

SERVICE MANUAL

8015 Rayjet





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CAUTION

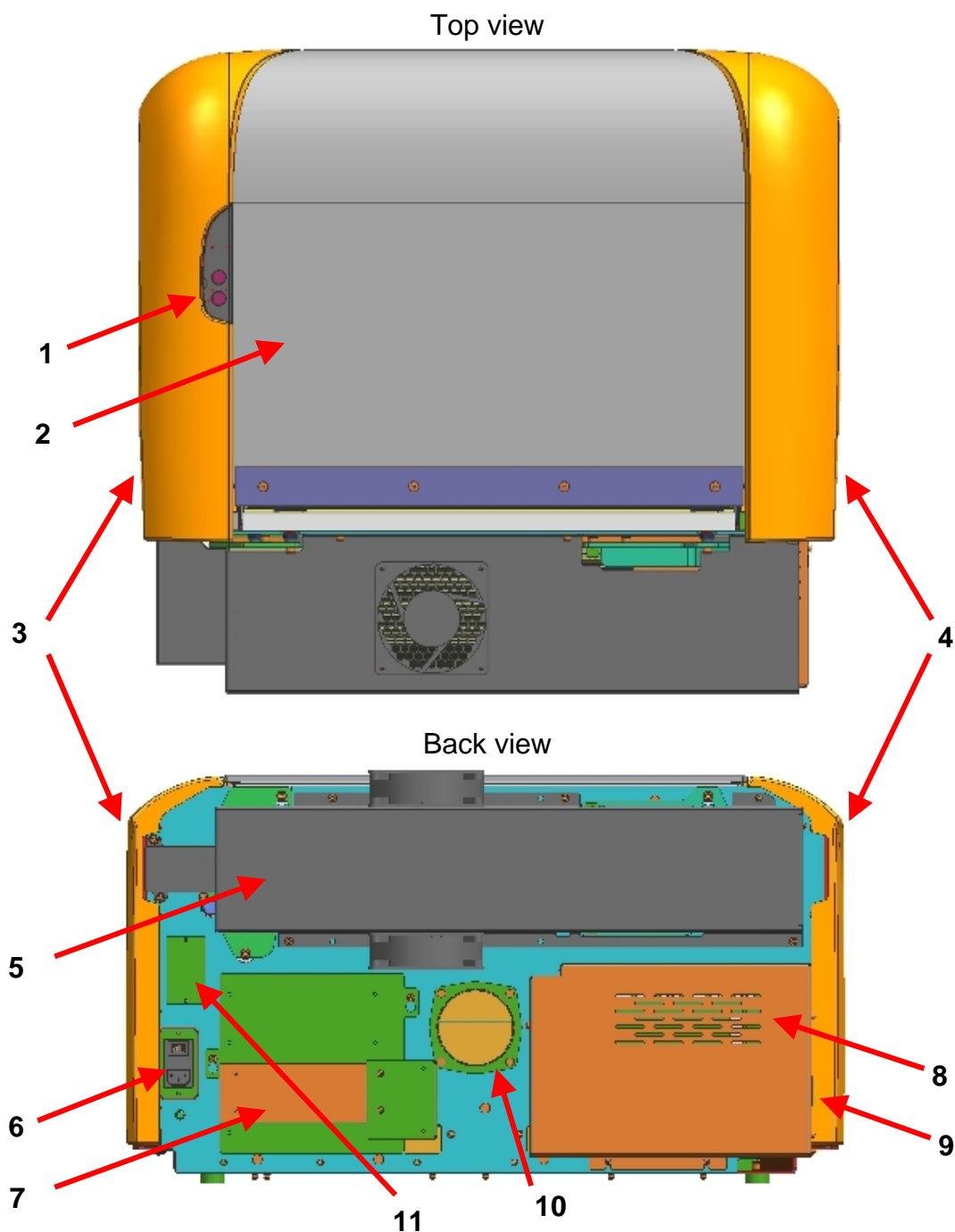
Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous laser radiation exposure.

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1 Main components



- 1 keypad
- 2 top lid
- 3 maintenance panel
- 4 service access panel
- 5 lasertube
- 6 on/off switch / power socket

- 7 power supply units
- 8 electronics
- 9 connection for PC and exhaust unit
- 10 connection for exhaust hose
- 11 product ID label

2 Safety information

Please read this chapter before operating or servicing a Rayjet laser system!

2.1 General

The Rayjet is an apparatus with a high level of security. To guarantee a safe operation it is necessary to know potential dangers and avoid risks. The dangers can be classified in three categories:

- Dangers caused by the laser beam
- Dangers caused by electricity
- mechanical dangers

General Safety Instructions

When working with the laser engraver please take note of the following safety instructions:

1. Operation and service of the Rayjet may only be performed by trained personnel.
2. Direct exposure of skin or eyes to laser radiation may cause severe injuries. The correct operation and service according to the manual can prevent hazards. Operators may perform procedures required inside the housing only through the interlocked door. They must never attempt to defeat the door interlocks nor remove non interlocked portions of the housing.
3. The laser beam can ignite flammable materials. Therefore a fire extinguisher should always be nearby. Do not store flammable materials near or inside the laser engraver. **Working with the laser or setting the system to service mode without supervision is not permitted.**
4. Many materials, especially non-anodized aluminium, copper, silver and gold, cannot be engraved with the laser engraver due to the very low absorption of laser radiation. This means that most of the energy of the laser beam is reflected. Therefore those materials must not be present in the laser beam path as otherwise a reflected laser beam could destroy the cover of the laser unit.
5. Beam adjustment may only be done by trained personnel. Otherwise there could be uncontrolled emission of laser radiation. There are only limited possibilities to adjust the mirrors due to a mechanic restriction. These restrictions may only be altered by authorized personnel.
6. Before starting to work check whether the engraving of the material can cause harmful fumes and whether the filters of your exhaust system are suitable for these fumes. It is emphasized that it is the user's responsibility to obey the national and regional threshold values for dusts, fumes and gases. (The maximum concentration of harmful substances **MUST NOT** be exceeded). Never use the laser engraver without an exhaust unit with appropriate filters for the treated material, as cutting or engraving certain materials can produce vapours. Materials causing toxic or carcinogenic smokes or fumes must not be treated without an exhaust unit with appropriate filters. Furthermore it is the user's

responsibility to ensure the safe removal and disposal of the smokes and particles from the laser machine according to the national and regional threshold values.

In the US reference should be made to Section 7.3 in the ANSI Z136.1-1993 Standard for the safe use of lasers, to the exposure criteria in CFR 1910 Subpart Z from the US government, and to the Threshold Limit Values (TLVs) published by the American Conference of Governmental Industrial Hygienists (ACGIH).

7. Please refer to the manual of your exhaust system regarding the change intervals of the filters. We recommend to make a note of the last change of filters on an adhesive label.
8. PVC (Polyvinylchloride) **MUST NOT** be processed with the laser engraver.

If you have any questions please contact your supplier or Trotec.

2.2 Laser Safety

The safety of a laser machine is defined by one of five safety classes.

The Rayjet without laser pointer would be safety class 2 in the EU safety class 2.

With an installed laser pointer it would be laser class 2M. Therefore it presents no hazard to personnel when properly used during normal operation or routine maintenance. In the US all machines are classified as class II laser products. This status is guaranteed by the safety housing and safety devices that are installed in the product.

Please be aware that improper operation of the laser machine nullifies this safety class and allows under certain circumstances the emission of radiation which can be potentially dangerous.

CO₂ - Laser

This laser engraving system may contain a carbon dioxide (CO₂)-laser class IV (4) product, which emits an *intensive* and *invisible* radiation. Without safety devices the direct radiation and also diffuse reflected radiation is dangerous.

Please be aware:

The Laser Radiation of a CO₂ Laser is invisible!

Risks of Laser Radiation:

If the built in safety mechanisms are defeated and the laser is operated with the housing open, there is a risk of setting clothing or other flammable materials on fire. Laser energy at a power of up to 45W at a wavelength of 10,6 μm for CO₂ - Laser could be present inside the housing. Therefore operators can perform procedures required inside the housing only when the interlocked door has been opened. (A normal user must never defeat the door interlocks or remove portions of the protective housing, except the machine is not powered).

Therefore you must under no circumstances neither alter the laser tube unit nor dismantle it nor set a system to work which has been altered or dismantled!

2.2.1 Safety Interlock System

Your Rayjet is equipped with an integrated safety interlock system which cuts off the power of the laser tube immediately as soon as one of the interlocked doors/panels is opened.



CAUTION

Do not attempt to alter the interlock system as that could result in hazardous radiation exposure.



CAUTION

Technicians who are performing service procedures must be trained in laser safety, and if they are defeating interlocks, they must wear laser protective eyewear designed for the 10,6 μ m CO₂ laser energy.

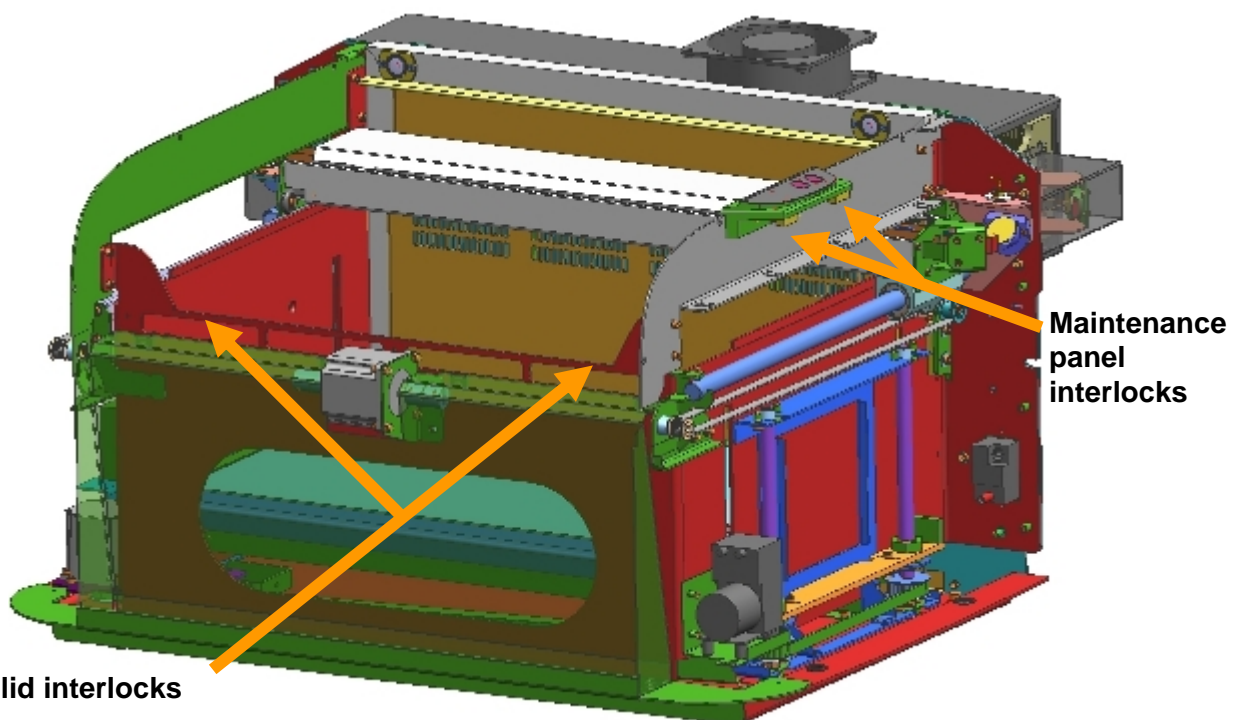
The top door and the maintenance panel on the right side, are interlocked. If the interlocks are defeated access to laser class IV radiation is possible through any of these doors.



CAUTION

When a non interlocked cover is opened (and the machine is powered) access to class IV laser radiation is possible.

These covers are labeled with „DANGER: INVISIBLE LASER RADIATION WHEN OPEN. AVOID EYE OR SKIN EXPOSURE TO DIRECT OR SCATTERED RADIATION“



2.3 Dangers of Electricity

When you open the covers of the engraving system there is the danger to get in contact with parts under high voltage. Therefore it is absolutely necessary that service and repair work is only done while the power supply is unplugged. In any case all safety laws and standards in connection with electricity must be obeyed.

IMPORTANT REMARK:



Usually you do not need to get in touch with the electrical and electronic components. In case you do that when servicing or repairing the laser engraver, please be sure that you first plug off the power supply.

2.4 Emission indication and safety labeling

2.4.1 Light Emitting Diodes

There is a red LED (light emitting diode) on the left hand side of the keypad which is illuminating when laser radiation is emitted.

During engraving, the LED flashes very fast and might be hardly seen by the eye. During cutting-mode it is durable.

2.4.2 Audible Warning

When starting up the laser engraver without closing the cover there is an intermittent beep. This indicates that the interlock system has not been checked yet. (You can run the machine only if all interlock switches are closed). Close the cover of the laser engraver to cause the machine to initialize.

On emitting a laser beam (which is called test pulse) by pressing the „Play/pause“- and "Stop" button simultaneously there is a beep (as long as you keep the buttons pressed) to remind you of the possible risks.

2.4.3 Safety Labels

The laser safety standards require that any removable panels that could permit access to laser energy include laser safety labels. These labels are visible before and after opening a cover.

Labels with the name of the manufacturer, date of production, description of the product, model number, serial number and safety labels are placed on the outside of the apparatus. All these labels are mounted when producing the laser engraver. These labels must not be removed.

If the labels are lost or damaged please contact Trotec. Replacements will be sent to you. All labels and their exact place is mentioned in the user manual.
The labeling meets the standards

☞ **21 CFR 1040 – Laser safety**

and

☞ **IEC 60825-1(2007)**

3 Beam alignment

3.1 Laser beam alignment

Attention: To do the laser pointer adjustment it is absolutely necessary to wear laser protection glasses!

What you need

laser protection glasses (for **CO₂** lasers) part number 69300
the toolbox enclosed to the engraver
beam alignment tools (BAT) for mirrors #2 & #3



CAUTION To make sure that there is no laser emission out of a controlled area establish a limited access area by using non flammable beam blocking curtains, temporary walls or other enclosures.



CAUTION The laser beam alignment may only be performed by service technicians that have been trained by Trotec and are familiar with the hazards from lasers



CAUTION
Never expose any part of your body to the beam as this could result in serious injuries.



CAUTION
To do the alignment it is absolutely necessary to wear laser protection glasses.

What you have to know

The number of the mirrors is counted from the outlet of the laser tube to the engraving head from one to three.

The whole alignment is done while your machine is running. To make sure the system works at a suitable power level change the test-pulse power in the Manager.

The laser beam is invisible. To find out its path, you use a BAT for **CO₂** lasers. It is burned at the spot, where it is hit by the laser beam and shows a mark.

The tolerable displacement (distance from burned dot to the centre) is one sixth of the diameter of the mirror or hole where you check the position.

Beam path of the Rayjet:

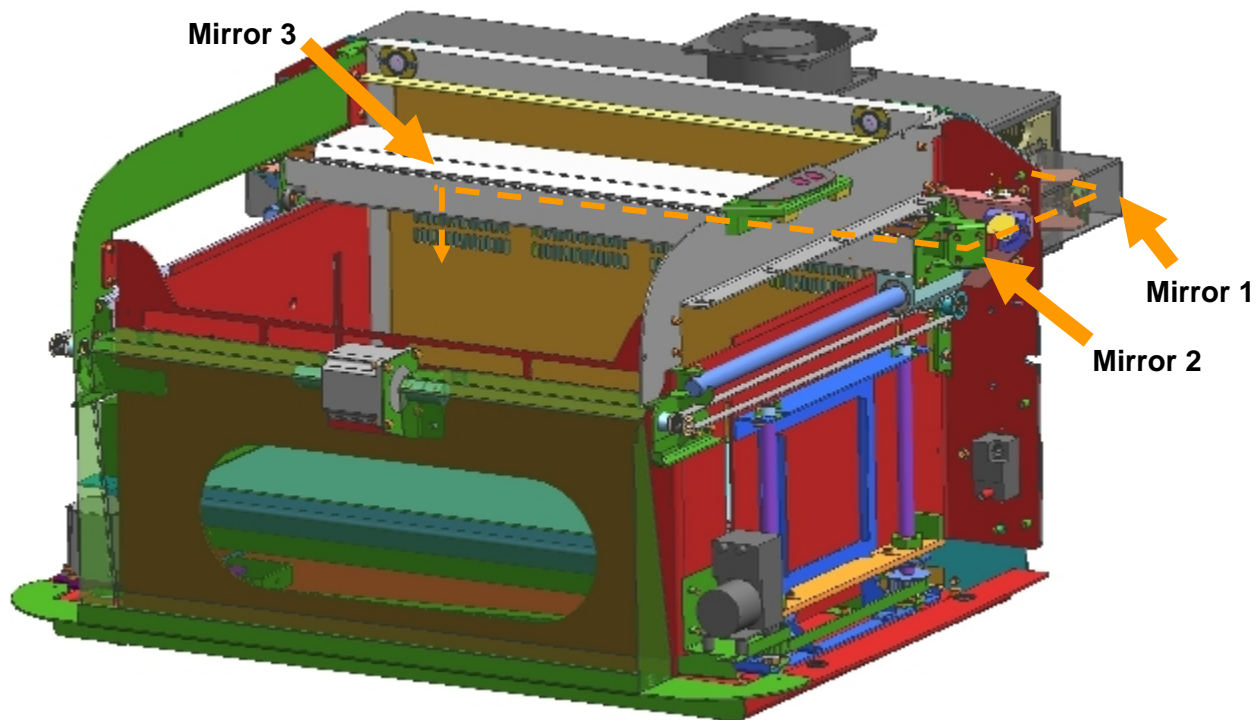
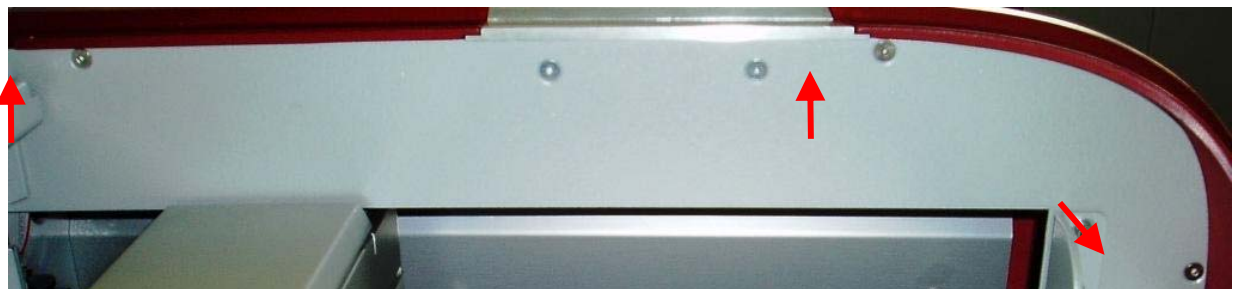


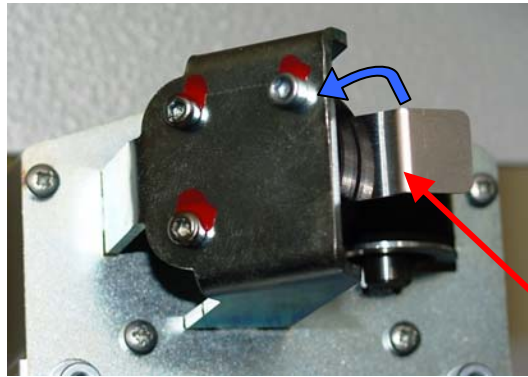
Illustration is with removed service and maintenance panel.

What you have to do

1. Put on your laser protection glasses.
2. Remove the three screws shown below on the right inside of the working area and disassemble the panel.



3. Remove mirror #2 on the right side of the x-axis.



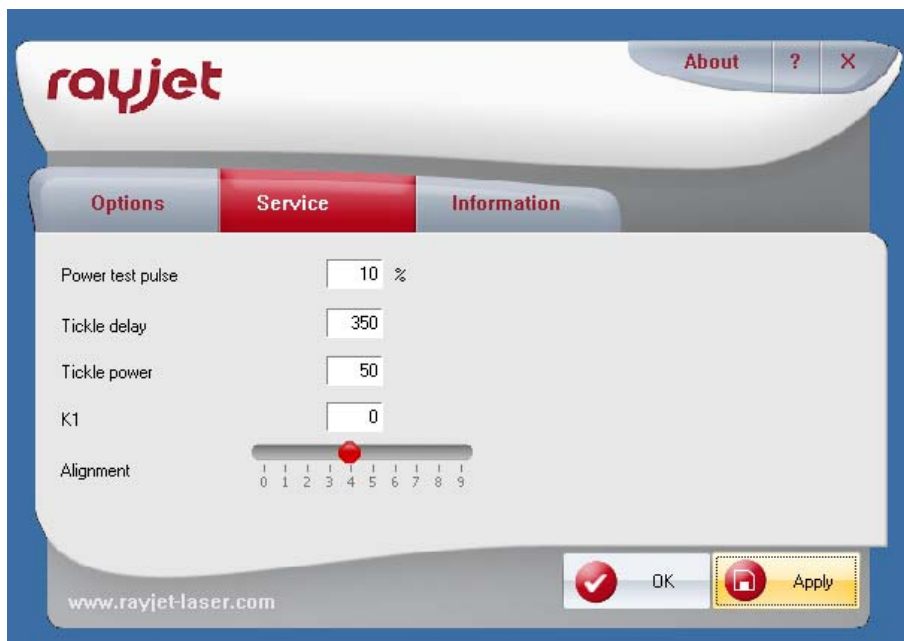
4. Remove the cover of mirror #1 carefully



5. Put the BAT for mirror #1 & 2 on the holder of mirror #2.

6. Turn on the Rayjet.

7. Connect the Rayjet to the Manager and ensure that the testpulse the options of the Mini manager is set to a low level (~10%) before doing the beam alignment. You find this menu through right-click on the small red icon on the left side of the task bar.



8. Bridge the interlock system by putting magnets on the interlocks.
9. Move the x-axis to the 0/0 position.
10. Press the "Start/Pause" and "Stop" buttons (see picture besides) simultaneously until you see a little mark on the BAT which is firstly getting grey (burned) and then lightening up. This is only possible if all interlocks are closed.
If you cannot see the mark at all, align mirror #1 until you can see it.
11. Move the x-axis with mirror #2 to the front side of the machine (400/0).
12. Again press the "Start/Pause" and "Stop" buttons simultaneously until you see a little mark.
Adjust mirror #1 until this second mark is at the same position as the first mark (generated in step 10).
13. Repeat the steps 9 to 12 until the marks are in the same position. As soon as they are in the same position, follow up with the next steps.
14. Put mirror #2 back on.
15. Put the BAT for mirror #3 on the beam entrance of mirror unit #3.
16. Move the engraving head to the 0/300 position.
17. Press the "Start/Pause" and "Stop" buttons simultaneously until you see a little mark on the BAT again.
18. Move the engraving head to the 0/0 position, do a testpulse again and adjust mirror #2 until you hit the mark created in step 17.
19. Repeat steps 16 to 18 until the marks are in the same position.
20. If the mark is not centered bring it to the center by adjusting one of the screws for the laser tube fixing plate. In this way you can bring the laser beam up or down.
21. Check the alignment at all four corners of the working table again.
22. When the position of the mark is in the centre with maximum displacement (distance from burned dot to the centre) which is one sixth of the diameter of the mirror or hole where you do the adjustment, you may remove the BAT from mirror #3.
23. Seal the adjustment screws by putting some varnish to them.
24. Put the cover for mirror #1 back on.
25. Now your engraver is aligned properly.
26. Put the maintenance panel back to the Rayjet and close it.



3.2 Laser pointer adjustment

Attention: To do the laser pointer adjustment it is absolutely necessary to wear laser protection glasses!

What you need:

laser protection glasses (for **CO₂** lasers) part number 69300
the toolbox enclosed to your engraver
beam alignment tool (BAT) for mirror #3

What you have to know:

Connect the laser to the Manager and ensure that the testpulse setting within the Manager is set to a low level (~10%) before doing the beam alignment.

The CO₂ laser beam is invisible. To find out its path, you use the BAT for **CO₂** lasers. It is burned at the spot, where it is hit by the laser beam and shows a mark.

The tolerable displacement (distance from burned dot to the centre) is one sixth of the diameter of the mirror or hole where you do the adjustment.

- 1.) After you've installed the laser pointer put the BAT on the mirror #3 on the x-axis.
- 2.) Move the engraving head to the lower left corner of the engraving table (0/300).
- 3.) Press the "Start/Pause" and "Stop" buttons simultaneously until you see a little mark on the BAT. This is only possible if all interlocks are closed.
- 4.) Adjust the three small screws close to the laser pointer until the red dot hits exactly the burned spot on the BAT.

4 Replacing the laser tube

The laser tube is one of the main components of any laser engraver. The Rayjet uses Synrad tubes for all systems.

To make the tube fire it must be

- *Connected to the power supply*
- *Provided with a control signal of the data cable (BNC connector)*
The control signal is a 5V TTL signal that comes from the main board.

All tubes have an integrated overtemperature protection. If the tube exceeds a certain temperature it is switched off to prevent a damage of the gas/electronics.

The following reasons might make it necessary to replace the tube:

- Too low laser power
- Fluctuations of laser power (typically jumps from 100% to 50% engraving depth)
The frequency of these power fluctuations is low (e.g. every 5 minutes)
- Uncontrollable timing behaviour (high frequency effect).
This effect shows shifted start/end points of the pulses so that the image looks frayed although the mechanics (of the motion system) and software adjustment are OK.

When you receive a new lasertube for the Rayjet, the tube is mounted on a plate and already adjusted in a way, that it should not be necessary to adjust the beampath. If there are some missalignments, do the alignment as described before in chapter 3.

Please consult the Rayjet Video DVD to find detailed instruction on how to exchange the laser tube.

4.1 Measuring the laser power:

To measure the laser power you need:

1. laser protection glasses (for **CO₂** lasers) part number 69300
2. Laser power meter



CAUTION To make sure that there is no laser emission out of a controlled area establish a limited access area by using non flammable beam blocking curtains, temporary walls or other enclosures.



CAUTION The laser power measurement may only be performed by service technicians that have been trained by Trotec and are familiar with the hazards from lasers

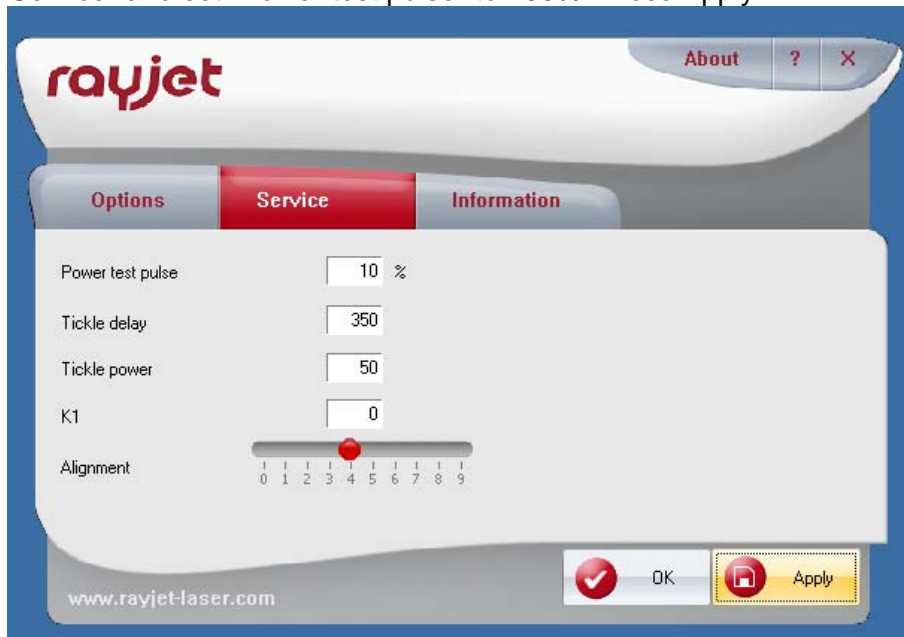


CAUTION Never expose any part of your body to the beam as this could result in serious injuries.



CAUTION To do the laser power measurement it is absolutely necessary to wear laser protection glasses.

1. Open the mini manager and connect to the engraver.
2. Enter the Options via right-click on the small red rayjet icon on the left side of the task-bar. Choose "Service" and set "Power test pulse" to 100%. Press Apply.



increasing the test pulse to full power

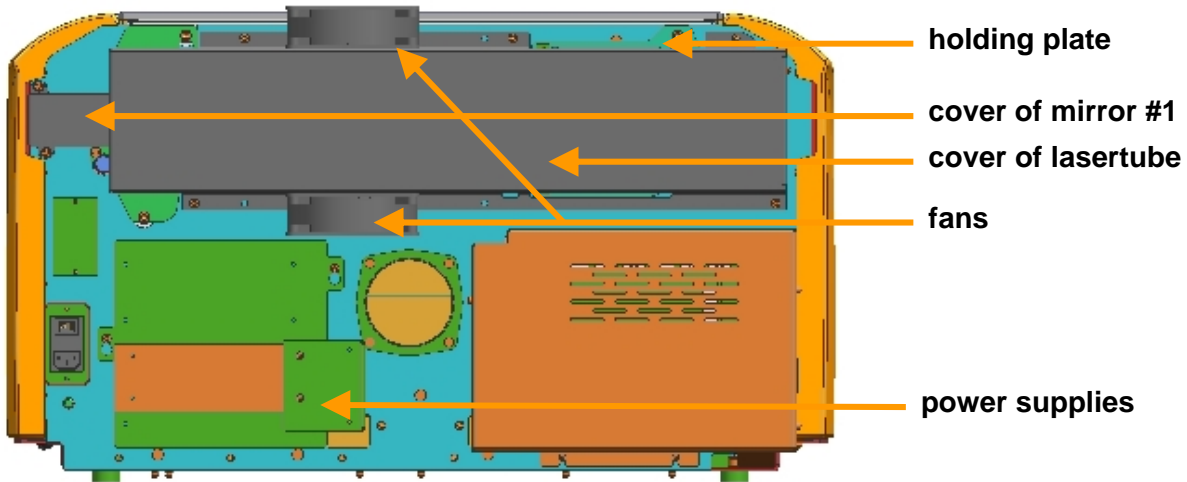
3. Put on your laser protection glasses.
4. Remove the cover of mirror #1.
5. Put the power meter with the black absorbing area between the aperture of the lasertube and mirror #1.
6. Press the reset button on the power meter and fire the testpulse (press "Start/Pause" and "Stop" buttons simultaneously)
7. After some seconds you will hear a beep sound from the power meter, which indicates that the measurement has been finished.
8. Repeat the procedure at least three times. Take care that the power meter will not overheat when doing this test.

The wattage difference between the tests should be less than 10% of the average laser power.

After this test, reset the "Power test pulse" to 10%.

4.2 Replacement of the lasertube

The concerned parts in replacement of lasertubes are placed on the backside of the machine.

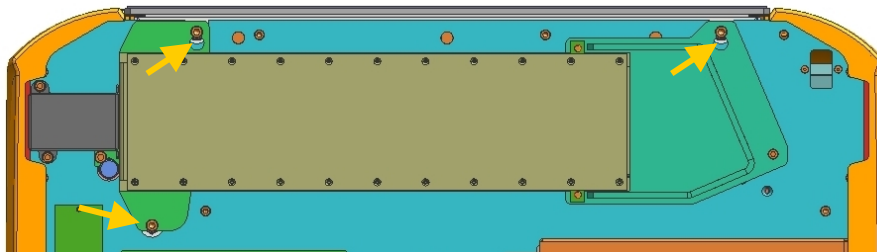


Do the following steps to exchange the lasertube.

1. Switch off the Machine and unplug it from the electrical outlet.
2. Unplug the power connectors of the lasertube-ventilators and the lasertube.
3. Unplug the data-cable of the lasertube.
4. Remove the cover of mirror #1 and remove the mirror itself. Keep the mirror to replace it again after mounting the new tube.
5. Loosen the five screws marked below and carefully remove the cover of the lasertube together with the ventilators.



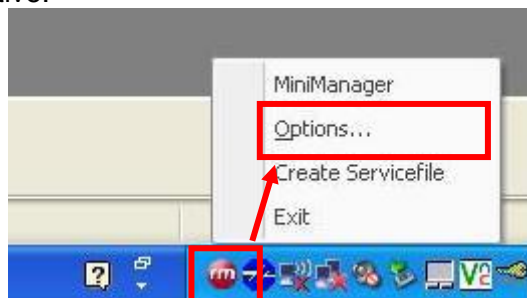
6. Loosen the three screws holding the holding plate of the lasertube (see picture below).



7. Lift and remove the lasertube together with the mounted holding unit of mirror #1.
8. Assemble the new tube in the reverse way.
9. After the replacement you've to check the beam alignment as described before.
10. Pack the old tube and ship it back to Trotec.

5 Adjusting the Mini-Manager Options

You enter the options menu via right-click on the small red rayjet-icon on the left side of the task bar when minimanager is active.

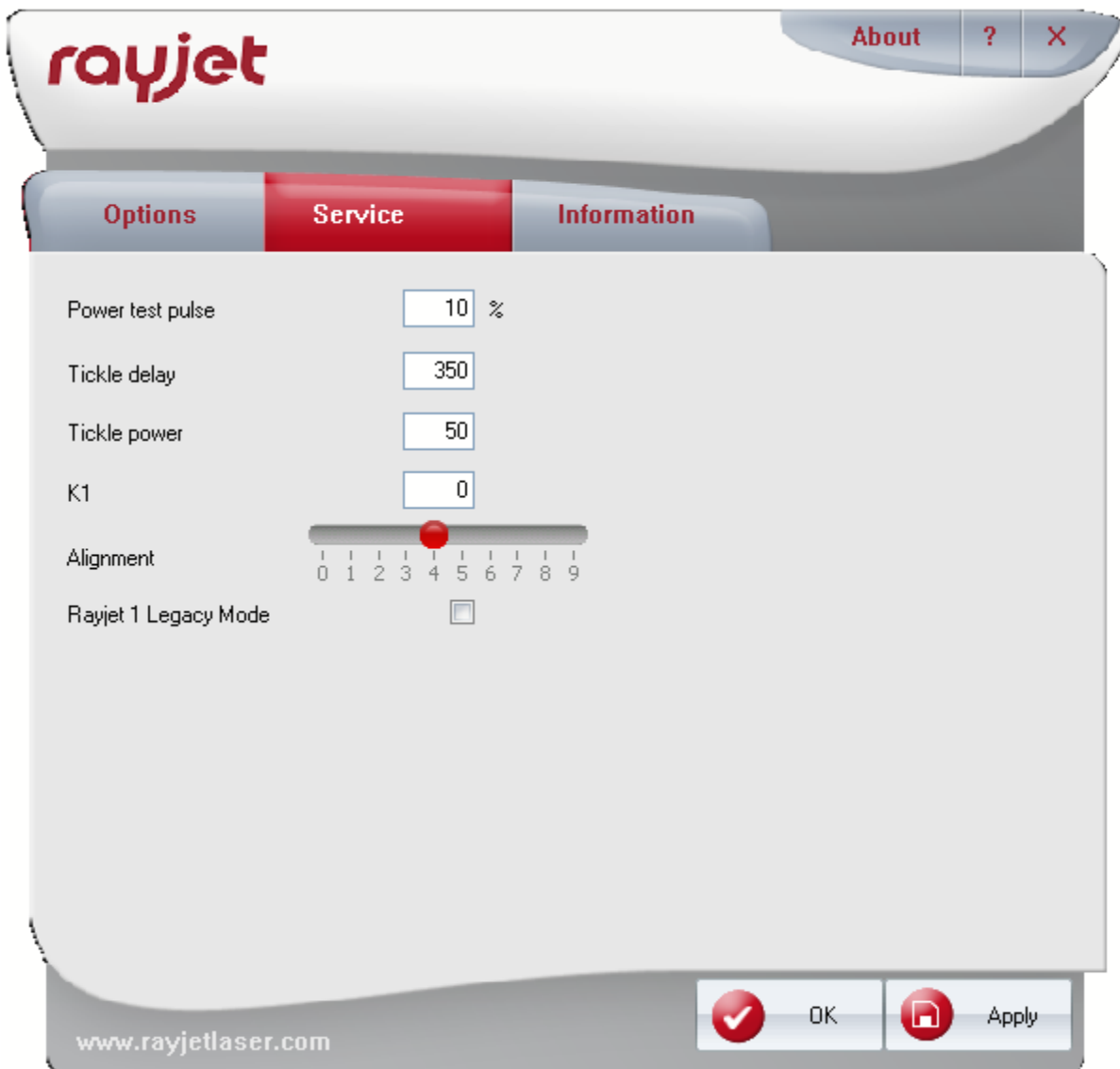


5.1 Tab „Options“

Here you can set preferred language and the used unit. Additionally you can set the maximum number of Jobs which are shown in the Job Queue of the Minimananger and decide if you want to suppress warnings of the (Trotec) exhaust system.



5.2 Tab „Service“



Power test puls defines, with which power the lasertube fires when initiating a test pulse by pressing the STOP and PAUSE button simultaneously on the keypad on the Rayjet.

The following parameters are responsible for achieving good engraving quality. Trotec uses a patented algorithm for compensating imperfections of the laser tube behaviour.

Tickle delay defines the minimal stimulation time to make the lasertube fire. If you discover dots between the objects to engrave, you might increase this value.

Tickle Power keeps the laser tube at a certain excitation level to make it fire as fast as possible. When increasing this value you have to make sure, that the lasertube barely does not shoot. Check this on sensitiv material as gold.

K1 provides a shift of the laser control signal linear with speed.

Alignment provides a continuous shift independent on the speed.

To find out the correct settings for K1 and Alignment, engrave the test pattern and choose the jobs with the best result.

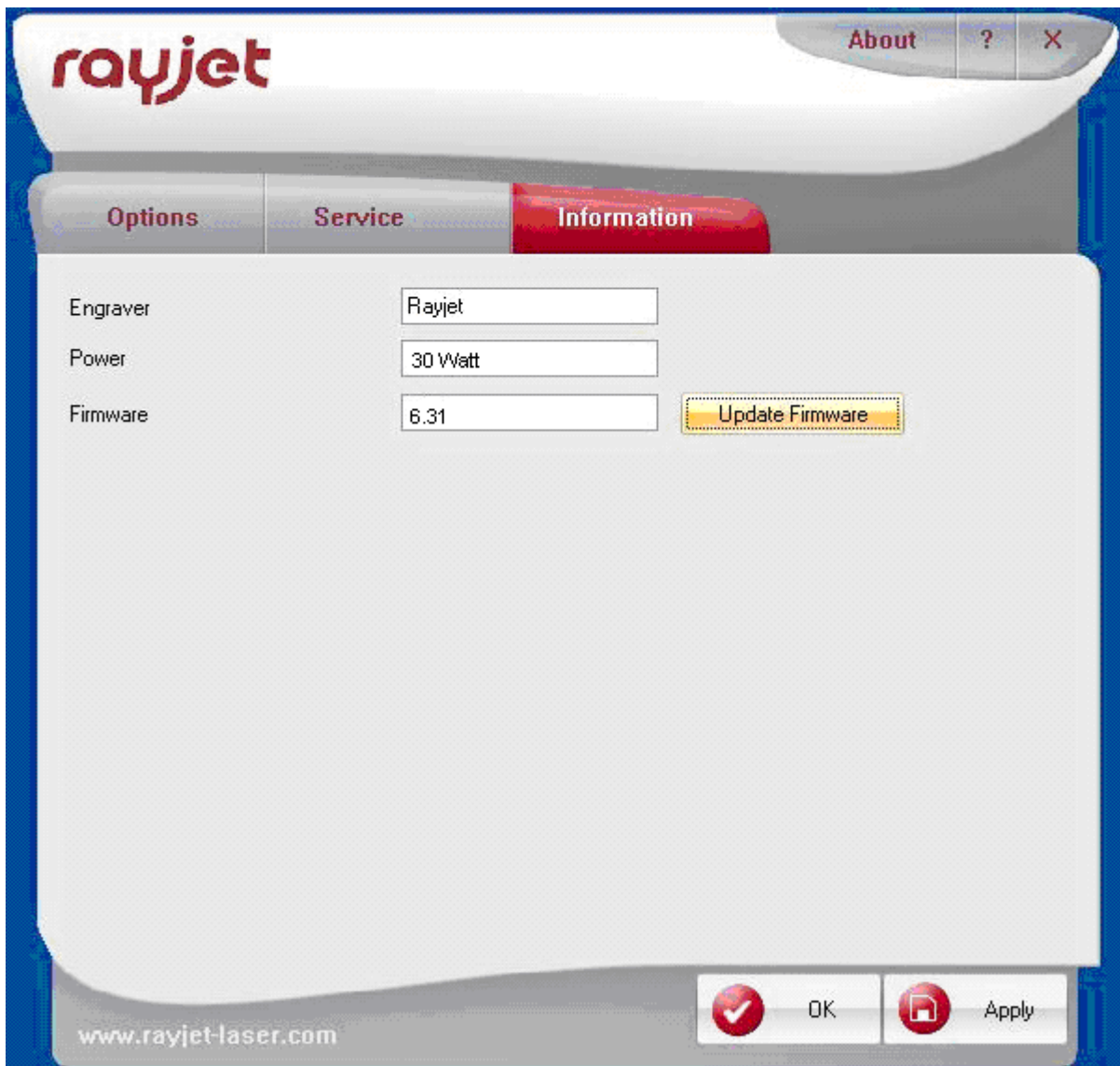
5.3 Tab „Information“ – Firmware Update

Engraver shows the model actually connected to the computer.

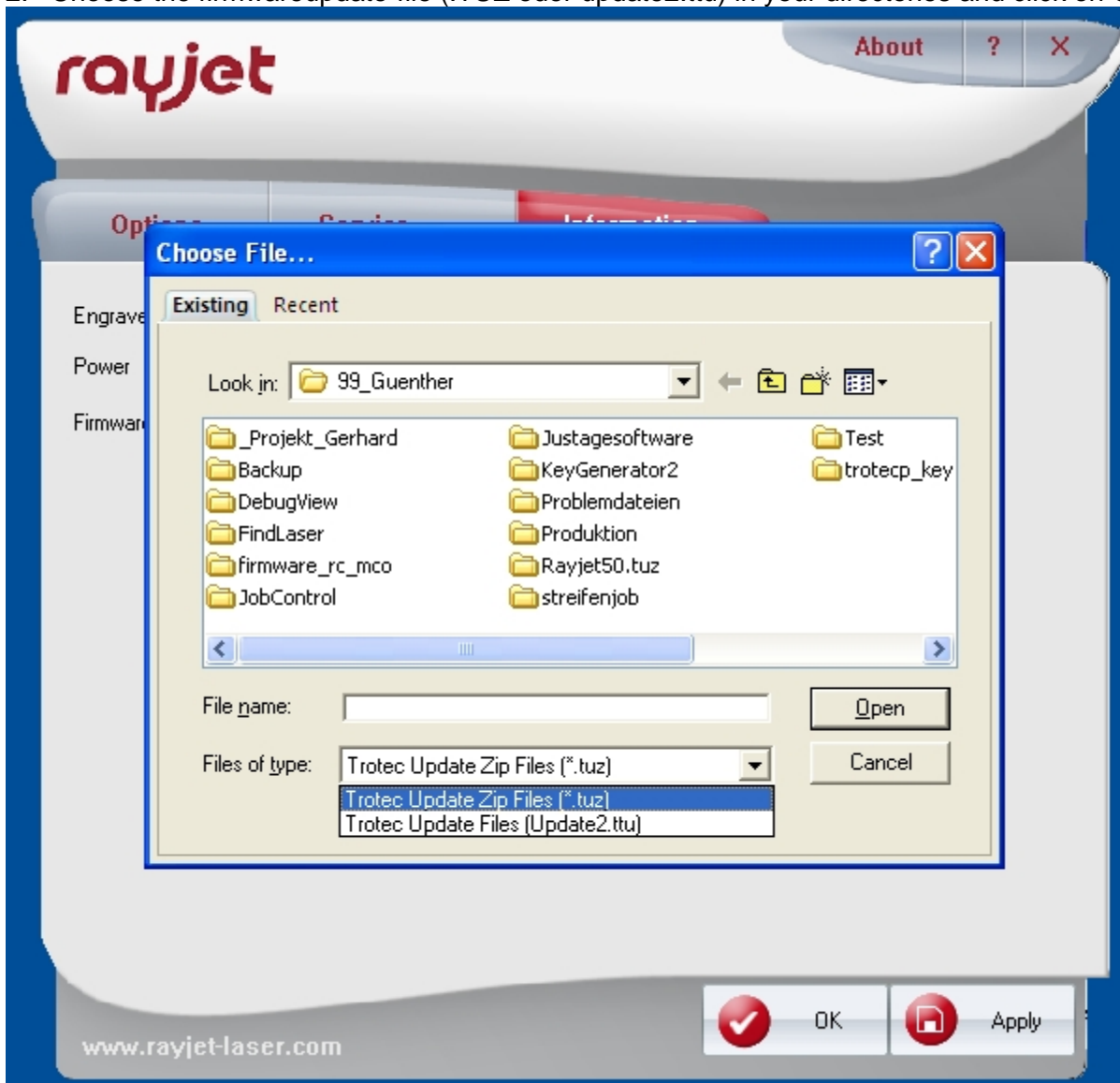
Power shows the power of the laser tube in W.

Firmware shows the actually installed firmware version of the laser machine. To update the firmware follow the following steps:

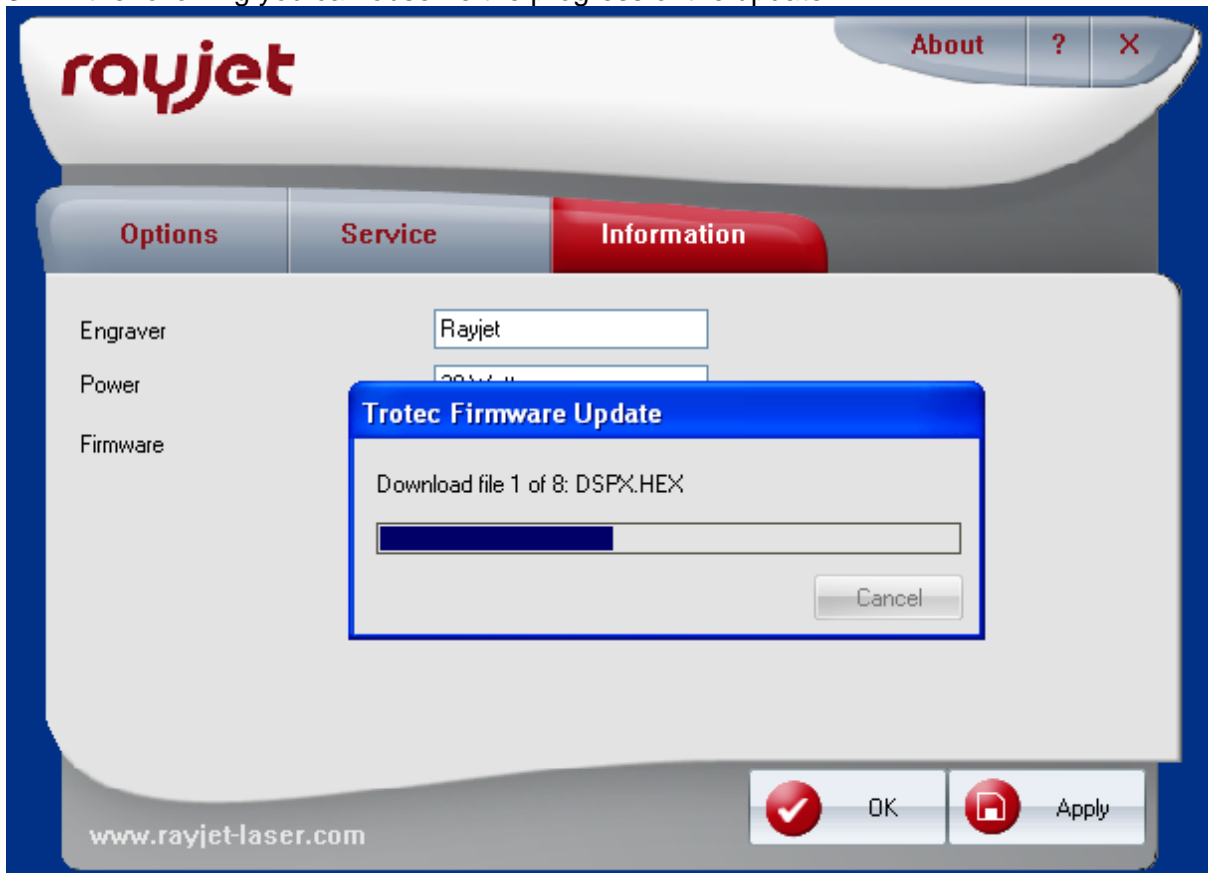
1. click on the button “Update Firmware”.



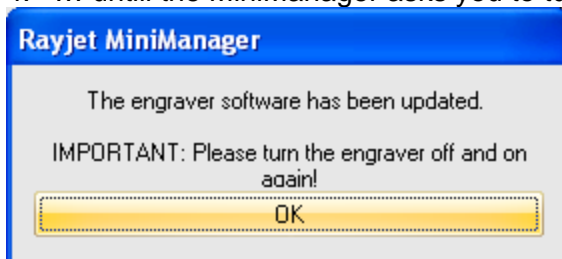
2. Choose the firmwareupdate-file (.TUZ oder update2.ttu) in your directories and click on OPEN.



3. In the following you can observe the progress of the update...



4. ... until the MiniManager asks you to turn your laser off and on again.



6 Hardware

Whenever you are servicing a machine, turn the machine off and unplug it!

Most of the described procedures are explained in detail on the Rayjet Video DVD. Please consult the DVD for additional information.

6.1 X- and Y-axis

The axes are the most strained mechanical components in a laser engraver. As we have to make sure that the precision is high enough to get a perfect engraving result it is important that possible positioning errors between incremental resolver and engraving head are minimized (engraving accuracy at $1000\text{dpi}=25.4\mu\text{m}$, at cutting $1\text{ increment}=10\mu\text{m}$).

To assure this, we have to service the axes periodically. The most important one is the X-axis, as it moves approximately 500 times farther than the Y axis (this is true for square jobs and a resolution of 500 dpi).

Each of the axes contains some wear and tear parts. These are for example:

- Belts (motor belt and main belt)
- X-motor including drive gear
- Ball bearings and reels

which have to be replaced in case of problems.

On every machine the technician has to decide which of the components are outworn.



CAUTION

The service may only be performed by service technicians that have been trained by Trotec and are familiar with the hazards from lasers.

6.1.1 Adjusting the Offset (0/0 position)

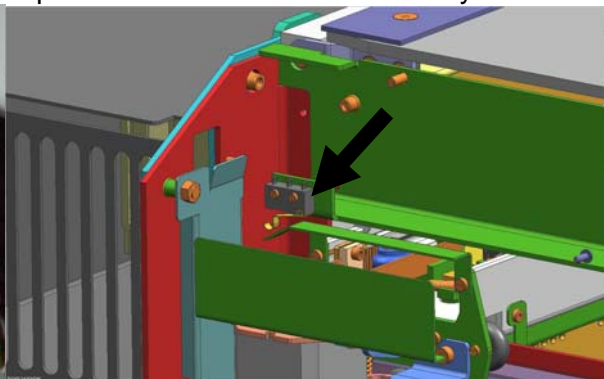
If the laser after focussing and “moving home” in the Mini Manager is not at the 0/0 position, you have to adjust the reference switches.

Steps for checking and adjusting the X and the Y offsets:

1. Focus the beam on the surface of the rulers and put some paper tape at the crosspoint.
2. Move the engraving head to 0/0 (Mini Manager > “move home”)
3. Fire the test pulse (~ 10%) until you can see a small spot on the paper tape.
4. The distance between this spot and the rulers should be smaller than 0.5mm.
5. If the distance is bigger: you have to align the position of the x-limit switch, placed on the left backside of x-axis and/or of the y-limit switch placed on the left side of the left y-axis.



x-axis limit switch



y-axis limit switch

6.1.2 Exchange of the reels on x-axis

To exchange the reels follow these steps – please compare the videomanual:

1. Open the cover of the machine
2. Open the cover of the x-axis
3. Loose the screw holding the reel
4. Remove the reel inclusively screw and shims
5. Put shims and screw onto the new reel
6. Replace the reel
7. Repeat steps 3 to 6 with all reels which need replace
8. Close all covers

6.1.3 Exchange of the belt on x-axis

1. Open the cover of the machine
2. Remove service and maintenance panel on left and right side of the machine.
3. Open the cover of the x-axis
4. Remove the small metal plate on the left part of the x-axis.
5. loose the screws fixing the motor to release the belt
6. remove both fixations of the belt.
7. take out the belt
8. If the guide pulley on the right side falls down while removing the belt, replace it now.
9. Place the new belt in the x-axis
10. Fix the belt in a way, that three hills and two valleys are free.
11. Tension the belt as described below (Special instructions for X-belt tensioning).
12. Replace and fix the small metal plate on the left part of the x-axis.
13. Replace service and maintenance panel on mith sides.
14. Close all covers.

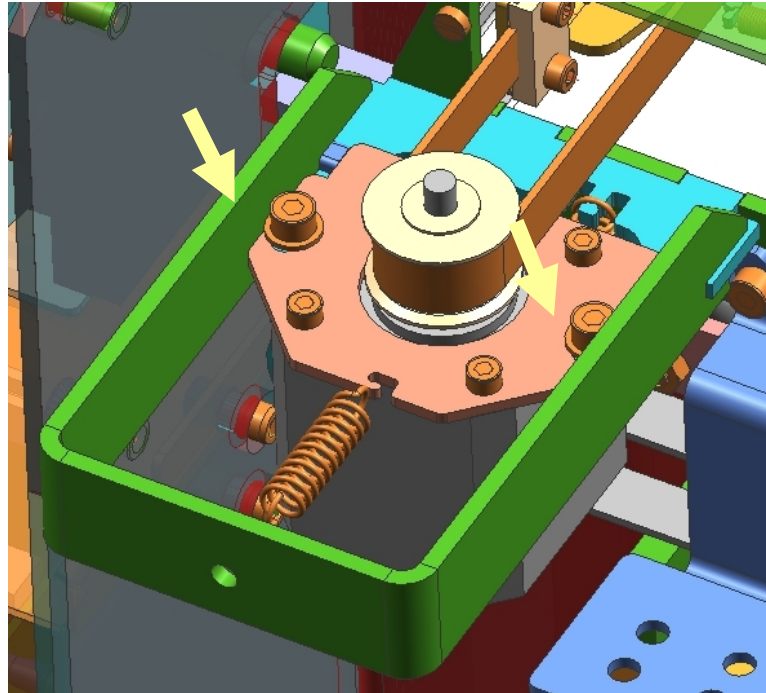
6.1.4 Special instructions for X-belt tensioning

Correct belt tensioning is very important for:

- obtaining good engraving results: if the belts are too loose, quality of engraving can be poor.
- life expectancy of mechanical parts will decrease if the belt tension is too high. (mechanics like ball bearings, belts or gears will wear out quickly)

To correct the belt tension follow the next steps:

1. Turn off the Rayjet and unplug it from the electrical outlet.
2. Remove the service panel at the left side of the machine.
3. Remove the small metal plate mounted on the motor.
4. Loosen the two screws fixing the motor plate.
5. Place the x-belt tensioning device in it's position and fix the spring to the motor plate as shown in the picture below.



6. Let the motor plate glide into the position enforced by the tensioning device.
7. Tighten the two screws fixing the motor plate.
8. Replace the small metal plate mounted on the motor.
9. Replace the service panel at the left side of the machine.

6.1.5 Exchange of x-motor

1. Open the cover of the machine.
2. Remove service panel on the left side of the machine.
3. Unplug the motor.
4. Remove the small metal plate, which is mounted on the motor.
5. Remove the screws fixing the motor to release the belt.
6. Remove the motorplate from the motor.
7. Fix the motorplate on the new motor.
8. Replace the motor into the machine, don't fix the screws yet.
9. Replace the x-axis belt.
10. Tension the belt as described before (Special instructions for X-belt tensioning).
11. Replace the small metal plate mounted on the motor.
12. Replace the service panel at the left side of the machine.

6.1.6 Exchange of x-axis

1. Open the cover of the machine.
2. Remove service and maintenance panel on left and right side of the machine.
3. Open the cover of the x-axis.
4. Remove mirror #2 and the working head containing mirror #3 and the lens.
5. Close the cover of the x-axis.
6. Unplug the motor cable at the left side.
7. Remove the plate fixing the x-axis on the y-axis belt on the left side.
8. Remove the screws fixing the x-axis on the y-axis on the right side.
9. Put the x-axis in the fore position where you examine a bigger hole in the sidewalls.
10. Remove the x-axis through pulling it out into the left.
11. Place the new x-axis in the machine in the reverse order.
12. If not already on, please mount the small metal plate at the motor on the new axis.
13. Don't forget to replace the optics and covers.

6.1.7 Exchange of y-motor

1. Open the cover of the machine.
2. Remove service and maintenance panel on left and right side of the machine.
3. Remove the three upper screws holding the front panel and remove the panel.
4. Unplug the interlocks on the right and the left side.
5. Remove the screws holding the air-guide plate and carefully remove the plate.
6. Loosen the screws on the clutches right and left of the y-motor.
7. Slide the clutches away from the motor to set the motor free.
8. Unplug the motor.
9. Remove the screws fixing the motor on the machine and remove the motor.
10. Remove the fixing plate on the motor.
11. Replace the fixing plate on the new motor.
12. Mount the motor on the machine and fix the clutches again.
13. Plug the motor and replace and fix the air guide plate.
14. Plug the interlocks on both sides.
15. Replace the front and sidepanels and close the cover.

6.2 The electric system

The Rayjet contains the following electrical components:

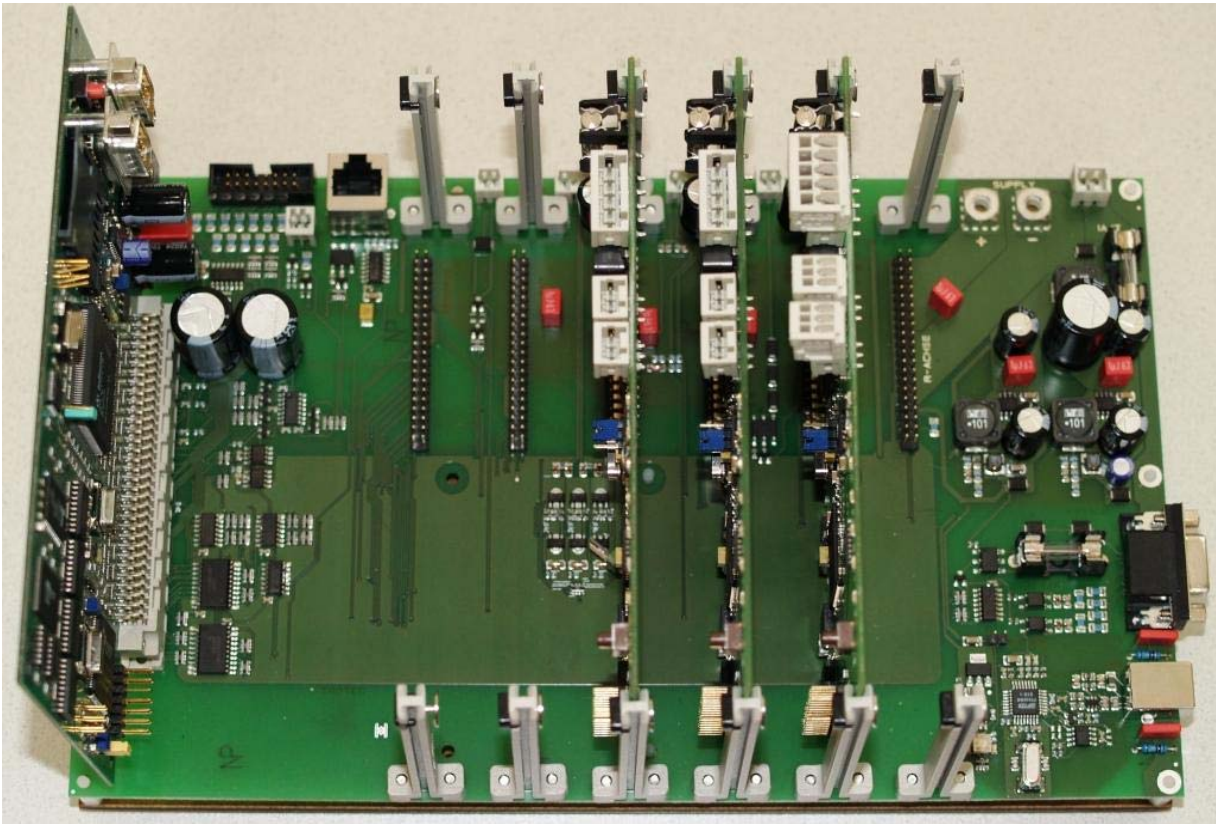
1. IO board
2. CPU board
3. Motor prints
4. Power supplies
5. Laser tube
6. Motors
7. Keypad

For checking the system we recommend to use an electronic multimeter (Voltage check, Ohmmeter)



Pictures

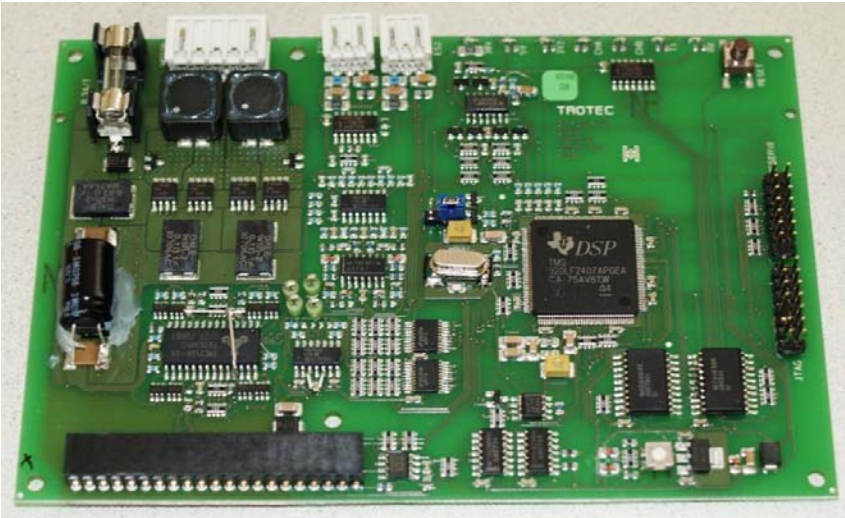
6.2.1 I/O board with CPU board and motor prints



6.2.2 CPU board

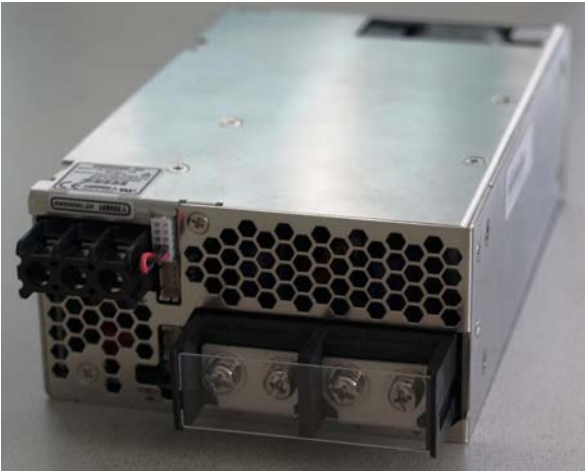


6.2.3 Motor prints



6.2.4 Power supplies

30 W



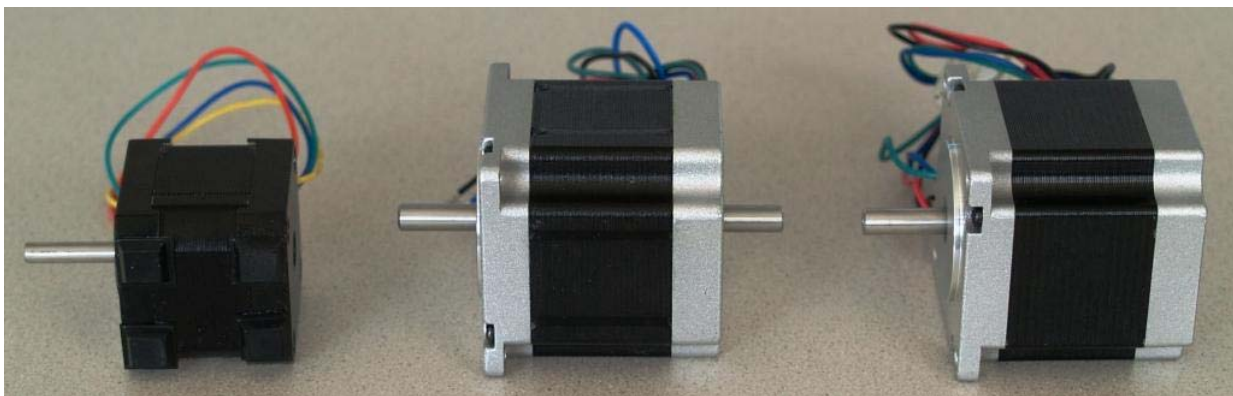
12 W



6.2.5 Lasertube



6.2.6 Motors



X-axis motor

Y-axis motor

Z-axis motor

6.2.7 Keypad



1 POSITIONING KEYS Z-axis

Use the positioning keys to manually move the working table up and down.

2 START / PAUSE



Used to start and pause the current working process.

3 STOP



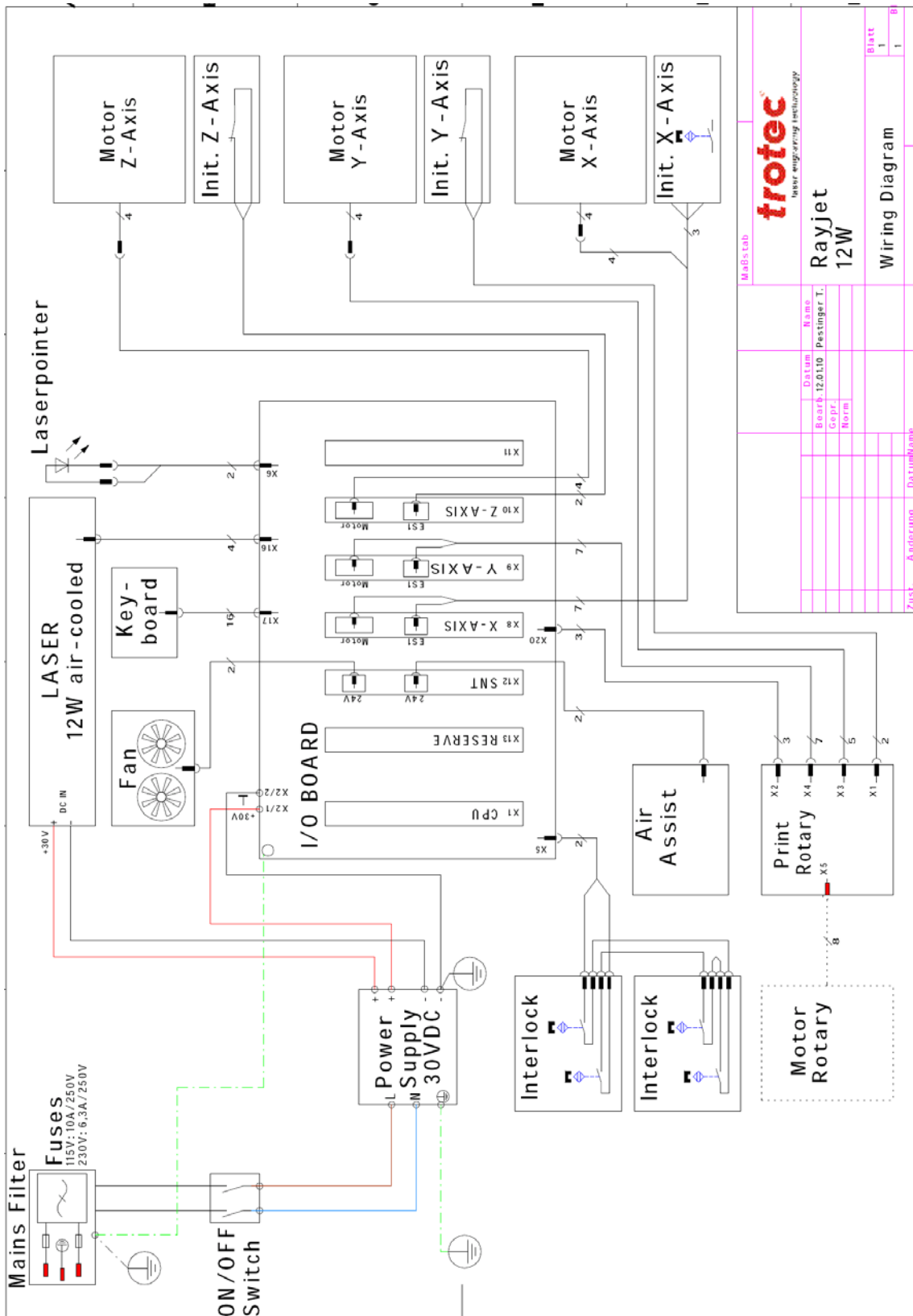
Stops the current working process.

4 / 5 STATUS LEDs (indicate the current status of the device):

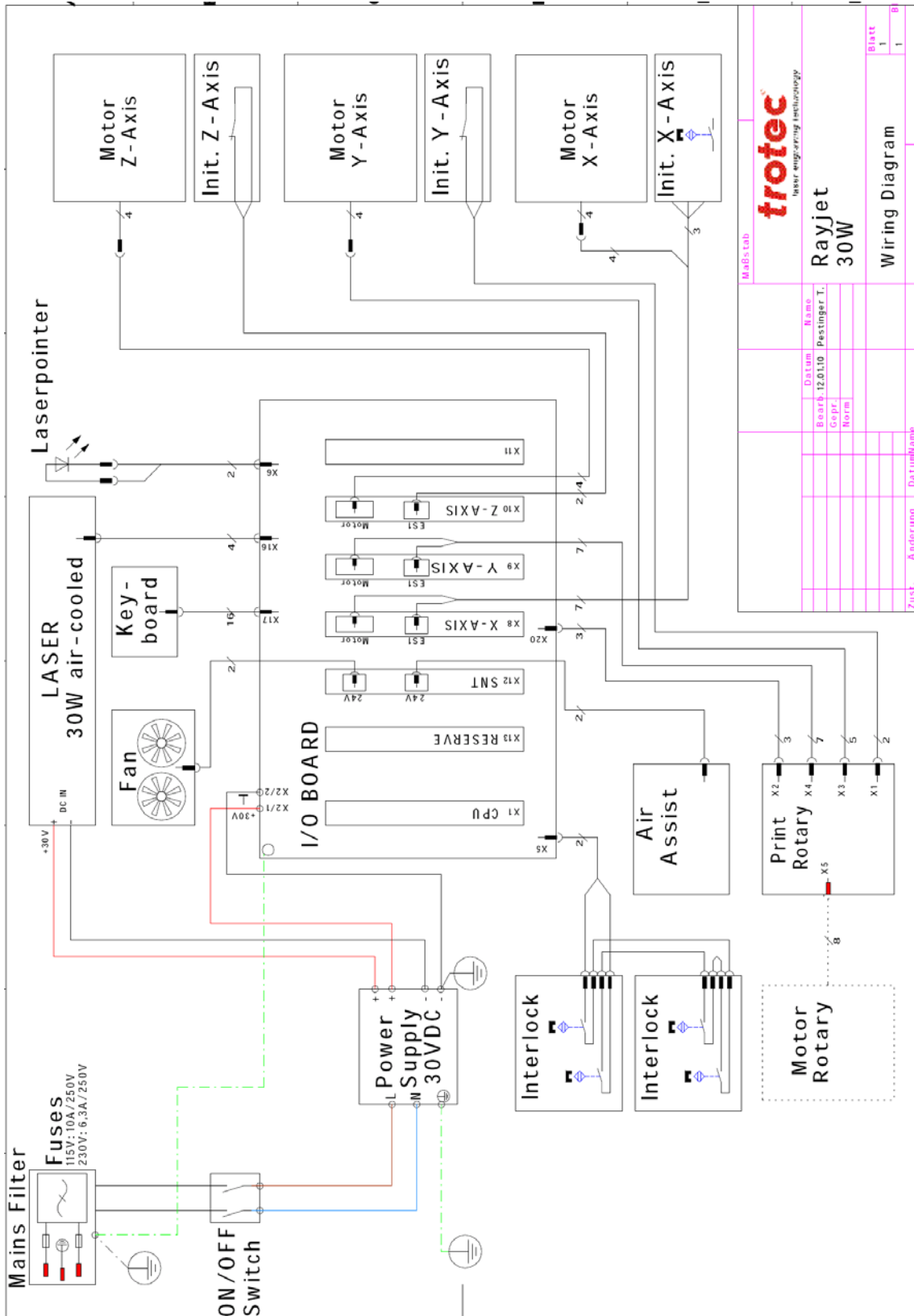
green, flashing slowly (0.5 Hz)	4	Rayjet is ready
green, flashing fast (2 Hz)	4	Cover has been opened
green permanent light / Pause mode	4	Data available in the Rayjet
red permanent light	5	Laser beam is being emitted
green/red flashing alternately	4 +	Cover open during switch-on process, simultaneously acoustic signal - no referencing

6.3 Wiring diagrams

6.3.1 12W air-cooled



6.3.2 30W air-cooled



Mafis Lab		trotec laser engraving technology	
Bezeichnung	Rayjet 30W	Revise	Pestinger T.
Datum		Gepr.	Norm
Zust.		DatumName	
Änderung		Blatt	
Wiring Diagram		1	
		8	

7 Error codes

The following error codes can be generated by the Trotec Minimanager, whenever it recognizes a machine or computer problem. In many cases these codes are a helpful information which makes it easier to sort out problems.

Nevertheless sometimes the indication of an error code can be confusing, because machine errors (that are indicated by beeping and blinking of the machine) might cause a software error as well although the true cause is the machine.

7.1 Software feedback

Number	Text
0	// no error occurred
-3	// Laser turned off
-100	// -2 (TP_ERR_INTERNAL) received from COMM module - mostly USB problems
-200	// Initialisation of com port failed
-201	// Echo packet not correctly received
-202	// Other transmission is in progress
-203	// Echo packet contains wrong data
-204	// Timeout occurred
-205	// No data pending
-206	// Some "TP" function failed to succeed
-207	// No abort valid in this state
-208	// No abort valid in this state
-209	// Failed to allocate memory
-210	// Failed to allocate memory
-211	// Wrong WS spool size
-212	// Wrong WS spool size
-213	// Wrong WS spool size
-214	// Wrong JOB spool size
-215	// No jobs found to transmit
-216	// Jobs on platte have different params
-217	// canceled update of settings
-218	// Switch of com speed failed
-250	// transmission should idle here
-251	// communication not ready
-252	// could not write data to comm
-300	// firmware download aborted
-301	// could not open data file
-302	// no answer for datagram
-303	// RAM error
-304	// FLASH error
-305	// Could not clear RAM
-800	// Could not open job file
-801	// Could read file header
-802	// wrong file format
-803	// compressed data currently not supported
-804	// Could read info header
-805	// Could read cut info
-806	// Could send query command
-807	// Got no info from graver (timeout)
-808	// SetMark of loader failed
-809	// loader is out of sync
-810	// Wrong color depth encountered

Number	Text
-811	// Could not create bitmap
-812	// No trotec info found
-812	// Error retrieving color table
-900	// could not initialize rubber
-901	// could not initialize bmp line
-902	// could not retrieve line from CRubber
-903	// invalid (NULL) job specified
-904	// move of file failed
-905	// copy of file failed
-906	// error in ICDDIK db Kernel
-907	// job history reports negative time value
-997	// This is an info for the user
-998	// Assertion failure in release version
-999	// should never occur
-1000	// Obsolete
-1010	// Attempt to select nozzle for unavailable color
-1011	// Attempt to move nozzle without connection to device
-1020	// Obsolete
-1021	// Obsolete
-1030	// Obsolete
-1100	// FW-Update - general information
-1101	// FW-Update successfully finished
-1102	// FW-Update finished with error
-1111	// FW-Update Version number of DSPX.HEX
-1112	// FW-Update Version number of DSPY.HEX
-1113	// FW-Update Version number of DSPZ.HEX
-1114	// FW-Update Version number of DSP_RGV.HEX
-1115	// FW-Update Version number of DSP_LASER.HEX
-1116	// FW-Update Fram version
-1117	// FW-Update Preload version
-1118	// FW-Update Download version
-1119	// FW-Update c167version
-1120	// FW-Update Date of Firmware-file
-1121	// FW-Update Time of Firmware-file
-1122	// FW-Update Model-Number in Firmware-file

7.2 Hardware feedback

Machine errors are shown after 30 seconds!

Error Code 123	A device on the CAN bus is not working properly
Error Code 124	Switching Point density is too high
Error Code 125	Bitmapline not finished (with engraving mode only)
Error Code 126	Wrong combination of firmware / JobControl
Error Code 128	Firmware Update Error
Error Code 129	Fault of Laser DSP
Error Code 130	x-axis Lost positions
Error Code 134	Wrong Connection of x-axis encoder
Error Code 135	Wrong x-axis Encoder
Error Code 138	Illegal reference switch operation X axis
Error Code 146	y-axis lost positions
Error Code 146	y-axis lost positions
Error Code 150	Wrong Connection of y-axis encoder
Error Code 150	Wrong Connection of y-axis encoder
Error Code 152	Wrong connection of y-axis motor
Error Code 154	y-axis reference switch triggered
Error Code 162	z-axis lost positions
Error Code 166	Wrong Connection of z-axis encoder
Error Code 166	Wrong Connection of z-axis encoder
Error Code 169	z-axis limit switch triggered
Error Code 170	z-axis reference switch triggered
Error Code 194	rotary lost positions
Error Code 198	Wrong Connection of rotary encoder
Error Code 202	rotary reference switch triggered

This list is just a hint on where to look at. For detailed information on reasons and possible solutions of the error code, please consult the Error Code list available on Merlin.

8 Recommended service intervals

Due to safety reasons we recommend to check the interlock mechanisms on a yearly basis. Nevertheless any fault on an interlock will switch off the laser tube to prevent personell of any injuries.

For any service technician it's important to have information about the life expectancy of the different components. Therefore we recommend a yearly service / maintenance on the machine.

Nevertheless the customer is responsible to do a maintenance according to the Operation Manual.

9 Recommended tools

laser protective goggles for CO ₂
Allen key set inch
Allen key set metric
set of screw drivers
set of screw drivers phillips
side cutting pliers
combination pliers
adjustable wrench
cutter knife
set of hexagon wrenches
laser power meter
electronic multimeter
paper tape for CO ₂
lens cleaner
lens tissue
magnifying glass
engraving materials
brushes in different sizes
x-axis belt tension device
y-axis belt tension device
z-axis belt tension device
BAT (beam alignment tool) for mirror #2
BAT (beam alignment tool) for mirror #3

10 Recommended spare parts Rayjet - Starter Kit

Lens 1,5"	32550
Lens 2,0"	32551
Lens 2,5"	32553
Mirror #1 & #2	32481
Mirror #3	32448
Motorboards (3x)	31498
CPU Board	84809
I/O Board	31497
X-Axis belt	30846
Y-Axis belt (2x)	30848
Z-Axis belt	30844
X-Axis Motor	32484
Y-Axis Motor	32491
Z-Axis Motor	32513
X-Axis Complete	31724
Power Supply for 30W	31394
Power Supply for 12W	31393

11 FAQ's

11.1 Problems you can see in the engraving or cutting result

11.1.1 Trotec test routine

Trotec has developed special test files for quality checks. Start the following tests if you recognize troubles in the engraving result on your laser system:

- Provide the first test file on anodized aluminum and laser plastics
On aluminum you can see if the tickle adjustment is good and if the edit factors have been adjusted correctly.

On plastics you can realize very good if the tickle power setting is too high.

The tests are done at 30% power (depends on your laserpower) and at 100% speed. Use a magnifier (8x) to judge the engraving result.



Tailing is shown on maximum speed

- circles not closed, thin vertical lines missing: too low tickle power
 - doubled images: edit factors/K1 not adjusted correctly
 - frayed edges: tickle delay too small
 - „snow“ in the background: tickle power too high
- Do the following test on laser rubber (2.3mm) from Trotec.
Here you can see if the laser power is big enough, if the shoulder setting is good and if the edit factors for rubber speed have been adjusted correctly.



- shadows beside test pattern: tickle power too high
- doubled images: edit factors/K1 not adjusted correctly

11.1.2 Customer experience

Problem description:	Possible reason:	Solution:
<ul style="list-style-type: none"> ☛ too low engraving depth 	<ul style="list-style-type: none"> ☛ imprecise focusing ☛ dirty optics ☛ table misaligned ☛ too low laser power ☛ dirty beam output window on tube 	<ul style="list-style-type: none"> ☛ check focus ☛ clean optics ☛ check table adjustment ☛ replace tube ☛ clean output window
<ul style="list-style-type: none"> ☛ blurred edges 	<ul style="list-style-type: none"> ☛ imprecise focusing ☛ table misaligned ☛ incorrect Alignment settings (Overtook) 	<ul style="list-style-type: none"> ☛ check focus ☛ check table adjustment ☛ adjust Alignment
<ul style="list-style-type: none"> ☛ bad shoulder angle 	<ul style="list-style-type: none"> ☛ table misaligned ☛ defect electronic board ☛ bad shoulder settings 	<ul style="list-style-type: none"> ☛ check table adjustment ☛ replace board ☛ improve shoulder settings
<ul style="list-style-type: none"> ☛ missing cut lines 	<ul style="list-style-type: none"> ☛ 0 passes in driver or JobControl selected ☛ line thickness in Corel Draw too big ☛ color is skipped 	<ul style="list-style-type: none"> ☛ increase the amount of passes ☛ reduce line thickness to smallest possible value ☛ Set to cutting
<ul style="list-style-type: none"> ☛ shadows on the edges 	<ul style="list-style-type: none"> ☛ tickle power too high 	<ul style="list-style-type: none"> ☛ adjust tickle power
<ul style="list-style-type: none"> ☛ Shadows between letters 	<ul style="list-style-type: none"> ☛ Tickle delay too low 	<ul style="list-style-type: none"> ☛ Adjust tickle delay
<ul style="list-style-type: none"> ☛ Inconstant / alternating engraving depths 	<ul style="list-style-type: none"> ☛ table misaligned ☛ Lasertube is defect / empty ☛ Laserbeam misaligned ☛ Material is not plane (foil) 	<ul style="list-style-type: none"> ☛ adjust table ☛ replace tube ☛ adjust Laserbeam ☛ use multimate
<ul style="list-style-type: none"> ☛ waviness of the lines 	<ul style="list-style-type: none"> ☛ bad THK guide ☛ bad belt tension ☛ too high acceleration settings ☛ Lens is loosen 	<ul style="list-style-type: none"> ☛ replace guide ☛ check belt tensions ☛ reduce acceleration ☛ check if lens sticks to lensholder
<ul style="list-style-type: none"> ☛ no visible marking result 	<ul style="list-style-type: none"> ☛ too low laser power ☛ too high velocity ☛ not focused ☛ wrong focus tool ☛ damaged lasertube 	<ul style="list-style-type: none"> ☛ increase power setting ☛ reduce velocity ☛ check focus ☛ change focus tool ☛ change the lasertube
<ul style="list-style-type: none"> ☛ fine details on stamps are engraved too thin 	<ul style="list-style-type: none"> ☛ incorrect Edit settings ☛ too steep shoulders 	<ul style="list-style-type: none"> ☛ adjust edits ☛ reduce T, increase W
<ul style="list-style-type: none"> ☛ not vertical cut edge 	<ul style="list-style-type: none"> ☛ beam isn't in the middle of the lens 	<ul style="list-style-type: none"> ☛ Problems with non right angled cutt
<ul style="list-style-type: none"> ☛ job has not been 	<ul style="list-style-type: none"> ☛ connection to machine broken 	<ul style="list-style-type: none"> ☛ check the cable connection, the electronics and the com port

finished correctly		on the computer
<ul style="list-style-type: none"> 🔧 Engraved or cut job size doesn't match with size in Corel Draw 	<ul style="list-style-type: none"> ➤ -Raster correction ON ➤ Wrong size settings in the printer driver ➤ Wrong image position is selected in the layout tab (printing) ➤ Wrong machine is selected in the JobControl 	<ul style="list-style-type: none"> ➤ Switch off raster correction in JobControl (settings/advanced options/laser tab) ➤ Use the same size as in Corel draw ➤ Switch in the layout settings to : as in document ➤ Switch to the proper machine
<ul style="list-style-type: none"> 🔧 Engraving quality in the center of jobs is different to the edges 	<ul style="list-style-type: none"> ➤ Incorrect factor K1 ➤ Loose belt ➤ Defect X-Axis 	<ul style="list-style-type: none"> ➤ Adjust K1 ➤ Tension belts ➤ Make a X-Axis service
<ul style="list-style-type: none"> 🔧 Curves looks a little bit angular in acrylic 	<ul style="list-style-type: none"> ➤ You have the wrong program for this application 	<ul style="list-style-type: none"> ➤ Use a CAD / CAM software like TROCAM to get really smooth curves
<ul style="list-style-type: none"> 🔧 Corners and angles not cut or marked through 	<ul style="list-style-type: none"> ➤ The power correction is to low 	<ul style="list-style-type: none"> ➤ Increase the powercorrection. Settings / Material Templates Setup.—correction—

11.2 Machine malfunctions

11.2.1 No error code is created

Problem description:	Possible reason:	Solution:
<ul style="list-style-type: none"> 🔧 no referencing 🔧 after start up 	<ul style="list-style-type: none"> ➤ top, front or side door not closed ➤ defect in the interlock system ➤ mechanical problem on axis ➤ bad limit switch ➤ defect power supply 	<ul style="list-style-type: none"> ➤ close doors ➤ check interlocks ➤ make sure that the mechanical resistance is small ➤ replace the limit switch ➤ measure voltage, if necessary replace it
<ul style="list-style-type: none"> 🔧 no response at switching on of the system 	<ul style="list-style-type: none"> ➤ main fuses blown ➤ power supply defect ➤ FRAM defective 	<ul style="list-style-type: none"> ➤ replace fuses ➤ replace power supply ➤ refresh FRAM / exchange CPU
<ul style="list-style-type: none"> 🔧 no communication to machine 	<ul style="list-style-type: none"> ➤ invalid COM port selection ➤ serial cable defect ➤ COM port is in use by an other program 	<ul style="list-style-type: none"> ➤ change selection ➤ replace cable ➤ close this program, or change the COM port
<ul style="list-style-type: none"> 🔧 connection to machine breaks frequently 	<ul style="list-style-type: none"> ➤ electromagnetic imissions 	<ul style="list-style-type: none"> ➤ make sure that machine and computer are connected to the same electric circuit the original cable lengths should not be exceeded
<ul style="list-style-type: none"> 🔧 offsets between 	<ul style="list-style-type: none"> ➤ dusty encoder ➤ top speed too high 	<ul style="list-style-type: none"> ➤ clean encoder ➤ reduce speed

engraving jobs and cut lines	↗ acceleration too high	↗ reduce acceleration
🔧 The machine makes unusual things	Destroyed FRAM parameters Damaged firmware	Refresh F-Ram parameters Update the firmware
🔧 The Axis make the wrong movements (X-Axis make the movement for the Y-Axis and inverse)	The jumpers on the motor boards are interchanged (The engraving result looks like mirrored)	Use the right codification on each Axis
🔧 Laser head doesn't move back to the exact home position 0 / 0	Wrong offset is adjusted Rulers are misaligned	Adjust the offset new in the service setup Adjust the rulers fixing























11.2.2 Error code is created

Also see Error Codes above **Fehler! Verweisquelle konnte nicht gefunden werden.Fehler! Verweisquelle konnte nicht gefunden werden..**

- Hardware ERROR codes

Error message:	Possible reason:	Solution:
🔧 Tracking error X axis	↗ Faulty X-motor cable ↗ Damaged encoder ↗ Damaged motor driver ↗ Bad wear parts	↗ Replace cable ↗ Replace motor / encoder ↗ Replace driver board ↗ Replace bearings, THK guide or Belts
🔧 Illegal limit switch operation	↗ Damaged limit switch	↗ Replace switch
🔧 Overcurrent Z axis	↗ High mechanical resistance of table ↗ To heavy material loaded	↗ Clean and oil lead screws ↗ Adjust table ↗ Align lead screws ↗ Move the table without loading
🔧 Big shift in the engraving result	↗ Damaged resolver or motor ↗ Bad gearing assembly	↗ Change resolver or motor ↗ Change gearing assembly / X-Axis service

11.3 Problems with the Software

Problem description:	Possible reason:	Solution:
 After installation it is not possible to send jobs to Job control	 spool settings don't match  Wrong settings in the properties of the printer driver	 link the spool directory in Job control to the spool folder in the explorer  select local port: [Directory of Trotec Printerdriver], and print directly to the printer (XP, Vista, Windows7)
 the installation is terminated	 incorrect serial number specified	 please check the serial number in the directory INIfiles on the CD  only here mentioned numbers will be accepted 
 missing material parameters	 on installation „Custom“ and/or wattage was not selected	 repeat the installation, install type custom  make sure that the box that represents the correct wattage is checked
 multiple positioning of jobs is not possible	 selected job is already on the plate	 select the job in the job queue  click on
 when clicking on start error messages occur	 damaged trlog.vol file  crowded Spool directory	 delete trlog.vol  empty spool directory
 missing objects	 RGB parameters don't match object line thickness invalid  Required color is skipped	 disable color calibration  load Trotec color palette from installation CD  change line thickness to 0.001mm  change color to cut or engrave
 Firmware update doesn't work	 no cable connection  main CPU lost FRAM Parameters  damaged CPU board  "Version" for any motor CPU is "0" in Settings-Information	 use cable like specified  refresh FRAM  change CPU board  change motor CPU
 Unable to position job in the center of a marker	 marker too close to page border	 reposition the marker, resize the job
 Not possible to open JobControl or print to JobControl	 Bad material file (e.g. TR_CO2_Material.dat)	 Update material file or reinstall JobControl













<p>🔧 No engraving or cutting</p>	<p>➤ Skipped cut lines or skipped engraving</p>	<p>➤ Set the right functions in the parameter window (double click on the plate)</p>
<p>🔧 Problems with printing jobs to the JobControl</p>	<p>➤ Printer settings</p>	<p>➤ Go to the TROTEC printer properties (start/settings/fax and printers). ➤ Choose the "Port" tab and select the right directory and "local port". ➤ Choose the "Advanced" tab and select "print directly to the printer" ➤ Click OK</p>
<p>🔧 Problems with cutting lines in Corel Draw</p>	<p>➤ Color management</p>	<p>➤ Disable the color management in Corel Draw. ➤ Please use the Corel help to find the color management in your Corel version</p>
<p>🔧 Printing fails There was an error found when printing the document "xyz.cdr" to TROTEC: Do you want to retry or cancel the job?</p>	<p>➤ Incorrect spool path</p>	<p>➤ Set valid spool path within JobControl/Settings/Options/General/Spoolpath.</p>
<p>🔧 Jumbled bitmaps when printing.</p>	<p>➤ "Print directly to the printer" not activated.</p>	<p>➤ Go to the printer properties (start/settings/fax and printers). ➤ Choose the "Advanced" tab and select "print directly to the printer" ➤ Click OK</p>
<p>🔧 No colors are displayed in material dialog.</p>	<p>➤ Material file (e.g. TR_CO2_Material.dat) is write protected (copy from CD-ROM)</p>	<p>➤ Override write protection.</p>
<p>🔧 Error message when attempting to print. "Unable to access printer driver. Try removing and reinstalling this printer driver."</p>	<p>➤ Previous job-size too small. ➤ Reinstallation of the driver does not resolve the problem!</p>	<p>➤ Go to the TROTEC printer properties (start/settings/fax and printers). ➤ Choose the "Print" tab and set Width and Height to something like 100mm (4 in) ➤ Click OK ➤</p>

<p>🔧 Job size orientation does not match the chosen settings.</p>	<p>➤ CorelDraw message "Printer paper orientation does not match one or more document pages. Adjust printer automatically?" was accepted with "Yes".</p>	<p>➤ Always prevent from automatic adjusted page sizes by selecting "No".</p>
<p>🔧 A new JobControl opens for each job printed.</p>	<p>➤ File jc.ini is write protected.</p>	<p>➤ Remove write protection.</p>
<p>🔧 Unwished printer driver default settings</p>	<p>➤ Default settings are bad</p>	<p>➤ Go to Trotec printer properties (Advanced / Printing defaults) and change it</p>
<p>🔧 Unable to change material settings</p>	<p>➤ You are logged in as an user</p>	<p>➤ Log in as administrator</p>
<p>🔧 Bad raster quality</p>	<p>➤ Default settings of raster options are bad</p> <p>➤ Raster correction in the JobControl is not activated</p>	<p>➤ Go to printer properties (Print/ Halftone Settings) and select 8x8</p> <p>➤ JobControl / Settings / Options / Process Options / Quality. Check raster correction</p>
<p>🔧 Automatic cutting line in not modifiable in JobControl</p>	<p>➤ You are not in the preview mode</p>	<p>➤ Make a double-click on the job</p>

11.4 Laser Quick Check

The laser quick check is thought for situations where you don't see an obvious problem, but want to do check the temporary condition of your machine.

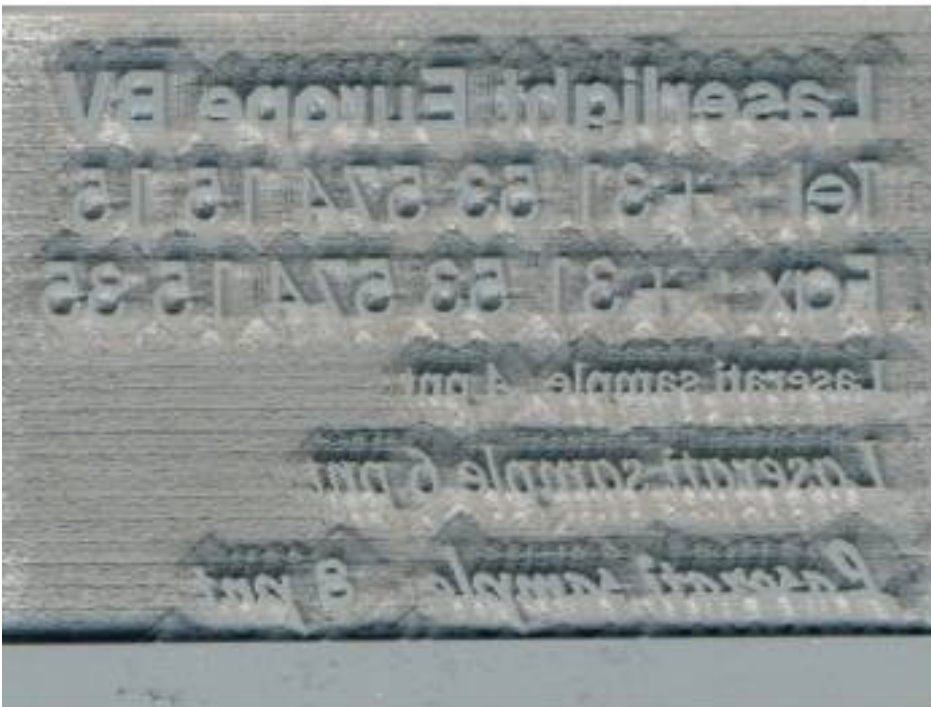
- check the optical components (lens, mirror#1, mirror#2, mirror#3, beam combiner)
- check the grade of soiling (engraving area)
- verify home position
- listen carefully to eventual noise generation

Problem description:	Possible reason:	Solution:
 noisy cooling fans	 damaged ball bearings  incorrect supply voltage  old fan version	 replace fan  wrong fan installed – change it
 noisy or vibrating table	 old version of the lead screws	 Oil and adjust the lead screws new. If you have no success change to the redesigned one.
 Lower laserpower (less engraving depth in rubber, reduced engraving speed)	 Scratches on the optical components	 Change the scratched optics

- classify the engraving quality of your results
- check the laser beam alignment (CO2 laser and red dot)

11.5 Samples

Good shoulder settings



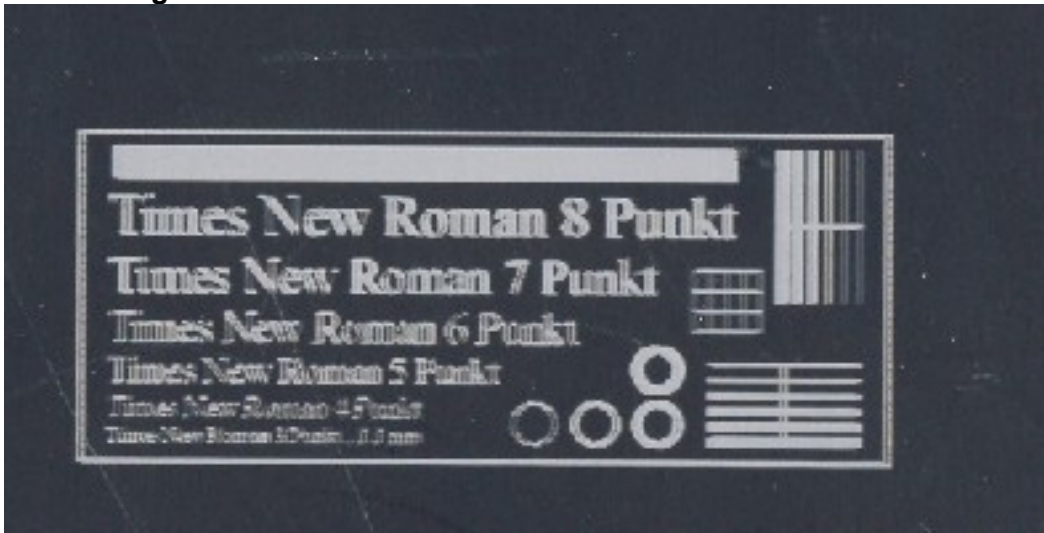
Bad shoulder settings



Shadow on the edges



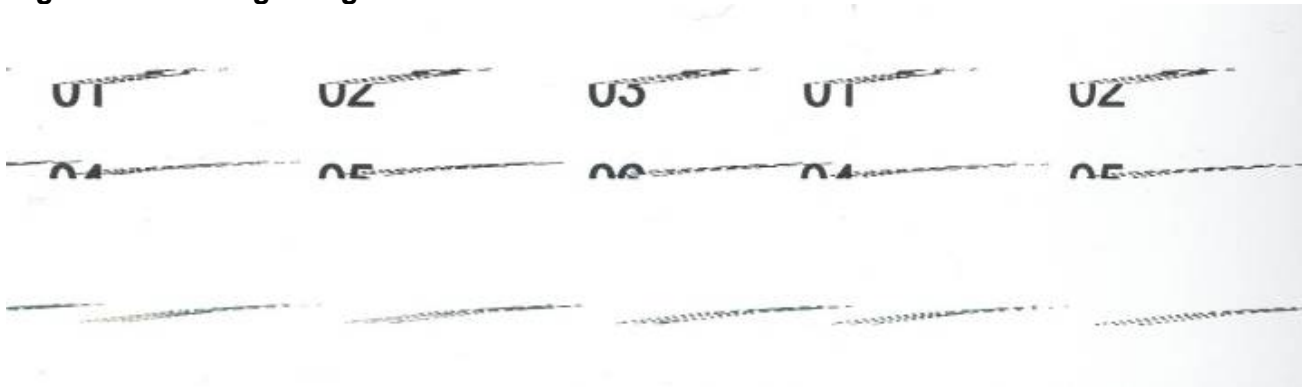
Blurred edges



Waviness of lines



Big shift in the engraving result



Engraving quality in the center is different to the edges



Bad power correction

