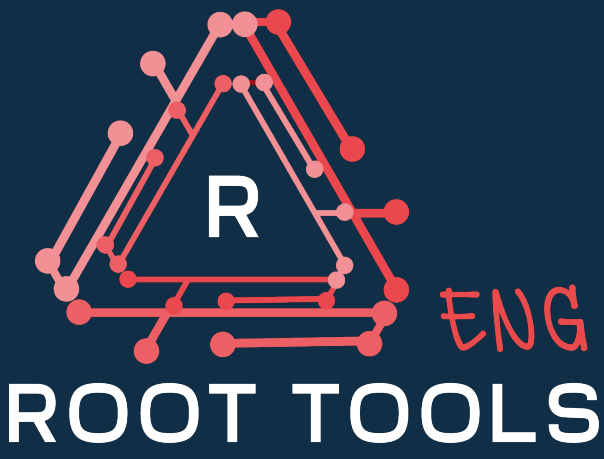
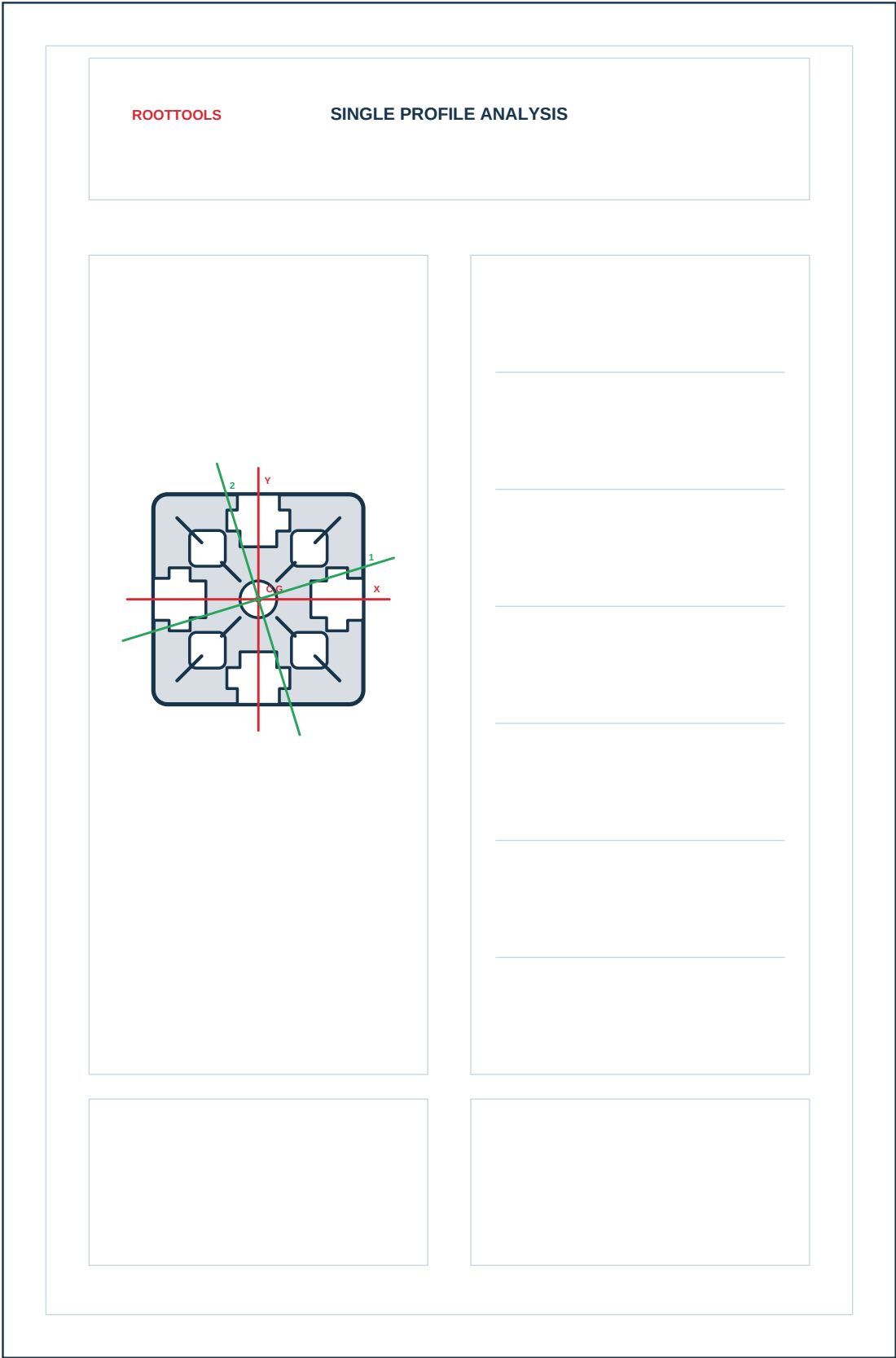
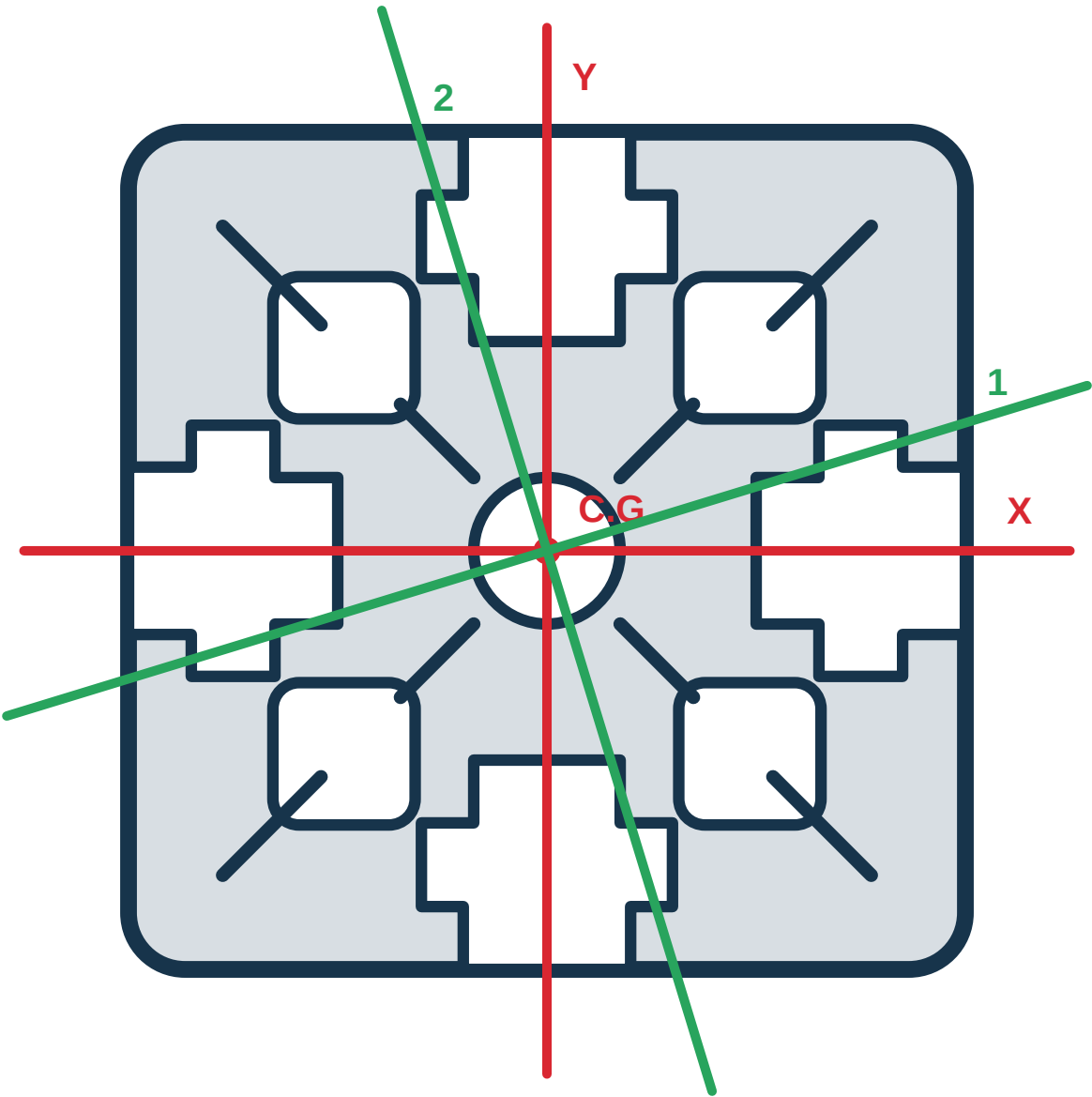




SINGLE PROFILE ANALYSIS

Geometric section properties directly from CAD profile geometry



FROM PROFILE GEOMETRY TO A CONSISTENT A2 TECHNICAL DATA SHEET

NAVIGATION

Everything needed to use the program correctly

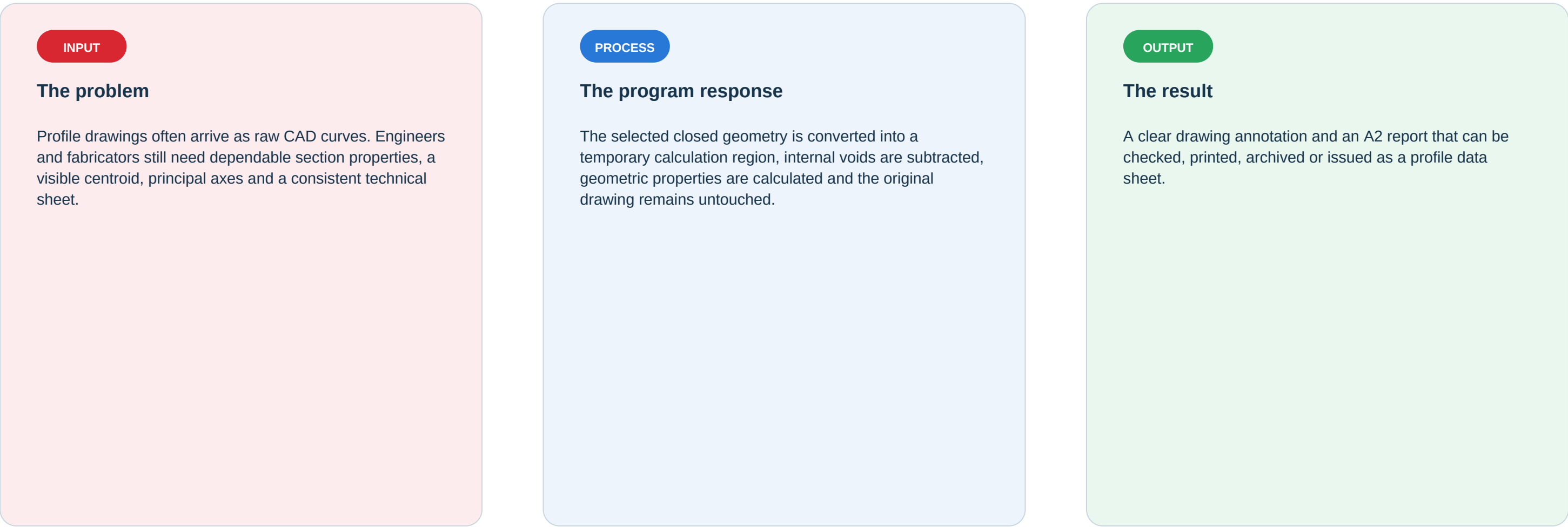
The catalogue follows the real operating sequence: prepare the drawing, run the program, select the section, read the output, and issue the A2 data sheet.

01	Purpose and value What the program solves and the decisions it supports.	02	Who benefits Engineering, CAD, fabrication, estimating and QA users.
03	Scope and outputs What is calculated, drawn and reported.	04	Workflow The complete operating sequence from geometry to PDF.
05	Drawing preparation Model Space, units, curve types, closure and connectivity.	06	Program inputs Reference, description, material and custom properties.
07	Selection and placement Selecting boundaries and positioning the A2 report.	08	Calculation logic Regions, void subtraction, centroid and principal properties.
09	Drawing output Centroidal axes, principal axes and verification markers.	10	A2 data sheet Auto-Fit section view, tables and print settings.
11	Property glossary Meaning and units of every reported value.	12	Real-world example A true structural extrusion example and interpretation.
13	Validation and troubleshooting Checks, common errors and recovery steps.	14	Daily checklist Fast reference for repeatable professional use.

WHY THE PROGRAM EXISTS

Turn section geometry into engineering-ready profile data

The program removes repetitive manual region construction, centroid calculations and report formatting from everyday profile analysis.



Practical value

- **Faster section verification:** no manual centroid or inertia worksheet is required for every profile.
- **Consistent deliverables:** the same A2 structure, units and terminology are used on every run.
- **Clear visual checks:** centroidal and principal axes are drawn on the original profile for immediate review.
- **Reduced transcription risk:** values are taken from the calculated region and written directly into the report.
- **Traceable project records:** profile reference, description, material, drawing name, user and date are recorded.

USERS AND DECISIONS

Who uses the program - and why

The program is most valuable wherever a 2D section must be understood, compared, documented or passed between teams.

ENGINEERING

Facade and aluminium engineers

Rapidly establish section properties for mullions, transoms, rails, brackets and custom extrusions before member checks.

STRUCTURAL

Structural engineers

Obtain area, centroid, inertias, section moduli and principal data for preliminary modelling or independent verification.

CAD

CAD technicians

Convert drawing geometry into a controlled data sheet without rebuilding the section in a separate analysis package.

FABRICATION

Fabricators and extrusion teams

Issue consistent profile references and property sheets alongside fabrication drawings and quotations.

COMMERCIAL

Estimators and procurement

Compare section area and mass per metre when assessing alternatives, cost or material usage.

QA

Quality and document control

Archive repeatable reports with drawing, operator, date, material and profile reference.

The program supports decisions; it does not replace design responsibility.

Use the reported properties as verified geometric inputs. Strength, stability, connection behaviour, local buckling, thermal effects and project-specific code checks remain separate engineering tasks.

WHAT THE PROGRAM DOES

Defined scope, clear outputs

A precise scope makes the result useful and prevents the data sheet from being mistaken for a full structural design certificate.

SECTION

Geometry analysis

One connected, closed 2D profile is analysed. Internal voids are allowed and are subtracted from the outer region.

MATERIAL

Material data

Aluminium 6063, Steel S235, preliminary PA66 GF25, or a custom material with user-entered density and elastic modulus.

DRAWING

Drawing output

Centroid marker, X/Y centroidal axes and, when uniquely defined, principal axes 1/2.

DATA

Calculated values

Area, external perimeter, mass per metre, width, height, fibre distances, lx, ly, lxy, Wx, Wy, rx, ry, I1, I2 and angle.

REPORT

A2 report

Fixed 380 x 524 mm report frame, Auto-Fit profile view, metadata, section summary and property tables.

SAFETY

Drawing protection

Original geometry is copied for calculation. Temporary curves and regions are removed before visible output is created.

OPERATING SEQUENCE

From CAD geometry to A2 report

Follow the sequence in order. Every step is designed to reduce ambiguity before the calculation begins.

1

Work in Model Space

Open the profile drawing and confirm the section lies in one plane.

2

Confirm drawing units

INSUNITS is read automatically; unsupported or undefined units trigger a user selection.

3

Enter profile identity

Profile reference and description are written into the report.

4

Select material

Choose a built-in material or enter custom density and E.

5

Select all boundaries

Choose the complete external boundary and every internal void.

6

Review section calculation

The program forms regions, subtracts voids and validates the resulting section.

7

Place the A2 report

Pick the lower-left corner of the 380 x 524 mm report frame.

8

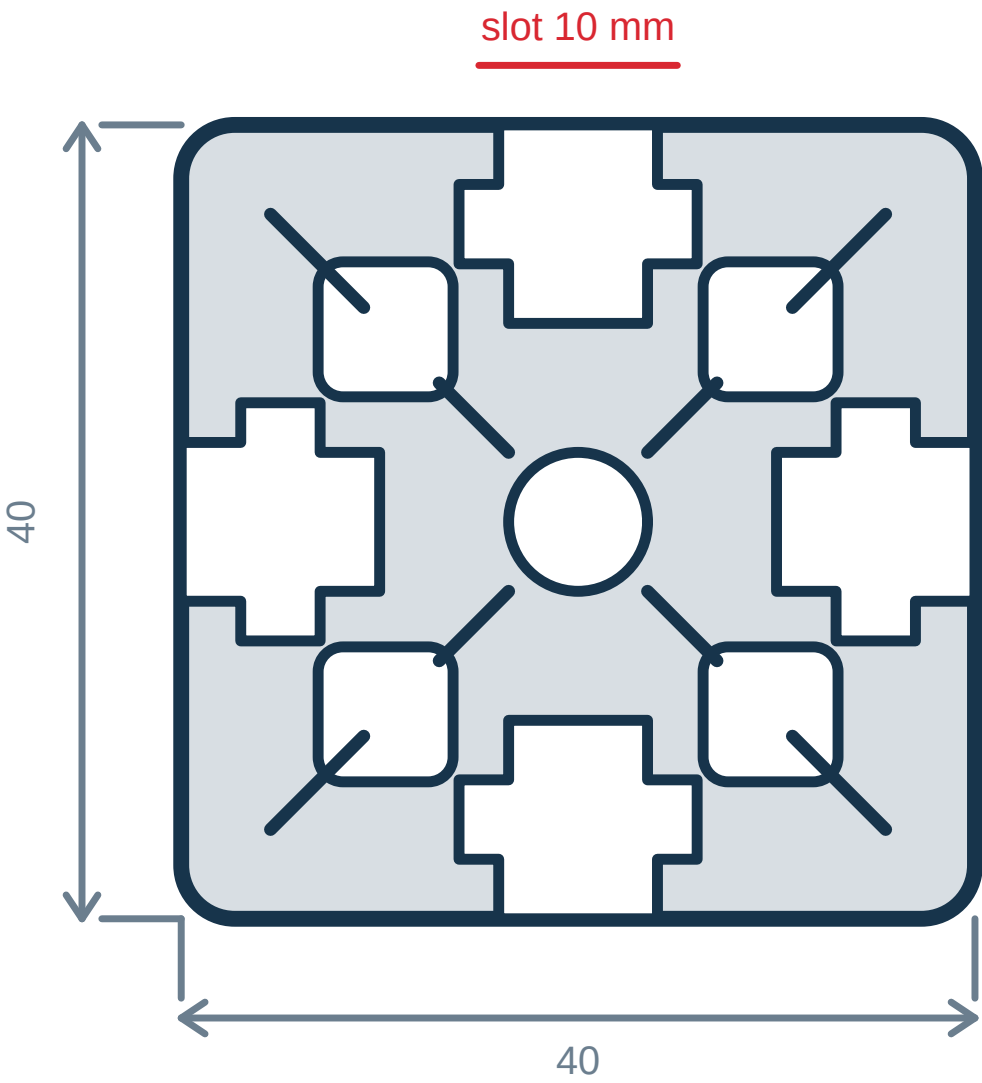
Verify and print

Check axes, values, units and profile view, then plot the report window to A2 portrait.

GEOMETRY AND UNITS

Prepare the profile correctly

Most failed runs are caused by open gaps, duplicate curves, disconnected bodies or incorrect drawing units - not by the calculation engine.



Real-world structural extrusion reference - 40 x 40 mm T-slot section

Select the complete section

- External closed boundary.
- Every internal void boundary.
- One connected material region.
- All curves on the same plane.
- No text, dimensions, hatches or blocks.

ACCEPTED

Accepted boundary objects

Lines, arcs, circles, ellipses, 2D polylines and splines that AutoCAD can convert into valid regions.

REQUIRED

Geometry must be

Closed, coplanar, non-duplicated and connected. Internal islands that do not subtract from the outer region are rejected.

EXCLUDE

Do not select

Dimensions, text, hatches, blocks, neighbouring profiles, open construction geometry or duplicate curves.

STEPS 1 TO 4

Enter identity, material and unit information

The program asks only for information that cannot be obtained reliably from geometry alone.

STEP 1

Profile reference

Enter a unique drawing, system or extrusion code. The default is UNNAMED.

STEP 2

Profile description

Use a short functional description such as curtain-wall mullion, transom or bracket section.

STEP 3

Material selection

Choose Aluminium 6063, Steel S235, preliminary PA66 GF25, or Custom material.

STEP 4

Custom material data

For custom materials enter a name, density [kg/m3] and elastic modulus E [MPa].

AUTOMATIC

Drawing units

INSUNITS is read for inches, feet, millimetres, centimetres, metres, yards, decimetres and US survey feet.

FALLBACK

Unknown units

When INSUNITS is unsupported, select the drawing unit manually before the profile is analysed.

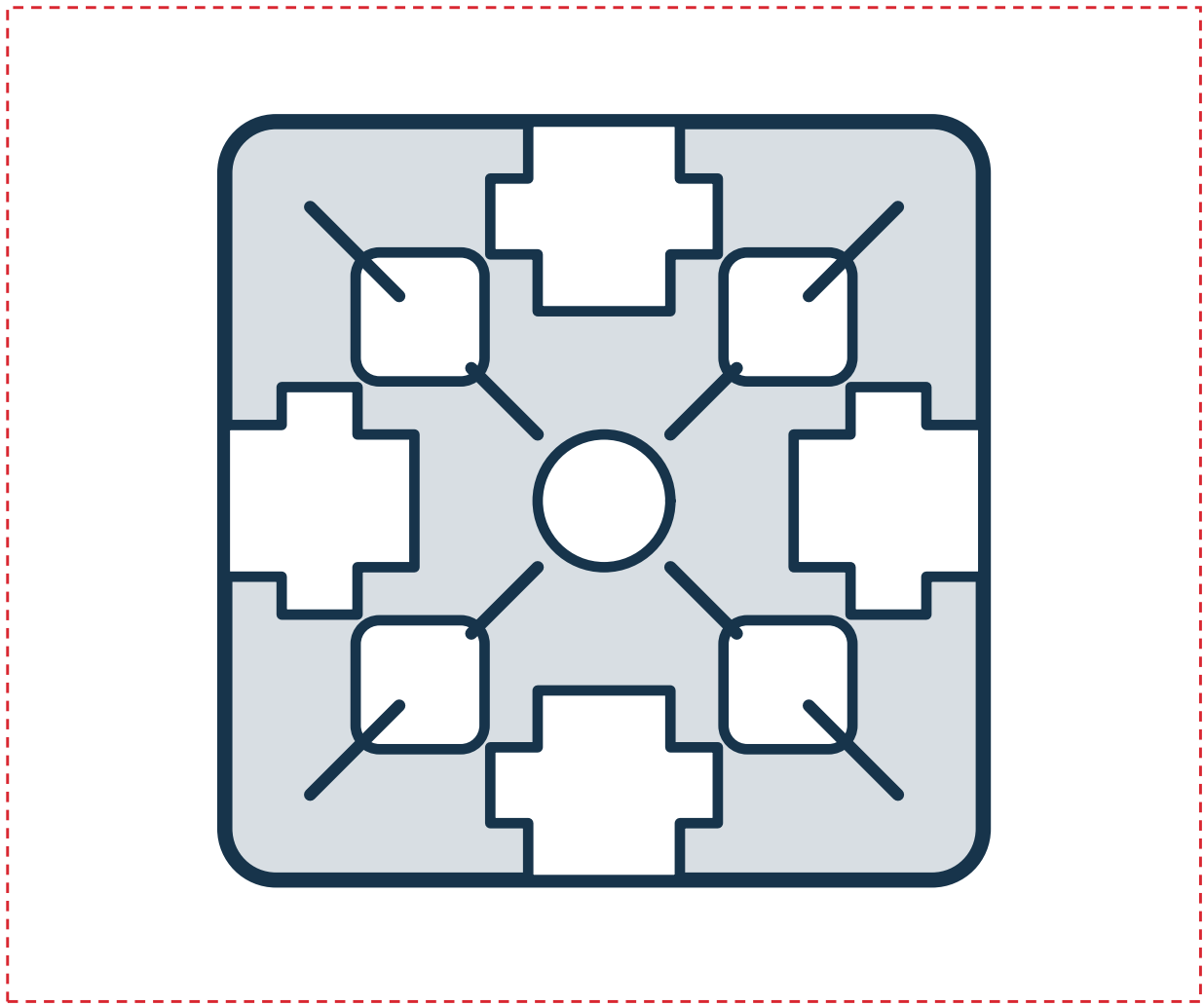
Important unit rule

Changing the unit label does not rescale existing geometry. The numerical size of the profile must represent the actual selected unit. For the same 100 mm profile, the drawing width must be 100 in millimetres, 10 in centimetres, or 3.937 in inches.

STEPS 5 AND 6

Select the profile and place the report

The program works with the selected boundary set and creates a print-ready report at the point you choose.



Window-select the external boundary and all internal voids

Selection rules

- Press Enter after the complete profile is selected.
- A maximum of 1500 selected objects protects the drawing from unstable processing.
- Unsupported objects trigger Retry or Cancel.
- Disconnected closed bodies are rejected.
- Internal voids are allowed and are subtracted.

GEOMETRY

Step 5 - Profile selection

The program copies the selected curves, hides the temporary copies, creates regions and identifies the largest region as the outer boundary. Every valid inner region is subtracted.

PLACEMENT

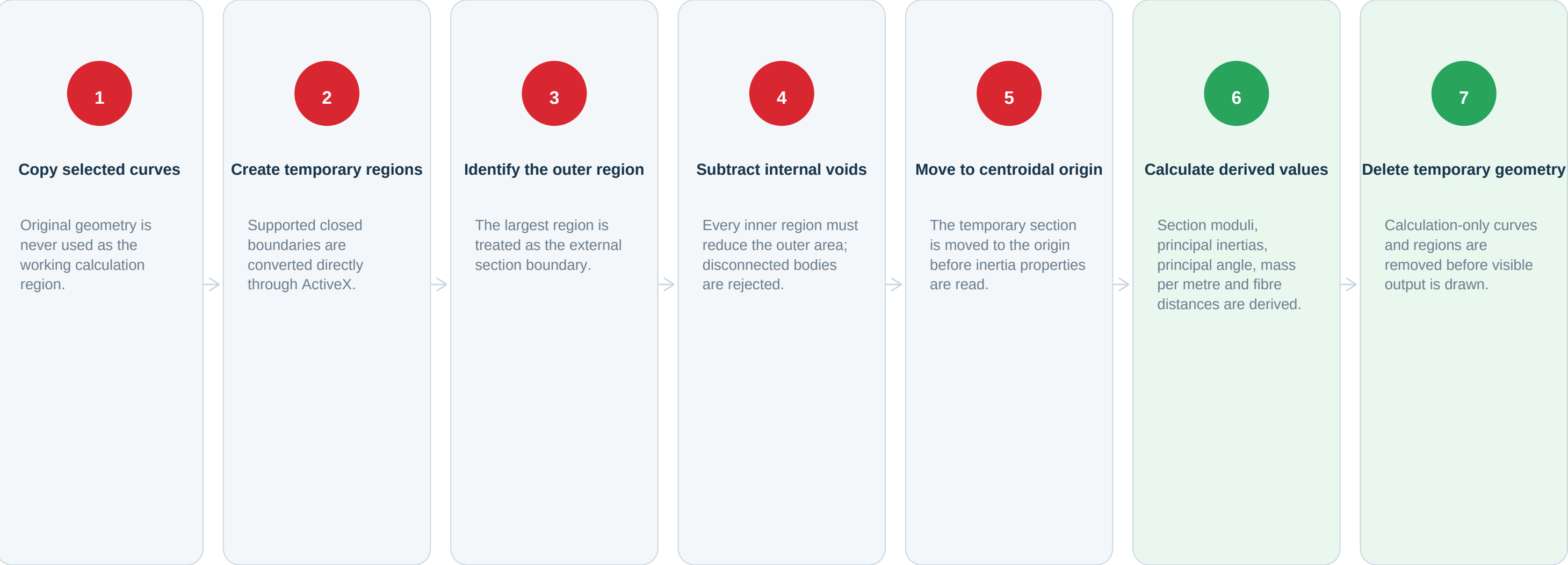
Step 6 - Report position

Pick the lower-left corner of the A2 report frame. The frame is created as 380 x 524 mm and converted into the current drawing units.

ENGINEERING ENGINE

How the section properties are produced

The calculation uses AutoCAD region properties, then converts all reported output to metric engineering units.



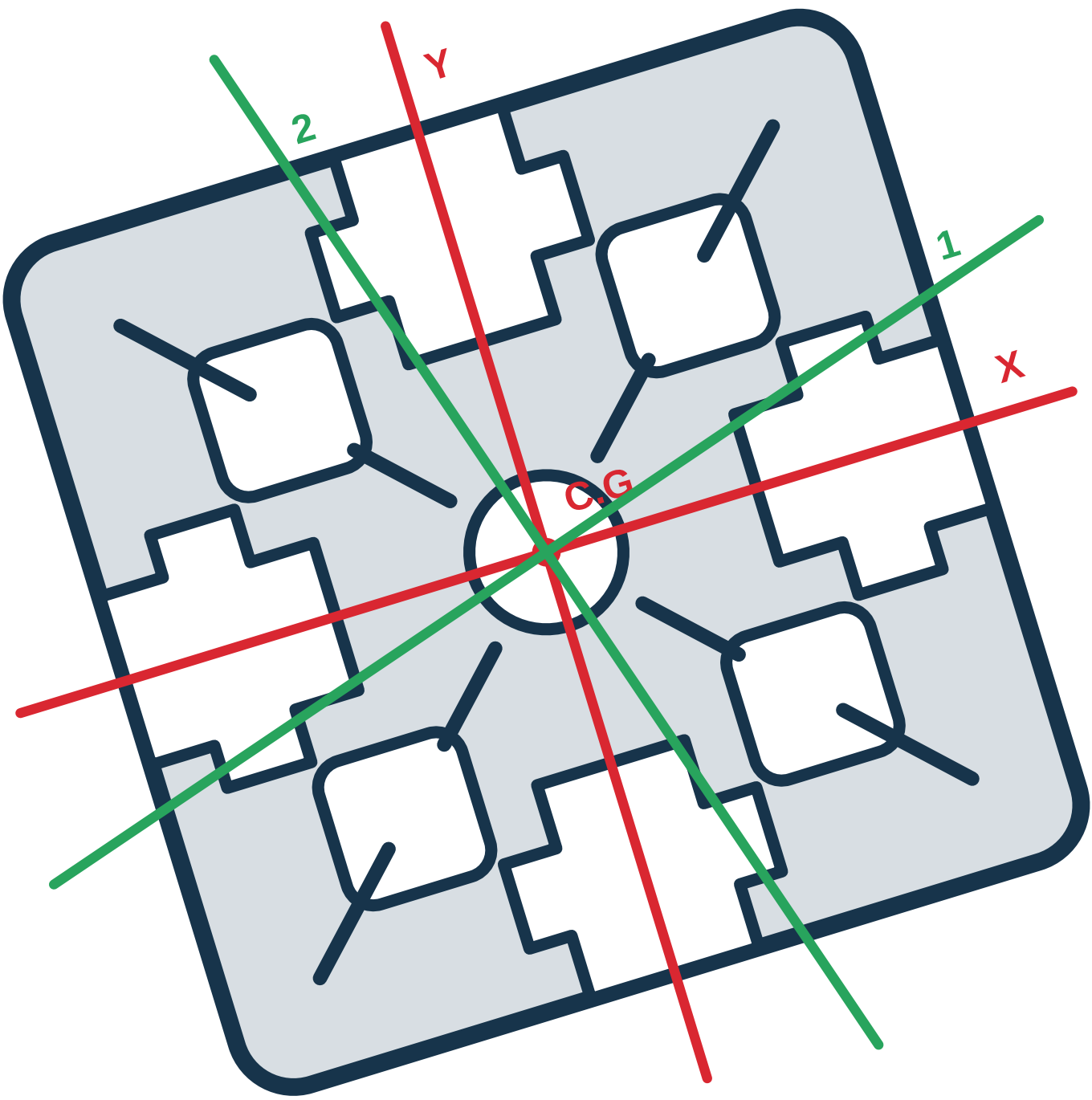
Drawing safety and repeatability

- **One Undo operation:** the complete run is enclosed in a single AutoCAD Undo mark.
- **Safe cancellation:** partial axes, report objects and temporary geometry are removed if the user cancels.
- **Safe errors:** the error message reports the active stage and confirms that the original section was not modified.
- **Layer control:** visible output uses ROOT_PROFILE_AXES and ROOT_PROFILE_REPORT, or safe numbered alternatives when an existing layer is locked or frozen.
- **Model Space only:** the program stops before analysis when it is launched from Paper Space.

VISUAL VERIFICATION

Centroid and principal axes

The drawing annotation lets the user compare the calculated geometry with the profile before relying on the report values.



C.G.

Centroid marker

The C.G. marker identifies the calculated centre of the selected material area after internal voids are removed.

X / Y

Centroidal X / Y axes

Red axes are aligned with the drawing coordinate system. Ix and Iy refer to these directions.

1 / 2

Principal axes 1 / 2

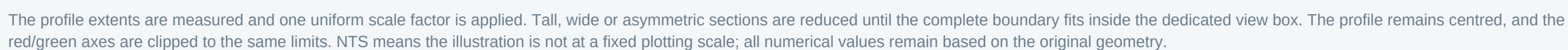
Green axes identify the directions where product of inertia is zero. I1 is maximum and I2 is minimum.

When principal axes are not unique

If Ix and Iy are effectively equal and Ixy is negligible, the program reports that no unique principal direction exists instead of drawing an arbitrary angle.

Understanding the technical data sheet

The report is a self-contained print unit. It does not depend on the location or size of the original profile in the drawing.



REPORT VALUES

Meaning, units and engineering use

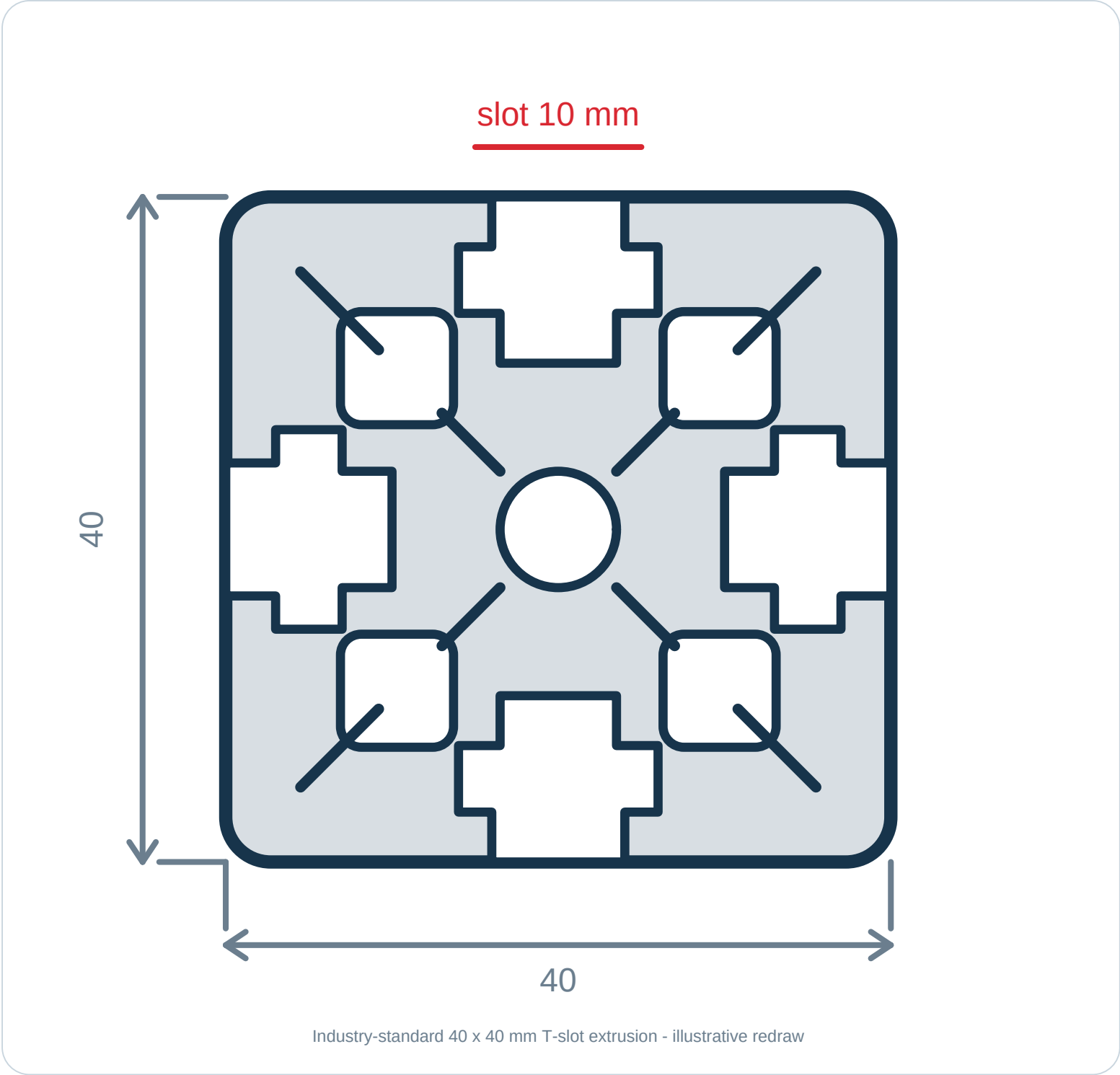
Read the values as geometric section data. Length results are shown in mm, section modulus in cm3, and inertia in cm4.

Property	Unit	Meaning
Area	mm2	Net material area after internal voids are removed.
Mass per metre	kg/m	Area multiplied by the selected material density.
External perimeter	mm	Perimeter of the outer boundary only.
Centroid X / Y	drawing units	Calculated centre of gravity in the original drawing coordinate system.
Overall width / height	mm	Bounding dimensions of the net section.
Top / bottom / left / right fibre	mm	Distance from the centroid to each extreme section boundary.
Ix / Iy	cm4	Second moments of area about the centroidal drawing axes.
Ixy	cm4	Product of inertia about the centroidal drawing axes.
Wx / Wy	cm3	Elastic section modulus using the farthest fibre in each direction.
rx / ry	mm	Radii of gyration about the centroidal drawing axes.
I1 / I2	cm4	Maximum and minimum principal second moments of area.
Principal-axis angle	degrees	Rotation from the drawing X-axis to principal axis 1.
Elastic modulus E	N/mm2	Material modulus reported for reference; it does not change geometric inertia.

INDUSTRY REFERENCE SECTION

A genuine structural extrusion workflow

The illustration is an original redraw based on common 40 x 40 mm structural T-slot extrusion conventions found in manufacturer dimensional resources.



How the program handles it

- The external profile and all slot/chamber boundaries are selected.
- Temporary regions are created without changing the original CAD section.
- Internal voids are subtracted from the outer material region.
- The centroid, Ix, Iy, Ixy, moduli and principal properties are calculated.
- The section is automatically scaled into the A2 report view box.

PREPARE

1. Geometry check

Confirm the 40 x 40 outer size, 10 mm slot convention and closed internal boundaries before analysis.

ANALYSE

2. Program analysis

Use Aluminium 6063 or the actual supplier material data. Select every boundary and place the report.

VERIFY

3. Independent review

Compare mass and section properties with the supplier data sheet when one is available.

REFERENCE NOTE

Geometry conventions were reviewed against public structural-extrusion resources from Bosch Rexroth, MISUMI and FLEXIMO. The catalogue drawing is independently redrawn and intentionally generic.

QUALITY CONTROL

Verify the result before issue

A professional report is accepted only after geometry, units, annotations and numerical reasonableness are checked together.

CHECK

Pre-issue validation

Confirm profile reference, description, material, drawing units, width, height, area, mass, centroid location and principal-axis orientation.

Region creation failed

Look for gaps, overlaps, duplicated curves, non-coplanar geometry or unsupported objects.

COMPARE

Independent comparison

For standard extrusions, compare mass per metre and available Ix/Iy values with the supplier data sheet. Small differences may indicate geometry simplification or unit error.

Disconnected profile

More than one independent closed material body was selected. Analyse one connected section only.

Values are 25.4 times too large

The geometry is numerically in millimetres while the drawing is declared as inches, or vice versa.

Temporary duplicate appears

Use v6.1.5. Temporary curves and regions should remain hidden and be deleted before visible output.

Principal axes are not drawn

The axes may coincide with X/Y, differ by less than the display threshold, or not be unique for an equal-inertia section.

Report appears small when plotting Extents

Plot a Window around the 380 x 524 mm report frame instead of plotting all drawing extents.

FAST OPERATING CHECKLIST

Repeatable use in eight checks

Keep this page beside the workstation for routine profile analysis and report issue.

Before running

- Model Space is active.
- INSUNITS matches the numeric geometry.
- The profile is one connected closed section.
- Every internal void is closed and included.
- No duplicate or neighbouring geometry is selected.

After running

- Centroid marker is inside a plausible material location.
- X/Y and principal axes are visually reasonable.
- Width, height, area and mass are reasonable.
- The profile fits completely inside the report view.
- The report is plotted as A2 portrait using Window.



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