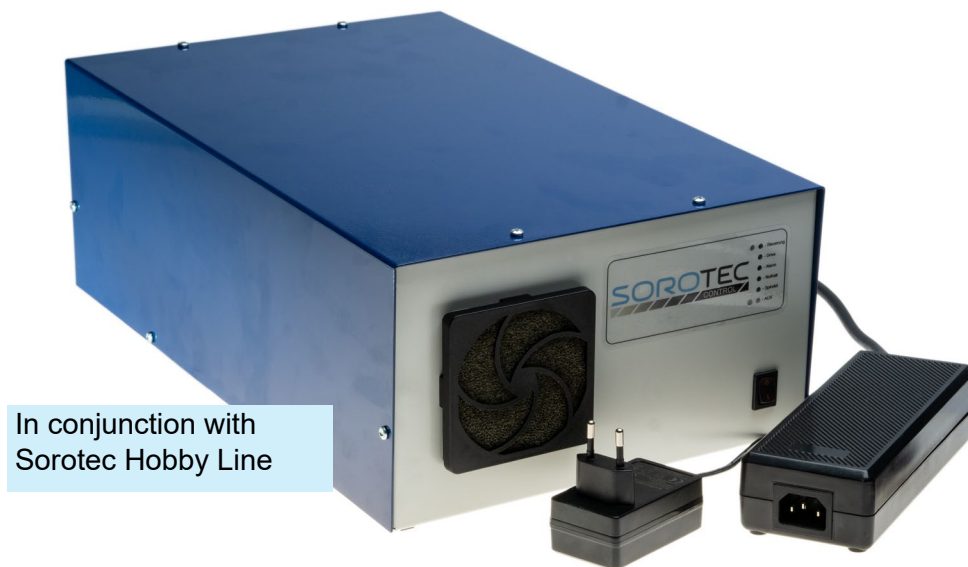




Assembly Instruction Parts kit C3 Control



In conjunction with
Sorotec Hobby Line

ETS.C3.ESTLSET.01
ETS.C3.BEAMSET.01

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Version 1.4.0

Technical specifications

| | |
|---|---|
| Main board supply: | with external power supplies |
| Protection class: | III (safety extra-low voltage) |
| Max. main board operating voltage: | 36 VDC |
| Max. sum of the output currents: | 2 A |
| Max. number of axis motors: | 3 (with optional extension 5) |
| Axis motor control: | Leadshine power amplifiers |
| Inputs: | 4 x reference input 1 x emergency stop 1 x tool length sensor (probe) |
| Exits: | 2 x transistor output +24 VDC (fog/flood cooling, Aux), max. each 100 mA 1 x relay output for spindle potential-free (FC circuit max 5 A) or +24 VDC, max. 100 mA 1 x fan connector +24 VDC, max. 4 W |

Power supplies:

| | Power supply 1 | Plug supply | |
|----------------------------------|----------------|-------------|----------------|
| Input voltage | 100 ... 240 | 100 ... 240 | VAC - 50/60 Hz |
| Max. current consumption (input) | 1.9 | 0.8 | A |
| Power consumption | 450 | 190 | VA |
| Output voltage | 36 | 24 | VDC |
| Max output current | 3.7 | 1 | A |
| Max output power | 133.2 | 24 | W |



General safety instructions

Only operate the controller indoors. Protect the controller from excessive heat and moisture, including condensation.

Do not turn on the controller if you suspect errors or obvious damage. In this case, secure the device against being switched on again until it is guaranteed to function properly. If in doubt, we will be happy to advise you at any time - give us a call.

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Introduction

Thank you for the trust you have placed in us by purchasing the C3 controller parts set. Before installation, we recommend reading through these instructions completely and then proceeding step by step as described.

Purpose of use

The set of parts described here is supplied by Sorotec for the construction of a three-axis control for CNC machines, especially of the „Hobby-Line“ type. For use with the Basic or Compact Line, there is another version of this manual, which you can download from our shop.

Tools needed

Common hand tools such as screwdrivers of various shapes and sizes, wire cutters, etc. should be available. In addition, the following tools are required:

- Wire stripper
- Crimping pliers for ferrules



Danger!

Only carry out the work if you are familiar with the necessary actions familiar and appropriate tools are available.

Sorotec GmbH assumes no liability for damage to property or personal injury occurring during assembly or operation of the control!



Danger!


The electrical structure described here works in the low voltage range below 60 volts, which is harmless to humans. Nevertheless, pay careful attention to possible sources of error (insulation, grounding, ...) in order to ensure trouble-free operation. Short circuits in particular can damage parts of the system or cause fires.



Fig. 1: The parts set for the C3 control

Scope of delivery

| | | | | | |
|---|---|--------|--|--|--------|
|  | Housing C3 | 1 |  | Rubber foot | 4 |
|  | Connector panel | 1 |  | Adhesive base for cable ties | 8 |
|  | Stepper motor power stage | 3 |  | Cable tie 3,6 x 200 mm | 10 |
|  | C3 Bob | 1 |  | Sticker | 1 |
|  | C3 IO-Module Basic | 1 |  | Fuse 2 A slow (T 2A) ¹⁸ 10 A slow (T 10A) ¹⁹ | 1 1 |
|  | C3 Drive-Module | 1 |  | Wire cable, ready-made 0.5 mm ² brown ²⁰ 0.5 mm ² black ²¹ | 2 2 |
|  | Power adapter | 1 |  | Ground wire 1 mm ² , 70 mm | 1 |
|  | Plug power adapter 24 V | 1 |  | 14-pin ribbon cable 150 mm | 1 |
|  | Fan set | 1 |  | 26-pin ribbon cable 150 mm | 1 |
|  | Main switch | 1 |  | Ring terminal 1,5 ... 2,5 mm ² | 5 |
|  | Cable gland M12 ¹¹ M16 ¹² | 7 8 |  | Jumper | 7 |
| | | |  | USB cable | 1 |

| | | |
|---|---|---------|
|  | Spacer nut M3 inside outside 18 mm 28 inside outside 20 mm 29 | 4 10 |
| 30  | Spacer nut M3 inside inside 10 mm | 17 |
| 31  | Pan head screw DIN 7981 3.5 x 9.5 | 20 |
| 32  | Fan screws 5 x 16 mm | 4 |
|  | Flat headed screw DIN 7380 M4 x 16 33 M6 x 20 34 | 1 1 |

| | | |
|--|---|--------|
| 35  | Cylinderhead screw DIN 7985 M3 x 6 | 32 |
|  | Washer DIN 125 Ø M4 36 Ø M6 37 | 1 1 |
|  | Toothed washer DIN 6797 Ø M4 38 Ø M6 39 | 3 3 |
|  | Nut DIN 934 M4 40 M6 41 | 2 2 |

Preparing the case

Bottom

| For this section you will need: | | # |
|---------------------------------|---------------------------|---|
| 1 | Housing | 1 |
| 4 | Rubber foot | 13 |
| 17 | Cylinderhead screw M3 x 6 | 35 |
| 17 | Spacer nut M3 | 30 |

- Glue the four feet 13 into the corners of the bottom 1. Lateral distance approx. 5 mm.
- Provide the 17 bottom holes in the rear area of the housing with spacer nuts 30 and screws 35 (see Figs. 2 and 3). The six bottom holes in the front area are intended for a retrofit option and remain free.



Fig. 2: Bottom of the housing



Fig. 3: Spacer nuts

Fan and switch

| For this section you will need: | | # |
|---------------------------------|-------------|----|
| 1 | Fan Set | 9 |
| 4 | Fan screw | 32 |
| 1 | Main switch | 10 |

- Mount the fan **9** to the housing **1** using the fan screws **32** as shown in Figure 4.

i Note

The fan should blow into the case. The flow direction is marked with an arrow on the edge of the fan.

- Place the filter fleece on the fan cover and attach the filter cover.
- Insert the main switch into the rectangular opening on the front of the housing. The switch snaps into place and does not need to be screwed down.



Fig. 4: Fan at the front, cables pointing to the ground

Connector panel

| For this section you will need: | | # |
|---------------------------------|----------------------------|----------|
| 1 | Connector panel | 1 |
| 7 | Cable gland M12 | 11 |
| 8 | Cable gland M16 | 12 |
| 1 | Front cover adapter module | i |

- Install the cable glands in the holes in the connection panel. The alignment of the nuts is sometimes important, see also Fig. 15 on page 10.
- Place the 3D-printed front cover that you received with the adapter module into the cut-out of the connection panel. See Fig. 5.

i Note

The cover is not part of the scope of delivery for the controller. It is included with the adapter module.

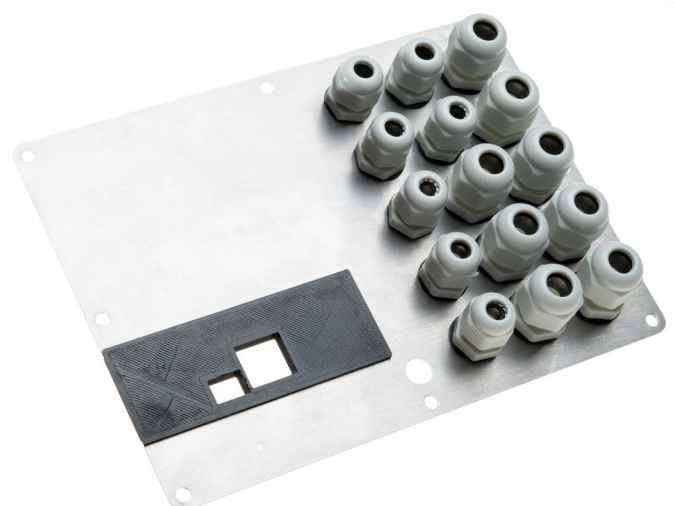


Fig. 5: Always install unused screw connections as well in order to close all openings.

Functional grounding (FG)

| For this section you will need: | | # |
|---------------------------------|----------------------|----|
| 1 | Flachkopfschraube M4 | 33 |
| 1 | Flachkopfschraube M6 | 34 |
| 1 | Scheibe M4 | 36 |
| 1 | Scheibe M6 | 37 |
| 3 | Zahnscheibe M4 | 38 |
| 3 | Zahnscheibe M6 | 39 |
| 1 | Erdungskabel | 22 |
| 2 | Mutter M4 | 40 |
| 2 | Mutter M6 | 41 |

- Remove the paint 2 mm inside and outside around the holes for the functional grounding screws (FG).
- Assemble the internal grounding screw connection from the screw 33, the washer 36, the toothed washers 38, the nuts 40 and the grounding cable 22 as shown in Figs. 6 and 7.
- Assemble the external grounding gland using the screw 34, washer 37, toothed washers 39 and nuts 41 as shown in Fig. 8.

i Note

The ring cable lugs of ground wires are screwed between washer and nut as shown in Fig. 7.



Attention!

Make sure there is good electrical contact between the earthing screw connections and the housing sheet metal!

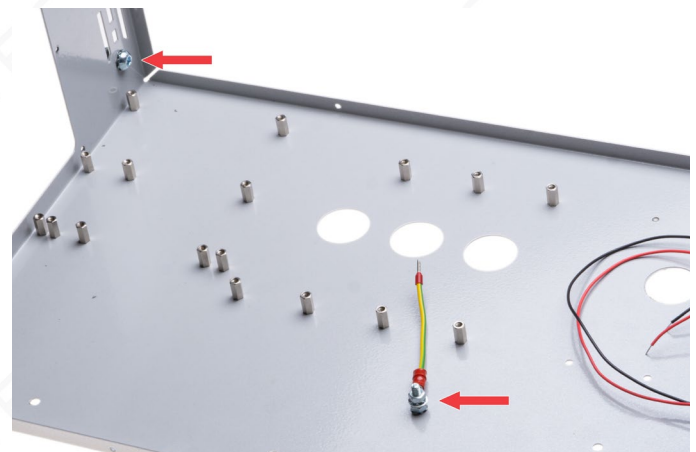


Fig. 6: Location of ground connections

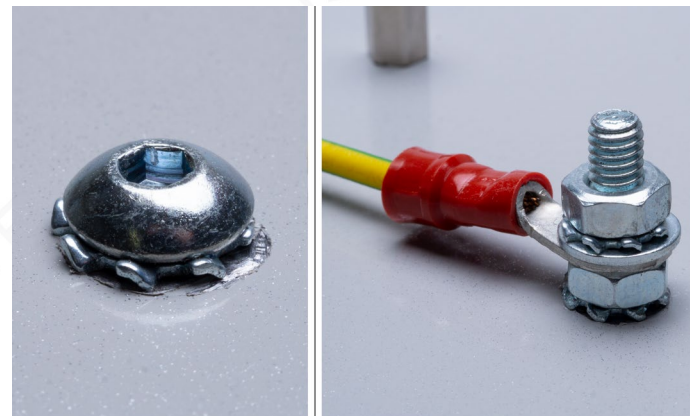


Fig. 7: Internal functional ground screw (FG) outside / inside



Fig. 8: External functional ground screw (FG) inside / outside

Assembly of the modules

Motherboard („MiniBOB“)

| For this section you will need: | | # |
|---------------------------------|---------------------------|----|
| 1 | C3 Bob | 4 |
| 4 | Cylinderhead screw M3 x 6 | 35 |
| 4 | Spacer nut M3 x 18 | 28 |
| 2 | Spacer nut M3 x 20 | 29 |
| 1 | Fuse 2 A | 18 |

Note

Before you touch one of the circuit boards, always first touch a good conductive earth connection (e.g. a water pipe) in order to dissipate any static charge that may be present.

- Assemble the C3 Bob **4** with cylinder head screws **35** and the spacers **28** and **29**, as shown in Fig. 9.

- Insert the 2 A fuse **18** into the fuse holder.

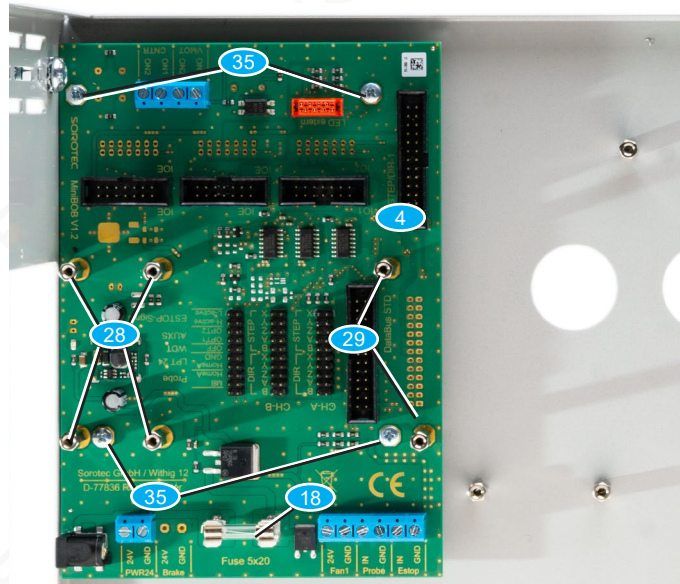


Fig. 9: C3 Bob

Jumper

- Check the jumpers on the C3 Bob.

Without using the optional axis extension, the jumper contacts of CH-A and CH-B should be unassigned. If necessary, you can find the exact assignment in the option description on page 16.

The jumpers on the C3 Bob from top to bottom (see also Fig. 10 and sheet 4/5 of the circuit diagram):

- n/a
- Probe:** Tool length sensor connection to main board (“MB” for motherboard) or to IO module (“HomeA”, 4th channel). Default is MB.
- LPT24:** „HomeA“ (default).
- WDT:** not used
- AUXS:** AUX selectable. The default is „OPT2“. When using the optional IO module Speed „OPT1“.
- ESTOP-Signal:** Type of emergency stop release. For EstlCam and Benezan „H-active“ (default).



Attention!

Correct setting of the jumpers is absolutely essential for the correct functioning of the control. If you have any questions, we are happy to answer them by phone.

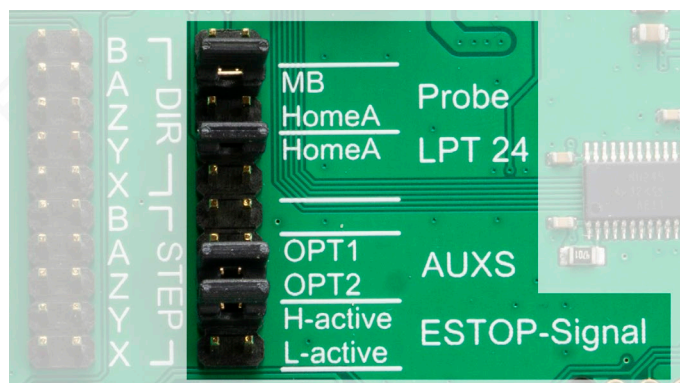


Fig. 10: Jumper setting for EstlCam without option modules

C3 Drive-Module

| For this section you will need: | | # |
|---------------------------------|---------------------------|----|
| 1 | C3 Drive-Module | 6 |
| 7 | Cylinderhead screw M3 x 6 | 35 |
| 1 | Fuse 10 A | 19 |
| 1 | 26-pin ribbon cable | 24 |

- Mount the C3 Drive-Module **6** with cylinder head screws **35** as shown in Fig. 11.
- Connect the C3 Bob and C3 Drive-Module with the 26-pin ribbon cable **24**.
- Connect the case fan to the terminal labeled „Fan“.
- Connect the internal ground wire to one of the terminals labeled „Shield“.
- Insert the 10 A fuse **19** into the fuse holder.

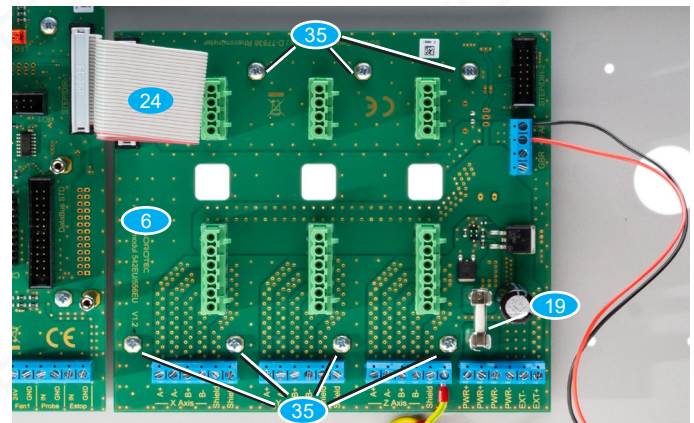


Fig. 11: C3 Drive-Module

i Note

The connectors of the ribbon cables are with a central lug secured against unintentionally twisted insertion. Don't force it in!

Adapter module

| For this section you will need: | | # |
|---------------------------------|---------------------------|----------|
| 1 | Adapter module | i |
| 1 | Connection cable | i |
| 2 | Cylinderhead screw M3 x 6 | 35 |
| 2 | Spacer nut M3 x 20 | 29 |

i Note

The adapter module and the matching connection cable depend on the control software you are using and are not part of the scope of delivery.

Both Estlcam and Beamicon2 are available for download from the manufacturers' websites.

- Mount the adapter module on the C3 Bob with cylinder head screws **35** and spacer nuts M3 x 20 **29**, as shown in Fig. 12.
- Connect the adapter module and the C3 Bob with the connection cable.

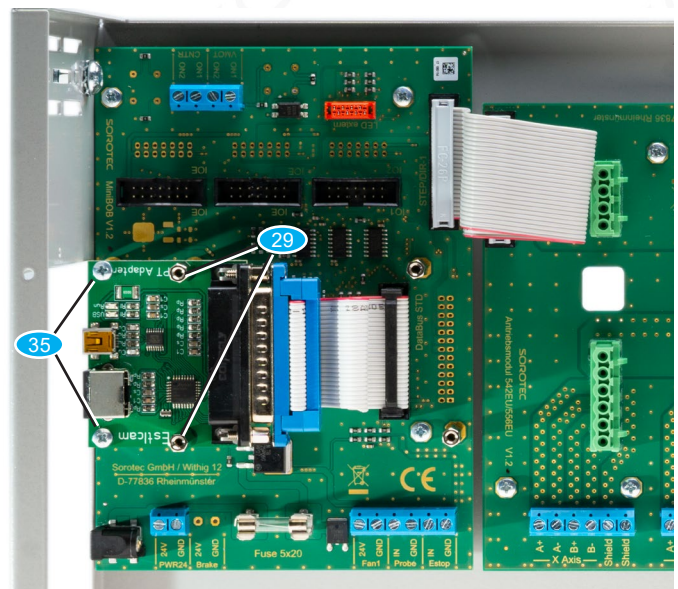


Fig. 12: Mounted adapter module, here Estlcam

i Note

The assignment of the cable for the adapter modules is 1:1. Pin 26 of the Estlcam adapter module cable is not connected. The corresponding core of the cable is therefore severed.

C3 IO-Module Basic

| For this section you will need: | | # |
|---------------------------------|---------------------|----|
| 1 | C3 IO-Module Basic | 5 |
| 6 | Spacer nut M3 x 20 | 29 |
| 1 | 14-pin ribbon cable | 23 |

- First, screw two more spacer nuts onto the still open spacer nuts on the C3 Bob (next to the drive module, see Fig. 13), so that the height is doubled.
- Mount the C3 IO-Module Basic **5** using four additional spacer sleeves M3 x 20 **29**, as shown in Fig. 14.
- Connect the IO2 socket on the C3 Bob and the IO module with the 14-pin ribbon cable **23**.

Note
The space above the C3 IO-Module Basic is intended for optional extensions.

Option inductive reference sensors

Instead of the mechanical reference switch, inductive sensors can also be connected to the C3 Control. To do this, exchange the IO module Basic for the optionally available IO module Pro (EIF.C3.IOPRO.V1.SET).

Note
Mixed operation of mechanical and inductive reference switches is not possible. The two IO modules cannot be operated in parallel.

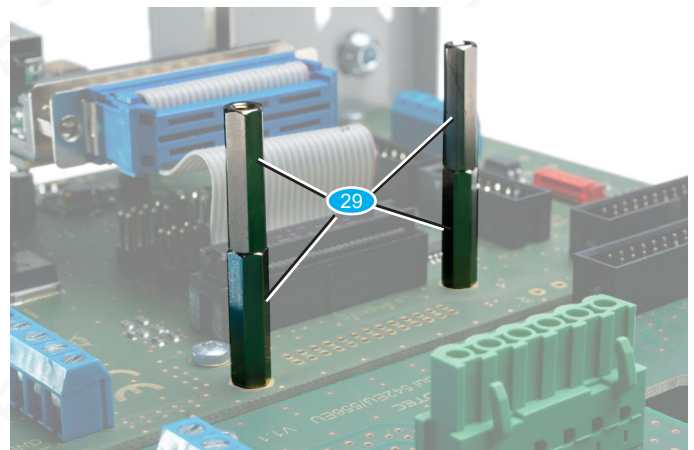


Fig. 13: Double spacers

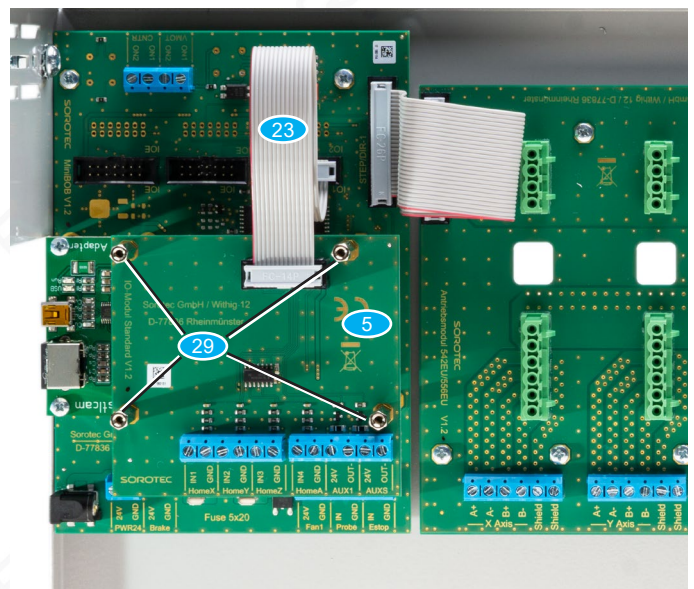


Fig. 14: Mounted C3 IO-Module Basic

Final assembly

Connector panel

| For this section you will need: | # |
|---------------------------------|----|
| 8 Pan head screw | 31 |

- Mount the connection panel to the back of the case with pan-head screws [31](#).

i Note

Pay attention to the inside nuts of the cable glands. The position must match the opening in the housing. Otherwise the panel cannot be inserted (see Fig. 15).



Fig. 15: Orientation of the left nuts to match the opening

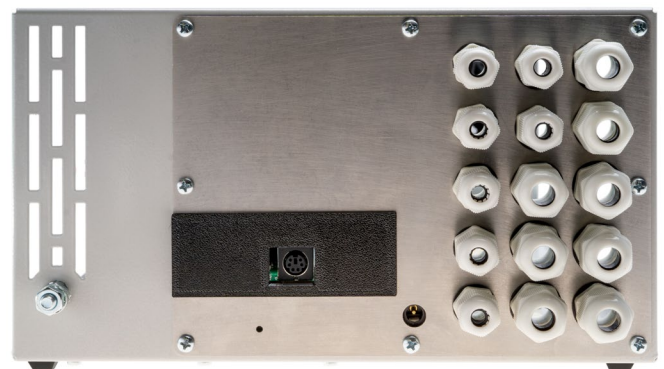


Fig. 16: Back side with installed connection panel

Sticker

| For this section you will need: | # |
|---------------------------------|----|
| 1 Sticker | 17 |

- Attach the sticker to the front of the control as shown in Fig. 17.

i Note

The holes are for the optional LED display (see page 15). Without LED, the holes should remain sealed.

Save the round stickers that are still on the sheet. They will later be used to seal the openings in the bottom of the case.



Fig. 17: The sticker seals unused holes

Wiring

| For this section you will need: | | # |
|---------------------------------|------------------------------|----|
| 7 | Adhesive base for cable ties | 14 |
| 7 | Cable tie | 16 |
| 2 | Wire brown | 20 |
| 2 | Wire black | 21 |
| 3 | Power adapter 36 V | 7 |

- Attach the adhesive bases as shown in picture 21.

- **Main switch**

Connect the main switch to the VMOT and CNTR terminals on the main circuit board. See Figs. 18 and 19.

- Secure the cables to the adhesive bases with cable ties.

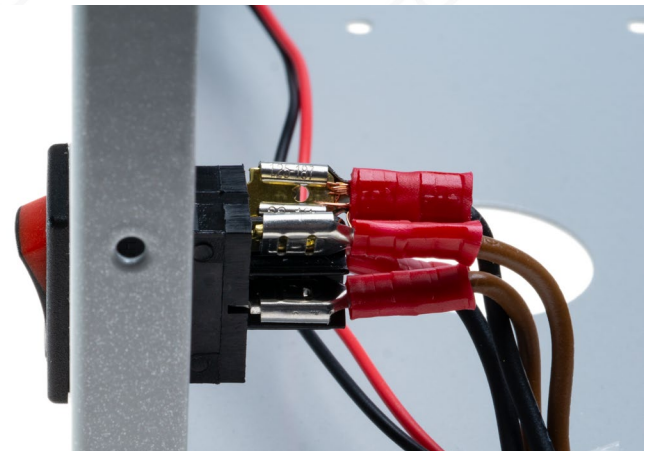


Fig. 18: Brown left, black right: main switch wiring

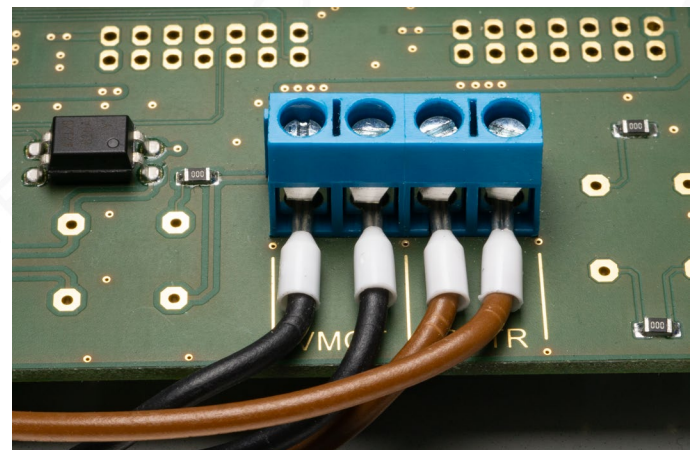


Fig. 19: Black to VMOT, brown to CNTR

- **Emergency stop**

Connect the emergency stop switch to the „Estop“ terminals on the C3 Bob. See Fig. 20.

- **Tool length sensor**

One of the most important accessory options is a tool length sensor. The terminals for the connection are marked „Probe“ on C3 Bob.

Connect the tool length sensor cable as shown in Fig. 20.

Note

Always connect your tool length sensor as an opener. The correct wiring can be found in the data sheet of the WLS, or determine this with a continuity tester.

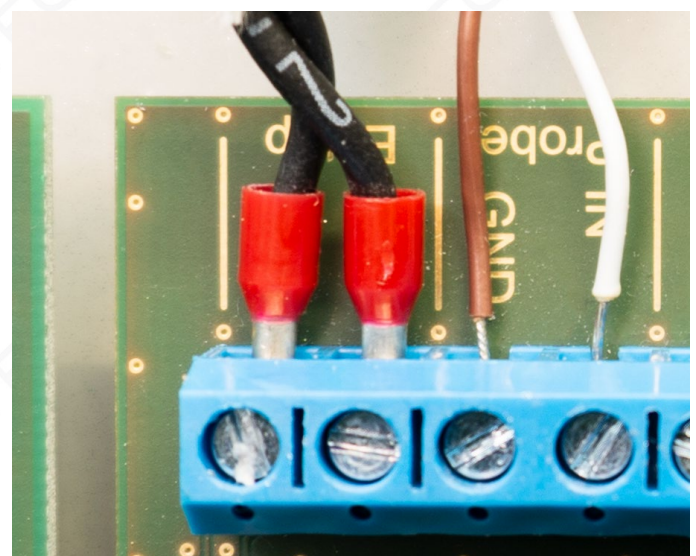


Fig. 20: Connection of the emergency stop switch to „Estop“ and the tool length sensor to „Probe“

- **Motors and reference switches**

Prepare the cables coming from the machine by stripping about 5 cm of the sheath after cutting them to length. Twist the braided shield and apply shrink tubing to protect against any loose wires. Provide the stripped ends with ferrules (see Fig. 22).

- Guide the cables through the respective cable gland. Don't tighten.

- Connect the cables as described in the wiring diagram.

- **Power supplies**

Connect the 36 V power supply to the C3 Drive-Module as shown in Fig. 23 (far right). The functional earth (yellow) comes to the second terminal „PWR-“.

- Bundle the cables with cable ties on the adhesive bases and tighten the cable glands. See Fig. 23.

- Connect the 24 V plug-in power supply to the socket on the back of the controller.

- **Ground wire**

Connect the ground wires coming from the machine to the ground screw connection as shown in Fig. 24.

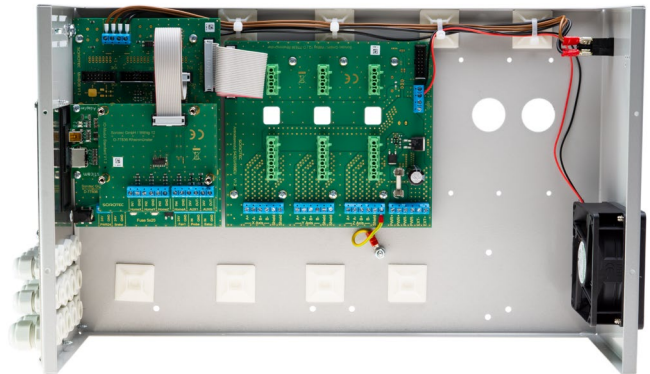


Fig. 21: Ready to connect the machine cables.

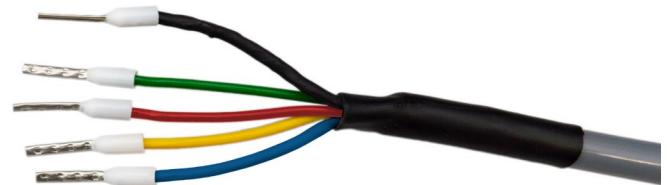


Fig. 22: Completely equipped cable end. Shielding (at the top) twisted into heat-shrink tubing.

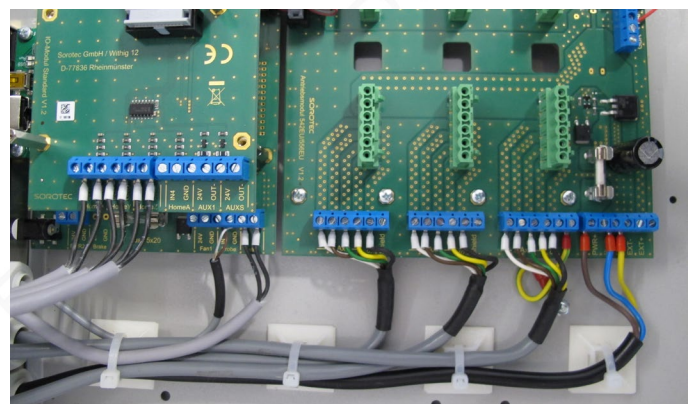


Fig. 23: Connected lines for stepper motors, limit switches and emergency stop.



Fig. 24: Earth screw connection with attached cables.

Preparing the power stages

Before installation, the output stages must be adapted to the stepper motors used. The eight DIP switches must be set correctly for this.

Example:

For the motor set offered by Sorotec for the Hobby Line with a rated current of 4.2 A, the following position of the DIP switches is correct for the 556 output stages from Leadshine:

| | | | | | | | |
|----|-----|----|-----|-----|-----|----|----|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| On | Off | On | Off | Off | Off | On | On |

i We strongly recommend that switches 1 through 3 are only set as directed, otherwise the motors may overheat.

However, this switch position is only an example. When using other motors, the setting must be made using the tables printed on the output stages (see Fig. 25).

The first three DIP switches determine the current with which the respective motor is operated. The last four switches in the row control the „resolution“: This means the number of steps into which a single motor revolution is broken down.

The stepper motors used carry out 200 steps of 1.8° per revolution. With the DIP switch setting shown, the output stage divides these full steps into 8 microsteps each. This then gives 1600 steps per revolution of the motor. With a spindle pitch of 10 mm/revolution, one microstep theoretically corresponds to a travel distance of 0.00625 mm.

Installing the power stages

Remove the screw terminal connectors (Fig. 26), they are not needed.

- Plug the fully prepared power amplifiers into slots one to three on the main circuit board. See Fig. 27.

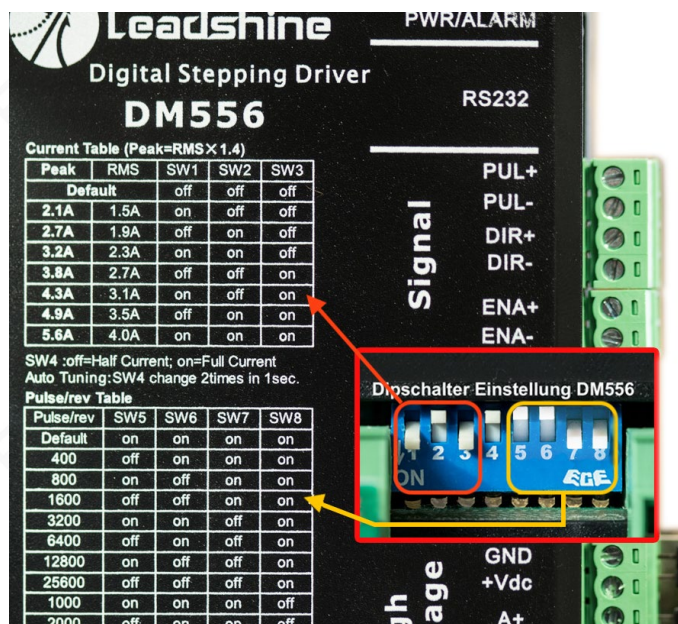


Fig. 25: DIP switch setting for current and resolution Example for motors with 4.2 A and 1600 steps



Attention!!

Before commissioning, check the resolution entries in your control software! The machine cannot function if the values do not match the setting.

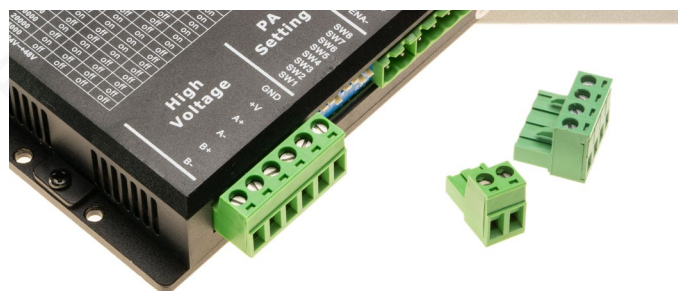


Fig. 26: The screw terminal plugs are not used



Fig. 27: Plugged-in power stages

Close the housing

| For this section you will need: | | # |
|---------------------------------|----------------|----|
| 12 | Pan head screw | 31 |

- Close the cover of the control with pan-head screws 31 and seal the openings in the bottom with the remaining stickers.

Finally, establish the connection to the control computer and to the power supply. The C3 control is now fully assembled and can be put into operation.

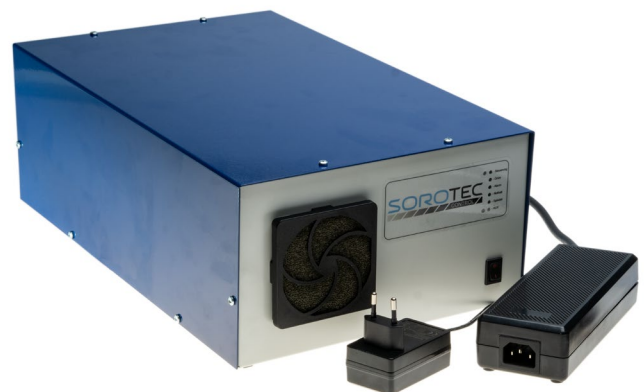


Fig. 28: Fully assembled C3 control

Options

Switchbox

The switch box (EZB.MINI.SBR.01) is optionally available in the Sorotec shop, with the help of which 230 V can be switched externally via a 24 V signal. Useful e.g. for the operation of a minimum quantity lubrication or a chip extraction (designated indiscriminately with „Cooling“ in the circuit diagram). For this purpose, the switch box is connected to the 24 V and OUT- terminals of AUX1 on the C3 IO-Module Basic.

A (possibly second) switch box can also be used to switch the milling spindle on and off. In this case, the terminals at AUXS must be assigned.

See wiring diagram sheet 4 and Fig. 30.



Fig. 29: Option Switchbox



Attention!

The sum of all currents at the outputs of the C3 Bob is limited to 2 A by the fuse. It is therefore advisable to supply any existing spindle fan with its own power supply unit.

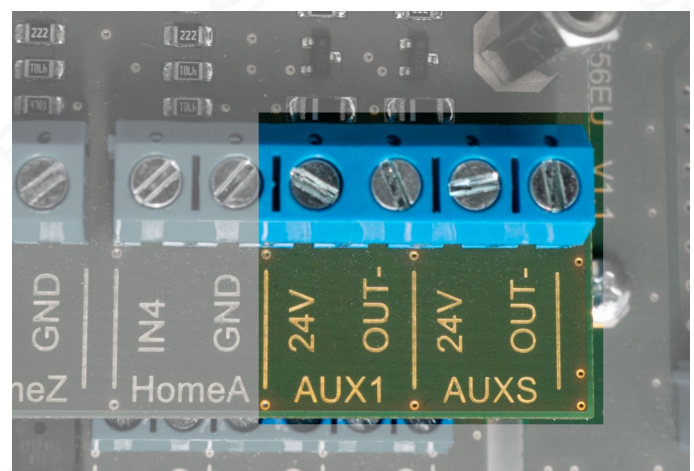


Fig. 30: The terminals AUX1 and AUXS on the C3 IO-Module Basic

LED Module



Fig. 31: Status LEDs show the operating status

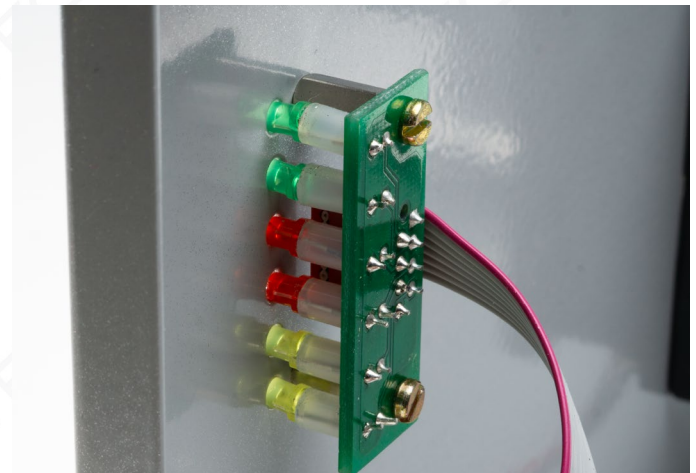


Fig. 32: Built-in LED board from inside

The optional LED board (parts number EZB.LED-PSET) is used for optical signaling of various switching states, such as emergency stop or spindle ON. The meanings of the individual LEDs are already marked on the sticker on the front.

- Open the holes for the LED board covered with the sticker with a sharp knife.
- Plug one end of the connection cable into the red socket on the module circuit board.
- Fasten the LED board with screws M3 x 6 ³⁵ (image 32). The screws are included in the control kit.
- Plug the other end of the connection cable into the red socket on the C3 Bob as shown in Fig. 33.

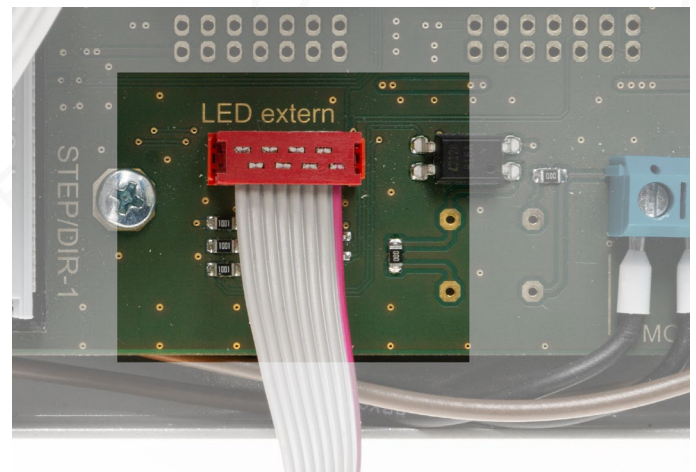


Fig. 33: Connector on the C3 Bob

Note

The plugs of the ribbon cables are secured with a side lug to prevent them from being plugged in accidentally. Don't force it in!



Attention!

Be sure to attach the ribbon cable to the adhesive sockets with cable ties! A cable that is supplied loose can easily be damaged by one of the screws fastening the housing cover. Risk of short circuit!

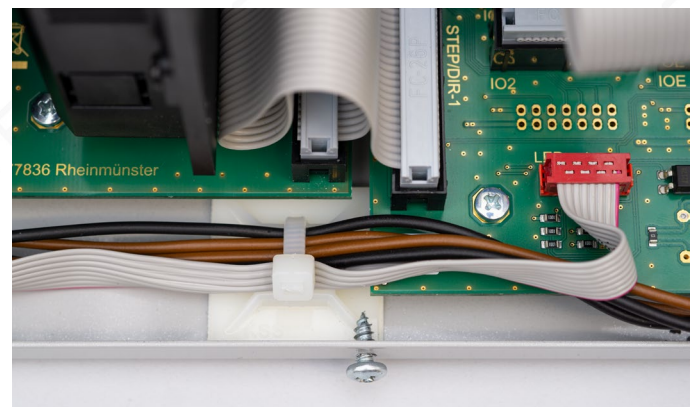


Fig. 34: Screw can puncture unfastened cables.

C3 Drive-Module Extension

With the C3 Drive-Module Extension, the control can be expanded to include slots for two additional stepper motor output stages. The function of the additional channels is determined with jumpers on the C3 Bob: Either ...

- ... as a second drive connected in parallel to one of the existing axes X, Y, or Z („slave“ circuit). Or ...
- ... as an additional axis A or B, for example for a rotary table.

Proceed as follows for installation:

- If necessary, first remove the existing other modules so that you have unhindered access to the jumpers on the C3 Bob (Fig. 35).
- Plug in the jumpers for „CH-A“ and „CH-B“ according to the desired purpose. One jumper each at STEP and DIR determines whether the additional stepping motor should run as a slave from X, Y, or Z, or whether the channel is to be controlled as an additional A or B axis. See also sheet 6 of the circuit diagram.
- If necessary, reassemble the removed modules.
- Assemble the C3 Drive-Module Extension in place using the spacers and screws provided.
- Connect the C3 Drive-Module and the C3 Drive-Module Extension with the enclosed ribbon cable.
- Connect the EXT +/- terminals of the C3 Drive-Module and C3 Drive-Module Extension with the enclosed cable bridges (Fig. 37).
- Ensure the correct parameterization of the additional power stage(s) as described on page 13.
- Plug the additional power stage(s) into place.

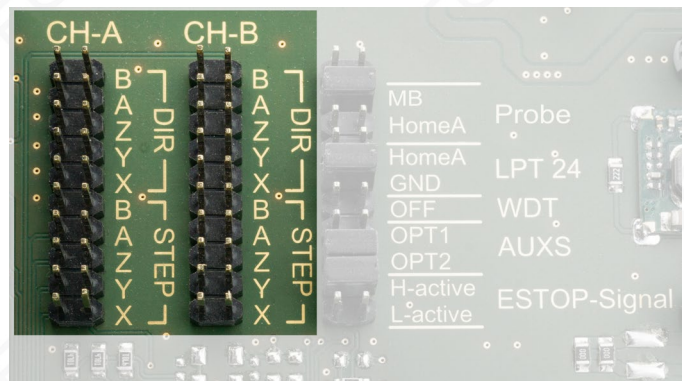


Fig. 35: The jumpers on the motherboard

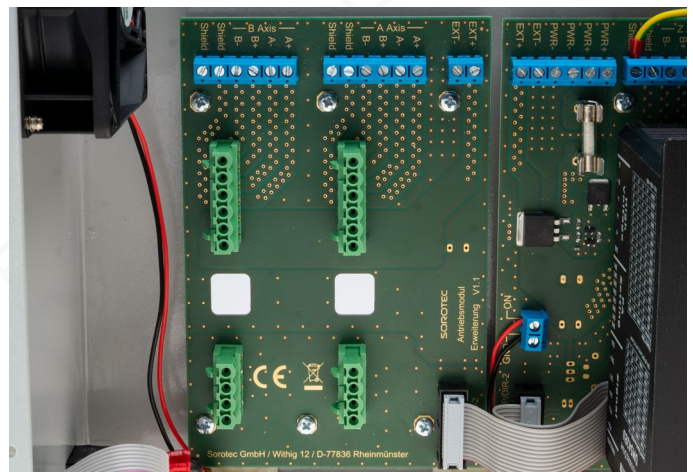


Fig. 36: Extension module for two additional output stages

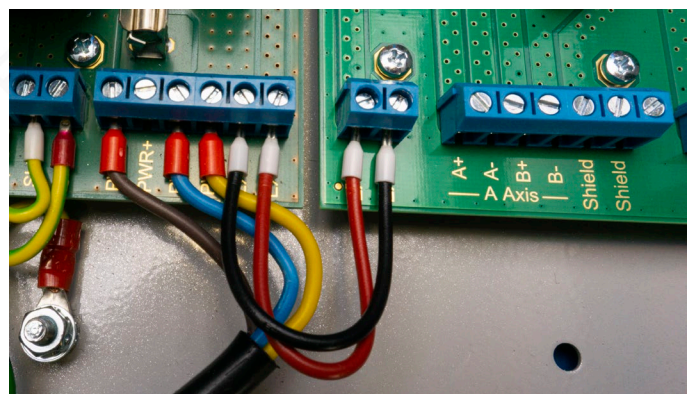


Fig. 37: Cable bridges on EXT +/- for power supply

i Note

The jumpers for STEP and DIR of a channel must each have the same designation in order to ensure a meaningful assignment. For example, STEP X and DIR X for operation as a slave of X, or STEP A and DIR A for use as an additional axis A.

C3 IO-Module Speed

The additional C3 IO-Module Speed enables, among other things, the connection of a speed-controlled spindle for control by the software.

- If necessary, first remove the existing other modules so that you have unhindered access to the jumpers on the C3 Bob (Fig. 10).
- Put the jumper for AUXS on OPT1 (see circuit diagram sheet 8 and 9)
- If necessary, reassemble the removed modules.
- Mount the C3 IO-Module Speed in its place above the standard C3 IO-Module Basic using the spacer sleeves supplied. See Fig. 38.

i Note

The mounting with spacer nuts enables the installation of another optional module above the C3 IO-Module Speed.

- Connect the module and one of the sockets IOE on the C3 Bob with the ribbon cable.

i Note

The C3 IO-Module Speed allows the connection of an additional LED module to display signals from the spindle control. The necessary holes in the housing must be made at your own discretion.

C3 IO-Module PRO

Instead of the mechanical reference switch, inductive sensors can also be connected to the MINI Control. To do this, exchange the IO module Basic for the optionally available IO module Pro (EIF.C3.IOPRO.V1.SET).

i Note

Mixed operation of mechanical and inductive reference switches is not possible. The two IO modules cannot be operated in parallel.



Attention!

A speed-controlled spindle can be connected in various ways. Take the time to carefully study the variant described for your case in the circuit diagram.

Sorotec declines all responsibility for damage caused by incorrect or improper connection of milling spindles or other peripheral devices.

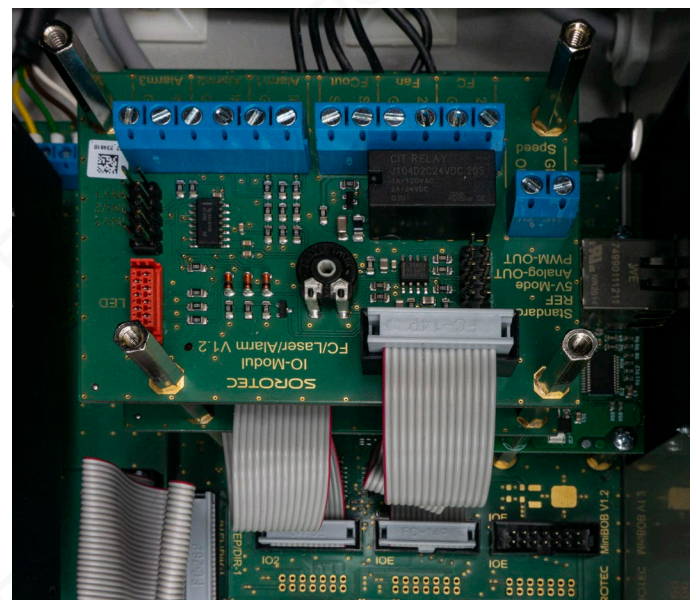


Fig. 38: C3 IO-Module Speed installed and connected

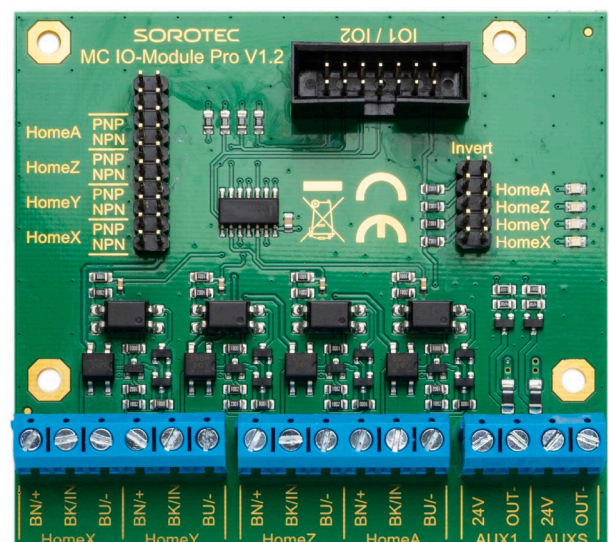


Fig. 39: C3 IO-Module PRO