

TriboSolver 3.2 operating manual

This manual covers the 3.2.0 portable Windows release with the six retained 3.1 simulation families. Extract the complete package, activate your signed license and keep your saved inputs and results.

Available calculations

Dry contact and coatings, adhesion and electroadhesion, contact temperature, mixed-lubrication load sharing, seizure and wear remain available as in 3.1. Batch analysis, parameter studies, result persistence and reports remain in this release. New numerical EHL routes (including the separately exposed legacy point and line full-film models), the analytical Tools menu and the in-app updater are deferred. A project that selects a deferred model cannot calculate in this release. Historical results do not qualify that model for a new calculation.

License renewal

In a licensed production build, open Help > License and privacy status to inspect access. Starting one calendar month before the signed expiry date, an in-app reminder shows the date and days remaining. The expiry date itself is included in the license period. This is a local reminder while the app is running, not an email or a notification from a closed application.

Select Refresh License... in the reminder or Help menu. Request renewal... opens the tribology.eu contact page. Install renewed license... accepts an already issued signed license; opening the website does not extend access. The replacement must pass validation and extend the installed expiry date. Finish or cancel the current calculation first. Save any results you need, then install the renewed file and reopen TriboSolver after it closes. Current inputs are saved for recovery; accept the EULA again if prompted. A rejected replacement leaves the installed license unchanged.

Pilot/trial license holders can select Help > Buy License... to open the license selection page on tribology.eu. Purchase and license issuance happen through the website; the button does not make a payment or install a license inside TriboSolver.

Installing a release

Downloads are installed manually. Save your work, close TriboSolver and extract the complete new package into a separate folder. Retain the previous complete package for rollback. A software update does not renew a license. Customer licenses are delivered separately and are not bundled.

Parameter studies

Open Results → Parameter study to vary normal load (N) or Body 1 speed (m/s), where applicable to the selected model. Enter distinct values separated by commas or spaces, check the preview, and select Start study and an output folder. Each point uses a fresh copy of the current setup and original geometry; Body 2 speed stays fixed. Adhesion and wear histories restart for each point.

Each successful point is saved as a complete .tribo file in a new study folder. The scalar CSV records every point's value, status and saved-file reference. Measured surface files are copied into the study's inputs folder before the first run, protecting later points from changes to the original files. Keep this folder with the saved results to retain their source geometry. Failed or cancelled outputs are unavailable, not zero. The response plot shows actual successful samples, sorted by parameter value. Choose a scalar, click a sample to select its run, or use Open selected result. Mouse-wheel zoom, reset and Save Image work as in other result plots. Use the CSV to retain study coordinates and all available scalar values after closing the dialog.

Run a simulation

1. Open Simulation Type and select one of the six product simulations: Dry Contact, Adhesion, Contact Temperature, Mixed Lubrication, Seizure, or Wear.
2. The application selects the corresponding model for that simulation type.
3. Use the left navigation to enter the inputs shown for that simulation. The available pages depend on the selected calculation: Lubricant Model appears only for Mixed Lubrication and Seizure, and Micro Geometry appears for a Dry/Thermal calculation only when Include micro geometry is checked. The navigation subtitles summarize the active values on each page.
4. Select Run solver. The calculation runs away from the UI thread. The status banner reports the active model and elapsed time until completion or cancellation.
5. Open Results to inspect the field and status diagnostics. In the portable ZIP, automatic result saves use the DATA folder beside TriboSolver.exe. An installed MSIX uses its writable per-user local application-data DATA folder because Windows makes the installation directory read-only. Check the save status before closing the result. Select Cancel to request bounded cancellation between solver operations.

Input rows also follow their controlling choice. In Macro Geometry, Point Contact shows four body radii, Line Contact shows the two X radii, and Flat Contact requires no radii. Coating, friction coefficient, second measured surface, PSD, and subsurface-depth rows appear only when their corresponding switch is enabled.

The X/Y numerical grid is solved directly. Open Settings > Numerical settings to configure the calculation controls: Initial load-sharing factor (γ_1), Load-sharing relaxation, Outer convergence tolerance, Zero-load tolerance, Maximum outer iterations, Conjugate-gradient tolerance, Maximum conjugate-gradient iterations, Adhesion relaxation factor, and Reuse previous solution. The dialog also contains Maximum grid points per axis. That limit defaults to 2048 and supplies the current ceiling for X/Y, subsurface-depth, coating-depth, and generated-PSD point controls in every simulation family. Normal project defaults are 128 x 128; increasing the ceiling does not enlarge an existing grid. Large grids can require substantial memory and calculation time. Use Restore Defaults in the dialog to restore the default numerical values and the 2048-point grid limit.

The Micro Geometry page defaults to Use only one measured surface. When a surface format contains physical sampling metadata, including Zygo DATX X Converter/Y Converter metadata, importing it automatically fills Step X and Step Y in metres. Formats without sampling metadata continue to use the values entered in those fields. The imported Body 1 surface is shown directly on the Micro Geometry page after it is interpolated to the active X/Y numerical grid using linear interpolation. If the measured physical area is smaller than the calculation domain, TriboSolver centers the measurement and extends it with edge-repeating mirrored tiles before interpolation.

Generated PSD surfaces use the same preparation path. Press Generate / preview PSD surface to show the generated topography on the active numerical grid; open the adjacent PSD preview tab to inspect the log-scale radial spectrum with labeled qL and qS cutoff markers. When Correct plane tilt is selected, a two-pass robust plane fit is applied after interpolation/mirrored extension. It rejects topographic outliers twice before fitting the residual tilt, preventing a raised burl or deep valley from biasing the reference plane.

Batch analysis of measured roughness

On Micro Geometry, select Batch analyze a roughness directory to run the selected simulation once for each supported surface file in a directory. The first chooser selects the input directory; the second selects a separate output location. Review the displayed file count and names before pressing Start batch. Discovery includes only files directly in the chosen directory, not subdirectories. The supported formats match Import Body 1. Previous tribosolver-batch-summary-*.csv files are excluded. Text files with recognized TriboSolver result or summary headers are also excluded, even after renaming.

The current calculation settings are copied for each file. That file becomes the Body 1 measured surface, replacing generated PSD or embedded Body 1 topography. If a Body 2 measured surface is selected, it remains a common input. Each file is solved independently; reuse of a previous solution is disabled for the batch. The single-file import and Run solver workflow is unchanged.

Each batch creates a new batch-... folder under the selected output location, so a repeated run does not overwrite an earlier one. A successful file gets its own complete .tribo result set with the actual input settings and source path. The same folder contains one tribosolver-batch-summary-*.csv file. It has a row for every discovered input, the source and result paths, status, error text, and a column for each scalar returned by the selected solver. Column names include units. Values use the displayed units at full saved precision; an unavailable value has a blank cell. Field arrays and volumes remain in the individual .tribo files, not in the scalar summary.

An invalid input or failed solver is recorded in its row, and processing continues with the next file. Press Cancel in the batch progress window to stop after the current solver operation. Completed result files remain; the summary marks a cancelled current file and files not yet started. If a result file or summary cannot be written, inspect the on-screen error and choose a writable output location before retrying.

Use the toolbar Surface Generator action to open the synthetic self-affine surface controls. Use Surface Analysis to load one measured surface and calculate Sa, Sq, Ssk, Sku, Sz, X/Y correlation lengths, and Hurst exponent. The analysis window also shows detrended topography, a height distribution, and the log-scale radially averaged 2D PSD; file-provided Step X/Step Y values are applied automatically when available.

Extract the complete desktop package before starting TriboSolver.

For Dry Contact, enabling Include coatings automatically selects the layered-contact calculation; no separate numerical model selection is required. Coating modulus, Poisson ratio, and thickness all reach that calculation. If a coating has exactly the same elastic modulus and Poisson ratio as its substrate, changing its thickness alone is physically equivalent to the homogeneous material and therefore does not change the elastic pressure solution; the run status calls this out explicitly.

Keyboard access

- Alt+1 through Alt+6 select Dry Contact, Adhesion, Contact Temperature, Mixed Lubrication, Seizure, and Wear respectively.
- Ctrl+Page Up and Ctrl+Page Down move through the visible setup pages.
- F6 moves focus to the setup-page navigation tree; use the arrow keys and Enter to select a page.
- Ctrl+Shift+O loads a complete native result set (or a legacy single-field CSV), and Ctrl+R runs the selected simulation. Standard Ctrl+O, Ctrl+S, F1, menu mnemonics, Tab, and Shift+Tab remain available.

Projects and exports

Use File > Save Inputs to create a versioned .tribo.json project. Use File > Load Inputs to reopen it. New projects use the formal native v1 contract with a stable project UUID, UTC timestamps, workflow identity, and a SHA-256 payload-integrity check. Normalized measured-surface geometry is embedded so the project remains portable if its original import file moves. Older UI schema versions 1 through 5 are migrated on read. The Results page lists every field returned by the selected solver. After a successful calculation, the application attempts to save a complete .tribo result set and a companion CSV for the selected field. Successive automatic saves choose a free filename so an earlier native result or companion CSV is preserved. Check the save message: a calculation can succeed even if saving fails. If the native result saves but the CSV fails, the message identifies the saved result and the CSV failure; reopen the native result and retry the export after correcting the destination problem. Load the complete set through File > Load Results, Ctrl+Shift+O, or the button on the Results page; the variable selector is repopulated with every stored field. Legacy .tribo-results.json files remain readable. Loading a native result also restores its captured setup when available. Use Save Results... to choose a destination for the complete native dataset, including all stress volumes; this saves all results regardless of the selected plot. Native saving reuses the stored numerical buffers to reduce temporary memory use; it still writes the complete dataset. If a companion CSV runs out of memory after the native file was saved, the save message identifies the retained native file. CSV exports contain only the selected field or slice, suggest a filename identifying that variable, and include its readable name and internal identifier in the header. Each entry opens directly in the active DATA folder; the Results page also has Open Results Folder. PDF and DOCX reports default to Documents\TriboSolver\Reports and contain inputs, diagnostics, summary values, and the selected plot. PDF reports also retain the complete result inventory and include a separate selected-output page. Select PDF+DOCX to create both formats from one base filename.

Keep results associated with their run

The Results page shows the run identity and capture time when available. It also indicates whether the current setup matches the captured setup. Editing inputs does not change the completed result: rerun the calculation to obtain results for the new setup. Displayed/exported results use their captured inputs and coordinates, including after a native result is reopened.

Older results may lack a complete input snapshot. A CSV can retain its source run identity without containing the original inputs. The application labels these limitations instead of filling them from the current form. Where neither physical coordinates nor stored spacing are available, plots show sample or row/column indices. Do not interpret those indices as physical distances.

Export a selected stress slice

1. Choose the desired body and stress component in Variable.
2. Use All X, All Y, and All Z to choose the varying axes: none for a point, one for a profile, or two for a plane. Set the indices of fixed axes.
3. Click Plot selected cross-section and review the body, values and fixed coordinates. After changing these controls, click Plot again before exporting.
4. Use Export CSV... or Export report... for that selection. If the changed selection has not been plotted, the application asks you to plot it before requesting a filename.

The selected CSV carries the selected values, units, body/component, coordinates and available run identity. Saving the complete native result retains all stored fields and volumes, so you can reopen it and choose another slice. A selected CSV contains only that exported selection.

Explicit coordinate arrays retain nonuniform spacing when reopened. Map rows follow the stored coordinate order, so depth can increase downward. In a 3D surface view, height represents the selected field value; the orientation guide names the two plane axes separately. Hover on a large, simplified surface picks its displayed mesh vertices, which may omit intermediate samples; use a profile or CSV to inspect those samples.

New native result files that preserve explicit slice coordinates may not open in TriboSolver 3.0. Keep original files when exchanging results across versions, and use 3.2 to reopen the new coordinate-aware files. Older CSV readers may read the numeric matrix while ignoring its coordinate comments.

Result maps include numeric X/Y tick values and axis units, a numeric colorbar with the displayed variable unit, and a labeled center-line cross-section with numeric ticks. One-dimensional profiles and iteration histories use line plots with numeric tick values, labeled axes, and units. When Calculate subsurface stresses is enabled, the same calculation result contains all XX, YY, ZZ, XY, XZ, and YZ stress tensors plus derived Von Mises stress; maximum, intermediate, and minimum principal normal stresses sigma 1, sigma 2, and sigma 3; and maximum principal shear stress tau max for every requested Body 1/Body 2 depth. Depth planes are not duplicated in the variable list. Select one of these stress volumes to reveal the All X/All Y/All Z cross-section controls and Plot selected cross-section button; ordinary 2D and scalar variables keep those controls hidden. The complete volumes are preserved when the result set is saved and reopened. Here $\text{sigma } 1 \geq \text{sigma } 2 \geq \text{sigma } 3$. Maximum principal shear is a separate derived result, $\text{tau max} = (\text{sigma } 1 - \text{sigma } 3) / 2$; it is not one of the three principal normal stresses.

Open report after export and Open folder after export are optional and off by default. When enabled, they ask Windows to open the successful export or its containing folder. Report filename, format, and these preferences are saved with the project.

Legacy project/result files are never guessed or silently converted. An unsupported file must fail with an explicit migration message so that the original data remains untouched.

The application writes a debounced, atomic recovery snapshot of the current inputs. If the previous process ended abnormally, the next launch restores the snapshot and reports that an interrupted session was recovered. A normal close clears the interruption marker; explicitly saved projects remain the durable record of work.

Diagnostics and support

Record the application version, simulation family, project file, outcome, iteration count, and displayed diagnostic when reporting a problem. Do not send confidential project data unless an authorized support channel asks for it.

Use Help > Export support diagnostics to create a JSON support record. It contains the application and Qt versions, exact executable hash, Windows and display metadata, selected simulation/workflow, result dimensions, and solver status. It deliberately excludes project inputs, imported paths, surface values, result fields, licenses, and user identity. Review the file before sending it through an authorized support channel.

For operating instructions, select Manual on the toolbar or Help > Manual to open the bundled operating manual offline.

Worked examples and interpretation

Open the Examples folder beside TriboSolver.exe. Each included example folder contains a Guide.pdf and one .tribo.json input file. Read the guide, load the input through File > Load Inputs, check the units and surface settings, then run the selected model. The included folders cover rough point contact, coatings, temperature, subsurface stress, mixed lubrication, seizure, adhesion, electroadhesion and wear.

A successful solver status establishes completion of that numerical calculation. It does not establish that the inputs represent your experiment or that the model is suitable for a design decision. Check convergence diagnostics, applied load, domain and grid resolution, material assumptions and the applicable example instructions. Retain the complete result and its input snapshot so another reviewer can inspect the calculation. Never interpret an unavailable or failed output as zero.

Problems opening or saving a package

If license access is unavailable, inspect Help > License and privacy status and the signed expiry date. Install an issued renewal through Refresh License; changing the computer clock or visiting the website does not renew access. A license file is separate from the software ZIP.

If a save fails, keep the application open and choose a writable destination. Check that the native result exists before closing. If Windows blocks extraction or execution, record its exact message for support and keep the downloaded package unchanged. For rollback, close the new application and reopen the previous complete package; keep original input and result copies when comparing versions.