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Introduction

WinTrans transforms a set of coordinates into a user-defined coordinate system and, if applicable, computes the differences between the two sets. WinTrans can also be used to compare two sets of coordinates directly without any transformation. Typically, WinTrans is used after a V-STARS measurement to transform the coordinates from the V-STARS coordinate system into the user's desired coordinate system.

Using Windows Applications

WinTrans runs in the Microsoft Windows 95, Windows NT, and Windows 2000 operating environments. To use WinTrans, you should be familiar with these operating systems and the basic procedures for starting programs, manipulating windows, opening and saving files, selecting from menus, and using dialog boxes. If you are unfamiliar with Windows and these techniques, refer to the relevant Window manuals.

Symbols and Conventions

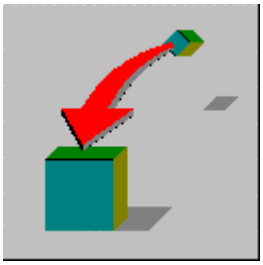
This manual uses the following symbols and conventions to aid in learning. The Hand symbol  indicates a tip that will help you understand or use WIINTRANS better. The Note symbol  indicates you should pay particular attention to the item mentioned.

Text that is blue and has a single underline is defined in the Glossary section at the back of the manual or links directly to another topic. Refer to the Glossary if you are unsure what the text means. Link to another topic for related information.

Menu names and options are printed in bold type. Dialog box names begin with uppercase letters. For example, the **File** menu or the Print Setup dialog box.

Transformation Basics

WinTrans performs a so-called "rigid-body" transformation. Rigid-body transformations allow up to seven parameters in the transformation. These include three translations (in X, Y and Z), three rotations (one about each axis) and scale. Such a transformation is called rigid body because it does not allow the shape of the object to change; it only allows the object to be moved, rotated, and (optionally) re-scaled into the user-defined coordinate system. This process is illustrated below.



Local and User Coordinate Systems

WinTrans is normally used to transform from the local V-STARS coordinate system into the user's desired coordinate system. If the AutoBar is used, the V-STARS measurement is in the coordinate system defined by the AutoBar. If an AutoBar is not used, the measurement is in the coordinate system defined by the first AutoStart measurement. In either case, this is not usually the final coordinate system desired by the user. Often, the user coordinate system is defined by a subset of the measured points that have coordinates in the user's desired coordinate system. These points may consist of precisely made tooling targets that are located in bushed holes, or they may be defined by features on the measured object (such as part edges, or hole locations or intersections of lines, planes, etc.) that are targeted in some way. In any case, it is important that the points representing the user-defined coordinate system be targeted precisely or else the accuracy of the measurement will be degraded. In fact, the accuracy of placing the targets precisely on the user coordinate system's defining features often is the determining factor in overall measurement accuracy.

WinTrans Basics

WinTrans can perform several different types of coordinate transformations. These include:

Direct	For averaging two files or for comparing two files directly without any transformation.
Axis Alignment	For exactly aligning the coordinate system with the coordinate axes.
Quick	For transformations where all the points used to define the coordinate system are of equal accuracy.
Standard	For transformations that cannot be handled by the other transformation types.

The files WinTrans uses and produces depend on the type of transformation performed.

In general, WinTrans uses the coordinate system defined by one file (the Primary) to transform a file of point coordinates (the Secondary) into another file of point coordinates (the Transformed Secondary).
In most cases, WinTrans also produces a Differences file. For the Direct transformation, the Differences file contains the differences between the Primary and Secondary files. For the Quick and Standard transformations, the Differences file contains the differences between the Primary and Transformed Secondary files. (No Differences file is produced for an Axis Alignment transformation since a set of coordinate data is not used to define the Primary coordinate system.) See WinTrans Files for a complete description of the files used in WinTrans.

Starting WinTrans

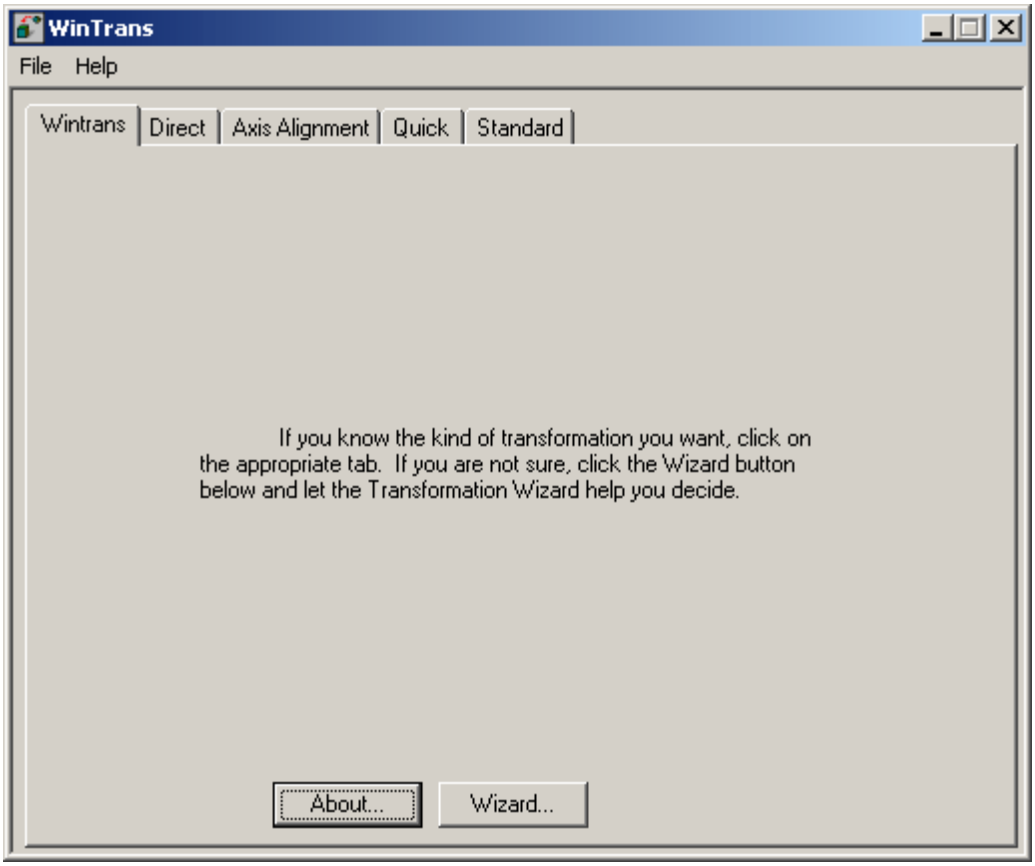
 WinTrans can be started in one of two ways. From V-STARS, start WinTrans by selecting **Transform...** from the **Tools** menu. In addition, you can start WinTrans by clicking on the **Start** button and selecting **Programs**. Then select **V-STARS**, and finally select **WinTrans**.

If you try to start WinTrans and nothing seems to happen, WinTrans is probably already running; if that is the case, you can switch to it using the

 key combination.

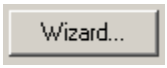
The WinTrans Main Dialog

After WinTrans is started, it displays the dialog box shown below.



The menu bar at the top of the dialog box provides commands for editing, creating, and printing files. These are available under the **File** menu item. The four types of transformations available in WinTrans are:

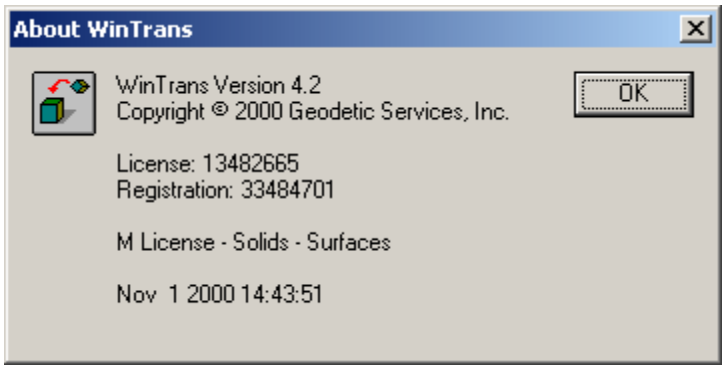
1. Direct
2. Axis Alignment Transformation
3. Quick Transformation
4. Standard Transformation



If you are not sure what type of transformation you want, just click on the **Wizard** button and let the Transformation Wizard help you decide, or see Choosing the Type of Transformation. When you know what type of transformation you want, just click on the appropriate tab at the top of the dialog box. The different transformations are described in detail in the following sections.

The About Button

Pressing the **About** button at the bottom of the WinTrans dialog provides some descriptive information about WinTrans. The most useful bit of information is the Version number. If you are having difficulty with WinTrans, knowing the version number can be helpful in diagnosing problems.



Choosing the Type of Transformation

Use the following questions to determine which type of transformation to perform.

1) Do you want to compare two sets of coordinates?

NO ==> Go to **3.**

2) Are the two sets of coordinates already in the same coordinate system?

YES ==> Use the **Direct Transformation.**

3) Is the user coordinate system defined by more than three points?

YES ==> Go to **5.**

4) Do you want the three points to be exactly aligned with the coordinate axes? That means, must the plane formed by the three points be parallel to one of the coordinate planes (the X-Y, X-Z, or Y-Z planes), **and** must the line connecting two of the points be parallel to a coordinate axis (the X, Y or Z axis)?

YES ==> Use the **Axis Alignment Transformation**.

NO ==> Go to **5.**

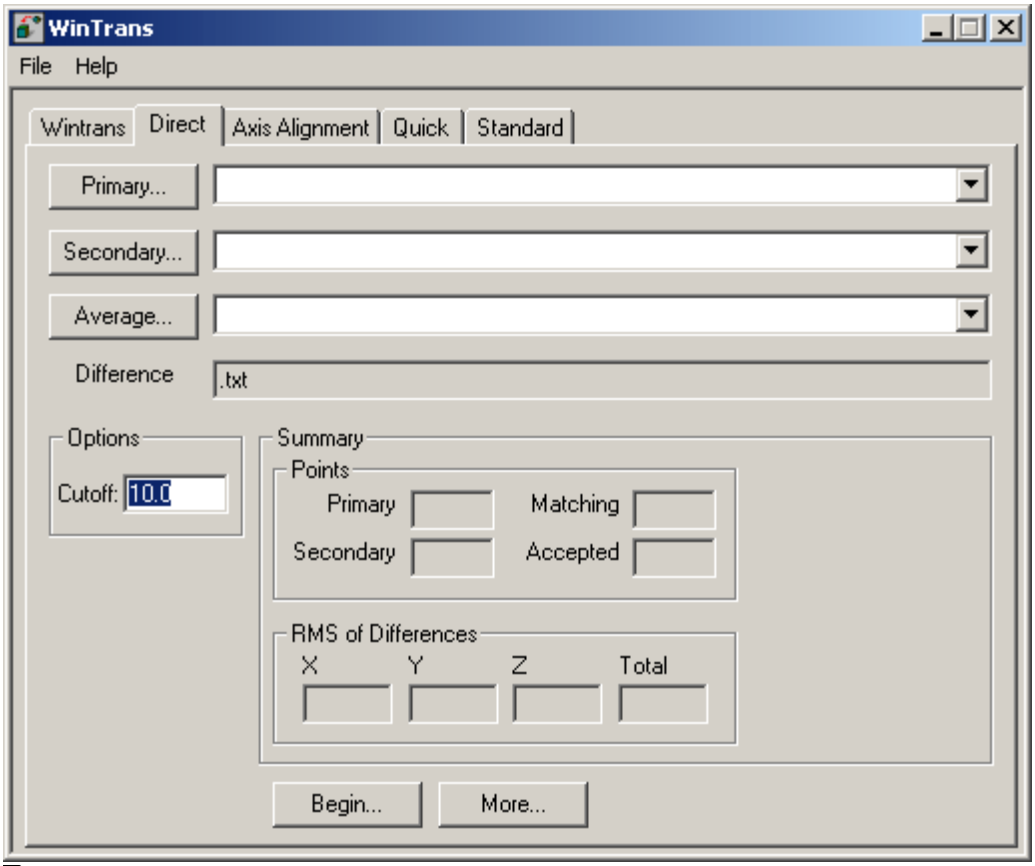
5) Are all the points that define the user coordinate system equally accurate?

YES ==> Use the **Quick Transformation**.

NO ==> Use the **Standard Transformation**.

Direct Transformation

The Direct transformation is not really a transformation at all. It actually is just a direct comparison between the coordinates of all the common points in two data sets without any transformation performed. It is commonly used to compare the differences between two data sets that are already in the same coordinate system (or at least should be).



Since no transformation is performed, no Transformed Secondary file is created. Instead, the two coordinate files are averaged and the result is stored in another file that you specify.

Direct Transformation is an easy way to produce the average of two measurements.

The Differences file for the Direct Transformation contains the coordinate differences between the two files you are comparing.

Instructions for Direct Transformations

To do a Direct Transformation perform the following steps.

1) Click on the Direct tab to bring up the Direct Transformation dialog box.
2) Select the first file to compare. See Selecting Files if you are not sure how to do this. The file must be in XYZ File or 3D file format.
3) Select the second file to compare. The file must be in XYZ file or 3D file format.
4) Select the Averages file. When the comparison is done, this file will contain the average of the two compared files. The file can be stored in either XYZ file or 3D file format. You choose which file format the results are stored in by the file's extension (extension .XYZ for XYZ file format, and extension .3D for 3D file format).
5) The Differences file will automatically be given the same name as the Averages file, but will have the extension .TXT. You cannot change the Differences file name (except by changing the Averages file name). When the comparison is done, this file will contain the differences between the two files.
6) Enter the Cutoff value. This value will be used to remove points with large differences from the comparison.
7) Press the Begin... button to start the comparison.
8) When done, the Summary area displays a summary of the results. These include:
    a) The number of points in the first file.
    b) The number of points in the second file.
    c) The number of matching points in the two files.
    d) The number of accepted points. If the difference between any coordinate of a matching point was greater than the cutoff value, the point was rejected and removed from the comparison.
    e) The RMS of the differences in each coordinate between all the accepted points in the first and second files and the total RMS of the differences.

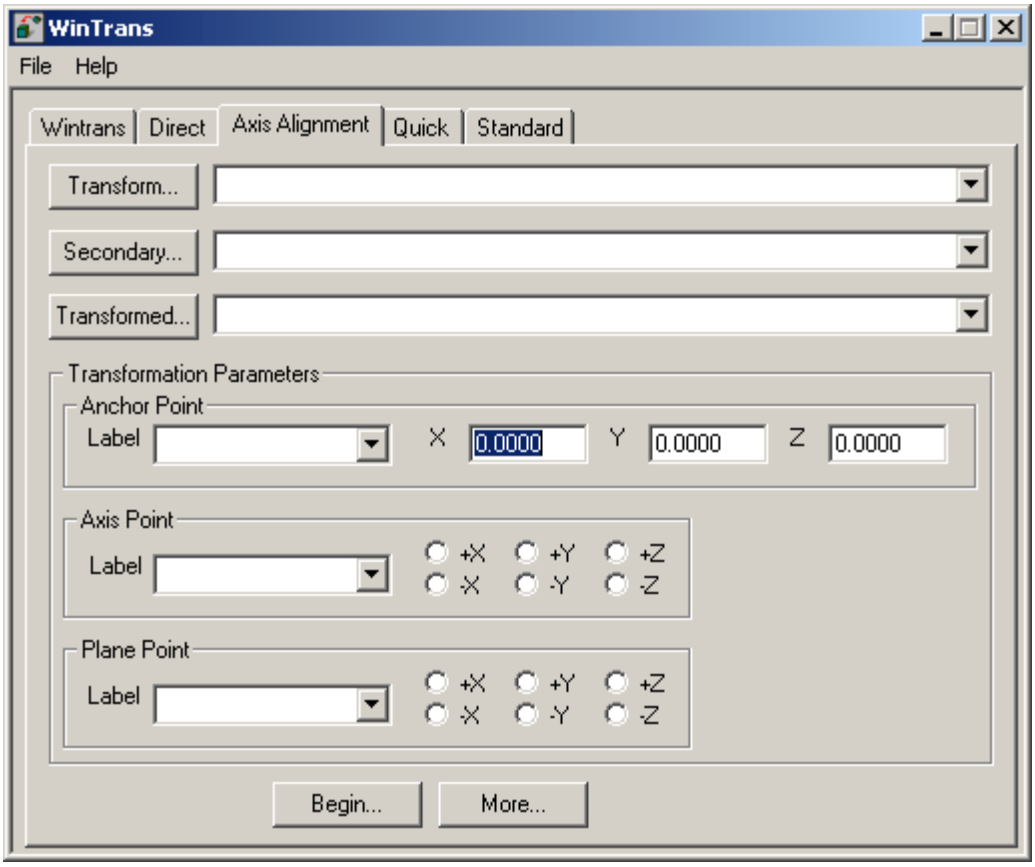
9) Pressing the **More**... button brings up a dialog box which allows you to look at the contents of any of the four Transformation Files by pressing the appropriate folder tab at the top of the box. When done, press the CLOSE button at the bottom of the box to return to the Direct Transformation dialog.

You can print any of the transformation files by pressing the **PRINT**... button at the bottom of the **More** dialog.

You can change any of the parameters of the Direct transformation (files, cutoff value, etc.) and run Direct again by pressing the BEGIN... button.

Axis Alignment Transformation

The Axis Alignment Transformation exactly aligns three specified points in the Secondary file with the coordinate axes. Axis alignment is also often called 321 alignment or Point-Line-Plane alignment. The Axis Alignment coordinate system is defined by the location of the first point (called the Anchor point), by the line connecting the first point to the second point (called the Axis Point, and by the plane defined by the first two points and the third point (called the Plane Point).



Instructions for Axis Alignment Transformations

To do an Axis Alignment transformation perform the following steps.

1) Click on the Axis Alignment tab to bring up the Axis Alignment dialog box.
2) If you want to use a previously defined axis alignment coordinate system, select the file containing the previously defined transformation. Otherwise, select a file name for storing the

definition of the new axis alignment transformation. See Selecting Files if you are not sure how to do this.

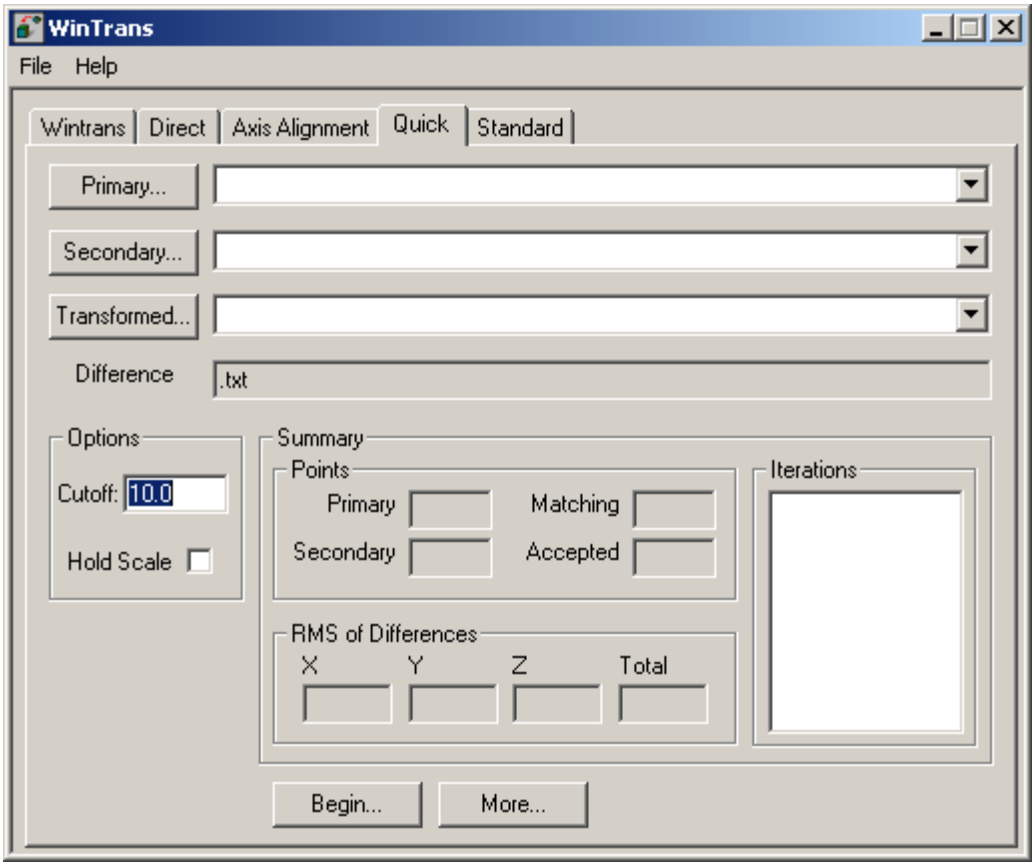
3) Select the Secondary File. You will transform this file. The file must be in XYZ File or 3D File format.
4) Select the Transformed Secondary File. This file will contain the coordinates of the Secondary file transformed into the axis-aligned coordinate system. The file can be stored in either XYZ file or 3D file format. You choose which file format the results are stored in by the file's extension (extension .XYZ for XYZ file format, and extension .3D for 3D file format).
5) Select the Anchor Point. You can either type in the point label of the Anchor Point, or select it from the drop-down list.
6) Enter the coordinates of the Anchor Point. The default is to place the Anchor Point at the origin (0,0,0), but you can enter any coordinates for the Anchor Point.
7) Select the Axis Point, and select the coordinate axis for this point to go through.
8) Select the Plane Point and select the second axis for the alignment.
9) Press the **Begin**... button to perform the transformation.
10) Pressing the **More**... button brings up a dialog box which allows you to look at the contents of any of the three Transformation Files by pressing the appropriate folder tab at the top of the box. When done, press the **Close** button at the bottom of the box to return to the Axis Alignment Transformation dialog.

You can print any of the transformation files by pressing the **Print**... button at the bottom of the **More** dialog.

You can change any of the parameters of the Axis Alignment transformation (files, cutoff value, etc.) and run it again by pressing the **Begin**... button.

Quick Transformation

The Quick transformation uses all of the common points in the Primary and Secondary files for the transformation. Quick transformation is commonly used when all the control points are considered equally accurate (for example, when some previously measured or otherwise established tooling points on a part are used to define the user's coordinate system). The Quick transformation gets its name from the fact that all the operator normally has to do is select the files and run the transformation. Since the accuracies for all the points are identical, there is no need to setup the accuracy estimates in the Primary file; the Quick transformation will do it for you. The Primary file contains the coordinates for the control points, and the measurement in the Secondary file is transformed into the coordinate system defined by the Primary file.



Quick transformation can also be useful when trying to get the best possible comparison between two sets of measurements. By comparing the two sets of measurements after transformation into a common coordinate system, the best possible agreement between the two sets is achieved.

Instructions for Quick Transformations

To do a Quick transformation perform the following steps.

1) Click on the Quick tab to bring up the Quick transformation dialog box.
2) If the Primary file has not yet been created or setup properly see WinTrans Editor for instructions on how to create and/or edit the Primary file. The Quick transformation only uses the coordinates in the Primary file. The accuracy estimates are ignored.

   The WinTrans Editor can only edit XYZ Files; it cannot be used to edit 3D Files.

3) Select the Primary file. See Selecting Files if you are not sure how to do this. The file must be in XYZ File or 3D file format.
4) Select the Secondary File. You will transform this file. The file must be in XYZ file or 3D file format.
5) Select the Transformed Secondary File. This file will contain the coordinates of the Secondary file transformed into the Primary file coordinate system. The file can be stored in either XYZ file or 3D file format. You choose which file format the results are stored in by the file's extension (extension .XYZ for XYZ file format, and extension .3D for 3D file format).
6) The Differences file will automatically be given the same name as the Transformed Secondary File, but will have the extension .TXT. You cannot change the Differences file name (except by changing the Transformed Secondary file name). When the transformation is done, this file will contain the differences between the Primary and Secondary files.
   7) Enter the Cutoff value.
   8) If you want to hold the scale of the Secondary file, click the Hold Scale check box. This means the scale of the Secondary coordinates will not be changed by the transformation.
   9) Press the **Begin**... button to start the transformation.
   10) The Iteration area of the folder displays the progress of the iterative transformation solution. If several hundred points are involved in the solution, the solution may take several seconds per iteration.
   11) When done the Summary area displays a summary of the results. These include:
      a) The number of points in the Primary file
      b) The number of points in the Secondary file.
      c) The number of matching points in the Primary and Secondary files.
      d) The number of accepted points. If the difference between the Primary and Transformed Secondary of any coordinate of a point was greater than the cutoff value, the point was rejected and removed from the transformation solution.

e) The RMS of the differences in each coordinate between all the accepted points in the Primary and the Transformed Secondary and the total RMS of the differences.

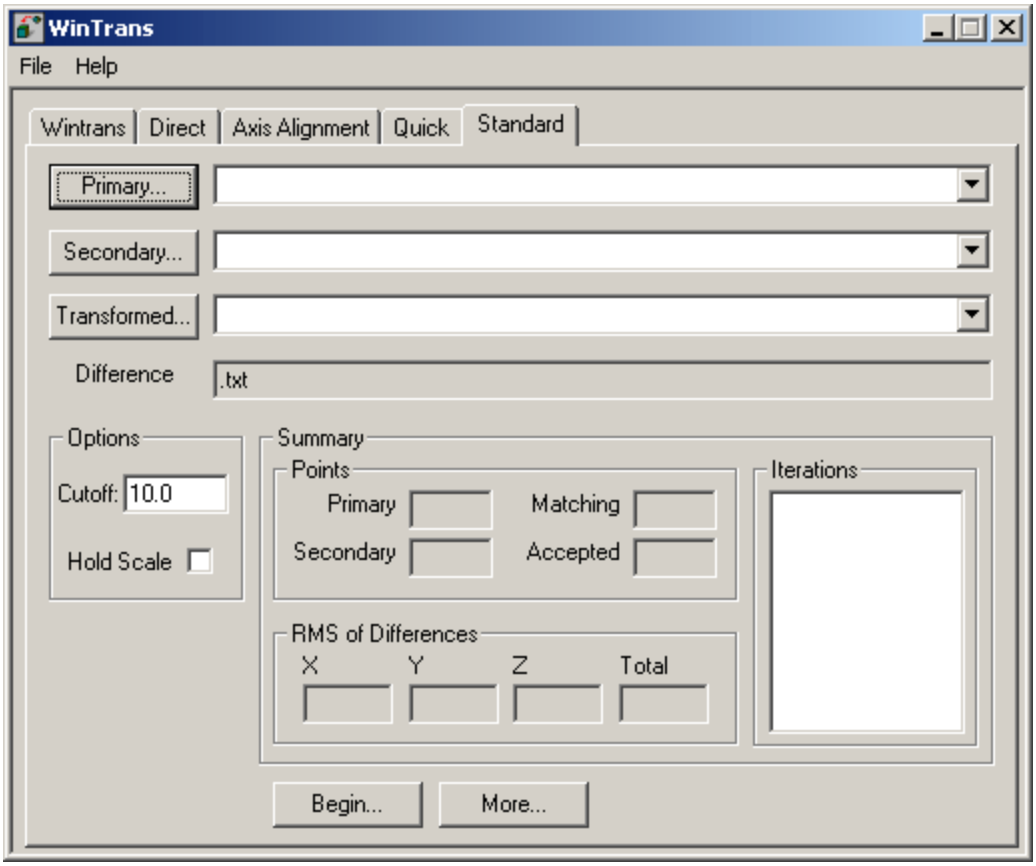
12) Pressing the **More**... button brings up a dialog box which allows you to look at the contents of any of the four Transformation Files by pressing the appropriate folder tab at the top of the box. When done, press the **Close** button at the bottom of the box to return to the Quick Transformation dialog.

You can print any of the transformation files by pressing the **Print**... button at the bottom of the **More** dialog.

You can change any of the parameters of the Quick transformation (files, cutoff value, etc.) and run it again by pressing the **Begin**... button.

Standard Transformation

The Standard transformation is the most powerful since it provides the operator with the greatest control over the transformation, but it is also the hardest to setup. Use the Standard transformation when the control points are of unequal accuracy. This is appropriate, for example, when two points are used to define an anchor point and axis (as in an Axis Alignment Transformation), but then many points are used to define a plane. You might do this if you were measuring a flat plate, and wanted to use all the points on the plate to define the X-Y plane instead of just three of the points.



As WinTrans automates the most common types of transformations, you will probably only rarely have to do a Standard transformation. However, when the other types of transformations will not do what you need, the Standard transformation usually will.

Instructions for Standard Transformations

To do a standard transformation perform the following steps.

1. Click on the Standard tab to bring up the Standard transformation dialog box.

2. If the Primary file has not yet been created or setup properly see WinTrans Editor for instructions on how to create and/or edit the Primary file.

The WinTrans Editor can only edit XYZ Files; it cannot be used to edit 3D files.

For standard transformations, WinTrans uses three well-distributed points in the Primary file to get starting approximations for the transformation. This means you must provide at least approximate values for all three coordinates of at least three points, and the three points cannot be in a line. You indicate which points have approximate or better values by setting the accuracy for the coordinate to APPROX or FIXED.

3. Select the Primary file. See Selecting Files if you are not sure how to do this. The file must be in XYZ File or 3D file format.
4. Select the Secondary File. You will transform this file. The file must be in XYZ file or 3D file format.
5. Select the Transformed Secondary File. This file will contain the coordinates of the Secondary file transformed into the Primary file coordinate system. The file can be stored in either XYZ file or 3D file format. You choose which file format the results are stored in by the file's extension (extension .XYZ for XYZ file format, and extension .3D for 3D file format).
6. The Differences file will automatically be given the same name as the Transformed Secondary File, but will have the extension .TXT. You cannot change the Differences file name (except by changing the Transformed Secondary file name). When the transformation is done, this file will contain the differences between the Primary and Secondary files.

If you are running in ECDS format, the Differences file will only display differences for the coordinates with FIXED accuracy estimates in the Primary file. All other coordinate fields will be blank. This is done to maintain format compatibility with ECDS type transformations. See Initialization File for information on how to set the format for WinTrans.

7. Enter the Cutoff value.

8. If you want to hold the scale of the Secondary file, click the Hold Scale check box. This means the scale of the Secondary coordinates will not be changed by the transformation.
9. Press the **Begin**... button to start the transformation.
10. The Iteration area of the folder displays the progress of the iterative transformation solution. If several hundred points are involved in the solution, the solution may take several seconds per iteration.
11. When done the Summary area displays a summary of the results. These include:
    a. The number of points in the Primary file.
    b. The number of points in the Secondary file.
    c. The number of matching points in the Primary and Secondary files.
    d. The number of accepted points. If the difference between the Primary and Transformed Secondary of any coordinate of a point was greater than the cutoff value, the point was rejected and removed from the transformation solution.
    e. The RMS of the differences in each coordinate between all the accepted points in the Primary and the Transformed Secondary and the total RMS of the differences.

    Coordinates with accuracy estimates of UNKNOWN or APPROX in the Primary file are automatically removed from the transformation solution and are not included in the RMS calculation.

12. Pressing the **More**... button brings up a dialog box which allows you to look at the contents of any of the four Transformation Files by pressing the appropriate folder tab at the top of the box. When done, press the CLOSE button at the bottom of the box to return to the Standard Transformation dialog.

In the Differences file, any point coordinate with accuracy estimates of UNKNOWN or APPROX in the Primary file will have brackets placed around it to indicate the point was not included in the transformation.
You can print any of the transformation files by pressing the **Print**... button at the bottom of the **More** dialog.
You can change any of the parameters of the Standard transformation (files, cutoff value, etc.) and run it again by pressing the **Begin**... button.

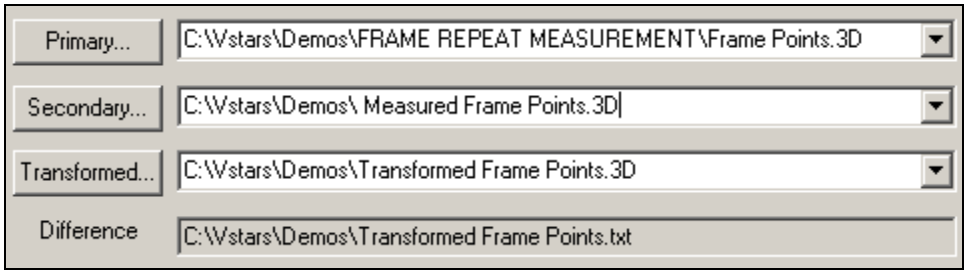
WinTrans Files

The files WinTrans uses and produces depend on the type of transformation performed.

In the Quick and Standard transformations, the coordinate system defined by one file of point coordinates (the Primary) is used to transform a second file of point coordinates (the Secondary) into another file of point coordinates (the Transformed Secondary). Point coordinate files are stored in one of two file formats, either as XYZ Files, or as 3D files. For Quick and Standard Transformations, WinTrans also produces a Differences file that contains the coordinate differences between all the common points in the Primary and Transformed Secondary files.
For the Direct transformation, WinTrans directly compares two point coordinate files you specify, and stores the average of the two files in another file of point coordinates that you specify. A Differences file is also produced that contains the coordinate differences between all the common points in the two files.
For the Axis Alignment transformation, WinTrans exactly aligns three specified points in the Secondary file with the coordinate axes. The definition of the coordinate system is stored in a file called the Axis Alignment Transformation file (or usually just the transform file for short) that the user creates or selects. All the points in the Secondary file are transformed into the coordinate system defined by the transform file and these transformed coordinates are stored in the Transformed Secondary file.

Selecting Files

WinTrans provides several ways to select the various files used in the transformation.



1) Press the select button associated with each file, and use the standard Windows browsing techniques to locate the file.

2) Type in the file name in the entry field associated with the file using standard Windows data entry techniques.

3) If the file was recently used, you can get it again by clicking on the drop-down list button associated with the file at the end of the data-entry field. Then, click on the entry you want.

XYZ Files

WinTrans uses files containing point coordinate data. The data can be stored in either XYZ file or 3D file format. Each record of an XYZ file has a valid Point Label followed by the point's X, Y and Z coordinates. Sometimes, accuracy estimates for the point in X, Y and Z may also be included. The format for an XYZ file is shown below.

Point	Point Coordinates			Point Accuracies		
Label	X	Y	Z	X	Y	Z

Examples of some records are given below:

Point1	12.5	-2.21	3.	FIXED	FIXED	FIXED
REF22	-1.31	3.59	5.	APPROX	FIXED	FIXED
Line1	19.	-6,	2,	100.	100.	FIXED

All the fields are free-format. If present, the X, Y, and Z accuracy fields can either contain numbers that represent the estimated accuracies of the points, or they can contain accuracy text codes that indicate the accuracy. The available text codes are: FIXED, APPROX and UNKNOWN. The codes can be upper or lower case. Text codes are a convenient way to represent default accuracies for a point. The actual default accuracies are system dependent.

You can easily create and edit XYZ files in WinTrans. See WinTrans Editor for instructions.

Although you can use the Editor to create or edit any XYZ file, you will normally only use it on the Primary File

3D Files

V-STARS now stores all measurement coordinate data in a new 3-D file format. This format allows new types of coordinate data (besides just points) to be stored and managed efficiently. Lines, circles, spheres, planes, and other forms of geometry are supported. 3D files have the extension .3D. WinTrans supports the 3D file format, as well as the original XYZ file format.

The WinTrans Editor cannot edit 3D files.

Primary File

The Primary file contains point coordinates and (optionally) accuracy estimates that define the user's desired coordinate system. It is stored as an XYZ file or as a 3D Files File.

 You can easily create and edit it in WinTrans with the WinTrans editor. See WinTrans Editor for instructions.

 The Axis Alignment Transformation does not use a Primary file since the Axis Alignment does not use coordinates to define the user coordinate system.

Secondary File

The Secondary file has the coordinate data that needs to be transformed from the local V-STARS coordinate system into the user desired coordinate system defined by the Primary file.
The file is stored in either XYZ file or 3Dfile format.
Since the Secondary file is usually produced by a V-STARS measurement, the file may also have X, Y, Z accuracy estimates, however, only the Point Label and X, Y, Z coordinates are used by WinTrans. All the fields are free-format. The format for the Secondary file and examples of some records are shown below.

Point	Point Coordinates			Point Accuracies		
Label	X	Y	Z	X	Y	Z
Point1	30.0082	20.6828	-0.6147	0.0002	0.0002	0.0002
REF22	21.0041	20.7277	-0.5253	0.0002	0.0002	0.0002
Line1	-2.0072	20.7657	-0.4203	0.0002	0.0002	0.0002
Point3	-3.0034	20.8543	-0.3104	0.0002	0.0002	0.0002

Transformed Secondary File

The Transformed Secondary file receives the coordinate data from the transformation. Every point in the Secondary file is transformed into the coordinate system defined by the Primary file and stored in this file. If the file is stored as an XYZ file, the first few lines of the file contain information such as the files used in the transformation, the cutoff value, etc. The following lines list the Transformed Secondary points and their coordinates. An example of a Transformed Secondary file is shown below.

```
Point          Point Coordinates
Label        X          Y          Z
Point1     30.0082    20.6828   -0.6147
REF22      21.0041    20.7277   -0.5253
Line1      -2.0072    20.7657   -0.4203
Point3     -3.0034    20.8543   -0.3104
```

Differences File

Each type of transformation except the Axis Alignment produces a Differences file that contains the coordinate differences between all the common points in two sets of coordinate data. (The Axis Alignment transformation does not produce a Differences file since a set of coordinate data is not used to define the coordinate system). For the Direct transformation, the Differences file contains the differences between the Primary and Secondary files. For the Quick and Standard transformations, the Differences file contains the differences between the Primary and Transformed Secondary files.
The first few lines of the file contain information such as the files used in the transformation, the cutoff value, etc. The following lines list the differences in X, Y, and Z between all the common points in the two data sets. The message "Rejected" is placed at the end of a line if any of the coordinate differences for that point were above the cutoff value. The last line of the file lists the RMS of the individual differences and the Total RMS of the differences.

A Differences file has the following format:

```
Point Label      X        Y        Z     Message
```

An example of a typical Differences file is shown below.

```
Point1        .0082      .0028   -0.0047
REF22         .0041      .0077   -0.0053
Line1        -.0072      .0057   -0.0003
Point3       -.3004      .0043   -0.0004   Rejected
```

If you are running in ECDS format, the Differences file will only display differences for the coordinates with FIXED accuracy estimates in the Primary file. All other coordinate fields will be blank. This is done to maintain format compatibility with ECDS type transformations. See Initialization File for information on how to set the format for WinTrans.

Axis Alignment Transformation Files

The Axis Alignment Transformation file contains the definition for an axis alignment. If you want to redo a particular type of transformation, you can select the Axis Alignment Transformation file used for that transformation rather than having to re-enter the data. These files typically have the extension .321. The file contains information about the three points used in the Axis Alignment. Although knowledge of its format and contents is not necessary, a typical file is shown below for completeness.

```
[anchor point]
name=1001
x_value=0.
y_value=0.
z_value=0.
[axis point]
name=1023
axis=+X
[plane point]
name=1061
axis=+Y
```

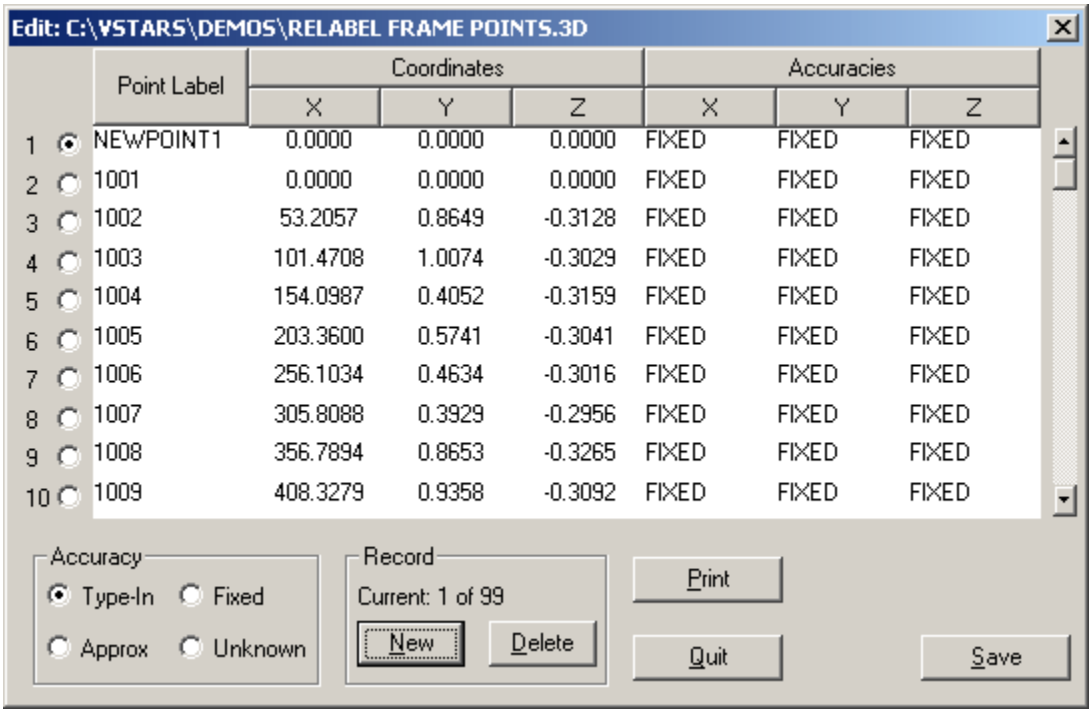
Printing Files

You can print WinTrans files by pressing the **PRINT**... button at the bottom of the WinTrans editor (if it is an XYZ File) or in the **More** dialog box that is used to look at the contents of files after a transformation is done.

WinTrans Editor

The WinTrans Editor can only be used to edit XYZ files. It cannot be used to edit 3D Files.

Although the XYZ files you need for the transformation may be available before you run WinTrans, (for example, they may have been generated by another program, or by an editor such as the one included with V-STARS), it is often convenient to use the built-in editor provided with WinTrans to create and/or edit these files. To create a file, select **New...** from the **File** menu. To edit an existing file, select **Open**... from the **File** menu, and select the file. After starting the editor, a form like the one shown below will appear.



If you are creating a new file, the fields are empty, except for the first record that will have a default point label, and default coordinates. If you are editing an existing file, the fields will have data from the file in them. You can edit labels, coordinates, and accuracies for a point. You can add and delete points. The text code buttons at the bottom of the Window make entering default accuracy values fast and easy.
To enter data in a field, click the right mouse button in the field, and type in the data. When done with a field you can move to the next field using the Tab key. Use Shift Tab to move to a previous field. The current record will have a mark at the beginning of the record. You can insert a new record either by pressing the **New** button or by pressing the Enter key.

key. Pressing the  key or NEW button when in the first field of the current record will insert the new record in front of the current record. Pressing the  key or **New** button when in any other field will insert a new record after the current record. The new record will have default entries for all the fields. You can delete the current record by pressing the **Delete** button, but be careful; there is currently no confirm or undo. The record number of the current record is displayed at the bottom of the dialog.

You can also change **all** the coordinate values for a column by clicking on the X, Y, or Z button at the top of each column, or you can change the values for **all three columns** by clicking on the Coordinates button. The editor will prompt you for a value which can either replace, be added to, or multiply every value in the selected column(s) depending on which button you press. However, be careful; there is currently no undo for this function.
The editor allows text codes to be used for the accuracy fields. The X, Y, and Z accuracy fields can either contain numbers that represent the estimated accuracies of the points, or they can contain accuracy text codes that indicate the accuracy. The available text codes are: FIXED, APPROX and UNKNOWN. You can type in the text codes, but it is much more convenient to use the text code buttons at the bottom of the dialog to do this. Click on the desired text code, and then click the left mouse button while in the desired field(s). Text codes are a convenient way to represent default accuracies for a point. The default accuracies are system dependent.

You can also change **all** the accuracy estimates for a column by clicking on the X, Y or Z button at the top of each column or you can change the accuracy estimates for **all three columns** by clicking on the Accuracies button at the top of the dialog box. However, be careful; there is currently no undo for this function.

You can print the file by pressing the **Print** button. To exit the editor without saving any changes, press the **Quit** button. To save the changes, press the **Save** button. The editor will allow you to save the file under a new name if you desire.

Initialization File

WinTrans uses an initialization file to set system dependent values. The file name is WinTrans.INI and it is found in the WINDOWS directory of your machine. The values in the file are properly set up for you when the system is installed. If you want to change any of the values after system installation you can edit the file with any text editor, however, the only value you should change is the WinTrans format. To set the WinTrans format so it is the same as ECDS format, change the line Format=GSI in the file to Format=ECDS, and save the file. To set the WinTrans format to the standard format (GSI), change the line Format=ECDS to Format=GSI and save the file.

 The only difference between ECDS and GSI format is in the format of the Differences file for Standard Transformations. In ECDS format, only the differences for those coordinates in the primary file with FIXED accuracy estimates will be displayed. All other fields will be blank. In GSI format, all differences will be displayed.

 WinTrans should not be running when you edit this file or else unpredictable results may occur.

Common Problems

This section lists some of the more common problems you may encounter running WinTrans.

1. *The number of accepted points is 0, and all the boxes have ERROR in them.*

All of the points are being rejected from the transformation. The cutoff value may be set too low. Try setting the cutoff higher until more of the points are accepted. The cutoff value should be larger than the Total RMS value. If increasing the cutoff does not work or the cutoff seems too high, you may not have selected the right Primary and/or Secondary files. Check the number of matching points to see if it is what you expect. Check your file selections to make sure they are what you wanted and/or look at the file contents with the **More**... button to make sure the files contain the right information.

2. *The RMS of the transformation is higher than I expected.*

You may have one or more bad points in the transformation. Use the MORE... button to look at the Differences file to see if the differences for one or more of the points are unusually high. If so, set the cutoff value low enough to remove the point(s) or edit the Primary or Secondary file to remove the point(s). The bad point(s) may have the wrong value(s), or you may have a poor measurement of the point(s). If all the points seem high, you may have the wrong values for the control data or a poor measurement. Use the **More**... button to look at the Primary and Secondary files to make sure they contain the right information.

Glossary

The terms below are defined in this section.

Anchor Point

The first point used to define an Axis Aligned coordinate system. The coordinate system is defined by the location of the first point, by the line connecting the first point to the second point, and by the plane defined by all three points. The first point is called the anchor point because all three of its coordinates are used, so its location is the anchor around which everything else is rotated to define the coordinate system.

Axis Point

The second point used to define an Axis Aligned coordinate system. The coordinate system is defined by the location of the first point, by the line connecting the first point to the second point, and by the plane defined by all three points. The second point is called the axis point because the line from the first to the second point is always transformed so it is parallel to a coordinate axis.

AutoBar

The AutoBar provide with the V-STARS system is a fixture with five targets arranged in the form of a cross that is used to get a measurement started by using the known coordinates of the five targets to determine the camera's orientation (location and aiming direction) relative to the AutoBar. The AutoBar is typically securely attached on or near the measured object preferably in a highly visible location.

AutoStart

AutoStart is the name given to the procedure used in V-STARS to get the orientation (position and aiming direction) of each photograph taken in a measurement. In order to AutoStart one must merely measure four target points with known X, Y, Z coordinates. The only requirement is that the four points should not lie on a line. AutoStart is often used in conjunction with the AutoBar provided with the V-STARS system to make measurements fast, easy and automatic.

Cutoff

A value used to automatically remove bad data from the transformation. If the difference between the Primary and Transformed Secondary for any coordinate of a point is greater than the cutoff value, the point will not be used in the transformation.

ECDS

Abbreviation for **E**lectronic **C**oordinate **D**etermination **S**ystem which is a widely used theodolite based measurement system. The ECDS system has transformation software which is similar in function to WinTrans. WinTrans can be set to operate in ECDS format for those users who are more comfortable with this format. See Initialization File for instructions on how to set the WinTrans format.

Free-format

Free-format fields do not have to occupy any particular columns of the record. Each field simply must end with a blank or comma or tab character. A free-format field may also have any number of leading blanks.

Plane Point

The third point used to define an Axis Aligned coordinate system. The coordinate system is defined by the location of the first point, by the line connecting the first point to the second point, and by the plane defined by all three points. The third point is called the plane point because the plane formed by it and the first two points is always transformed so it is parallel to a coordinate plane.

RMS

Root-Mean-Square - a statistical measure of the dispersion or spread of a group of data. The name comes from the fact that the RMS is equal to the square Root of the Mean (average) of the sum of Squares of the values in the data set. Concerning transformations, the RMS of the Transformation Residuals (the differences between the coordinates of the Primary and the Transformed Secondary data sets) provides a measure of the quality of the transformation.