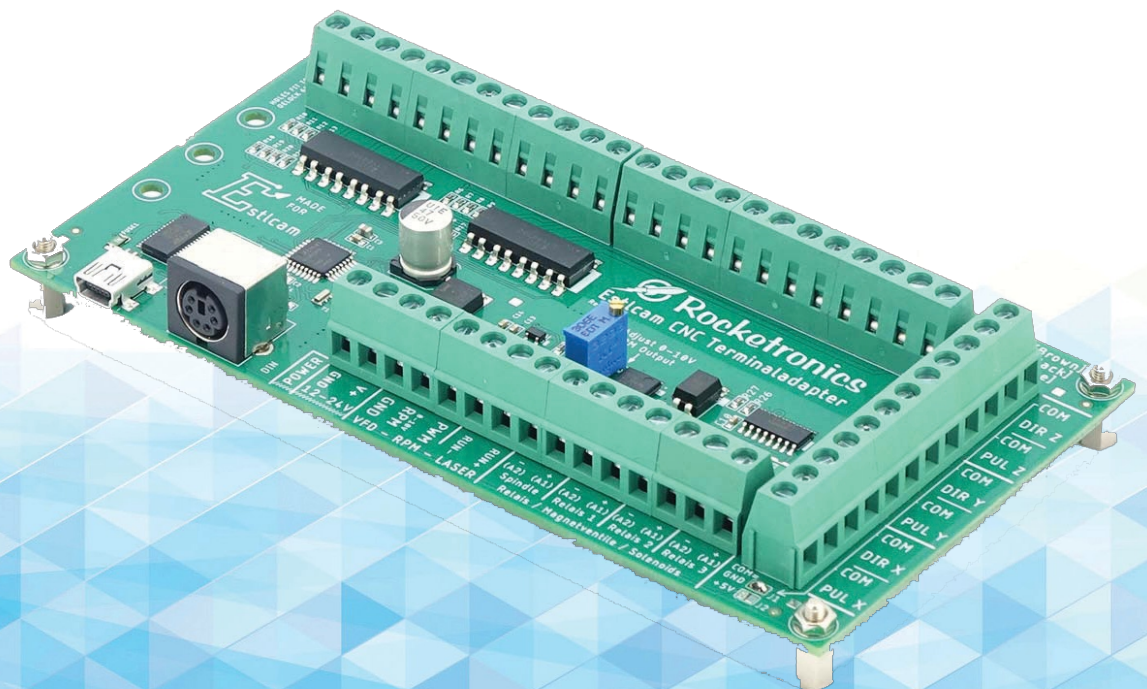


ESTLCAM TERMINAL ADAPTER

User manual



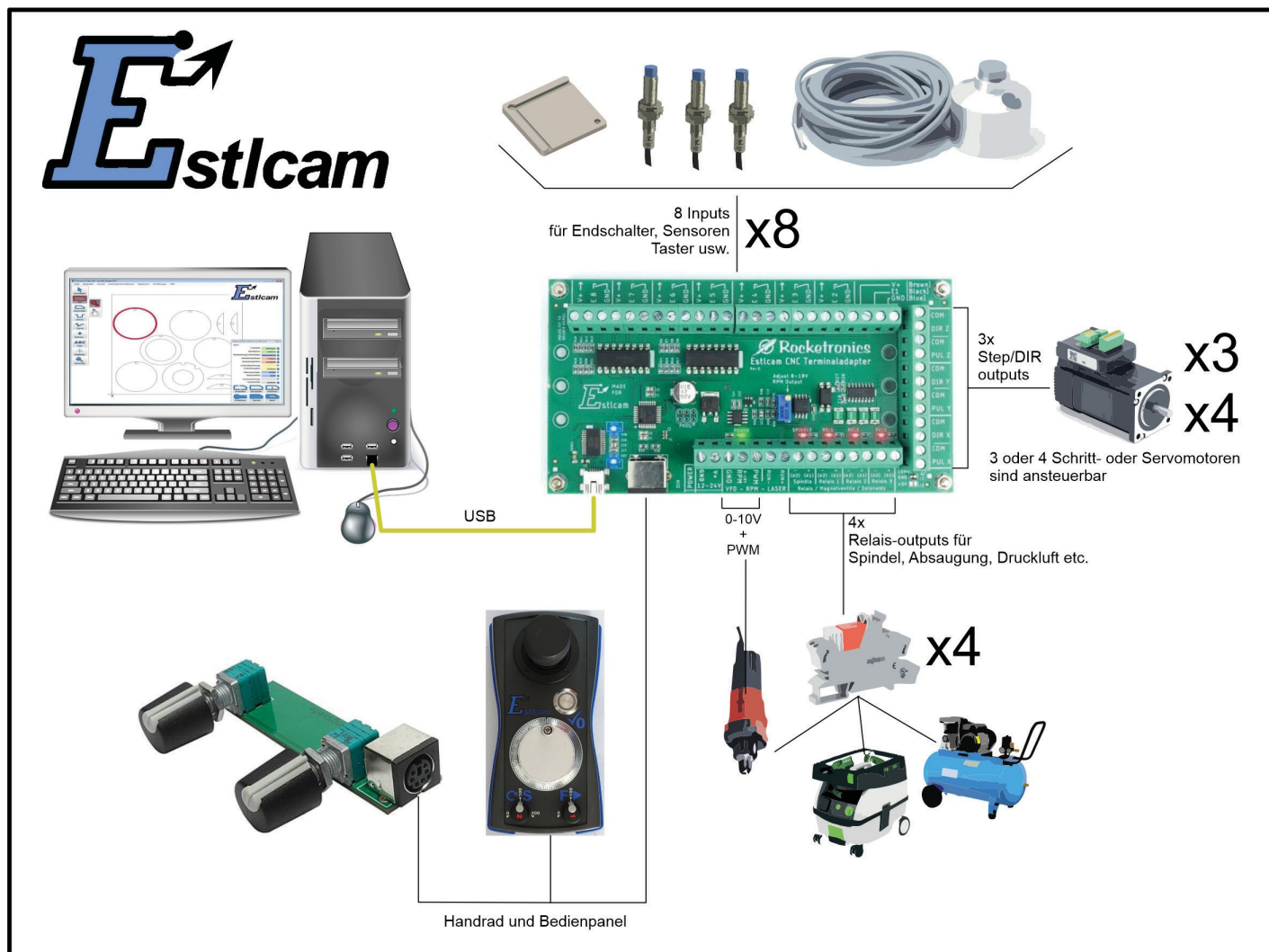
ORIGINAL OPERATING
INSTRUCTIONS

German

This manual describes the commissioning and use of the Estlcam terminal adapter

REV D

SYSTEM SCHEME



PROTECTIVE NOTE

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All product names mentioned in this manual are trademarks of the respective companies. We reserve the right to make technical changes. All safety regulations, in particular the CE directives, were observed during production. Each individual product has undergone a comprehensive final inspection at the factory.

DISCLAIMER

We have checked the contents of this publication for conformity with the hardware and software described. Nevertheless, deviations cannot be ruled out, so that we cannot guarantee complete conformity. However, the information in this publication is checked regularly and any necessary corrections are included in subsequent editions

ADDRESSEE OF THE DOCUMENTATION

This documentation is intended for machine tool users and installation personnel. The publication describes in detail the information necessary for the user to install and operate the control unit.

SAFETY INSTRUCTIONS

This manual contains instructions that you must follow for your personal safety and to prevent damage to property. The instructions for your personal safety are highlighted by a warning triangle, instructions for property damage alone are shown without a warning triangle. Depending on the hazard level, the warnings are shown in descending order as follows.



DANGER

means that death or serious bodily injury will occur, if the appropriate precautions are not taken.



WARNING

This warning means that death or serious injury may occur if the appropriate precautions are not taken.



CAUTION

with warning triangle means that minor personal injury may occur if the appropriate precautions are not taken

CAUTION

without a warning triangle means that material damage may occur if the appropriate precautions are not taken.

ATTENTION

means that an undesirable result or an undesirable outcome condition can occur if the relevant instructions are not followed

NOTES ON THE FUNCTION

The Estlcam terminal adapter is a simple CNC controller that is controlled by the Estlcam software. The terminal adapter is the hardware, the Estlcam software is the associated software. This manual only describes the hardware and its commissioning and connection.

The terminal adapter is used to connect motor drivers, sensors, limit switches, spindles, suction etc. so that the software can control them. For this purpose, it has a series of connection terminals. The exact function of these terminals is described below.

The Estlcam V11 or V12 software runs on a Windows PC and uses the loaded G-code, which defines the movement commands. Control commands are **generated** from this G-code and sent to the terminal adapter via the USB interface. Among other things, this has a microprocessor that receives the commands and uses them to generate control signals for the motors. At the same time, it controls the outputs and reads the inputs, reporting their statuses back to the software, which can react accordingly.

It is therefore a CNC control system, consisting of hardware and software, with which a milling machine can be controlled automatically.

The Estlcam software can be used with this hardware in version 11 or 12.

NOTES ON INSTALLATION

The control unit is intended to be installed in a stationary system. It can only be used on its own as a device if it is connected to a machine that has drive motors and other components. An automatic machine is only created in combination with these parts. The user or installer must therefore ensure that the entire machine complies with the legal guidelines once installation is complete.

INTENDED USE

The control unit is used to control stepper or servomotors (or similar drives) for operation on a milling machine. Any other use is considered improper use.

Supplied accessories such as power supply units, output stages, sensors or motors must only ever be used as intended.

DISCLAIMER

Rocketronics manufactures components that are used in a wide variety of machines. The selection and use of Rocketronics products is the responsibility of the system builder or end user. Rocketronics accepts no responsibility for the integration of the products into the end system.

Under no circumstances may a Rocketronics product be incorporated into a product or structure as a safety control. All products containing a component manufactured by Rocketronics must be supplied to the end user with appropriate warnings and instructions for safe use and operation. All warnings provided by Rocketronics must be communicated directly to the end user.

The user of this control system must ensure that all necessary safety precautions have been taken and checked for proper functioning to ensure safe operation of the machine. The construction or conversion of a machine modifies a potentially dangerous device. The automation of movements can lead to damage to the machine, but also to serious injury to the operating personnel.

Professionally qualified staff

Qualified personnel must be able to correctly interpret and implement the safety instructions and warnings. They must also be familiar with the safety concepts of automation technology and have received appropriate training. Unqualified intervention in the devices or failure to observe the warnings in this documentation or the warnings displayed by the device may result in damage to property or personal injury.

EU directives on product safety

The following EU directives were observed:

2011/65EU	RoHS
2014/30/EU	Electromagnetic compatibility (EMC)
DIN EN 61010-1	Safety requirements for electrical equipment for measurement, control and laboratory use - Part 1: General requirements
DIN EN 61326-1	Electrical equipment for measurement, control and laboratory use - EMC requirements

Applicable regulations

In addition to this technical manual, the following regulations must be observed:

- Accident prevention regulations
- Local regulations on occupational safety

Safety regulations

- The control unit should only be used by authorized specialist personnel and in compliance with the accident prevention regulations and the regulations of the electrical industry.
- Unqualified persons must not operate the control unit.
- The control unit is designed for operating temperatures of +5 to +40 °C and storage temperatures of -10 to +50 °C. It must be protected from high humidity, vibrations and explosive gases.
- **CAUTION:** Connection and installation work may only be carried out when the appliance is de-energized. be carried out. The installation and use of equipment must be carried out in accordance with the standards of the Declaration of Conformity.
- **CAUTION:** When connecting motors to motor drivers, the correct polarity must be observed. the. Furthermore, the correct motor current must always be set on the driver. To ensure that the speed of the motor can be controlled correctly, the setting of the steps / revolution must be made on the driver. This setting must also be adopted in the control unit settings.
- The respective configuration of the control unit may only be operated with the motor types configured for it. Other or more extensive uses do not correspond to the intended purpose.
- Currents and voltages: The control unit operates with an extra-low voltage of 24V, which can be provided by a power supply unit. No special safety precautions are therefore required on the output side.
- The control unit is built in accordance with the recognized safety regulations and complies with the standards and directives listed in the previous chapter.

Ambient conditions

Protection class:	NONE
Ambient temperature (operating):	+5 ... +80°C
Humidity (non-condensing):	0 ... 95 %
Ambient temperature (storage)	-25 ... +85°C

Safety instructions and warnings

- The operating instructions must be read before commissioning and using the appliance for the first time.
- The safety and accident prevention regulations applicable in the individual case must be observed.
- Before switching on the control unit, ensure that the operating voltage specified on the device matches the supply voltage.
- Proper and safe operation of the product requires proper transportation, storage, installation and assembly as well as careful operation and maintenance.
- Do not use a damaged control unit
- Switch off the appliance immediately if it shows any noticeable deviations from normal operation.
- Rocketronics.de only guarantees the proper functioning of the device if no changes have been made to the mechanics, electronics or software.
- The appliance may only be opened and adjustment, maintenance and repair work may only be carried out by appropriately trained specialist personnel.
- The controller may only be used for the purpose described in these operating instructions. Any other use is considered improper use. The manufacturer is not liable for any resulting damage. The user alone bears the risk for this.
- The control unit must not be put into operation until it has been established that the entire machine in which this control unit is to be installed complies with the provisions of the EC Machinery Directive as amended.



WARNING

If incorrect entries are made, the machine equipped with this control system can perform unexpected movements that can be fatal for the operating personnel. It is therefore the responsibility of the system designer or end user to ensure that the settings are correct and have been checked.



WARNING

It is essential that the control system is integrated into the emergency stop function of the machine. This function must be designed in such a way that after the emergency stop condition has been eliminated, a release by the user is required before the machine is ready for operation again. It must not be possible to restart the machine independently.

EMERGENCY STOP FACILITY

The complete machine must have an emergency stop device in which the control system must also be integrated. An automatic restart after the emergency stop has been triggered must be safely prevented! For this purpose, the emergency stop circuit should contain a contact that is connected to one of the inputs of the control unit. This input must then be set to the "Error message" function. If it is activated, the control unit stops further movements of the axes.

A category 1 emergency stop is required:

CONTROLLED SHUTDOWN WHILE MAINTAINING THE ENERGY SUPPLY IN ORDER TO CARRY OUT THE SHUTDOWN. INTERRUPTION OF THE ENERGY SUPPLY ONLY AFTER THE MACHINE HAS COME TO A STANDSTILL.

This procedure brings the spindle and drives to a standstill as quickly as possible. Only then can the power supply be interrupted. A blunt shutdown of the power supply usually leads to the spindle running on for a longer period of time.

SCOPE OF DELIVERY AND ACCESSORIES

The scope of delivery includes a control board and a bag with 4 spacer bolts M3 with nuts for fastening as well as these instructions in printed form.

A top-hat rail holder is available as an accessory, with which the board can be mounted on a standard top-hat rail. A power supply unit with 24V and approx. 1A is also required as an accessory if the inputs and outputs of the board are to be used.

TECHNICAL DATA:

- Dimensions: 151 x 80 mm
- Four M3 threaded bushes / spacers included
- All connections routed to sturdy screw terminals
- Firmware can be easily updated via the Estlcam PC software
- Suitable for CNC milling machines and laser machines
- ATMEGA328 Controller
- USB connection (Mini-B socket)
- 5V TTL step and direction signals X / Y / Z for motors with step/direction inputs.
- Each signal with its own "GND" terminal for easy wiring
- If required, 2 output stages can be connected per axis.
- 8 inputs for mechanical buttons and NPN sensors.
Each input has its own "GND" and supply voltage terminals. Each input is isolated from the controller via optocouplers
- 0-10V speed and "Run" signal for speed control via frequency inverter.
- 1 optocoupler output (open collector up to 20mA) for laser control
- 4 open collector outputs for relays (24V, max. 200mA).
- Mini-DIN connection socket for additional modules: Control panel or handwheel.

COMPATIBLE MOTOR SYSTEMS:

All stepper and servo motors that can be controlled via a 5V TTL step/direction signal are compatible, including almost all motors from Leadshine, JMC and many more.

Bus-controlled systems with Ethercat, Modbus, RS232, RS485, field buses, CAN etc. can NOT be used.

SETUP:

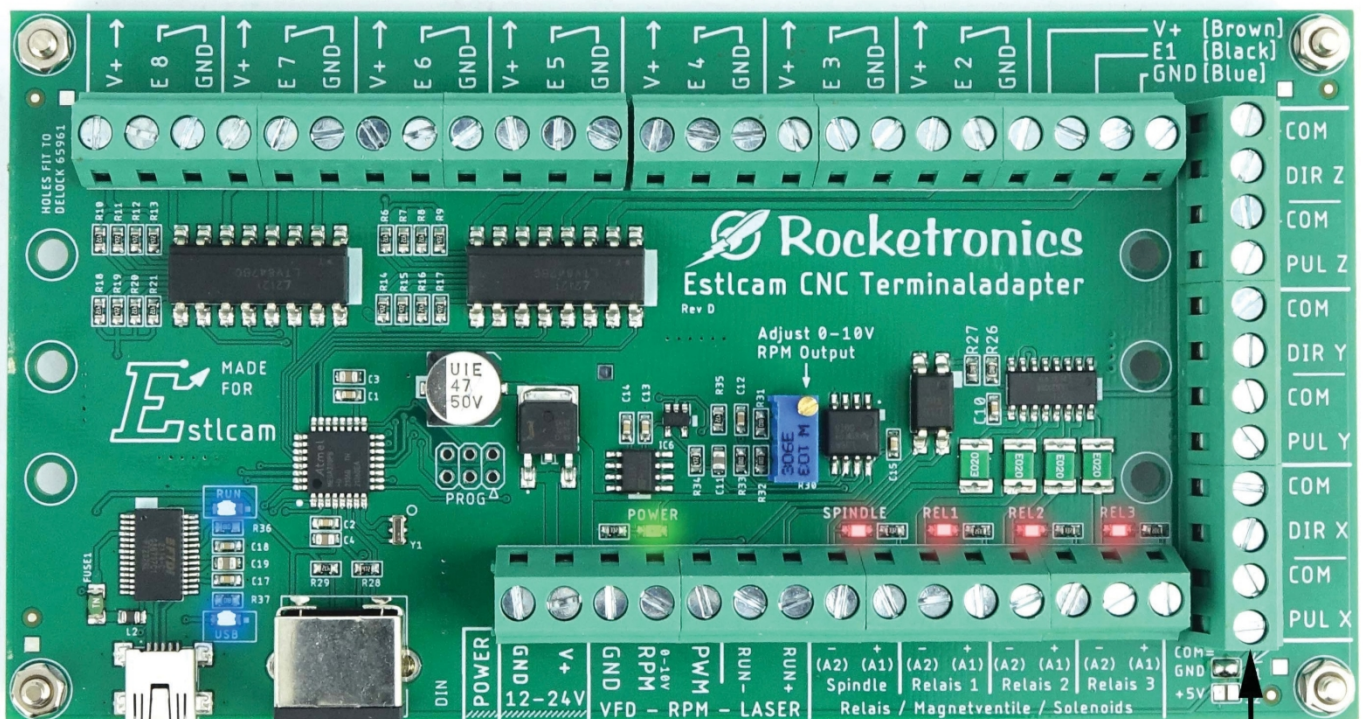
- Important: Read first, then screw!
- Always install the latest Estlcam version from www.estlcam.de

CAUTION:

- Prevent short circuits and reverse polarity
 - **Short circuits and polarity reversals can damage the controller, connected components and, in the worst case, your computer! This is NOT covered by the warranty.**
 - Mount the adapter so that no chips can fall onto the circuit board during milling.
 - Avoid working on a plastic surface (table, etc.): Static charge can destroy the electronics.
 - When mounting on a metal plate, it must be ensured that the underside of the circuit board does not touch any metal: Risk of short circuit!
 - Ensure that all connections are firmly connected and well insulated.
 - Do not use frayed cable ends! Use wire end ferrules, cable lugs, etc.
 - Always carry out changes without power and with the USB cable disconnected.
-
- Check everything thoroughly before putting the control unit into operation.
 - Be prepared for surprises during commissioning - e.g. the milling motor suddenly starting up. Test without the milling cutter in the air first, keep your distance until everything works as desired.
 - Only use high-quality, well-shielded USB cables. Inferior cables can cause the control unit to suddenly stop in the middle of work.
 - Comprehensive instructions can be found at <https://www.estlcam.de/anleitung.php>

CONNECTION OVERVIEW:

8 Eingänge für Endschalter, Längensensor etc.
Mit Optokoppler entkoppelt.



USB

Handrad
+
Bedienpanel

Versorgung
12-24V

Drehzahlausgang
0-10V
und PWM

1x Laserausgang
Optokoppler

4 Ausgänge für Relais
für Spindel, Absaugung etc.

3 Motorausgänge
Schritt/Richtung
4. Achse kann parallel
angeschlossen werden.

FIRST COMMISSIONING:

- Download the software first, it can also be used without a license: Version 12:
64-bit version: https://www.estlcam.de/downloads/Estlcam_64_12.exe

Version 11:

64-bit version: https://www.estlcam.de/downloads/Estlcam_64_11.exe 32-bit version: https://www.estlcam.de/downloads/Estlcam_32_11.exe

- Install the circuit board in the intended location, e.g. a switch cabinet or other suitable housing. **Please do not test on the plastic table top, as this can emit very high static discharges to the electronics and destroy them.**
- Do NOT connect anything yet.
- Connect a well-shielded USB cable with a maximum length of 2 m to the USB port on the control unit and plug the other end into a free port on a PC. The PC should now recognize a new device. If nothing happens, the driver may need to be installed. You can find this at: <https://tinyurl.com/2j7f542p> or on our website.
- Install and start the "Estlcam" software on the PC, which must be running Windows 7 or higher.
- In the software, open the settings window under Settings -> CNC control. Go to and set at "Control electronics" and select type "Terminal adapter" .



The screenshot shows the 'Steuerungseinstellungen' (Control Settings) window in Estlcam. The 'Klemmenadapter' (Terminal Adapter) settings are highlighted with a red box. The settings include:

- Voreinstellungen: Klemmen Adapter
- Steuerungselektronik: Klemmen Adapter
- USB / COM Anschluss: COM2

Below these settings, there are fields for X, Y, and Z axis parameters:

	X-Achse:	Y-Achse:	Z-Achse:
Schritte je Umdrehung:	1600	1600	1600
Weg je Umdrehung:	5,00mm	5,00mm	5,00mm
Maximalvorschub:	3000mm/min	3000mm/min	3000mm/min
Trägheit:	85,0%	85,0%	85,0%

Other settings include: Richtung umkehren (checkboxes), Beschleunigungsweg (2,00mm), Mindestvorschub (60mm/min), Schrittpulslänge (Automatisch), Schrittpulspause (0), and Schrittsignal invertieren (checked).

A red box highlights the 'Steuerung programmieren' button at the bottom of the window.

- Under USB/COM port, set the comport provided by the control unit, e.g. COM2. If you do not know the number, select "Search" and follow the instructions.
- Then click on "Program control unit" to test whether the control unit is responsive:
- Once the process is complete, the connection is established!
- Then disconnect the USB cable again first: **ALWAYS connect components with the USB cable disconnected and without power supply to the control unit.**
- You can then start connecting the components. It is best to do this bit by bit and test the function from time to time.

SETTINGS

Basically, the software must be set to determine how the motors of the axes should move and how the inputs and outputs should be used. This is necessary for the machine to function correctly with the control system. You can also find online instructions for this at <https://www.estlcam.de/anleitung.php>

If settings have been changed, these must ALWAYS be transferred to the terminal adapter with "Program control"!

The settings window has several tabs for basic settings, milling motor, inputs, outputs, etc. **If you hold the mouse over one of the input fields, a help text appears explaining everything.**

On the basic settings page, the number of steps/revolution, travel per revolution, maximum feed, inertia and direction reversal are set for each axis. These values must be adapted to the hardware.

Steps per revolution:

Is determined by the output stages / motor drivers. These are adjustable; the value set on the driver must also be entered here. The usual values are 400, 800 or 1600. 1600 is usually a good choice.

Travel per revolution:

Distance traveled per revolution of the stepper motor axis. Corresponds to the spindle pitch for threaded rods and ball screws. For toothed belts: Belt pitch x number of teeth of the belt pulley.

This is also an alternative entry for the step resolution (distance the axis travels per motor step): Set the value for steps per revolution to 1 and enter the step resolution in the distance per revolution field. The value will be displayed strongly rounded, or usually simply "0.00" will be displayed. However, Estlcam will still use the exact value entered.

Maximum feed:

This is the maximum speed of the axle, which depends on the performance of the drive components.

The theoretically possible maximum feed rate results from the maximum speed of the motor and the distance per revolution: If you have a servo motor that achieves 3000 rpm and a 5 mm spindle on the axis, you can theoretically move $3000 \times 5 = 15,000$ mm/min. In reality, it should be less, you have to adjust this in real operation. Also remember: High speeds entail high risks! Set the value slowly to begin with.

Maximum feed and acceleration travel are closely linked:

Carry out tests with different acceleration paths to see how they affect the speed:

- Start with an acceleration path that corresponds approximately to the spindle pitch.
- Determine the achievable speeds of the individual axes: Increase the feed rate, reprogram the control unit and then try to move the machine at maximum speed.
- If this works without any problems, increase the feed rate further and try again.
- If the motor stalls, write down the value and repeat the test with a different acceleration path.
- At the end you can draw an X/Y diagram of the acceleration paths against the maximum speeds:
- You will notice that longer acceleration distances enable higher speeds, but also make the machine more sluggish.

- Shorter acceleration distances in turn improve the dynamics, but at the expense of the maximum speeds that can be achieved.
- There will be a certain range in which the acceleration paths correlate well with the feed rates. Outside this range, small improvements in one property will lead to disproportionate deterioration in the other. The curve bends at a certain point - a good compromise between speed and dynamics is usually achieved there.
- Subtract 20-30% safety reserve from the maximum achievable feed rates!

Inertia:

Similar to cars, CNC milling machines cannot drive through bends at any speed without causing an accident or losing steps. The higher the inertia value, the more the machine is slowed down before changing direction in order to avoid step losses. The aim is to set the inertia as high as necessary to prevent step losses, but also to keep it as low as possible so as not to slow down the machine unnecessarily.

In the event of step losses:

Is it more of a gradual step loss during milling that slowly builds up over time? inertia? Then increase the inertia of the affected axis.

Are there sudden, severe step losses with complete standstill of an axis during a fast positioning run? Then reduce the maximum feed of the axis or increase the acceleration distance.

Further possible settings and optimization:

For many power amplifiers, such as the Leadshine DM542EU, DM556, etc., the checkbox "**Step-invert signal**" can be set:

These output stages read in the direction signal on the rising edge of the step signal, which has not been present for long with a "normal" step signal. This can result in direction changes only being recognized at the next clock pulse and position deviations accumulating over time. The inversion ensures that the change of direction is output on the falling edge and is then correctly present for much longer on the next rising edge. If there are problems with creeping position deviations, the "Invert step signal" checkbox should be the first port of call.

For output stages that require even more time between the change of direction signal and the next cycle, the time in the "**Step pause**" field can be increased further. However, this only affects a few output stages with particularly slow optocouplers on the direction signal. The value should not be set unnecessarily high as the field has a negative effect on running smoothness.

Some output stages only work reliably with step pulses within a certain length.

This can be set in the "**Step pulse length**" field. As a rule, however, the "Automatic" setting is best. Only output stages with a very low maximum input frequency are affected by this problem.

CONFIGURATION OF THE INPUTS:

For an input to perform the desired task, it must be configured accordingly in the controller configuration. This can be done in the software under Settings -> CNC control. Select the "Inputs" tab in the window. The function can be set there for input 1 - 8:

Possible functions of the inputs

Unused

For unused inputs. Unused inputs are hidden in the control window.

Limit switch

For limit or reference switches:

It does not matter whether there are 0, 1 or 2 limit switches per axis.

If there is a lack of inputs, several limit switches can be connected to one input at the same time.

Limit switch Y / left" and "Limit switch Y / right

Only available for hardware with axis alignment function! (i.e. not for this control unit)

If the Y-axis of the machine is driven by a left and right motor and limit switches are mounted on both sides, the machine is automatically aligned during the reference run.

Sensor

For sensors such as tool length sensor, touch plate, etc.

Error message

For critical errors that should trigger an immediate stop of all axes and the milling motor: This is the brute force method to stop the machine abruptly, which usually leads to step losses. See also the "Pause / Stop" function as a milder alternative.

ATTENTION: NO "EMERGENCY STOP"! It is a software function that cannot provide 100% protection! If a real emergency stop is required, this must be implemented using suitable hardware; the error message signal can only be used as an optional additional measure.

Signal bypass

Used to bypass the limit switch, sensor and error messages in order to machine manually from the triggering switch or sensor if required.

Milling motor start

Starts and stops the milling motor.

Program start

Starts and pauses the CNC program.

Pause / Stop

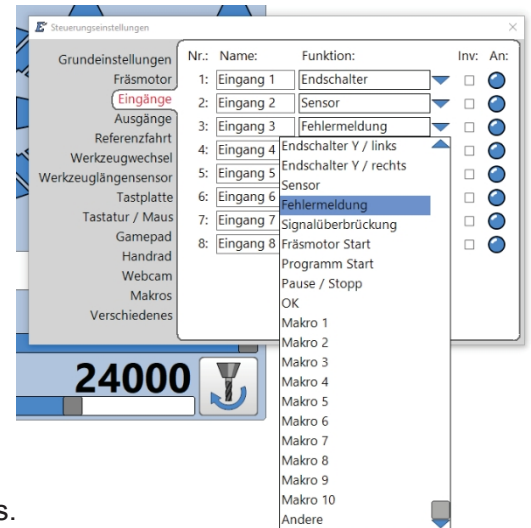
Stops the milling motor / Pauses CNC programs.

OK

Cancel axes / confirm selection etc..

MAKRO up to 10

Starts macros 1 to 10...



Other

For everything else. Has no function, but the status of the input is displayed in the control window.

The blue "LED" next to the input indicates the current status of the input, which is helpful in the event of a fault.

However, the configuration should only be carried out at the end after successful commissioning. otherwise Estlcam may overwrite everything with the default settings.

Important:

- Unused inputs should also be configured as "Unused".
- For openers, the "Invert" checkbox must be ticked!
- Always set the "limit switch", whether mechanical or as an inductive sensor, as a "limit switch", not as a sensor!
- A "sensor" is, for example, a length measuring sensor, edge finder, etc.
- We use the "Error message" type for error signals
- Push-buttons for starting or stopping a program can be connected, the input must be can then be configured as "Program Start" or "Program Stop".

If settings have been changed, these must ALWAYS be transferred to the terminal adapter with "Program control"!

The ESTLCAM license

The software can be used free of charge for test purposes. The free version is fully functional. It only pauses longer and longer over time when opening and saving certain files.

However, a license is required for permanent use.

The freeware version of the software is unlocked by entering the license key for the full version. After entering the license key, the software is unlocked and there are no more waiting times with instructions for purchasing a license.

Version 12 License keys can be used on a maximum of 3 computers simultaneously by default and also work for the older version 11. Licenses that are no longer used on old computers can be deactivated and then transferred to a new one. This also works if the old PC no longer exists or is defective.

You can enter the license key on the same PC (e.g. after new installations) as often as you like.

Order your license code now from Rocketronics:

<https://www.rocketronics.de/shop/de/estlcam-lizenz.html>

POWER SUPPLY

The core of the controller is supplied with power via the USB connection, which supplies the microcontroller and its outputs that provide the STEP and DIR signals for the motors. All other parts of the circuit board are dependent on an external voltage of 24V. Without this extra power supply, the inputs and outputs will not work and there will be no speed control signal.

Small power supply units, e.g. the Meanwell MDR-20-24, provide a suitable 24 V. The supply voltage is connected to the GND and V+ terminals. The power supply unit should be able to supply about 1A current.

It can also be operated with 12V-24V. The choice of voltage depends primarily on the requirements of any relays used:

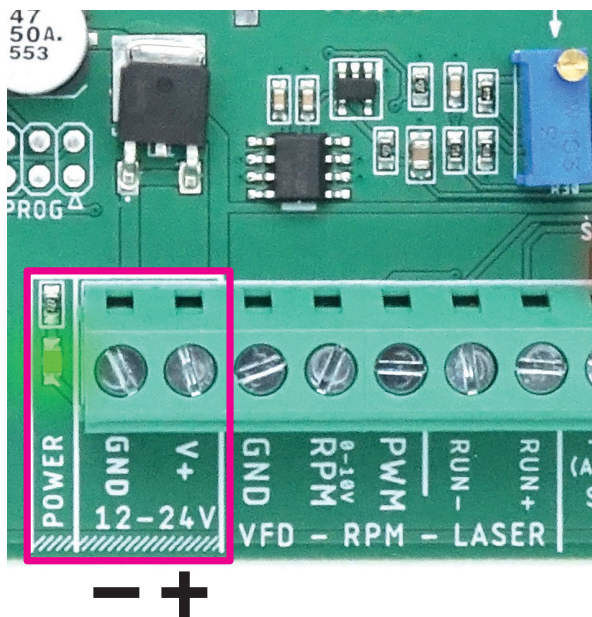
- When using 24V relays, a 24V power supply unit must be used.
- When using 12V relays, a 12V power supply unit must be used.
- For solid-state relays with a wide input voltage range or without relays, the voltage is usually arbitrary.

Our recommendation: Simply use 24V, which is the industry standard.

Connection:

- Connect the positive output / "+" of the power supply unit to "V+".
- Negative output / "-" of the power supply unit to "GND" next to it.

The voltage input is protected against reverse polarity. A green LED indicates that voltage is present.



CAUTION

Voltages above 30V can damage or destroy the adapter.

CAUTION

If peripherals are used that are not suitable for the operating voltage, they may be damaged or destroyed

CONNECTING THE MOTOR DRIVERS

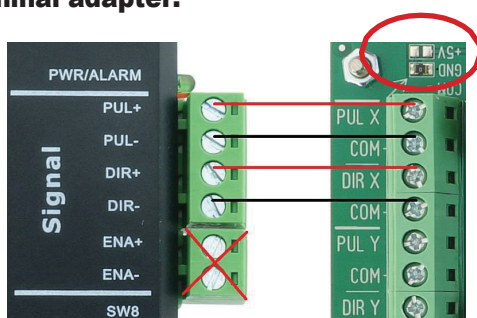
All motor drivers that can process a **step/direction signal with 5V** voltage can be used. The adapter has terminals on the right-hand side for connecting the motor drivers. There are 4 terminals per axis X, Y and Z:

Clamp	Function
PUL	Clock signal / PULSE
COM	Ground or 5V depending on the solder bridge (see below)
DIR	Direction signal / DIRECTION
COM	Ground or 5V depending on the solder bridge (see below)

COM is connected to ground when delivered. The usual drivers from Leadshine or motors from JMC have matching inputs that are labeled PUL+ PUL- DIR+ and DIR-.

Wiring the motor driver with the terminal adapter:

Drivers	Terminal adapter
PUL+	PUL
PUL-	COM
DIR+	DIR
DIR-	COM
ENA+	Leave free
ENA-	Leave free



Repeat this for the output stages of all axes, X, Y and Z.

If required, 2 power amplifiers can be connected per axis:

E.g. for machines with drives on both sides of the gantry. Simply connect both output stages to the respective connections of the adapter. Attention: More than 2 power amplifiers per output can lead to damage due to excessive current consumption!

Special case: Driver with "Opto" / "+5V" connection (common anode):

There are drivers that only have 3 connections PUL, DIR and OPTO instead of "PUL+" / "PUL-" / "DIR+" / "DIR-". These can also be used, but must be connected differently:

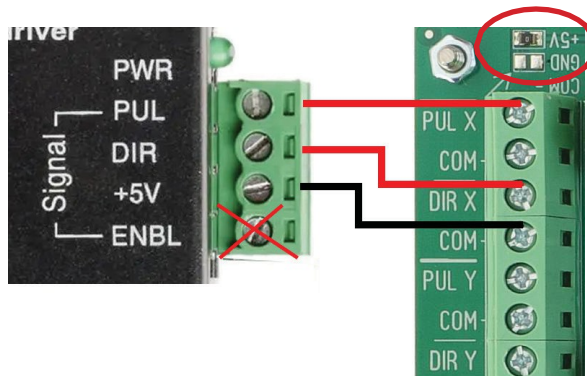
This requires a small adjustment as shown in the picture on the right to switch the "COM" connections from "GND" to "+5V":

- Remove the 0 Ohm resistor in the "GND" field.
- Then solder it into the "+5V" field

If the resistor is broken or lost, simply short-circuit both pads in the "+5V" field with a thick lump of solder.

Then connect as follows:

Drivers	Terminal adapter
PUL+	PUL
DIR+	DIR
OPTO	COM
ENA+	Leave free
ENA-	Leave free



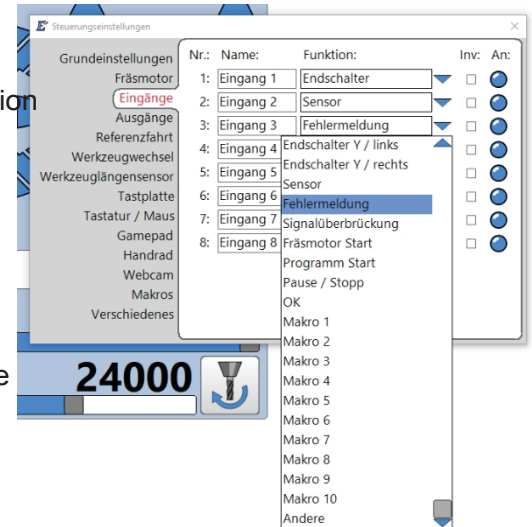
Alarm outputs of the motors:

JMC servos and closed loop steppers are connected to the PUL and DIR connections as shown above. Optionally, the alarm signal (ALM+/ALM-) can also be connected to the adapter. The alarm output of the motor driver is an Open-Collector output, which pulls the input to ground in the event of an error.

It can be used to bring the machine to a standstill in the event of position deviations:

1. Connect "ALM+" to any input of the adapter (E1 to E8).
2. Connect "ALM-" with "GND" next to it.
3. Configure the input in the software as "Error message" as shown on the right. See also "Setting the inputs"

It is possible to connect several "ALM" signals to the same input of the terminal adapter in order to save inputs.



CONNECTING THE INPUTS

The adapter has 8 digital inputs, e.g. for

- Limit switch
- Edge finder
- Buttons
- and other digital sensors and signals are available.

Each input is pulled up to supply voltage level via a 4.7 kohm resistor. Switching takes place by connecting the input to "GND". This means that no voltage is applied here, only that the input is switched to GND!

This can be done via a mechanical switch, relay contact, optocoupler or open collector output, for example. The inputs can be used very universally.

If in doubt, ask by email if you want to connect something unusual Each input has 3 connections to

simplify wiring:

- "GND" Ground, i.e. 0V
- "E1" to "E8": The actual input
- "V+": Supply voltage connection for supplying electronic sensors (24V)

Connection of mechanical switches and sensors:

- Connect one connection of the switch (no matter which one) to "GND"
- Connect the other connection to "E1" to "E8"
- Ignore "V+" Simply leave it open.
- Normally closed or normally open contacts can be used.
- Several switches can be connected to the same input:
 - For normally open contacts as parallel connection.
 - For normally closed contacts as series connection.
 - However, the purpose of the switches must be the same:
 - Several limit switches can be combined, for example,
 - However, limit switches with tool length sensors, for example, cannot be connected to the same input.

Connection of inductive proximity switches / NPN sensors:

- Connect the blue wire of the sensor to "GND"
- Connect the black wire of the sensor to "E..."
- Connect the brown wire of the sensor to "V+"

Normally closed (NC) or normally open (NO) does not matter.

CAUTION: Only "NPN" type sensors are compatible. Never connect "PNP" sensors!

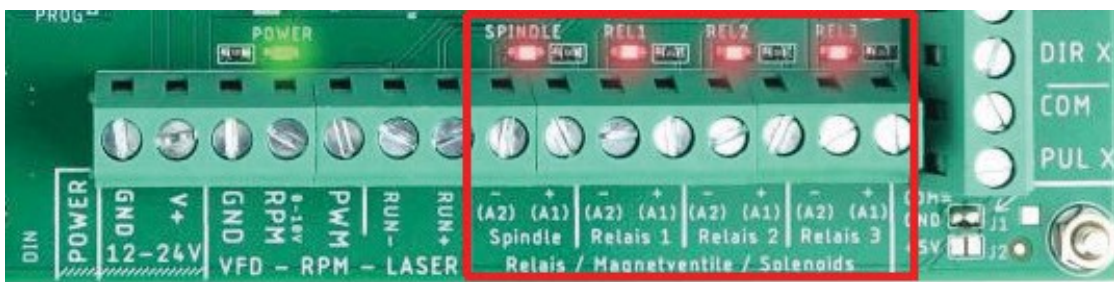
With normally open contacts, it is possible to connect several sensors in parallel to the same input in order to save inputs. Make sure that the sensor is suitable for the selected supply voltage!

CAUTION

- Inputs are not compatible with tri-state / push-pull pins (e.g. microcontrollers)!
- Do not apply any voltages to the inputs!
- Never use PNP sensors!

CONNECTION OF THE RELAY OUTPUTS

The adapter has 4 outputs for relays: "Spindle" and "Relay 1-3". Above these are red LEDs which indicate the switching status for easier control.



Mechanical relays, solenoid valves or solid-state relays can be connected. These must be suitable for the operating voltage of the terminal adapter (24V) and must not consume more than 200mA current. Mechanical relays should always have a free-wheeling diode. SSRs should always have a zero-crossing switch.

Connect relays or solenoid valves:

The adapter offers 4 outputs for controlling external relays or solenoid valves:

"Spindle" for the milling motor.

"Relay 1 to 3" for freely selectable additional functions such as vacuum cleaner, light, etc.

- Each output consists of a "+" and "-" connection for easy wiring:
- The "+" connection is connected directly to the adapter's supply voltage.
- The "-" connection is the actual switching connection and is switched through to "GND" when the output is activated.
- A red LED indicates the switching status and facilitates troubleshooting

Attention:

- The adapter connections themselves cannot switch high currents (max. 200mA)!
- A relay must always be connected in between for large loads!
- Make sure that the relay is suitable for the selected supply voltage!

Connection of mechanical relays:

The cheapest solution, but in rare cases interference with USB communication is possible. Many relays have integrated freewheeling diodes:

- If a relay with a freewheeling diode is connected the wrong way round, this will result in a short circuit!
- The relay outputs are largely short-circuit-proof, but without guarantee!
- Relays for which it is not clear whether freewheeling diodes are present - and how they are polarized - must not be connected!

- Connect "A1 (+)" of the relay to the "+" connection of the desired output.
- Connect "A2 (-)" of the relay to the "-" connection of the desired output.
- Ensure that the coil voltage matches the supply voltage of the terminal adapter, see 12 to 24V power supply
- Relay with 24V coil voltage suitable for most applications: Wago 788-304 24V

If the relay has a contact, this contact is used to switch the L conductor of the mains to the load. N is then permanently connected to the load.

If the relay has 2 contacts, you can switch L and N to the load.

Contacts 11 and 14 or 21 and 24 are the NO contacts on the relay.

Connection of solid state relays (SSR):

SSRs are relatively expensive, but switch with low interference and can be connected without the risk of short circuits due to the lack of freewheeling diodes.

- Connect "A1 (+)" of the relay to the "+" connection of the desired output.
- Connect "A2 (-)" of the relay to the "-" connection of the desired output.

Attention:

- Only use SSRs with a zero crossing circuit. Otherwise the relay may be destroyed by inductive loads such as motors!
- Sufficient current and voltage resistance is required.
- A heat sink may be required if the design is tight.
- Ensure that the input voltage range matches the supply voltage of the terminal adapter (12 or 24V).
- Cooling is often necessary for SSRs when high loads are switched, e.g. they are screwed to the control cabinet wall.

Solenoid valve connection:

Solenoid valves behave like mechanical relays. This means that pneumatic clamping devices, for example, can be controlled quite easily via the terminal adapter. Observe the maximum permissible coil current of 200mA and the necessary freewheeling diodes!

TIP:

For consumers such as pumps, vacuum cleaners, spindles, etc., it is very helpful to use **built-in sockets**. The relay is used to switch the mains voltage to the socket, the load is then simply plugged in and can be easily removed or replaced if defective. You will find switching examples on the next page. These sockets are also available in our store at www.rocktronics.de



CONNECTION OF ADDITIONAL MODULES TO THE MINI-DIN CONNECTOR:

The Mini-DIN socket is primarily used to connect ready-made additional modules, including the following

- The Estlcam handwheel
- The Estlcam control panel.
- The potentiometer and push-button module.

In principle, however, you can also make your own. You can find more information about the mini-DIN socket here: https://www.estlcam.de/DIN_Detail.php



Handwheel for Estlcam for easy control of all 3 axes

Fits the Estlcam terminal adapter and the Estlcam LPT adapter!

- Pre-assembled robust handwheel for Estlcam.
- With joystick for very sensitive movement of all 3 axes.
- With encoder wheel for step-by-step movement of all 3 axes.
- Illuminated button for zeroing the axes.

It also has 2 potentiometers, one for setting the spindle speed and one for the feed speed; the potentiometers can also be pressed as they have a push-button function to start and stop the spindles and start programs.

Supplied with 3m flexible cable, packed in cardboard box, with printed operating instructions. Technical data:

- Dimensions: 185x98x95 mm (LxWxH)
- 3 m long cable with bend protection
- MINI-DIN connector for Estlcam hardware
- Joystick and encoder wheel for movement of all 3 axes
- Including protective rubber pad
- Ready to use.



Order now:

<https://www.rocketronics.de/shop/de/estlcam-handrad.html>

SPEED CONTROL WITH 0-10V AND PWM OUTPUT

The adapter has an analog output with 0-10V "RPM" and a digital PWM output "PWM". These outputs are used to provide a control signal for setting the spindle speed. Some spindles require the analog 0-10V signal, others the digital PWM signal with 5V signal level.

There are spindles with integrated electronics and others that require an external frequency converter. What they all have in common is that you usually have to set parameters first, for which you need to consult the manual.

It is then important to ensure that the adapter signals are connected to the correct terminals on the converter, as an incorrect connection can cause major damage.

The terminal adapter can directly control most commercially available frequency inverters:

- The SPINDLE output provides a switching output for a relay with which the spindle can be switched on. This means that a START/STOP input of an inverter can also be switched potential-free via a relay.
- The terminal pair "RUN+" and "RUN-" provides a potential-free switching contact (open collector optocoupler output) via which a digital input of the FI can be switched to start the motor.
- The "RPM" and "GND" terminals provide a calibratable 0-10V analog signal that can be used to control the speed of the motor.
- Always calibrate the speed output first - see below!
- Unfortunately, the terminal markings on the frequency inverters vary greatly depending on the manufacturer and type.
- Almost all frequency inverters are parameterized to start/stop via their own control panel when delivered!
- Start/stop via the terminal adapter is usually only possible after the parameterization has been adjusted accordingly (depending on the manufacturer and type). As a rule, only a look at the manual will help.
- VSDs with a potentiometer in the control panel are usually parameterized for speed control via their own potentiometer when delivered. Here, too, it is usually necessary to adjust the parameters first, sometimes even to reconnect jumpers inside the FI.

We recommend decoupling the switching signals to the inverter using relays. Use the "Spindle" output to switch a relay and then use its contact to switch the input of the inverter.

Important:

ALWAYS use a mains filter upstream of frequency inverters and spindles! This prevents high-frequency interference from being fed into the mains and interfering with communication with the PC. The use of mains filters is required by law. ALWAYS use shielded cables between the inverter and spindle and earth all parts to one point in a star configuration.

Calibrate 0-10V RPM output:

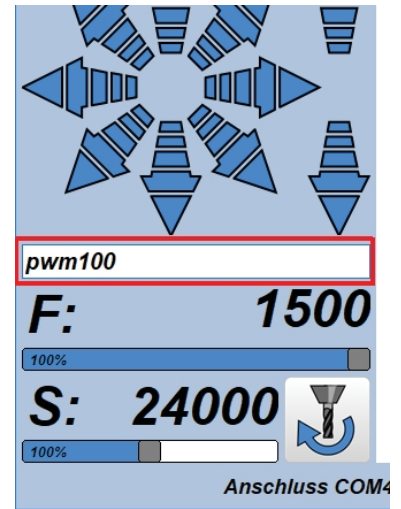
The 0-10V signal can be finely adjusted with the small blue trimmer. This setting must be made by the user:

For calibration, the adapter must be connected, supplied with power and configured in Estlcam and have been programmed. However, the frequency inverter itself should not yet be connected!

- Start the control unit by pressing F2 in the software. Alternatively via menu View -> CNC control
- Type "pwm100" into the command line of the control unit and press the "Enter" key.
- The spindle symbol (bottom right image) must change from blue to red.
- Now measure the voltage between the "RPM" and "GND" terminals with a multimeter. Attention: Not between PWM and GND!
- Make sure that the screws of the clamps are tightened to measure, loose screws

- do not have good contact and lead to incorrect measured values.
- Turn the screw on the blue potentiometer until the voltage is approx. 9V (intentionally less than 10V).
- Now switch off the power, exit Estlcam and disconnect the USB cable.
- Connect the frequency inverter.
- USB cable in, power on and start Estlcam again.
- Type "pwm100" again in the command line of the control unit and press the "Enter" key.
- The milling motor should now run at slightly less than the maximum speed.
- Turn the potentiometer until it has reached exactly its maximum speed and then a little further.

The output is now set exactly.



CONNECTION AMB / KRESS MILLING MOTORS

with external speed control

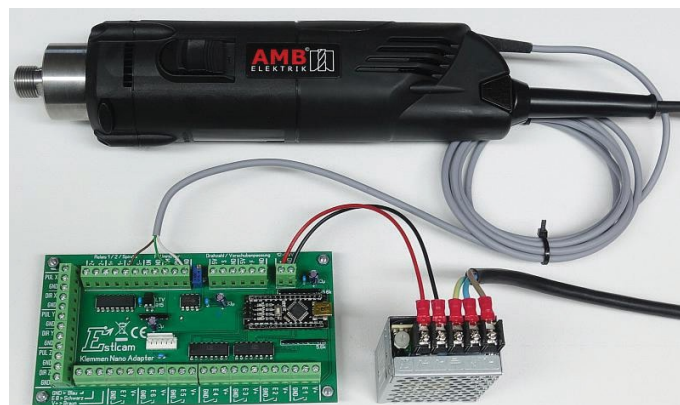
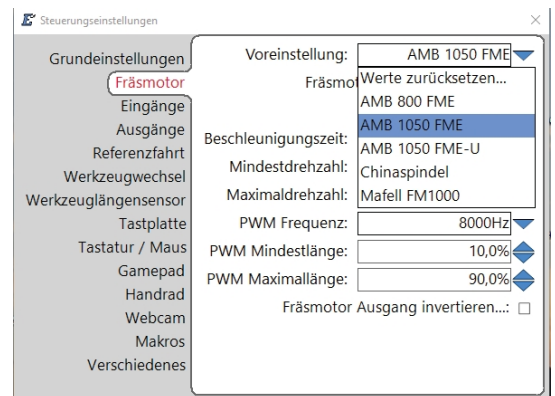
1. Configure software

- Go to the CNC control settings -> Milling motor.
- Select your milling motor from the "Preset" list.
- At least Estlcam version 11.041 is required!

2. Connect the milling motor:

- First stop Estlcam and disconnect the terminal adapter from the power supply. Then connect as follows:

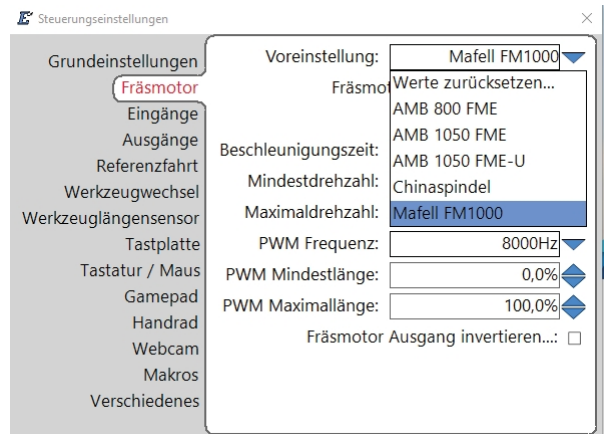
- Connect the white wire to "GND".
- Connect the green wire to "RPM".
- Connect the brown wire to "V+" (there are several of these on the adapter - it doesn't matter which one).
- Connect the milling motor to the socket.
- Reapply power to the terminal adapter.
- Start Estlcam.
- Set the switch on the milling motor to "on" - be aware that it may start up unexpectedly if something is set incorrectly!
- The milling motor should now be able to be switched on and off and its speed controlled via Estlcam.



CONNECTION OF MAFELL MILLING MOTORS WITH EXTERNAL SPEED CONTROL

1. Configure software

- Go to the CNC control settings -> Milling motor.
- Select Mafell MF1000 from the "Preset" list.
- Or manually enter the minimum and maximum speed of your milling motor in the fields for lower and upper speed limit.
- At least Estlcam version 11.041 is required!



2. Connect the milling motor:

- First stop Estlcam and de-energize the terminal adapter. Then connect the spindle as follows:

Pin no.	Parameters	Color	Connection to terminal adapter
1	UPV	BROWN	V+ or one of the (A1) terminals of the relay outputs
2	US	WHITE	RPM
3	U0	BLACK	Do not clamp, insulate well!
4	GND	BLUE	GND

To do this, the mains voltage must be switched to the spindle via a relay; the best way to do this is via a socket whose phase is switched via a relay. To do this, connect a relay to the "Spindle" output and connect terminal A1 of the relay to terminal A1 of the output "Spindle" and A2 accordingly with A2 of the "Spindle" output. Now switch the mains voltage to a socket via the relay's switching contact. Plug the spindle plug into this socket. **See page 19.**

Once the connection is ready, proceed as follows:

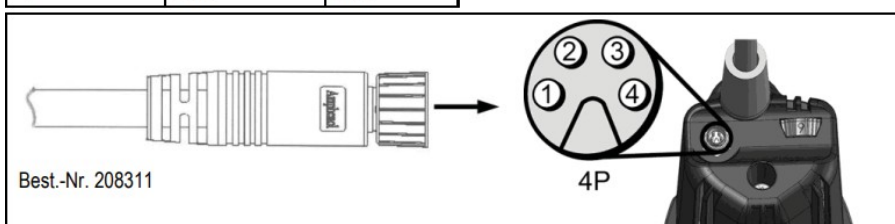
- Connect the milling motor to the socket.
- Reapply power to the terminal adapter.
- Start Estlcam.
- Set the switch on the milling motor to "on" - be aware that it may start up unexpectedly if something is set incorrectly!
- The milling motor should now be able to be switched on and off and its speed controlled via Estlcam.

Please also refer to the spindle manual!

5.2.1 Belegung Portalstecker

Alle Pins am Portalstecker sind gegen Verpolen geschützt. Bei Spannungen über 30 V ist ein verpoltter Dauerbetrieb zu vermeiden, da es zum Ausfall der PV-Schnittstelle führen kann.

Pin Nr.	Parameter	Litzenfarbe Best.-Nr. 208311
1	U _{PV}	Braun
2	U _S	Weiß
3	U ₀	Schwarz
4	GND	Blau



Connection of frequency inverters

The terminal adapter can directly control most commercially available frequency inverters:

- The terminal pair "RUN+" and "RUN-" provides a potential-free switching contact (open collector optocoupler output) via which a digital input of the FI can be switched to start the motor.
- The "RPM" and "GND" terminals provide a calibratable 0-10V analog signal that can be used to control the speed of the motor.

Important: Calibrate the speed output first, see above!

Unfortunately, the terminal labels of the frequency inverters vary greatly depending on the manufacturer and type. Almost all frequency inverters are parameterized to start/stop via their own control panel on delivery, start/stop via the terminal adapter is usually only possible after the parameterization has been adapted accordingly (depending on the manufacturer and type), usually only a look in the manual will help.

FIs with potentiometers in the control panel are usually parameterized for speed control via their own potentiometer when delivered; here, too, it is usually necessary to adjust the parameters first, sometimes even to reconnect jumpers inside the FI.

Connection examples / without guarantee - at your own risk:

Huanyang Hy... Series:

- "RUN+" -> "FOR"
- "RUN-" -> "DCM"
- "RPM" -> "VI"
- "GND" -> "ACM"
- Parameter 1: "1"
- Parameter 2: "1"
- Parameter 72: "400"
- Parameter 73: "100"
- If potentiometer in the control panel: Move jumper from "VR" to "VI".

YL620:

- "RUN+" -> "FWD"
- "RUN-" -> "XGND"
- "RPM" -> "VI1"
- "GND" -> "GND"
- Parameter 00.01: "1"
- Parameter 07.08: "3"

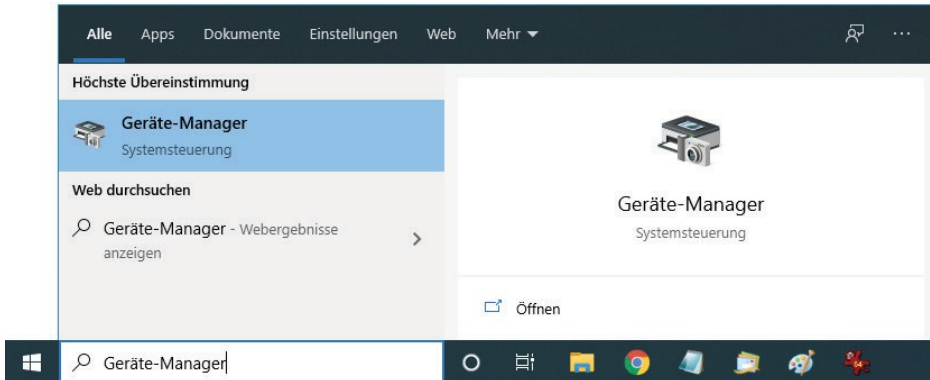
A2 Inverter (China Noname):

- "RUN+" -> "FWD"
- "RUN-" -> "GND"
- "RPM" -> "10V IN"
- "GND" -> "GND"
- Parameter Pn 03: "4"

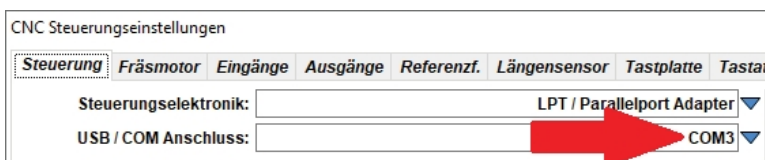
VERY IMPORTANT - INCREASE USB COMMUNICATION SPEED:

By default, the USB driver checks every 16ms whether data needs to be transferred from the controller. This is sufficient in principle, but is not optimal. To optimize the responsiveness of the control unit, do the following:

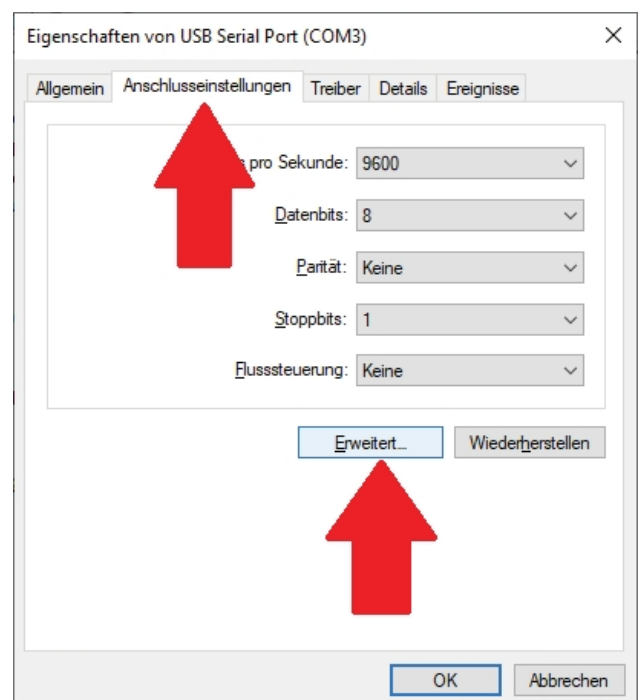
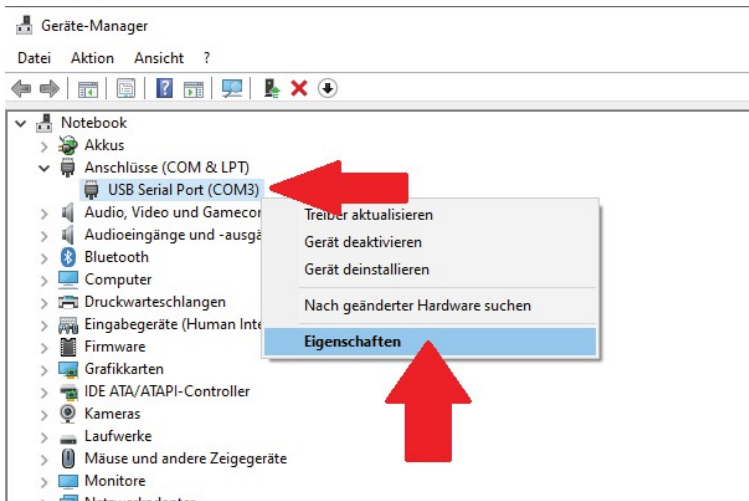
With the terminal adapter connected, open the Device Manager (e.g. enter "Device Manager" in the Windows search bar or call it up via "Control Panel" -> "System and Security" -> "Device Manager"):



Check in Estlcam which "COM" port is entered under "USB / COM port:". In our example, this is "COM3":



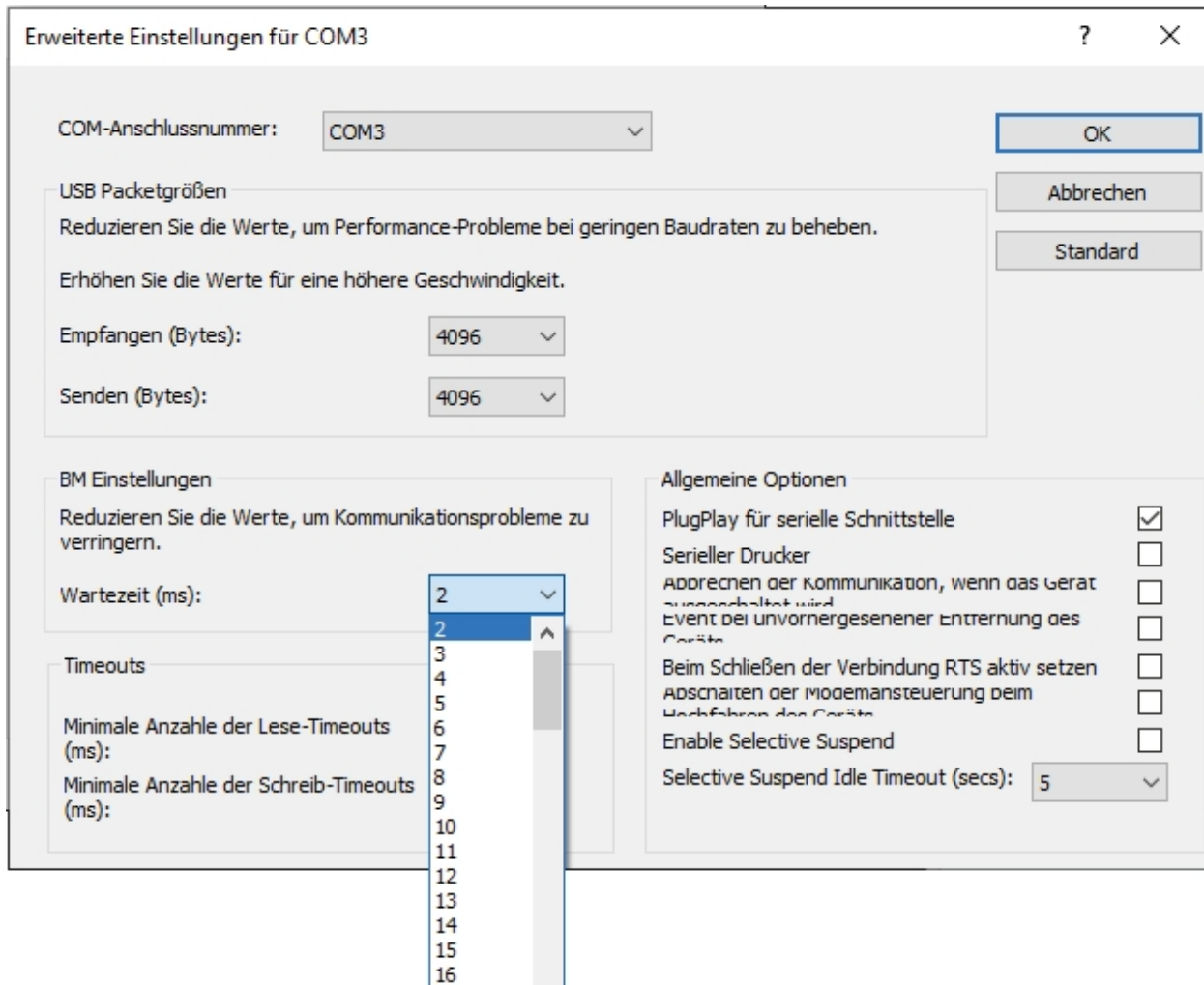
Search for a "USB Serial Port" with this "COM" number under "Ports (COM & LPT)". In our example "USB Serial Port COM3". Right-click on this entry and select "Properties" from:



Select the "Connection settings" tab and click on "Advanced":

Increase communication speed:

Change the value for the "Waiting time" to 2ms and click OK to save.



TIPS: ELIMINATE USB FAULTS

If the connection to the controller is interrupted with a USB error, you can check the following:

1. Check whether a well shielded short USB cable has been used. It should never be longer than 2m, shorter is better.
2. Earth power supply units at the earth connection if available.
3. Metallic parts of the machine should always be connected to earth.
4. Bring all underground cables together at one point in a star shape.
5. Are all control cables to the motors shielded?
6. Cables from driver to motor and frequency inverter to spindle MUST also be shielded.
7. Do not use cables for power supply and as control cables at the same time, use separate cables and do not lay them directly next to each other in parallel: cables can induce voltages in other cables through current flow, even if they are shielded. This can easily generate a few volts, which can lead to incorrect control commands.
8. Always install a suitable mains filter upstream of the frequency inverter; this is absolutely essential.
9. Place power components such as frequency inverters, power supply units and drivers as far away from the control unit as possible. Frequency inverters can quickly cause interference directly next to the control unit.
10. Lay control cables as far away as possible from frequency converters and the cables leading to them.
11. The shield of the cables may only be connected to earth on one side of the cable.

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Closed-loop stepper



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Power supply units



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Cables, terminals,
connectors



Accessories

THE ESTLCAM HANDWHEEL

Fits the Estlcam terminal adapter and the Estlcam LPT adapter!

- Pre-assembled robust handwheel for Estlcam.
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- Ready to use.

Order now:

<https://www.rocketronics.de/shop/estlcam-handrad.html>



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