

RhinoLaserGRBL

USER MANUAL

Complete user and operation manual

Version 1.0.1 | Rhino 8 for Windows

Design -> Prepare -> Preview -> Send -> Machine

Product scope: RhinoLaserGRBL 1.0.1 is a laser-only Rhino 8 plug-in for preparation, preview, G-code generation and GRBL-family laser control. CNC spindle, pocket, drilling and general Z-axis machining workflows are intentionally outside this release.

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1. Product overview

RhinoLaserGRBL keeps the fabrication workflow inside Rhinoceros 8. Geometry can be prepared, assigned to laser processes, previewed, framed and streamed to a supported controller without exporting the design to a separate laser application.

- Vector cut, mark, line engraving, fill and fill+outline.
- Kerf compensation, lead-in and lead-out for supported vector workflows.
- Material presets and layer-to-process bindings.
- Raster image engraving with live Rhino placement and scan-angle control.
- Material power/speed test matrix.

- Toolpath preview, G-code view/export and job analysis.
- Buffered GRBL streaming with pause/resume, cancel and emergency stop.
- Manual-origin and homing workflows.
- Live machine-head position and workspace overlays.
- Persistent diagnostics, self-check and support report export.

Primary workflow: Design -> Prepare -> Preview -> Frame -> Send -> Machine.

2. System requirements and compatibility

Item	Current release
Rhino	Rhino 8
Operating system	Windows
Transport	USB / serial
Primary tested protocol	GRBL 1.1 family; GRBL 1.1f is the primary physically tested target
Other detected families	grblHAL, FluidNC and conservative GRBL-compatible mode; broader hardware validation is still required
Not claimed in 1.0.1	Marlin laser mode, Smoothieware, Ruida, Trocen and proprietary DSP controllers
Network / Wi-Fi	Not enabled in this release

Compatibility: Controller-family detection does not automatically mean every machine variant has been physically validated. Test machine-specific behavior during the 15-day trial.

3. Installation and updates

3.1 Rhino Package Manager

1. Open Rhino 8.
2. Run _PackageManager.
3. Search for RhinoLaserGRBL.
4. Install the desired version.
5. Restart Rhino before first use.

3.2 Direct .yak installation

The Yak CLI included with Rhino 8 can install a local .yak file. Example:

```
"C:\Program Files\Rhino 8\System\yak.exe" install "C:\Downloads\rhinolasergrbl-1.0.1-rh8_0-win.yak"
```

3.3 Updates

The Package Manager can detect newer published versions. Commercial licenses are perpetual for eligible builds; update entitlement is tracked separately. A build released after the update-entitlement date may require renewal, while an older eligible build remains usable.

4. Trial and commercial licensing

Plan	Use / capacity
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Free Trial	15 days, full features while active.
Individual	Perpetual use, up to 2 computers.
Studio	Perpetual use, up to 5 computers.
Business	10+ computers by agreement.

The plug-in verifies signed .rlglicense files locally. The private signing key is not included in the public plug-in.

4.1 Trial

- Trial starts on first use.
- Trial data is protected locally and bound to the computer.
- If the system clock moves backwards significantly, validation may be required.
- When the trial expires, machine-control actions are blocked; non-machine functions remain available for evaluation and support.

4.2 Import a purchased license

6. Open TOOLS -> LICENSE.
7. Copy the Machine ID if requested by the licensing process.
8. Use IMPORT LICENSE and select the signed .rlglicense file issued for that computer.
9. Confirm the status changes to ACTIVE and shows the correct edition.

Licensing support: grbl@osbase.com.br

5. Interface overview

Area	Purpose
COLORS	Assign vector processes and edit fill/kerf/lead settings.
MOVE	Jog, workspace overlay, origin recovery, laser-off and emergency controls.
TEST	Create and run a material power/speed matrix.
IMAGE	Import and prepare raster image engraving.
TOOLS	Job analysis, materials/layers, machine/controller, licensing and diagnostics.
Settings tab	Workspace and lower-level machine/application settings.
Global controls	FRAME, SEND, PAUSE/RESUME and STOP are shared by the active main workflow.

6. Machine profiles

Machine profiles store the connection and physical-workspace settings for a laser system. In the current UI, selecting a saved profile asks whether it should be loaded.

Profile field	Meaning
Name	Human-readable machine/profile name.

Port	Preferred serial port. Automatic startup connection does not fall back silently to another COM port.
Baud	Serial baud rate. Default is 115200.
Width / Height	Configured work area in millimeters.
Max S	Maximum controller S value used for power mapping.
Homing / limit switches	Explicitly enables the homing workflow for a physically configured machine.

- SAVE CURRENT updates the selected saved profile after confirmation.
- DELETE removes the saved profile but does not alter the currently loaded runtime settings.
- FIRST-RUN WIZARD / NEW PROFILE creates a new profile and synchronizes the workspace.
- Applying a different profile invalidates the current position reference and refreshes the workspace.

7. USB / serial controller connection

7.1 Connect

10. Connect the laser controller by USB.
11. Select the correct COM port.
12. Connect using the saved profile baud rate.
13. Allow the controller detector to process startup text, realtime status (?) and read-only build information (\$!).
14. Confirm the controller is identified before machine actions.

Read-only detection: The identification handshake does not move the machine, home it, fire the laser, reset it, unlock it or rewrite persistent controller settings.

7.2 Controller classifications

Display	Meaning
GRBL 1.1	A direct GRBL 1.1-family controller was identified.
grblHAL	Banner/build data identified grblHAL; compatible GRBL command path is used.
FluidNC	Banner/build data identified FluidNC; compatible serial GRBL command path is used.
GRBL-compatible	Protocol evidence is sufficient for safe conservative operation, but exact firmware family was not proven.
detecting / unknown	Do not use raw machine commands until identification succeeds.

8. Workspace and machine reference

8.1 Workspace

Workspace width and height are the single source used by MOVE limits, FRAME/SEND validation, raster bounds, the viewport overlay and the Rhino workspace rectangle. The default settings file uses 350 x 350 mm, but profiles can use other dimensions.

- HIDE/SHOW BED toggles the viewport workspace overlay.
- HIDE/SHOW HEAD toggles the live work-position marker.
- RECREATE BED synchronizes the locked document workspace rectangle to the active profile dimensions.

8.2 Manual-origin workflow

15. If necessary, click RELEASE MOTORS. This forces laser off and invalidates the reference.
16. Move the head physically to the intended work origin.
17. Click SET ORIGIN.
18. Wait for READY. The current position is established as work X0 Y0.

Reference validity: Reset, sleep, manual motor release, power loss or other lost-position events make the software position reference invalid on a machine without homing. Re-establish the origin before running a job.

8.3 Homing workflow

19. Use only on a machine with working homing/limit switches.
20. Enable Homing / limit switches in the active machine profile.
21. Click HOME MACHINE.
22. Wait for the homing cycle to complete.
23. The plug-in establishes a deterministic work origin at homed X0 Y0 after successful completion.

9. MOVE / jog controls

Control	Behavior
Step mm	Jog distance for X/Y buttons.
Feed	Jog feed rate.
X- / X+	Jog negative or positive X.
Y- / Y+	Jog negative or positive Y.
HOME 0,0	Return to known work origin X0 Y0; does not execute automatic homing on a manual-origin profile.
HOME MACHINE	Run machine homing only when the profile explicitly uses limit switches.
RELEASE MOTORS	Laser off, release motors, invalidate position reference.
SET ORIGIN	Set current physical position as work X0 Y0.
LASER OFF	Request M5 / S0 without changing origin.
E-STOP	Laser off, soft reset, clear active job and invalidate position.

10. Vector processes and COLORS

Select Rhino curves and assign a configured process/color. Completed vector objects can be marked as done and are skipped by subsequent SEND/FRAME operations until the cut state is reset.

Process / option	Purpose
LINE / CUT	Follow the curve as a line path.
FILL	Generate hatch-style engraving inside closed curves.
FILL + OUTLINE	Run fill plus an outline path.
Fill interval	Spacing between fill scan lines.
Fill angle	Angle of fill lines.
Cross hatch	Adds a second fill direction when enabled.
Kerf CENTER / INSIDE / OUTSIDE	Controls offset side for closed line/cut paths.
Kerf mm	Full beam/tool width used by compensation.
Lead-in / Lead-out	Optional path extensions for supported closed paths.

11. Job preparation, preview and G-code

- Job analysis summarizes the prepared geometry and path complexity.
- Toolpath preview shows the generated path before sending.
- VIEW G-CODE opens the generated file in Windows Notepad.
- EXPORT G-CODE saves the generated commands for inspection or external use.
- Path optimization can reduce unnecessary travel/order overhead for compatible geometry.

Preflight: Before SEND, RhinoLaserGRBL checks connection/controller status, position reference, machine state, toolpath/workspace validity, power/feed data and whether another job is active.

12. Global FRAME / SEND / PAUSE / STOP controls

Control	When active	What it does
FRAME	Connected + GRBL-compatible + valid reference + Idle + no conflicting operation	Runs the active workflow frame boundary.
SEND	Same readiness conditions as FRAME	Runs preflight and streams the active workflow.
PAUSE	Only while a stream is active	Sends realtime hold and changes to RESUME while paused.
RESUME	While paused	Continues the active GRBL stream.
STOP	Only while a stream is active	Cancels the job, forces laser off and performs safe recovery logic.

The active main tab determines what FRAME and SEND act on. For example, when IMAGE is active, global FRAME frames the image placement and global SEND runs the raster job.

13. Material test matrix

The TEST tab creates a calibration matrix where columns are power values and rows are speed values.

- Material name for reference.
- Square size and gap.
- Passes.
- Power From / To / Step.
- Speed From / To / Step.
- Light label power and speed.
- CREATE / UPDATE MATRIX generates the test geometry.
- FRAME TEST and RUN TEST operate on the matrix.

Fit check: The test matrix is rejected if it does not fit inside the configured workspace.

14. Raster image engraving

The IMAGE tab imports PNG, JPG or BMP images for bidirectional raster engraving. Image placement can be moved, rotated or scaled in Rhino and then synchronized back to the raster settings.

Setting	Purpose
X mm / Y mm	Image placement origin in the workspace.
Width	Physical width of the raster job.
Line mm	Spacing between raster scan lines; larger values reduce command count and detail.
Scan angle	Raster scan direction relative to the image placement.
Speed	Raster feed rate.
Min % / Max %	Power range used for image intensity mapping.
Brightness / Contrast / Gamma	Image tonal adjustments.
Gray levels	Number of quantized intensity levels.
Mode	GRAYSCALE, THRESHOLD or FLOYD-STEINBERG.
Invert grayscale	Invert dark/light mapping.
Skip blank scan lines	Avoid generating empty raster passes when possible.

- IMPORT IMAGE selects the source image.
- UPDATE / SYNC PREVIEW updates the Rhino placement and raster summary.
- Use the global FRAME and SEND controls while IMAGE is the active tab. Dedicated FRAME IMAGE / RUN IMAGE buttons were removed because they duplicated the global actions.

Large raster jobs: Increase Line mm, reduce physical image size or gray levels, or use Threshold/Floyd-Steinberg when command counts become excessive.

15. Controller detection and machine states

State	Meaning / action
OFFLINE	No active serial connection.
detecting / unknown	Serial is open but controller identity has not been proven.
POSITION UNKNOWN	The physical reference cannot be trusted; use SET ORIGIN or HOME MACHINE according to profile.
READY	Controller is Idle and the work reference is valid.
HOMING	Homing cycle is in progress.
MOTORS RELEASED	Reference is invalid until re-established.
PAUSED	GRBL realtime hold is active.
ALARM	Do not blindly continue; diagnose limit/homing/controller condition first.

16. Diagnostics and support reports

- PROBE CONTROLLER repeats safe controller identification.
- SELF-CHECK validates internal parser/state assumptions and diagnostics logic.
- Support Report includes controller identity/capabilities, machine settings, process rules and recent technical log lines.
- Support Report does not include Rhino geometry, generated G-code, image contents or document file names.

When contacting support, send the report to grbl@osbase.com.br together with a concise description of what happened.

17. Troubleshooting

Symptom	What to check
Controller stays unknown	Correct COM port; USB driver/cable; use PROBE CONTROLLER; look for GRBL-style status or \$I output.
FRAME/SEND disabled	Controller must be verified, reference valid, machine Idle and no job/homing/cancel pending.
POSITION UNKNOWN	Manual profile: move to physical origin and SET ORIGIN. Homing profile: HOME MACHINE.
Job stutters	Check USB stability and streaming telemetry; simplify heavily segmented geometry.
Raster command count is very high	Increase Line mm, use Threshold/Floyd-Steinberg, reduce image size/detail, keep blank-line skipping enabled.
Alarm after homing	Check switches, homing direction and GRBL homing configuration. Do not blindly unlock and continue.
Workspace rectangle does not match profile	Load the intended profile and use RECREATE BED. The overlay and document rectangle should use the same width/height settings.
License rejected	Confirm the license is for this product and Machine ID and that the file has not been modified.

18. Safety rules

Critical: RhinoLaserGRBL controls real machine motion and a laser source. Software checks are supplementary. They do not replace machine-side interlocks, emergency controls, correct wiring, enclosure/PPE, ventilation or operator supervision.

- Laser output is intended to remain off during connection, travel, frame and recovery.
- A serial port is not treated as a usable controller until GRBL-compatible behavior is identified.
- Jobs are blocked when the work reference is unknown.
- Emergency stop resets the controller and invalidates the software position reference.
- Verify material suitability and fire risk before every job.
- Never leave a laser job unattended.

19. Privacy and local data

The current licensing and diagnostics design is local-first. The public plug-in does not need to send your Rhino geometry, project files, image contents or G-code to a licensing server. Local license/trial state and machine settings are stored on the computer. Future online licensing may add explicit account/activation communication, which should be documented separately when released.

20. Support and commercial plans

Website: <https://osbase.com.br/rhinolasergrbl>

Support and licensing: grbl@osbase.com.br

Plan	Capacity
Free Trial	15 days, full features.
Individual	Up to 2 computers.
Studio	Up to 5 computers.
Business	10+ computers by agreement.

Commercial licenses are designed as perpetual-use licenses for eligible builds, with update entitlement managed separately.

Appendix A. GRBL command behavior

Action	Typical GRBL behavior
Connection identification	Read-only realtime ? and \$I probing.
Travel / recovery	Laser off commands M5 / S0 are used where appropriate.
Pause	Realtime ! hold.
Resume	Realtime ~ resume.
Manual SET ORIGIN	Establishes the current physical position as work X0 Y0.
HOME MACHINE	Uses \$H only when homing mode is explicitly configured.

E-STOP	Soft reset, job clear and reference invalidation.
Persistent settings	No automatic rewriting of \$20/\$21/\$22/\$30/\$32 during detection.

Appendix B. Glossary

Term	Definition
Workspace	Configured XY work area used by validation, overlays and job bounds.
Work origin	The X0 Y0 reference used by the current RhinoLaserGRBL job.
Machine profile	Saved connection, workspace and origin-mode configuration for a laser.
Frame	Boundary-only positioning pass used to verify placement before a job.
Preflight	Safety/validity checks performed before execution.
GRBL-compatible	Endpoint that demonstrates sufficient GRBL protocol behavior for conservative operation.
Maintenance / update entitlement	Date through which newer releases are included for a commercial license.
Machine ID	Local computer identifier used to bind a signed license file.