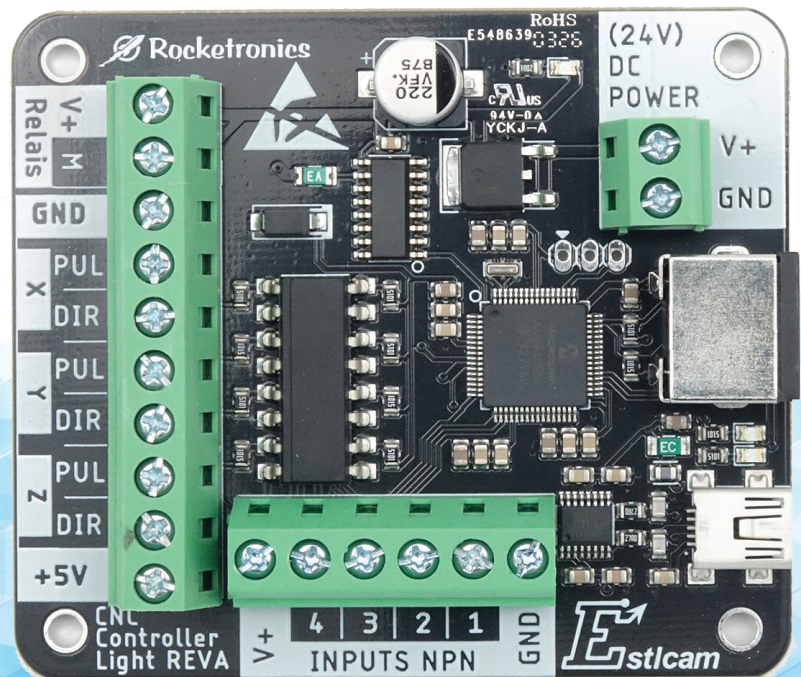


ESTLCAM TERMINALADAPTER LIGHT

User Manual

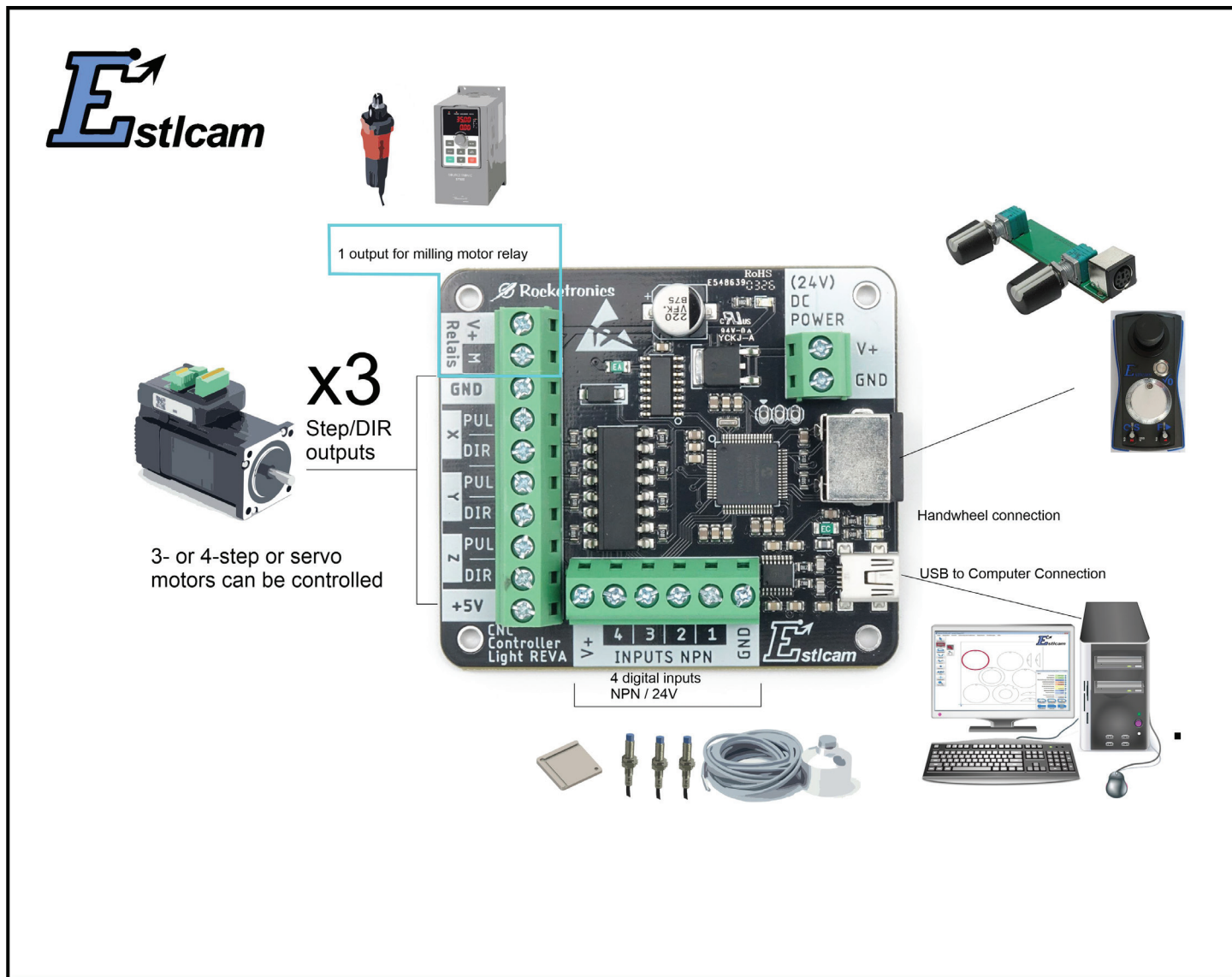


English

This manual describes how to set up and use the Estlcam terminal adapter Light

REV A

SYSTEM DIAGRAM



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All product names mentioned in this manual are trademarks of the respective companies. Subject to technical changes. All safety regulations, in particular the CE directives, were observed during manufacture. Every single product underwent a comprehensive final inspection at the factory.

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DISCLAIMER

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

INTENDED AUDIENCE OF THE DOCUMENTATION

This documentation is intended for machine tool users and installation personnel. It provides a detailed description of the information required by the user for the installation and operation of the control system.

SAFETY INSTRUCTIONS

This manual contains instructions that you must observe for your own personal safety and to prevent damage to property. Instructions relating to your personal safety are highlighted by a warning triangle; instructions relating solely to damage to property are not marked with a warning triangle. Depending on the level of risk, the warning notices are presented in descending order as follows.



DANGER

means that death or serious injury will result if the appropriate precautions are not taken.



WARNING

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



CAUTION

with a warning triangle indicates that minor injury may occur if the appropriate precautions are not taken

CAUTION

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

WARNING

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

NOTES ON THE FUNCTION

The Estlcam Terminal Adapter is a simple CNC controller operated by the Estlcam software. The Terminal Adapter is the hardware; the Estlcam software is the associated software. This manual describes only the hardware, its commissioning and connection.

The terminal adapter is used to connect motor drivers, sensors, limit switches, spindles, extraction systems, etc., so that the software can control them. For this purpose, it features 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, the terminal adapter features a microprocessor which receives the commands and generates control signals for the motors from them. At the same time, it controls the outputs and reads the inputs, reporting their statuses back to the software, which can then react accordingly.

It is therefore a CNC control system, comprising hardware and software, which can be used to control a milling machine automatically.

The Estlcam software can only be used with this hardware from version 12 onwards.

NOTES ON INSTALLING THE

The control system is designed to be installed in a fixed installation. It is only usable as a device when connected to a machine that has drive motors and other components. Only in combination with these parts does an automatic machine come into being. The user or installer must therefore ensure that the entire machine complies with legal guidelines once installation is complete.

INTENDED USE

The controller is designed to drive stepper or servo motors (or similar drives) for use on a milling machine. Any other use is considered improper.

Supplied accessories such as power supplies, power amplifiers, sensors or motors must always be used in accordance with their intended purpose.

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 plant manufacturer or the end user. Rocketronics accepts no responsibility for the integration of the products into the end system.

Under no circumstances may a Rocketronics product be integrated into a product or design as a safety control. All products containing a component manufactured by Rocketronics must be provided with appropriate warnings and instructions for safe use and operation upon delivery to the end user. All warnings provided by Rocketronics must be passed on directly to the end user.

The user of this controller must ensure that all necessary safety precautions have been taken and checked for functionality to ensure the safe operation of the machine. The construction or modification of a machine alters a potentially hazardous device. The automation of movements can lead to damage to the machine, but also to serious injury to operating personnel.

Qualified personnel

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. Unauthorised tampering with the equipment or failure to observe the warnings in this documentation or those displayed by the equipment may result in damage to property or personal injury.

EU Directives on Product Safety

The following EU directives have been complied with:

2011/65/EU	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 measuring, control, regulation and laboratory equipment – EMC requirements

Applicable regulations

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

- Accident prevention regulations
- Local health and safety regulations

Safety regulations

- The control system must only be operated by authorised qualified personnel, in accordance with accident prevention regulations and the regulations of the electrical industry.
- Unqualified persons must not commission 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 must only be carried out when the device is de-. The installation and use of equipment must comply with the standards set out in the Declaration of Conformity.
- **CAUTION:** When connecting motors to motor drivers, ensure correct polarity is observed. Furthermore, the correct motor current must always be set on the driver. To ensure that the motor speed can be controlled correctly, the step per revolution must also be set on the driver. This setting must also be applied in the controller settings.
- The respective configuration of the controller must only be operated with the motor types configured for it. Other or further uses do not correspond to the intended purpose.
- Currents and voltages: The controller operates at a low voltage of 24 V, which can be supplied by a power supply unit. No special safety precautions are therefore required on the output side.
- The controller is constructed in accordance with recognised safety regulations and complies with the standards and guidelines listed in the previous chapter.

Ambient conditions

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

Safety and warning notices

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



WARNING

Incorrect inputs may cause the machine equipped with this control system to perform unexpected movements, which could be fatal to operating personnel. It is therefore the responsibility of the plant designer or end user to ensure that the settings are correct and have been checked.



WARNING

It is absolutely essential that the control system is integrated into the machine's emergency stop function. This function must be designed such that, once the emergency condition has been resolved, user authorisation is required before the machine becomes operational again. Automatic restart must not be possible.

EMERGENCY STOP SETUP

The complete machine must be fitted with an emergency stop device, into which the control system must also be integrated. Automatic restart following the activation of the emergency stop must be reliably prevented! To this end, the emergency stop circuit should include a contact connected to one of the control system's inputs. This input must then be set to the 'Fault Message' function. If activated, the control system stops any further movement of the axes.

A Category 1 emergency stop is required:

CONTROLLED STOPPING WHILE MAINTAINING THE POWER SUPPLY IN ORDER TO COMPLETE THE SHUTDOWN. INTERRUPTION OF THE POWER 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. Abruptly switching off the power supply usually results in the spindle continuing to run for some time.

SCOPE OF DELIVERY AND ACCESSORIES

The scope of delivery comprises a control board and a bag containing 4 M3 spacer bolts with nuts for mounting, as well as this manual in printed form.

A DIN rail mount is available as an accessory, allowing the board to be mounted on a standard DIN rail. A 24V power supply unit with an output of approx. 1A is also required as an accessory if the board's inputs and outputs are to be used.

TECHNICAL SPECIFICATIONS:

- Dimensions: 101 x 90 mm
- Four M3 threaded inserts / spacers included
- All connections routed to sturdy screw terminals
- Firmware easily updatable via the Estlcam PC software
- Suitable for CNC milling machines and laser machines
- 3 axis connections, X, Y, Z
- 4 inputs for switches, proximity sensors, 8x NPN, 8x PNP
- 1 output for spindle/milling motor relay
- USB port (Mini-B socket)
- Mini-DIN 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; this includes almost all motors from Leadshine, JMC and many others.

Bus-controlled systems using EtherCAT, Modbus, RS232, RS485, fieldbuses, CAN, etc. **CANNOT** be used.

SETUP:

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

CAUTION:

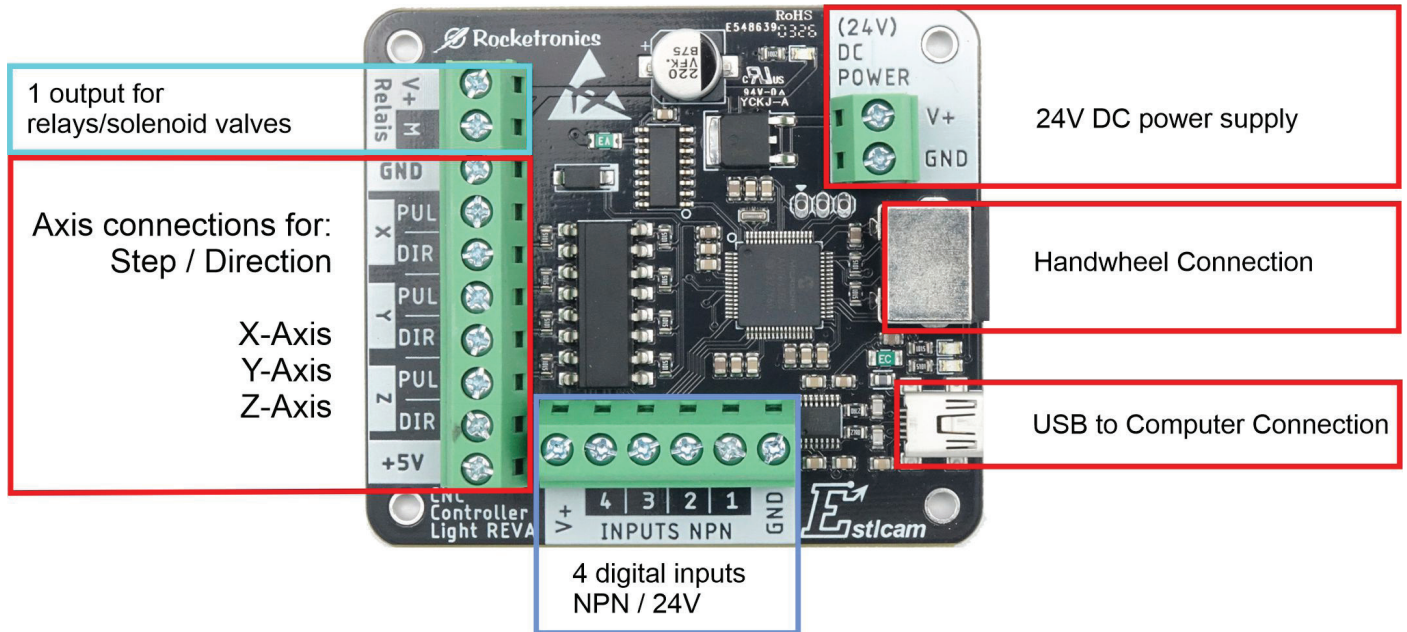
- Prevent short circuits and reverse polarity!
- **Short circuits and reverse polarity can damage the controller, connected components and, in the worst case, your computer! This is NOT covered by the warranty.**
- Mount the adapter so that no chips can fall onto the circuit board during milling.
- Avoid working on a plastic surface (table, etc.): static electricity can destroy the electronics.
- When mounting on a metal plate, ensure that the underside of the circuit board does not come into contact with any metal: risk of short circuit!
- Ensure that all connections are secure and well insulated.
- Do not use frayed cable ends! Use ferrules, cable lugs, etc.
- Always carry out modifications with the power off and the USB cable **disconnected**.

- Check everything thoroughly before commissioning the control system.
- Expect surprises during commissioning – e.g. the milling motor starting up suddenly. Test initially without a cutter in the air, and keep your distance until everything is working as intended.
- Use only high-quality, well-shielded USB cables. Poor-quality cables can cause the controller to suddenly stop working in the middle of a task.

We strongly recommend proceeding step by step during commissioning:

First, connect just one motor and check whether it moves! Then connect the other motors one by one. Follow a similar procedure with the limit switches and other peripherals. Always proceed step by step and test as you go.

CONNECTION OVERVIEW:



Power supply adapter (24V):

Connect the “GND” and “V+” terminals at the top right to a 24V power supply.

This connection powers the adapter and is also available at the remaining “V+” terminals to power additional components

USB connection

The Light terminal adapter has 1 USB port for connecting to a PC. Use a well-shielded cable that is as short as possible.

1x mini-DIN socket:

For the Estlcam handwheel

Pulse / direction signals:

Terminals are available for 3 motors: X, Y and Z. Terminal function:

- PUL: PUL+ clock signal from the motor driver
- DIR: Direction signal DIR+ from the motor driver
- +5V: 5V voltage
- GND: Ground (Connects to PUL and DIR on the motor driver)

For machines with dual-sided gantry drives, the Y-axis signals are duplicated: Y LI PUL and Y LI DIR for the left side.

Y RE PUL and Y RE DIR for the right-hand side.

If the machine has only one Y-axis motor, it does not matter whether the connections are used for the left or right side.

4 digital inputs:

- GND: Ground
- Inputs 1 to 4 are ‘NPN’ logic switching against ‘GND’.
- V+: Power supply (24V)

Relay / solenoid valve output:

V+: Common power supply (24V) for the relays / valves

M: Output specifically for the relay to switch the milling motor; the NEGATIVE TERMINAL of the relay is connected here.

SETTING UP THE HARDWARE

CONNECT THE CONTROLLER TO THE COMPUTER AND, IF NECESSARY, INSTALL THE DRIVER :

The Rocketronics Light terminal adapter has a USB socket, which is connected to your computer via a mini-USB cable. This USB connection is electrically isolated from the rest of the adapter:

- This protects the computer from damage caused by wiring errors or faults in the control unit.
- Improved interference resistance for communication in electrically noisy environments.

A high-quality USB cable is required for connection to the computer: The cable should meet at least the USB 2.0 (480 Mbit/s) standard. Do not use cables that were supplied with other devices as charging cables or that are unusually thin:

- CNC machines are electrically ‘noisy’ environments that can interfere with USB connections.
- If cables are inadequately shielded, the USB connection may suddenly be interrupted and the machine will stop.
- The total cable length should not exceed 3 metres.
- This length also includes any USB hubs or extension cables connected upstream.
- It is best to connect the Light terminal adapter directly to the PC – without any hubs in between: In principle, USB hubs are fine, but the chain is only as strong as its weakest link. If the hub is poorly shielded, the entire connection becomes prone to interference.
- If you insert a USB stick whilst the system is running and you are statically charged, this can disrupt the connection and bring the machine to a standstill.

If your computer is connected to the internet, the necessary driver is usually installed automatically. If not, you can download the driver from the Rocketronics website and copy it to the computer without internet access using a USB stick.

GENERAL INFORMATION ON THE ‘ ’ WIRING:

To prevent the Light terminal adapter from becoming too large and expensive, many functions share common ground (‘GND’) and power supply terminals (‘V+’).

The adapter itself does not, by any means, have a separate terminal for every cable.

Otherwise, connection terminals such as Wago 221 or the distribution blocks or terminal blocks commonly used in control cabinet construction are suitable. If you don’t use too many functions, you can certainly combine 2 to 3 cables in a suitable ferrule and thus possibly make do with the existing terminals. As all ‘GND’ and ‘V+’ terminals are connected to one another, it doesn’t matter which ones you use.

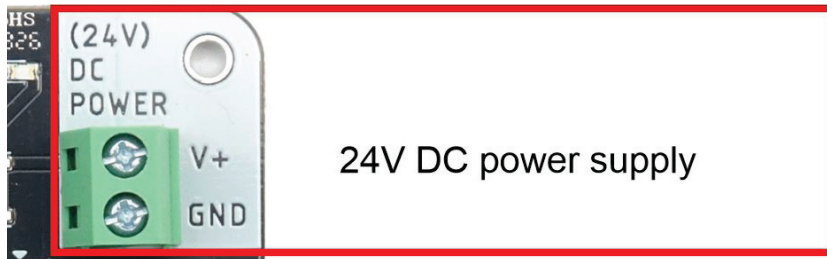
Please ensure that no wires are mixed up!

- Most of the adapter’s connections are relatively tolerant of short circuits to “GND” – this often works fine, and if not, the damage is usually limited to a single component.
- However, if a terminal or part of the board that is not intended for this purpose accidentally , e.g. with the 24 V supply voltage, this usually results in the immediate destruction of the adapter, causing damage to several components!
- Past experience shows that the processor is usually damaged in such cases, which is irreparable
- **Damage caused by short circuits and incorrect wiring is NOT COVERED BY THE WARRANTY.**
- Use wire end ferrules: frayed cable ends are one of the main causes of accidental short circuits!
- Before commissioning, ensure that all connections are secure and well insulated.

Tip: If you want to measure the voltage at a terminal to which nothing is connected, tighten the screw completely first! When open, the terminals make barely any contact.

CONNECTING THE EXTERNAL 24V POWER SUPPLY ():

The Light terminal adapter requires an external 24V DC power supply for the relay output and the digital inputs. The step/direction outputs for the axes also function without this operating voltage!



Connection:

Connect the positive output / “+” of the power supply to “V+”
 Connect the negative output / “-” of the power supply to “GND”
 When power is applied, the blue LED above the terminal lights up.

- Permissible voltage range: 12–30 volts
- Higher voltages can damage the adapter!
- At lower voltages, some functions may not work correctly.
- The power supply connection is protected against reverse polarity.

Recommendation: 24V, as 24V is a standard control voltage with a wide range of compatible components.

The power supply is also available via various “V+” terminals on the adapter for powering other components, such as sensors.

Recommended power supply rating: 15–50 watts

Suitable power supplies – e.g.: MEAN WELL MDR-20-24 24V 1 A

When connecting several solenoid valves and an MMS injector, a power rating of approx. 50W is recommended, e.g. MDR-60-24.

WARNING: With very high-power power supplies, there is a risk that the adapter’s cables may burn out in the event of a short circuit!

Notes:

The clock/direction signals and the PWM output of the Light terminal adapter always operate at 5V and are independent of the selected power supply

The motor drivers should always be powered via a separate power supply unit: Firstly, because the voltage there is usually >30V and would destroy the adapter. Secondly, because stepper motor drivers are sources of interference whose power supply should not be shared with other components of the control system, even at the correct voltage.

CAUTION

Voltages exceeding 30V may damage or destroy the adapter.

CAUTION

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

CONNECTION OF POWER AMPLIFIERS, DRIVERS AND MOTORS:

The Light terminal adapter is suitable for all systems operating with 5V Step/Dir signals (step/direction):

- These can include classic stepper motor/driver combinations, such as those using the Leadshine DM542EU or DM556, etc.
- As well as servos/stepper motors with integrated or external drivers.
- Or 'closed-loop' stepper motors with an integrated or external driver.
- As long as it can be controlled with a 5V clock signal per direction, it will work!

There are 4 terminal blocks: X, YL, YR and Z.

Function of each of these terminals:

Terminal	Function
PUL	PULSE clock signal
DIR	Directional signal DIRECTION
GND	Ground
+5V	5V voltage output

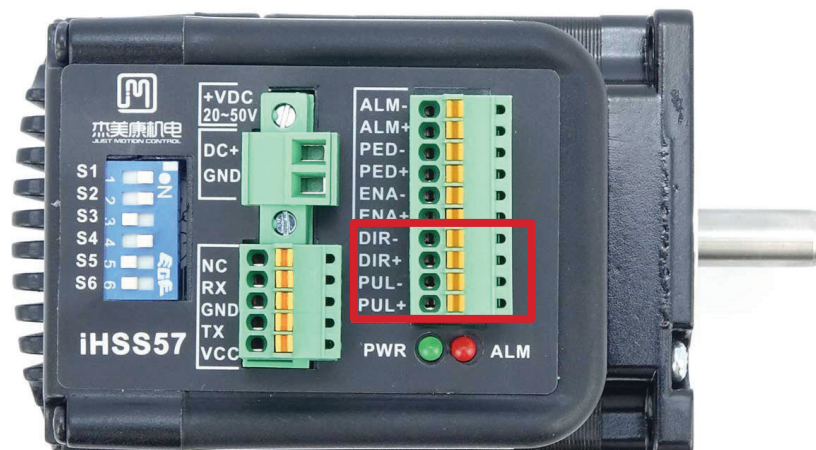
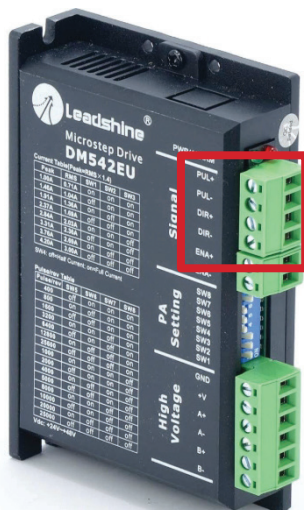
Basic diagram for connecting a motor driver:

Driver/Motor	Terminal adapter Light	Connection
PUL+	PUL	Required
PUL-	GND	Required
DIR+	DIR	Required
DIR-	GND	Required

Drivers with OPTO connection: Some drivers have only 3 connections (PUL / DIR / Opto) instead of the 4 connections (PUL+ / PUL- / DIR+ / DIR-).

'Opto' is a shared anode / '+' connection for PUL and DIR, and occasionally also with Labelled '+5V'. The connection diagram is then:

Driver/Motor	Light terminal adapter	Connection
OPTO	+5V	Required
PUL	PUL	Required
DIR	DIR	Required



Tips:

- Most stepper motor/servo power amplifiers are galvanically isolated to minimise interference with the rest of the electronics.
- Therefore, the '-V' / 'GND' of the power supply feeding the driver stages should not be connected to the 'GND' of the rest of the control system, as this would negate the galvanic isolation.
- The cables between the driver stages and the motors should be shielded:
 - Connect the shielding at the driver to "GND".
 - Do not connect the shielding at the motor/machine:
 - As this would negate the galvanic isolation between the drive and the rest of the electronics. Instead, connect the protective conductor (yellow/green) from the socket to all axes of the machine using separate cables:
 - Earthing -> Protection against electric shock.
 - Dissipation of static discharges that might otherwise interfere with the control system.
 - Use separate cables for each axis, as linear guides are insulated by the oil film and no reliable connection can otherwise be established.

Common problems and tips:

- Some power amplifiers have a 5V/24V input signal selector that is set to 24V by default. In this case, the power amplifier will not respond to control signals, or will respond intermittently.
- If you've got one of these power amplifiers, set the switch to the 5V position.
- Avoid the cheapest power amplifiers. It doesn't have to be anything fancy, and no-name power amplifiers usually do the job very well, but you should be prepared to spend around 20 euros per axle if you want to enjoy them in the long term.

4 DIGITAL INPUTS FOR SWITCHES, PROXIMITY SENSORS , ETC.:

The Light terminal block adapter has a total of 4 digital inputs:

- Inputs 1 to 4 use 'NPN' logic and respond when connected to the 'GND' terminal.

The digital inputs can be used, for example, for

- limit switches (mechanical or proximity sensors).
- edge sensors.
- Touch panels.
- Push-buttons.
- And other digital sensors with an 'open-collector' output can be connected.

Connecting mechanical switches and sensors:

- Connect one terminal of the switch (either one) to one of the inputs 1 to 4.
- The other terminal is connected to GND.
- Both normally open and normally closed contacts can be used.
- And multiple switches can be connected to the same input:
 - For normally open contacts, in parallel
 - For normally open contacts, in series.
 - However, the purpose of switches connected together must be identical:
 - For example, several limit switches can be combined.
 - However, limit switches cannot be combined with tool length sensors, for example.

Connection of inductive proximity switches or NPN sensors:

- Sensors of the "NPN" type can be connected to the inputs
- Connect the blue wire of the sensor to 'GND'
- Connect the black wire of the sensor to one of the inputs 1 to 4
- Connect the brown wire of the sensor to 'V+'
- Both normally open and normally closed contacts can be used.
- With normally open contacts, it is possible to connect several sensors in parallel to the same input.
- Series connection of normally open contacts is theoretically possible, but may not be reliable.

Connection of other sensors and signals:

- Inputs 1 to 4 are internally pulled up to the supply voltage level 'V+' via a 4 k Ω resistor and are switched by connecting to 'GND'.
- This can be done, for example, via a mechanical switch, relay contact, optocoupler or open-collector output.
- Not compatible with tri-state / push-pull pins (e.g. microcontrollers)!
- If in doubt, please email us if you wish to connect something unusual.

OUTPUT FOR MILLING MOTOR, RELAY AND SOLENOID VALVES:

The Light terminal adapter has one output to which, for example, relays or solenoid valves can be connected. Relays can then be used to switch devices such as the router motor, vacuum cleaner, lighting, etc. Alternatively, solenoid valves can be used to open and close clamping devices, switch on and off the air supply and exhaust air for spindles, and so on.

Connections:

- “V+” Common power supply for all relay connections.
- “M” Relay connection specifically for switching the milling motor on/off.

Warning: Maximum current load 100mA per output:

With standard relays and pilot-operated solenoid valves, there are normally no issues here. However, with force-operated valves, you should take a closer look and, if necessary, connect a relay in series. Avoid short circuits! Although the outputs are largely short-circuit-proof, in rare cases this can still lead to damage to the adapter!

Connection of mechanical relays:

The most cost-effective solution, although in rare cases USB communication may be disrupted.

Many relays have integrated free-wheeling diodes:

- If a relay with a free-wheeling diode is connected the wrong way round, this will cause a short circuit!
- The relay outputs are largely short-circuit-proof, but no guarantee is given!
- Relays where it is unclear whether free-wheeling diodes are present – and which way round they are polarised – must not be connected!

- Connect “A1 (+)” of the relay to V+
- Connect “A2 (-)” of the relay to M
- Ensure the coil voltage matches the supply voltage of the terminal adapter; see 12 to 24V power supply
- For most applications, a suitable relay with a 24V coil voltage is: Wago 788-304 24V

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

If the relay has two contacts, you can connect L and N to the load.

On the relay, contacts 11 and 14, and 21 and 24, are the normally open contacts.

Connection of solid-state relays (SSR):

SSRs are relatively expensive, but they switch with low interference and, as they lack free-wheeling diodes, can be connected without the risk of short circuits.

- Connect ‘A1 (+)’ of the relay to V+
- Connect “A2 (-)” of the relay to M
-

Caution:

- 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.
- If the design is marginal, a heat sink may be required.
- Ensure that the input voltage range matches the supply voltage of the terminal adapter (12 or 24 V).
- Cooling is often necessary for SSRs when switching high loads; for this purpose, they are, for example, screwed to the control cabinet wall.

Solenoid valve connection:

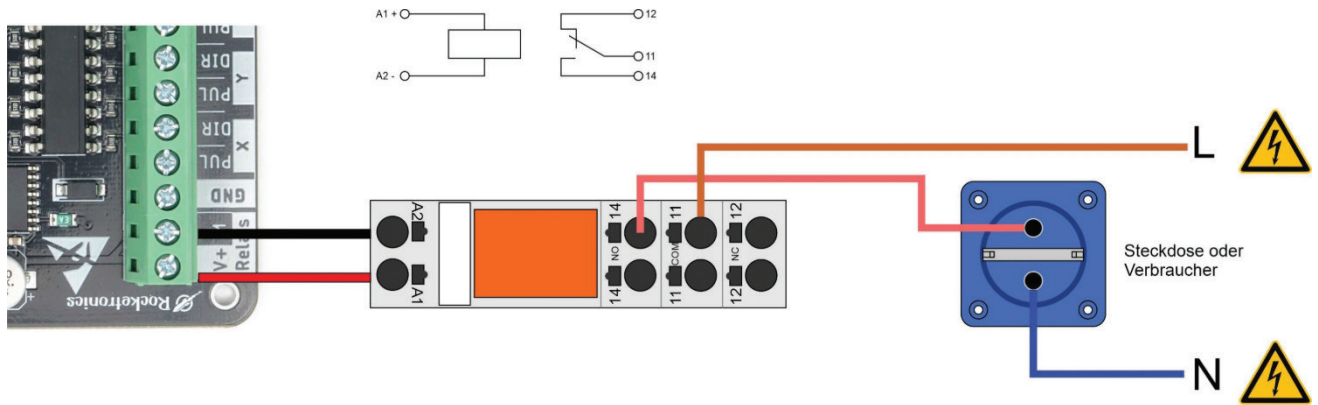
Solenoid valves behave like mechanical relays. This makes it quite easy to control pneumatic clamping devices, for example, via the terminal adapter. Observe the maximum permissible coil current of 200mA and the necessary free-wheeling diodes!

TIP:

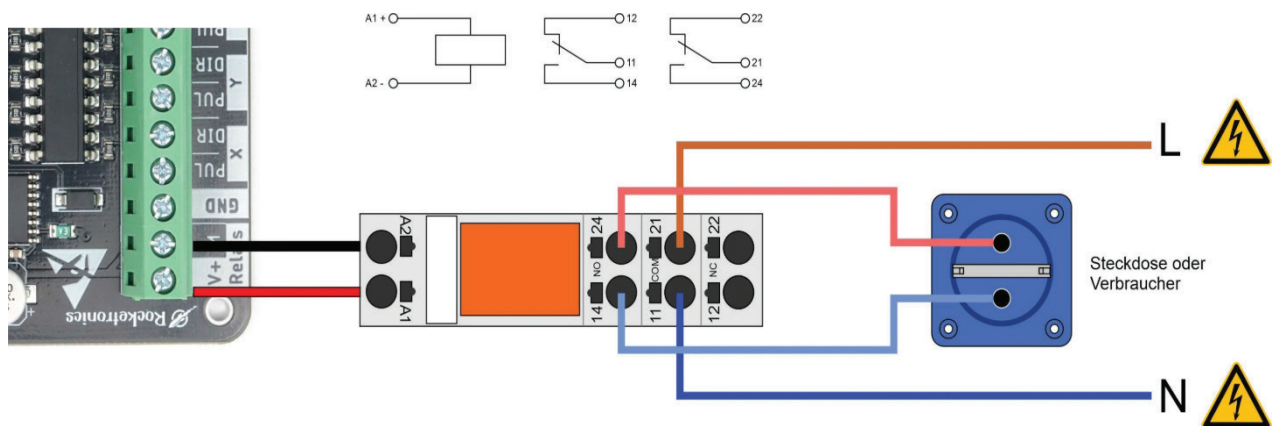
For appliances such as pumps, vacuum cleaners, spindles, etc., it is very useful to use **flush-mounted sockets**. The relay is used to switch the mains voltage to the socket; the appliance is then simply plugged in and can be easily removed or replaced if faulty. You will find wiring examples on the next page. These sockets are also available from our shop at www.rocketronics.de



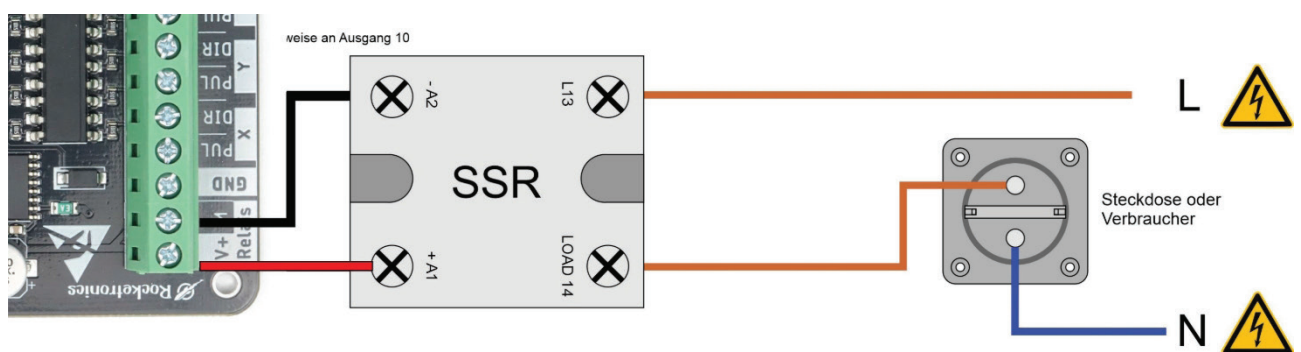
Connection of coupling relays with 2 changeover contacts (e.g. Wago 788-312):



Connection of coupling relays with 1 changeover contact (e.g. Wago 788-304):



Connection of solid-state relays (e.g. Finder 77.25.9.024.8250 with a 24V input):



DANGER

- Only qualified electricians are permitted to carry out work on electrical installations independently!
- The mains voltage must always be protected by fuses.
- Only use cables that are approved for mains voltages

INITIAL SETUP OF THE SOFTWARE:

- First download the software; this can also be used without a licence: It only works with version 12:
64-bit version: https://www.estlcam.de/downloads/Estlcam_64_12.exe

You will then have two Estlcam icons on your desktop:

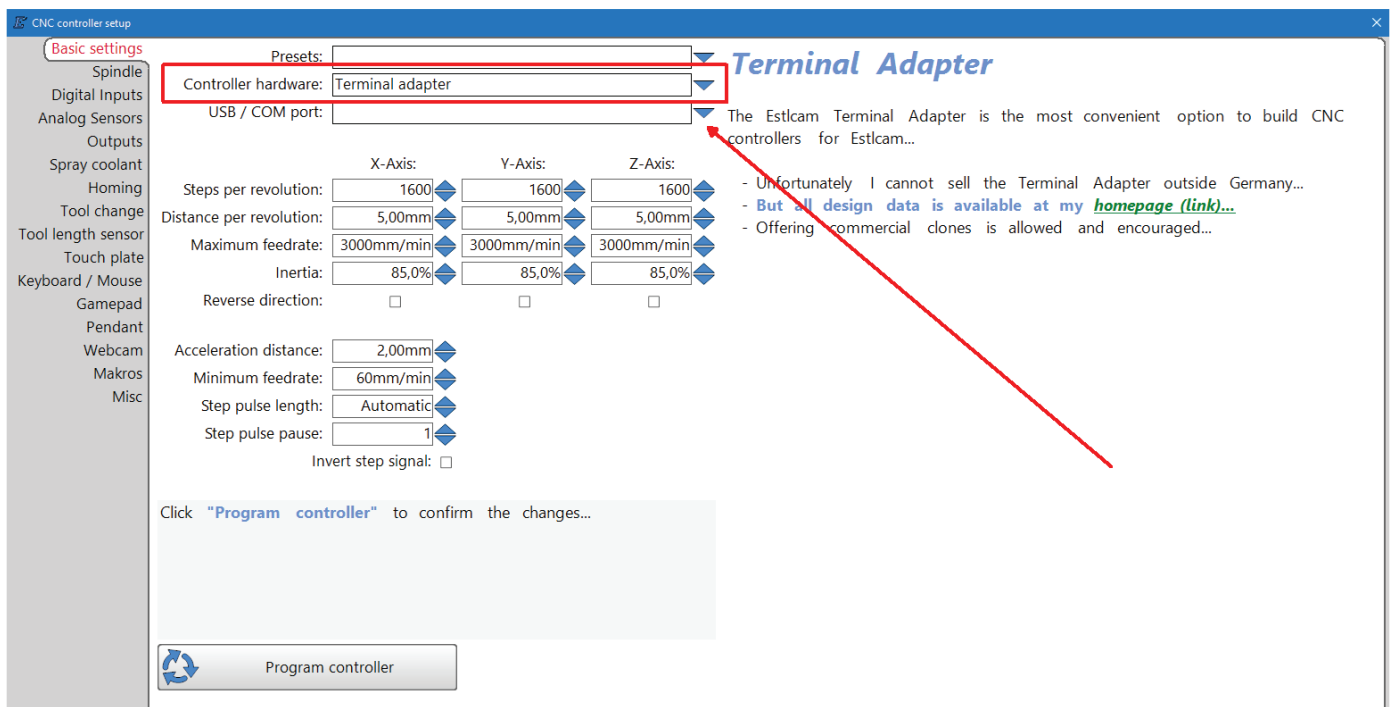
‘Estlcam V12 CAM’ for the Estlcam CAM module...

“Estlcam V12 CNC” for the Estlcam control module...

Launch the control software by double-clicking the “Estlcam V12 CNC” icon...

Then click on the “spanner” button on the right-hand side of the control window to open the control settings...

- Install the circuit board in the designated location, e.g. a control cabinet or other suitable enclosure. **Please do not test it on a plastic tabletop, as this can cause very high static discharges to be transferred to the electronics and destroy them.**
- Do NOT connect anything yet.
- Connect a well-shielded USB cable (maximum 2 m long) to the USB port on the controller and plug the other end into a free port on a PC. The PC should now recognise a new device. If nothing happens, you may need to install the driver. You can find this at: <https://tinyurl.com/2j7f542p> or on our website.
- In the software, open the settings window via Settings -> CNC Control. There, under ‘Control Electronics’, set the type to ‘Terminal Adapter’.
- Under USB/COM port, select the COM port provided by the controller, e.g.



COM2. If you do not know the number, select ‘Search’ and follow the instructions.

- Then click on “Programme controller” to test whether the controller is responding:
- If the process runs through, the connection is established!
- Then disconnect the USB cable first: **please ALWAYS connect components with the USB cable disconnected and the controller powered off.**
- You can then begin connecting the components. It is best to do this one by one, testing the function repeatedly in between.

SETTINGS

You must first configure the software to specify how the axis motors should move and how the inputs and outputs are to be used. This is necessary to ensure that the machine operates correctly with the controller. You can also find online instructions at <https://www.estlcam.de/anleitung.php>

If settings have been changed, they must ALWAYS be transferred to the terminal adapter using “Programme Control”!

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

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

Steps per revolution:

This is determined by the power amplifiers / motor drivers. These are adjustable; the value set on the driver must also be entered here. Common values are 400, 800 or 1600. A value of 1600 is generally recommended. Maximum step rate per output: 160 kHz.

Distance per revolution:

Distance travelled per revolution of the stepper motor axis. For threaded rods and ball screws, this corresponds to the lead. For toothed belts: belt pitch × number of teeth on the pulley.

This is also an alternative way of entering the step resolution (distance travelled by the axis 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 is displayed as a rounded figure, or in most cases will simply show as ‘0.00’. However, Estlcam still uses the exact value you have entered.

Maximum feed rate:

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

The theoretically possible maximum feed rate is calculated from the motor’s maximum speed and the travel per revolution: if you have a servo motor capable of 3000 rpm and a 5 mm spindle on the axis, then theoretically you can achieve a feed rate of $3000 \times 5 = 15,000$ mm/min. In practice, it is likely to be less; this needs to be adjusted during actual operation. Also bear in mind: high speeds carry significant risks! Start by setting the value to a low speed initially.

Maximum feed rate and acceleration path are closely linked:

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

- Start with an acceleration path that roughly corresponds to the lead of the spindle.
- Determine the speeds achievable for each axis: increase the feed rate, reprogram the control system, and then attempt to move the machine at maximum speed.
- If this worked without any problems, increase the feed rate further and try again.
- If the motor stalls, note down the value and repeat the test with a different acceleration profile.
- Finally, you can plot an X/Y diagram of the acceleration paths against the maximum speeds:
- You will find that longer acceleration paths allow for higher speeds, but also make the machine more sluggish.

- Shorter acceleration paths, on the other hand, improve dynamics, albeit at the expense of the achievable maximum speeds.
- There will be a certain range in which the acceleration paths correlate well with the feed rates. Outside this range, small improvements in one characteristic lead to disproportionate deteriorations in the other. The curve bends at a certain point – this is usually where a good compromise between speed and dynamics is achieved.
- Subtract a 20–30% safety margin from the maximum achievable feed rates!

Inertia:

Just like cars, CNC milling machines cannot navigate curves 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 to prevent step loss. The aim is, on the one hand, to set the inertia as high as necessary to reliably prevent step losses, but on the other hand to keep it as low as possible so as not to slow the machine down unnecessarily.

In the event of lost steps:

Are you experiencing gradual loss of steps during milling that builds up slowly over time? If so, increase the inertia of the affected axis.

Are there sudden, severe step losses resulting in a complete standstill of an axis during a rapid positioning movement? If so, reduce the maximum feed rate of the axis or increase the acceleration distance.

Further possible settings and optimisation:

For many driver boards, such as the Leadshine DM542EU, DM556, etc., the **‘Invert step’** signal box should be ticked:

These output stages read the direction signal on the rising edge of the step signal; however, with a ‘normal’ step signal, this signal has not been present for very long at that point. As a result, direction changes may only be detected at the next clock cycle, leading to position deviations accumulating over time. Inversion ensures that the direction change is output on the falling edge and is then present correctly for a significantly longer duration on the next rising edge. If you encounter problems with creeping position deviations, ticking the ‘Invert step signal’ box should therefore be your first port of call.

For power amplifiers that require even more time between the change in the direction signal and the next clock cycle, the time in the ‘Step Pause’ field can be increased further. However, this only applies to a few power amplifiers with particularly slow optocouplers on the direction signal. As this field has a negative effect on smooth operation, the value should not be set unnecessarily high.

Some power amplifiers only operate reliably with step pulses of a certain length.

This can be set in the “Step Pulse Length” field. As a rule, however, the “Automatic” setting is best. Only driver stages with a very low maximum input frequency are affected by this issue.

The maximum step frequency is 160 kHz per output! At 1600 steps per revolution, this would therefore correspond to a maximum of 6000 rpm for the motor.

CONFIGURATION OF THE INPUTS:

For an input to perform the desired function, it must be configured accordingly in the control settings. This can be done in the software under Settings -> CNC Control. In the window that opens, select the 'Inputs' tab. Here, you can set the function for inputs 1–16:

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 are not enough inputs, several limit switches can be connected to a single input simultaneously.

Sensor

For sensors such as tool length sensors, touch plates, etc.

Tool length sensor

For sensors such as the tool length sensor, this input is monitored ONLY during length measurement!

Error message

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

WARNING: NOT AN "EMERGENCY STOP"! This is a software function that cannot provide 100% protection! If a genuine emergency stop is required, this must be implemented using suitable hardware; the error signal can only serve as an optional additional measure.

Signal bypass

Used to bypass limit switches, sensors and error messages in order to shut down the machine manually via the triggering switch or sensor if necessary.

Milling motor start

Starts and stops the milling motor.

Start programme

Starts and pauses the CNC programme.

Pause / Stop

Stops the milling motor / Pauses CNC programmes.

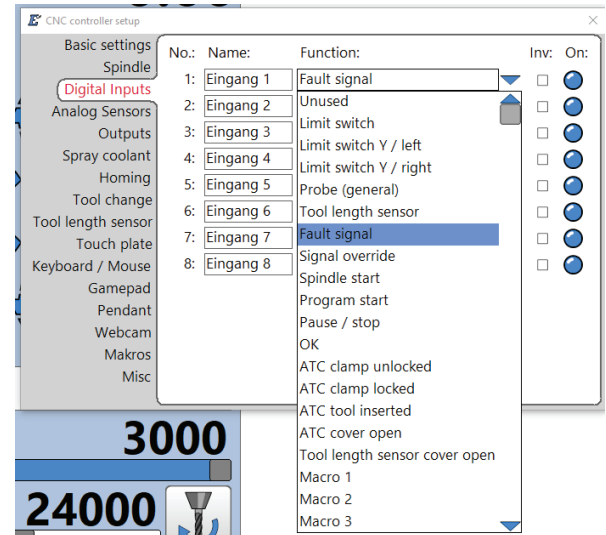
OK

Zero axes / Confirm selection etc.

MACRO 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 for checks.

However, 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 normally closed contacts, the tick must be set next to ‘Invert’!
- “Limit switches”, whether mechanical or inductive, must always be set as “limit switches”, not as sensors!
- A “sensor” is, for example, a linear position sensor, edge sensor, etc.
- For error signals, we use the “Error message” type
- Buttons for starting or stopping a programme can be connected; the input must then be configured as “Programme Start” or “Programme Stop”.

If settings have been changed, these must ALWAYS be transferred to the terminal adapter using “Programme Control”!

The ESTLCAM licence

The software can be used free of charge for testing purposes. The free version is fully functional. It simply introduces delays – which become longer over time – when opening and saving certain files.

However, a licence is required for long-term use.

The freeware version of the software is upgraded to the full version by entering the licence key. Once the licence key has been entered, the software is activated and there are no more waiting times with prompts to purchase a licence.

Version 12 licence keys can, by default, be used on up to three computers at the same time, and are also compatible with the older Version 11. Licences no longer in use on old computers can be deactivated and then transferred to a new one. This works even if the old PC no longer exists or is faulty.

You can enter the licence key on the same PC as often as you like (e.g. after reinstallations).

Order your license code here:

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

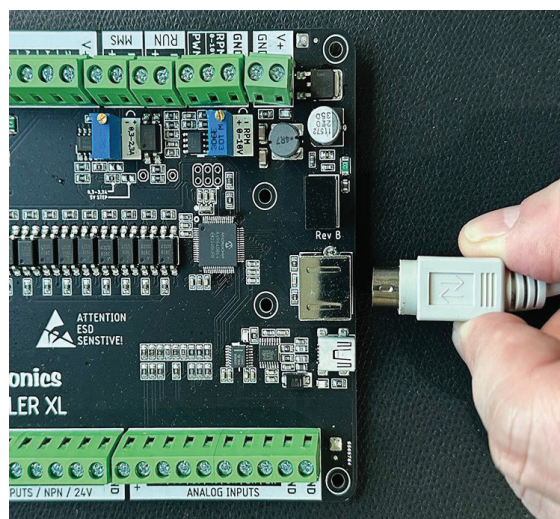
CONNECTING ADD-ON MODULES TO THE MINI-DIN CONNECTOR:

The Mini-DIN socket is primarily used to connect ready-made add-on modules; the following are compatible, amongst others

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

In principle, however, you can also use your own DIY projects. You can find more information about the Mini-DIN socket here:

https://www.estlcam.de/DIN_Detail.php



HAND WHEEL FOR ESTLCAM FOR EASY CONTROL OF ALL 3 AXES

Fits all Estlcam clamp adaptors!

- Fully assembled, robust handwheel for Estlcam.
- With joystick for very precise movement of all 3 axes.
- With encoder wheel for incremental movement of all 3 axes.
- Illuminated button for zeroing the axes.

It also features two potentiometers: one for adjusting the spindle speed and one for the feed rate. The potentiometers can also be pressed, as they have a momentary function, which is used to start and stop the spindle and launch programmes.

Supplied with a 3m flexible cable, packed in a box, with a printed instruction manual.

Technical specifications:

- Dimensions: 185 x 98 x 95 mm (L x W x H)
- 3 m cable with kink protection
- MINI-DIN connector for Estlcam hardware
- Joystick and encoder wheel for movement of all 3 axes
- Includes rubber protective padding
- Ready to use.



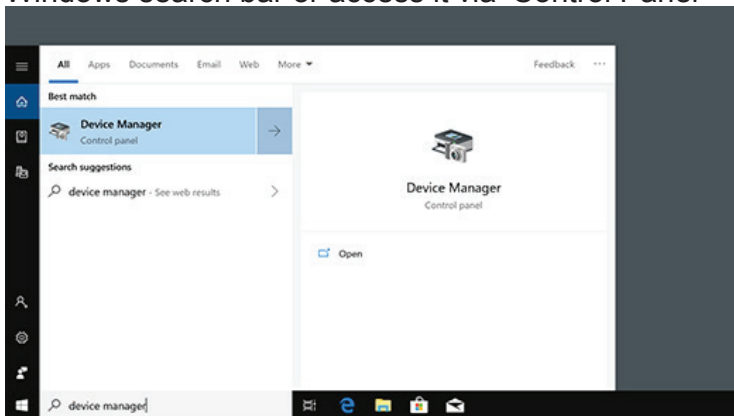
Order here:

<https://www.rocketronics.de/shop/en/Estlcam-pendant.html>

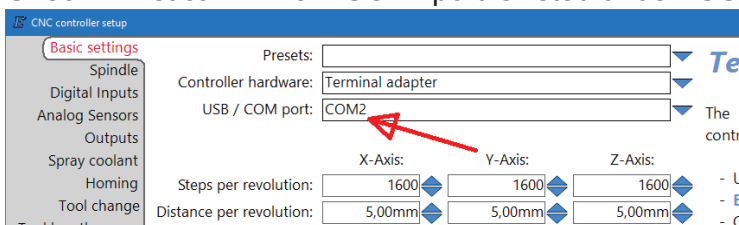
VERY IMPORTANT – INCREASE THE USB COMMUNICATION SPEED :

By default, the USB driver checks every 16 ms to see if data needs to be transferred from the controller. Whilst this is generally sufficient, it is not ideal. To optimise the controller’s responsiveness, do the following:

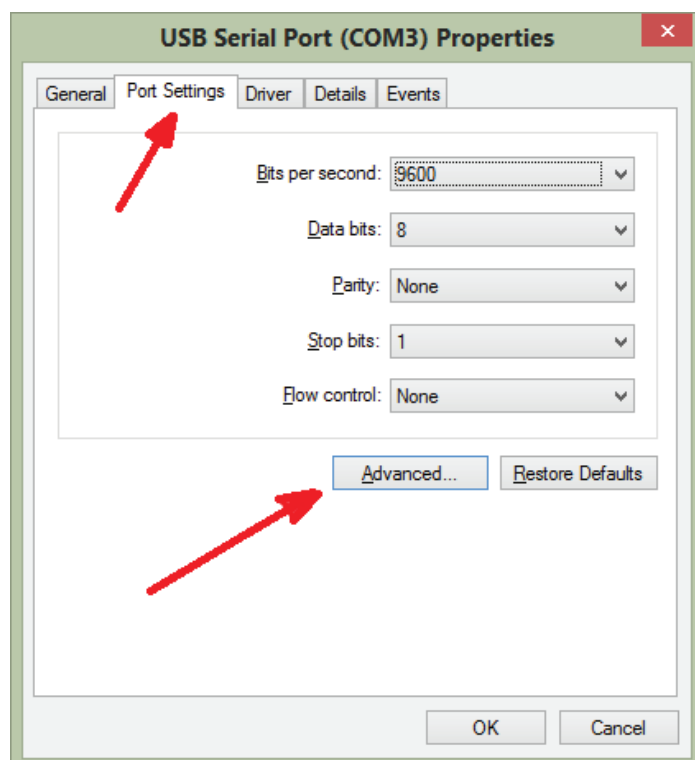
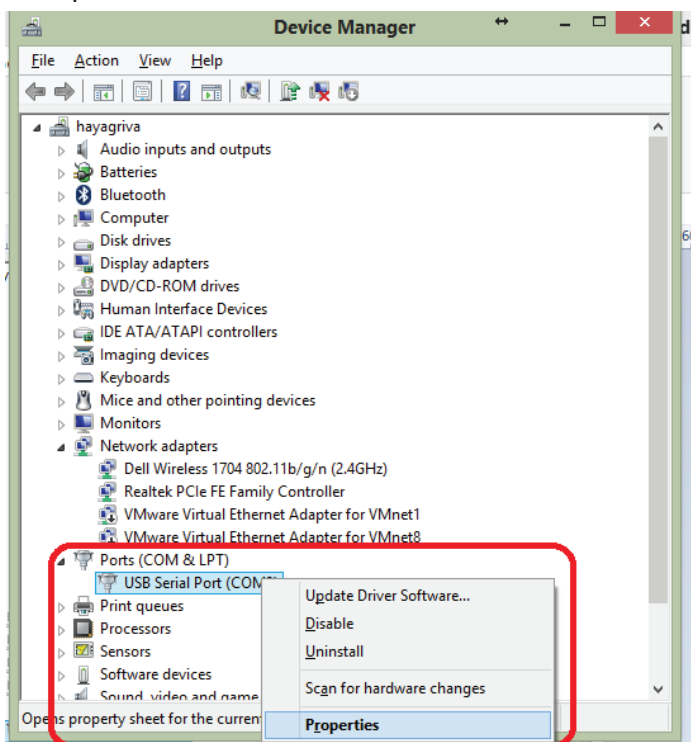
With the terminal adapter connected, open Device Manager (e.g. type ‘Device Manager’ into the Windows search bar or access it via ‘Control Panel’ -> ‘System and Security’ -> ‘Device Manager’):



Check in Estlcam which “COM” port is listed under “USB / COM Port:”. In our example, this is “COM3”:



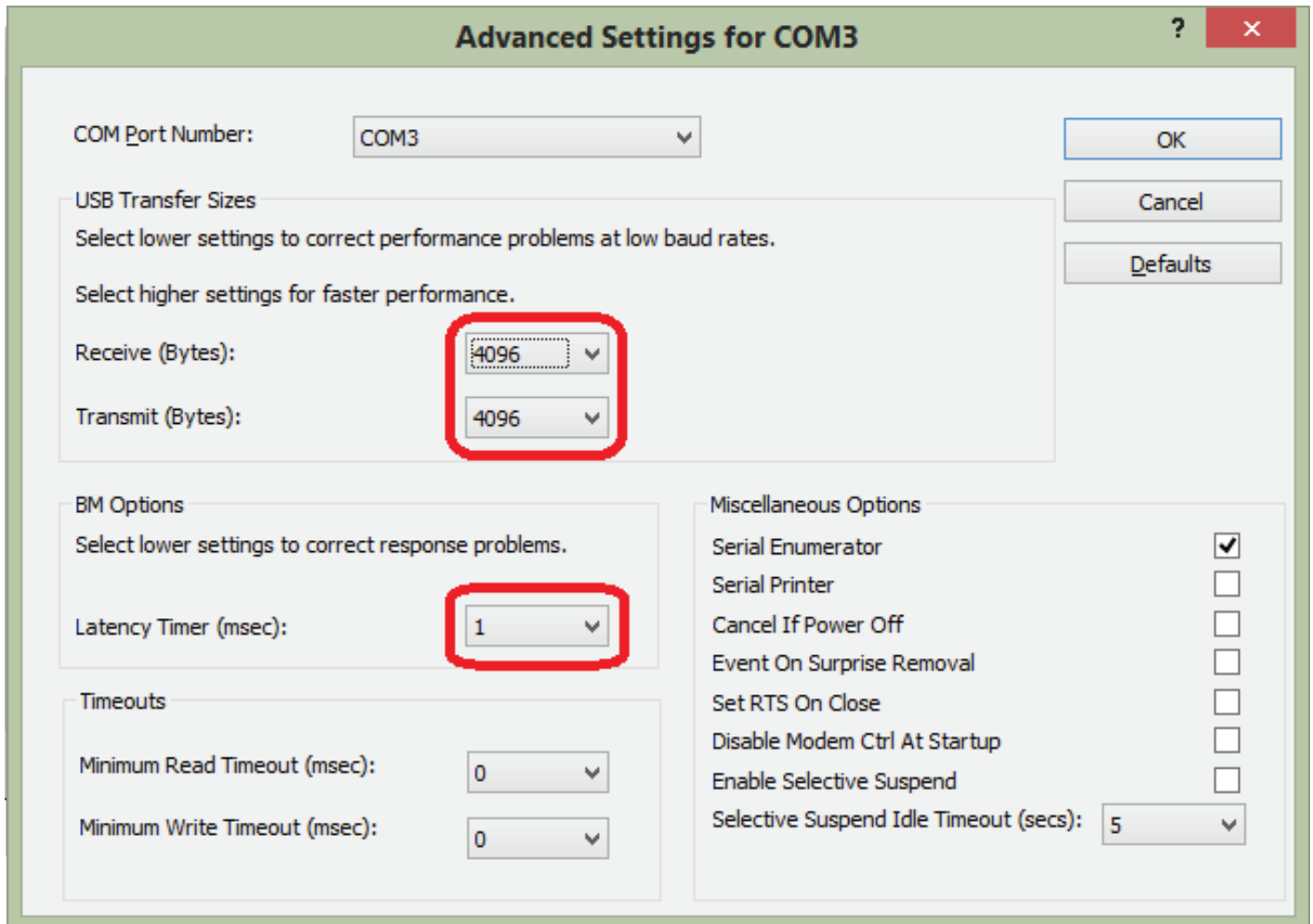
Look for a “USB Serial Port” with this “COM” number under “Ports (COM & LPT)”. In our example, this is “USB Serial Port COM3”. Right-click on this entry and select “Properties”:



Select the “Port Settings” tab and click on “Advanced”:

Increase the baud rate:

Change the value for the “Timeout” to 2ms and click OK to save.



Advanced Settings for COM3

COM Port Number: COM3

USB Transfer Sizes
Select lower settings to correct performance problems at low baud rates.
Select higher settings for faster performance.

Receive (Bytes): 4096

Transmit (Bytes): 4096

BM Options
Select lower settings to correct response problems.

Latency Timer (msec): 1

Timeouts

Minimum Read Timeout (msec): 0

Minimum Write Timeout (msec): 0

Miscellaneous Options

Serial Enumerator

Serial Printer

Cancel If Power Off

Event On Surprise Removal

Set RTS On Close

Disable Modem Ctrl At Startup

Enable Selective Suspend

Selective Suspend Idle Timeout (secs): 5

OK

Cancel

Defaults

TIPS: TROUBLESHOOTING USB ISSUES

If the connection to the controller is lost due to a USB error, you can check the following:

1. Check that a well-shielded, short USB cable is being used. It should never be longer than 2m; shorter is better.
2. Ground power supplies to the earth terminal, if available.
3. Metal parts of the machine should always be earthed.
4. Route all earth cables to a single point in a star configuration.
5. Are all control cables to the motors shielded?
6. Cables from the driver to the motor and from the frequency converter to the spindle MUST also be shielded.
7. Do not use cables simultaneously for power supply and as control lines; use separate cables and do not lay them directly parallel to one another: cables can induce voltages in other cables due to current flow, even if they are shielded. This can easily generate a few volts, which may lead to incorrect control commands.
8. Always fit a suitable mains filter upstream of the frequency converter; this is absolutely essential.
9. Position power components such as frequency converters, power supplies and drivers as far away from the control unit as possible. Frequency converters can quickly cause interference if placed directly next to the control unit.
10. Route control cables as far away as possible from frequency converters and the cables leading to them.
11. The cable shield must only be earthed on one side of the cable.

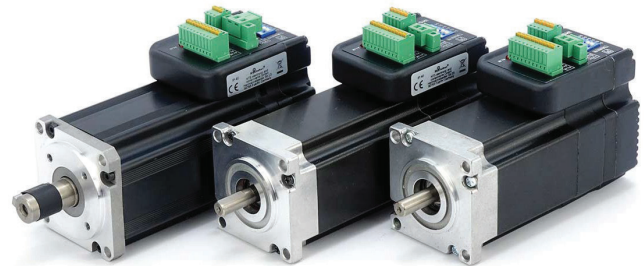
Visit us at www.rocketronics.de

On the Rocketronics website, you will find plenty of information, data sheets and new software for the products.

In our shop, we also offer high-quality accessories for lathes and milling machines. These include drives, power amplifiers, power supplies, couplings, cables, adapters, encoders and much more. We provide detailed wiring diagrams with all motor/power amplifier combinations!



Closed-loop stepper



Servo motors



Power supplies



Motors and drivers



Cables, terminals, connectors



Accessories

THE ESTLCAM HANDWHEEL

Fits the Estlcam clamp adapter and the Estlcam LPT adapter!

- Fully 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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