PITCHmaster

Servo controller for pitch systems
18 A to 54 A

Operation Manual

No: 181-50005

Date: 03/2012
Rev.: 4

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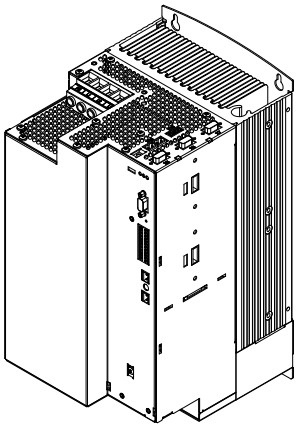
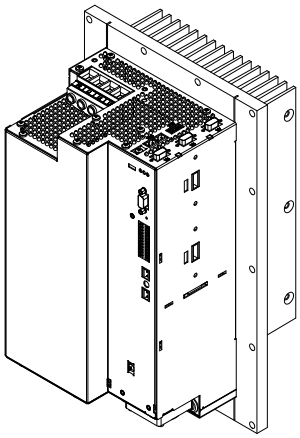
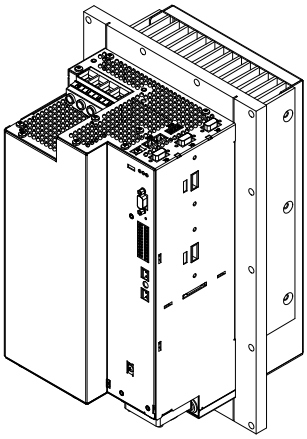
Cooling variants

Wall-mounted	Push-through-mounted, passively cooled	Push-through-mounted, actively cooled
		

Only valid from software: V 260.40-0

Subject to technical changes.

History of change

Revision overview			
No.	**Date**	**Changes / additions**	**on page**
0	02/2007	Initial creation	-
0.1	02/2007	Revision logo/layout	all
1	01/2010	Revision logo	all
2	04/2010	Revision security advices Technical data	all A-3
3	01/2012	A.7 Item 5: Specification of device cables corrected.	A-6
		A.7 Item 7: Specification of overload protection adjusted.	A-6
4	03/2012	Table 2.1 Dimensional drawings wall mounting:Tightening torque added	2-2
		Table 2.2 Dimensional drawings push-through mounting: Screw size corrected Tightening torque added	2-5

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1 Safety

1.1 Measures for your safety

In order to avoid physical injury and/or material damage the following information must be read before initial start-up.
The safety regulations must be strictly observed at any time.

Read the Operation Manual first!

- Follow the safety instructions!
- Please observe the user information

Electric drives are generally potential danger sources:

- Electrical voltage 230 V/480 V:
  Dangerously high voltage may still be present 10 minutes after the power is cut. You should therefore always
  check that there is no voltage present.
- Rotating parts
- Hot surfaces

Protection against magnetic and/or electromagnetic fields during installation and operation.

- For persons with pacemakers, metal containing implants and hearing aids etc. access to the following areas is prohibited:
  – Areas in which drive systems are installed, repaired and operated.
  – Areas in which motors are assembled, repaired and operated. Motors with permanent magnets are sources of special dangers.

Note:

If there is a necessity to access such areas a decision from a physician is required.

Your qualification:

- In order to prevent personal injury or damage to property, only personnel with electrical engineering qualifications may work on the device.
- The qualified personnel must familiarise themselves with the Operation Manual (refer to IEC364, DIN VDE0100).
- Knowledge of the national accident prevention regulations
  (e. g. BGV A3 (VBG 4) in Germany)

During installation follow these instructions:

- Always comply with the connection conditions and technical specifications.
- Comply with the standards for electrical installations, such as wire cross-section, earthing lead and ground connections.
- Do not touch electronic components and contacts (electrostatic discharge may destroy components).

1.2 Explanation of danger categories

The safety and warning notes were created according to corresponding internationally valid standards. A differentiation must here be made between different danger categories. These are emphasized by means of corresponding signal words and colours. Another distinct differentiation is made between personal and material damage (pictogram). The existing danger categories are explained in general below.

DANGER

Disregarding this warning notes will **in any case** result in severe or even fatal injuries.

WARNING

Disregarding this warning notes **may** result in severe or even fatal injuries.

CAUTION

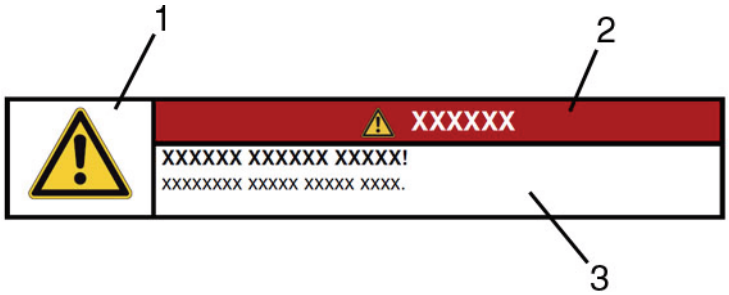
Disregarding this warning notes **may** result in minor injuries.

CAUTION

Disregarding this warning notes **may** result in material damage.

1.2.1 Layout of safety and warning notes

Safety and warning notes are designed as shown below:



Explanation:
1 = Corresponding symbol
2 = Corresponding danger category
3 = Text structured as follows:

- Nature and source of danger
- Possible consequences
- Measures / prohibitions

NOTE

Notes and more detailed information can also contain safety relevant information, which must also be strictly followed.

Warning notes can also be combined with a second symbol indicating the described measures (mandatory) or the prohibition.

Example:

WARNING

XXXXX XXXXX XXXXXX!
xxxx xxxxxx xxxxx xxxxx.

1.2.2 Further notes

NOTE

Important information.

REFERENCE

Reference to more detailed information.

1.3 Warning notices

Please observe the following before initial commissioning:

DANGER

Danger to life from uncontrolled rotation!
Before motors with feather keys are commissioned, the feather key should be secured against being ejected, if this cannot be prevented by drive elements such as pulleys, couplings, or the like.

CAUTION

Test run with motor installed!
Make sure that the test will not cause any damage to the system! In particular, pay attention to positioning range limits. Please note that you yourself are responsible for safe operation. Moog Unna GmbH cannot be held liable for any damage incurred.

	CAUTION
	**Destruction of the motor!** – The motors are intended for operation on the servocontroller. Direct connection to the mains supply may destroy the motor. – The motor surfaces may become extremely hot. Temperature-sensitive items should therefore not be placed on top of or attached to the motors. Protective measures may be needed to prevent touching. – In order to avoid overheating of the motor, the temperature sensor installed in the winding must be connected to the terminals of the temperature monitoring system for the servocontroller (X5, X11 or X13). – The motor brake (if installed) should be checked for fault-free functioning before commissioning of the motor. The optional motor holding brake is only designed for a limited number of emergency braking operations. Use as a working brake is prohibited.

1.4 Intended use

The PITCHmaster is intended for installation in switch cabinets integrated in the rotor hubs of wind turbine generator systems. It must only be installed in switch cabinets providing minimum IP 4x protection.

Commissioning of the PITCHmaster (i.e. start-up of intended operation) is prohibited, unless it has been ascertained that the machine fully complies with the provisions of EU Directive 2006/42/EC (Machinery Directive); compliance with EN60204 is mandatory.

Commissioning (i.e. start-up of intended operation) is only permitted when strictly complying with the EMC Directive (2004/108/EC).

CE	PITCHmaster is compliant with the Low Voltage Directive 2006/95/EC

PITCHmaster fulfils the requirements of the harmonized product standard EN 61800-5-1:2003.

If the PITCHmaster is used for special applications, e.g. in explosion endangered environments, the required standards and regulations (e.g. for explosion endangered environments, EN 50014, "General provisions" and EN 50018, "Pressure proof housing") must always be observed.

Repairs may only be carried out by authorized repair workshops. Unauthorized opening and incorrect intervention could lead to death, physical injury or material damage. The warranty provided by Moog Unna GmbH would thereby be rendered void.

1.5 Responsibility

Electronic devices are fundamentally not fail-safe. The company setting up and/or operating the machine or plant is itself responsible for ensuring that the drive is rendered safe if the device fails.

In the section on "Electrical equipment of machines" the standard EN 60204-1/ DIN VDE 0113 "Safety of machines" stipulates safety requirements for electrical controls. They are intended to protect personnel and machinery, and to maintain the function capability of the machine or plant concerned, and must be observed.

The function of an emergency stop system does not necessarily have to cut the power supply to the drive. To protect against danger, it may be more beneficial to maintain individual drives in operation or to initiate specific safety sequences. Execution of the emergency stop measure is assessed by means of a risk analysis of the machine or plant, including the electrical equipment in accordance with EN ISO 14121 (previously DIN EN 1050), and is determined by selecting the circuit category in accordance with EN ISO 13849-1 (previously DIN EN 954-1) "Safety of machines - Safety-related parts of controls".

2 Mechanical installation

2.1 Notes for operation!

CAUTION

The PITCHmaster is intended for the installation in a hub of a wind turbine.
Please ensure that ...

- no moisture enters into the device,
- no aggressive or conductive substances are in the immediate vicinity,
- no drill chippings, screws or foreign bodies drop into the device,
- the ventilation openings are not covered over,
- the PITCHmaster is not used in other mobile equipment.

The unit may otherwise be damaged.

2.2 Cooling variant Wall-mounted

Step	Action	Comment
1	Mark the position of the tapped holes on the backing plate. Cut a tap for each fixing screw in the backing plate.	Dimensional drawings/hole spacing see Table 2.1./see Figure 2.1 The tapping area will provide you with good, full-area contact.
2	Mount the PITCHmaster **vertically** on the backing plate.	Do not forget the mounting clearances! The metal of the contact surface must not be insulated. **In the pitch system:** Mount the PITCHmaster in the way that the rotating axes of the fans and the hub are parallel.
3	If necessary mount the additional components, such as line filter and power choke, on the backing plate.	The cable between line filter and PITCHmaster must not be longer than max. 30 cm
4	Continue with the electrical installation in section 3.	

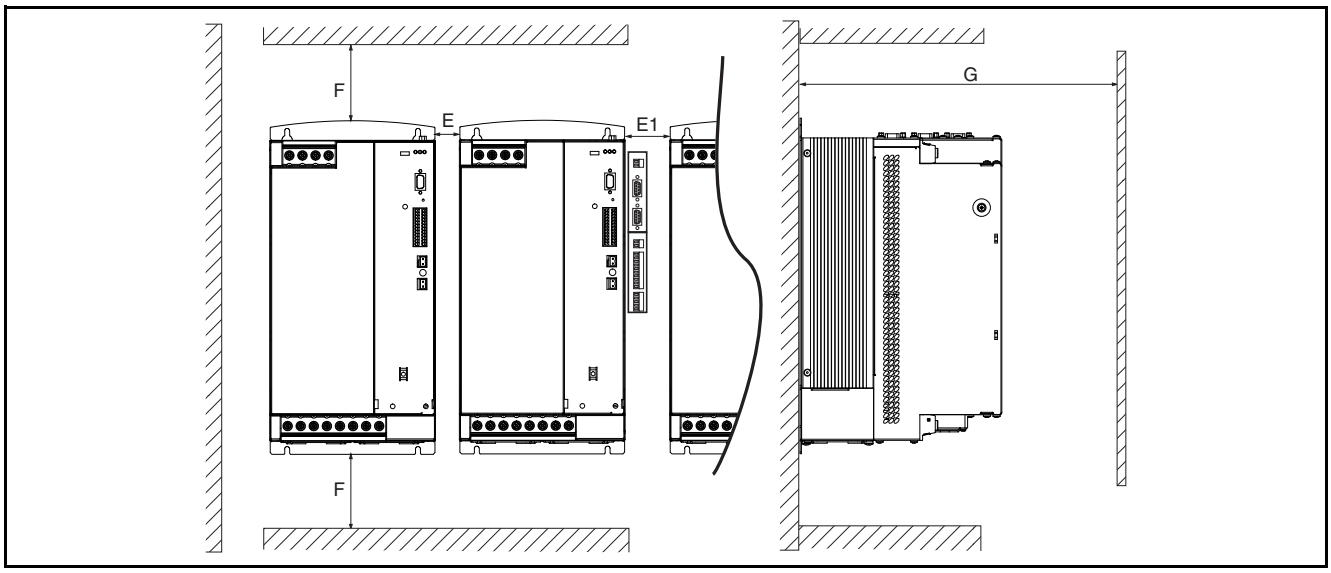
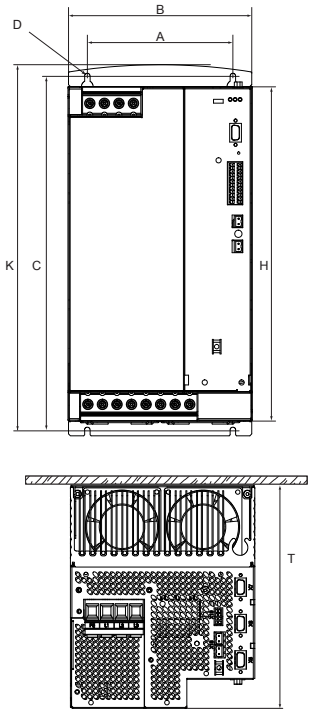


Figure 2.1 Mounting clearances wall mounting (dimensions see Table 2.1)

PITCHmaster 54.xxx,Wx.x		Dimensional drawing
Weight	13 kg	
B (Width)	190 mm	
H (Height)	348 mm	
T (Depth)	230 mm	
A	150 mm	
C	365 mm	
K	382 mm	
D ∅	∅ 5.6 mm	
Screws	4 x M5	
Tightening torque	2.5 - 3.5 Nm	
E see Figure 2.1	10 mm	
E1 see Figure 2.1	50 mm[1)]	
F see Figure 2.1	100 mm[2)]	
G see Figure 2.1	≥ 300 mm	

1) 50 mm distance between the PITCHmasters to be able to replace the lateral optional module (without having to disassemble the PITCHmaster).
2) Also allow enough space at the bottom for the bending radii of the connecting cables.

Table 2.1 Dimensional drawings wall mounting

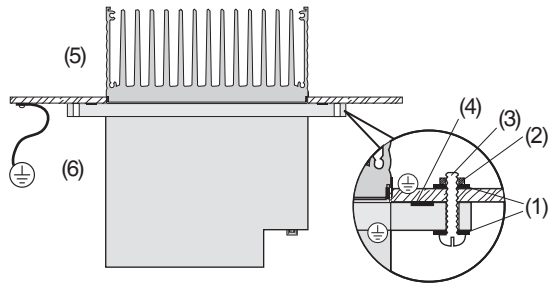
2.3 Cooling variant Push-through-mounted

Step	Action	Comment
1	Mark out the positions of the tapped holes and the break-through on the backing plate. Cut a tap for each fixing screw in the backing plate.	Dimensional drawings/hole spacing see Table 2.2., Figure 2.2 and Figure 2.3. The tapping area will provide you with good, full-area contactt.
2	Mount the PITCHmaster **vertically** on the backing plate.	Observe the mounting clearances! The mounting seal must have good contact on the surface. **In the pitch system:** Mount the PITCHmaster in the way that the rotating axes of the fans and the hub are parallel.
3	If necessary mount the additional components, such as the line filter and power choke, on the backing plate.	Connecting line between line filter and PITCHmaster max. 30 cm
4	Continue with the electrical installation in section 3.	

Distribution of power loss:

	PITCHmaster	**54.018**	**54.044**	**54.058**	**54.070**
Power loss	Outside (3)	83.3 %	88.7 %	90.7 %	89.8 %
	Inside (4)	16.7 %	10.3 %	9.3 %	10.2 %
Protection class	Heat sink side (3)	IP54			
	PITCHmaster side (4)	IP20			

- The all-around mounting collar is fitted with a seal. This seal must have good surface contact and should be free of damaged:



(1) Seal disc screw
(2) Nut
(3) Tapped hole for EMC-compatible contact
(4) Seal disc heat sink
(5) Outside
(6) Inside

- The backing plate must be well earthed.

CAUTION

- To maintain the protection category, the screws have to be sealed resp. actions have to be taken , such as e. g. using
  – welded on tapped bushs resp. blind holes in the back board of the control cabinet
  seal discs (e. g. Würth, Art.-Nr. 20016)

- To attain the best result for effective EMC installation use a chromated or galvanised backing plate. If backing plates are varnished, remove the coating in the area of the contact surface.

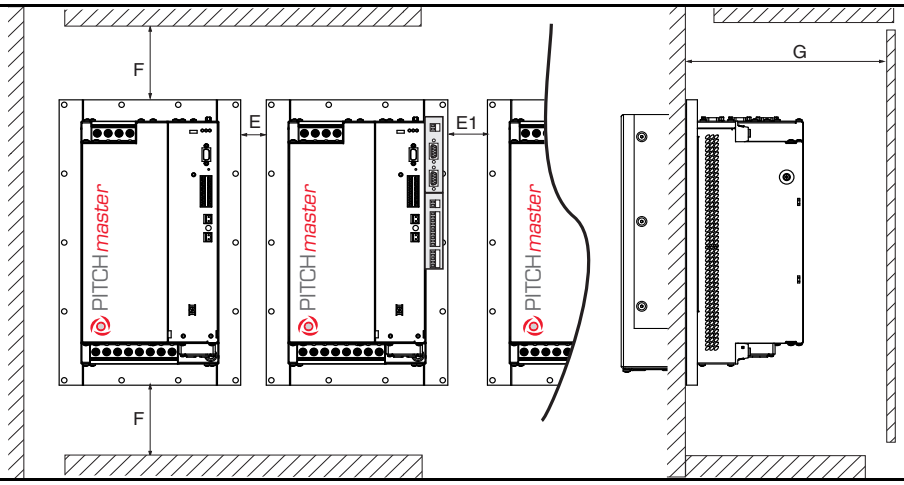


Figure 2.2 Mounting clearances push-through heat sink (dimensions see Table 2.2)

PITCHmaster **54.xxx,Dx.x**	
Weight	15 kg
B (Width)	190 mm
B1	250 mm
H (Height)	345 mm
T (Depth)	161 mm
T1 (actively coo-	85 mm
T2 (passively	68 mm
A	236 mm
A1	78 mm
F1	7 mm
F2	104.75 mm
F3	202.5 mm
F4	300.25 mm
F5	398 mm
K	405 mm
D ∅	∅ 7.5 mm
Screws	14 x M6
Tightening torque	4.5 - 6.5 Nm
E see Figure	405 mm
E1 see Figure	40 mm
F see Figure	100 mm[1)]
G see Figure	≥ 300 mm
1) Also allow enough space at the bottom for the bending radii of the connecting cables.	

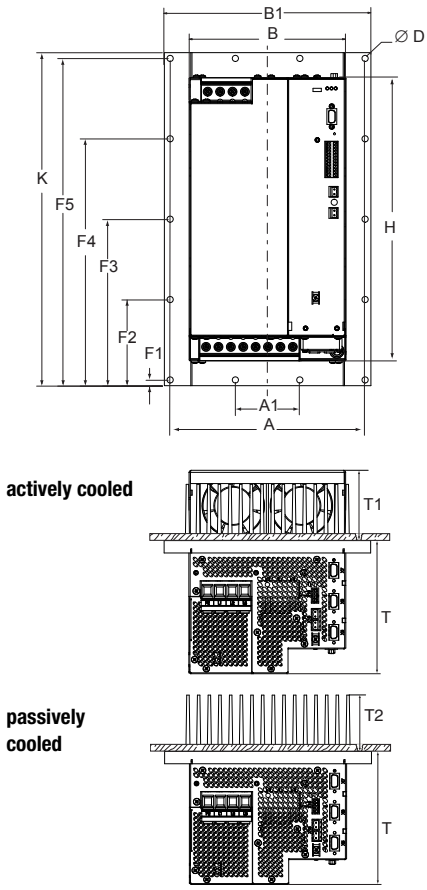


Table 2.2 Dimensional drawings push-through mounting

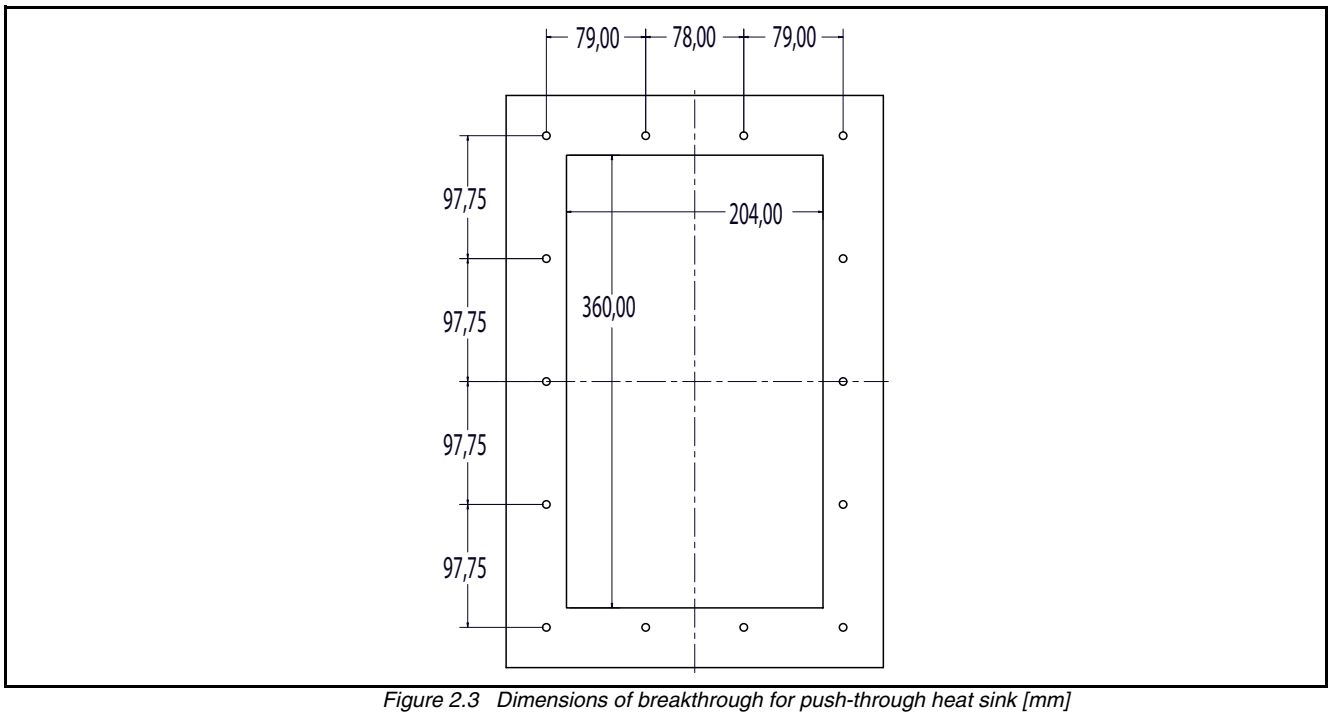


Figure 2.3 Dimensions of breakthrough for push-through heat sink [mm]

	NOTE
	To achieve a seal that complies with the protection category, please use welded srews (sleeve nuts).

3 Installation

CAUTION

Installation must only be carried out by qualified electricians who have undergone instruction in the necessary accident prevention measures.

3.1 Overview of connections

Terminal diagram PITCHmaster

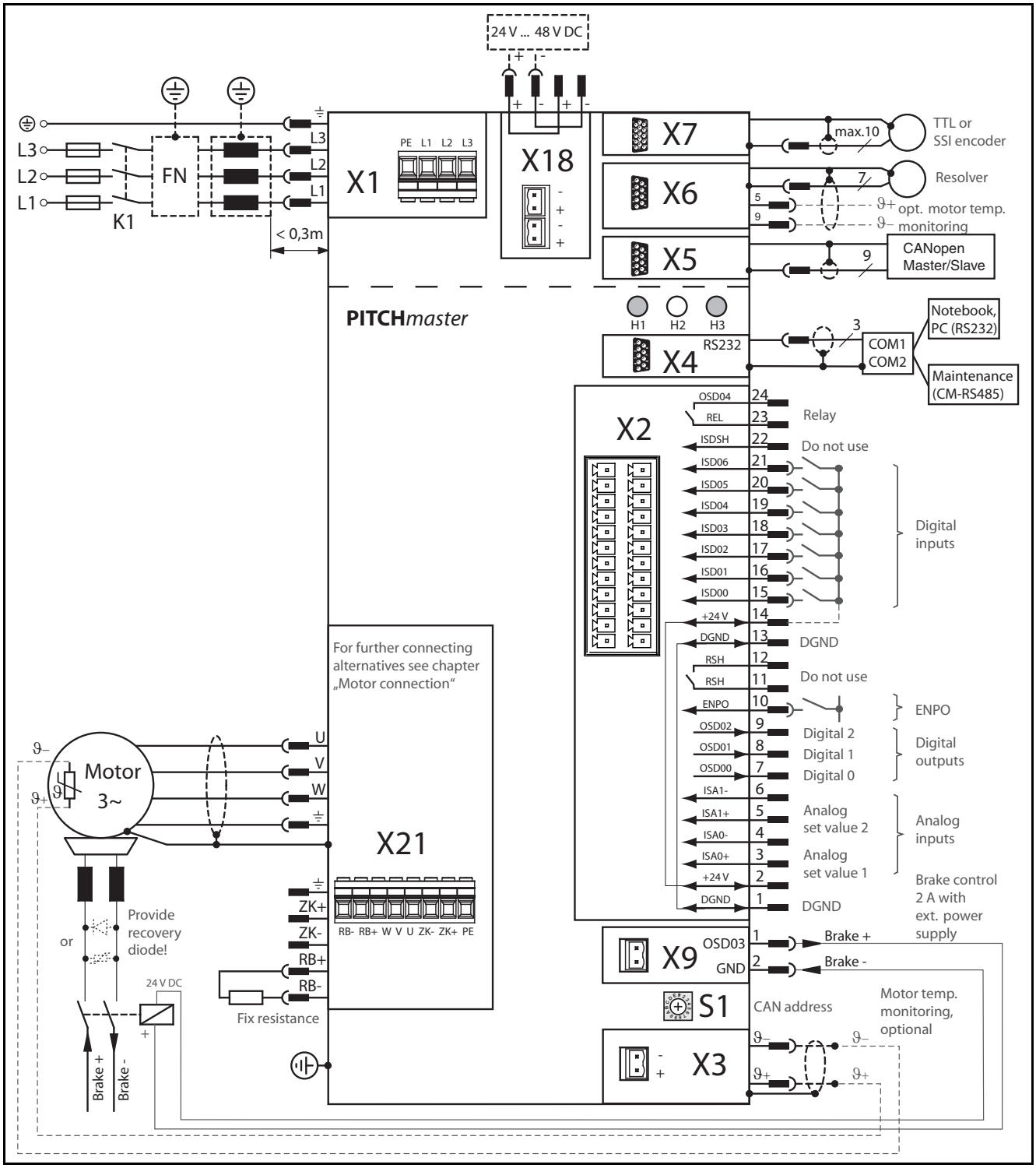


Figure 3.1 Terminal diagram PITCHmaster

CAUTION

All cables have to be laid vibration-proof.

No.	Page	Designation	Function
H1, H2, H3	5-1	Light emitting diodes	Equipment status display
S1	3-25	Encoder switch	Setting the CAN-address
X1	3-11	Mains connection	Mains
X2	3-13	Control terminal	7 digital inputs, 2 analog inputs, 10 bit 2 digital outputs, 1 relay
X3[1)]	3-21	Motor temperature monitoring	PTC, following DIN 44082 linear temperature sensor KTY 84-130 or thermal circuit breaker Klixon
X4	3-24	RS232 port	For user terminals, PC with DRIVEMANAGER or interface converter CM-RS485
X5	3-25	CAN-interface	Access to integrated CAN-interface DSP402
X6	3-17	Resolver connection	with temperature monitoring
X7	3-17	TTL/SSI encoder interface	TTL encoder SSI absolute value transducer
X8		Optional board slot	Expansion board slot for e.g. optional module Profibus-DP
X9	3-17	Brake driver	2 A with external voltage supply via X2
X18		External inverter-power supply	24 V -25 % to 48 V +10 % DC (required from U_{ZK} < 200 V)
X21	3-21 a. 3-26	Power terminal	Motor, DC supply (ZK+/ZK-) Braking resistor RB+/RB-

1) the PTC must only be connected to one of the two possible terminals X3 or X6.

Table 3.1 Key to connection diagram of PITCHmaster

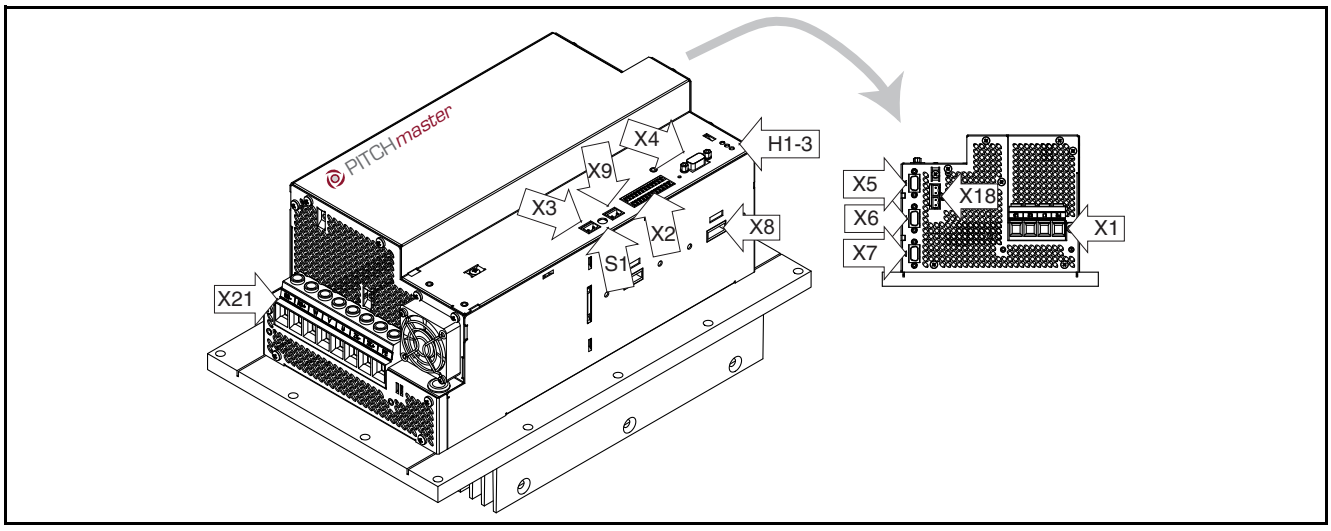


Figure 3.2 Position plan of the PITCHmaster

	CAUTION
	Installation must only be carried out by qualified electricians who have undergone instruction in the necessary accident prevention measures.

3.2 EMC compliant installation

PITCHmasters are components intended for installation into industrially and commercially used equipment and machines.

Commissioning (i. e. starting inteded operation) is only permitted when strictly complying with EMC-directive (89/336/EEC).

The installer/operator of a machine and/or equipment must provide evidence of the compliance with the protection targets stipulated in the EMC-directive.

	CAUTION
	Compliance with the required EMC-protection targets is normally achieved by observing the installation instructions in this manual and using the appropriate radio interference suppression filters.

Assignment of PITCHmasters with internal line filter

All PITCHmasters are fitted with a sheet steel housing with aluminium-zink surface to improve the interference immunity factor as specified in IEC61800-3, environment 1 and 2.

The PITCHmasters are equipped with integrated line filters. With the measuring methods specified in the standard these PITCHmasters comply with the EMC product standard IEC61800-3 for "Environment 1" (living area) and "Environment 2" (industrial area).

– Public low voltage network (environment 1) living area: up to **10 m** motor cable length, exact data can be found in appendix A.5.

	CAUTION
	This is a restricted availability product in accordance with IEC 61800-3. This product may cause radio interference in domestic environments; in such cases the operator may need to take appropriate countermeasures.

– Industrial low voltage network (environment 2) industrial area: up to **25 m** motor cable length, exact data can be found in appendix A.5.

Assignment of PITCHmasters with external line filter

An external radio interference suppression filter (EMCxxx) is available for all PITCHmasters. With this line filter the PITCHmasters comply with the EMC product standard IEC61800-3 for "Environment 1" (living area) and "Environment 2" (industrial area).

– Public low voltage network (environment 1) living area: up to **100 m** motor cable length.

	CAUTION
	This is a restricted availability product in accordance with IEC 61800-3. This product may cause radio interference in domestic environments; in such cases the operator may need to take appropriate countermeasures.

– Industrial low voltage network (environment 2) industrial area: up to **150 m** motor cable length.

	NOTE
	When using external line filters the status "general availability" can be reached too with shorter motor cable length. If this is of importance to you, please do not hesitate to contact our sales engineers or your projecting engineer.

Subject	Projecting and installation regulations
PE-terminal equipotential bonding	Use a bright backing plate. Use cables and/or ground straps with cross sections as large as possible. Route the PE-terminal connection for the components in a star-shaped fashion and ensure large area contact of earthing (PE) and shielding connecting on the PE-bar of the backing plate to establish a low-resistance HF-connection. PE-mains connection in accordance with DIN VDE 0100 part 540 • Mains connection < 10 mm² Protective conductor cross-section min. 10 mm² or use 2 conductors with a cross-section of the mains supply lines. • Mains connection > 10 mm²: Use a protective conductor cross-section in compliance with the cross-section of the mains supply lines.
Routing of cables	• Route the motor cable separated from signal and mains supply lines. The minimum distance between motor cable and signal line/mains line must be 20 cm, if necessary us separator. • Always route the motor cable without interruptions and the shortest way out of the control cabinet. • When using a motor contactor or a reactance control/motor filter, this should be directly mounted to the PITCHmaster. Do not bare the core ends of the motor cable too soon. • Avoid unnecessary cable lengths.
Cable type	The PITCHmasters must always be wired with screened motor cables and signal lines. A cable type with double copper braiding with 60 -70 % coverage must be used for all screened connections.
Further hints for the control cabinet design	• Contactors, relays, solenoid valves (switched inductivities) must be wired with fuses. The wiring must be directly connected to the respective coil. • The switched inductivities should be at least 20 cm away from the process sontrolled assemblies. • Place larger consumers near the supply. • If possible enter signal lines only from one side. • Lines of the same electric circuit must be twisted. Crosstalk is generally reduced by routing cables in close vicinity to earthed plates. Connect residual strands at both ends with the control cabinet ground (earth).
Supplementary information	Supplementary information can be found in the corresponding connection description

Table 3.2 Projecting and installation regulations

3.3 PE-terminal

Step	Action	Note: PE-mains connection in accordance with DIN VDE 0100 part 540
1	Earth each of the PITCHmasters! Connect terminal ⏚ (X1 or X21) **in star configuration** with the PE-rail (main earth) in the switch cabinet.	**Mains connection < 10 mm²:** Protective conductor cross-section min. 10 mm² or use 2 conductors with a cross-section of the mains supply lines. **Mains connection > 10 mm²:** Use a protective conductor cross-section in compliance with the cross-section of the mains supply lines.
2	Also connect the protective conductor terminals of all other components, such as line reactor, filter, etc. **in a star-shaped way** to the PE-bar (main earth) in the control cabinet.	

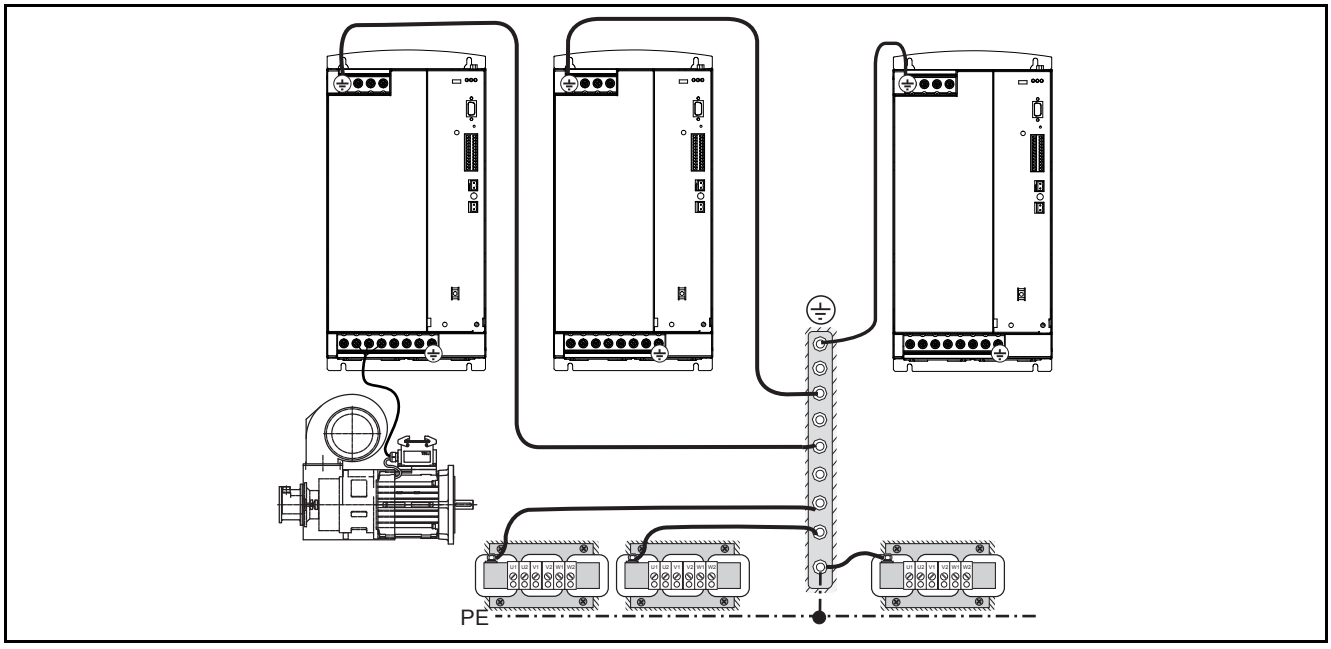


Figure 3.3 Star configuration layout of the earthing lead

NOTE

- The earthing lead must be laid out in star configuration to conform to the EMC standards.
- The backing plate must be well earthed.
- The motor cable, mains lead and control cable must be laid out separately from each other.
- Avoid loops, and lay cable over short distances.
- The operational leakage current is > 3.5 mA.

3.4 Electrical isolation concept

The control electronics with its logics, inputs and outputs is galvanically separated from the d.c.-link direct voltage by means of a two-stage power supply unit.

1) The first stage SNT1 converts the d.c.-link direct voltage to a 24 V voltage. This, on the one hand supplies the secondary side or the input or output side of the digital inputs and outputs. In order to increase the permissible current load it can be externally protected. This is generally required, if the 24 V is loaded with a current higher than 100 mA (e.g. by connected motor holding brake on OSD03).

2) On the other hand, this 24 V voltage feeds into a second power supply unit SNT2, in which the voltages for micro-controller, encoder interfaces, primary side of the CANopen interface and the analoge inputs are generated on basis of the same potential. The analog ground serves as reference potential for the specification of the analog setpoint.

The digital inputs and outputs supplied with voltage under 1.) are thus electrically isolated from 2.). Disturbances are thereby kept away from processor and analog signal processing.

The equipment internal CANopen interface is electrically isolated from the control electronics. The 24 V power supply for the secondary side or the interface to the application must be externally supplied via plug connector X5.

Expansion modules, such as I/O-terminal expansion UM-8I4O or the Profibus-DP-Module CM-DPV1 are also electrically isolated from the basic unit. The interface to the application of the module must be externally supplied through a 24 V terminal on the expansion module.

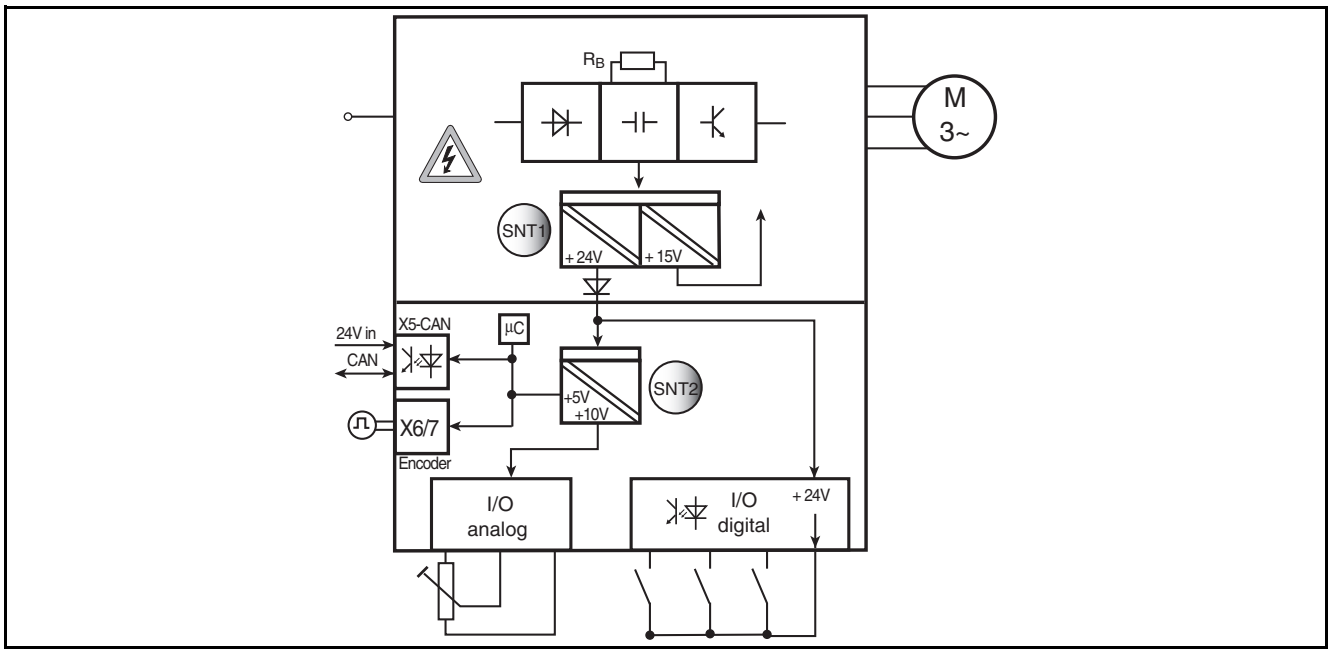


Figure 3.4 Electrical isolation concept/voltage supply PITCHmaster

When choosing the lines please bear in mind that the lines for analog inputs and outputs must in any case be screened. On pair screened cables the conductor and strand screens should be put on as generously as possible, under EMC aspects. High frequency disturbance voltages are thus reliably discharged (Skin effect). An EMC-compatible wiring is mandatory and must be strictly assured.

Special case: Utilizing the analog inputs as digital inputs

NOTE

The analog inputs must either be both used only with analog or both with digital function. Mixing the analog inputs with one input with analog function and another input with digital function is not permitted.

The use of the equipment internal 24 V DC as supply voltage while utilizing an analog input with the function "digital input" requires the connection of analog and digital ground. This can cause disturbances, as described above, and requires extreme care when selecting and connecting the control lines.

Safe operation is affected by the connection of analog and digital grounds. As a measure to minimize the parasitic currents affecting the ground connection, both the analog (AGND) and the digital ground (DGND) must be connected via a VHF-choke (820 µH, 0.5 A, e. g. EPCOS B82500-C-A5, wired).

X2	Function
1	Digital ground DGND
2	Auxiliary voltage U_V = 24 V DC
3	Analog input ISA0+
4	Analog input ISA0-
5	Analog input ISA1+
6	Analog input ISA1-

Table 3.3 Disabling the electrical isolation when using the analog inputs with digital function

CAUTION

The ground connection or introduction into the unit must not use the analog ground (terminals X2/4, X2/6). The connection must only be made via the DGND-terminals (see Figure 3.5).

Example: Risk of disturbing influence

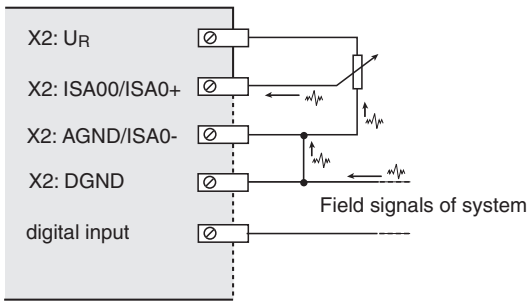


Figure 3.5 Disturbing influence on the analog input in case of inappropriate wiring

	NOTE
	If the number of digital inputs and outputs on the PITCHmaster is not high enough, we recommend the use of a terminal expansion module UM-8I4O with 8 digital inputs and 4 digital outputs.

3.5 Mains connection

Step	Action	Comment
1	Determine the **wire cross-section**, depending on maximum current and ambient temperature.	Wire cross-section according to VDE0100, part 523
2	Wire the PITCHmaster with the **line filter**, max. 0.3 m between filter housing and PITCHmaster!	Mains filter see A.5 Line filter
3	Wire the **power choke** (see A.4 Use of a power choke) **Please mind:** max. 0,3 m distance between choke housing and PITCHmaster!	Reduces the voltage distortions (THD) in the net and prolongs the lifetime.
4	Install a K1 circuit breaker (power switch, contactor, etc.).	**Do not connect the power!**
5	Use the mains fuses (type gL) or miniature circuit-breakers (trip characteristic C) to cut the mains power to all poles of the PITCHmaster.	To protect the line in accordance with VDE636, part 1

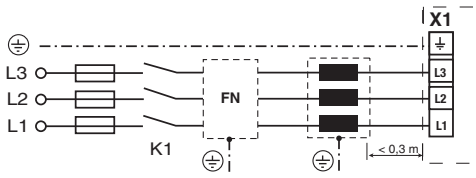


Figure 3.6 Mains connection

	CAUTION
	Due to the precharging technology one must make sure that the power choke is installed between PITCHmaster and line filter, as otherwise the line filter may get damaged.

DANGER

Risk of fatal injury!
Never wire or disconnect electrical connections while these are live. Always disconnect the power before working on the device. Wait until the d.c.-link voltage on terminals X21/ ZK+, ZK- has dropped to the safety-low voltage before starting work on the equipment (approx. 10 minutes).

CAUTION

If residual current circuit breakers are used:

- only all-current sensitive residual current circuit breakers suitable for PITCHmasters operation may be used. **Residual current compatibility:** In case of a fault the PITCHmaster is able to generate d.c. residual currents without zero crossing. The PITCHmasters must therefore only be operated on all-current sensitive RCM (residual current operated protective device), see DIN VDE 0160 and DIN VDE 0664.
- the common leakage current circuit breaker (RCD = Residual Current operated Device) **Type A** are not adequate to operate this kind of leakage current safely. Due to this fact leakage current circuit breakers **TYPE B** should be provided.
- Typical leakage currents of PITCHmasters with internal line filters for 3-phase power supply see chapter A.5.
- Switching the mains power: Cyclic power switching is permitted every 60 seconds; jog mode with mains contactor is not permitted.
  - In case of too frequent switching the units protects itself by high-resistance isolation from the system.
  - After a rest phase of a few minutes the device is ready to start once again.
- TN network and TT network: permitted without restriction.
- IT network (insulated centre point): not permitted!
  - In the event of a earthing fault the voltage stress is around twice as high, and creepages and clearances in accordance with EN50178 are no longer maintained.
- Connection of the PITCHmaster via power choke with an impedance voltage of U_K = 2 % of the rated voltage is mandatory:
  - where the PITCHmaster is used in applications with disturbance variables corresponding to environment class 3, as per EN 61000-2-4 and above (hostile industrial environment).
  - for compliance with EN61800-3 or IEC 1800-3, see chapter A.5
  - with a d.c.-link between multiple PITCHmasters.

For further information on permissible current loads, technical data and environmental conditions please refer to the appendix A.1 to A.3 .

Environment class 3 acc. to EN61000-2-4:

Among others, environment class 3 is characterized by:

- Mains voltage fluctuations > $\pm$ 10 % U_N
- Short-term interruptions between 10 ms to 60 s
- Voltage unbalance between the phases > 3%

Environment class 3 typically applies where:

- a major part of the load is supplied by power converters (dc choppers or soft-start equipment),
- welding machines are present,
- induction or arc furnaces are present,
- large motors are frequently started,
- electric loads fluctuate rapidly.

PITCHmaster	Max. possible cable cross-section for terminals [mm²][1)]	Recommended mains fuse (gL)[A]
54.018 54.044 54.058 54.070	max. 25 mm²	35 50 50 80
[1)] The minimum cross-section of the power supply cable depends on the local regulations (VDE 0100 part 523, VDE 0298 part 4), the ambient temperature and the required nominal current for the PITCHmaster.		

Table 3.4 Wire cross-sections and mains fuses (observe VDE100 and VDE0298)

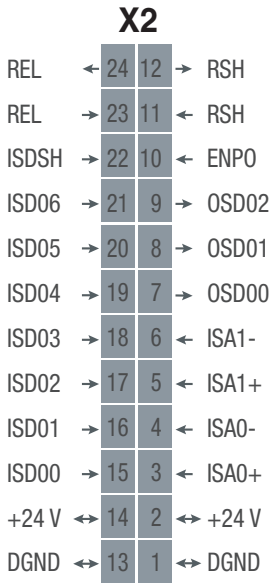
3.6 Control connections

Step	Action	Comment
1	Please check whether you already have a DRIVEMANAGER **data set** with a complete device setup available, i.e. the drive has already been planned as required.	
2	If this is the case, a special control terminal assignment applies. Please contact your project engineer to obtain the terminal assignment.	**Bulk customers** For details of how to load the data set into the PITCHmaster refer to section 4.2.
3	Choose a terminal assignment.	**Initial commissioning** There are various pre-set solutions available to make it easier to commission the device.
4	Wire the control terminals with shielded cables. The following is strictly required: ENPO X2.10 and a start signal (with control via terminal).	Earth the cable shields over a wide area at both ends. Wire cross-section maximum 1.5 mm² or two strands with 0.5 mm² per terminal

Step	Action	Comment
5	Keep all contacts open (inputs inactive).	
6	Check all connections once again!	Continue with commissioning in section 4.

NOTE

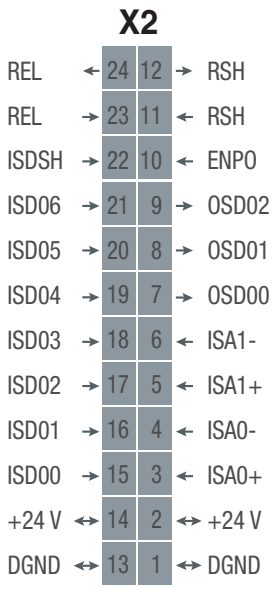
- Always wire the control terminals with shielded cables.
- Lay the control cables separately from the mains lead and motor cable.
- A cable type with double copper braiding with 60 - 70 % coverage must be used for all screened connections.



Specification of control connections

Des.	Terminal	Specification	Electrical isolation
Analogue inputs			
ISA0+ ISA0- ISA1+ ISA1-	X2-3 X2-4 X2-5 X2-6	• U_{IN} = ±10 V DC; • Resolution 10 bit; R_{IN}=110 kΩ • Terminal scan cycle = 1 ms • Tolerance:U: ±1 % of the measuring range end value.	no
Digital inputs			
ISD00 ISD01 ISD02 ISD03 ISD04 ISD05	X2-15 X2-16 X2-17 X2-18 X2-19 X2-20	• Frequency range < 500Hz • Terminal scan cycle = 1ms • Switching level low/high: < 4,8 V / > 18 V • at 24 V typ. 3 mA • R_{IN} = 3 kΩ	yes
ISD06	X2-21	• Frequency range < 500Hz • Switching level low/high: < 4,8 V / > 18 V • I_{max} at 24 V = 10 mA • R_{IN} = 3 kΩ • internal signal delay time < 2µs suitable as trigger input for quick saving of the actual position	yes
ISDSH	X2-22	• Do not use	
ENPO	X2-10	• Power stage enable = High-Level • Frequency range < 500Hz • Reaction time approx. 10 ms • Switching level low/high: < 4,8 V / > 18 V • at 24 V typ. 3 mA • R_{IN} = 3 kΩ	yes
Digital outputs			
OSD00 OSD01 OSD02	X2-7 X2-8 X2-9	• short-circuit proof • I_{max} = 50 mA (per terminal, however, $I_{max, total}$ = 100 mA), PLC-compatible	yes
Relay outputs			

Tabla 3.5 Specification of control terminal



Des.	Terminal	Specification	Electrical isolation
REL REL	X2-23 X2-24	• Relay, 1 normally open • 25 V / 1 A AC, utilization category AC1 • 30 V / 1 A DC, utilization category DC1 • Operating delay approx. 10 ms • Cycle time 1 ms	yes
RSH RSH	X2-11 X2-12	• Do not use	
Voltage supply			
+24 V	X2-2 X2-14	• Auxiliary voltage U_V = 24 V DC ± 25 %, short-circuit proof • I_{max} = 100 mA (overall, also includes driver currents for outputs OSD00 and OSD01, OSD02 and OSD03) • external 24 V - feed for supply of the control electronics in case of a mains failure possible, current consumption Imax = 1000 mA + holding brake current Tolerance of feed ± 20 % **ATTENTION:** Depending on the type of power supply unit a decoupling diode to protect the mains unit may be required as a protective measure, because the 24 V of the PITCHmaster and the 24 V mains unit may feed back, depending on the tolerances.	yes
Digital ground			
DGND	X2-1 X2-13	Reference ground for 24 V	yes

Tabla 3.5 Specification of control terminal

Brake driver X9

The plug X9 is intended for connection of a motor brake.

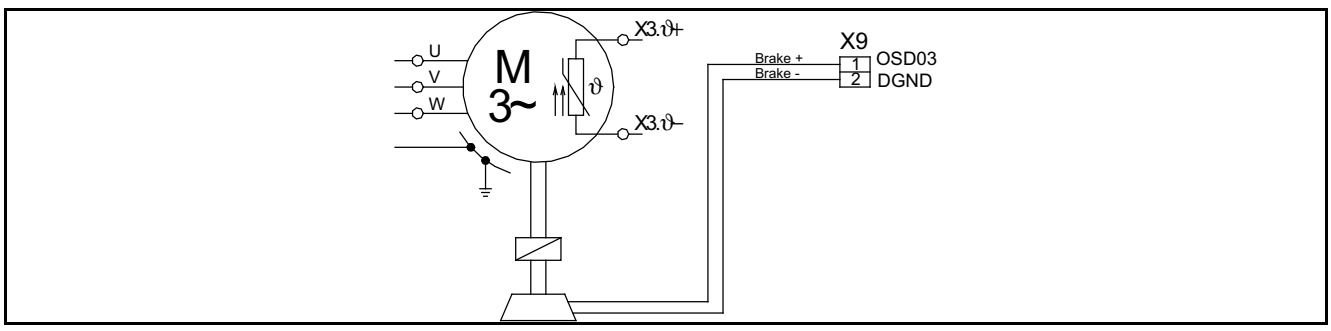


Figure 3.7 Connection of motor brake

Brake driver X9			Electrical isolation
OSD03 DGND	X9-1 X9-2	Short-circuit proof Cable breakage monitioring • 24 V external voltage supply required (I_{IN} = 2.1 A) • Suitable for controlling a motor holding brake • I_{max} = 2.0 A to ϑ_{Umax} < 45 °C Reduced from I_{max} (with external 24 V supply via X2) • Overcurrent causes shut down • Can also be used as configurable digital output without external voltage supply. Without external voltage supply I_{max} = 50 mA	yes

Table 3.6 Specification of terminal connections X9

3.7 Encoder connection

Encoder connection for motors

Please use the prefabricated motor and sensor line to connect the synchronous motors.

Assignment motor - encoder cable - PITCHmaster connection

Compare the type plates on the components. Make absolutely sure to use the correct components according to a variant A, B or D!

NOTE

Do not separate the encoder cable, for example to route the signals via terminals in the switch cabinet. The knurled screws on the D-Sub plug housing are tightly locked!

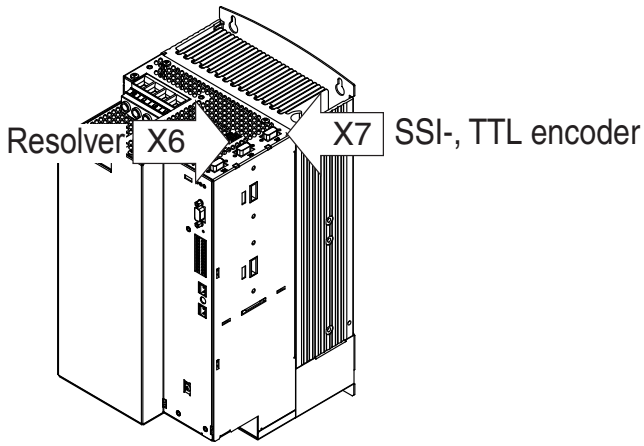


Figure 3.8 Assignment encoder cable

Type	Motor (with encoder installed)	Encoder cable	Connection of the PITCHmaster
A	with resolver R,3R xxx - xx - xxRxx	KRY2- KSxxx	X6
B	with SSi absolute value transducer G2, G3 or G5 xxx - xx - xxG3x or - xxG5x	KGS2- KSxxx	X7
D	with TTL-encoder G8 xxx - xx - xxG8x	-	X7

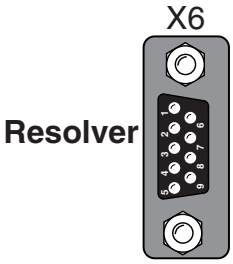
Table 3.7 Enocder types

NOTE

With simultaneous connection of a resolver to X6 and an encoder to X7 the unit requires a 24 V/1 A power supply (X2).

Encoder connection other motors

A resolver is connected to board slot X6 (9-pin D.Sub socket) .

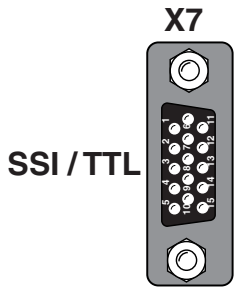


X6/Pin	Function
Pin	Function
1	Sin+ / (S2)(track A)
2	Refsin / (S4)(track A)
3	Cos+ / (S1)(track B)

Table 3.8 Pin assignment X6

X6/Pin	Function
4	+ 5 V (opposite pin 7)
5*	ϑ + (PTC, KTY, Klixon)
6	Ref+ (index signal)
7	Ref- (index signal)
8	Refcos / (S3) (track B)
9*	ϑ - (PTC, KTY, Klixon)
* The motor PTC must be sufficiently insulated against the motor winding (safe separation 4 kV withstand voltage). When using Moog Unna GmbH motors this insulation is assured.	

Table 3.8 Pin assignment X6



Encoder interface X7 is suitable for connection of an encoder with an

- incremental TTL-interface
  or
- SSI-interface

- Encoder voltage supply
  – Voltage supply on encoder: + 5 V ±5 %, max. power consumption 150 mA (including load)
  – The encoders must have a separate sensor line terminal. The sensor lines are required to measure a supply voltage driop in the encoder line. Only the use of the sensor lines assures that the encoder is supplied with the correct voltage.
  The sensor lines must always be connected!
- Incremental encoder with RS422 compatible track signals (TTL-compatible)
  – 32-8192 pulses/revolution
- SSI-Multiturn encoder acc. to the reference list with general specifications:
  – Line protocol "SSI", gray coded
  – 25 bit-Multiturn (12/13 bit Multi-/Singleturn information, MSB first)

The electrical specification of the interface is given in the Table 3.9, the terminal assignment in the Table 3.10.

	TTL encoder	SSI encoder
Connection	Miniature D-SUB 15-pin socket (high-density)	
Interface	RS422 (differential)	
Wave terminating resistor	Track A, B, R: 120 Ω (internal)	DATA: 120 Ω (internal) CLK: no connection necessary
Max. signal frequency f_{Limit}	500 kHz	

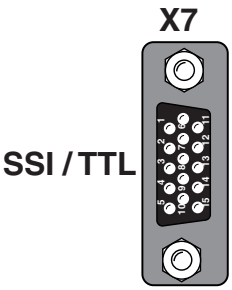
Table 3.9 Specification of encoder interface X7

	TTL encoder	SSI encoder
Voltage supply	+ 5 V ±5 % (controlled via sensor lines) max. 150 mA not isolated from the control electronics	
Sampling rate of the controls	4 kHz	4 kHz
Interface log	-	SSI (Graycode)
Lines per revolution / resolution	32-8192	13 bit (single turn) 25 bit (multi turn)
Max. cable length	50 m (further cable specifications as specified by motor manufacturer)	

Table 3.9 Specification of encoder interface X7

Select the cable type specified by the motor or encoder manufacturer. Thereby please observe the following boundary conditions:

- Always used shielded cables. The shielding must be placed on both sides of the cable.
- Connect the differential track signals A, B, R or CLK, DATA to each other via twisted wires.
- Do not separate the encoder cable, for example to route the signals via terminals in the switch cabinet.



X7-Pin	Function TTL	Function SSI
1	A-, (track A) 1)	don't use
2	A+, (track A)	don't use
3	+ 5 V (150 mA)	
4	don't use	Data + differential input RS485
5	don't use	Data - differential input RS485
6	B-, (track B) 1)	don't use
7	don't use	don't use
8	GND (for 5 V on Pin 3)	
9	R- (index signal) 1)	don't use
10	R+ (index signal)	don't use
11	B+, analog differential input track B 1)	don't use
12	Sensor + sensor line to measure the 5 V supply on the encoder	
13	Sensor - sensor line to measure the 5 V supply on the encoder	
1) The lines of tracks A, B, R and Data are internally terminated with 120 Ω.		

Table 3.10 Pin assignment of encoder interface X7

X7-Pin	Function TTL	Function SSI
14	don't use	CLK +differential output cycle signal
15	don't use	CLK -differential output cycle signal
1) The lines of tracks A, B, R and Data are internally terminated with 120 Ω.		

Table 3.10 Pin assignment of encoder interface X7

3.8 Motor connection

Step	Action	Comment
1	Determine the **wire cross-section**, depending on maximum current and ambient temperature.	Wire cross-section according to VDE0100, part 523, see chapter 3.8.
2	Wire the **motor phases** U, V, W via a shielded cable and earth the motor to X21/⏚.	Mount screen at both ends to reduce interference emission.
3	Wire the temperature sensor (PTC, KTY, Klixon) (if present) to X3 with separately shielded cables and activate the tempra-ture evaluation via the DRIVEMANAGER.	Mount screen at both ends to reduce interference emission.

CAUTION

It must be assured that the temperature monitor used is sufficiently insulated towards the motor winding (2 kV withstand voltage)).

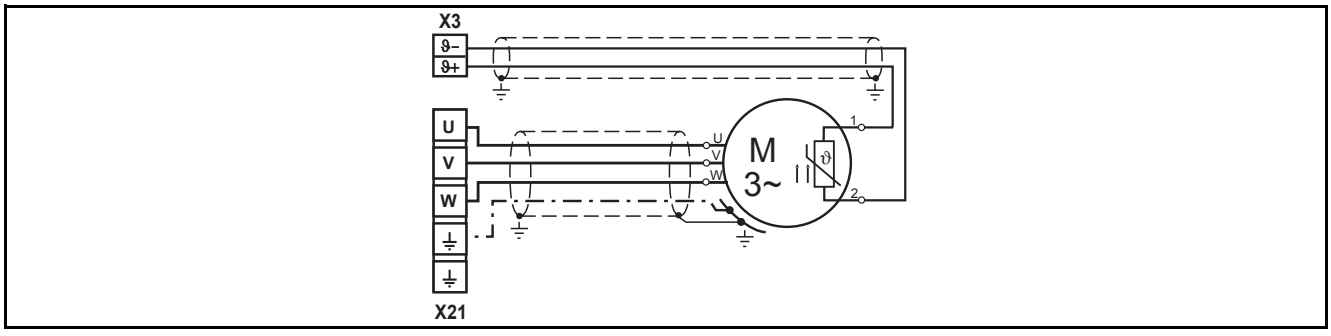


Figure 3.9 Connection of AC motor

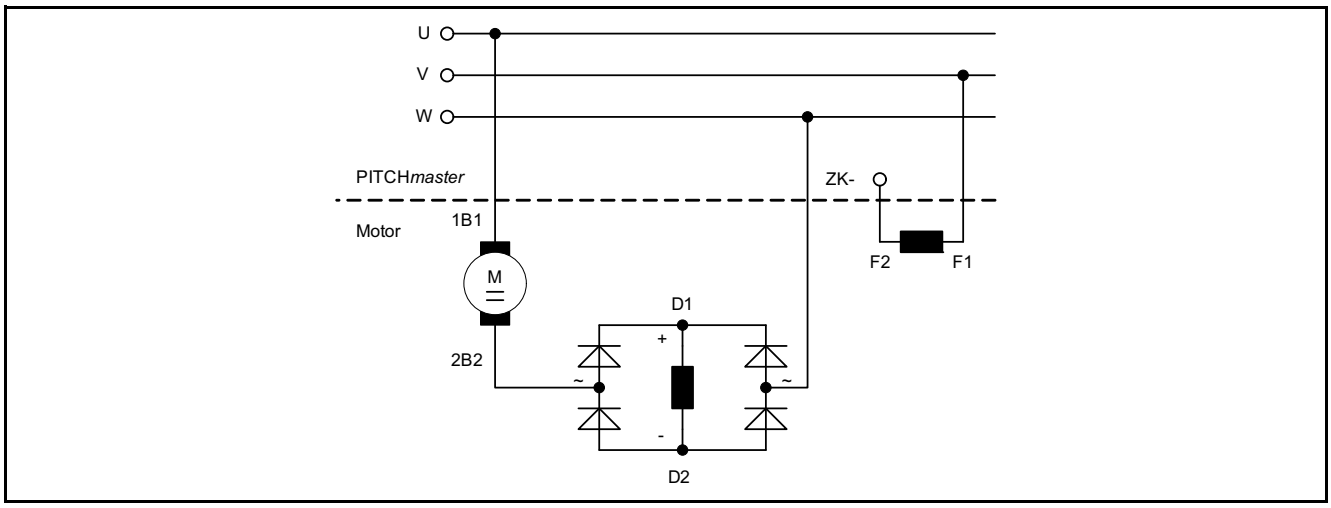


Figure 3.10 Connection DC compound motor

NOTE

During operation the PITCHmaster is protected against shorting and earth faults at the terminals. In the event of a short-circuit or earth fault in the motor cable, the power stage is disabled and an error message is delivered.

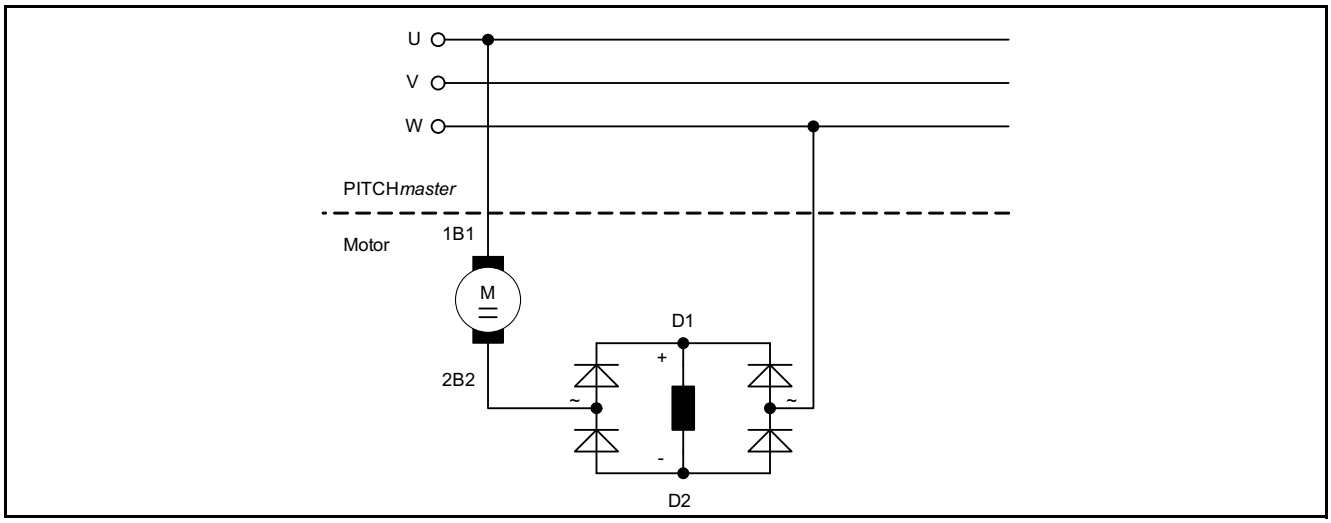


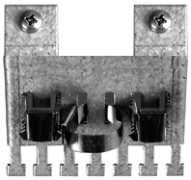
Figure 3.11 Connection DC series-wound motor

CAUTION

The field rectifier is not included in delivery.

When dimensioning and mounting the field rectifier pay attention to the ampacity, the cooling and the withstand voltage of the diodes.

For further information please consult your project engineer.



STxx

NOTE
• Establish shield contact via shield connection STxx. • For proper EMC installation the motor terminal box must be HF-tight (metal or metallised plastic). For cable introduction, packing glands with large-area screen contact should be used. • Further information on permissible current load, technical data and environmental conditions can be found in appendices A1 to A3.

Motor protection

This mask (Figure 3.12) can be used to set the appropriate motor temperature sensor (PTC) or the temperature dependent switch and a I²xt-monitoring as a measure to protect the motor.

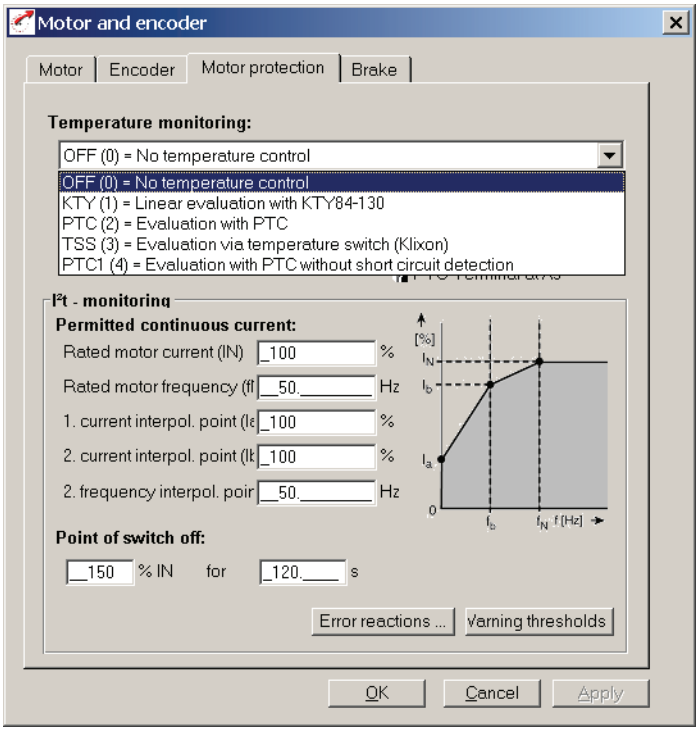


Figure 3.12 Register motor protection

3.9 Connection energy storage (e. g. battery)

An external energy storage can be connected to the terminals ZK+ and ZK-, e. g. a battery or an external d. c. link.

CAUTION
The contactors, diodes, fuses as well as the energy storage are not included in delivery. When dimensioning and mounting the components pay attention to the ampacity and the withstand voltage. For further information consult your project engineer!

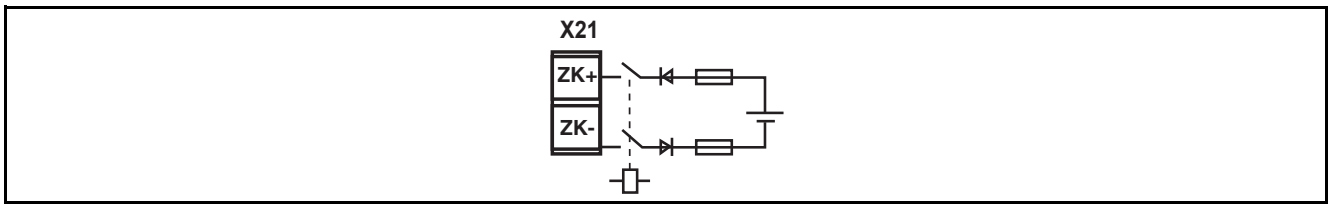


Figure 3.13 Connection energy storage

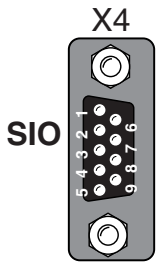
CAUTION

Do not switch on the contactor relais of the external enery storage before the PITCHmaster indicates „ready-to-operate“ (LED). Otherwise, a high charging current could affect the capacitors of the internal d. c.-link as well as the external energy storage.

For further information consult your project engineer.

3.10 Serial interface (SIO)

The serial interface (SIO, X4) is used to connect the DRIVEMANAGER and serves as a slot for the optional RS232-RS485 interface converter (CM-RS485).



Pin-Nr.	Funktion
1	+15 V DC
2	TxD, data transmission
3	RxD, data reception
4	not used
5	GND for +15 V DC
6	+24 V DC
7	not used
8	not used
9	GND for +24 V DC

Table 3.11 Pin assignment of the serial interface X4

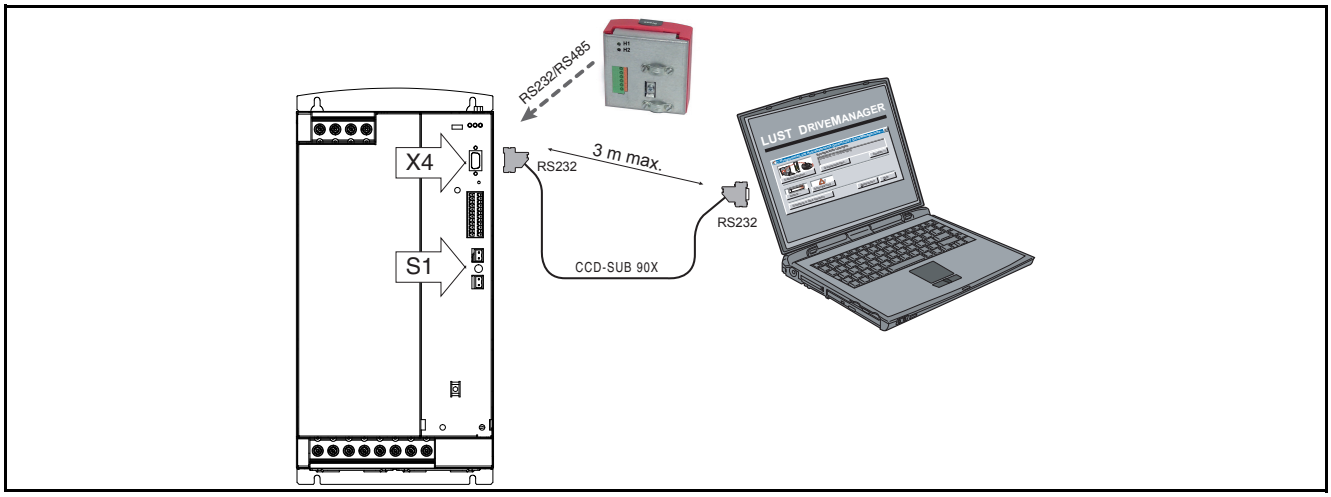


Figure 3.14 Terminal X4

Please use only the prefabricated RS232 cable CCD-SUB 90X (max. length 3 m) to connect the PITCHmaster to the PC / DRIVEMANAGER.

	CAUTION
	The RS232-interface should only be used as a service diagnostics interface. Using the interface for control purposes is not permitted.

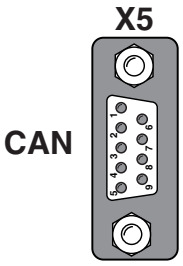
3.11 CAN interface

The CAN_{open}-interface is integrated in the PITCHmaster. It is connected via connector X5. The customer is responsible for providing a power supply to the isolated connection.

Connection	Miniature D-Sub 9-pin pin
Wave terminating resistor - Bus termination -	a bridge (Pin 1-2) activates the internal terminating resistance (120 Ω)
Max. incoming frequency	1 MHz
External voltage supply	+ 24 V ±25 %, 50 mA (potential-free to PITCHmaster)

Table 3.12 Terminal X5

Assignment of connection X5:



Pin	Function
1	Bridge on Pin 2 for active bus termination
2	CAN_LOW
3	CAN_GND
4	Do not use
5	Do not use
6	**CAN_GND**
7	CAN_HIGH
8	Do not use
9	**CAN_+24 V external supply voltage**

Table 3.13 Pin assignment X5

The CAN-bus node address is set via the encoder switch (**S1**, see Figure 3.14 Terminal X4).

A bus address can be alternatively set via parameters. The addresses via encoder switch and parameter are added up.

Project planning and description of function:

For informatiuon please refer to the **CANopen Communication Manual**. In the factory setting **ASTER: OLT_1** the interface is switched off.

3.12 DC-network

The PITCHmasters operated in a regenerative mode (braking operation) in a DC-network, feed energy into the DC-network, which is then consumed by the motor operated PITCHmasters.

CAUTION

It is essential that a DC network operation be checked at the project planning stage. Please consult your project engineer.

3.13 Braking resistor (RB)

In regenerative operation, e. g. when braking the PITCHmaster, the motor feeds energy back to the PITCHmaster. This increases the voltage in the d.c.-link. If the voltage exceeds a threshold value, the internal braking transistor is activated and the regenerated power is converted into heat by means of a braking resistor.

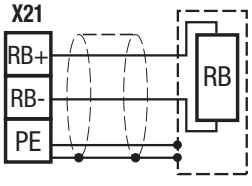


Figure 3.15 Braking resistor connection

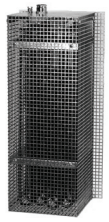
DANGER

Risk of fatal injury!
Never wire or disconnect electrical connections while these are live. Always disconnect the power before working on the device. Wait until the d.c.-link voltage on terminals X21/ ZK+, ZK- has dropped to the safety-low voltage before starting work on the equipment (approx. 10 minutes).

Connection of an external brake resistor

CAUTION

- The installation instructions for the external braking resistor must be strictly observed.
- The temperature sensor (bimetal switch) on the braking resistor must be wired in such a way, that the connected PITCHmaster is disconnected from the mains supply if the system overheats.
- The minimum permissible connection resistance of the PITCHmaster must not be fallen short of, technical data see A.2.
- For further information please consult your project engineer.



CAUTION

An external brake resistor must be monitored by the control.

The temperature of the braking resistor is monitored by a temperature watchdog (Klixon).

In case of excessive temperatures the PITCHmaster must be disconnected from the mains supply.

4 Commissioning

CAUTION

Commissioning must only be carried out by qualified electricians who have undergone instruction in the necessary accident prevention measures.

4.1 Choice of commissioning

Mode of commissioning	Commissioning steps	Continued on
• Project planning and commissioning have already been completed. • Loading an existing data set.	“4.2 Serial commissioning”	4-1
• Initial project planning and commissioning of the drive system.	“4.3 Initial commissioning”	4-3
• Project planning and basic setting of the drive system have already been carried out.	“4.4 Test run”	4-9

4.2 Serial commissioning

Apply this mode of commissioning when you want to commission several identical PITCHmasters (i.e. serial commissioning). The same PITCHmaster and motor must be set for each drive in an identical application.

Prerequisite:

- All PITCHmasters are completely connected.
- The **first** drive has already been fully taken into operation.
- A PC with the user software DRIVEMANAGER (valid from Version V 260.40-0) installed is connected.

Step	Action	Comment
1	Connect your PC with the PITCHmaster of the **first** drive and switch on the mains supply for the PITCHmaster.	Use a standard serial cable (9pole D-SUB, socket/pin).
2	START DRIVEMANAGER.	Automatically links the connected PITCHmaster.
	If the connection setup fails you should check the settings in the menu **Extras** > **Options** and retry it via the icon. 	

Step	Action	Comment
3	Save the current data set by clicking on the icon  , either to the parameter data-base (directory: c:/../userdata) of the DRIVEMANAGER or to a floppy disk (a:/).	The icon always saves the most current data set of the connected unit. Name the file as desired.
4a	Use this icon to discon-nect from all devices 	
4b	Connect your PC with the PITCHmaster of the **next** drive and switch on the mains supply for the PITCHmaster.	
5	Click on icon  to establish a link between the DRIVEMANAGER and the newly connected device.	
6	Click on icon  to load the data set saved in step 4 into the device.	
7	Use the icon  to select the main window. Save the settings with the button -> 	
	Repeat steps 4 ... 7 for all further drives.	

Load data set from file into unit

Please remember to save the setting.

REFERENCE

For further information concerning the DRIVEMANAGER please refer to the **DRIVEMANAGER Manual** (Id.-Nr.:0842.01B.x-xx).

4.3 Initial commissioning

Prerequisites:

- The PITCHmaster is completely connected, see chapter 3.1
- Installed DRIVEMANAGER from version V 260.40-0
- The database for motors is installed on the PC
- The unit is connected to the PC via the RS232 interface (X4)

DANGER

Risk of fatal injury!
Never wire or disconnect electrical connections while these are live. Always disconnect the power before working on the device. Wait until the d.c.-link voltage on terminals X21/ ZK+, ZK- has dropped to the safety-low voltage before starting work on the equipment (approx. 10 minutes).

Input ENPO = apply Low-Level (terminal (X2)) to avoid unintended starting of the motor (power stage locked, mains voltage for PITCHmaster switched on).

Preparations:

- Switch on the PITCHmaster - a self-test is performed.
- Start the DRIVEMANAGER.

DRIVEMANAGER Connect or: Communication > Connect...

Set up a connection to the device.

Opening the main window "Settings":

DRIVEMANAGER *or: Active device > Change settings*

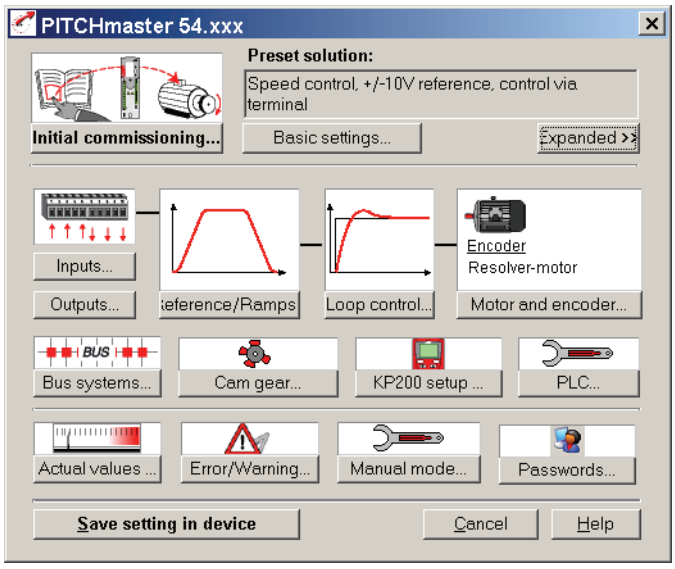
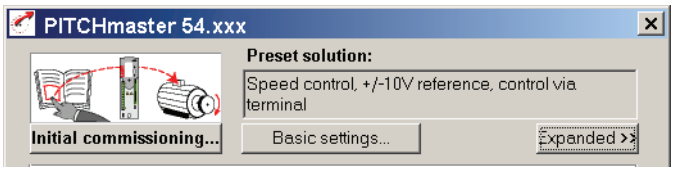


Figure 4.1 Main window for the different settings in the DRIVEMANAGER.

Continue with:

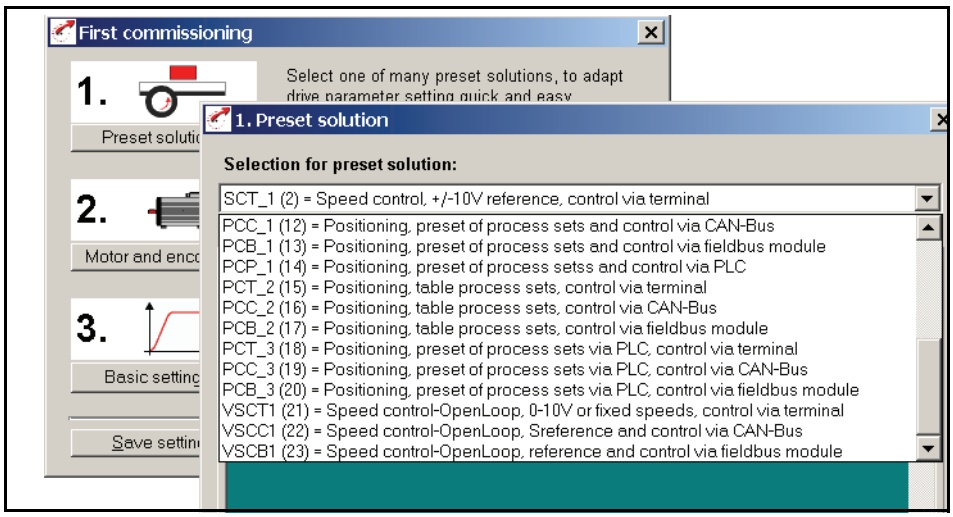


4.3.1 Preset solutions

Pre-set solutions are complete parameter data sets which are provided to handle a wide variety of typical application movement tasks. The PITCHmaster is automatically configured by loading a pre-set solution into the random access memory (RAM). The parameters for

- the control location of the PITCHmaster,
- the reference source,
- the assignment of signal processing input and outputs and
- the type of control

are the focal points of the setting.



By changing individual parameters, the preset solutions can be adapted to the needs of the specific task. Pre-set solutions modified this way are stored in the unit as user data sets.

A total of 23 preset solutions covers the typical areas of application for speed control with the PITCHmaster.

Abbreviation	Reference source	Start of inverter via/ Bus control profile
TCT_1	+/-10V-analog - torque	I/O-terminals
SCT_1	+/-10V-analog	I/O-terminals
SCT_2	Fixed speed table	I/O-terminals

Table 4.1 Preset solutions for speed control

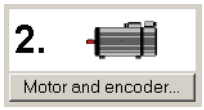
Abbreviation	Reference source	Start of inverter via/ Bus control profile
SCC_2	Fixed speed table	CANopen field bus interface - EasyDrive-Profile "Basic"
SCB_2	Fixed speed table	Field bus options module (Profibus) - EasyDrive-Profile "Basic"
SCC_3	CANopen field bus interface	CANopen field bus interface - EasyDrive-Profile "Basic"
SCB_3	Field bus options module (Profibus)	Field bus options module (Profibus) - EasyDrive-Profile "Basic"
SCP_3	PLC	PLC
SCT_4	PLC	I/O-terminals
SCC_4	PLC	CANopen field bus interface - EasyDrive-Profile "Basic"
SCB_4	PLC	Field bus options module (Profibus) - EasyDrive-Profile "Basic"
PCT_2	Drive set tables	I/O-terminals
PCC_2	Drive set tables	CANopen field bus interface - EasyDrive-Profile "TabPos"
PCB_2	Drive set tables	Field bus options module (Profibus) - EasyDrive-Profile "TabPos"
PCC_1	CANopen field bus interface	CANopen field bus interface - DSP402-Profiles position mode - DSP402-Profiles velocity mode - DSP 402-Interpolated Mode
PCB_1	Field bus options module (Profibus)	Field bus options module (Profibus) - EasyDrive-Profile "DirectPos"
PCP_1	PLC	PLC
PCT_3	PLC	I/O-terminals
PCC_3	PLC	CANopen field bus interface - EasyDrive-Profile "PlcPos"
PCB_3	PLC	Field bus options module (Profibus) - EasyDrive-Profile "PlcPos"
VSCT1	0-10 V or fixed speed	I/O terminals
VSCC1	CANopen field bus interface	CANopen field bus interface
VSCB1	Field bus opional module (PROFIBUS)	Field bus opional module (PROFIBUS)

Table 4.1 Preset solutions for speed control

All pre-set solutions have an individual window for basic settings in DRIVEMANAGER. In many cases the pre-set solutions are adapted to the application. Please refer to your project engineer.

	REFERENCE
	For more detailed information on pre-set solutions and terminal assignment please refer to the **CDE/CDB/CDF3000 Application Manual**.

4.3.2 Setting motor and encoder



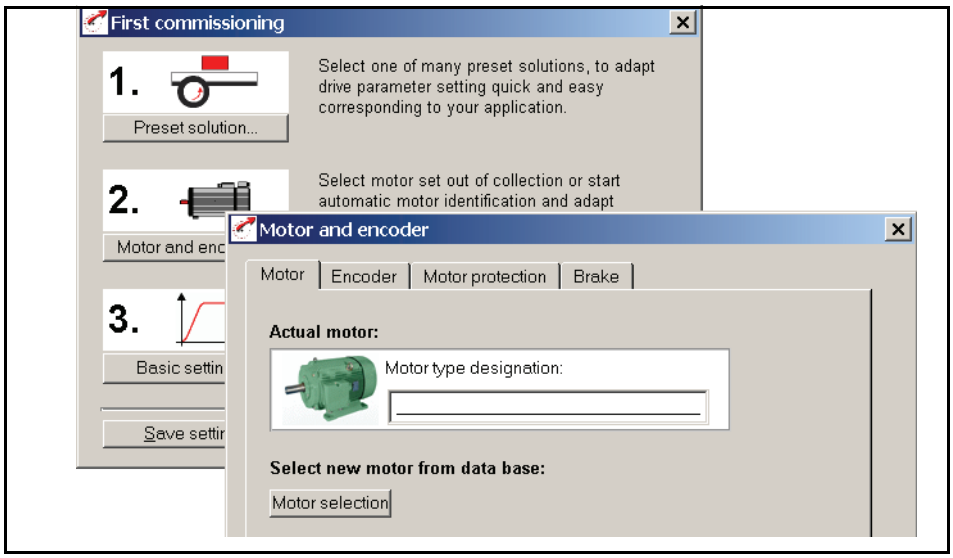


Figure 4.2 Setting the motor and encoder

Setting up the motor data via the motor database

A database with all settings for motors is available. Using the correct motor data set ensures:

- that the electrical parameters of the motor are correctly set,
- that the motor protection ("Motor protection" tab) is correctly set and
- the control circuits for the drive are pre-set.

Motor data sets for motors which aren't yet in the current motor database, can be created at Moog Unna GmbH. Please refer to your project engineer.

	NOTE
	The torque control is optimally adjusted, so that no further adaptations are required. The setting of the speed control is based on the assumption that the moment of inertia of the machine reduced to the motor shaft is identical with the moment of inertia of the motor. The speed and PITCHmasters have a high level of attenuation and therefore also suitable for the control of elastic mechanical components.

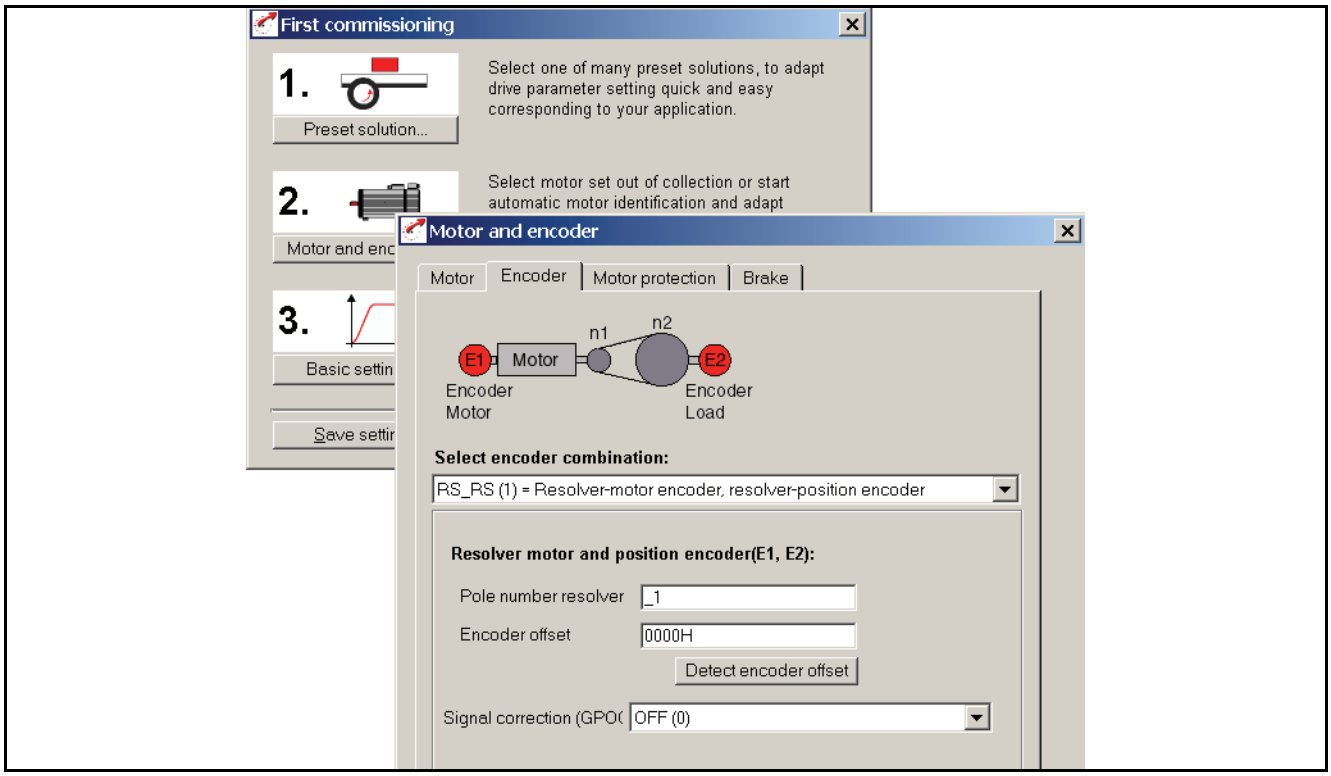
For special settings in optimizing the speed and position control circuitry you should use the CDE/CDB/CDF3000 Application Manual.

With the button "Motor selection" in tab "Motor" you can select the required motor from your installed motor database. The motor type is stamped on the motor type plate. If the motor data set is supplied on a data carrier (floppy disk, CD-ROM) it

can be directly loaded via button "Other directory".

Setting up the encoder

The encoder connected to the motor is set in the tab "Encoder". There is also the possibility to work with two encoders. In such cases, the first rotary encoder is used for commutation and speed control of the motor (motor encoder), the second one for position control (PITCHmaster). It is also possible to perform both functions with a single encoder.



Every rotary encoder combination has a special setup screen.

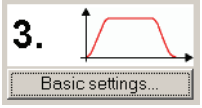
	REFERENCE
	For more information on setting the encoders, refer to the **CDE/CDB/CDF3000 Application Manual**.

Checking the encoder

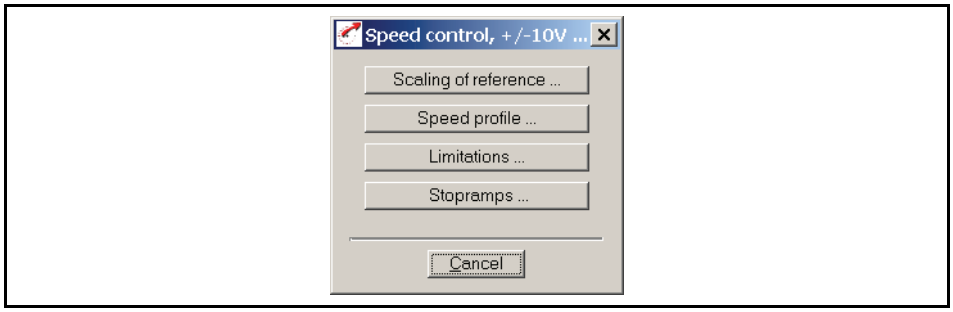
To check the encoder, rotate the motor shaft by hand. The viewing is from the front onto the end of the shaft (flange). The "reference and actual values" status display, under "n_{ist}, Actual speed", must indicate a positive speed in clockwise rotation and a negative speed in counter-clockwise rotation. If the speed is incorrect, check the following points:

- Is the encoder cable correctly connected to the motor and the PITCHmaster?
- Is the encoder cable in use the correct one for the type of encoder?

4.3.3 Making basic settings



Custom setup screens are provided for fine adjustment of each preset solution. You can use them to adapt the drive to your application. A detailed description of the individual functions can be found in the CDE/CDB/CDF3000 Application Manual.



4.3.4 Saving the settings

Saving the settings in the device

DRIVEMANAGER
Settings

or:
Active device > Change settings

All changes that are to be permanently stored in the device, must be saved via this button.

These changes can also be saved in a file.

Saving the settings in a file

DRIVEMANAGER
Settings
or:
Active device > Save device settings in a > file

Choose the file name (e.g. mydata). All parameters are saved under the chosen file names (e.g. mydata) with the appropriate extension (*.00D). It is possible to assign a description to the device data prior to saving it.

Continue with "Test run", siehe Kapitel 4.4.

4.4 Test run

The drive is tested without the coupled mechanics. The Test run is conducted in the speed controlled mode, independently from the selected pre-set solution.

A test run is still possible, even if the motor has already been coupled to the system:

DANGER

Test run with motor installed:
In this case it must be assured that the test will not cause any damage to the system! Pay particular attention to the limitations of the positioning range.
Please note that you yourself are responsible for safe operation. Moog Unna GmbH will not assume liability for any occurring damage.

Danger to life from uncontrolled rotation!
Before starting motors with feather keys in the shaft end these must be reliably secured against being ejected, as far as this is not already prevented by drive elements such as belt pulleys, couplings or similar.

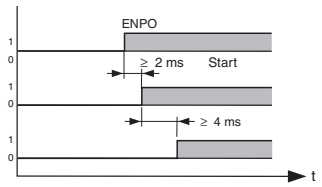
Pre-set solution for torque control:
In this pre-set solution the drive must not be operated without load torque, because otherwise the motor shaft would accelerate uncontrolled up to the adjusted speed limit.

CAUTION

Destruction of motor:

The motors are intended for operation on the PITCHmaster. Direct connection to the mains can destroy the motor.
The surface temperatures on the motors may increase to a very high level. No temperature sensitive parts may touch or be mounted to these areas, appropriate measures to prevent contact must be applied wherever necessary.
A temperature sensor that may possibly be installed in the winding, must be connected to the PITCHmaster, so that overheating of the motor can be prevented by the temperature monitoring system.
Before starting the motor the motor brake (if present) must be checked for correct function.
The optionally installed holding brake is only designed for a limited number of emergency brake operations. Use as working brake is strictly prohibited.

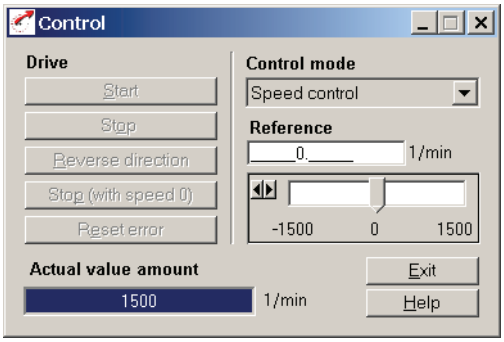
1) **Power stage enable**
High-level at terminal 8 (X2)

	Input ENPO Input Start Device status: „Loop control active“

Observe the temporal behaviour of the inputs.

2) **Control with DRIVEMANAGER:**
Set the input ENPO, select "Speed control" and start the drive, e.g. with nominal value 100 min^{-1}.

DRIVEMANAGER
Open-loop control
or:
Active device > Open-loop control> Basic operating modes

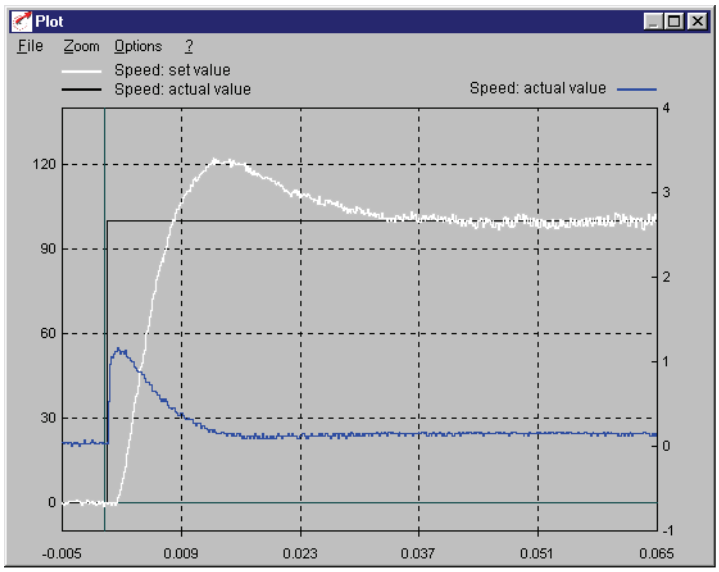


Check the drive response

DRIVEMANAGER
Digital Scope
or:
Active device > Monitor > Quickly changing digital scope values

Now you can assess the drive performance with the aid of step responses, which can be recorded using the digital scope function of the DRIVEMANAGER.
Select the following three recording variables:
- 0:Speed:Reference
- 1:Speed:Actual value
- 2:Torque:Actual value

Triggering conditions:
Channel 0; rising flank, pre-trigger 10 %; level: 30 min $^{-1}$



Start the drive with a reference value of e.g. 100 min^{-1}.
Compare the step response of your drive with the illustration. With resolvers the overshoot of the actual speed value should be around 20 %; with incremental encoders approx. 30 % (with reference to the nominal value). Make sure that the drive system shows small-signal response (the nominal value of the torque must be less than the maximum value).

If the torque reference reaches its maximum, reduce the speed step.

The time response (rise time, correction time) of the speed control loop is independent of the speed step.

Result:

If the step response of your drive does approximately correspond with the illustration, it is assured that the motor phases are correctly wired, the encoder is correctly connected and the PITCHmaster is parameterized to the correct motor.

If the step response deviates considerably from the illustration, it is to be assumed that

- the motor data set was incorrectly selected or
- the wiring is incorrect

Check the individual steps from chapter 3 "Installation" and chapter 4.3 "Initial commissioning" and repeat the test run.

The step response may also deviate if the ratio of the machine moment of inertia reduced onto the motor shaft relative to the motor moment of inertia is very high. Here the loop control settings must be optimized. For special settings to optimize the speed and position control circuitry, please use the CDE/CDB/CDF3000 Application Manual.

4.5 Operation with DRIVEMANAGER

Prerequisite:

- DRIVEMANAGER version V 260.40-0 or higher is installed on the PC.

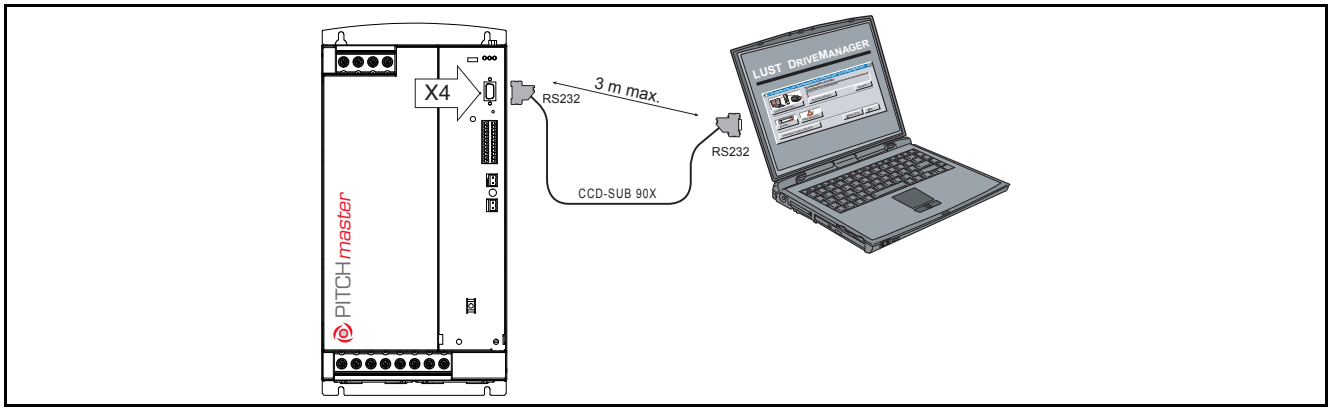


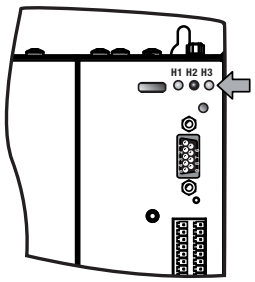
Figure 4.3 Connection of PITCHmaster *to PC/*DRIVEMANAGER

Quick-access toolbar

Icon	Function	Menu
	Changing the setting of the active device	Active device > Change settings
	Print parameter data set	Active device > Print settings
	Digital Scope	Active device > Monitor > Quickly changing digital scope
	Control drive	Active device > Open-loop control > Basic operation
	Connect to device	Communication > Connect > Single device
	Bus-initialization, Change settings	Communication> Bus-configuration
	Disconnect all devices	Communication > Disconnect
	Save data set of active device in file	Active device > Save settings of device to...
	data set transfer from file to active device	Active device > Load settings into device from...
	Setting the user level	Extras > Select new user level

5 Diagnosis/Troubleshooting

5.1 Light emitting diodes



The PITCHmaster is fitted with three status LED's in red (H1), yellow (H2) and green (H3) at the top right.

Device status	red LED (H1)	yellow LED (H2)	green LED (H3)
Power on	-	-	●
Ready (ENPO set)	❍	●	●
In service/auto-tuning active	❍	✳	●
Warning	●	● / ✳	●
Error	✳ (flash code)	❍	●
❍ LED off, ● LED on, ✳ LED flashing			

5.2 Error messages

If an error occurs during operation it is indicated by a flash code from LED H1 (red) on the PITCHmaster. The code indicates the type of error.

Flash code of red LED H1	Explanation	Cause/Remedy
1x	Collective error	The exact error code can be read out via the KEYPAD or the DRIVEMANAGER.
2x	Undervoltage shut-off	Check power supply, also occurs briefly in response to normal power-off.
1) For further information please refer also to the **CDE/CDB/CDF3000 Application Manual**		

Table 5.1 Error messages

Flash code of red LED H1	Explanation	Cause/Remedy
3x	Overcurrent shut-off	**Short-circuit, earthing fault**: Check cabling of connections, check motor coil, check neutral conductor and earthing (see also section 3, Installation). **Device setup not correct**: Check parameters of control circuits, check ramp setting.
4x	Overvoltage shut-off	**Voltage overload from mains**: Check mains voltage, restart device. **Voltage overload resulting from feedback from motor** (regenerative operation): Decelerate brake ramps - if not possible use braking resistor.
5x	Motor protection shut-off	**Motor overloaded** (after I x t-monitoring): If possible slow down process cycle, check dimensioning of motor.
6x	Device protection shut-off	**Device overloaded**: Check dimensioning, if necessary use a larger device.
7x	Motor temperature too high	**Motor-PTC correctly connected**? **Parameter MOPTC correctly set** (type of motor-PTC evaluation)? **Motor overloaded**: Allow motor to cool down, check dimensioning.
8x	Excessive temperature of PITCHmaster	**Ambient temperature too high**: Improve ventilation in control cabinet. Excessive load during driving/braking: Check dimensioning, if necessary use braking resistor.
1) For further information please refer also to the **CDE/CDB/CDF3000 Application Manual**		

Table 5.1 Error messages

5.3 Errors in power switching

Error	Cause	Remedy
Power on. PITCHmaster shows no response (LEDs off).	In case of too frequent switching the units protects itself by high-resistance isolation from the system.	After a rest phase of a few minutes the device is ready to start once again.

5.4 Reset

The reset function is divided into two areas with differing effects. Parameter reset restores to the last value stored in the device. Device reset restores the entire data set to factory setting (delivery defaults).

Parameter reset with KEYPAD

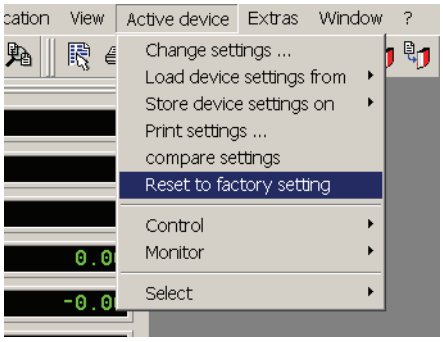
If you are in the setup mode of a parameter and press the two cursor keys simultaneously, the parameter you are currently editing will be reset to the last setting saved (= saved with parameter 150-SAVE).

Factory setting with KEYPAD

Press both cursor keys simultaneously during PITCHmaster power-up to reset all parameters to their factory defaults and reinitialise the system

Factory setting with DRIVEMANAGER

In the "Active device" menu, the "Reset to factory setting" option can be used to restore the delivery defaults of the device.



CAUTION

This factory setting also resets the selected default solution. Check the terminal assignment and the functionality of the PITCHmaster in these operating modes or load your user data set.

A Appendix

A.1 Ampacity

Maximum permissible PITCHmaster output current and peak current depend on the mains voltage, the motor cable length and the ambient temperature. With changing application related conditions, the maximum permissible ampacity of the PITCHmasters will also change, see also chapter “A.2 Technical Data”.

A.2 Technical Data

Designation	54.018	54.044	54.058	54.070	Unit
Asynchronous/synchronous machine					
Rated current[1)]	18	45	60	72	A_{AC}
Peak current[2)]	36	90	120	144	A_{AC}
DC machine					
Rated current[1)]	25	63	84	101	A_{DC}
Peak current[2)]	50	127	169	203	A_{DC}
Field current	5	5	5	5	A_{DC}
Input mains					
Mains voltage	3 x 230 ... 3 x 460 ±10 %				V_{AC}
Asymmetry of mains voltage	3 %				
Frequency	50/60 ±10 %				Hz
Switching frequency of power stage	4				kHz

Brake chopper electronics are integrated in all inverters. All values are designed for an equipment/coolant temperature of 45 °C at a switching frequency of 4 kHz.

1) For temperatures from 45 °C up to max. 55 °C the rated current is reduced by 2.5 %/°C.
The derating must be observed by the user and is not taken into account in the software.
2) For 10 seconds; permissible at a heat sink output temperature < 45 °C. For temperatures between 45 °C and max. 55 °C the overload duration is reduced to 3 seconds. The derating must be observed by the user and is not taken into account in the software.
3) External braking resistance required
4) Heat sink fanless
5) Size of equipment alone in switch cabinet, through-mounted heat sink excluded

Table A.1 Technical data PITCHmaster

Designation	54.018	54.044	54.058	54.070	Unit
Rotating field frequency	0 ... 500				Hz
Min. external braking resistance[3)]	15	10	10	10	Ohm
Wall-mounted		x	x	x	
Push-through heat sink		x	x	x	
Push-through heat sind, passive[4)]	x				
Dissipation, inside surface	60	70	85	100	W
Dissipation, outside surface	300	610	830	980	W
Approval	CE, UL				
Dimensions, push-through mounted (BxHxT)[5)]	190x345x161				mm
Dimensions, wall-mounted (BxHxT)	190x348x230				mm

Brake chopper electronics are integrated in all inverters. All values are designed for an equipment/coolant temperature of 45 °C at a switching frequency of 4 kHz.

1) For temperatures from 45 °C up to max. 55 °C the rated current is reduced by 2.5 %/°C.
The derating must be observed by the user and is not taken into account in the software.
2) For 10 seconds; permissible at a heat sink output temperature < 45 °C. For temperatures between 45 °C and max. 55 °C the overload duration is reduced to 3 seconds. The derating must be observed by the user and is not taken into account in the software.
3) External braking resistance required
4) Heat sink fanless
5) Size of equipment alone in switch cabinet, through-mounted heat sink excluded

Table A.1 Technical data PITCHmaster

A.3 Environmental conditions

Characteristic		Ambient condition
Tempera-ture range	during operation	-0 ... 55 °C at 4 kHz (For temperatures between 45 °C and max. 55 °C the rated current and the overload duration are reduced.)
	during storage	-25 ... +55 °C
	during transport	-25 ... +70 °C
Relative air humidity		15 ... 85 %, dewing not permitted
Protection	Device	IP20 (NEMA 1)
	Cooling concept	Cold Plate IP20 Wall mounting IP20 Push-through heat sink IP54 (3 -37 kW)
Protection against direct contact		VBG 4
Mounting height		up to 1000 m above MSL without power reduction, (at mains voltage 3 x 230 V_{AC} ... 3 x 460 V_{AC} , max. 2000 m above MSL, higher than 1000 m above MSL with power reduction of 1 % per 100 m) (at mains voltage 3 x 230 V_{AC} , max. 3000 m above MSL, higher than 1000 m above MSL with power reduction of 1 % per 100 m)

Table A.2Environmental conditions CDE/CDB3000 and modules

CAUTION

Only install the PITCHmaster in places where it is exposed to the least possible vibrations.

(Shock withstand, half sinus acc. to IEC 60068-2-27:

Amplitude:15 g

Shock period: 6 ms

Shock directions: 6

Total number of shocks: 600)

A.4 Use of a power choke

The use of power chokes is necessary:

- Where the PITCHmaster is used in applications with disturbance variables corresponding to environment class 3, as per EN 61000-2-4 and above (hostile industrial environment).
- With a d.c.-link between multiple PITCHmasters.

Among others, **environment class 3** is characterized by:

- Mains voltage fluctuations > ± 10 % U_N
- Short-term interruptions between 10 ms to 60 s
- Voltage asymmetry > 3 %

Environment class 3 typically applies where:

- a major part of the load is supplied by power converters (dc choppers or soft-start equipment).
- welding machines are present.
- induction or arc furnaces are present.
- large motors are frequently started.
- loads fluctuate rapidly.

A.5 Line filter

For further details concerning „Electromagnetic Compatibility (EMC)“ refer to chapter 3.2.

A.5.1 Permissible motor cable length with internal radio interference suppression filter

Electromagnetic interference acc. to EN 61800-3 with internal radio interference suppression filter:

Category C2

The PITCHmaster complies with the requirements of a public low voltage network (first environment) with motor cable lengths up to 10 m.

CAUTION

This is a restricted availability product in accordance with **IEC 61800-3**, **category 2**. This product may cause radio interference in domestic environments; in such cases the operator may need to take appropriate countermeasures.

A.5.2 Definitions

Industrial area: Limit value acc. to EN 61800-3 (second environment), restricted availability

Maximum allowable motor cable length that allows an emitted interference (> 9 kHz) under the admissible limit value.

First environment (domestic, business and industrial area): The first environment includes domestic premises. It also includes establishments directly connected without intermediate transformer to a low-voltage power supply network which supplies buildings used for domestic purposes.

Second environment (industrial area): Second Environment includes all establishments other than those directly connected to a low-voltage power supply network which supplies buildings used for domestic purposes.

Power drive system (PDS) of category C1

PDS with power supply voltage < 1000 V to be used in first environment

Power drive system (PDS) of category C2

PDS to be used in first environment, that complies with the following:

- Nominal voltage < 1000 V
- Not connected via plug connections
- Stationary
- Only qualified electricians, who have undergone the EMC instruction , connect and commission the PITCHmaster.
- Warning required*
- * This is a restricted availability product in accordance with IEC 61800-3, category 2. This product may cause radio interference in domestic environments; in such cases the operator may need to take appropriate countermeasures.

A.5.3 External line filter

Option with external line filter

Kategorie C1 (up to max. 25 m motor cable length)

A one-level line filter is required to comply with first environment, category C1 acc. to EN 61800-3.

This limit value complies with **EN 55011 Class B**.

Category C2 (up to max. 150 m motor cable length)

A one-level line filter is required to comply with first environment, category C2 acc. to EN 61800-3.

With motor cable lengths over 25 m and external line filter always provide power chokes (Uk = 2 %).

Recommended line filters:

PITCHmaster	Designation mains filter
54.018	EMC35.0
54.044	EMC50.0
54.058	EMC63.0
54.070	EMC80.0

Table A.3 Recommended line filters

A.6 Typical leakage currents

Typical leakage currents of PITCHmasters with internal line filters with 3-phase power supply

PITCHmaster	Inverter ON (Standby) Motor OFF [mA]	Invert ON Motor OFF [mA]
54.018	11.0	12.0
54.044	11.0	12.0
54.058	11.0	12.0
54.070	11.0	12.0

Table A.4 Typical leakage currents

A.7 UL approbation

Measures to maintain UL approbation

1) Switch cabinet mounting with IP54 protection and pollution degree 2 is mandatory.
2) The devices are evaluated to be used in overvoltage category III in accordance with UL 508C. These devices are intended for installation in a pollution degree 2 environment.
3) 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.
4) Only UL approved branch circuit fuses may be used (siehe Table A.5 for details regarding type and sizes of the fuses).
5) The connecting cables (mains power, motor and control cables) must be UL approved.
   - Min. 600 V cables (mains/motor), Cu 75 °C min
   - To indicate the proper tightening torque value of each field wiring terminal (22 lb-in. for main power terminals).
6) Maximum surrounding air temperature: 55 °C.
7) Internal overload protection operates at maximum 200 % of the motor full load current after 3 seconds.
8) In case these devices are to be used with an externally mounted braking resistor, over-temperature protection means shall be provided separately.
9) For devices with liquid cooling (suffix LC ; LB) :
   - Maximum pressure rating for liquid cooling system: 2 bar (29.0 Psi)
   - To avoid condensation, inlet temperature of the cooling medium shall be at least 40 °C.
   - The cooling medium used in the cooling system shall be water, glycol, a mixture of water and glycol, oil, or other refrigerants investigated for the purpose.
10) Suitable for use on a circuit capable of delivering not more than 10 kA rms. Symmetrical amperes, 480 volts maximum when protected by RK1 class fuses as specified in the following table.

PITCHmaster	Tightening torque of grounding lead terminal [Nm]	Tightening torque of mains terminals [Nm]	Wire cross-section	Mains fuse
54.018	2.5	2.5	AWG 6 N/M	35 A
54.044	2.5	2.5	AWG 6 N/M	50 A
54.058	2.5	2.5	AWG 6 N/M	50 A
54.070	2.5	2.5	AWG 4 N/M	80 A

Table A.5 Cable cross-sections - mains (N), motor (M)

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