be made by qualified personnel adhering to all necessary safety precautions.

The following testing steps must be performed:

STO Test	Action, activity	Expected reaction and effect
1	24 VDC voltage on Connect terminal X17.12* and X17.16* Apply 0 VDC voltage to terminal X17.14*	
2	Switch on supply power and 24 VDC supply voltage	No error must be present
3	Configuring the device	No error must be present
4	Testing active STO on terminal X17.12 and X17.16: Simultaneous removing of 24 VDC on terminal X17.12 and X17.16*	Active STO must be displayed via LED or fieldbus.** No error must be present if object STO_Setup=0. Error message 0x5492 if object STO-Setup=1.
5	Apply again 24 VDC voltage to terminal X17.12 and X17.16 and acknowledge STO afterwards*	No error must be present; torque at the motor should be present.
6	Then switch off and on again 24 VDC voltage supply.	No error must be present

* The same test with terminals X21.12 & X21.16 & X21.14 is necessary for two or three axis controllers.

** With two or three axis controllers STO status for all motors should apply.
A manual check of the torqueless drive is here also sufficient.
The triggering of the STO can also be made by actuating the emergency stop switch.
During the automated test, the STO can also be triggered via the contacts of an external relay

Following the test steps

Once all of the relevant safety test steps have been accomplished, the actions taken must be documented. A protocol specimen can be found in the following section.
Depending on the machine version, additional or other test steps may be required.

6.7.1. STO test protocol specimen

Project/machine:

Name of the tester: _____

Servo axis: _____

Settings
STO_Setup: _____

STO function test:

STO function test steps 1-6: o successfully tested

Safe stop 1: o successfully tested
o is not used

Initial acceptance on: _____

Signature of the tester

Repeat check on: _____

Signature of the tester

6.8 Technical data STO

Category	Specifications	
STO Certificate (http://www.Parker.com/Literature/Electromechanical Europe/Certificates/DOC-0014-01_PSD_STO_Certificate.pdf)	According to EN ISO13849 Device certified if “STO certified” is stated in type plate (below the CE sign)	
Nominal voltage of the inputs	24 VDC	
Required isolation of the 24V control voltage	Grounded protective extra low voltage, PELV	
Fuse protection	Protection of the STO control voltage: 1 A	
Number of inputs **Signal inputs via optocoupler**	2 Low = 0 ... 5 V DC or open High = 15 ... 26.4 VDC I_{in} at 24 VDC: 9 mA +/-1 mA	
STO Input A, Level	Low or open = STO activated High = STO deactivated Reaction time max. 5 ms	
STO Input B, Level	Low or open = STO activated High = STO deactivated Reaction time max. 5 ms	
Switch-off time	Switch-off time with unequal input statuses: 10 s (max. error response time) During the inequality, it is ensured within 5 ms that the motor torque is switched off single-channel.	
Maximum tolerable test pulse time	Maximum tolerable test pulse time (low active) for external safety control: 1 ms	
Grouping of safety level	• Category 3 • PL=e • SIL 3 • PFHd=1.00E-9 per STO circuit • Mission time: 20 years • MTTFd = 800 years (when using EN ISO 13849-1 the MTTFd value must be limited to 100 years)	

7. Accessories

In this chapter you can read about:

- SMH Servo Motors with HIPERFACE DSL® - Feedback 113
- EMC measures 115
- Line choke 123
- External braking resistors 126
- EAM06: Terminal block for inputs and outputs 131
- Interface Cables 131

7.1 SMH Servo Motors with HIPERFACE DSL® - Feedback

Low Inertia Servo Motors - SMH

Product Overview

Description

The SMH Series of highly-dynamic brushless servo motors have been design to combine the cuttingedge technology of Parker Hannifin products with extremely high performance.
Thanks to the innovative "salient pole" technology, the motor's dimensions are considerably reduced with significant advantages in terms of specific torque, overall dimensions and dynamic performance.
Compared to traditional-technology brushless servo motors, the specific torque is approximately 30 % higher, overall dimensions are considerably reduced and, consequently rotor inertias are extremely low.
Thanks to the high quality of Neodymium-Iron-Boron magnets, and also the encapslutation method used to fasten them to the shaft, the SMH motors can achieve very high acceleration and withstand high overloads without risk of demagnetisation or detachement of the magnets.
Specific applications for the SMH Series include all types especially those for the packaging and handling industry, and all those applications where very high dynamic performances and very low inertias are required.



Features

- Single Cable solution (Hiperface DSL® feedback)
- Further Feedback support:
  Resolver, Hiperface and EnDat interface,
  Hall sensors, rotary and linear encoders
- Customised windings/voltages
- Increased Inertia option
- Multiple connection options

Application

- Packaging Machinery
- Food & Beverage
- Pharma
- Material Handling
- Material Forming
- Factory Automation
- In-Plant Automotive
- Robotics
- Printing
- Servo Hydraulic Pumps

Technical Characteristics - Overview

Motor Type	Permanent magnets synchronous servomotor
Rotor Design	Rotor with surface rare earth magnets
Power Range	0.2...9.4 kW
Torque Range	0.5...60 Nm
Speed Range	0...7500 min^{-1}
Mounting	Flange with smooth holes
Shaft End	Plain keyed shaft Plain smooth shaft (option)
Cooling	Natural ventilation
Protection Level (IEC60034-5)	IP64 IP65 (option)
Feedback sensor	Encoder Hiperface DSL® (option S5, S6)
Other options	Brake Thermal protection (PTC) Increased inertia
Marking	CE / UL
Voltage Supply	230 / 400 VAC other voltage under request
Temperature Class	Class F
Connections	Single rotatable connector

7.1.1. Order code of motor cable

	1	2	3	4	5	6	7	8
Ordering example	**CBM**	**015**	**H**	**B**	**C01**	**D01**	**0050**	**00**

1	**Cables**	
	CBM	Motor cable
	CBF	Feedback cable
2	**Cross-section**	
	007	0.75 mm²
	015	1.5 mm²
	025	2.5 mm²
	040	4 mm²
	060	6 mm²
	RE0	Resolver
3	**Cable type**	
	H	high-flex
	T	high temperature (for ATEX motors)
4	**Brake wires**	
	O	Standard
	B	with brake wire
	D	With brake wire and HIPERFACE DSL®
5	**Assembly of motor side**	
	C01	SMH Motor Power - M15
	C02	SMH or MH - M23
	C04	NX Motor Power -M23
	C06	SMH or MH Motor Resolver - M23
	C07	NX2-8 - Resolver Connector - M23
	C11	M15 HIPERFACE DSL® Feedback+Power
	C12	M23 HIPERFACE DSL® Feedback+Power - SMH, NX
	C13	M40 HIPERFACE DSL® Feedback+Power - MH [1)]
	C14	SMH Motor Resolver - M15
	T02	SMx82-100-115 & MB105-205 motor voltage connection box
	T03	EX/EY Motor Power with Hiperface DSL connection box
	T04	EX motor voltage connection box
	T05	EX motor resolver connection box
6	**Assembly of drive side**	
	D01	PSD1-S & PSD1MW1800
	D02	PSD1MW1-3 (without PSD1MW18)
	D03	Resolver/...Feedback
7	**Length [10 cm steps]**	
	0100	Length in 10 cm (max. 50 m) Example: 0025 = 2.5 m, 0205 = 20.5 m, 1020 = 102.0 m Standard lengths [m]: 3 / 5 / 7 / 10 / 12 / 15 / 20 /25 / 30 / 35 / 40 / 45 / 50
8	**Special design**	
	00	Standard

[1)] is required for Mx 205 series motors and Smx 170 with 60 Nm

NOTICE

Follow the notes in the chapters "**Motor connection with self-made motor cable PSD-S** (see page 44)","**Motor connection with self-made motor cable PSD-M** (see page 69)" and "**Motor connection with self-made motor cable PSD-MW1800** (see page 67)"

7.2 EMC measures

In this chapter you can read about:

- Mains filter 115
- motor output choke 118

7.2.1. Mains filter

In this chapter you can read about:

- Mains filters for PSD1-S single-phase ECP-0001-01 115
- Mains filters for PSD1-SW1400 single-phase ECP-0001-03 116
- Mains filters for PSD1-S 3-phases operation ECP-0002-01 116
- Mains filters for PSD1-SW1400 three-phase ECP-0002-02 117
- Mains filters for PSD1-M_P010 and PSD1-M_P020 118

For radio disturbance suppression and for complying with the emission limit values for CE conform operationwe offer mains filters:
Observe the maximum permitted length of the connection between the mains filter and the device:

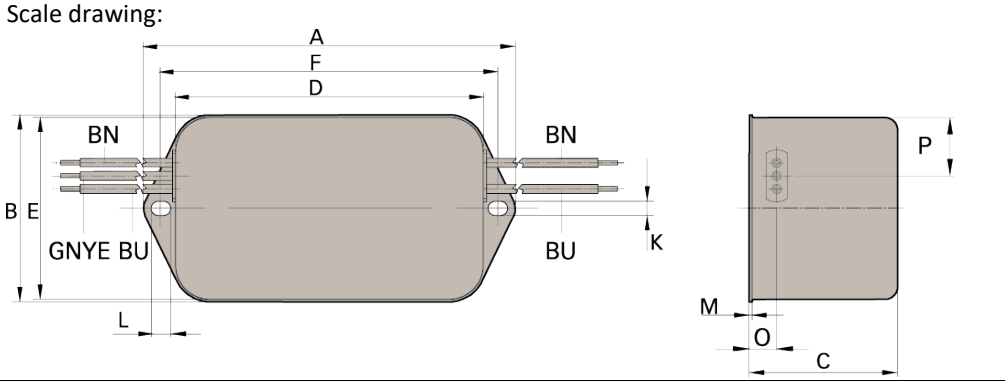
- unshielded <0.5m;
- shielded: <5m (fully shielded on ground e.g. ground of control cabinet)

7.2.1.1 Mains filters for PSD1-S single-phase ECP-0001-01

Mains filters with UL certification for PSD1-S_1200 (2 A) and PSD1-S_1300 (5 A)

Necessary for limit value class C3 (in accordance with EN 61800-3) in single-phase operation with motor cable length > 10 m

Scale drawing:



A	B	C	D	E	F	L	M	O	P
156	57.5	45.4	130.5	56	143	6	1	8.4	18

Stated in mm

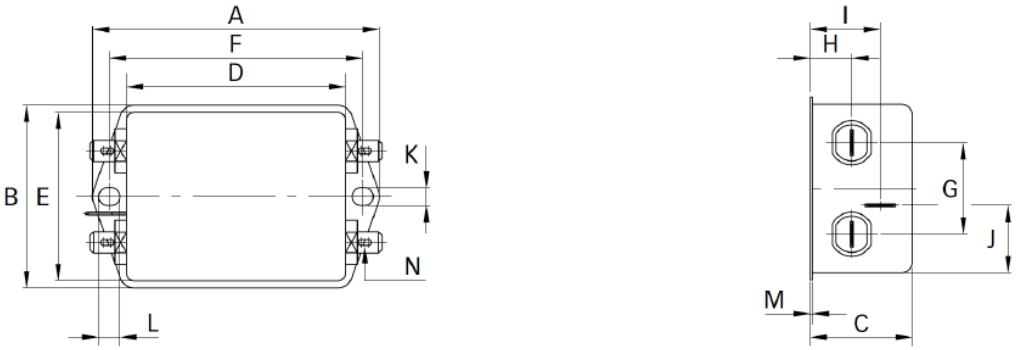
Color code:
BN brown
BU blue
GNYE green-yellow
Weight: 0.67 kg

7.2.1.2 Mains filters for PSD1-SW1400 single-phase ECP-0001-03

Mains filters with UL certification for PSD1-S_1400 (7.5 A)

Necessary for limit value class C3 (in accordance with EN 61800-3) in single-phase operation with motor cable length > 5 m

Scale drawing:



A	B	C	D	E	F	G	H	I	J	K	L	M	N
113,5	57,5	45,4	94	56	103	25	12,4	32,4	15,5	4,4	6	1	6,3x0,8

Stated in mm

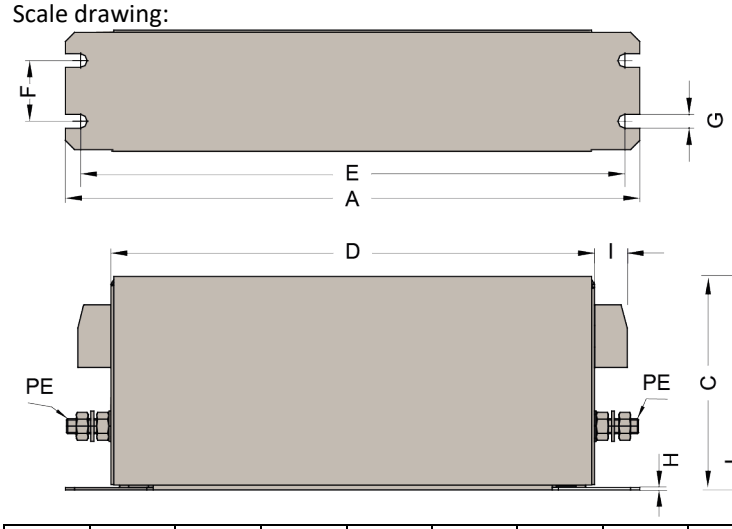
Weight: 0.43 kg
Connections: AWG16
Tightening torque: 1.2 ... 1.3 Nm

7.2.1.3 Mains filters for PSD1-S 3-phases operation ECP-0002-01

Mains filters with UL certification for PSD1-S_1200 (2 A) and PSD1-S_1300 (5 A) for 3-phases operation

Required for limit value class C3 (In accordance with EN 61800-3) in 3-phase operation with motor cable length > 10m

Scale drawing:



O	B	C	D	E	F	G	H	I	PE	K	L
250	45	70	220	235	25	5.4	1	22	M5	22.5	29.5

Stated in mm

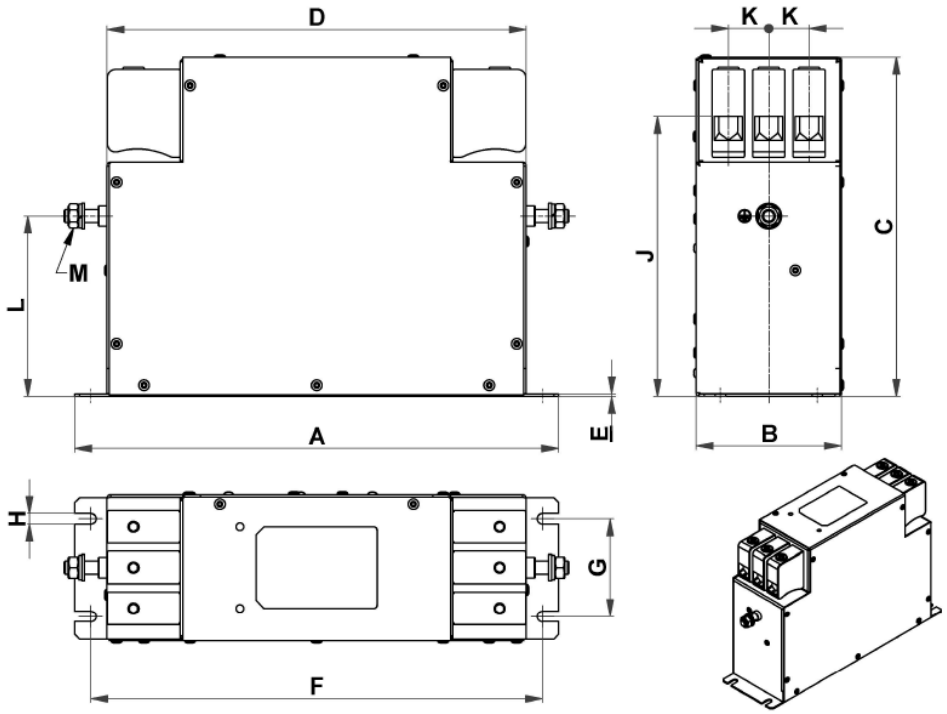
Weight: 0.8 kg
Port Connections: AWG8 (10 mm² rigid, 6 mm² flexible)
tightening torque: 1.5 ... 1.8 Nm

7.2.1.4 Mains filters for PSD1-SW1400 three-phase ECP-0002-02

Mains filters with UL certification for PSD1-S_1400 (7.5 A) in three-phase operation

Required for limit value class C3 (In accordance with EN 61800-3) in 3-phase operation with motor cable length > 5 m

Scale drawing:



A	B	C	D	E	F	G	H	J+/-2	K	L+/-1	M
185	45	120	157	0.8	175	20	4.5	102	11	76	M5

Stated in mm

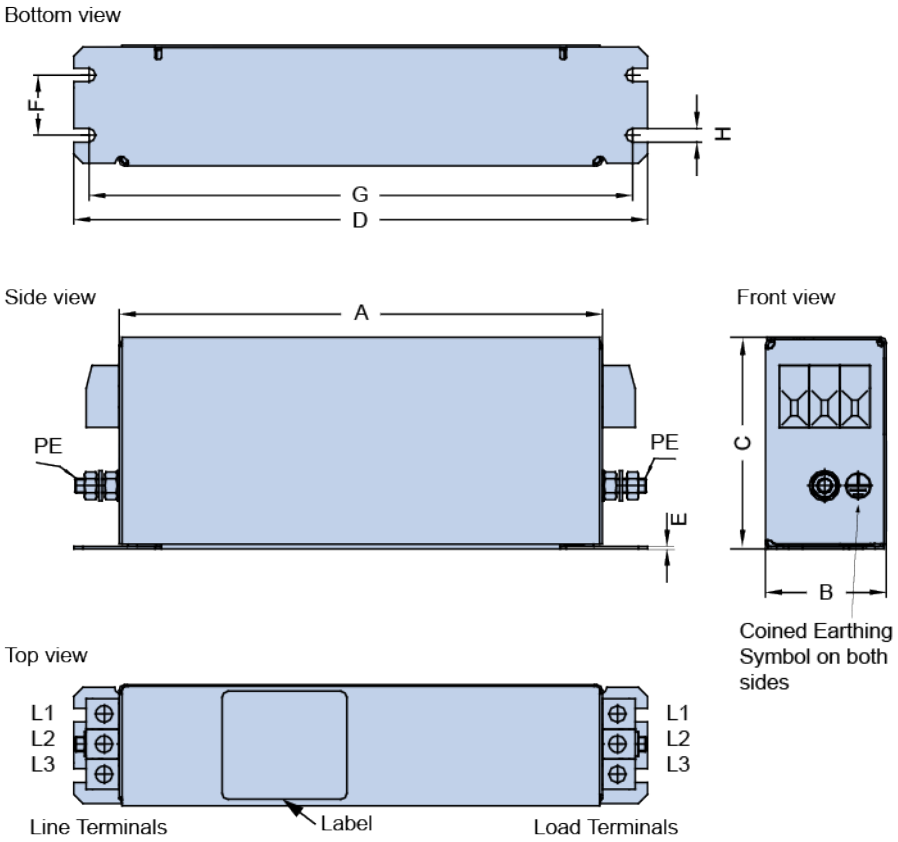
Weight: 0.8 kg
Connections: AWG8 (10 mm² rigid, 6 mm² flexible)
Tightening torque: 1.0 ... 1.2 Nm

7.2.1.5 Mains filters for PSD1-M_P010 and PSD1-M_P020

Mains filters with UL certification

- Mains filter ECP-0003-01 for PSD1-M_P010: Axis system with motor cable up to 6 x 10 m (max. 60 m cable length in total)
- Mains filter ECP-0003-02 for PSD1-M_P010: Axis system with motor cable up to 6 x 50 m (max. 300 m cable length in total)
- Mains filter ECP-0003-03 for PSD1-M_P020: Axis system with motor cable up to 6 x 50 m (max. 300 m cable length in total)

Scale drawing:



Filter type	A	B	C	D	E	F	G	H	Weight	GND(I)	Connection clamp
	mm								kg		
ECP-0003-01	240	50	85	270	0.8	30	255	5.4	1.5	M5	10mm²
ECP-0003-02	305	60	150	335	1.0	35	320	6.4	3.05	M5	10mm²
ECP-0003-03	220	85	90	250	1.0	60	235	5.4	2.4	M6	16mm²

7.2.2. Motor output choke

In this chapter you can read about:

- Motor output chokes ECM-0005-01 for PSD1-S (up to 7 A/ 1 mH)..... 119
- Motor output chokes ECM-0005-02 for PSD1-S (up to 8 A/ 2 mH))..... 120
- Output motor chokes ECM-0004-01 for PSD1-M (up to 6.3 A/ 3.6 mH)..... 120
- Motor output chokes ECM-0001-01 for PSD1-M (up to 16 A 2 mH) 121
- Motor output chokes ECM-0002-01 for PSD1-M (up to 30 A/ 1.1 mH) 121
- Wiring of the motor output filter..... 122

We offer motor output chokes for disturbance suppression when the motor connecting cables are long.

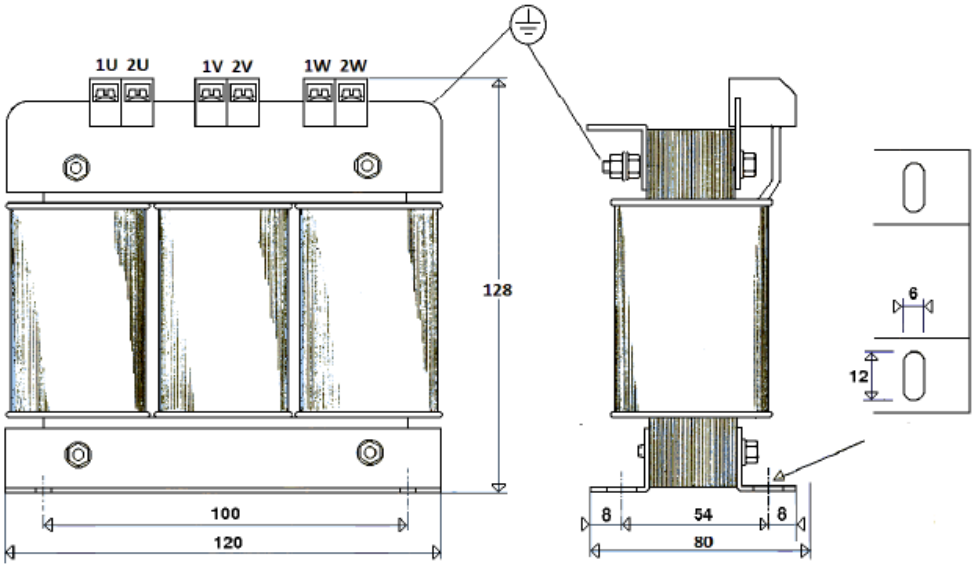
7.2.2.1 Motor output chokes ECM-0005-01 for PSD1-S (up to 7 A/ 1 mH)

For motor cable length > 50m

Inductance	1 mH
Rated current	7 A
Protection class	Not defined
Ambient temperature	0 - 40 °C
Max. Elevation of operating site	1000 m above sea level
Weight	2.5 kg

Up to 7 A nominal motor current (1 mH)

Scale drawing:



Stated in mm

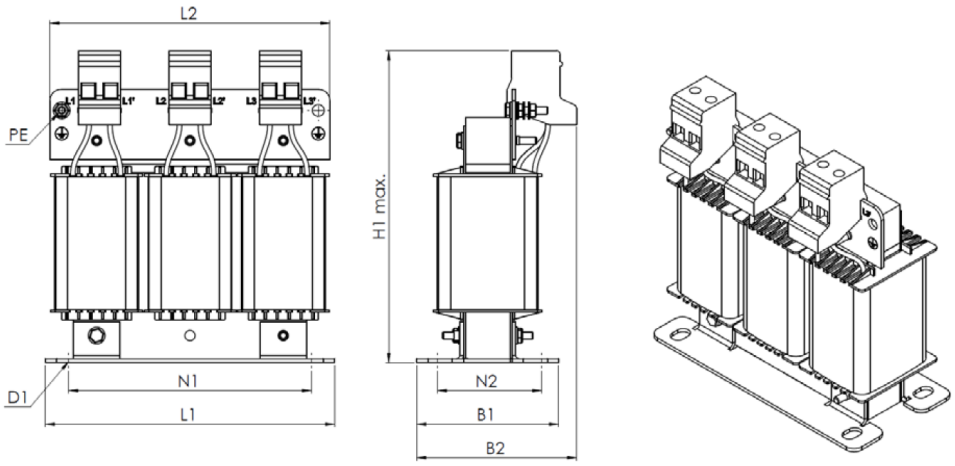
7.2.2.2 Motor output chokes ECM-0005-02 for PSD1-S (up to 8 A/ 2 mH))

For motor cable length > 50 m

Inductance	2 mH
Rated current	8 A
Protection mode	Not defined
Ambient temperature	0 - 40 °C
Max. elevation of operating site	Not defined
Weight	2.0 kg

to 8 A rated motor current (2 mH)

Scale drawing:



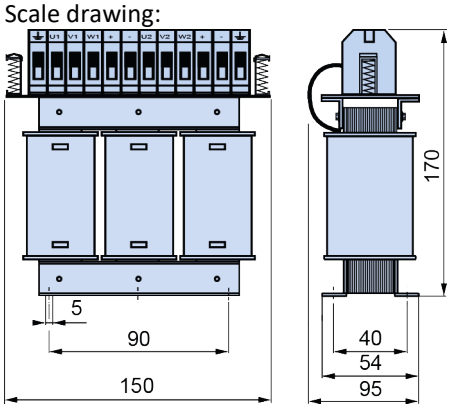
L1	L2	W1	W2	H1	N1	N2	D1	PE
80	96	45	55	110	56	34	5x8	M4

7.2.2.3 Output motor chokes ECM-0004-01 for PSD1-M (up to 6.3 A/ 3.6 mH)

For motor cable length > 20m

Inductance	3.6 mH
Rated current	6.3 A
Protection	IP00
Ambient temperature	0 -40 °C
Max. Elevation of operating site	1000 m above sea level
Weight	3.2 kg

Scale drawing:



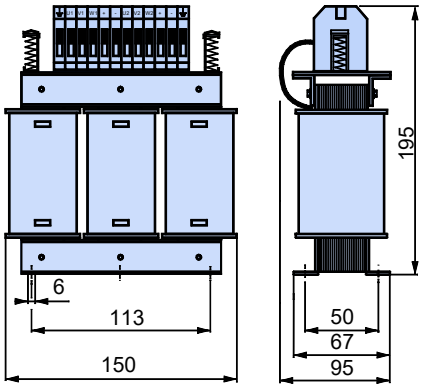
Stated in mm

7.2.2.4 Motor output chokes ECM-0001-01 for PSD1-M (up to 16 A 2 mH)

For motor cable length > 20m

Inductance	2 mH
Rated current	16 A
Protection class	IP00
Ambient temperature	0 -40 °C
Max. Elevation of operating site	1000 m above sea level
Weight	4 kg

Scale drawing:



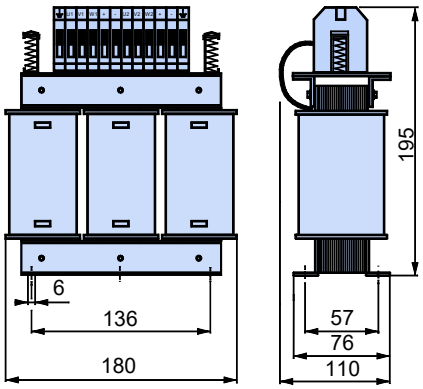
Stated in mm

7.2.2.5 Motor output chokes ECM-0002-01 for PSD1-M (up to 30 A/ 1.1 mH)

For motor cable length > 20m

Inductance	1.1 mH
Rated current	30 A
Protection	IP00
Ambient temperature	0 -40 °C
Max. Elevation of operating site	1000 m above sea level
Weight	7 kg

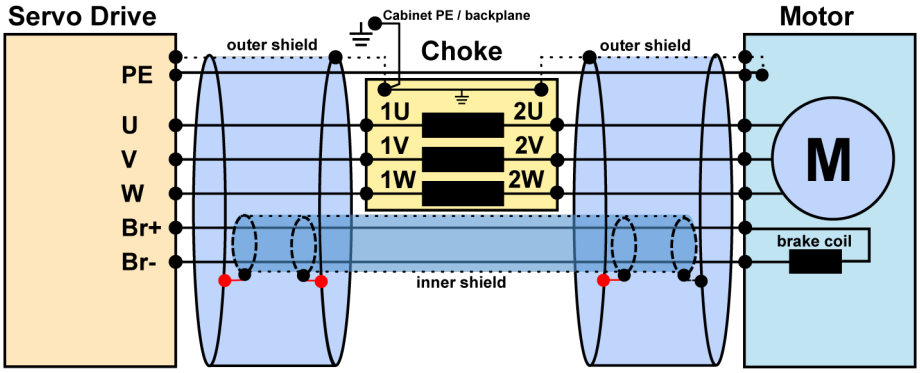
Scale drawing:



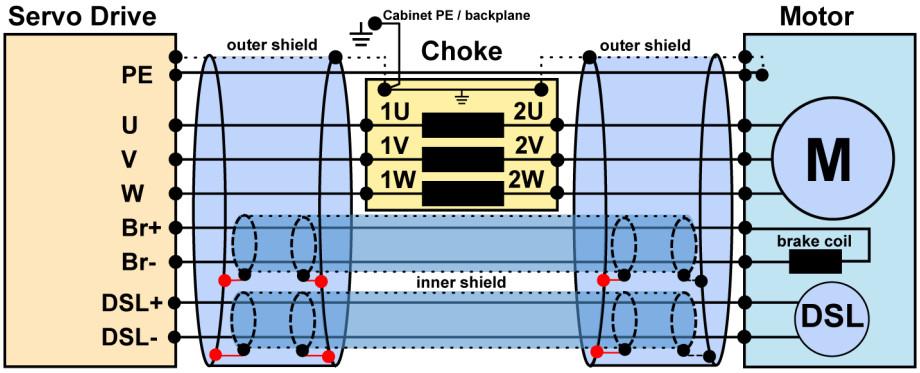
Stated in mm

7.2.2.6 Wiring of the motor output filter

Wiring using a standard motor-cable:



Wiring using HIPERFACE DSL® Feedback:

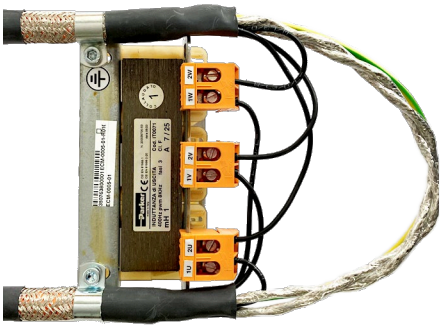


NOTICE

Please note the following instructions if you are using the hybrid cable with DSL lines with a **motor choke**:

- The DSL cable must not be cut (also or especially the DSL cable shield must remain intact).
  In case of a motor with brake, the same applies to the brake control line in the hybrid cable.
- A shield connection of the complete outer shield and DSL shield must be ensured at the input and the output side of the motor choke (e.g. braiding the cable, soldering or connecting by using self-adhesive EMC copper tape).
- The motor cable shield must not be interrupted at the motor choke. This is ensured by using the ground cable shield clamps of the motor choke at the input and the output side.
- Make sure that the shielding is carried out over a large area!
- The overall connection between choke & motor has to be done by a modified **DSL motor cable** (see page 114) (CBMxxxH...).

Example of a possible wiring of a hybrid cable using a motor choke:



7.3 Line choke

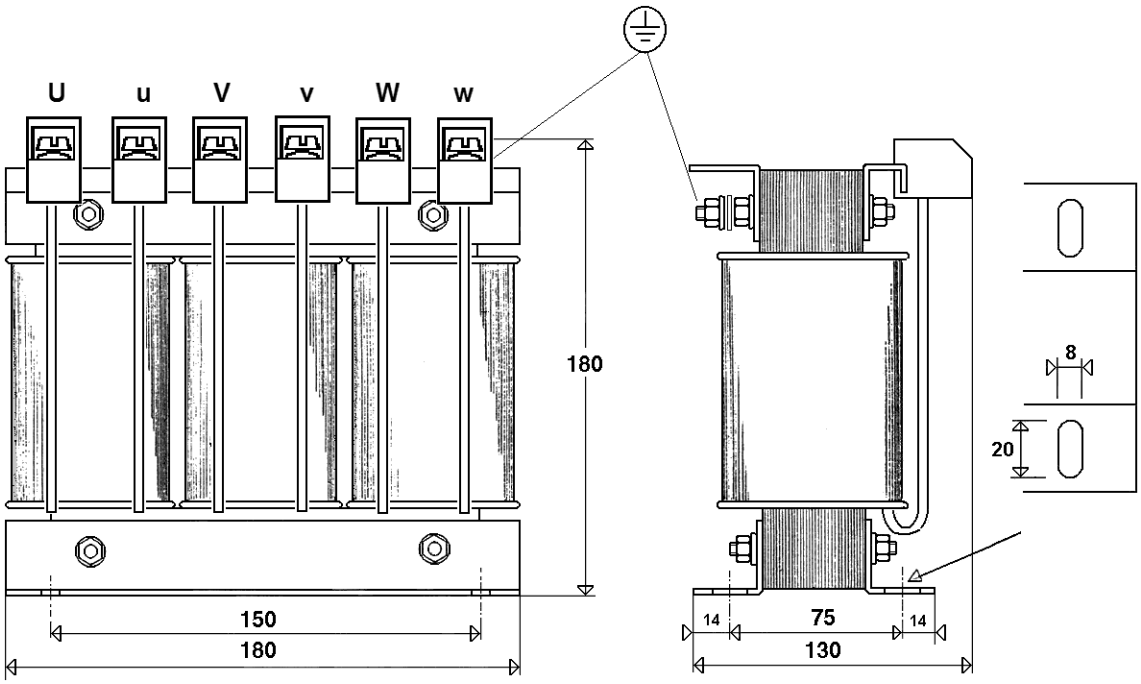
In this chapter you can read about:

- Line choke für PSD1-M_P010: 0.86 mH / 30 A 124
- Line choke for PSD1_M_P020: 0.45 mH / 55 A 124

7.3.1. Line choke für PSD1-M_P010: 0.86 mH / 30 A

By means of the line choke IND-0001-02 (with UL certification) the output performance of PSD1-M_P010 can be increased by 50 %. Line chokes for reducing the low-frequency interferences on the mains side.
0.86 mH / 30 A

Scale drawing: IND-0001-02



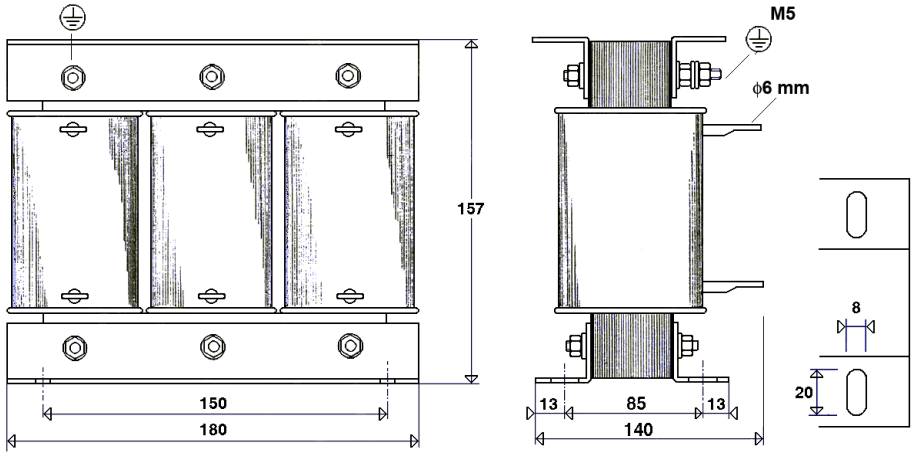
Weight: 8 kg

7.3.2. Line choke for PSD1_M_P020: 0.45 mH / 55 A

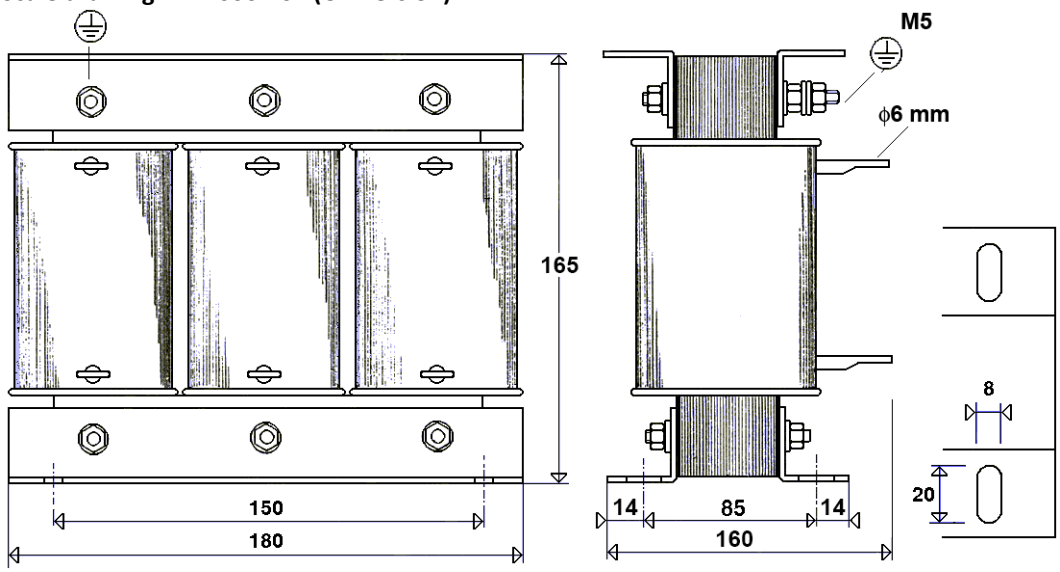
By means of the line choke IND-0002-01 (with UL certification) resp. IND-0002-02 (mit UL certification), the output performance of PSD1-M_P020 can be increased by 50 %. Line chokes for reducing the low-frequency interferences on the mains side.
We offer the following line chokes:

- IND-0002-01: 0.45 mH / 55 A / 10 kg
- IND-0002-02: 0.45 mH / 55 A / 9 kg / UL

Scale drawing: IND-0002-01



Scale drawing: IND-0002-02 (UL-Version)



7.4 External braking resistors

In this chapter you can read about:

- Overview Braking Resistors PSD1 126
- Braking resistor ACB-0004-01 127
- Braking resistor ACB-0005-01 & ACB-0005-02 128
- Braking resistor ACB-0001-1 and ACB-0002-1 129
- Braking resistor ACB-0003-01 for PSD1-M_P020 130

⚠DANGER **Hazards when handling ballast resistors!**
Housing temperature up to 200°C!
Dangerous voltage!
The device may be operated only in the mounted state!
The external braking resistors must be installed such that protection against contact is ensured (IP20).
Install the connecting leads at the bottom.
The braking resistors must be grounded.
We recommend to use a thrust washer for the ACB-0001-01 and ACB-0002-01.
Observe the instructions on the resistors (warning plate).

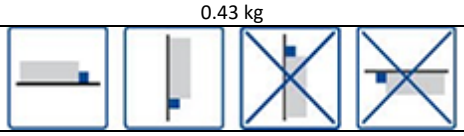
Note that a length of the cable >2 m is not permitted!

⚠WARNING When mounting the brake resistor, please observe the expansion of the housing of max. 0.85 mm / 100 mm due to heating (mounting with fixed and floating bearings).
Mount the resistors in such a way that supply and extract air access is possible in order to avoid heat accumulation. Resistors need to be protected by respective protective measures.
The resistors with the thermal contact surface are to be mounted continuously to a flat clamping area.

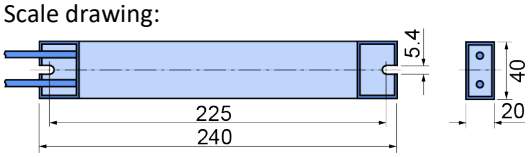
7.4.1. Overview Braking Resistors PSD1

Category	Specification		
Brake resistor **(see page 126)**	**Device**	**Nominal power rating**	**UL certification**
ACB-0004-01 (51 Ω) **(see page 127)**	PSD1-S_1200 / 1300	100 W	With UL
ACB-0005-01 (56 Ω) **(see page 128)**	PSD1-S_1200 / 1300	120 W	With UL
ACB-0005-02 (56 Ω) **(see page 128)**	PSD1-S_1200 / 1300 / 1400	190 W	With UL
ACB-0001-01 (30 Ω) **(see page 129)**	PSD1-S_1400 PSD1-M_P010 PSD1-M_P020 with 2x30 Ω parallel	400 W 2*400 W	With UL
ACB-0002-01 (15 Ω) **(see page 129)**	PSD1-M_P010 with 2x15 Ω in series PSD1-M_P020	2*400 W 400 W	With UL
ACB-0003-01 (15 Ω) **(see page 130)**	PSD1-M_P020	1500 W	Without UL

7.4.2. Braking resistor ACB-0004-01

Pulse power (W) Tu ~ 40 °C *referring to a cycle time of120 s (reference value)	**ED 6 %***	900
	ED 15 %*	500
	ED 25 %*	300
	ED 40 %*	200
Nominal continuous output (W) Ta ~ 40°C		100
Nominal resistance value at 20°C		51 Ω
Nominal tolerance at 20°C		±10%
Type of protection (EN 60529) (in the corresponding bolted state)		IP 65
Max. permitted operation voltage		UL 1000 V
Cooling		Natural convection
Housing temperature at a continuous nominal output Tu ~ 40 °C		approx. 180 °C
Electrical connection		2x AWG 14 / l=25 cm
Operating temperature range		-25 ... +40 °C
Test voltage		2.7 kV AC 1 s
Certification / Marking		UL; CSA
Weight		0.43 kg
Mounting positions		

Scale drawing:

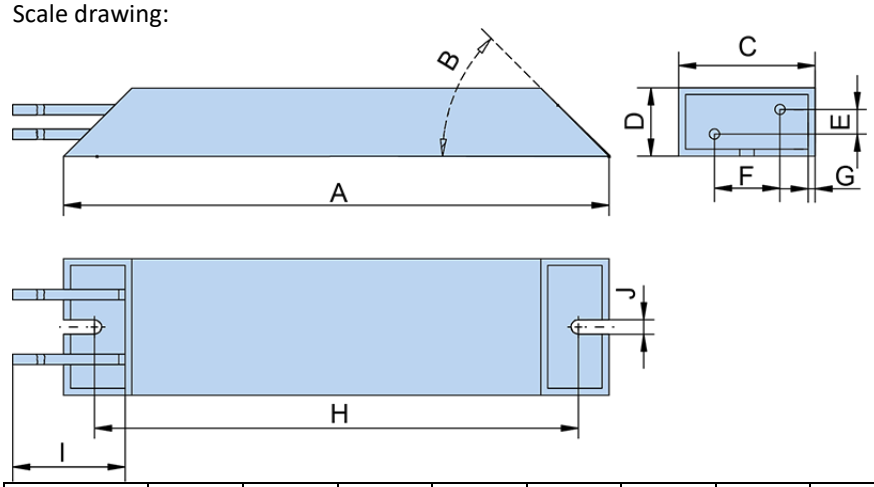


Stated in mm

7.4.3. Braking resistor ACB-0005-01 & ACB-0005-02

	Type:	ACB-0005-01	ACB-0005-02
Pulse power (W) Tu ~ 40 °C *referring to a cycle time of120 s (reference value)	**ED 6 %***	984	1558
	ED 15 %*	504	798
	ED 25 %*	360	570
	ED 40 %*	264	418
Nominal continuous output (W) Ta ~ 40°C		120	190
Nominal resistance value at 20°C		56 Ω	
Nominal tolerance at 20°C		±10%	
Type of protection (EN 60529) (in the corresponding bolted state)		IP 54	
Max. permitted operation voltage		UL 800 V	
Cooling		Natural convection	
Housing temperature at a continuous nominal output Tu ~ 40 °C		approx. 200 °C	
Electrical connection		2x AWG 18/19 / l=50 cm	
Operating temperature range		-30 ... +40 °C > 40 °C 4% reduction per 10 K	
Test voltage		4.2 kV DC	
Certification / Marking		UL; CSA	
Weight		0.34 kg	0.515 kg
Mounting positions			

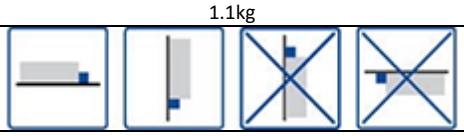
Scale drawing:



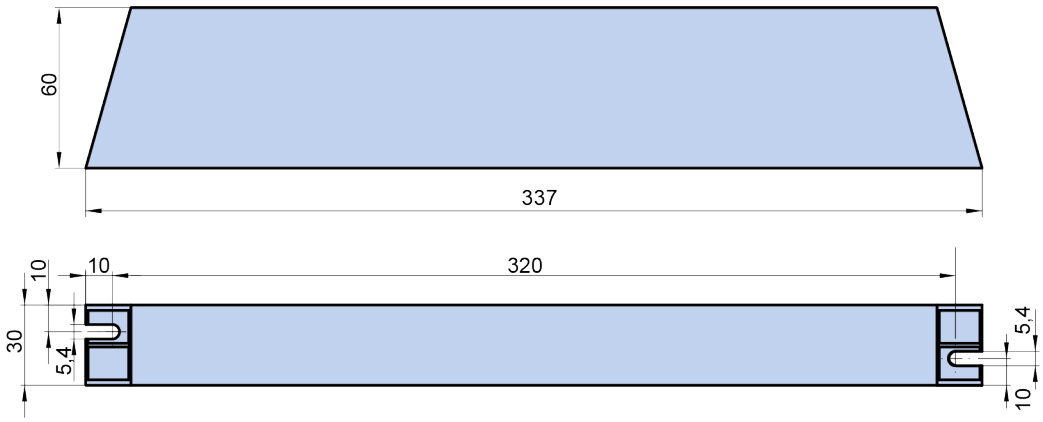
Dimensions	O	B	C	D	E	F	G	H	J
ACB-0005-01	240	45	40	20	6.2	18.2	2	222	4.3
ACB-0005-02	360	45	40	20	6.2	18.2	2	342	4.3

Stated in mm

7.4.4. Braking resistor ACB-0001-1 and ACB-0002-1

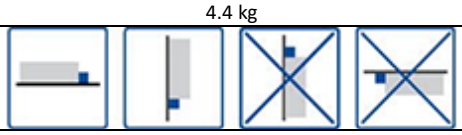
Pulse power (W) Tu ~ 40 °C *referring to a cycle time of120 s (reference value)	**ED 6 %***	3600
	ED 15 %*	2000
	ED 25 %*	1200
	ED 40 %*	800
Nominal continuous output (W) Ta ~ 40°C		400
Nominal resistance value at 20°C		ACB-0001-01: 30 Ω ACB-0002-01: 15 Ω
Nominal tolerance at 20°C		±10%
Type of protection (EN 60529) (in the corresponding bolted state)		IP 54
Max. permitted operation voltage		UL 600 / 1000 V
Cooling		Natural convection
Housing temperature at a continuous nominal output Tu ~ 40 °C		approx. 340 °C
Electrical connection		2x AWG 16 / l=25 cm
Operating temperature range		-25 ... +40 °C
Test voltage		2.7 kV AC 1 s
Certification / Marking		UL; CSA
Weight		1.1kg
Mounting positions		

Scale drawing:

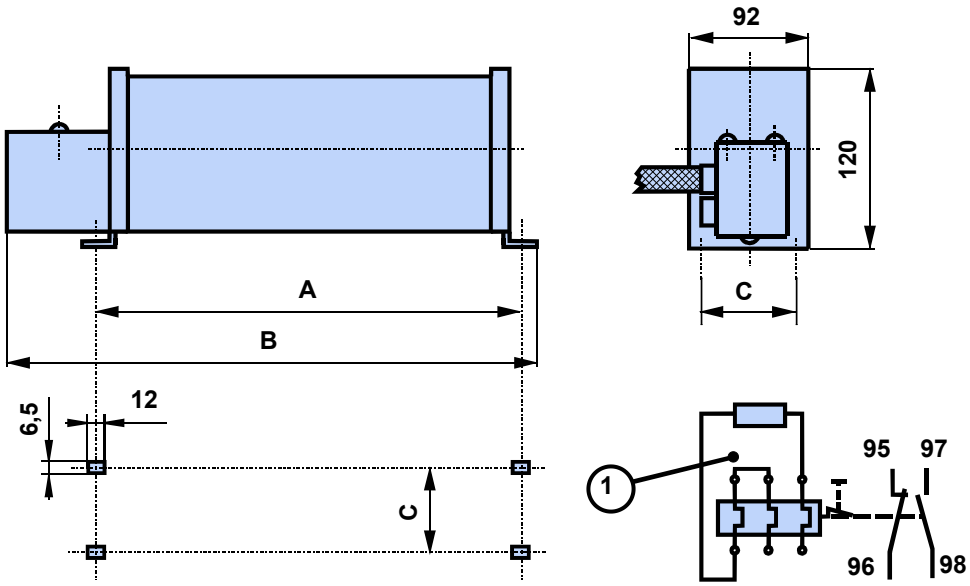


Stated in mm

7.4.5. Braking resistor ACB-0003-01 for PSD1-M_P020

Pulse power (W) Tu ~ 40 °C *referring to a cycle time of120 s (reference value)	**ED 1%***	30.0
	ED 6%*	12.0
	ED 15%*	6.8
	ED 25%*	4.5
	ED 40%*	3.2
	ED 60%*	2.3
Nominal continuous output (W) Ta ~ 40°C		1.5
Nominal resistance value at 20°C		15 Ω
Nominal tolerance at 20°C		±10%
Type of protection (EN 60529) (in the corresponding bolted state)		IP 20
Max. permitted operation voltage		600 VAC or 800 V DC
Cooling		Natural convection
Electrical connection		on the thermal current overload cut-off 2.5 mm²
Operating temperature range		+5 ... +40 °C
Test voltage		2.5 kV AC
Certification / Marking		CE
Weight		4.4 kg
Mounting positions		

Scale drawing:



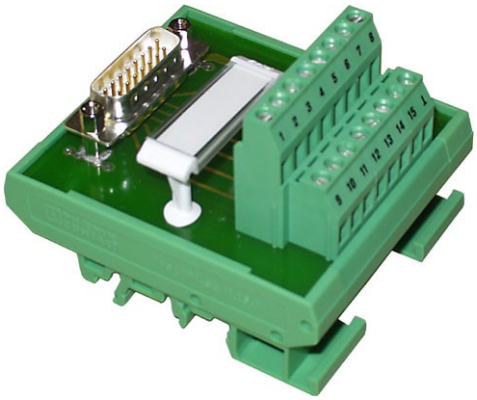
1: thermal overcurrent relay

		ACB-0003-01
O	mm	540
B	mm	620
C	mm	64

7.5 EAM06: Terminal block for inputs and outputs

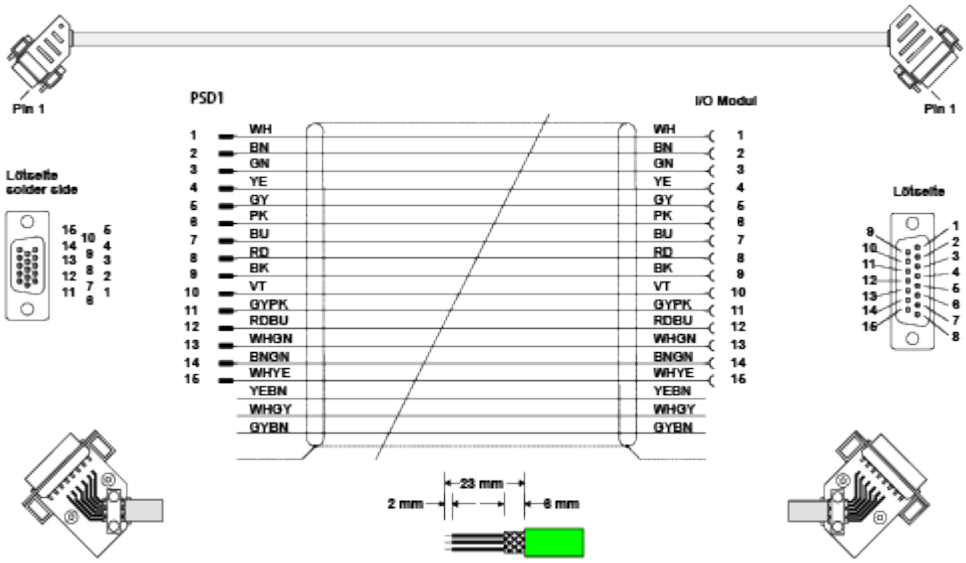
With the EAM06/01 terminal block, you can route the PSD connector X31/X38 to a terminal strip and a Sub-D plug connector for further wiring. The PSD can be connected to this terminal block via the SSK23 connection cable.
The terminal block sits on a mounting rail, which can be used to attach it to a mounting rail in the control cabinet.

EAM6/01: Terminal block for X31/X38



Width: 67.5 mm

Cable plan SSK23/..: X31/38 on EAM 06/01



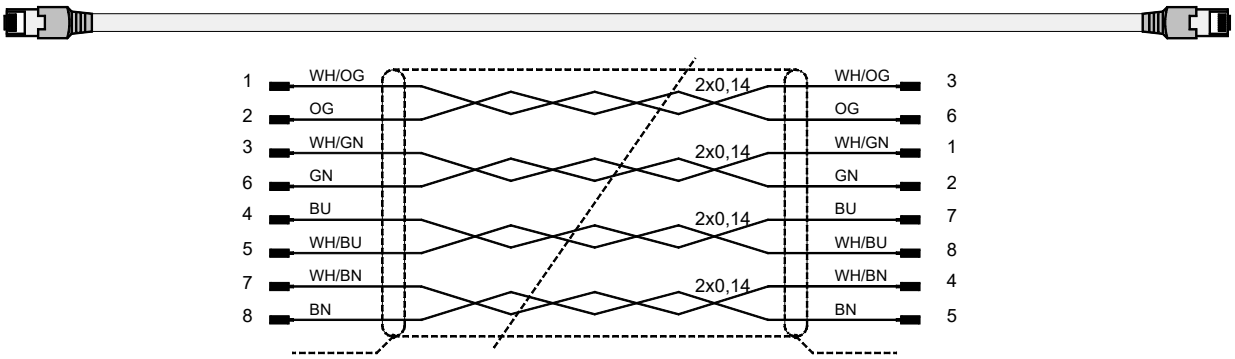
7.6 Interface Cables

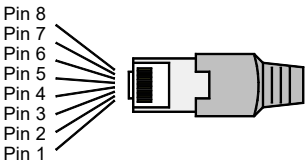
In this chapter you can read about:

- Ethernet Cable 132
- Ref X31 / X38 - SSK21 132
- Encoder coupling of 2 PSD axes / SSK29 133

7.6.1. Ethernet Cable

Ethernet - Crossover - cable Cat5e



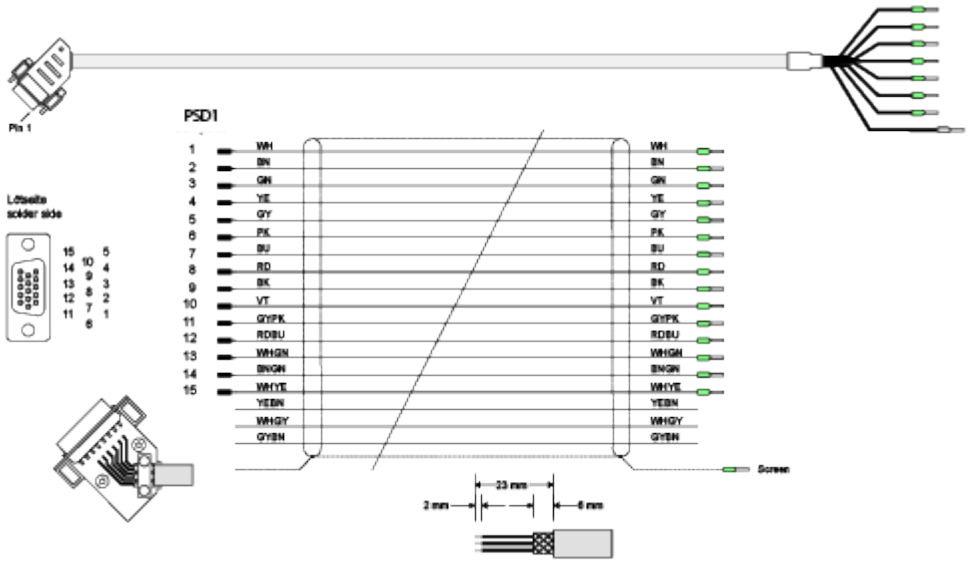


Length code des Ethernet - Crossover - cables

0.25 m	SSK28/20
0.5 m	SSK28/21
1 m =	CBD000D0-T00-T00-0010-00

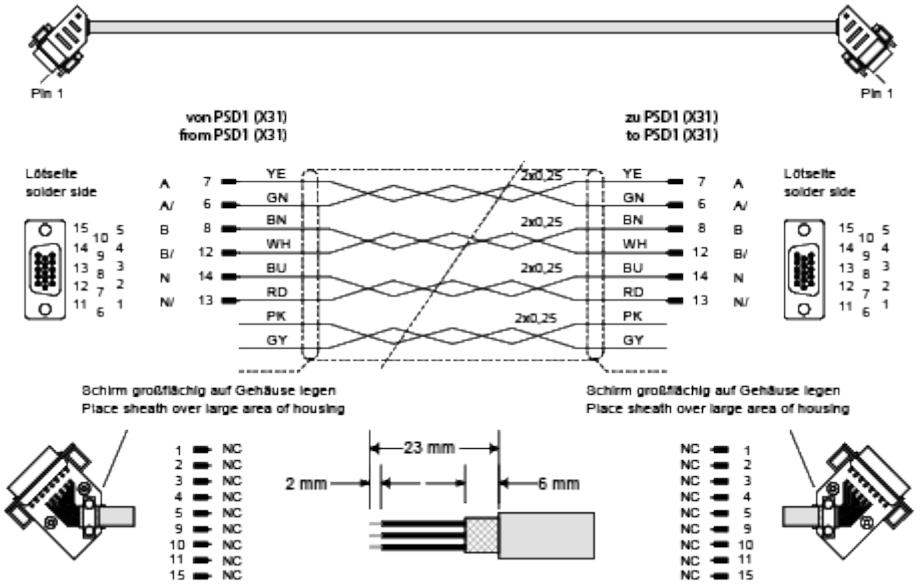
7.6.2. Ref X31 / X38 - SSK21

SSK21/..: cable for X31 / X38 with open ends



7.6.3. Encoder coupling of 2 PSD axes / SSK29

SSK29/..: Cable from PSD X31/X38 to PSD X31/X38



8. Technical data

8.1 PSD1-S: Single device

In this chapter you can read about:

- Mains connection PSD1-S 134
- Output data PSD1-S 1/3*230 VAC 135
- Control Voltage 24 VDC PSD1-S 135
- Braking operation PSD1-S 135
- Size / weight of PSD1-S 136

8.1.1. Mains connection PSD1-S

Category	Specification		
PSD1-S	**PSD1-S_1200**	**PSD1-S_1300**	**PSD1-S_1400**
Mains voltage	AC single-phase (1 AC) or AC three-phase (3 AC) Technically permissible voltage range: 30 ... 253 VAC / 50-60 Hz Voltages previously supported in ServoManager: 1* or 3* 230 VAC ±10% 1* or 3* 208 VAC ±10% 1* or 3* 110/115 VAC ±10% (Operation on DC direct voltage may be possible after checking the technical details with Parker Support)		
Input current	1AC230V: 6.8 Arms 3AC230V: 1.7 Arms	1AC230V: 11 Arms 3AC230V: 4.2 Arms	1AC230V: 13.2 Arms 3AC230V: 6.7 Arms
Maximum fuse per device*	Single phase: 8 A Device protection: fuse 8A gS (gRL), time delay Line protection: S202U-K8 (ABB) / 5SJ4208-8HG42 (SIEMENS)	Single-phase: 12 A Device protection: fuse 12A gS (gRL), time delay Line protection: S202U-K16 (ABB) / 5SJ4216-8HG42 (SIEMENS)	Single-phase: 16 A Device protection: fuse 16A gS (gRL), time delay Line protection: S202U-K16 (ABB) / 5SJ4216-8HG42 (SIEMENS)
	3-phase: 3 A Device protection: fuse 3A gS (gRL), time delay Line protection: S202U-K4 (ABB) / 5SJ4304-8HG42 (SIEMENS)	3-phase: 6 A Device protection: fuse 6A gS (gRL), time delay Line protection: S202U-K10 (ABB) / 5SJ4308-8HG42 (SIEMENS)	3-phase: 8 A Device protection: fuse 8A gS (gRL), time delay Line protection: S202U-K10 (ABB) / 5SJ4310-8HG42 (SIEMENS)
Earth leakage current	**Current on the mains PE** (see page 27) (>3.5 mA)		
Supply networks	**Possible supply networks** (see page 27): TN		

* Fuses for operation in accordance with CE.
Fuses for UL and CSA in the **UL chapter** (see page 19, see page 23).

Please observe the notes in chapter "Operating conditions for CE-conform operation **(see page 15)".**

8.1.2. Output data PSD1-S 1/3*230 VAC

Category		Specification		
Device type		**PSD1-S_1200 (2 A)**	**PSD1-S_1300 (5 A)**	**PSD1-S_1400 (7.5A)**
Output voltage		3 x 0 ... 230 V ±10 %		
Output current [1]				
$I_{Nominal}$ [Arms]	**4 kHz**	2	5	7.5
I_{Peak} (2 s) [Arms] [2]	**4 kHz**	6	15	20
$I_{Nominal}$ [Arms]	**8 kHz**	**2**	**5**	**7.5**
I_{Peak} (2 s) [Arms] [2]	**8 kHz**	**6**	**15**	**20**
$I_{Nominal}$ [Arms]	**16 kHz**	1.332	3.33	5.62
I_{Peak} (2 s) [Arms] [2]	**16 kHz**	3.996	9.99	15
Power at continuous operation		0.64 kW (3-phase mains supply) 0.64 kW (single-phase mains supply)	1.6 kW (3-phase mains supply) 1.6 kW (single-phase mains supply)	2.5 kW (3-phase mains supply) 2.5 kW (single-phase mains supply)
Switching frequency of the motor current		8 kHz	8 kHz	8 kHz
Heat dissipation for In		13 W	35 W	260W

[1] Output current at different switching frequency. The default settings of the currents und switching frequencies are grayed out & in bold.

[2] "Duty Cycle": 10% @10 s (ON=1.0 s - OFF=9.0 s)

8.1.3. Control Voltage 24 VDC PSD1-S

Category	Specifications
Voltage operating range	21.6 - 27.0 VDC (24 VDC -10% +12.5%)
Ripple	0.5 Vpp
Requirement according to safe extra low voltage (PELV)	yes (class 2 mains module)
Electric current drain	0.5 A + Output current of digital output currents (fed via connectors X17/2, 3) + Output current of motor brakes (fed via connectors X51/1 & 2)) + Current requirements of optional boards

8.1.4. Braking operation PSD1-S

Category	Specification		
Controller type	**PSD1-S_1200 (2 A)**	**PSD1-S_1300 (5 A)**	**PSD1-S_1400 (7.5 A)**
Capacity / storable energy	760 µF / 15 Ws	1140 µF / 23 Ws	1680 µF / 33 Ws
Minimum braking resistance	51 Ω	51 Ω	30 Ω
Maximum current	7.84 A	7.84 A	13.33 A

Data of the integrated braking resistor PSD1-S

Category	Specification			
Device	**Maximum current**		**Max. duty cycle**	**Resistance value, Nominal power rating**
	Peak	**Duration**		
PSD1-SW1200 PSD1-SW1300	7.84 A	0.1 A	1.27% @ 60 s	51 Ω, 40 W

No internal braking resistor is integrated in the PSD1-SW1400.

External ballast resistors from Parker **(see page *126*)**.

8.1.5. Size / weight of PSD1-S

Category	Specification	
Controller type	Weight [kg]	Dimensions Height x Width x Depth [mm]
PSD1-S_1200	1.33	200 x 50 x 180
PSD1-S_1300		
PSD1-S_1400	1.6	200 x 65 x 180

Assembly (see page 31)

8.2 PSD1-M: Multi-axes system

In this chapter you can read about:

- Mains Connection Power module PSD1-M_P010 with line choke 136
- Mains connection power module PSD1-M_P010 with line choke 137
- Mains Connection Power module PSD1-M_P020 without line choke 137
- Mains connection Power module PSD1-M_P020 with line choke 138
- Output data servo modules PSD1-M (3*400 VAC) 138
- Detailed output data for PSD1-M servo modules 139
- Control voltage 24 VDC PSD1-M (X9 on the mains module) 139
- Braking operation PSD1-M 140
- Dynamic braking module 140
- Size / Weight PSD1-M 140

8.2.1. Mains Connection Power module PSD1-M_P010 with line choke

Category	Specification				
PSD1-M_P010	110 V	200 V	230 V	400 V	480 V
Mains voltage	110 VAC ±10 % 50-60 Hz	200 VAC ±10 % 50-60 Hz	230 VAC ±10 % 50-60 Hz	400 VAC ±10 % 50-60 Hz	480VAC ±10% 50-60Hz
Rated voltage	3AC 110 V	3AC 200 V	3AC 230 V	3AC 400 V	3AC 480 V
Input current	22 Arms	22 Arms	22 Arms	22 Arms	18 Arms
Output voltage	156 VDC ±10 %	283 VDC ±10 %	325 VDC ±10 %	565 VDC ±10 %	680 VDC ±10 %
Output power	2.8 kW	5.1 kW	6 kW	10 kW	10 kW
Pulse power (<5 s)	4.6 kW	10.2 kW	12 kW	20 kW	20 kW
Heat dissipation	60 W	60 W	60 W	60 W	60 W
Maximum fuse rating per device	Measure for line and device protection: UL listing (DIVQ) circuit breakers Manufacturer: ABB, Stotz-Kontakt GmbH (E212323) Model no.: S203UP-K, 1 circuit breaker 480 VAC, 3-phase, 25 A, operating temperature 55 °C				

8.2.2. Mains connection power module PSD1-M_P010 with line choke

Increased power by means of a Line choke **(see page *124*)**

Category	Specification				
PSD1-M_P010 with line choke	**110 V**	**200 V**	**230 V**	**400 V**	**480 V**
Mains voltage	110 VAC ±10 % 50-60 Hz	200 VAC ±10 % 50-60 Hz	230 VAC ±10 % 50-60 Hz	400 VAC ±10 % 50-60 Hz	480VAC ±10% 50-60Hz
Rated voltage	3AC 110 V	3AC 200 V	3AC 230 V	3AC 400 V	3AC 480 V
Input current	24.5 Arms	24.5 Arms	24.5 Arms	24.5 Arms	20.4 Arms
Output voltage	156 VDC ±10 %	283 VDC ±10 %	325 VDC ±10 %	565 VDC ±10 %	680 VDC ±10 %
Output power	3.9 kW	7.1 kW	9 kW	15 kW	15 kW
Pulse power (<5 s)	7.8 kW	14.2 kW	18 kW	30 kW	30 kW
Heat dissipation	60 W	60 W	70 W	70 W	70 W

Maximum fuse rating per device	Measure for line and device protection: UL listing (DIVQ) circuit breakers Manufacturer: ABB, Stotz-Kontakt GmbH (E212323) Model no.: S203UP-K, 1 circuit breaker 480 VAC, 3-phase, 25 A, operating temperature 55 °C
Earth leakage current	**Current on the mains PE** (see page 27) (>3.5 mA)
Supply networks	**Possible supply networks** (see page 27): TN

⚠WARNING The specified performance data are only valid in connection with line choke **IND-0001-02** (see page 124) .

8.2.3. Mains Connection Power module PSD1-M_P020 without line choke

Category	Specification				
PSD1-M_P020	**110 V**	**200 V**	**230 V**	**400 V**	**480 V**
Mains voltage	110 VAC ±10 % 50-60 Hz	200 VAC ±10 % 50-60 Hz	230 VAC ±10 % 50-60 Hz	400 VAC ±10 % 50-60 Hz	480VAC ±10% 50-60Hz
Rated voltage	3AC 110 V	3AC 200 V	3AC 230 V	3AC 400 V	3AC 480 V
Input current	44 Arms	44 Arms	44 Arms	44 Arms	35 Arms
Output voltage	156 VDC ±10 %	283 VDC ±10 %	325 VDC ±10 %	565 VDC ±10 %	680 VDC ±10 %
Output power	5.7 kW	10.5 kW	12 kW	20 kW	20 kW
Pulse power (<5 s)	11.4 kW	21 kW	24 kW	40 kW	40 kW
Heat dissipation	120 W	120 W	120 W	120 W	120 W

Maximum fuse rating per device 2 special purpose fuses in line are required	**Cable protection measure:** MCB (K characteristic) with a rating of 50A / 4xxVAC (depending on the input voltage). Recommendation: (ABB) S203U-K50 (440VAC) **Device protection measure:** Fuses 80A / 700VAC per supply leg in accordance with UL category JFHR2: Required: Bussmann 170M1366 or 170M1566D

8.2.4. Mains connection Power module PSD1-M_P020 with line choke

Increased power by means of a Line choke **(see page *124*)**

Category	Specification				
PSD1-M_P020 with line choke	**110 V**	**200 V**	**230 V**	**400 V**	**480 V**
Mains voltage	110 VAC ±10 % 50-60 Hz	200 VAC ±10 % 50-60 Hz	230 VAC ±10 % 50-60 Hz	400 VAC ±10 % 50-60 Hz	480VAC ±10% 50-60Hz
Rated voltage	3AC 110 V	3AC 200 V	3AC 230 V	3AC 400 V	3AC 480 V
Input Current [rms]	44 Arms	44 Arms	44 Arms	44 Arms	40 Arms
Output voltage	156 VDC ±10 %	283 VDC ±10 %	325 VDC ±10 %	565 VDC ±10 %	680 VDC ±10 %
Output power	7.5 kW	13.5 kW	15.5 kW	27 kW	30 kW
Pulse power (<5 s)	15 kW	27 kW	31 kW	54 kW	60 kW
Heat dissipation	120 W	120 W	140 W	140 W	140 W

Maximum fuse rating per device 2 special purpose fuses in line are required	**Cable protection measure:** MCB (K characteristic) with a rating of 50A / 4xxVAC (depending on the input voltage). Recommendation: (ABB) S203U-K50 (440VAC) **Device protection measure:** Fuses 80A / 700VAC per supply leg in accordance with UL category JFHR2: Required: Bussmann 170M1366 or 170M1566D
Earth leakage current	**Current on the mains PE** (see page 27) (>3.5 mA)
Supply networks	**Possible supply networks** (see page 27): TN

⚠WARNING The specified performance data are only valid in connection with a **Line choke** (see page 124) IND-0002-01 or IND-0002-02 (UL).

8.2.5. Output data servo modules PSD1-M (3*400 VAC)

Category	Specification [1]		
Controller type	**Number of power output stage**	**Output nominal current [A_{rms}]**	**Pulse current for 2 s [A_{rms}] [4]**
PSD1-M_1300	1	5	10
PSD1-M_1400	1	8	16
PSD1-M_1600	1	15	30 [2]
PSD1-M_1800	1	30	60 [2]
PSD1-M_2220	2	2 + 2	4 + 4
PSD1-M_2330	2	5 + 5	10 + 10
PSD1-M_2440	2	8 + 8	16 + 16
PSD1-M_2630	2	15 + 5 [3]	30 [2] 10
PSD1-M_3222	3	2 + 2 + 2	4 + 4 + 4
PSD1-M_3433	3	8 + 5 + 5 [3]	16 + 10 + 10

[1] At the **default setting of the switching frequency** (see page 83).

[2] **Minimum rotating field frequency for peak current at 15 A & 30 A output stages:**
f > 3 Hz; with a rotating field frequency of f <3 Hz the maximum peak current duration is 100 ms

[3] Maximum total output current per device: 16 A.

[4] "Duty Cycle": 20% @10 s (ON=2.0 s - OFF=8.0 s)

8.2.6. Detailed output data for PSD1-M servo modules

Category		Specification				
Power output stage		**2 A**	**5 A**	**8 A**	**15 A** [2]	**30 A** [2]
Input Voltage				300 ... 750 VDC		
Output voltage		3x 0-400 V (0...590 Hz)				
Power at continuous operation [1]		1.2 kVA	3 kVA	4.8 kVA	9 kVA	18 kVA
Heat dissipation [1]		20 W	45 W	75 W	105 W	220 W
Output currents [3]		**With 400 VAC at the mains module**				
$I_{Nominal}$ [Arms]	**4 kHz**	2	5	8	**15**	**30**
I_{Peak} (2 s) [Arms] [4]	**4 kHz**	4	10	16	**30**	**60**
$I_{nominal}$ [Arms]	**8 kHz**	**2**	**5**	**8**	10	20
I_{peak} (2 s) [Arms] [4]	**8 kHz**	**4**	**10**	**16**	20	40
$I_{nominal}$ [Arms]	**16 kHz**	1.33	3.33	5.33	5	11
I_{peak} (2 s) [Arms] [4]	**16 kHz**	2.67	6.66	10.66	10	22
Output currents [3]		**With 480 VAC at the mains module**				
$I_{Nominal}$ [Arms]	**4 kHz**	2	5	8	**12.5**	**25**
I_{Peak} (2 s) [Arms] [4]	**4 kHz**	4	10	16	**25**	**50**
$I_{Nominal}$ [Arms]	**8 kHz**	**1.8**	**4.5**	**7.2**	8	15
I_{Peak} (2 s) [Arms] [4]	**8 kHz**	**3.6**	**10**	**14.4**	16	30
$I_{Nominal}$ [Arms]	**16 kHz**	1.07	2.67	4.27	4	8.5
I_{Peak} (2 s) [Arms] [4]	**16 kHz**	2.13	5.33	8.53	8	17

[1] For continuous operation with a mains supply of 400 VAC at the mains module

[2] **Minimum rotating field frequency for peak current at 15 A & 30 A output stages:**
f > 3 Hz; with a rotating field frequency of f <3 Hz the maximum peak current duration is 100 ms

[3] Output current at different switching frequencies. The default settings of the currents und switching frequencies are grayed out & in bold.

[4] "Duty Cycle": 20% @10 s (ON=2.0 s - OFF=8.0 s)

8.2.7. Control voltage 24 VDC PSD1-M (X9 on the mains module)

Category	Specification
Voltage range	21.6 - 27.0 VDC (24 VDC -10 % +12.5 %)
Ripple	0.5 Vpp
Requirement according to safe extra low voltage (PELV)	Yes
Electric current drain	PSD1-M_P010: 0.2 A PSD1-M_P020: 0.3 A ea. PSD1-M Axis: 1.0 A + Output current of digital outputs (fed via connectors X17/2, 3) + Output current of motor brakes (fed via connectors X46/7 & 8; PSD1M_1800 X44/3 & 4) + Current requirements of optional boards

8.2.8. Braking operation PSD1-M

Mains modules

Device type	PSD1-M_P010	PSD1-M_P020
Capacity/ storable energy	550 µF/ 92 Ws at 400 V 53 Ws at 480 V	1175 µF/ 197 Ws at 400 V 114 Ws at 480 V
Minimum braking resistance	27 Ω	10 Ω
Recommended nominal power rating	500 ... 1500 W	500...5000 W
Pulse power for 1s	22 kW	60 kW
Maximum permissible continuous current	13 A	25 A

Servo Drives

Category	Specification	
Controller type	PSD1-M (unless PSD1-M_1800)	PSD1-M_1800 (30 A)
Capacity / storable energy (±20 %)	220 µF / 37 Ws at 400 V 21 Ws at 480 V	440 µFF74 Ws at 400 V 42 Ws at 480 V

8.2.9. Dynamic braking module

Data of the integrated dynamic brake module PSD1-M_P

Category	Specifications			
Mains module	Maximum current		Max. Duty Cycle	Minimum resistance value
	Peak	Duration		
PSD1-M_P010	28.8 A	4.27 A (500 W)	2.2 % (@60 s)	27 Ω
		7.5 A (1500 W)	6.7 % (@60 s)	
PSD1-M_P020	78.0 A	7.06 A (500 W)	0.82 % (@60 s)	10 Ω
		22.3 A (5000 W)	8.2 % (@60 s)	

Recommended braking resistors

Category	Specifications	
Mains module	Minimum resistance value	Power
PSD1-M_P010	27 Ω	500 W ... 1500 W
PSD1-M_P020	10 Ω	500 W ... 5000 W

External ballast resistors from Parker (see page 126).

8.2.10. Size / Weight PSD1-M

Category	Specifications	
Controller type	Weight [kg]	Dimensions Height x Width x Depth (mm)
PSD1-M_1300	4	360 x 50 x 270
PSD1-M_1500		
PSD1-M_1600		
PSD1-M_P010		
PSD1-M_2220	4	
PSD1-M_2330		
PSD1-M_2440		
PSD1-M_2630		
PSD1-M_3222	4.2	
PSD1-M_3433		
PSD1-M_1800	6.8	360 x 100 x 270
PSD1-M_P020	6,3	

Mounting (see page 55, see page 57, see page 31)

8.3 Motors/ feedback/ motor holding brake

In this chapter you can read about:

- Motor technologies supported 141
- Feedback system HIPERFACE DSL® 141
- Resolver 141
- Incremental encoder / analog Hall sensor 142
- Motor holding brake output 142

8.3.1. Motor technologies supported

Category	Specifications
Motors **Direct drives** • Linear motors • Torque motors	• Sinusoidally commutated synchronous motors ♦ Maximum rotating field frequency: 590 Hz max. Velocity: 60*590/number of pole pairs in [min^{-1}]. ♦ Maximum number of poles = 1200 • Temperature sensor supported: ♦ KTY84-130(insulated in accordance with EN60664-1 or IEC60664-1) ♦ PTC / NTC switches ♦ KTY83-110 ♦ PT1000 • 3 phase synchronous direct drives

8.3.2. Feedback system HIPERFACE DSL®

	Single Turn	Multiturn
Order Number	ENCODERS5	ENCODERS6
Resolution	18 Bit	18 Bit
Measurement steps per revolution	262144	262144
Captured revolutions	1	4096
Integral non-linearity	± 80 "	± 80 "
Differential non-linearity	± 40 "	± 40 "
Maximum speed	12000 min^{-1}	9000 min^{-1}
Rotor moment of inertia	450 gmm^2	450 gmm^2
Operating Temperature	-20 .. +105 °C	-20 .. +105 °C
Protection class	IP40	IP40
Safety technology (IEC 61508 – EN ISO 13849)	SIL2; PL d	SIL2; PL d

8.3.3. Resolver

Category	Specifications
Resolution of the motor position	• Position resolution: 16.6 Bits (= 0.005°) • Absolute accuracy: ±0.167°
Resolver supported	• **LTN**: RE-21-1-A05, RE-15-1-B04 • **Tamagawa:** TS2610N171E64, TS2620N21E11, TS2640N321E64, TS2660N31E64 • **Tyco (AMP):** V23401-T2009-B202
Resolver data supported	• Transformation ratio: 0.25... 1 (typical 0.5) • Excitation frequency 8 Hz • Amplitude of the excitation signal: max. 9.5 V_{pp}. (The resolver must be approved for at least this value).

Accuracy

The precision of the position signal is above all determined by the exactitude of the feedback system used.

8.3.4. Incremental encoder / analog Hall sensor

Category	Specification
Incremental encoder **(see page 41) * (Sine / Cosine or A/B square wave signal)**	• Linear or rotary • 5V power supply voltage (optionally controlled on the encoder side by voltage feedback via sense measuring lines) • **Supported signals**: ♦**Sin/Cos** Signal: Differential with 2.5V reference voltage, typically 1 Vss (max. 4.7 Vss), sine/cosine 90° phase-shifted, max. frequency 400 kHz (an existing reference mark (ref signal) is evaluated (if the machine zero mode is set accordingly) during the machine zero run) **Position resolution:** 14 bits per sine/cosine period (at 1Vpp) -> for rotary encoder, unit incr./rev: Encoder line number [periods/rev.]*16384[incr./period] -> for linear encoder, unit e.g. incr./mm: 16384[incr./period]*1000[um/mm]/encoder_period length[um] or ♦**A/B pulses**: Physical RS422 (differential), A/B 90° phase-shifted, max. 5 MHz (an existing reference mark (Z-track) is evaluated (if the machine zero mode is set accordingly) during the machine zero run) with the following **commutation options**: • Auto commutation or • U, V, W or R, S, T commutation signals (NPN open collector) e.g. digital Hall sensors**, incremental encoders with commutation track (such as Hengstler F series with electrical ordering variant 6)
Analog Hall sensor **(see page 41) ***	• Linear or rotary • 5V power supply voltage (optionally controlled on the encoder side by voltage feedback via sense measuring lines) • Sine/cosine signal: Differential with 2.5V reference voltage, typically 1 Vss (max. 4.7 Vss), sine/cosine 90° phase-shifted, max. frequency 400 kHz • **Position resolution:** 14 bits (at 1Vpp) per sine/cosine period (= 14 bits per motor magnetic period) -> for rotary motor, unit incr./rev: number of motor pole pairs [1/rev]*16384 incr. -> for linear motor: 16384 [incr./pitch] for unit e.g. incr./mm: 16384[incr.]/MotorPitch[mm]

* in the first expansion stage only for PSD1S and PSD1MW**1**...: multi-axis device with **one** performance level.
** the digital Hall sensors must be supplied via the encoder supply pin Vcc (5V nominal, higher voltage possible with connected sense measuring lines).

8.3.5. Motor holding brake output

Category	Specifications
Voltage operating range	21 ... 27 VDC
Maximum output current (short circuit proof)	PSD1-S: 1.0 A PSD1-M: 1.6 A

8.4 Digital inputs / outputs (specifications)

Category	Specifications
Digital inputs	• 4 Digital inputs • Input resistor 22 kΩ All inputs and outputs do have 24 V level. Input level: "0" (low) = Rated Input Voltage ≤ 12.5 V "1" (high= Rated Input Voltage ≥ 13.5 V
Digital outputs	• 2 Digital outputs (4 on mains module) • Load max. 100 mA

8.5 IO option board

Signal input/output	Specification
Digital inputs/outputs	• 8 digital inputs/outputs • Input resistor: 22 kΩ • All inputs and outputs have a 24V level
	Digital inputs • Input level ♦ "0" (low) = input voltage ≤ 8.05V ♦ "1" (high) = input voltage ≥ 9.15V • 125µs scanning rate
	Digital outputs • Operation voltage 12...30V • Loading max. 70mA • Short circuit detection
Analog inputs	• 2x analog voltage input ♦ +/-10V / 0..10V ♦ Input resistor 180kΩ • 2x analog current input ♦ 0..20mA, 4..20mA (error detection) • Input resistor 100Ω • 14Bit resolution • 125µs scanning rate.
Encoder input	**Encoder input (RS422)** • A/B encoder with zero pulse • Step Direction with zero pulse • up to max. 5MHz
	Encoder simulation (RS422) • The resolution that can be set depends on the selected encoder mode and motor type, see object documentation 0x2928.05. • A zero pulse can also be set for the encoder simulation. • Limit frequency 400kHz • Bypass function

8.6 Technical data STO

Category	Specifications	
STO Certificate (http://www.Parker.com/Literature/Electromechanical Europe/Certificates/DOC-0014-01_PSD_STO_Certificate.pdf)	According to EN ISO13849 Device certified if “STO certified” is stated in type plate (below the CE sign)	
Nominal voltage of the inputs	24 VDC	
Required isolation of the 24V control voltage	Grounded protective extra low voltage, PELV	
Fuse protection	Protection of the STO control voltage: 1 A	
Number of inputs **Signal inputs via optocoupler**	2 Low = 0 ... 5 V DC or open High = 15 ... 26.4 VDC I_{in} at 24 VDC: 9 mA +/-1 mA	
STO Input A, Level	Low or open = STO activated High = STO deactivated Reaction time max. 5 ms	
STO Input B, Level	Low or open = STO activated High = STO deactivated Reaction time max. 5 ms	
Switch-off time	Switch-off time with unequal input statuses: 10 s (max. error response time) During the inequality, it is ensured within 5 ms that the motor torque is switched off single-channel.	
Maximum tolerable test pulse time	Maximum tolerable test pulse time (low active) for external safety control: 1 ms	
Grouping of safety level	• Category 3 • PL=e • SIL 3 • PFHd=1.00E-9 per STO circuit • Mission time: 20 years • MTTFd = 800 years (when using EN ISO 13849-1 the MTTFd value must be limited to 100 years)	

8.7 EC directives and applied harmonized EC norms (PSD1)

Category	Specifications
EU Low Voltage Directive 2014/35/EU	**EN 61800-5-1,** Standard for electric power drives with settable speed; requirements to electric safety **EN 60664-1,** isolation coordinates for electrical equipment in low-voltage systems **EN 60204-1, machinery norm** partly applied
EC-EMC directive 2014/30/EU	**EN 61800-3, EMC standard** Product standard for variable speed drives

8.8 EMC limit values PSD1

Category	Specifications
EMC interference emission	Limit values in accordance with EN 61 800-3, Limit value class C3 with mains filter.
EMC disturbances	Industrial area limit values in accordance with EN 61 800-3

8.9 Insulation requirements PSD1

Category	Specifications
Protection class	Protection class in accordance with EN 60664-1
Protection against human contact with dangerous voltages	In accordance with EN 61800-5-1
Overvoltage Category	Voltage category III in accordance with EN 60664-1

8.10 Environmental requirements PSD1

Category	Specification
General ambient conditions	In accordance with **EN 60 721-3-3** Climate (temperature/humidity/barometric pressure): Class 3K22
Permissible ambient temperatures:	Operation 0 to +40 °C Class 3K22 Storage -25 to +70 °C Transportatio -25 to +70 °C n
Tolerated humidity:	Operation <= 85% Class 3K22 Storage <= 95 % Transport <= 95 % (Relative humidity)
Elevation of operating site	<=1000m above sea level for 100% load ratings <=2000m above sea level for 1% / 100m power reduction >2000m above sea level likewise with 1% / 100m power reduction but without UL & CE certification
Sealing	IP20 protection level in accordance with EN 60 529
Mechanical vibrations:	With packaging (transport/ storage): 10 m/s²; 9 – 200 Hz Without packaging: 10 m/s²; 57 – 150 Hz
Pollution degree	Pollution degree 2 in accordance with EN 60664-1 and EN 61800-5-1

8.11 cUL certification

Category	Specifications
PSD1M:	UL508C, 3rd Edition, power supply load revision November 9th, 2010. C22.2 N°.274-13, 12th Edition, last revision March 2013.
PSD1S:	UL61800-5-1 1st Edition, issued June, 8th, 2012 C22.2 No.274-13, 1st Edition, issued March, 2013
Certified	E-File_No.: E142140 The cUL approval is documented by a “UL” logo on the device (type specification plate). c UL US LISTED

8.12 EtherCAT characteristics

Category	Specifications
Profile	Motion Control CiA DS402
Baud rate	100 MBits (FastEthernet)
Service data object	SDO
Cycle Time	n*500µs (500µs, 1000µs (=1ms), 1500µs (=1.5ms), ...)
Synchronicity accuracy	maximum jitter: +/-25µs

8.13 PROFINET Characteristics

Category	Specifications
Profile	• PROFIdrive profile drive technology V4.2
PROFINET Version	• PROFINET IO (RT)
Transmission mode	• 100BASE-TX (Full Duplex)
Profinet ID	• PSD1-S: 0x5331 PSD1-M: 0x4D78
Device master file	• **PSD1-S http://www.Parker.com/Literature/Electromechanical Europe/Downloads/GSDML-V2.3-Parker-PSD1S.zip** • **PSD1-M http://www.Parker.com/Literature/Electromechanical Europe/Downloads/GSDML-V2.3-Parker-PSD1M.zip**
Realized application class	• AC 3 Positioning

8.14 Ethernet IP characteristics

Category	Specifications
Profile	DS402
Ethernet/IP	• Generic device support for CIP and encapsulated layer
Ethernet	• Several Ehernet interfaces are supported e.g., for devices with embedded switch technology (for the support of linear or ring topology)
Connection established	• Device Level ring (DLR) functionality is supported (announce based ring nod)
Connections	• Simultaneous support for up to 10 I/O connections • Simultaneous support for up to 10 encapsulation sessions • Simultaneous support for up to 2 explicit messaging connections per encapsulation session • Unconnected explicit messaging is supported
Service(s)	• Quality of Service (QoS) supported • UDP for order list services, list targets and list identity for encapsulation protocol available • Pv4 address conflict detection for EtherNet/IP devices
Device master file	• **PSD1 http://solutions.parker.com/psd_support**
Product Code	• PSD1S: 21297 (0x5331) • PSD1M_1: 19761 (0x4D31) (1 power stage) • PSD1M_2: 19762 (0x4D32) (2 power stages) • PSD1M_3: 19763 (0x4D33) (3 power stages)
Vendor code	• 4
Realized object grades	• Identity • Message Router • Assembly • Connection manager • Device level ring • QoS • PSD1 object pool • TCP/IP Interface • Ethernet Link

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