CNC-STEP GmbH & Co. KG

Operating Instructions
Zero-4 / 5-Channel Stepper Controller

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Motor current X/Y/Z: ***3.5A***

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Zero-4 / 5-Channel Stepper Controller

Brief description

The "Zero-4" control is a further development of the well-known "Zero-3" control.
It contains the complete electronics required to operate a milling machine with up to 4 axes and up to 5 stepper motors. The hardware interface "CncPod" and the control software KinetiC-NC are already included.
The connection to the PC takes place directly via the network interface (LAN). This manual describes the installation, commissioning, and maintenance of the controller.

List of contents

1 General

The present stepper motor control was designed based on all common and known guidelines at the time of development and tested very elaborately and carefully. Nevertheless, a guarantee for error-free function cannot be given. The developers guarantee that the Control Zero-4 in conjunction with suitable mechanical components in the sense of the description and user manual is basically suitable for the intended purpose.

Any liability for consequential damages or damages resulting from loss of profit, business interruption, loss of information, etc. is excluded. The stepper motor control Zero-4 is a component that can only run in conjunction with a suitable personal computer and software. It is by no means an independent control.

Since mistakes, despite all efforts, can never be completely avoided, we are grateful for every hint.

1.1 Symbol description

NOTE: Information concerning the economic use of the installation

ATTENTION: Special information or rules and prohibitions for damage prevention.

Information or rules and prohibitions for the prevention of personal injury or extensive property damage.

Ban on people with pacemakers
This sign faces activities in areas that are prohibited for people with pacemakers.

Warning of dangerous electrical voltage
This sign presalts activities on voltage-carrying system components.

Warning of hot surface
This sign presalens activities in dealing with hot objects.

2 Features

Up to 4 axes or up to 5 stepper motors can be controlled. For one of the axes, two motors can be used in parallel (X1, X2)

The phase current for the motors of the X, Y and Z axes can be set together to either 2.8 or 3.5A. The phase current of the C-axis can be set separately in 4 steps between 1.4 and 3.5A. At a standstill, the motor current is automatically lowered to 66%.

The step resolution can be selected for each axis separately between 1/5 and 1/10 micro step. This corresponds to 1000 or 2000 steps per revolution for standard stepper motors (1.8° full step).

The 15-pin Sub-D connector of the C-axis has a 24V PWM output and a 12V power supply for controlling tangential cutting modules. (z.B.TCM-4 or ETO-3) with or without oscillating knives.

If no oscillating knife is used, alternative a holding brake can be connected to the ST plug. By switching the corresponding DIP switch, the 24V output on the ST connector is activated.

Both together is not possible!

Via a 9-pin Sub-D socket, the 4 reference or limit switches, as well as an emergency stop switch can be connected. On a 25-pin Sub-D socket at the back, a 0...10V analog signal is available for speed control with an (external) frequency converter.

Via two relays, the mains voltage for external consumers can be switched on and off by the software at two sockets on the back. The sockets can each be loaded with 8A and are secured separately.
Via 12 LEDs on the front panel, the current operating status of the controller can be recognized at any time.

3 Security measures

3.1 Organizational measures for security

- Keep the operating instructions constantly at hand at the place of use of the system (in the tool compartment or the container provided for this purpose)!
- Observe the generally valid legal and other binding regulations for accident prevention and environmental protection in addition to the operating instructions! Provide appropriate instructions to the operator.
- Supplement the operating instructions with instructions including supervisory and reporting obligations to consider operational peculiarities, e.g., regarding work organization, work processes, personnel employed.
- Use personal protective equipment as required or required by regulations. Make them available to the operating staff!
- Regularly check the safety- and hazard-conscious work of the staff in compliance with the operating instructions!
- Staff are not allowed to wear open long hair, loose clothing, or jewelry, including rings. There is a risk of injury for example by getting stuck.
- Always observe all safety and hazard instructions on the system!
- Always keep all safety and hazard information on the system in complete readable condition!
- Ensure cleanliness and order at the plant!
- Shut down the system immediately in the event of changes in its operating behavior and report the fault to the competent body or person!
- Do not make any changes, additions, and conversions to the plant, without permission!
- Spare parts must comply with the technical requirements laid down by the manufacturer. This is always guaranteed with original spare parts.
- Comply with prescribed deadlines or deadlines specified in the operating instructions for recurring inspections and maintenance!
- To carry out maintenance measures, workshop equipment appropriate to the task is necessary.

NOTE: Please pay attention to the manufacturer documentation of the supplier companies.

NOTE: Please note the special safety instructions in the individual chapters!

3.2 Personnel selection and qualification, basic obligations

- Define the plant operator responsibility also regarding traffic regulations and enable him to refuse safety-violating instructions from third parties!
- Use only trained or instructed personnel. Clearly define the responsibilities of the staff for operation, set-up, maintenance, and repair!
- Work on / with the plant may only be carried out by reliable personnel. (Observe the legally permissible minimum age!)
- Make sure that only personnel commissioned for this purpose will work at the plant!
- Allow personnel to be trained, to be trained, to be instructed or in the context of a general training only under the constant supervision of an experienced person at the plant!
- All work on the electrical system may only be carried out by the trained and qualified personnel for this purpose.

3.3 Safety

The stepper motor control Zero-4 is partially exposed to high thermal loads. Any modifications and changes to the control system are made at the risk of the operator and lead to the loss of any warranty and warranty claims.

The controller is provided with a forced ventilation. The heat-developing components reach temperatures of over 70°C in the normal operating state. Pay attention to adequate air supply. In particular, the ventilation openings must not be closed, covered, or penetrated.

Furthermore, all applicable electrical regulations and CE standards must be complied with. Especially when connecting the supply voltage, extreme caution is appropriate. For the connection of motors and end/reference switches, use separate and shielded cables. For motor cables, we recommend a cable cross-section of at least 0.5 mm².

3.4 Safety instructions for specific operating phases

3.4.1 in normal operation

- Before switching on the system, make sure that only authorized persons are in the work area of the system!
- Refrain from any safety-related way of working!
- Take all measures to ensure that the system is only operated in safe and functional condition!
- Operate the system only if all protective devices and safety-related devices, e.g., detachable protective devices, emergency stop devices, extraction devices, are available and functional!
- Check the system at least once per shift for externally recognizable damage and defects! Report any changes that have occurred immediately to the competent authority or person! If necessary, shut down the system immediately!
- Shut down the system immediately in case of malfunctions! Have faults eliminated immediately!
- Observe the control indicators during the switching on and off processes according to the operating instructions!

NOTE: Please note the special safety instructions in the individual chapters!

3.4.2 for set-up, maintenance, repair, disposal

- Comply with the setting, maintenance and inspection activities and dates prescribed in the operating instructions! These activities may only be carried out by qualified personnel.
- Inform the operating staff before the start of the execution of special and maintenance work! Appoint a supervisor!
- For all work, observe the switching on and off processes in accordance with the operating instructions and the instructions for maintenance work!
- Secure the maintenance area, if necessary, over a wide area!
- If the system is completely switched off during maintenance and repair work, it must be secured against unexpected reactivating. For example, by locking the main switch or attaching a
- Warning sign on the main switch.
- For assembly work above body height, use only safety-related ascent aids. Do not use plant parts as ascent aids! For maintenance work at a higher altitude, use fall protection devices!
- Keep all handles, kicks, railings, pedestals, stages, and ladders free of pollution!
- During maintenance and repair work, tighten loosened screw connections again and again!
- If the disassembly of safety devices is required during set-up, maintenance and repair, the reassembly and inspection of the safety devices must take place immediately after completion of the maintenance and repair work.
- Ensure safe and environmentally friendly disposal of operating and auxiliary materials as well as replacement parts!

NOTE: Please note the special safety instructions in the individual chapters!

3.5 Indications of special dangers

3.5.1 electrical energy

- Work on electrical systems or equipment may only be carried out by an electrical specialist or by instructed persons under the direction and supervision of an electrical specialist in accordance with the electrotechnical rules.

- People with pacemakers are not allowed to enter the control cabinet areas!

- Plant components on which inspection, maintenance and repair work is carried out must - if prescribed - be switched voltage-free. First check the unlocked parts for freedom from tension, then ground and short-circuit as well as isolate adjacent parts under tension!
- Use only original fuses with prescribed current! In the event of disturbances in the electrical power supply, switch off the system immediately!
- Inspect or check the electrical equipment of the system regularly. Eliminate defects, such as loose connections, damaged or brittle cables, etc. immediately.

- If work on voltage-carrying parts is necessary, then call in a second person who, in an emergency, operates the emergency stop or the main switch with voltage release. Lock off the work area with a red and white safety chain and a warning sign. Use only voltage-insulated tools!

NOTE: Please note the special safety instructions in the individual chapters!

3.5.2 Gas, dust, sparking

- Carry out welding, burning, and grinding work on the system only if this is expressly approved. There may be a risk of fire and explosion!
- Clean the system and its environment of dust and combustible substances before welding, burning, and grinding and ensure sufficient ventilation (risk of explosion)!
- When working in enclosed rooms, please observe all existing national regulations!

3.5.3 Hydraulics, pneumatics, steam

- Work on hydraulic equipment may only be carried out by people with special knowledge and experience in hydraulics!
- Check all cables, hoses, and screws regularly for leaks and externally recognizable damage! Eliminate damage immediately! Oil spraying out can lead to injuries and fires.
- Open system sections and pressure lines to (hydraulics, compressed air, coolants) make them pressure less before the start of the repair work according to the assembly descriptions!
- Lay and assemble hydraulic, coolant and compressed air lines professionally! Do not swap the connections! Fittings, as well as length and quality of the hose lines must meet the technical requirements.

3.5.4 Oils, fats, gases, and other chemical substances

- When handling oils, fats, gases, and other chemical substances, observe the safety regulations applicable to the product!
- Be careful when handling hot operating and auxiliary substances (risk of combustion or scalding)!

3.6 Safety

- Emergency stop device with emergency stop buttons on control housing. (Emergency stop chain according to valid regulation)

3.7 Possible hazards to people

Remaining danger points

- The safety devices on the system are based on many years of experience and comply with the relevant regulations. Nevertheless, hazards in dealing with systems cannot be completely ruled out.
- The operating and service personnel should know the remaining danger points exactly and always carry out the work on the plant accordingly attentively to avert risks to life and limb of persons, or impairments of the plant and other tangible assets.
- The safety devices or measures shall be fully effective only when the installation is used as intended. Special care should be taken with the operating modes with limited safety equipment (set-up, maintenance, repair).

3.8 Obligations of the plant operator

- Plant safety can only be implemented in operational practice if all necessary measures are taken. It is subject to the duty of care of the operator of the plant to plan these measures and to control their execution.
- The plant operator is obliged to maintain the protective devices on the plant and its periphery as at the time of commissioning.
- Through appropriate instructions and controls, the user must ensure cleanliness and clarity of the workplace. The operator is also encouraged to bring safety-conscious behavior close to and educate the operating personnel through internal, application-specific specifications and protective measures.

4 commissioning

4.1 list

The control should be set up in such a way that the controls on the front side, in particular the emergency stop switch, are always freely accessible. It is important to ensure a continuous air supply to the ventilation openings on the housing.

Suitable measures (enclosure, protective walls, extraction...) must ensure that the control remains free of chips, dust, and liquids (oil, cooling water). Metallic chips and cooling water can cause short circuits. Dust can affect ventilation and thus cause overheating. Both can lead to irreparable damage and fire hazards.

4.2 mains connection

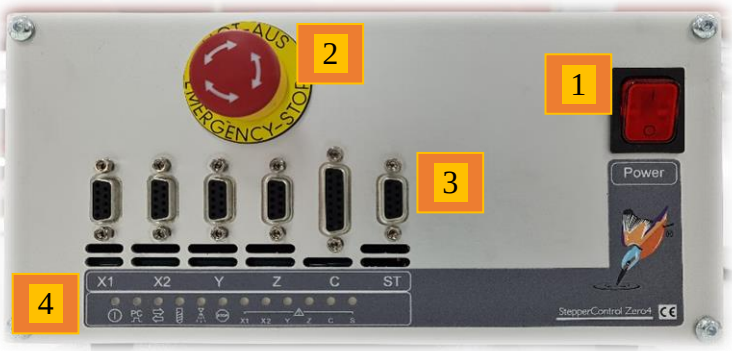
The controller is equipped with a universal power supply and can be operated without changes to mains voltages from 115 to 240V AC voltage. If you operate the device abroad, be sure to use only suitable and approved power cords and socket adapters. These must have a protective conductor connection and be designed for a load of up to 16A.

4.3 Connection of the machine (front)

At the front are the connections for the positioning motors (plugs X1, X2, Y and Z), the 4th axis such as axis of rotation or tangential unit (plug C), if available, and the end position and emergency stop switches (plug ST). Before you connect the connectors, make sure that the assignment of each contact corresponds to the scheme listed below.

- In the case of incompatible connections, there is a risk that parts of the controller will be damaged or destroyed.
- Furthermore, the functionality of the system can be limited here by and safety functions that serve to protect life and limb can be overridden.

- Plug on or off only when the control is switched off!
- Always lock the plugs with the screws located on the plug housing. The electronics are protected against short circuits and interruption of the motor lines. However, unreliable contacts can lead to incorrect positioning and/or arc formation, which can result in tool breakage, destruction of the workpiece or impairment of the service life of the system.



1 - On-off switch

2 - Hardship-Off button

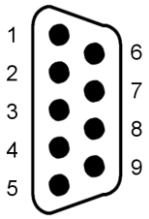
3 - Connection's machine

4 – Status LEDs

Fig.1: Connection's front

4.3.1 Motor connector (X1, X2, Y, Z)

Pin No.	signal	Color *
1+6	Motor winding A+	yellow
2+7	Motor winding A-	green
3+8	Motor winding B+	brown
4+9	Motor winding B-	white
5	Earth, screen	



* Color of the wires of the 4-wire motor connection cable

For motors with 3A or higher current, a cable cross-section of at least0.34mm² must be used, and both pins must always be connected per wire.

For motors with smaller current,0.25mm² and one pin are sufficient.

The shielding can alternatively be connected to pin 5 or the tin collar of the plug.

The engine outputs are short-circuiting resistant (winding and ground closure).

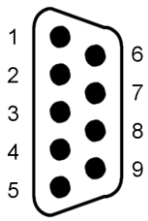
4.3.2 Control signals (ST)

On this plug, limit switch and emergency stop are connected.
Emergency stop must be an opener.
In contrast to the Zero-3, the switch inputs are now designed for PNP sensor types.

When using mechanical or magnetic (reed) switches, the switch must be connected between +24V (pin 9) and pin 1 to 5. This is compatible with the Zero-3, where pin 9 was signal mass !

For inductive sensors, the following applies: blue wire at pin 6 (-), black ones at pin 1 to 4, brown ones (+) at pin 9.

Pin No.	signal	Color*	Software PIN
1	Limit switch C or length switch	grey	LPT1 - PIN15 (-)
2	Limit switch X	pink	LPT1 - PIN13 (-)
3	Limit switch Y	green	LPT1 - PIN12 (-)
4	Limit switch Z	brown	LPT1 - PIN10 (-)
5	Emergency stop (closed = OK, open = stop)	white	LPT1 - PIN11 (-)
6	Signal mass		
7	optional holding brake (+24V)		
8	optional holding brake (mass)		
9 frame	+24V sensor supply Shielding, if available. Attention: do not connect to PIN9! (was mass, is now +24V!	yellow	



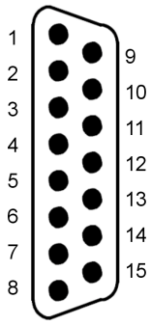
** Color of the wires of the 6-wire ST connection cable*

The holding brake, if available, please only connect to pin 7 and 8. The mass of pin 8 may not be used as a signal mass or for other purposes, since it runs together with pin 7 via a suppression choke.
In the case of asymmetric currents, this leads to EMC problems. Pin7's 24V are generated by PWM from the 48V power supply and may only be used for a holding brake or other passive consumers, not for sensors or sensitive electronics.

4.3.3 Axis of rotation / tangential knife (C)

The 4th axis can be used either for an axis of rotation (sub-apparatus) or for a tangential knife. So that this axis can also be retrofitted afterwards without having to intervene in the existing wiring, all the necessary additional signals are also available on this connector.

Pin No.	signal	Software PIN
1+9	Stepper motor winding A+	
2+10	Stepper motor winding A-	
3+11	Stepper motor winding B+	
4+12	Stepper motor winding B-	
7+8	Oscillation motor +12...24V (max. 3A)	
14+15	Oscillation motor mass	
13	Limit switch C (input low-active - NPN)	LPT1 - PIN15 (-)
5	Signal mass, screen	
6	Fan, sensor +12V max. 150mA	



Stepper motor, oscillation motor and 12V output are short-circuit resistant. Since the 12V supply is also used internally, however, malfunctions of the control are possible in the event of a short circuit. Pins 5 and 14-15 (ground) are internally connected but should be moved separately to prevent interference from the limit switch signals by the motor.
The limit switch can be an opener or closer to ground. The polarity can be selected in the software KinetiC-NC.

Because of the necessary compatibility with the tangential knife, the PIN assignment remains the same as with the Zero-3.

12V can still be used for the fan. The reference switch remains low-active (NPN) or a mechanical switch is connected between pin 5 and 13.

4.3.4 Status LEDs

To indicate the operating status, several LEDs are arranged on the front panel (numbers from left to right).

LED No.	color	symbol	meaning
1	green		Power (control turned on)
2	green		Ready (PC software ready, toggle signal)
3	yellow		Running (power cut when off)
4	yellow		Relay 1 (spindle on)
5	yellow		Relay 2 (cooling, suction)
6	red		Emergency stop (mushroom button or ext. Entrance)
7	red		Disturbance X1 axis
8	red		Disturbance X2 axis
9	red		Disturbance Y-axis
10	red		Perturbation Z-axis
11	red		Disturbance C-axis
12	red		Disturbance oscillation motor or brake

Some special states are indicated with flashing signals:

- Overheating: LEDs 7-12 flash simultaneously
- Overvoltage: LEDs 1 and 7-12 flash simultaneously
- Undervoltage: LED 1 flashes

4.4 Connections back (PC and accessories)

1 - Mains connection 110-230V

2 - Socket Rel.1

3 - Socket Rel. 2

4 - External distress - from Connector

5 - Connections PC and accessories

6 – Grounding connection to the machine

Fig.2: Connections back

4.4.1 External consumers (sockets)

To the two sockets at the back, two 230V consumers can be connected. The left socket seen from behind is switched with relay 1 and is usually intended for the spindle motor. The right socket is switched with relay 2 and can be used either for a vacuum cleaner, a coolant pump, or other aggregates.

The maximum current consumption of each individual consumer must not exceed ***8A.*** The sum of the current consumption must not exceed ***13.5A*** (16A minus the maximum own consumption). Please note that the maximum current consumption may be higher than the nominal power of the device would suggest. The maximum current consumption, which also considers start-up and reactive currents, can be found on the type of plate or in the documents of the manufacturers. Exceeding the maximum current leads to the triggering of the fuses located inside the housing.

4.4.2 External emergency stop

Here an external emergency stop button can be connected. If no external emergency stop is connected, the supplied bridging plug must be plugged in.

Fig.3: External emergency stop

1 - Bridging plug

(Bridge over PIN 1 + 3)

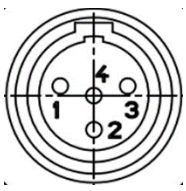


Fig.: miniXLR 4-pin

4.4.3 Grounding connection

For machines with grounding connection, the grounding cable of the machine is connected here.

e.g., High-Z series from year of construction 03/2015

Fig.4: Grounding

4.4.4 Other connections

The controller offers various connection options for accessories.

Fig.5: In / Out

4.4.4.1 Sensor inputs XLR 1-5

The xlr1 to xlr5 connectors can be used for PNP inductive sensors or mechanical switches. Mechanical or magnetic switches (reed) must be connected between pin 1 and 3.

For inductive sensors: brown wire on pin 1 (+), blue (-) on pin 2, black on pin 3.

Pin No.	signal
1	+24V supply
2	mass
3	Signal

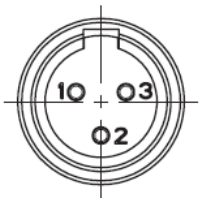


Fig.: miniXLR 3-pin

The PIN allocation of the 5 XLRinputs in the software is:

XLR	Application	Software Pin
1	Security door enclosure	LPT2 - PIN5 (-)
2	Tool length button	LPT2 - PIN6 (+)
3	3D Finder	LPT2 - PIN7 (+)
4	2-hand operation	LPT2 - PIN8 (+)
5	reserve	LPT2 - PIN9

4.4.4.2 PC connection (LAN)

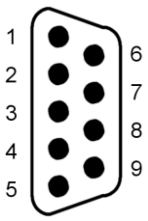
The control PC is connected via the LAN port of the Zero-4 controller.

4.4.4.3 Connection frequency converter (FU) for RF spindles

A frequency converter can be connected to the 9-pin D-Sub socket or optional accessories that require an analog 0–10-volt signal (e.g. portal control for AMB milling motors).

All outputs on the FU connector are high-active, i.e., output 24V when switched on. All inputs are also high-active, i.e., designed for PNP sensors (0V= off, 24V = on).

Pin No.	signal	Software PIN
1	Entrance 2 (Reserve)	LPT2 PIN4
2	Input 1 (error /alarm inverter)	LPT2 PIN3 (-)
3	Output 1 (spindle start backwards M4)	LPT1 PIN 14
4	Output 2 (spindle start forward M3)	LPT1 PIN1
5	Speed setpoint, analog 0-10 Volt	LPT1 PIN17 (PWM)
6	Digital Mass	
7	Output 3 (Reserve)	LPT2 PIN1
8	Digital Mass	
9	Analog mass	

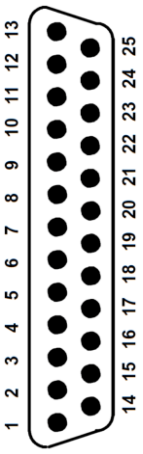


4.4.4.4 In / Out

The 25pol. D-Sub socket is largely backwards compatible with zero-3 control.
Here the analog 0-10Volt signal is also output.

The occupancy is as follows:

Pin No.	signal	Software PIN
1	Motor on/off (open collector)	LPT1 PIN1
2	Output	LPT2 PIN2
3	Output	LPT2 PIN3
4	Output	LPT2 PIN4
5	Not used	
6	Not used	
7	Not used	
8	Not used	
9	Not used	
10	Input NPN	LPT2 PIN10
11	Input NPN	LPT2 PIN11
12	Input NPN	LPT2 PIN12
13	Input NPN	LPT2 PIN13
14	Output	LPT2 PIN14
15	Input NPN	LPT2 PIN15
16	Output	LPT2 PIN16
17	Output	LPT2 PIN17
18	Analog 0–10-volt signal	LPT1 PIN17 (PWM)
19	Signal mass	
20	Signal mass	
21	Signal mass	
22	Signal mass	
23	Signal mass	
24	Signal mass	
25	Signal mass	



Pin No. 1 is an open collector signal, i.e., it is switched to ground when the spindle motor is switched on and can be used to activate (start/stop input) a frequency converter (max. 30V 50mA). Pin no. 18 is the analog speed signal. It is short-circuiting resistant, so no damage is caused if a normal LPT cable (pin 18 = ground) is connected by mistake.

4.5 commissioning

Before the final commissioning, please check again whether all connectors are connected correctly, and the locking screws are tightened. After that, you can turn on the PC and install and start the control software.

- Carry out the necessary settings of the machine parameters according to the manual of the control software.
- Before the first test run, make sure that there is no tool in the collet of the spindle motor and no workpiece or other objects on the work surface. If necessary, turn the positioning drives by hand to a safe position with sufficient distance to the end positions. Close the covers or make sure that no one is in the danger area.

- Only now plug in the power plug of the controller and turn on the control on the main switch.
- First, check the correct functioning of the limit switches and all emergency stop switches.
- Check the correct direction of rotation of the stepper motors by using manual travel (jog) at a slow speed (e.g., 1mm/s). Check whether the route displayed corresponds to the actual distance travelled (steps/mm setting).
- If anything does not work as expected, shut down the machine immediately and check the connections or settings of the software.
- If all switches work as expected, and the directions of movement and distances driven are correct, you can perform a reference ride (homing).

The machine is now ready for operation. In order to familiarize yourself with the operation, it is recommended to run a CNC program "in the air" before the first "correct" machining, i.e., without tools and without material or workpiece.

5 Cleaning and maintenance

The controller normally works wear- and maintenance-free. However, for correct and safe operation, it is necessary to regularly check the perfect condition of all cables and the unhindered air supply at the ventilation openings of the housing.

procedure

- Turn off the control on the main switch and unplug the power plug.
- Wait about 2 minutes so that the energy stored in the capacitors can discharge.
- Check the power supply line, the power cords of the external consumers and all motor cables for external damage. Damaged or brittle cables must be replaced immediately.

- Control the ventilation slots at the front and back. They must be free of chips and dust deposits. If necessary, vacuum the slots with a vacuum cleaner. Be sure not to blow out with compressed air! This could blow chips into the interior of the controller. Chips or small parts could come loose and cause injuries. In case of stubborn dirt, use a brush or a soft brush.
- If necessary, clean the surface of the case with a slightly damp cloth. Avoid the use of aggressive detergents or solvents. If liquid erroneously enters the housing, DO NOT put the device back into operation, but have it checked by a specialist.

5.1 Working inside the housing

Normally, no maintenance work must be carried out inside the housing. Repairs may only be carried out by the manufacturer or authorized workshops. Exceptions are the replacement of fuses and the change of the factory parameters with the help of the DIP switches. For all work that requires opening the housing, be sure to pay attention to the following points:

- Turn off the control on the main switch and unplug the power plug.
- Wait about 2 minutes so that the energy stored in the capacitors can discharge.
- **Failure to comply with this instruction is a danger to life due to an electric shock.** The control can also be damaged if objects accidentally fall into the controller when opening the case.

- If the controller is opened directly after operation, individual components in the controller can still have temperatures of more than 50°C. When touching, there is a risk of burn. We therefore recommend that you comply with a cooling time of 30min
- Store all screws and dismantled small parts carefully. During the subsequent assembly, make sure to mount all original parts again in the designated place. Too long screws can cause short circuits, or damage components inside.

- Metallic housing parts must be connected to the protective conductor. When assembling, make sure to reconnect all grounding lines and tighten screws firmly.

5.1.1 Open the chassis

- Remove the left, upper aluminum profiles by turning out one of the round head screws on the front and back walls.
- Loosen the screw of the case lid and remove it.
- Leave side panels, front panel, and back wall in your place if possible.

5.1.2 Replacement of fuses

The fuses are in two plastic fuse holders (green components in the picture on the right). First, remove the top of the fuse holder and check the fuse with a pass-through tester. If necessary, then replace the fuse and reseat the top of the holder on the circuit board.
Attention! Use only fuses with equal value (sluggish 8A) and allow for the voltage used (250V~). If the fuse triggers more often, the connected consumer has too high a current consumption, or there is a defect. Never use fuses with a higher current value!

5.1.3 Setting the DIP switches

The switches are located at the edge of the circuit board next to the fuses (blue component in the picture above). They are numbered from 1 to 8, the AN state is marked with "ON".

No.	meaning	standard
1	Resolution X-axis (***OFF=1/10***, AN=1/5 micro step)	***Off***
2	Resolution Y-axis (***OFF=1/10***, AN=1/5 micro step)	***Off***
3	Resolution Z-axis ***(OFF=1/10***, AN=1/5 micro step)	***Off***
4	Resolution C-axis ***(OFF=1/10***, AN=1/5 micro step)	***Off***
5	Current C-Motor	***5=OFF***
6	5=OFF 6=OFF: 1,4A 5=ON 6=OFF: 2,0A ***5=OFF 6=ON: 2,8A*** 5=ON 6=ON: 3,5A	***6=ON***
7	Current XYZ motors (OFF=2,0A, **ON=*3.5A***)	***ON***
8	Assignment of the 24V Signal ***(OFF=oscillation motor PWM-controlled,*** ON=holding brake)	***OFF***

Attention! The DIP switches are usually factory already set correctly to the supplied machine. A change is only required if the controller is to be operated with another machine. Never set the current higher than specified in the stepper motor specification. This can lead to overheating of the motors or cables and destroy them.

5.1.4 Closing the chassis

- Check whether all possibly removed connectors and cables are back in place, in particular the grounding connections of the housing parts (green/yellow).
- Insert the case cover into the right profile and screw it to the power supply.
- Insert the left, upper aluminum profile and screw it to the front and back wall.

6 Technical data

6.1 Absolute limits

The following parameters must not be exceeded under any circumstances to prevent damage to the device:

parameter	Min.	Max.	unit
line voltage	-	264	V AC
Power consumption incl. consumer		16	A AC
Voltage on XLR 1-5	20	26	V DC
Voltage at LPT2 signal inputs and outputs	-5	+5,5	V DC
Voltage on LPT2 Pin 1	-0,5	+30	V DC
Voltage on LPT2 pin 18	-0,5	+12	V DC
Storage	-40	+85	°C

6.2 Electrical connection values

parameter	Min.	Max.	unit
Main's voltage +10% -15%	115	240	V AC
power frequency	47	63	Hz
Power consumption (with power supply, without ext. Consumers)		2,5	A AC
Ambient temperature during operation	0	+40	°C
Level logical 0 for LPT signal inputs and outputs	-0,5	+0,8	V DC
Level logical 1 for signal inputs	+2,5	+5	V DC
Input resistance signal inputs	1	1,5	kΩ
Pulse width for step signal	2		µs
Setup time direction signal valid until step[1]	0		µs
Cadence	0	100	khz
Delay time automatic power reduction	0,5	0,7	S
Response threshold overtemperature	70	85	°C
Accuracy of current control	-10	+10	%
Number of micro steps per full step	5, 10		-
Micro steps/revolution at standard motor[2]	1000, 2000		-

[1] Step is executed with increasing edge, i.e., transition from logical 0 to logical 1

[2] Standard motor: 1.8°/full step, 200 full steps/revolution

6.3 Housing dimensions

parameter		unit
Length (without connectors and controls)	260	mm
width	251	mm
height	130	mm
Weight (without cable)	3,0	kg

7 customer service

For technical information, our customer service is at your disposal:

address	CNC-STEP GmbH & Co. KG Siemensstrasse 13-15 D-47608 Geldern	
telephone	+49 (0)2831/91021-50	(Mon. - Fri. 07.00 - 15.00)
mobile	+49 80)2831/91021-20 Only in urgent cases	(Mon. - Thu. 15.30 - 18.00)
fax	+49 (0)2831/91021-99	
email	support@cnc-step.de	
Internet	***https://www.cnc-step.com/***	

If you have any questions, please contact our customer service by e-mail or phone. We are happy to advise you.

Numerous suggestions and information can also be found on our website:

https://www.cnc-step.com/