

I. Using TransPack

A. User Interface

The screen is divided into three generic areas

Files: Identify input and output files

Transformation: Select transformation type and generate transformation coefficients

Action Keys: Initiate particular actions.

B. Transformation Process

1. Select a Control file.

Click **Control** to open a file dialog.

After a file is selected, the number of points it contains is displayed.

The *Transformation* area becomes active.

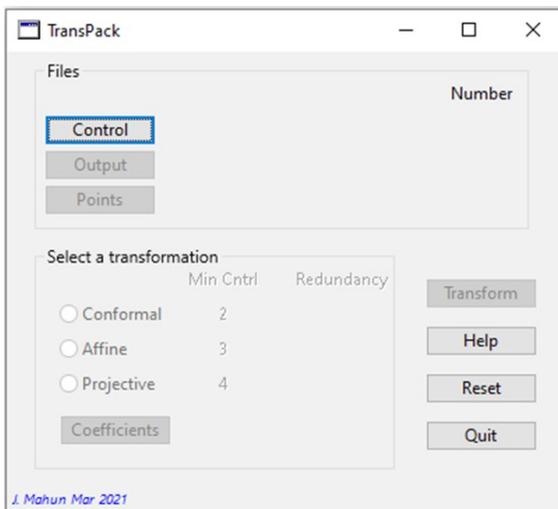
2. Select Transformation: Screen 2

Each transformation type shows the minimum number of control points needed to compute its coefficients.

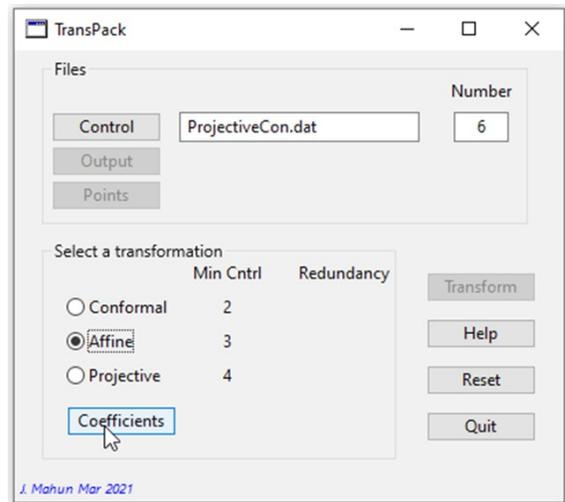
Select a transformation

The number of redundancies is shown for the transformation type.

A message will inform you if there aren't enough control points for the particular transformation.



Screen 1

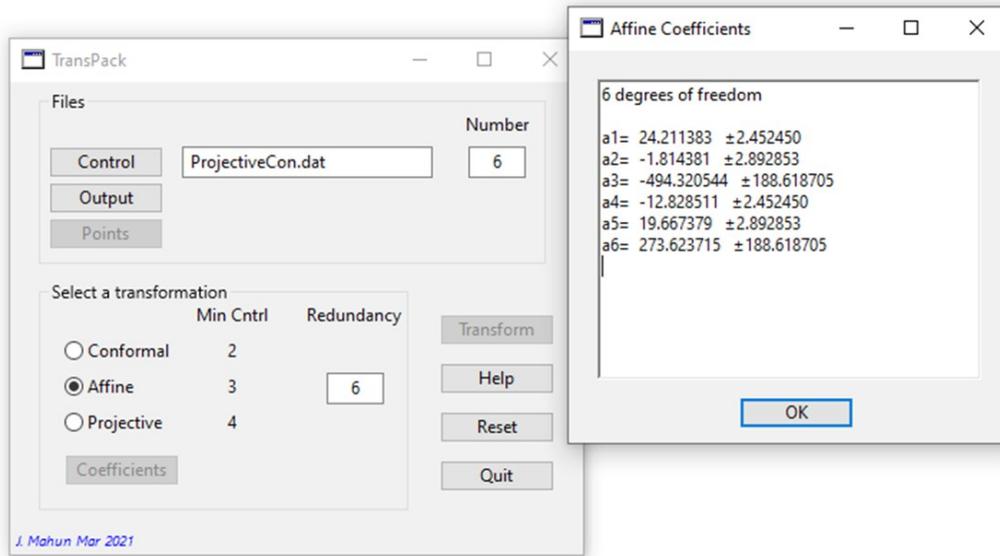


Screen 2

Click **Coefficients** to generate and display the coefficients: Screen 3.

If Redundancy > 0 **TransPack** determines and displays the standard deviation for each coefficient.

These are propagated into transformed points.



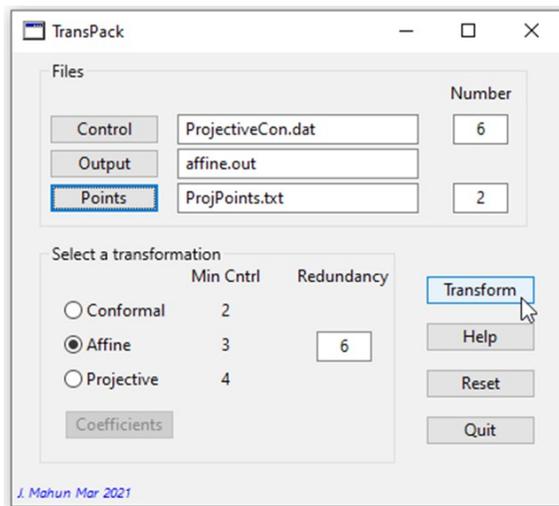
Screen 3

3. Transform points

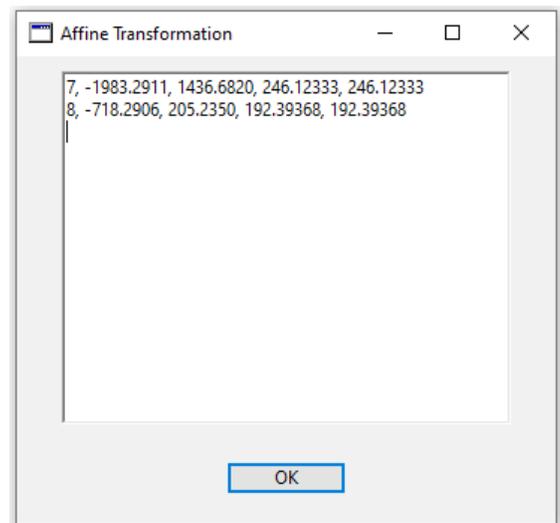
Click **Points** in the *Files* area to get the point file you want converted.

Once the points file is selected, click **Transform**.

The transformed points are written to the output file and displayed on screen.



Screen 4



Screen 5

If you want to perform a different transformation, select it and click the **Coefficients** button before re-transforming your points. You can also specify a different output file.

C. File Formats

1. Data elements

ID	Point ID
E	East (To) coordinate
N	North (To) coordinate
x	x (From) coordinate
y	y (From) coordinate
SDe	Standard Deviation of the transformed E
SDn	Standard Deviation of the transformed N

All data elements are comma delimited.

2. Input

Control: ID, E, N, x, y

Points: ID, x, y

Caution: **TransPack** does not check validity of the input files. It expects text files of the specified format and will freeze if provided anything else.

3. Output

ID, E, N, SDe, SDn

SDe and SDn are only written if **TransPack**

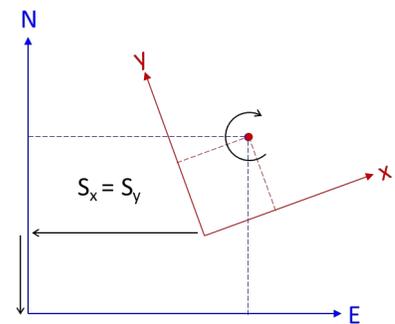
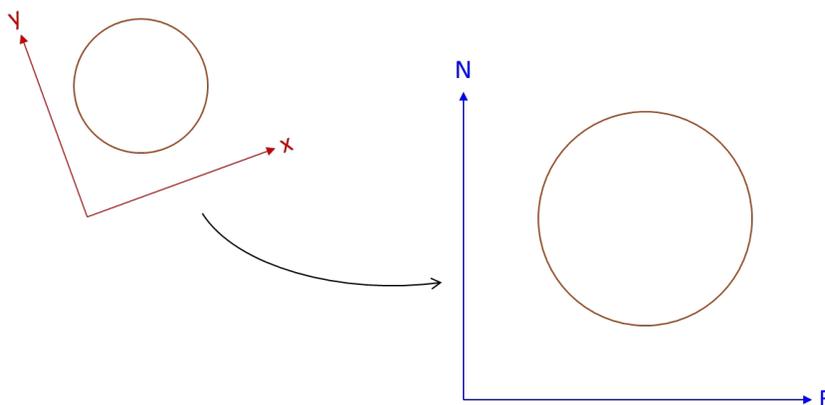
Units of transformed coordinates are the same as the control's To units

II. Transformations

A. Conformal

1. Characteristics

A conformal transformation uses scaling, axes rotation, and origin relocation to relate one coordinate system to another. It is "conformal" because it does not distort object shapes when converting between systems; scaling is uniform in all directions which preserves angular relationships.



2. Transformation equations

$$E = a_1x - a_2y + a_3$$

$$N = a_2x + a_1y + a_4$$

$$a_1 = s \times \cos \theta$$

$$a_2 = s \times \sin \theta$$

θ : Axes rotation

s: Scale

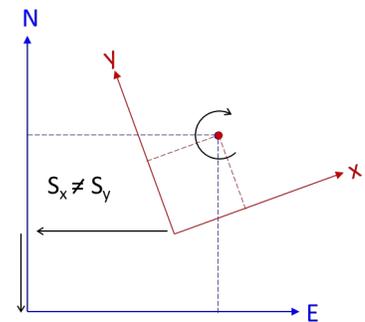
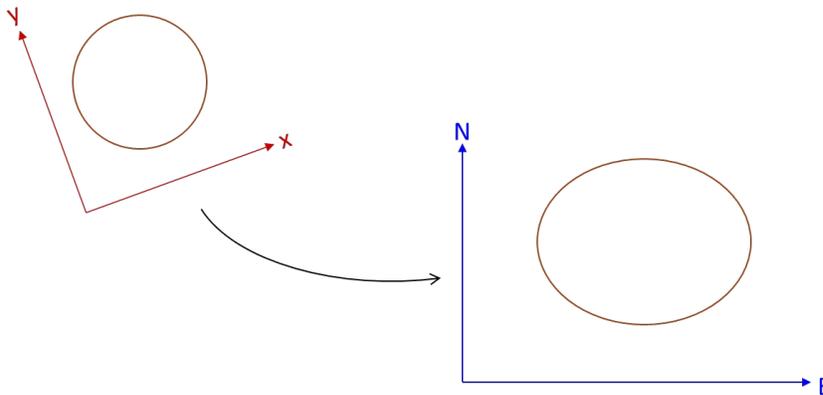
a_3, a_4 : East and North translations

There are 4 unknowns (n) so two points known in the (x,y) and (N,E) systems are needed for a unique solution (m=n). Three or more provide redundancy (m>n) and least squares can be used for best coefficient determination.

B. Affine

1. Characteristics

An Affine Transformation is similar to a Conformal except it allows for different scales in the north-south and east-west directions. This can distort shapes.



2. Transformation equations

$$E = a_1x + a_2y + a_3$$

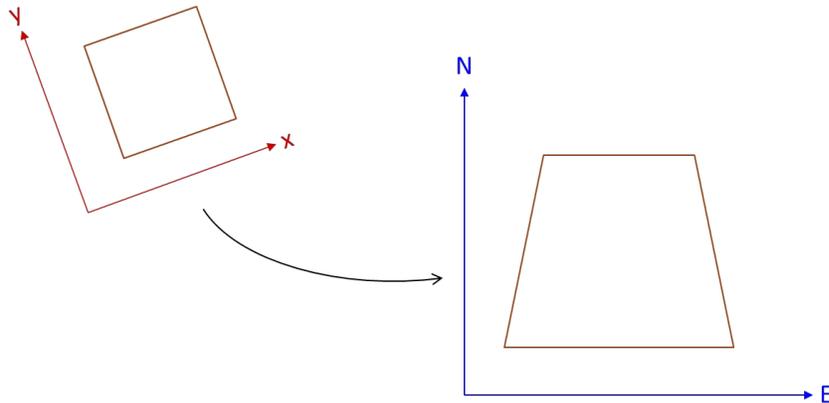
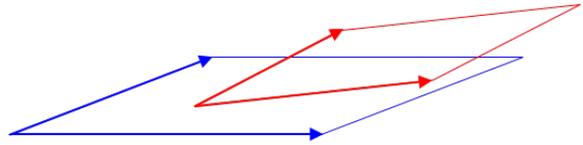
$$N = a_4x + a_5y + a_6$$

Because there are six unknowns, at least three points must be known in the two coordinate systems for a unique solution. Four or more allow least squares determination of the best fit coefficients.

C. Projective

1. General

A Projective Transformation can account for some degree of non-parallelism between the two coordinate systems. This transformation was particularly useful in analog aerial photogrammetry where the photograph was tilted slightly in relation to the ground coordinate system.



2. Transformation Equations

The transformation equations are:

$$E = \frac{a_1x + b_1y + c_1}{a_3x + b_3y + 1}$$

$$N = \frac{a_2x + b_2y + c_2}{a_3x + b_3y + 1}$$

It is an eight-parameter transformation which requires four points known in both systems for a unique solution, five or more for a least squares solution.

3. Iterative Solution

The projective transformation equations are not linear. If more than four control points are used, **TransPack** determines initial coefficients approximations and uses an iterative solution. Each iteration determines and applies corrections to coefficients. This continues until either 10 iterations have been exceeded or any maximum incremental correction is less than 0.001.

With good control data, **TransPack** should achieve a solution within 2-3 iterations. If you receive a message that a solution was not reached within 10 iterations, it probably means that the control data is weak or erroneous.