MeStar 2.0.0

User manual / English

01 Install and update

Native packages include Python and the application libraries. On Windows 11 x64, close MeStar and run the new setup in the existing installation folder. On Ubuntu use apt install ./PACKAGE.deb. On macOS replace MeStar.app in Applications, choosing the correct processor architecture. Uninstalling first is unnecessary for these packages.

For a portable distribution, extract the complete new bundle into a fresh folder and launch its executable; do not merge old and new runtime libraries. Source distributions require Python and requirements.txt. Keep your FITS and measurement exports separately. User preferences are stored outside the application folder and are retained during updates.

02 First launch and settings

The default interface language is Automatic (system). MeStar uses the system language when supported and otherwise English. A saved manual language choice is preserved. Open Settings to change language, telescope, observer and working folder.

The Performance slider ranges from serial calculation to AUTO with a 90% CPU target. Intermediate AUTO levels target 20-80%; these are scheduling budgets, not instantaneous CPU guarantees. Focused dialogs configure plate solving, aperture and centroid search, optional camera gain/read noise, and optional site latitude, east-positive longitude and height. Save each dialog.

03 Identify a source

Import FITS or demo data in Identify object; the measurements share this session. Solve the field with a separately installed solve-field executable and indices, or import WCS. WCS can also be exported. Select the subject, save a shorter name if desired, and add comparison stars manually or with automatic references once the subject is identified.

FITS grouping registers and combines frames. Inspect alignment and tracking. Online searches can identify moving objects and overlay known variable stars; Gaia, SIMBAD, VSX and JPL require network access unless cached. Their catalogue classifications and visual magnitudes do not calibrate your instrumental photometry.

04 RGB photometry

In Photometry, green is the default channel. Request red and blue as needed and choose the channel to display. Aperture photometry follows the selected subject and references. Inspect exclusions, saturation, tracking and the reference-star curves before interpreting variability.

The plotted quantity is relative instrumental magnitude, not calibrated Johnson V. Error bars are partial 1σ estimates; optional gain and read noise improve the noise inputs. ZIP export contains CSV and figures, with R/G/B folders when several channels were measured. Filenames use the first-frame date and subject name, or unknown.

05 Astrometry and motion

Astrometry measures celestial positions using the available WCS and the selected target. Inspect the trajectory, per-point error bars, residuals and angular speed with its uncertainty. Export CSV and figures or the motion GIF. The observatory position is included in new astrometry exports when available.

Use reliable exposure-midpoint UTC times, a correct WCS and a correctly tracked target. The graph and speed are measured motion on the sky, not by themselves an orbital solution. Exported figures have white backgrounds and a small MeStar version signature; GIF frames retain the astronomical image and a signature.

06 Preliminary asteroid orbits

In Asteroids, add astrometry ZIP/CSV exports of the same asteroid. MeStar assumes the subject is the same; no confirmation box is required. The solver needs at least six valid, distinct measurements from at least two observing nights and valid observatory positions. Settings provide the fallback site if an export lacks it.

Two-night data, an arc shorter than 48 hours and saturated measurements are permitted with warnings. The warning button lists quality criteria that were not met. A short-arc solution can be ambiguous even with small residuals. Inspect elements, semimajor axis a, full major axis 2a, perihelion q and aphelion Q in AU, and the formal uncertainties. The orbit graph marks Earth and the asteroid at the stated epoch. Acquire more nights to check the orbit.

Use the IERS dialog in Settings to update Earth-orientation tables over HTTPS. Updates remain available offline. Stale or insufficient tables can add warnings; the program does not silently claim a certified orbit.

07 Combine photometric sessions

Open Photometric analysis and add one or more compatible MeStar photometry ZIPs. The light curve appears immediately in UTC, before choosing a source type. Imports are assumed to describe the same subject. Choose variable star, nova/supernova or asteroid to enable the appropriate analysis; exoplanet analysis is not implemented.

Green/red/blue and graph selection occupy one toolbar row. The time unit is automatic. Bin applies only to the light curve; zero retains original points. Bins combine measurements without interpolating gaps. Filter labels are retained as metadata and do not split data. Incompatible instruments, apertures or reference scales remain separate; choose an independent series only when necessary. Session normalization is optional and changes the scale. BJD_TDB correction requires valid fixed-source coordinates and site data.

08 Find and inspect a period

For a variable star choose Pulsating, Eclipsing or Not sure. Search for a period uses the selected original points, independent of display binning. Pulsating/unknown compare one to four Fourier harmonics with BIC; eclipsing uses phase-dispersion minimization. Optional search limits and the manual phase-period field use hours. The main result uses minutes.

The phase curve spans 0-2: the second cycle repeats the same observations, not extra data. The title includes the period, the legend names the datasets, and the fitted line differs from the points. The local 1σ period error is conditional on the chosen model and may be small with many points; it excludes aliases, correlated noise and systematics. Read warnings and check more nights. Nova/supernova and asteroid light curves currently have no automatic period analysis.

09 Transfer settings and report faults

In Settings open Settings and logs. Export saved settings to JSON and import them on another installation. Invalid files are rejected before settings change; unavailable folder and solver paths are cleared. The debug-enabled choice is local and is not transferred.

Debug logs are off by default. Enable them, reproduce the issue and export the diagnostic ZIP. It contains runtime/library versions, processing settings, recorded actions and error tracebacks. Logs rotate at about 12 MB total, remain local and are never sent automatically. Tracebacks can include filenames or paths. Turning logging off preserves existing logs for export.

10 Troubleshooting, information and license

In Settings and logs, open Network and catalogs… for Gaia/VSX: defaults are a 30 s timeout, 2 attempts per mirror and 180 s overall. CDS, Harvard, NAOJ and IDIA are available; choose the first mirror if needed. Retries retain TLS checks and valid caches avoid downloads. Longer waits cannot resolve network blocks. Settings also provides reset, inactive-cache cleanup and IERS updates.

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