



# **Data Format Guide**

*Tecplot 360 EX 2016 Release 2*

Tecplot 360 EX Data Format Guide is for use with Tecplot 360 EX 2016 R2.

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Tecplot, Inc.  
Post Office Box 52708  
Bellevue, WA 98015-2708 U.S.A.

Tel: 1.800.763.7005 (within the U.S. or Canada), 00 1 (425)653-1200 (internationally)

E-mail: [sales@tecplot.com](mailto:sales@tecplot.com), [support@tecplot.com](mailto:support@tecplot.com)  
Questions, comments or concerns regarding this document: [documentation@tecplot.com](mailto:documentation@tecplot.com)

For more information, visit <http://www.tecplot.com>

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16-360-05-2

Rev 4/2016

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# Introduction

Tecplot 360 can read data produced in many different formats using the data loaders provided with the product. This manual describes a complementary approach: writing your data in the Tecplot 360 data format so it can be read natively, providing the best experience for Tecplot 360 users. This Data Format Guide includes the following topics:

- [Chapter 2: “Data Structure”](#) Learn about the different types of data structure available in Tecplot 360 and how to use them.
- [Chapter 3: “Binary Data”](#) Refer to this chapter for details on outputting data in Tecplot 360’s binary file format (*.plt*) or the newer subzone load format (*.szplt*) using the TecIO library, a collection of routines we provide that you can use to write files in these format from your software.
- [Chapter 4: “ASCII Data”](#) We strongly recommend that you create binary data files. However, we provide the ASCII data chapter to allow you to create simple data files.
- [Chapter 5: “Glossary”](#) Refer to the Glossary for the definitions of terms used throughout the manual.
- The Appendix, [Binary Data File Format](#), documents the *.plt* binary file format.



Before continuing to either the Binary or ASCII chapter, please review this overview of [Best Practices](#).

## 1 - 1 Subzone Loading

Tecplot 360 EX introduced a new subzone file format with extension *.szplt* that is optimized for loading partial zones (“subzones”) as individual chunks of data are needed for a plot or for other operations. Subzone loading improves performance substantially for many common operations on large cases while also reducing RAM usage. If your software generates large data files, we strongly encourage you to support this format, as it will significantly improve your user experience. The API is the same as is used to write *.plt* files, so if your program already uses TecIO, it is straightforward to upgrade it to write *.szplt* files instead of, or in addition to, *.plt* files.

## 1 - 2 Creating Data Files for Tecplot 360 EX and Focus



For the purposes of this discussion, “polyhedral” refers to either polyhedral or polygonal zones.

If you intend to create data files that will load in both Tecplot 360 and Tecplot Focus, be aware that polyhedral and polygonal zones are not supported by Tecplot Focus. If any of the zones in a given data file are polyhedral, you will not be able to load the data file into Tecplot Focus. To create data files that will load in both products, you must use either ordered zones or “classic” (cell-based) finite element zones (triangular, quadrilateral, tetrahedral or brick elements).

The TecIO library file included with each release of Tecplot Focus is identical to the library file included with the corresponding release of Tecplot 360 and can create polyhedral zones, even though you will not be able to load the data files into Tecplot Focus. Similarly, this guide is largely the same for both products, although we have called out in many places the fact that polygonal and polyhedral data cannot be read by Tecplot Focus.

The subzone load file format (*.szplt*) is not supported by Tecplot Focus, nor by legacy versions of Tecplot 360 (versions without “EX” in their designation). Current versions of Tecplot Focus (2016 R1 and later), derived from Tecplot 360 EX, also limit the number of data elements in a single data set to 5 million.

## 1 - 3 Best Practices

Users who wish to generate native Tecplot 360 data files automatically from applications such as complex flow solvers have a number of options for outputting data into Tecplot’s data format. This section outlines a few “best practices” for outputting your data into Tecplot 360 data format.

### 1. Offer the Option to Write Subzone Load Files (*.szplt*)

Users of Tecplot 360 EX will appreciate the improved experience provided by these files, especially for large cases.

### 2. Create Binary Data Files (*.plt* or *.szplt*) instead of ASCII (*.dat*)

Binary data files are more efficient than ASCII files, in terms of disk space and time to first image. To create binary data files, you may use functions provided in the TecIO library. To create ASCII files, you can write out plain text in the usual manner.

There are some cases where ASCII files are preferred. Create ASCII files when:

- Your data files are small.
- Your application runs on a platform for which the TecIO library is not provided. Even if this is the case, please contact us at [support@tecplot.com](mailto:support@tecplot.com). There may be a way to resolve this issue.
- You wish users to be able to view or edit the data in a text editor.

### 3. Use Block Format instead of Point Format

Block format is by far the most efficient format when it comes to loading the file into Tecplot 360. If your data files are small and you can only obtain the data in a point-like format (for example, with a spreadsheet), then using point format is acceptable.



Binary files can only be written in block format. Point format is allowed for ASCII files, but running the preplot utility will convert the data to block format.



#### 4. Use the Native Byte Ordering for the Target Machine

When you create binary data, you can elect to produce these files in either Motorola byte order or Intel byte order. Today's most popular platforms all use Intel byte order, and generally this is the order you should use when writing binary data. The exceptions involve older platforms no longer supported by Tecplot. If you are using such legacy platforms, be sure to write the binary data in the order native to the platform on which it will be viewed. While Tecplot 360 automatically detects the byte order and loads either format, it is more efficient if the file uses the byte order used on the platform where you run Tecplot 360. For See the notes about this option in [Section B - 3 "Preplot"](#) in the [User's Manual](#) for the Preplot flag.

#### 5. Add Auxiliary data to Preset Variable Assignments in Tecplot 360

Zone Auxiliary data can be used to give Tecplot 360 hints about properties of your data. For example, it can be used to set the defaults for which variables to use for certain kinds of plots. Auxiliary data is supported by both binary and ASCII formats. Refer to [Section "TECAUXSTR142"](#) on page 25 or [Section 4 - 3.6 "Data Set Auxiliary Data Record"](#) for information on working with auxiliary data in binary or ASCII data files, respectively.

#### 6. Data Sharing

Share variables whenever possible. Variable sharing is commonly used for the spatial variables (X, Y, and Z) when you have many sets of data that use the same basic grid. This saves disk space, as well as memory when the data is loaded into Tecplot 360. In addition, the benefits are compounded with scratch data derived from these variables because it is also shared within Tecplot 360. See also [Section "TECZNE142"](#) on page 52 (for binary data) or [Section 4 - 5.1 "Variable and Connectivity List Sharing"](#) (for ASCII data).

#### 7. Passive Variables

Tecplot 360 can manage many data sets at the same time. However, within a given data set you must supply the same number of variables for each zone. In some cases you may have data where there are many variables and, for some of the zones some of those variables are not important. If that is the case, you can set selected variables in those zones to be passive. A passive variable is one that will always return the value zero if queried (e.g. in a probe) but will not involve itself in operations such as the calculations of the min and max range. This is very useful when calculating default contour levels.



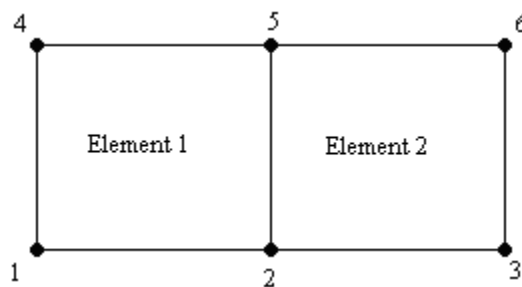
## Data Structure

Tecplot 360 accommodates two different types of data: [Ordered Data](#) and [Finite Element Data](#). Ordered data is a set of points logically stored in a one-, two-, or three-dimensional array, where I, J, and K are the index values within the array. The number of data points is the product of all of the dimensions within the array. Finite-element data is arranged in two arrays, a variable array and a connectivity matrix. The variable array is a collection of points in 2D or 3D space that are connected into polygonal or polyhedral units called elements. The connections between the nodes are defined by the connectivity matrix.

A *connectivity list* is used to define which nodes are included in each element of an ordered or cell-based finite element zone. You should know your zone type and the number of elements in each zone in order to create your connectivity list.

The number of nodes required for each element is implied by your zone type. For example, if you have a finite element quadrilateral zone, you will have four nodes defined for each element. Likewise, you must provide eight numbers for each cell in a BRICK zone, and three numbers for each element in a TRIANGLE zone. If you have a cell that has a smaller number of nodes than that required by your zone type, simply repeat a node number. For example, if you are working with a finite element quadrilateral zone and you would like to create a triangular element, simply repeat a node in the list (e.g., 1,4,5,5).

In the example below, the zone contains two quadrilateral elements. Therefore, the connectivity list must have eight values. The first four values define the nodes that form Element 1. Similarly, the second four values define the nodes that form Element 2.



The connectivity list for this example would appear as follows:

```
ConnList[8] = {4,5,2,1,      /* nodes for Element 1 */
```

```
5,6,3,2}; /* nodes for Element 2 */
```

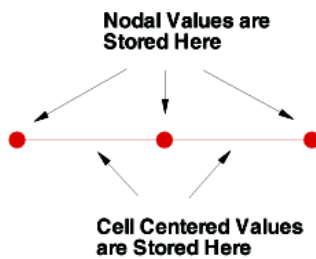


It is important to provide your node list in either a clockwise or counter-clockwise order. Otherwise, your cell will twist, and the element produced will be misshapen.

## 2 - 1 Ordered Data

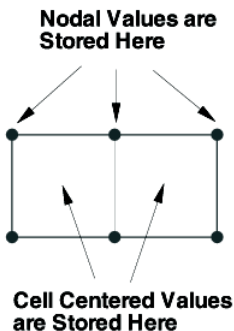
Ordered data is defined by one, two, or three-dimensional logical arrays, dimensioned by IMAX, JMAX, and KMAX. These arrays define the interconnections between nodes and cells. The variables can be either nodal or cell-centered. Nodal variables are stored at the nodes; cell-centered values are stored within the cells.

- **One-dimensional Ordered Data (I-ordered, J-ordered, or K-ordered)**



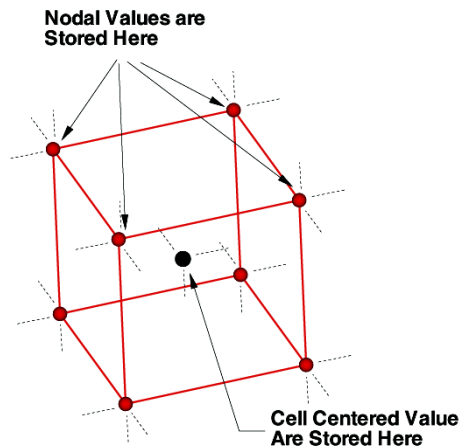
A single dimensional array where either IMAX, JMAX or KMAX is greater than or equal to one, and the others are equal to one. For nodal data, the number of stored values is equal to  $IMAX * JMAX * KMAX$ . For cell-centered I-ordered data (where IMAX is greater than one, and JMAX and KMAX are equal to one), the number of stored values is  $(IMAX-1)$  - similarly for J-ordered and K-ordered data.

- **Two-dimensional Ordered Data (IJ-ordered, JK-ordered, IK-ordered)**



A two-dimensional array where two of the three dimensions (IMAX, JMAX, KMAX) are greater than one, and the other dimension is equal to one. For nodal data, the number of stored values is equal to  $IMAX * JMAX * KMAX$ . For cell-centered IJ-ordered data (where IMAX and JMAX are greater than one, and KMAX is equal to one), the number of stored values is  $(IMAX-1)(JMAX-1)$  - similarly for JK-ordered and IK-ordered data.

- Three-dimensional **Ordered Data** (IJK-ordered)



A three-dimensional array where all IMAX, JMAX and KMAX are each greater than one. For nodal ordered data, the number of nodes is the product of the I-, J-, and K-dimensions. For nodal data, the number of stored values is equal to  $IMAX * JMAX * KMAX$ . For cell-centered data, the number of stored values is  $(IMAX-1)(JMAX-1)(KMAX-1)$ .

## 2 - 2 Finite Element Data

While finite element data is usually associated with numerical analysis for modeling complex problems in 3D structures (heat transfer, fluid dynamics, and electromagnetics), it also provides an effective approach for organizing data points in or around complex geometrical shapes. For example, you may not have the same number of data points on different lines, there may be holes in the middle of the dataset, or the data points may be irregularly (randomly) positioned. For such difficult cases, you may be able to organize your data as a patchwork of elements. Each element can be independent of the other elements, so you can group your elements to fit complex boundaries and leave voids within sets of elements. The figure below shows how finite element data can be used to model a complex boundary.

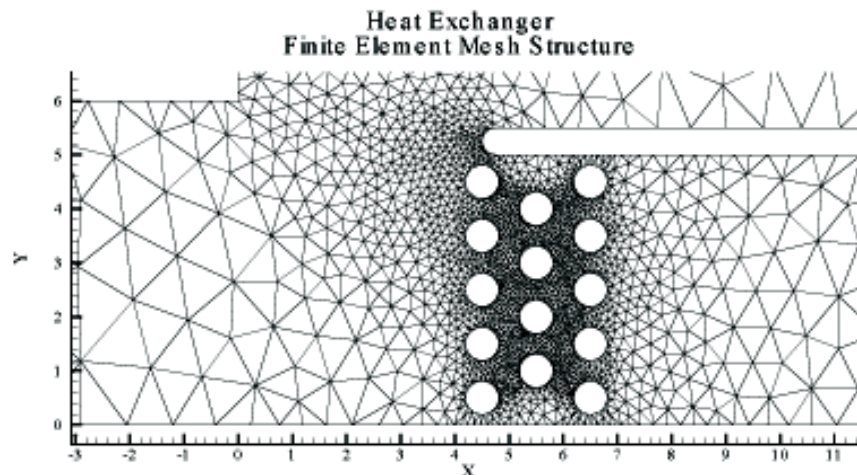


Figure 2-1. This figure shows finite element data used to model a complex boundary. This plot file, *feexchg.plt*, is located in your Tecplot 360 distribution under the *examples/2D* subdirectory.

Finite element data defines a set of points (nodes) and the connected elements of these points. The variables may be defined either at the nodes or at the cell (element) center. Finite element data can be divided into three types:

- **Line data** is a set of line segments defining a 2D or 3D line. Unlike I-ordered data, a single finite element line zone may consist of multiple disconnected sections. The values of the variables at each data point (node) are entered in the data file similarly to I-ordered data, where the nodes are numbered with the I-index. This data is followed by another set of data

defining connections between nodes. This second section is often referred to as the connectivity list. All elements are lines consisting of two nodes, specified in the connectivity list.

- **Surface data** is a set of triangular, quadrilateral, or polygonal elements defining a 2D field or a 3D surface. When using polygonal elements, the number of sides may vary from element to element. In finite element surface data, you can choose (by zone) to arrange your data in three point (triangle), four point (quadrilateral), or variable-point (polygonal) elements. The number of points per node and their arrangement are determined by the element type of the zone. If a mixture of quadrilaterals and triangles is necessary, you may repeat a node in the quadrilateral element type to create a triangle, or you may use polygonal elements.



Remember that Tecplot Focus cannot load face-based (polygonal or polyhedral) data.

- **Volume data** is a set of tetrahedral, brick, or polyhedral elements defining a 3D volume field. When using polyhedral elements, the number of sides may vary from element to element. Finite element volume cells may contain four points (tetrahedron), eight points (brick), or variable points (polyhedral). The figure below shows the arrangement of the nodes for tetrahedral and brick elements. The connectivity arrangement for polyhedral data is governed by the method in which the polyhedral facemap data is supplied.

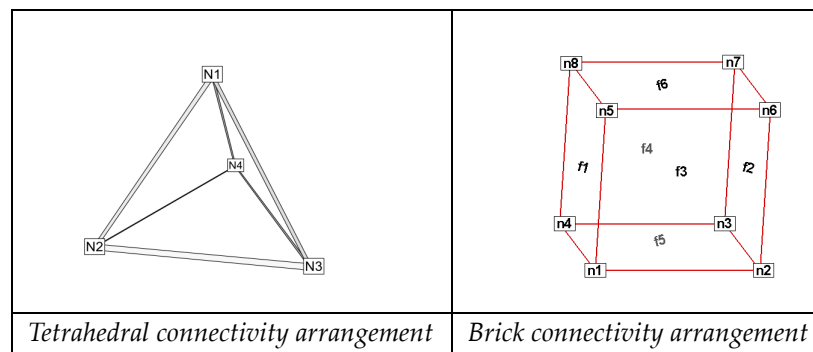


Figure 2-2. Connectivity arrangements for FE-volume datasets

In the brick format, points may be repeated to achieve 4, 5, 6, or 7 point elements. For example, a connectivity list of “n1 n1 n1 n1 n5 n6 n7 n8” (where n1 is repeated four times) results in a quadrilateral-based pyramid element.



For cell-based element types (triangular, quadrilateral, tetrahedral, or brick), you can simulate zones with mixed element types by repeating nodes as necessary. For example, a triangle element can be included in a quadrilateral zone by repeating one node in the element’s connectivity list, and tetrahedral, pyramidal, and prismatic elements can be included in a brick zone by repeating nodes appropriately.

[Section 4 - 5 “Finite Element Data”](#) on page 136 provides detailed information about how to format your FE data in Tecplot’s data file format.

## 2 - 2.1 Line Data

Unlike I-ordered data, a single finite element line zone may consist of multiple disconnected sections. The values of the variables at each data point (node) are entered in the data file similarly to I-ordered data, where the nodes are numbered with the I-index. This data is followed by another set of data defining

connections between nodes. This second section is often referred to as the *connectivity list*. All elements are lines consisting of two nodes, specified in the connectivity list.

## 2 - 2.2 Surface Data

In finite element surface data, you can choose (by zone) to arrange your data in three point (triangle), four point (quadrilateral), or variable-point (polygonal) elements. The number of points per node and their arrangement are determined by the element type of the zone. If a mixture of quadrilaterals and triangles is necessary, you may repeat a node in the quadrilateral element type to create a triangle or you may use polygonal elements.



Remember that Tecplot Focus cannot load face-based (polygonal or polyhedral) data.

## 2 - 2.3 Volume Data

- Finite element volume cells may contain four points (tetrahedron), eight points (brick) or a variable number of points (polyhedral). The figure below shows the arrangement of the nodes for tetrahedral and brick elements. The connectivity arrangement for polyhedral data is governed by the method in which the polyhedral facemap data is supplied.

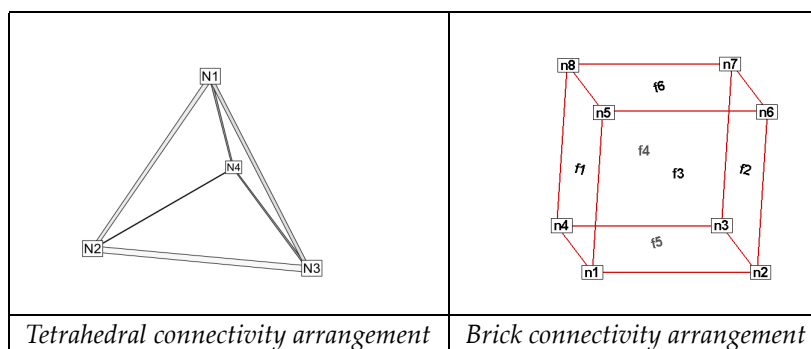


Figure 2-3. Connectivity arrangements for FE-volume datasets

In the brick format, points may be repeated to achieve 4, 5, 6, or 7 point elements. For example, a connectivity list of “n1 n1 n1 n1 n5 n6 n7 n8” (where n1 is repeated four times) results in a quadrilateral-based pyramid element.



Remember that Tecplot Focus cannot load face-based (polygonal or polyhedral) data.

## 2 - 2.4 Finite Element Data Limitations

Working with finite element data has some limitations:

- XY-plots of finite element data treat the data as I-ordered; that is, the connectivity list is ignored. Only nodes are plotted, not elements, and the nodes are plotted in the order in which they appear in the data file.
- Index skipping in vector and scatter plots treats finite element data as I-ordered; the connectivity list is ignored. Nodes are skipped according to their order in the data file.

## 2 - 3 Variable Location

Data values can be stored at the nodes or at the cell centers.

- For finite element meshes, cell-centers are the centers (centroids) of elements.
- For many types of plots, cell-centered values are interpolated to the nodes internally.

## 2 - 4 Face Neighbors

For polygonal and polyhedral data, face neighbors are the fundamental means of defining the topology.

A cell is considered a neighbor if one of its faces shares all nodes in common with the selected cell, or if it is identified as a neighbor by face neighbor data in the dataset. The face numbers for cells in the various zone types are defined below.

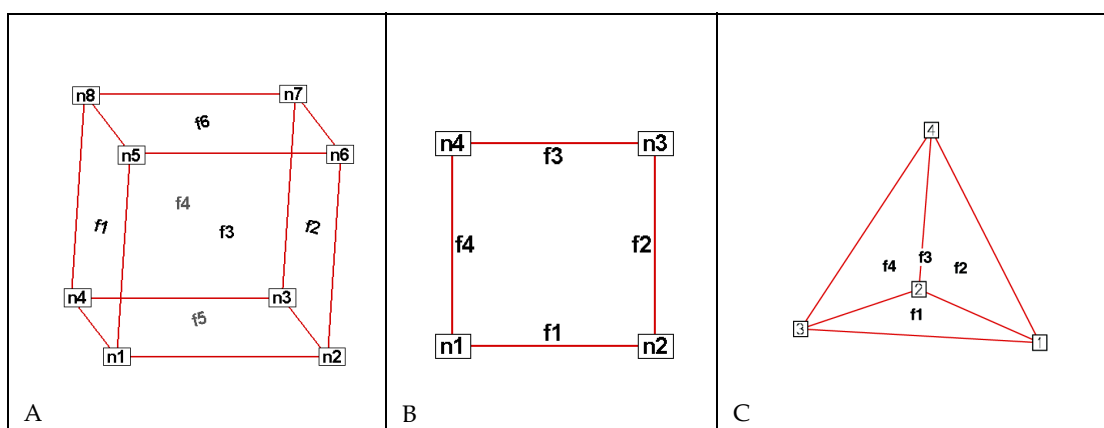


Figure 2-1. **A:** Example of node and face neighbors for an FE-brick cell or IJK-ordered cell. **B:** Example of node and face numbering for an IJ-ordered/ FE-quadrilateral cell. **C:** Example of tetrahedron face neighbors.

The implicit connections between elements in a zone may be overridden, or connections between cells in adjacent zones established by specifying face neighbor criteria in the data file. Refer to [Section "TECFACE142"](#) on page 28 for additional information.

## 2 - 5 Working with Unorganized Data Sets

Tecplot 360 loads unorganized data as a single I-ordered zone and displays them in XY Mode, by default. Tecplot products consider an I-ordered zone irregular if it has more than one dependent variable. An I-ordered data set with one dependent variable (i.e. an XY or polar line) is NOT an irregular zone.

It is also easy to tell if you have irregular data by looking at the plot. If you are looking at irregular data with the Mesh layer turned on, the data points will be connected by lines in the order the points appear in the data set.

You can organize your data set for Tecplot 360 in one of the following ways .

1. Manually order the data file using a text editor.
2. Use one of the **Data>Interpolation** options.



## 2 - 5.1 Example - Unorganized Three-Dimensional Volume

To use 3D volume irregular data in field plots, you must interpolate the data onto a regular, IJK-ordered zone. To interpolate your data, perform the following steps:

1. Place your 3D volume irregular data into an I-ordered zone in a data file.
2. Read in your data file and create a 3D scatter plot.
3. From the **Data** menu, choose **Create Zone>Rectangular**. (**Circular** will also work.)
4. In the **Create Rectangular Zone** dialog, enter the I-, J-, and K-dimensions for the new zone; at a minimum, you should enter 10 for each dimension. The higher the dimensions, the finer the interpolation grid, but the longer the interpolating and plotting time.
5. Enter the minimum and maximum X, Y, and Z values for the new zone. The default values are the minimums and maximums of the current (irregular) dataset.
6. Click [Create] to create the new zone, and [Close] to dismiss the dialog.
7. From the **Data** menu, choose **Interpolate>Inverse Distance**. (**Linear** or **Kriging** also works.)
8. In the **Inverse-Distance Interpolation** dialog, choose the irregular data zone as the source zone, and the newly created IJK-ordered zone as the destination zone. Set any other parameters as desired (see [Section 20 - 8.3 "Kriging"](#) for details).
9. Select the [Compute] button to perform the interpolation.

Once the interpolation is complete, you can plot the new IJK-ordered zone as any other 3D volume zone. You may plot iso-surfaces, volume streamtraces, and so forth. At this point, you may want to deactivate or delete the original irregular zone so as not to conflict with plots of the new zone.

[Figure 2-2](#) shows an example of irregular data interpolated into an IJK-ordered zone, with iso-surfaces plotted on the resultant zone.

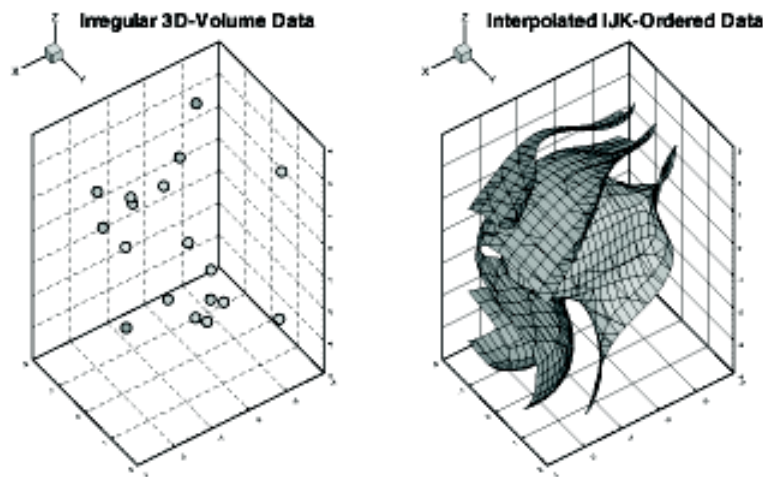


Figure 2-2. Irregular data interpolated into an IJK-ordered zone.

## 2 - 6 Time and Date Representation

Tecplot 360 uses floating point numbers to represent times and dates. The integer portion represents the number of days since December 30, 1899. The decimal portion represents a fractional portion of a day. The table below illustrates some examples of this method.

Date	Time	Floating Point Number
1900-01-01	00:00:00	2.0
1900-01-01	12:00:00	2.5
2008-07-31	00:00:00	39660.0
2008-07-31	12:00:00	39660.5
2008-07-31	12:01:00	39660.5006944444
2008-07-31	13:00:00	39660.5416666667

Tecplot 360 supports dates from 1800-01-01 through 9999-12-31. This formatting matches the representation method used by Microsoft Excel, enabling you to load time/date data easily from Excel into Tecplot 360. However, because Excel software's original formatting incorrectly calculated 1900 as a leap year, only dates from Mar 1, 1900 forward will import correctly into Tecplot 360.

# Binary Data

This chapter is intended for experienced programmers who need to create Tecplot binary data files directly. Support for topics discussed in this chapter is limited to general questions about writing Tecplot binary files. It is beyond the scope of our Technical Support to offer programming advice and to debug programs. For additional help, visit <http://www.tecplottalk.com>.

It is easy to write ASCII files in text format, and they have the advantage that you can inspect them using a text editor to make sure they are being written correctly. Their primary disadvantages are that they can consume much more disk space than binary files and are slower to load, which is especially noticeable when they are large. While users can convert them to the binary format with the Preplot utility (see [Section 4 - 1 “Converting ASCII to Binary”](#) for additional information), it is much more efficient to simply write them in binary format to begin with.

To output your data directly into Tecplot’s basic binary file format, *.plt*, you may use the TecIO library, which is provided at no cost by Tecplot, Inc., or you may write your own binary functions. If you wish to write your own functions, refer to [Appendix A: Section “Binary Data File Format”](#) for details on the structure of *.plt* files. If you wish to link with the library provided by Tecplot, begin with [Section 3 - 1 “Getting Started”](#) and use [Appendix A: Section “Binary Data File Format”](#) only for reference.

If you wish to write files in the newer *.szplt* format, you must use the TecIO library, as this file format is currently not documented.



You can find source files for most of the examples in this chapter in the *util/tecio/examples* folder of your Tecplot 360 EX installation.

## 3 - 1 Getting Started

TecIO is a library of utility functions that your application can use to create binary data files directly, bypassing the use of ASCII files. This makes for fewer files to manage, conserves disk space, and saves the time required to convert the files to binary (whether as a separate step or when loading them).

TecIO supports two binary file formats:

- **Tecplot Binary** (.plt) - The legacy format written by versions of Tecplot 360 and Tecplot Focus prior to Tecplot 360 EX. It is of course also supported by Tecplot 360 EX.
- **Tecplot Subzone** (.szplt) - A newer format introduced with Tecplot 360 EX, optimized for large data sets, that enables substantially improved interactive performance and a reduced memory footprint for common workflows.

We encourage you to support both formats. Users of Tecplot 360 EX will appreciate the improved interactive experience, while users of older versions of Tecplot 360, Tecplot Focus, and other programs that can read Tecplot-format binary files will appreciate being able to use your data with their software.

A copy of the TecIO library is installed with your Tecplot 360 installation. The path of the file varies slightly depending on the platform.

Platform	Standard TecIO	MPI TecIO
Linux	lib/libtecio.so	lib/libteciompi.so
Mac OS X	tecio/libtecio.dylib	tecio/libteciompi.dylib
Windows	lib/tecio.dll	lib/libteciompi.dll

You may also download the latest version of TecIO from the [Tecplot Web site](#). (This may be a newer version than the one described in this document.)

Before preparing to output your data in Tecplot's binary format using the TecIO library, we recommend you proceed as follows:

1. Review [Section 3 - 5 "Binary Data File Function Calling Sequence"](#) and [Section 3 - 6 "Writing to Multiple Binary Data Files"](#).
2. Review the example files in the *examples/tecio* folder. The example programs demonstrate the use of the TecIO utility functions and are provided in both FORTRAN and C/C++:
  - *simtest.f*, *simtest.f90*, *simtest.c* - These files demonstrate simple use of the TecIO utility functions.
  - *comtest.f*, *comtest.f90*, *comtest.c* - These files demonstrate complex use of TecIO utility functions, such as multiple file generation and transient data.

Numerous additional, more modern examples included in the TecIO package target specific actions, like writing polyhedral data. Review these examples for additional guidance.
3. Follow the instructions in [Section 3 - 7 "Linking with the TecIO Library"](#) for information on setting up your project to develop with TecIO and linking with the library.
4. Begin developing your code.

## 3 - 2 Viewing Your Output

You may load your binary files in Tecplot 360 or Tecplot Focus using the Tecplot Data loader or the Tecplot Subzone Data Loader, as appropriate. Once loaded, you may view information about your data file using any of the following techniques:

- [Dataset Information](#) dialog - You may use the **Data Set Information** dialog (accessed via the **Data** menu) to display information about your file (once it is loaded into Tecplot). Refer to this dialog for a list of the zones, variables, variable ranges, auxiliary data and more. Refer to [Section 5 - 4 "Dataset Information"](#) on page 147 in the [User's Manual](#) for details.
- [Data Spreadsheet](#) - Use the Data Spreadsheet to view a table of every variable value in your file. Refer to [Section 20 - 10 "Data Spreadsheet"](#) in the [User's Manual](#) for details.

### 3 - 3 Partitioned Data

The TecIO library supports partitioning finite-element zones when writing *.szplt* data files. That is, the zone does not need to be written all at once, but can be written in sections. This capability is intended primarily for use with CFD codes that compute large solutions in parallel, with multiple solver processes running on independent nodes in a cluster, each solving a subset of the simulation. However, it can also be used by a single-process solver running on a desktop workstation if desired, for example for development purposes.

TecIO writes the partitioned zones into a single Tecplot *.szplt* file that can later be opened and visualized by Tecplot 360 EX. To enable this functionality on large multiprocessing systems, TecIO utilizes the Message-Passing Interface (MPI) library.<sup>1</sup> By comparison to non-partitioned zones, only a couple of additional TecIO function calls are required when writing partitioned zones, and only a couple more beyond that when writing in parallel using MPI. Two versions of the TecIO library are provided: *tecio* and *teciompi*. The latter requires a compatible MPI library. (Note that *tecio* does support writing partitioned zones, just not in parallel.)

Partitioned solution of large CFD cases typically requires that zone partitions overlap slightly. That is, the nodes or cells on the each side of the boundary between partitions will reside in more than one solver process: in the one that “owns” it according to the partitioning rules, as well as in any processes solving a partition spatially adjacent to it. In processes other than the one that “owns” them, such data are commonly referred to as “ghost cells” and “ghost nodes.” The TecIO library needs information about these overlapping cells and nodes in order to later allow the partitioned data to be joined into a single virtual data set suitable for visualization. For finite-element zones, each solver process must pass a list of its ghost nodes and cells along with the zone data (which should include the ghost nodes and cells). For ordered zones, the solver need pass only the nodes owned by each process, as the indices of each partition are sufficient for later reassembling the data.

The code sample *brickpartitioned* is useful for understanding how to write partitioned zones, and includes the additional function calls needed for writing partitioned data in parallel using MPI.

### 3 - 4 Binary File Compatibility

The *.plt* file that you create will be compatible with the version of Tecplot 360 EX tied to the version of the TecIO library that you use. For example, if you were to use the TecIO library that was bundled with Tecplot 360 EX 2006, your files can be loaded with Tecplot 360 EX 2006 and newer.

This rule is independent of the version number used for the binary functions (for example, the 142 in TECZNE142). For example, even if you use 142 functions with the version of the TecIO library included with this distribution, your *.plt* file will be compatible with this version of Tecplot 360 EX and newer.

A *.plt* file is also backward compatible to the first version of Tecplot 360 or Focus that uses the file format version supported by the library being used. However, these older Tecplot products cannot read *.szplt* files regardless of their version. Subzone data files (*.szplt*) can be loaded only in Tecplot 360 EX, not Tecplot 360 (pre-EX) or Tecplot Focus.

This file format was introduced in Tecplot 360 EX 2014 R1 and was revised in Tecplot 360 EX 2016 R1 to support partitioned output. Similar to the situation with the *.plt* format, newer versions of Tecplot 360 EX can read the format generated with the older TecIO library, but older versions of Tecplot 360 EX may not always be able to read the files generated by the newer versions of TecIO.

Files containing face-based (polygonal or polyhedral) finite-element zones cannot be read by Tecplot Focus. Tecplot Focus 2016 R1 and later can read files containing a maximum of five million data points.

---

1. On Windows, TecIO-MPI is compiled against Microsoft MPI 4.2.4400.0. On Mac OS X and Linux, it is compiled against OpenMPI 1.10.0.

### 3 - 4.1 Deprecated Binary Functions

Functions whose names end in an integer less than 142 are deprecated and are provided only for compatibility with older client code. We recommend you use the 142 binary function family with new code and/or if you need to update your application to take advantage of the new functionality provided with version 142. In order to use the 142 family of functions, use the TecIO library included in your Tecplot 360 2016 distribution. If you have existing code using deprecated functions, and want to use any binary function calls from version 142, you must update all your TecIO library calls to 142.

API version 142 or later allows applications to select between the *.plt* and *.szplt* file formats at runtime, a feature introduced with Tecplot 360 2014 R2. In Tecplot 360 2014 R1, two versions of the TecIO library were provided, one that wrote *.plt* files and one that wrote the new *.szplt* files. Both had identical APIs; the file format was determined solely by the version of the library you linked with your application. In Tecplot 360 2014 R2 and later, a parameter was added to TECINI to choose the format when opening the file for writing (see [TECINI142](#)). The current library always writes *.plt* files when using an API version below 142, since there is no way to specify the file format with these older APIs.

### 3 - 4.2 Character Strings in FORTRAN

All character string parameters passed to TecIO must use C-style strings: that is, they must terminate with a null character. In FORTRAN, this can be done by concatenating `char(0)` to the end of a character string.

For example, to send the character string "Hi Mom" to a function called A, use the following syntax:

```
I=A("Hi Mom"//char(0))
```

### 3 - 4.3 Boolean Flags

Integer parameters identified as "flags" indicate boolean values. Pass 1 for true, and 0 for false.

## 3 - 5 Binary Data File Function Calling Sequence

The binary data file functions in the TecIO library must be called in a specific order, which varies slightly depending on the type of data file being written.

- [Non-partitioned Zones](#)
- [Partitioned Zones](#)

Note that a single process may, if desired, write both ordinary or partitioned data to up to ten files simultaneously. For partitioned data, these files may be written by different groups of processes if desired by specifying different communicators in the TECMPIINIT142 call. [Section 3 - 6 "Writing to Multiple Binary Data Files"](#) explains how to use the [TECFIL142](#) function to write to multiple files simultaneously.

### 3 - 5.1 Non-partitioned Zones

If you are writing only non-partitioned zones to a file, calls should be made to TecIO in this order:

[TECINI142](#)

For each call to [TECINI142](#), use one or more of the following:

[TECAUXSTR142](#) (Optional)

[TECVAUXSTR142](#) (Optional)

[TECZNE142](#) (One or more to create multiple zones)

For each call to [TECZNE142](#), use one or more of these:

[TECDAT142](#) (One or more to fill each zone)

[TECNOD142](#) or [TECNODE142](#) (One or more for each finite element zone)

[TECFACE142](#) (One for each zone with face connections)

[TECPOLY142](#) or [TECPOLYFACE142](#)/[TECPOLYBCONN142](#) (polyhedral data)  
[TECZAUXSTR142](#) (Optional)  
[TECLAB142](#) (Optional)  
[TECGEO142](#) (Optional)  
[TECTXT142](#) (Optional)  
[TECUSR142](#) (Optional)  
[TECEND142](#)



Remember that Tecplot Focus cannot load face-based (polygonal or polyhedral) data.

### 3 - 5.2 Partitioned Zones

If you are writing zones in partitions, the required sequence of calls to TecIO functions is slightly different for the main process and the worker processes: the main process is the only process that may output non-zone data, such as text, geometries, and aux data. The calls that may be used only by the main process are noted in the calling sequence below.

It is not necessary that every zone in a data file actually be a partitioned zone (i.e., one solved by multiple processes). It is possible for any process to write either partitioned or non-partitioned zones, or a mix of the two. If the [TECZNEMAP142](#) call specifies only a single process, the zone is considered a non-partitioned zone written entirely by that process.

The main process must call [TECZNE142](#) for all zones, including non-partitioned zones that it writes itself. For non-partitioned zones written by processes other than the main process, that process must also call [TECZNE142](#). Partitioned zones must have a [TECZNE142](#) and [TECZNEMAP142](#) call from all processes involved in writing the zone, as well as the main process. If [TECZNE142](#) and [TECZNEMAP142](#) specify processes that do not own any of the zone's partitions, these calls have no effect and are ignored.

Currently, only classic finite-element zones can be written in partitioned fashion. IJK-ordered zones and polygonal/polyhedral FE zones are planned for future development.

The calling sequence for writing partitioned zone(s) is as follows:

[TECINI142](#), then [TECMPIINIT142](#) if using TecIO-MPI

Then, for each partition or zone to be written by the process, use one or more of the following:

[TECAUXSTR142](#) (main process only)

[TECVAUXSTR142](#) (main process only)

[TECZNE142](#) then [TECZNEMAP142](#) (if using TecIO-MPI) followed by either [TECFEPTN142](#) or [TECIJKPTN142](#), depending on whether the zone is FE or ordered. Then call one or more of the following:

[TECDAT142](#) (One or more calls to fill each zone)

[TECNOD142](#) or [TECNODE142](#) (One or more calls for each finite element zone)

[TECFACE142](#) (One call for each zone with face connections)

[TECZAUXSTR142](#) (main process only)

[TECLAB142](#) (main process only)

[TECGEO142](#) (main process only)

[TECTXT142](#) (main process only)

[TECUSR142](#) (main process only)

[TECEND142](#)

## 3 - 6 Writing to Multiple Binary Data Files

Each time `TECINI142` is called, it sets up a new file context. For each file context, you must maintain the order of the calls as described earlier. The `TECFIL142` function is used to switch between file contexts. Up to 10 files can be written to at a time. `TECFIL142` can be called almost anywhere after `TECINI142` has been called. The only parameter to `TECFIL142`, an integer,  $n$ , shifts the file context to the  $n$ th open file. The files are numbered relative to the order of the calls to `TECINI142`.

Note that when writing a subzone (*.szplt*) file, all data written is held in memory and not actually committed to disk until `TECEND142` is called. Ordinary binary files (*.plt*) files may be partially written to disk before `TECEND142` is called.

## 3 - 7 Linking with the TecIO Library

Follow the instructions below to link with the TecIO library. The library is provided as a dynamic library on all platforms, meaning that it remains a separate file and must be distributed with your application. If you wish instead to use a static library that will be combined into your application, you may obtain the TecIO or TecIO-MPI source code by contacting [support@tecplot.com](mailto:support@tecplot.com). For TecIO-MPI on Mac or Linux platforms, you should strongly consider building the library from source on your solver machine, since various MPI versions are not binary-compatible.

### 3 - 7.1 Linux/Macintosh

To link with the TecIO library, pass the full path to the *tecio* (or *teciompi*) library to your compiler or linker along with all other input files needed to compile and link your application. The TecIO library is written in C++, so in addition to linking it, you will likely also need to link in the C++ standard library.

For example, to create an output file *my-executable* from a C source file of *my-prog.c* and link in the TecIO library and the C++ standard library:

```
cc -o my-executable my-prog.c /path/to/libtecio.so -lstdc++ (Linux) or
cc -o my-executable my-prog.c /path/to/libtecio.dylib -lstdc++ (Mac OS X)
```

For TecIO-MPI, instead use */path/to/libteciompi.so* or */path/to/libteciompi.dylib* depending on platform.

The *stdc++* library used to build the *tecio* library in your Tecplot 360 EX installation may be newer than the one provided on your platform. If so, link against the version of the *stdc++* library provided in your Tecplot 360 EX installation. See the file *util/tecioexamples/base.make* inside your Tecplot 360 EX installation directory for an example of this.

#include the TecIO header file `TECIO.h` in your source files. It may be found in the *include* directory of your Tecplot 360 installation.



Fortran programmers: some Fortran 90 compilers do not recognize the *.f90* filename extension.

### 3 - 7.2 Windows

To link with the TecIO library, list *tecio.dll* (or, for TecIO-MPI, *teciompi.dll*) as an additional dependency in your Visual Studio project. #include the TecIO header file `TECIO.h` in your source files. It may be found in the *include* directory of your Tecplot 360 installation.

To ensure Windows finds *tecio.dll* when launching your executable, ensure its location is in your `PATH` environment variable, or else copy it to your executable's directory. The latter approach is generally best, as it ensures that the correct version will be used if multiple copies of the library are installed on the machine.



### 3 - 7.3 Notes for Windows Programmers using Fortran

Files *tecio.f90* and *tecio.for*, located in the *include* folder in your installation, contain both Fortran-90 interfaces for all TecIO routines and several compiler-specific directives (the `!MS$ATTRIBUTES` lines). These direct Microsoft Visual Fortran to use STDCALL calling conventions with by-reference parameter passing. While *tecio.f90* is free-formatted, *tecio.for* uses the traditional column-based formatting. Include the appropriate file in any of your subroutines that call TecIO routines. Both files were developed for Intel Visual Fortran 9.

Users of other compilers may need to adjust the Fortran settings or add other compiler directives to achieve the same effect. In particular, Fortran strings must be null-terminated and passed without a length argument.

## 3 - 8 Binary Data File Function Reference

This section describes each of the TecIO functions in detail.

---

### TECAUXSTR142

---

Writes auxiliary data for the data set to the data file. The function may be called at any time between [TECINI142](#) and [TECEND142](#). Auxiliary data may be used by text, macros, equations (if it is numeric) and add-ons. It may be viewed directly in the *Aux Data* page of the **Data Set Information** dialog (accessed via the **Data** menu).

When using TecIO-MPI, may only be called from the main process.

#### **FORTTRAN Syntax:**

```
INTEGER*4 FUNCTION TECAUXSTR142(Name,
&                               Value)
CHARACTER*(*) Name
CHARACTER*(*) Value
```

#### **C Syntax:**

```
#include TECIO.h
INTEGER4 TECAUXSTR142(           char *Name,
                                char *Value)
```

#### **Return Value:**

0 if successful, -1 if unsuccessful.

#### **Parameters:**

Parameter	Description
Name	The name of the auxiliary data. If this duplicates an existing name, the value will overwrite the existing value. It must be a null-terminated character string and cannot contain spaces.
Value	The value to assign to the named auxiliary data. It must be a null-terminated character string.

#### **Example**

For example, to set an Auxiliary Variable called DeformationValue to 0.98:

```
char DeformationValue[128];
strcpy(DeformationValue,"0.98");

TECAUXSTR142("DeformationValue",
             DeformationValue);
```

When the data file is loaded into Tecplot, "Deformation Value" will appear on the *Aux Page* of the **Data Set Information** dialog when "for Data Set" is selected in *Show Auxiliary Data* menu.

---

## TECDAT142

---

Writes an array of data to the data file. Data should not be passed for variables that have been indicated as passive or shared (via [TECZNE142](#)).

TECDAT142 allows you to write your data in piecemeal fashion in case it is not contained in one contiguous block in your program or is not available all at once. TECDAT142 must be called enough times to ensure that the correct number of values is written for each zone and that the aggregate order for the data is correct.

In the above summary, NumVars is based on the number of variable names supplied in a previous call to [TECINI142](#).

### **FORTRAN Syntax:**

INTEGER*4 FUNCTION	TECDAT142(N,
&	Data,
&	IsDouble)
INTEGER*4	N
REAL or DOUBLE PRECISION	Data(1)
INTEGER*4	IsDouble

### **C Syntax:**

```
#include TECIO.h
INTEGER4 TECDAT142(  INTEGER4   *N,
                     void        *Data,
                     INTEGER4    *IsDouble);
```

### **Return Value:**

0 if successful, -1 if unsuccessful.

**Parameters:**

Parameter	Description
N	Pointer to an integer value specifying number of values to write.
Data	Array of single or double precision data values. Refer to <a href="#">Table 3 - 1</a> for a description of how to arrange your data.
IsDouble	Pointer to the integer flag stating whether the array Data is single (0) or double (1) precision.

**Data Arrangement**

The following table describes the order the data must be supplied given different zone types. IsBlock and VarLocation are parameters supplied to [TECZNE142](#). The value of IsBlock should always be 1, since binary data must be written in block format:

Zone Type	Var. Location	IsBlock	Number of Values	Order
Ordered	Nodal	1	IMax* JMax* KMax* NumVars	I varies fastest, then J, then K, then Vars. That is, the numbers should be supplied in the following order: for (Var=1;Var<=NumVars;Var++) for (K=1;K<=KMax;K++) for (J=1;J<=JMax;J++) for (I=1;I<=IMax;I++) Data[I, J, K, Var] = value;
Ordered	Cell Centered	1	(IMax-1)* (JMax-1)* (KMax-1)* NumVars	I varies fastest, then J, then K, then Vars. That is, the numbers should be supplied in the following order: for (Var=1;Var<=NumVars;Var++) for (K=1;K<=(KMax-1);K++) for (J=1;J<=(JMax-1);J++) for (I=1;I<=(IMax-1);I++) Data[I, J, K, Var] = value;
Finite element	Nodal	1	IMax (i.e. NumNodes) * NumVars	N varies fastest, then Vars. That is, the numbers should be supplied in the following order: for (Var=1;Var<=NumVars;Var++) for (N=1;N<=NumNodes;N++) Data[N, Var] = value;
Finite element	Cell Centered	1	JMax (i.e. NumElements) * NumVars	E varies fastest, then Var. That is, the numbers should be supplied in the following order: for (Var=1;Var<=NumVars;Var++) for (E=1;E<=NumElements;E++) Data[E, Var] = value;

**Table 3 - 1: Data Arrangement****Example**

Refer to the following examples in [Section 3 - 10 "Examples"](#) for examples using TECDAT142:

- [Section 3 - 10.1 "Face Neighbors"](#)
- [Section 3 - 10.2 "Polygonal Example"](#)

- [Section 3 - 10.3 "Multiple Polyhedral Zones"](#)
- [Section 3 - 10.4 "Multiple Polygonal Zones"](#)
- [Section 3 - 10.5 "Polyhedral Example"](#)
- [Section 3 - 10.6 "IJ-ordered zone"](#)

---

## TECEND142

---

*Must* be called to close the current data file. There must be one call to TECEND142 for each [TECINI142](#) or data may be lost. (When writing *.szplt* files, all data are held in memory until TECEND142 is called.)

When writing partitioned data, this call will block until all processes involved in writing the data have called it.

### **FORTRAN Syntax:**

```
INTEGER*4 FUNCTION TECEND142()
```

### **C Syntax:**

```
#include TECIO.h
INTEGER4 TECEND142();
```

### **Return Value:**

0 if successful, -1 if unsuccessful.

### **Parameters:**

None.

---

## TECFACE142

---

Writes face connections for the current zone to the file. Face Neighbor Connections are used for ordered or cell-based finite element zones to specify connections that are not explicitly defined by the connectivity list or ordered zone structure. You may use face neighbors to specify connections between zones (global connections) or connections within zones (local connections). Face neighbor connections are used by Tecplot when deriving variables or drawing contour lines. Specifying face neighbors, typically leads to smoother connections. NOTE: face neighbors have expensive performance implications. Use face neighbors only to manually specify connections that are not defined via the connectivity list.



Remember that Tecplot Focus cannot load face-based (polygonal or polyhedral) data.

This function must be called after [TECNOD142](#) or [TECNODE142](#), and may only be called if a non-zero value of *NumFaceConnections* was used in the previous call to [TECZNE142](#).

### **FORTRAN Syntax:**

```
INTEGER*4 FUNCTION TECFACE142(FaceConnections)
INTEGER*4                                FACECONNECTIONS(*)
```

**C Syntax:**

```
#include TECIO.h
INTEGER4 TECFACE142(INTEGER4 *FaceConnections);
```

**Return Value:**

0 if successful, -1 if unsuccessful.

**Parameters:**

Parameter	Description
<b>FaceConnections</b>	The array that specifies the face connections. The array must have L values, where L is the sum of the number of values for each face neighbor connection in the data file. The number of values in a face neighbor connection is dependent upon the <b>FaceNeighborMode</b> parameter (set via <a href="#">TECZNE142</a> ) and is described in the following table.

FaceNeighbor Mode	Number of values	Data
LocalOneToOne	3	cz1,fz,cz2
LocalOneToMany	nz+4	cz1,fz,oz,nz,cz2,cz3,...,czn
GlobalOneToOne	4	cz, fz, ZZ, CZ
GlobalOneToMany	2*nz+4	cz, fz, oz, nz, ZZ1, CZ1, ZZ2, CZ2, ...,ZZn, CZn

Where:

cz = cell in current zone

fz = face of cell in current zone

oz = face obscuration flag (only applies to one-to-many):

0 = face partially obscured

1 = face entirely obscured

nz = number of cell or zone/cell associations (only applies to one-to-many)

ZZ = remote Zone

CZ = cell in remote zone

cz,fz combinations must be unique. Additionally, Tecplot 360 assumes that with the one-to-one face neighbor modes a supplied cell face is entirely obscured by its neighbor. With one-to-many, the obscuration flag must be supplied. Faces that are not supplied with neighbors are run through Tecplot 360's auto face neighbor generator (FE only).

The face numbers for cells in the various zone types are defined in [Figure 3-1](#).

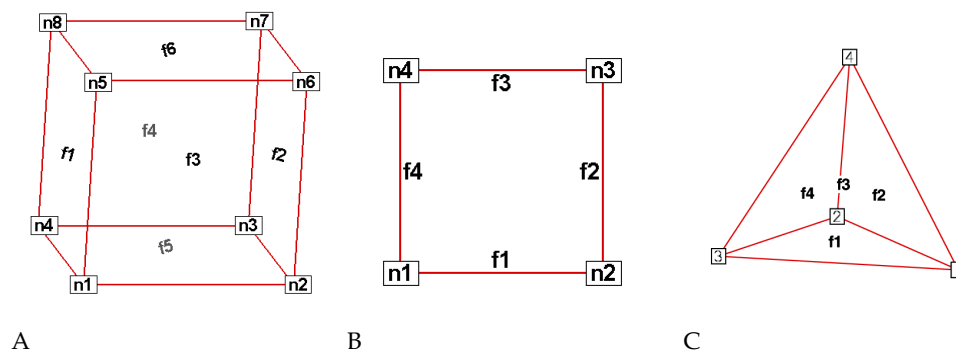


Figure 3-1. **A:** Example of node and face neighbors for an FE-brick cell or IJK-ordered cell. **B:** Example of node and face numbering for an IJ-ordered/ FE-quadrilateral cell. **C:** Example of tetrahedron face neighbors.

### Example

Refer to [Section 3 - 10.1 “Face Neighbors”](#) for an example of working with face neighbors. In this example, face neighbors are used to prevent an Edge line from being drawn between the two zones.

## TECFEPTN142

When writing a partitioned classic finite-element zone to a *.szplt* file, provides information about the partition about to be written. Must be called after [TECZNE142](#) (and, for TecIO-MPI, [TECZNEMAP142](#)) but before calling [TECDAT142](#) and [TECNOD142/TECNODE142](#) to actually write the data.

A partition may include nodes and cells that overlap other partitions, commonly referred to as “ghost nodes” and “ghost cells.” The TECFEPTN142 function call specifies this ghost data, allowing the partitions to be later reassembled seamlessly into a single zone when loaded for visualization. Each node or cell should be considered to be “owned” by one process, and that process should not report that node or cell as a “ghost.” Any other process that has that node or cell in its partition should include it in the list of ghost nodes or cells, respectively, passed to TECFEPTN142. All processes must write data for the actual “ghost” nodes and cells using the appropriate function calls (e.g. [TECDAT142](#), [TECNOD142](#)/[TECNODE142](#)).

## ***FORTTRAN Syntax:***

```
INTEGER*4 FUNCTION      TECFEPTN142(partition,  
&                        numnodes,  
&                        numcells,  
&                        ngnodes,  
&                        gnodes,  
&                        gnpartitions,  
&                        gnpnodes,  
&                        ngcells,  
&                        gccells)  
    INTEGER*4            partition  
    INTEGER*4            numnodes  
    INTEGER*4            numcells  
    INTEGER*4            ngnodes  
    INTEGER*4            gnodes  
    INTEGER*4            gnpartitions  
    INTEGER*4            gnpnodes
```

```

INTEGER*4          ngcells
INTEGER*4          gcells

```

**C Syntax:**

```

#include TECIO.h
INTEGER4 TECFIL142(INTEGER4 *partition,
                   INTEGER4 *numnodes,
                   INTEGER4 *numcells,
                   INTEGER4 *ngnodes,
                   INTEGER4 *gnodes,
                   INTEGER4 *gnpartitions,
                   INTEGER4 *gnpnodes,
                   INTEGER4 *ngcells,
                   INTEGER4 *gcells);

```

**Return Value:**

0 if successful, nonzero if unsuccessful.

**Parameters:**

Parameter	Description
<b>partition</b>	The number of the current partition. Partitions are numbered from 1 to the number of partitions (as specified in the <a href="#">TECZNEMAP142</a> call) inclusive.
<b>numnodes</b>	The number of nodes in the partition, including any ghost nodes.
<b>numcells</b>	The number of cells in the partition, including any ghost cells.
<b>ngnodes</b>	The number of ghost nodes in the partition.
<b>gnodes</b>	Array of length <b>ngnodes</b> specifying the indices of the ghost nodes. Each ghost node must be specified exactly once.
<b>gnpartitions</b>	Array of length <b>ngnodes</b> specifying the owning partition of each ghost node, in the order in which they are specified in <b>gnodes</b> .
<b>gnpnodes</b>	Array of length <b>ngnodes</b> specifying the node index by which each ghost node is known in its owning partition, again in the order specified in <b>gnodes</b> .
<b>ngcells</b>	Number of ghost cells.
<b>gcells</b>	Array of length <b>ngcells</b> specifying the indices of the ghost cells. Each ghost cell must be specified exactly once.

---

**TECFIL142**

---

Switch output context to a different file. Each time [TECINI142](#) is called, a new file context is created. This allows you to write multiple data files concurrently. When working with multiple files, be sure to call [TECFIL142](#) each time you wish to write to a file to ensure your data is written to the expected file.

**FORTTRAN Syntax:**

```

INTEGER*4 FUNCTION TECFIL142(F)
INTEGER*4      F

```

### **C Syntax:**

```
#include TECIO.h
INTEGER4 TECFIL142(INTEGER4 *F);
```

### **Return Value:**

0 if successful, -1 if unsuccessful.

### **Parameters:**

Parameter	Description
F	Pointer to integer specifying file number to switch to. A value of 1 indicates a switch to the file opened by the first call to <a href="#">TECINI142</a> .

### **Examples**

Refer to [Section 3 - 10.7 "Switching Between Two Files"](#) for a simple example of working with TECFIL142.

---

## **TECFOREIGN142**

---

Optional function that sets the byte ordering request for subsequent calls to [TECINI142](#). The byte ordering request will remain in effect until the next call to this function. This has no effect on any files already opened via [TECINI142](#). Use this function to reverse the byte ordering from the format native to your operating system. This function is not much needed today, since current Tecplot products are supported only on Intel-based platforms; however, it may be useful with older versions of TecIO running on legacy UNIX platforms that have non-Intel byte orders.

If the function call is omitted, native byte ordering is used.

### **FORTTRAN Syntax:**

```
INTEGER*4 FUNCTION TECFOREIGN142(DoForeignByteOrder)
INTEGER*4 DoForeignByteOrder
```

### **C Syntax:**

```
#include TECIO.h
INTEGER4 TECFOREIGN142(INTEGER4 *DoForeignByteOrder);
```

### **Return Value:**

0 if successful, -1 if unsuccessful.



**Parameters:**

Parameter	Description
<b>DoForeignByteOrder</b>	Pointer to boolean value indicating if future files created by <a href="#">TECINI142</a> should be written out in foreign byte order. 0 indicates native byte order. 1 indicates foreign byte order.

**TECGEO142**

Adds a geometry object to the file (e.g. a circle or a square). You cannot set unused parameters to NULL; use dummy values for unused parameters.

When using TecIO-MPI, may only be called from the main process.

**FORTRAN Syntax:**

```

      INTEGER*4 FUNCTION TECGEO142( XOrThetaPos,
&                                YOrRPos,
&                                ZPos,
&                                PosCoordMode,
&                                AttachToZone,
&                                Zone,
&                                Color,
&                                FillColor,
&                                IsFilled,
&                                GeomType,
&                                LinePattern,
&                                PatternLength,
&                                LineThicknessness,
&                                NumEllipsePts,
&                                ArrowheadStyle,
&                                ArrowheadAttachment,
&                                ArrowheadSize,
&                                ArrowheadAngle,
&                                Scope,
&                                Clipping,
&                                NumSegments,
&                                NumSegPts,
&                                XOrThetaGeomData,
&                                YOrRGeomData,
&                                ZGeomData,
&                                MFC)
      DOUBLE PRECISION XOrThetaPos
      DOUBLE PRECISION YOrRPos
      DOUBLE PRECISION ZPos
      INTEGER*4 PosCoordMode
      INTEGER*4 AttachToZone
      INTEGER*4 Zone
      INTEGER*4 Color
      INTEGER*4 FillColor
      INTEGER*4 IsFilled
      INTEGER*4 GeomType
      INTEGER*4 LinePattern
      DOUBLE PRECISION PatternLength
      DOUBLE PRECISION LineThicknessness
      INTEGER*4 NumEllipsePts
      INTEGER*4 ArrowheadStyle
      INTEGER*4 ArrowheadAttachment
      DOUBLE PRECISION ArrowheadSize
      DOUBLE PRECISION ArrowheadAngle
      INTEGER*4 Scope
      INTEGER*4 Clipping
      INTEGER*4 NumSegments

```

INTEGER*4	NumSegPts
REAL*4	XOrThetaGeomData
REAL*4	YOrRGeomData
REAL*4	ZGeomData
CHARACTER*(*)	MFC

### ***C Syntax:***

```
#include TECIO.h
INTEGER4 TECGE0142(double *XOrThetaPos,
double *YOrRPos,
double *ZPos,
INTEGER4 *PosCoordMode,
INTEGER4 *AttachToZone,
INTEGER4 *Zone,
INTEGER4 *Color,
INTEGER4 *FillColor,
INTEGER4 *IsFilled,
INTEGER4 *GeomType,
INTEGER4 *LinePattern,
double *PatternLength,
double *LineThicknessness,
INTEGER4 *NumEllipsePts,
INTEGER4 *ArrowheadStyle,
INTEGER4 *ArrowheadAttachment,
double *ArrowheadSize,
double *ArrowheadAngle,
INTEGER4 *Scope,
INTEGER4 *Clipping,
INTEGER4 *NumSegments,
INTEGER4 *NumSegPts,
float *XOrThetaGeomData,
float *YOrRGeomData,
float *ZGeomData,
char *MFC)
```

### ***Return Value:***

0 if successful, -1 if unsuccessful.

**Parameters:**

Parameter	Description
XPos	Pointer to double value specifying the X- position or, for polar line plots, the Theta-position of the geometry.
or	
ThetaPos	
YPos	Pointer to double value specifying the Y-position or, for polar line plots, the R-position of the geometry.
or	
RPos	
ZPos	Pointer to double value specifying the Z-position of the geometry.
PosCoordMode	Pointer to integer value specifying the position coordinate system. 0=Grid 1=Frame 6=Grid3D Grid3D is available only when the <a href="#">GeomType</a> is equal to 3D Line Segments.
AttachToZone	Pointer to integer flag to signal that the geometry is “attached” to a zone. When a geometry is attached to a zone, it will be visible only when that zone is visible. 1 = Yes                      0 = No
Zone	Pointer to integer value specifying the number of the zone to attach to. Must be greater than or equal to one.
Color	Pointer to integer value specifying the color to assign to the geometry. 0=Black                      8=Custom1 1=Red                        9=Custom2 2=Green                     10=Custom3 3=Blue                      11=Custom4 4=Cyan                      12=Custom5 5=Yellow                    13=Custom6 6=Purple                    14=Custom7 7=White                     15=Custom8
FillColor	Pointer to integer value specifying the color used to fill the geometry. Refer to <a href="#">Color</a> for a list of available values.
IsFilled	Pointer to integer flag to specify if geometry is to be filled. 1 = Yes                      0 = No
GeomType	Pointer to integer value specifying the geometry type. 0=2D Line Segments      3=Circle 1=Rectangle               4=Ellipse 2=Square                   5=3D Line Segments
LinePattern	Pointer to integer value specifying the line pattern. 0=Solid                      3=Dotted 1=Dashed                   4=LongDash 2=DashDot                5=DashDotDot
PatternLength	Pointer to double value specifying the pattern length in frame units (from 0.01 and less than 100).
LineThickness	Pointer to double value specifying the line thickness in frame units. The value must be greater than 0.0001 and less than 100.
NumEllipsePts	Pointer to integer value specifying the number of points to use for circles and ellipses. The value must be between 2 and 720.

Parameter	Description
ArrowheadStyle	Pointer to integer value specifying the arrowhead style. 0=Plain                      2=Hollow 1=Filled
ArrowheadAttachment	Pointer to integer value specifying where to attach arrowheads. 0=None                      2=End 1=Beginning              3=Both
ArrowheadSize	Pointer to double value specifying the arrowhead size in frame units (from 0 to 100).
ArrowheadAngle	Pointer to double value specifying the arrowhead angle in degrees.
Scope	Pointer to integer value specifying the scope with respect to frames. A local scope places the object in the active frame. A global scope places the object in all frames that contain the active frame's data set. 0=Global              1=Local.
Clipping	Specifies whether to clip the geometry (that is, only plot the geometry within) to the viewport or the frame. 0=ClipToViewport              1=ClipToFrame.
NumSegments	Pointer to integer value specifying the number of polyline segments.
NumSegPts	Array of integer values specifying the number of points in each of the <a href="#">NumSegments</a> segments.
XGeomData	Array of floating-point values specifying the X-, Y- and Z-coordinates. Refer to " <a href="#">Data Values</a> " on page 36 for information regarding the values required for each <a href="#">GeomType</a> .
ThetaGeomData	
YGeomData	
RGeomData	
ZGeomData	
MFC	Macro function command. Must be null terminated.

## Origin positions

The origin (**XOrThetaPos**, **YOrRPos**, **ZPos**) of each geometry type is listed below:

- SQUARE - lower left corner at **XOrThetaPos**, **YOrRPos**.
- RECTANGLE - lower left corner at **XOrThetaPos**, **YOrRPos**.
- CIRCLE - centered at **XOrThetaPos**, **YOrRPos**.
- ELLIPSE - centered at **XOrThetaPos**, **YOrRPos**.
- LINE - anchored at **XOrThetaPos**, **YOrRPos**.
- LINE3D - anchored at **XOrThetaPos**, **YOrRPos**, **ZPos**.

## Data Values

The origin (**XOrThetaGeomData**, **YOrRGeomData**, **ZGeomData**) of each geometry type is listed below:

- SQUARE - set **XOrThetaGeomData** equal to the desired length.
- RECTANGLE - set **XOrThetaGeomData** equal to the desired width and **YOrThetaGeomData** equal to the desired height.
- CIRCLE - set **XOrThetaGeomData** equal to the desired radius.

- **ELLIPSE** - set **XOrThetaGeomData** equal to the desired width along the x-axis and **YOrThetaGeomData** equal to the desired width along the y-axis.
- **LINE** - specify the coordinate positions for the data points in each line segment with **XOrThetaGeomData** and **YOrRGeomData**.
- **LINE3D** - specify the coordinate positions for the data points in each line segment with **XOrThetaGeomData**, **YOrRGeomData** and **ZGeomData**.

**TECIJKPTN142**

When writing a partitioned IJK-ordered zone to a *.szplt* file, provides information about the partition about to be written. Must be called after [TECZNE142](#) (and, for TecIO-MPI, [TECZNEMAP142](#)) but before calling [TECDAT142](#) to actually write the data.

A partition may include cells that overlap other partitions, commonly referred to as “ghost cells.” The TECIJKPTN142 function specifies the I, J, and K indices of the partition (excluding any “ghost” data), allowing the partitions to be later reassembled seamlessly into a single zone when loaded for visualization. The indices passed refer to indices of the entire IJK-ordered zone. Therefore, the I dimension (for example) of a partition is  $\text{imax} - \text{imin} + 1$ .

Each index value should be considered to be “owned” by one process and to “belong” to that process’s partition, and only that process should include these index values in its TECIJKPTN142 call. Any other process that has that node or cell in its partition (“ghost nodes” and “ghost cells”) should exclude it from the index values passed to TECIJKPTN142.

Note, however, that any node that is part of a non-ghost cell is not considered a ghost node, even if it is also part of a ghost cell. Therefore, index ranges of neighboring partitions must exactly coincide: for example, if one zone's `imax` is 25, the `imin` of the partition to the right must also be 25.

Only data actually belonging to a given process should be written by that process using [TECDAT142](#) (that is, “ghost” data should *not* be written, unlike with FE data).

## ***FORTTRAN Syntax:***

```
INTEGER*4 FUNCTION          TECIJKPTN142(partition,  
&                             imin,  
&                             jmin,  
&                             kmin,  
&                             imax,  
&                             jmax,  
&                             kmax)  
    INTEGER*4               imin  
    INTEGER*4               jmin  
    INTEGER*4               kmin  
    INTEGER*4               imax  
    INTEGER*4               jmax  
    INTEGER*4               kmax
```

## C Syntax:

```
#include TECIO.h
INTEGER4 TECFIL142(INTEGER4 *partition,
                    INTEGER4 *imin,
                    INTEGER4 *jmin,
                    INTEGER4 *kmin,
                    INTEGER4 *imax,
                    INTEGER4 *jmax,
                    INTEGER4 *kmax);
```

## Return Value:

0 if successful, nonzero if unsuccessful.

## Parameters:

Parameter	Description
<b>partition</b>	The number of the current partition. Partitions are numbered from 1 to the number of partitions (as specified in the <a href="#">TECZNEMAP142</a> call) inclusive.
<b>imin</b>	The smallest I index in the partition.
<b>jmin</b>	The smallest J index in the partition.
<b>kmin</b>	The smallest K index in the partition.
<b>imax</b>	The largest I index in the partition.
<b>jmax</b>	The largest J index in the partition.
<b>kmax</b>	The largest K index in the partition.

---

## TECINI142

---

Initializes the process of writing a binary data file. This function must be called *first* before any other TecIO calls are made (except [TECFORIGN142](#)).

You may write to multiple files by calling TECINI142 more than once. Each time TECINI142 is called, a new file is created and a new context established for it. Use [TECFIL142](#) to switch between files. For each call to TECINI, there must be a corresponding call to [TECEND142](#).

If writing a partitioned zone using TecIO-MPI, the TECINI142 call must be followed immediately by a call to [TECMPIINIT142](#).

## FORTRAN Syntax:

```
INTEGER*4 FUNCTION TECINI142( Title,  
&                               Variables,  
&                               FName,  
&                               ScratchDir,  
&                               FileFormat,  
&                               FileType,  
&                               Debug,  
&                               VIsDouble)  
CHARACTER*(*) Title  
CHARACTER*(*) Variables  
CHARACTER*(*) ScratchDir  
CHARACTER*(*) FName  
INTEGER*4 FileFormat  
INTEGER*4 FileType  
INTEGER*4 Debug  
INTEGER*4 VIsDouble
```

## C Syntax:

```
#include TECIO.h  
INTEGER4 TECINI142(char  
    *Title,  
    char *Variables,  
    char *FName,  
    char*ScratchDir,
```

```

INTEGER*4*FileFormat,
INTEGER*4*FileType,
INTEGER*4*Debug
INTEGER*4*VIsDouble);

```

**Return Value:**

0 if successful, -1 if unsuccessful.

**Parameters:**

Parameter	Description
Title	Title of the data set. <i>Must be null terminated.</i>
Variables	List of variable names. If a comma appears in the string it will be used as the separator between variable names, otherwise a space is used. <i>Must be null terminated.</i>
FName	Name of the file to create. <i>Must be null terminated.</i>
ScratchDir	Name of the directory to put the scratch file. <i>Must be null terminated.</i>
FileFormat	Specifies the file format to be used. 0=Tecplot binary (.plt)    1=Tecplot subzone (.szplt)
FileType	Specify whether the file is a full data file (containing both grid and solution data), a grid file or a solution file. 0=Full    1=Grid    2=Solution
Debug	Pointer to the integer flag for debugging. Set to 0 for no debugging or 1 to debug. When set to 1, the debug messages will be sent to the standard output (stdout).
VIsDouble	Pointer to the integer flag for specifying whether field data generated in future calls to <a href="#">TECDAT142</a> are to be written in single or double precision. 0=Single    1=Double

**Examples**

Each example in [Section 3 - 10 "Examples"](#) calls TECINI142 at least once. Refer to this section for details.

**TECLAB142**

Adds custom labels to the data file. Custom Labels can be used for axis labels, legend text, and tick mark labels. The first custom label string corresponds to a value of one on the axis, the next to a value of two, the next to a value of three, and so forth. You must have at least one zone in your data set.

A custom label set is added to your file each time you call TECLAB142. You may have up to sixty labels in a set and up to ten sets in a file. Each label must be surrounded by double-quotes, e.g. "Mon" "Tues" "Wed", etc. The \n escape sequence may be used to indicate a line break.

Custom labels are assigned to an object via the Tecplot interface. Refer to [Section 17 - 8 "Axis Title Options"](#) in the [User's Manual](#) for details.

When using TecIO-MPI, may only be called from the main process.

**FORTRAN Syntax:**

```

INTEGER*4 FUNCTION TECLAB142(Labels)
CHARACTER*(*)          Labels

```

### **C Syntax:**

```
#include TECIO.h
INTEGER4 TECLAB142(char *Labels);
```

### **Return Value:**

0 if successful, -1 if unsuccessful.

### **Parameters:**

Parameter	Description
Labels	Character string of custom labels. Each label must be surrounded by double-quotes. Separate labels by a comma or space. You may have up to sixty labels in each call to TECLAB142.

### **Examples**

To add the days of the week to your data file, to be displayed along the x-axis:

```
char    Labels[60] = "\"Mon\", \"Tues\", \"Wed\", \"Thurs\", \"Fri\"";
TECLAB142(&Labels[0]);
```

---

## **TECMPIINIT142**

---

Initializes MPI and joins a specified MPI communicator. This is a collective function. Must be called immediately after TECINI142 by all processes in the supplied communicator, and will block until all processes have called it. If processes call TECINI142 multiple times to create multiple files, TECMPIINIT142 must be called immediately after each call to TECINI142. All processes may then switch output among the open files by calling TECFILE142 as usual.

The mainrank process is the only process that may output non-zone data, such as text, geometries and aux data.

For TecIO-MPI only; does not exist in standard TecIO library.

### **FORTTRAN Syntax:**

```
INTEGER*4 FUNCTION TECMPIINIT142(communicator, mainrank)
INTEGER*4 communicator
INTEGER*4 mainrank
```

### **C Syntax:**

```
#include TECIO.h
INTEGER4 TECMPIINIT142(void* communicator, INTEGER4 const* mainrank);
```

### **Return Value:**

0 if successful, nonzero if error.



**Parameters:**

Parameter	Description
communicator	Pointer to MPI communicator. May be <code>MPI_COMM_WORLD</code> or any other <code>MPI_Comm</code> that includes all MPI processes involved in output.
mainrank	The ID of the process (rank) within the communicator designated as the main process. Must be the same for all calling processes.

**TECNOD142**

Writes an array of node data to the binary data file. This is the connectivity list for cell-based finite element zones (line segment, triangle, quadrilateral, brick, and tetrahedral zones). The connectivity list for face-based finite element zones (polygonal and polyhedral) is specified via [TECPOLY142](#).



Remember that Tecplot Focus cannot load face-based (polygonal or polyhedral) data.

See also [TECNODE142](#), which allows you to provide connectivity information in arbitrarily-sized chunks rather than requiring it all at once.

**FORTTRAN Syntax:**

```
INTEGER*4 FUNCTION TECNOD142(NData)
INTEGER*4 NData (T, M)
```

**C Syntax:**

```
#include TECIO.h
INTEGER4 TECNOD142(INTEGER4 *NData);
```

**Return Value:**

0 if successful, -1 if unsuccessful.

**Parameters:**

Parameter	Description
NData	Array of integers listing the nodes for each element. This is the connectivity list, dimensioned (T, M) (T moving fastest), where M is the number of elements in the zone and T is set according to the following list: <div style="display: flex; justify-content: space-around; margin-top: 5px;"> <div>2=Line Segment</div> <div>4=Tetrahedral</div> </div> <div style="display: flex; justify-content: space-around; margin-top: 5px;"> <div>3=Triangle</div> <div>8=Brick</div> </div> <div style="display: flex; justify-content: space-around; margin-top: 5px;"> <div>4=Quadrilateral</div> <div></div> </div>

**Examples:**

Refer to [Section 3 - 10.1 "Face Neighbors"](#) for examples using TECNOD142.

Writes a chunk of node data to the binary data file. This is the connectivity list for cell-based finite element zones (line segment, triangle, quadrilateral, brick, and tetrahedral zones). The connectivity list for face-based finite element zones (polygonal and polyhedral) is specified via [TECPOLY142](#).



Remember that Tecplot Focus cannot load face-based (polygonal or polyhedral) data.

This function is similar to [TECNOD142](#) but does not require that the entire connectivity list be provided at once. Rather, you may call TECNODE142 as many times as you like, providing connectivity information for as many elements as you like each time, so long as you eventually provide connectivity information for all elements in the zone.

### **FORTRAN Syntax:**

```
INTEGER*4 FUNCTION TECNODE142(N, NData)
INTEGER*4 N
INTEGER*4 NData (T, M)
```

### **C Syntax:**

```
#include TECIO.h
INTEGER4 TECNODE142(INTEGER4 *N, INTEGER4 *NData);
```

### **Return Value:**

0 if successful, -1 if unsuccessful.

### **Parameters:**

Parameter	Description
N	Handle to an integer indicating the number of values to write.
NData	Array of integers listing the nodes for each element. This is the connectivity list, dimensioned (T, N) (T moving fastest), where N is the number of elements provided in this call to TECNODE142 and T is set according to the following list: 2=Line Segment                      4=Tetrahedral 3=Triangle                            8=Brick 4=Quadrilateral

Writes the face map for polygonal and polyhedral zones to the data file. All numbering schemes are one-based. The first node is Node 1, the first face is Face 1, and so forth. Refer to [Section 3 - 9 "Defining Polyhedral and Polygonal Data"](#) on page 57 for additional information.



Remember that Tecplot Focus cannot load face-based (polygonal or polyhedral) data.

The TECPOLY142 function requires that all face map data, both face nodes and boundary connections, be provided with a single call. For most applications, we recommend you use [TECPOLYFACE142](#) and [TECPOLYBCONN142](#) instead, as these do not have this requirement and can be used when the face map data is not available all at once or will not fit into memory.

Avoid creating concave objects (or bad meshes), as they will not look good when plotted.

### ***FORTTRAN syntax:***

```

INTEGER*4 FUNCTION TECPOLY142(
&                                FaceNodeCounts,
&                                FaceNodes,
&                                FaceLeftElems,
&                                FaceRightElems,
&                                FaceBndryConnectionCounts,
&                                FaceBndryConnectionElems,
&                                FaceBndryConnectionZones)
&                                FaceNodeCounts(*)
&                                FaceNodes(*)
&                                FaceLeftElems(*)
&                                FaceRightElems(*)
&                                FaceBndryConnectionCounts(*)
&                                FaceBndryConnectionElems(*)
&                                FaceBndryConnectionZones(*)
    INTEGER*4
    INTEGER*4
    INTEGER*4
    INTEGER*4
    INTEGER*4
    INTEGER*4
    INTEGER*4

```

### ***C Syntax:***

```

include TECIO.h
INTEGER4 TECPOLY142(INTEGER4    *FaceNodeCounts,
                    INTEGER4    *FaceNodes,
                    INTEGER4    *FaceLeftElems,
                    INTEGER4    *FaceRightElems,
                    INTEGER4    *FaceBndryConnectionCounts,
                    INTEGER4    *FaceBndryConnectionElems,
                    INTEGER4    *FaceBndryConnectionZones);

```

### ***Return Value:***

0 if successful, -1 if unsuccessful.

## Parameters:

Parameter	Description
FaceNodeCounts	An array used to define the number of nodes in each face. The array is dimensioned by the number of faces (defined in <a href="#">TECPOLYFACE142</a> ). This is NULL for polygonal zones, as each face in a polygonal zone has exactly two nodes.
FaceNodes	An array used to specify which nodes belong to which face. The array is dimensioned by TotalNumFaceNodes (defined in <a href="#">TECPOLYFACE142</a> ).
FaceLeftElems	An array used to define the left neighboring element for each face. The array is dimensioned by NumFaces (defined in <a href="#">TECPOLYFACE142</a> ).
FaceRightElems	An array used to define the right neighboring element for each face. The array is dimensioned by NumFaces (defined in <a href="#">TECPOLYFACE142</a> ).
FaceBndryConnectionCounts	An array used to define the number of boundary connections for each boundary face. The array is dimensioned by NumConnectedBoundaryFaces (defined in <a href="#">TECPOLYFACE142</a> ).
FaceBndryConnectionElems	An array used to define the boundary element(s) to which each boundary face is connected. The array is dimensioned by TotalNumBndryConnections (defined in <a href="#">TECPOLYFACE142</a> ).
FaceBndryConnectionZones	An array used to define the zone(s) to which each boundary element belongs. The array is dimensioned by TotalNumBndryConnections (defined in <a href="#">TECPOLYFACE142</a> ).

---

## TECPOLYFACE142

---

Writes the face nodes of the face map for polygonal and polyhedral zones. All numbering schemes are one-based. The first node is Node 1, the first Face is Face 1, and so forth. Refer to [Section 3 - 9 "Defining Polyhedral and Polygonal Data"](#) on page 57 for additional information.



Remember that Tecplot Focus cannot load face-based (polygonal or polyhedral) data.

This function may be called any number of times, with any number of face nodes each time, so long as face nodes for all faces are eventually written. You must also, at some point, call [TECPOLYBCONN142](#) to specify any boundary connections in the zone; this can be done in any order, even to the point of interleaving calls to specify boundary connections and face nodes.

Using the two functions [TECPOLYFACE142](#) and [TECPOLYBCONN142](#) is generally preferred to using [TECPOLY142](#), as the latter requires all face node data be available at once.

Avoid creating concave objects (or bad meshes), as they will not look good when plotted.

## FORTRAN syntax:

```
INTEGER*4 FUNCTION TECPOLYFACE142(  
&                               NumFaces,  
&                               FaceNodeCounts,  
&                               FaceNodes,  
&                               FaceLeftElems,  
&                               FaceRightElems)  
    INTEGER*4  
    NumFaces(*)
```

```

INTEGER*4      FaceNodeCounts(*)
INTEGER*4      FaceNodes(*)
INTEGER*4      FaceLeftElems(*)
INTEGER*4      FaceRightElems(*)

```

**C Syntax:**

```

include TECIO.h
INTEGER4  TECPOLYFACE142(INTEGER4  *NumFaces,
                          INTEGER4  *FaceNodeCounts,
                          INTEGER4  *FaceNodes,
                          INTEGER4  *FaceLeftElems,
                          INTEGER4  *FaceRightElems);

```

**Return Value:**

0 if successful; -1 if unsuccessful.

**Parameters:**

Parameter	Description
NumFaces	The number of faces being defined in this call. TECPOLYFACE142 may be called any number of times with any number of faces in each call, so long as all faces in the zone are eventually defined.
FaceNodeCounts	An array used to define the number of nodes in each face. The array is dimensioned by NumFaces. This is NULL for polygonal zones, as each face in a polygonal zone is already known to have exactly two nodes.
FaceNodes	An array used to specify the nodes belonging to each face. The array is dimensioned by the sum of the FaceNodeCounts array for polyhedral zones or, for polygonal zones, twice NumFaces.
FaceLeftElems	An array used to define the left neighboring element for each face. The array is dimensioned by NumFaces.
FaceRightElems	An array used to define the right neighboring element for each face. The array is dimensioned by NumFaces.

**Examples:**

Refer to the following sections for examples using TECPOLYFACE142:

- [3 - 10.2 "Polygonal Example"](#)
- [3 - 10.3 "Multiple Polyhedral Zones"](#)
- [3 - 10.4 "Multiple Polygonal Zones"](#)
- [3 - 10.5 "Polyhedral Example"](#)

---

**TECPOLYBCONN142**


---

Writes the boundary connections of the face map for polygonal and polyhedral zones. Boundary faces are faces that either have more than one neighboring cell on a side or have at least one neighboring cell in

another zone. (Refer to [Section 3 - 9.1 “Boundary Faces and Boundary Connections”](#) on page 58 for a simple example.)



Remember that Tecplot Focus cannot load face-based (polygonal or polyhedral) data.

All numbering schemes are one-based. The first node is Node 1, the first face is Face 1, and so forth. Refer to [Section 3 - 9 “Defining Polyhedral and Polygonal Data”](#) on page 57 for additional information.

This function may be called any number of times, with any number of boundary connections each time, so long as boundary connections for all faces are eventually written. You must also, at some point, call [TECPOLYFACE142](#) at least once to specify the face nodes. This can be done in any order, even to the point of interleaving calls to specify boundary connections and face nodes.

Using the two functions [TECPOLYFACE142](#) and [TECPOLYBCONN142](#) is generally preferred to using [TECPOLY142](#), as the latter requires that all face map data (including boundary connections) be available at once.

Avoid creating concave objects (or bad meshes), as they will not look good when plotted.

### ***FORTTRAN syntax:***

```
INTEGER*4 FUNCTION TECPOLYBCONN142(  
&                               NumBndryFaces,  
&                               FaceBndryConnectionCounts,  
&                               FaceBndryConnectionElems,  
&                               FaceBndryConnectionZones)  
    INTEGER*4 NumBndryFaces(*)  
    INTEGER*4 FaceBndryConnectionCounts(*)  
    INTEGER*4 FaceBndryConnectionElems(*)  
    INTEGER*2 FaceBndryConnectionZones(*)
```

### ***C Syntax:***

```
#include TECIO.h  
INTEGER4 TECPOLYBCONN142(INTEGER4 *NumBndryFaces,  
                          INTEGER4 *FaceBndryConnectionCounts,  
                          INTEGER4 *FaceBndryConnectionElems,  
                          INTEGER4 *FaceBndryConnectionZones);
```

### ***Return Value:***

0 if successful, -1 if unsuccessful.

### Parameters:

Parameter	Description
NumBndryFaces	The number of boundary faces being defined in this call. Each call to TECPOLYBCONN142 may define any number of boundary faces, so long as all boundary faces (i.e., NumConnectedBoundaryFaces in <a href="#">TECZNE142</a> ) are eventually defined.
FaceBndryConnectionCounts	An array used to define the number of boundary connections for each boundary face. The array is dimensioned by NumBndryFaces.
FaceBndryConnectionElems	An array used to define the boundary element(s) to which each boundary face is connected.
FaceBndryConnectionZones	An array used to define the zone(s) to which each boundary element belongs.

**Examples:**

Refer to the following sections for examples using TECPOLYBCONN142:

- [3 - 10.2 "Polygonal Example"](#)
- [3 - 10.3 "Multiple Polyhedral Zones"](#)
- [3 - 10.4 "Multiple Polygonal Zones"](#)
- [3 - 10.5 "Polyhedral Example"](#)

**TECTXT142**

Adds a text box to the file. When using TecIO-MPI, may only be called from the main process.

## ***FORTTRAN Syntax:***

```
INTEGER*4 FUNCTION TECTXT142(  
&  
&  
&  
&  
&  
&  
&  
&  
&  
&  
&  
&  
&  
&  
&  
&  
&  
&  
&  
&  
DOUBLE PRECISION XOrThetaPos  
DOUBLE PRECISION YORRPos  
DOUBLE PRECISION ZOrUnusedPos  
INTEGER*4 PosCoordMode  
INTEGER*4 AttachToZone  
INTEGER*4 Zone  
INTEGER*4 Font
```

INTEGER*4	<i>FontHeightUnits</i>
DOUBLE PRECISION	<i>FontHeight</i>
INTEGER*4	<i>BoxType</i>
DOUBLE PRECISION	<i>BoxMargin</i>
DOUBLE PRECISION	<i>BoxLineThickness</i>
INTEGER*4	<i>BoxColor</i>
INTEGER*4	<i>BoxFillColor</i>
DOUBLE PRECISION	<i>Angle</i>
INTEGER*4	<i>Anchor</i>
DOUBLE PRECISION	<i>LineSpacing</i>
INTEGER*4	<i>TextColor</i>
INTEGER*4	<i>Scope</i>
INTEGER*4	<i>Clipping</i>
CHARACTER*(*)	<i>Text</i>
CHARACTER*(*)	<i>MFC</i>

### **C Syntax:**

```
#include TECIO.h
INTEGER4 TECTXT142(  double
    *XOrThetaPos,
    double *YOrRPos,
    double *ZOrUnusedPos,
    INTEGER4*PosCoordMode,
    INTEGER4*AttachToZone,
    INTEGER4*Zone,
    INTEGER4*Font,
    INTEGER4*FontHeightUnits,
    double*FontHeight,
    INTEGER4*BoxType,
    double*BoxMargin,
    double*BoxLineThickness,
    INTEGER4*BoxColor,
    INTEGER4*BoxFillColor,
    double*Angle,
    INTEGER4*Anchor,
    double*LineSpacing,
    INTEGER4*TextColor,
    INTEGER4*Scope,
    INTEGER4*Clipping,
    char*Text,
    char*MFC)
```

### **Return Value:**

0 if successful, -1 if unsuccessful.



**Parameters:**

Parameter	Description
XOrThetaPos	Pointer to double value specifying the X-position or Theta-position (polar plots only) of the text.
YOrRPos	Pointer to double value specifying the Y-position or R-position (polar plots only) of the text.
ZOrUnusedPos	Pointer to double value specifying the Z-position of the text.
PosCoordMode	Pointer to integer value specifying the position coordinate system. 0=Grid 1=Frame 6=Grid3D If you use Grid3D, the plot type must be set to 3D Cartesian to view your text box.
AttachToZone	Pointer to integer flag to signal that the text is “attached” to a zone.
Zone	Pointer to integer value specifying the zone number to attach to.
Font	Pointer to integer value specifying the font. 0=Helvetica 1=Helvetica Bold 2=Greek 3=Math 4=User-Defined 5=Times 6=Times Italic 7=Times Bold 8=Times Italic Bold 9=Courier 10=Courier Bold
FontHeightUnits	Pointer to integer value specifying the font height units. 0=Grid 1=Frame 2=Point
FontHeight	Pointer to double value specifying the font height. If <a href="#">PosCoordMode</a> is set to FRAME, the value range is zero to 100.
BoxType	Pointer to integer value specifying the box type. 0=None 1=Filled 2=Hollow
BoxMargin	Pointer to double value specifying the box margin (in frame units ranging from 0 to 100).
BoxLineThickness	Pointer to double value specifying the box line thickness (in frame units ranging from 0.0001 to 100).
BoxColor	Pointer to integer value specifying the color to assign to the box. 0=Black 1=Red 2=Green 3=Blue 4=Cyan 5=Yellow 6=Purple 7=White 8=Custom1 9=Custom2 10=Custom3 11=Custom4 12=Custom5 13=Custom6 14=Custom7 15=Custom8
BoxFillColor	Pointer to integer value specifying the fill color to assign to the box. (See <a href="#">BoxColor</a> )
Angle	Pointer to double value specifying the text angle in degrees.
Anchor	Pointer to integer value specifying where to anchor the text. 0=Left 1=Center 2=Right 3=MidLeft 4=MidCenter 5=MidRight 6=HeadLeft 7=HeadCenter 8=HeadRight

Parameter	Description
LineSpacing	Pointer to double value specifying the text line spacing.
TextColor	Pointer to integer value specifying the color to assign to the text. (See <a href="#">BoxColor</a> )
Scope	Pointer to integer value specifying the scope with respect to frames. A local scope places the object in the active frame. A global scope places the object in all frames that contain the active frame's data set. 0=Global 1=Local
Clipping	Specifies whether to clip the geometry (that is, only plot the geometry within) to the viewport or the frame. 0=ClipToViewport 1=ClipToFrame.
Text	Character string representing text to display. <i>Must be null terminated.</i>
MFC	Macro function command. Must be null terminated.

## Examples

Refer to [Section 3 - 10.8 "Text Example"](#) for an example of working with TECTXT142.

---

## TECUSR142

---

Writes a character string to the data file in a USERREC record. USERREC records are ignored by Tecplot 360, but may be used by add-ons.

When using TecIO-MPI, may only be called from the main process.

### FORTRAN Syntax:

```
INTEGER*4 FUNCTION TECUSR142(S)
CHARACTER*(*) S
```

### C Syntax:

```
#include TECIO.h
INTEGER4 TECUSR142(CHAR *S);
```

### Return Value:

0 if successful, -1 if unsuccessful.

### Parameters:

Parameter	Description
S	The character string to write to the data file. Must be null-terminated.

---

## TECVAUXSTR142

---

Writes an auxiliary data item to the data file for the specified variable. Must be called after [TECINI142](#) and before [TECEND142](#). Auxiliary data may be used by text, macros, equations (if the data is numeric) and add-ons. It may be viewed directly in the *Aux Data* page of the **Data Set Information** dialog (accessed via the

**Data** menu). The value can be verified by selecting “Variable” from the “Show Auxiliary Data” menu and selecting the corresponding variable number from the menu.

When using TecIO-MPI, may only be called from the main process.

### **FORTRAN Syntax:**

```
INTEGER*4 FUNCTION TECVAUXSTR142(Var, Name, Value)
INTEGER*4      Var
CHARACTER*(*)  Name
CHARACTER*(*)  Value
```

### **C Syntax:**

```
#include TECIO.h
INTEGER4 TECVAUXSTR142(INTEGER4 *Var,
                        char *Name,
                        char *Value);
```

### **Return Value:**

0 if successful, -1 if unsuccessful.

### **Parameters:**

Parameter	Description
<b>Var</b>	The variable number for which to set the auxiliary data. Variable numbers start at one.
<b>Name</b>	The name of the auxiliary data item. If a data item with this name already exists, its value will be overwritten. Must be a null-terminated character string and cannot contain spaces.
<b>Value</b>	The auxiliary data value to be written to the data file. Must be a null-terminated character string.

### **Example:**

The following example illustrates adding auxiliary data to the pressure variable in the data file. In this case, pressure is the third variable.

```
INTEGER4 Var      = 3;
char      PressureUnitsName[16] = "PressureUnits";
char      PressureUnitsValue[16] = "Pascal (Pa)";

TECVAUXSTR142(&Var,
              &PressureUnitsName[0],
              &PressureUnitsValue[0]);
```

---

## **TECZAUXSTR142**

---

Writes an auxiliary data item for the current zone to the data file. Must be called immediately after [TECZONE142](#) for the desired zone. Auxiliary data may be used by text, macros, equations (if it is numeric) and add-ons. It may be viewed directly in the *Aux Data* page of the **Data Set Information** dialog (accessed via the **Data** menu). The value can be verified by selecting “Zone” from the “Show Auxiliary Data” menu and selecting the corresponding zone number.

When using TecIO-MPI, may only be called from the main process.

## ***FORTRAN Syntax:***

```
INTEGER*4 FUNCTION TECZAUSTR142(Name, Value)
CHARACTER*(*)      Name
CHARACTER*(*)      Value
```

## ***C Syntax:***

```
#include TECIO.h
INTEGER4 TECZAUSTR142(char *Name,
                      char *Value);
```

## ***Return Value:***

0 if successful, -1 if unsuccessful.

## ***Parameters:***

Parameter	Description
Name	The name of the auxiliary data item. If a data item with this name already exists, its value will be overwritten. Must be a null-terminated character string and cannot contain spaces.
Value	The auxiliary data value to be written to the data file. Must be a null-terminated character string.

## ***Example:***

The following example code adds auxiliary data to the zone. NOTE: TECZAUSTR142 must be called immediately after [TECZNE142](#) for the desired zone.

```
char    CreatedByName[16]    = "CreatedBy";
char    CreatedByValue[16]   = "My Company";

TECZAUSTR142(&CreatedByName[0],
            &CreatedByValue[0]);
```

---

## ***TECZNE142***

---

Writes header information about the next zone to be added to the data file. When writing a partitioned zone, should be immediately followed by a call to [TECZNEMAP142](#).

After TECZNE142 (and TECZNEMAP142, if necessary) is called, you must call [TECDAT142](#) one or more times. If the zone is a finite element zone, call [TECNOD142/TECNODE142](#) (cell-based zones) or [TECPOLY142/TECPOLYFACE142/TECPOLYBCONN142](#) (face-based zones) after calling [TECDAT142](#).



Remember that Tecplot Focus cannot load face-based (polygonal or polyhedral) data.

## ***FORTRAN Syntax:***

```
INTEGER*4 FUNCTION TECZNE142(ZoneTitle,
&                             ZoneType,
&                             IMxOrNumPts,
&                             JMxOrNumElements,
&                             KMxOrNumFaces,
&                             ICellMax,
&                             JCellMax,
&                             KCellMax,
```

```
&
&
&
&
&
&
&
&
&
&
&
CHARACTER*(*)      SolutionTime,
INTEGER*4           StrandID,
INTEGER*4           ParentZone,
INTEGER*4           IsBlock,
INTEGER*4           NumFaceConnections,
INTEGER*4           FaceNeighborMode,
INTEGER*4           TotalNumFaceNodes,
INTEGER*4           NumConnectedBoundaryFaces,
INTEGER*4           TotalNumBoundaryConnections,
INTEGER*4           PassiveVarList,
INTEGER*4           ValueLocation,
INTEGER*4           ShareVarFromZone,
INTEGER*4           ShareConnectivityFromZone)
CHARACTER*(*)       ZoneTitle
INTEGER*4            ZoneType
INTEGER*4            IMxOrNumPts
INTEGER*4            JMxOrNumElements
INTEGER*4            KMxOrNumFaces
INTEGER*4            ICellMax
INTEGER*4            JCellMax
INTEGER*4            KCellMax
DOUBLE PRECISION     Solution Time
INTEGER*4            StrandID
INTEGER*4            ParentZone
INTEGER*4            IsBlock
INTEGER*4            NumFaceConnections
INTEGER*4            FaceNeighborMode
INTEGER*4            TotalNumFaceNodes,
INTEGER*4            NumConnectedBoundaryFaces,
INTEGER*4            TotalNumBoundaryConnections,
INTEGER*4            PassiveVarList(*)
INTEGER*4            ValueLocation
INTEGER*4            ShareVarFromZone(*)
INTEGER*4            ShareConnectivityFromZone
```

## C Syntax:

```
#include TECIO.h
```

```

INTEGER4
TECZNE142(char *ZoneTitle,
            INTEGER4*ZoneType,
            INTEGER4*IMxOrNumPts,
            INTEGER4*JMxOrNumElements,
            INTEGER4*KMxOrNumFaces,
            INTEGER4*ICellMax,
            INTEGER4*JCellMax,
            INTEGER4*KCellMax,
            DOUBLE*SolutionTime,
            INTEGER4*StrandID,
            INTEGER4*ParentZone,
            INTEGER4*IsBlock,
            INTEGER4*NumFaceConnections,
            INTEGER4*FaceNeighborMode,
            INTEGER4*TotalNumFaceNodes,
            INTEGER4*NumConnectedBoundaryFaces,
            INTEGER4*TotalNumBoundaryConnections,
            INTEGER4*PassiveVarList,
            INTEGER4*ValueLocation,
            INTEGER4*ShareVarFromZone,
            INTEGER4*ShareConnectivityFromZone)

```

***Return Value:***

0 if successful, -1 if unsuccessful.

## Parameters:

Parameter	Applies to Zone Type(s)	Notes
ZoneTitle	ALL	The title of the zone. Must be null-terminated.
ZoneType	ALL	The type of the zone: 0=ORDERED 1=FELINESEG 2=FETRIANGLE 3=FEQUADRILATERAL 4=FETETRAHEDRON 5=FEBRICK 6=FEPOLYGON 7=FEPOLYHEDRON
IMax or NumPts	ALL	For ordered zones, the number of nodes in the I-index direction. For finite element zones (cell-based and face-based), the number of nodes.
JMax or NumElements	ALL	For ordered zones, the number of nodes in the J index direction. For finite element zones (cell-based and face-based), the number of elements.
KMax or NumFaces	ORDERED FEPOLYGON FEPOLYHEDRON	For ordered zones, the number of nodes in the K index direction. For polyhedral and polygonal finite element zones, the number of faces. Not used for all other finite element zone types.
ICellMax	N/A	Reserved for future use. Set to zero.
JCellMax	N/A	Reserved for future use. Set to zero.
KCellMax	N/A	Reserved for future use. Set to zero.
SolutionTime	ALL	Scalar double precision value specifying the time associated with the zone. Refer to <a href="#">Section 7 - 2 "Time Aware"</a> in the <a href="#">User's Manual</a> for additional information on working with transient data.
StrandID	ALL	Scalar integer value specifying the strand to which the zone is associated.  0 = static zone, not associated with a strand. Values greater than 0 indicate a zone is assigned to a given strand.  Refer to <a href="#">Section 7 - 2 "Time Aware"</a> in the <a href="#">User's Manual</a> for additional information on strands.  If you are converting your function calls from function calls 109 or older, use "0" for StrandID.

Parameter	Applies to Zone Type(s)	Notes
ParentZone	ALL	<p>Scalar integer value representing the relationship between this zone and its parent. With a parent zone association, Tecplot 360 can generate a surface streamtrace on a no-slip boundary zone. A zone may not specify itself as its own parent.</p> <p>0 = indicates that this zone is not associated with a parent zone.  &gt;0 = A value greater than zero is considered this zone's parent.</p> <p>Refer to <a href="#">Section 7 - 2 "Time Aware"</a> in the <a href="#">User's Manual</a> for additional information on parent zones and <a href="#">Section 15 - 2 "Surface Streamtraces on No-slip Boundaries"</a> in the <a href="#">User's Manual</a> for additional information regarding no-slip boundaries.</p>
IsBlock	ALL	Indicates that data will be passed into <a href="#">TECDAT142</a> in BLOCK format. Always use 1 to indicate the BLOCK format, as TecZne functions do not output in point format.
NumFaceConnections	ORDERED FELINESEG FETRIANGLE FEQUADRILATERAL FETETRAHEDRON FEBRICK	Used for cell-based finite element and ordered zones only. The number of face connections that will be passed in routine <a href="#">TECFACE142</a> .
FaceNeighborMode	ORDERED FELINESEG FETRIANGLE FEQUADRILATERAL FETETRAHEDRON FEBRICK	<p>Used for cell-based<sup>a</sup> finite element and ordered zones only. The type of face connections that will be passed in routine <a href="#">TECFACE142</a>.</p> <p>0=LocalOneToOne  2=GlobalOneToOne  1=LocalOneToMany  3=GlobalOneToMany</p>
TotalNumFaceNodes	FEPOLYGON FEPOLYHEDRON	Used for face-based <sup>b</sup> finite element zones. Total number of nodes for all faces. It is also the sum of the FaceNodeCounts array (defined in <a href="#">TECPOLY142</a> ). For polygonal zones this value is equivalent to 2 * NumFaces. NumFaces = the number of faces in the zone. Refer to <a href="#">Section 3 - 9.2 "FaceNodeCounts and FaceNodes"</a> for simple example.
NumConnectedBoundaryFaces	FEPOLYGON FEPOLYHEDRON	Used for face-based <sup>b</sup> finite element zones. Total number of boundary faces, where boundary faces are faces that either have more than one neighboring cell on a side or have a neighboring cell from another zone. Refer to <a href="#">Section 3 - 9.1 "Boundary Faces and Boundary Connections"</a> for simple example.

Parameter	Applies to Zone Type(s)	Notes
TotalNumBoundaryConnections	FEPOLYGON FEPOLYHEDRON	Used for face-based <sup>b</sup> finite element zones. Total number of boundary connections for all faces. In general, <a href="#">TotalNumBoundaryConnections</a> will be equal to <a href="#">NumConnectedBoundaryFaces</a> . However, <a href="#">TotalNumBoundaryConnections</a> must be greater than or equal to <a href="#">NumConnectedBoundaryFaces</a> . Refer to <a href="#">Section 3 - 9.1 "Boundary Faces and Boundary Connections"</a> for simple example.
PassiveVarList	ALL	Array, dimensioned by the number of variables, of 4 byte integer values specifying the active/passive nature of each variable. A value of 0 indicates the associated variable is active while a value of 1 indicates that it is passive. If all variables are active, you may pass NULL rather than an array of zeroes. Refer to <a href="#">"Passive Variables"</a> on page 9 for additional information.
ValueLocation	ALL	The location of each variable in the data set. ValueLocation(I) indicates the location of variable I for this zone. 0=cell-centered, 1=node-centered. Pass null to indicate that all variables are node-centered.
ShareVarFromZone	ALL	Indicates variable sharing. Array, dimensioned by the number of variables. ShareVarFromZone(I) indicates the zone number with which variable I will be shared. This reduces the amount of data to be passed via <a href="#">TECDAT142</a> . A value of 0 indicates that the variable is not shared. Pass null to indicate no variable sharing for this zone. You must pass null for the first zone in a data set (there is no data available to share).
ShareConnectivityFromZone	ALL	Indicates the zone number with which connectivity is shared. Pass 0 to indicate no connectivity sharing. You must pass 0 for the first zone in a data set. NOTE: Connectivity and/or face neighbors cannot be shared when the face neighbor mode is set to Global. Connectivity cannot be shared between cell-based and face-based finite element zones.

a. Cell-based finite element zones: FELINESEG, FETRIANGLE, FEQUADRILATERAL, FETETRAHEDRON, and FEBRICK.

b. Face-based finite element zones: FEPOLYGON and FEPOLYHEDRON.

## Examples:

Refer to the following examples for illustrations of working with TECZNE142:

- [Section 2 - 4 "Face Neighbors"](#)
- [Section 3 - 6 "Writing to Multiple Binary Data Files"](#)
- [Section 3 - 10.2 "Polygonal Example"](#)
- [Section 3 - 10.3 "Multiple Polyhedral Zones"](#)
- [Section 3 - 10.4 "Multiple Polygonal Zones"](#)
- [Section 3 - 10.5 "Polyhedral Example"](#)



- [Section 3 - 10.9 "Partitioned Data Examples"](#)

---

## TECZNE142

---

For partitioned zone output using TecIO-MPI. Must be called immediately after calling [TECZNE142](#), and must be called by the main process and by each process that will write a zone to indicate which processes will output each partition of the zone. A zone may be written in non-partitioned fashion (that is, as in the standard TecIO library) by indicating that a single process will output it (npartitions of 1, and a one-element ptnranks array).

### **FORTRAN Syntax:**

```
INTEGER*4 FUNCTION TECZNE142(npartitions, ptnranks)
INTEGER*4      npartitions
INTEGER*4      ptnranks
```

### **C Syntax:**

```
#include TECIO.h
INTEGER4 TECZNE142(INTEGER4 *npartitions,
                  INTEGER4 *ptnranks);
```

### **Return Value:**

0 if successful, nonzero if unsuccessful.

### **Parameters:**

Parameter	Description
<b>npartitions</b>	The number of partitions for this zone (1 for a non-partitioned zone).
<b>ptnranks</b>	An array of MPI ranks (processes) that indicates the process that will output that partition. The array may include the main process. For non-partitioned zones, contains a single entry.

## 3 - 9 Defining Polyhedral and Polygonal Data

Polyhedral data is defined using [TECPOLY142](#) (or [TECPOLYFACE142](#)/[TECPOLYBCONN142](#)) and [TECZNE142](#). Via [TECZNE142](#) the number of nodes, faces, elements, boundary faces, and boundary connections are specified. [TECPOLY142](#) is used to specify the face mapping connections for the zone.



Remember that Tecplot Focus cannot load face-based (polygonal or polyhedral) data.

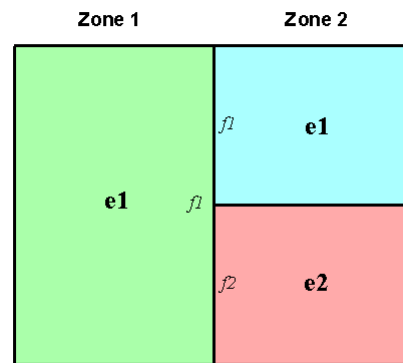
Before defining your polyhedral or polygonal data, you should determine the numbering scheme for the nodes, faces and elements in each zone of your data set. The numbering scheme is communicated to Tecplot implicitly by the order in which you supply the data. For example, the first nodal value supplied is for Node 1, followed by the value for Node 2, continuing to node N (where N is the total number of nodes). Similarly, for faces and elements.

The remainder of this section provides simple examples illustrating how to define polygonal and polyhedral data.

### 3 - 9.1 Boundary Faces and Boundary Connections

A “Connected Boundary Face” is a face with at least one neighboring element that belongs to another zone. Each “Connected Boundary Face” has one or more “Boundary Connections”. A “Boundary Connection” is defined as the element-zone tuple used to identify the neighboring element when the element is part of another zone.

Consider the following picture:



In the figure shown above, Zone 1 contains a single element (e1) and Zone 2 contains two elements (e1 and e2). The boundary faces and boundary connections for each zone are as follows:

- **Zone 1** - In Zone 1, Face 1 (f1) is the sole connected boundary face. It has two boundary connections. The first boundary connection is Element 1 in Zone 2. The second boundary connection is Element 2 in Zone 2.
  - NumConnectedBoundaryFaces = 1
  - TotalNumBndryConnections = 2
- **Zone 2** - In Zone 2, both Face 1 and Face 2 are connected boundary faces. There is a total of two boundary connections. The boundary connection for each boundary face in Zone 2 is Element 1 in Zone 1.
  - NumConnectedBoundaryFaces = 2
  - TotalNumBndryConnections = 2

### 3 - 9.2 FaceNodeCounts and FaceNodes

For illustration purposes, consider a zone composed of a single pyramidal element. The pyramid is composed of five nodes and five faces.

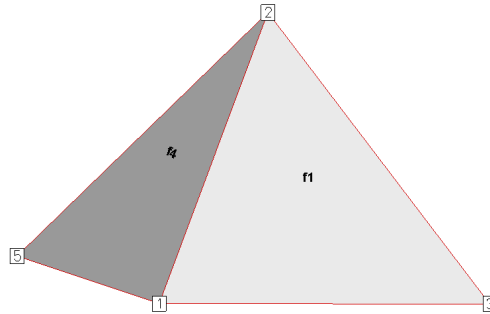


Figure 3-2. A simple pyramid. The remaining triangular faces are Faces 2 and 3. The bottom rectangular face is Face 5. Node 4 is obscured from view.

The FaceNodeCounts array is used to specify the number of nodes that compose each face. The values in the array are arranged as follows:

```
FaceNodeCounts = [NumNodesInFace1,
                  NumNodesInFace2,
                  ...
                  NumNodesInFaceF]
```

where  $F$  is the total number of faces in the zone

In this example, the FaceNodeCounts array is: [3 3 3 3 4]. The first four faces are composed of three nodes and the last face is composed of four nodes.

The FaceNodes array is used to specify which nodes belong to which face. The array is dimensioned by the total number of face nodes in the zone (specified via TECZNE142). The total number of face nodes is defined as the sum of the number of nodes in each face.

The first  $K$  values in the FaceNodes array are the node numbers for Face 1, where  $K$  is the first value in the FaceNodeCounts array. The next  $L$  values are the node numbers for Face 2, where  $L$  is the second value in the FaceNodeCounts array.



When supplying the node numbers for each face, you must supply the numbers in either a clockwise or counter-clockwise configuration around the face. Otherwise, the faces will be contorted when the data is plotted.

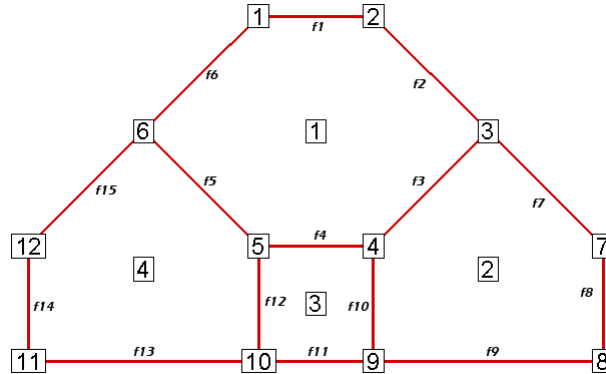
It is not important to be consistent when choosing between clockwise or counter-clockwise ordering. The key is to present the numbers consistently within the numbering scheme. For example, you may present the node numbers for face 1 in a clockwise order and the node numbers for the remaining faces in counter-clockwise order.

Consider the pyramid used above. Using the FaceNodeCounts array we have already defined and the figure, we can create the FaceNodes array for the pyramid.

```
FaceNodes = [1, 2, 3
             3, 2, 4,
             5, 2, 4,
             5, 1, 2,
             1, 5, 4, 3]
```

### 3 - 9.3 FaceRightElems and FaceLeftElems

After specifying the face map data (using the FaceNodeCounts and FaceNodes array), the next step is to identify the element on either side of each face. To illustrate this, we will switch from the single element zone to the following data set:



The neighboring elements can be determined using the right-hand rule:

- **2D Data** - For each face, place your right-hand along the face with your fingers pointing in the direction of incrementing node numbers (i.e. from Node 1 to Node 2). The right side of your hand will indicate the right element, and the left side of your hand will indicate the left element.
- **3D Data** - For each face, curl the fingers of your right-hand following the order that the nodes were presented in the FaceNodes array. Your thumb will point to the right element. The left element is the other adjacent element. If the face has more than one neighboring element on a single side, you will need to use the FaceBoundaryConnectionCounts, FaceBoundaryConnectionElems and FaceBoundaryConnectionZones array.

The neighboring elements for each face are stored in the FaceRightElems and FaceLeftElems array. Each array is dimensioned by the total number of faces in the zone. The first value in each array is the right or left neighboring element for Face 1, followed by the neighboring element for Face 2, and so forth.

```
FaceRightElems = [RightNeighborToFace1,
                  RightNeighborToFace2,
                  ...
                  RightNeighborToFaceF]
FaceLeftElems  = [LeftNeighborToFace1,
                  LeftNeighborToFace2,
                  ...
                  LeftNeighborToFaceF]
```

where F is the total number of faces

In the above plot, the face neighbors are as follows:

Face Number	Right Neighboring Element	Left Neighboring Element
Face 1	1	0
Face 2	1	0
Face 3	1	2
Face 4	1	3

Face Number	Right Neighboring Element	Left Neighboring Element
Face 5	1	4
Face 6	1	0
Face 7	2	0
Face 8	2	0
Face 9	2	0
Face 10	2	3
Face 11	3	0
Face 12	3	4
Face 13	4	0
Face 14	4	0
Face 15	4	0

The number zero is used to indicate that the face is on the edge of the data (i.e. has “no neighboring element”).

### 3 - 9.4 FaceBoundaryConnectionElements and Zones

When working with multiple zones, an additional aspect is folded into the FaceLeftElems and FaceRightElems arrays. When the neighboring element is not within the current zone, you cannot identify the element by its element number alone. Instead you need to specify both the element number and its zone number. This is accomplished using the FaceBoundaryConnectionElements and FaceBoundaryConnectionZones arrays. For each boundary connection, the element number of the boundary connection is stored in the FaceBoundaryConnectionElements array while its zone number is stored in the FaceBoundaryConnectionZones array.

A negative value in the FaceLeftElems or FaceRightElems array is used to indicate that the neighboring element belongs to another zone. The magnitude of the negative number is a pointer to a value in the FaceBoundaryConnectionElements and FaceBoundaryConnectionZones arrays. For example, given the following FaceBoundaryConnectionElements and FaceBoundaryConnectionZones arrays:

```
FaceBoundaryConnectionElements = [ 1 1 3 4 ]
FaceBoundaryConnectionZones   = [ 2 2 3 3 ]
```

A value of -4 in the FaceLeftElems indicates that the left neighboring element for that face is element four in zone three.

### 3 - 9.5 Partially Obscured Boundary Faces

A face on the boundary of a zone may be partially obscured by its boundary connections (neighboring elements). While Tecplot 360 does not draw fully obscured boundary faces (because it treats those faces as internal faces), Tecplot 360 does draw partially obscured boundary faces. Thus, Tecplot 360 requires definition of partially obscured boundary faces.

To indicate a partially obscured face, indicate the appropriate neighboring element as zero in the FaceBndryConnectionElems and FaceBndryConnectionZones arrays, followed by the actual neighboring elements. When Tecplot 360 sees a list of neighboring elements for a boundary face that begin with element zero, it marks that boundary face as partially obscured.

If Tecplot 360 sees a zero in FaceBndryConnectionElems that is not the first boundary element listed for a face, an error message will appear, indicating that either the partially obscured boundary face was not indicated correctly, or FaceBndryConnectionsElems and/or FaceBndryConnectionsZones was not completely filled out.

## 3 - 10 Examples

Source code for example programs that use the TecIO library is provided with your Tecplot 360 EX installation in the *util/tecio/examples* folder in the installation directory. See the *readme.txt* file in that folder for additional information on building the examples.

The examples (written in C) provide a basic illustration of creating a \*.plt file using the TecIO library. If you plan to compile the examples, be sure to review the instructions in [Section 3 - 7 "Linking with the TecIO Library"](#) first.

In order to keep the examples as simple as possible, error checking is not included. For complete details on the parameters used and the function syntax for each TecIO function, refer to [Section 3 - 8 "Binary Data File Function Reference"](#). When creating a binary data file using the TecIO library, the functions must be called in a specific order. Refer to [Section 3 - 5 "Binary Data File Function Calling Sequence"](#) for details.

### 3 - 10.1 Face Neighbors

This example illustrates how to (1) create two simple FE-quadrilateral zones and (2) create a face neighbor connection between the two zones. In order to keep the example as simple as possible, error checking is not included. If you plan to compile this example, be sure to include TECIO.h.

For complete details on the parameters used and the function syntax for each TecIO function, refer to [Section 3 - 8 "Binary Data File Function Reference"](#). When creating a binary data file using the TecIO library, the functions must be called in a specific order. Refer to [Section 3 - 5 "Binary Data File Function Calling Sequence"](#) for details.

#### Step 1 Initialize the data file using TECINI

TECINI is required for all data files. It is used to: open the data file and initialize the file header information (name the data file, the variables for the data file, and the file type).

```

INTEGER4 Debug      = 1;
INTEGER4 VIsDouble  = 0;
INTEGER4 FileType   = 0;
INTEGER4 FileFormat = 0; // 0 == PLT, 1 == SZPLT
INTEGER4 I          = 0; /* Used to track return codes */

I = TECINI142((char*)"Face Neighbors Example", /* Specifies the name
                                                * of the entire
                                                * dataset
                                                */
              (char*)"X Y P",                /* Defines the
                                                * variables for the
                                                * data file. Each
                                                * zone must contain
                                                * each of the vars
                                                * listed. The order
                                                * of the variables in
                                                * the list is used to
                                                * define the variable
                                                * number (e.g. X is
                                                * Var 1.)
                                                */
              (char*)"FaceNeighbors.plt",    /* Specifies the

```

```

                                * file name.
                                */
                                (char*)" ",
                                &FileFormat,
                                &FileType,
                                /* The FileType is set to
                                * zero, indicating it is
                                * a full file (containing
                                * both grid and solution
                                * data).
                                */
                                &Debug,
                                &IsDouble);

```

## Step 2 Create Zone 1

After TECINI is called, call TECZNE to create one or more zones for your data file.

```

INTEGER4 ZoneType = 3; /* set the zone type to
                        * FEQuadrilateral
                        */
INTEGER4 NumPts    = 6;
INTEGER4 NumElems  = 2;
INTEGER4 NumFaces  = 8;
INTEGER4 ICellMax  = 0; /* not used */
INTEGER4 JCellMax  = 0; /* not used */
INTEGER4 KCellMax  = 0; /* not used */
double   SolTime   = 360.0;
INTEGER4 StrandID  = 0; /* StaticZone */
INTEGER4 ParentZn  = 0;
INTEGER4 IsBlock   = 1; /* Block */
INTEGER4 NFConns   = 1; /* Specify the number of Face
                        * Neighbor Connections in the
                        * Zone. When this value is
                        * greater than zero, TECFACE must
                        * be called prior to creating the
                        * next zone or ending the file.
                        */

/* Specify the Face Neighbor Mode.
 * A value of 2 indicated that the face neighbor mode is global
 * one-to-one. The scope of the face neighbors (local or
 * global) is with respect to the zones. A value of global
 * indicates that the face neighbor(s) is/are shared across zones;
 * a value of local indicates that the face neighbor(s) are
 * shared within the current zone. The terms one-to-one and
 * one-to-many are used to indicate whether the face in question
 * is shared with one cell or several cells.
 * For example, if your data is arranged as follows:

```

1	2	3
4	5	

```

 * The face between 1 & 4 is local-one-to-one. The face between
 * 5 and (2 & 3) is local one-to-many.
 */
INTEGER4 FNMode = 2;

```

```

INTEGER4 TotalNumFaceNodes      = 1; /* Not used for
                                     * FEQuad zones*/
INTEGER4 NumConnectedBoundaryFaces = 1; /* Not used for
                                     * FEQuad zones*/
INTEGER4 TotalNumBoundaryConnections = 1; /* Not used for
                                     * FEQuad zones*/
INTEGER4 ShrConn                = 0;

INTEGER4 ValueLocation[3] = {1, 1, 1}; /* Specify the variable
                                     * values at the nodes.
                                     * NOTE: Because all of
                                     * the variables are
                                     * defined at the nodes,
                                     * we can just pass
                                     * NULL for this array.
                                     * We are providing the
                                     * array for illustration
                                     * purposes.
                                     */

I = TECZNE142((char*)"Zone 1",
              &ZoneType,
              &NumPts,
              &NumElems,
              &NumFaces,
              &ICellMax,
              &JCellMax,
              &KCellMax,
              &SolTime,
              &StrandID,
              &ParentZn,
              &IsBlock,
              &NFConns,
              &FNMode,
              &TotalNumFaceNodes,
              &NumConnectedBoundaryFaces,
              &TotalNumBoundaryConnections,
              NULL,
              ValueLocation,
              NULL,
              &ShrConn);

```

### Step 3 Define the node numbering for Zone 1

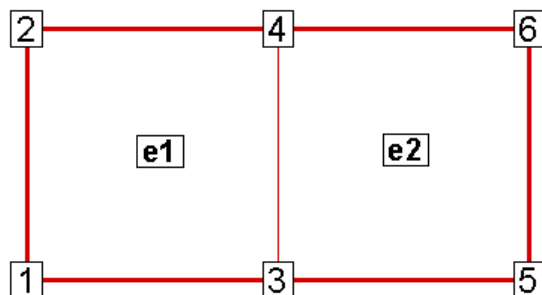
For this example, we will create 2 rectangular cells in Zone 1. Before defining your variables, you must establish a consistent node numbering scheme for your data. Once the node numbers are defined, supply the variable values in the node numbering order. In this example, Node 1 is defined at  $X = 0$  and  $Y = 0$ . As such, the first value supplied for  $X$  (i.e.  $X[0]$ ) is 0. Similarly, the first value supplied for  $Y$  is 0.



It is important that you refer to node numbers consistently. The node numbers will be used later to define the connectivity for each element.



For this example, we will create two quadrilateral elements. The node numbering for the elements is defined in the following picture.



#### Step 4 Set up the variable values

The variable values will be written to the file using TECDAT. Because we are specifying nodal variables (as specified via the ValueLocation parameter in TECZNE), each variable is dimensioned by the number of points (NumPts) in the Zone. You have the option to specify some variables with nodal values and some with cell-centered values. Refer to the [Section “TECZNE142”](#) on page 52 for details.

```

float *X = new float[NumPts];
float *Y = new float[NumPts];
float *P = new float[NumPts];

/* For this example, we will create 2 rectangular cells in Zone
 * 1. Before defining your variables, you must establish a
 * consistent node numbering scheme for your data. Once the
 * node numbers are defined, supply the variable values in the
 * node numbering order. In this example, node 1 is defined at
 * X = 0 and Y = 0. As such, the first value supplied for X
 * (i.e. X[0]) is 0. Similarly, the first value supplied for Y
 * is 0.
 *
 * It is important that you refer to node numbers consistently.
 * The node numbers will be used later to define the
 * connectivity for each element.
 */

X[0] = 0;
X[1] = 0;
X[2] = 1;
X[3] = 1;
X[4] = 2;
X[5] = 2;

Y[0] = 0;
Y[1] = 1;
Y[2] = 0;
Y[3] = 1;
Y[4] = 0;
Y[5] = 1;

for (INTEGER4 ii = 0; ii < NumPts; ii++)
    P[ii] = (float)(NumPts - ii);

INTEGER4 DIsDouble = 0; /* Set DIsDouble to zero to use
 * variables in float format.
 */

```

```

/* Call TECDAT once for each variable */
I = TECDAT142(&NumPts, &X[0], &DisDouble);
I = TECDAT142(&NumPts, &Y[0], &DisDouble);
I = TECDAT142(&NumPts, &P[0], &DisDouble);

```

## Step 5 Define the connectivity list for Zone 1

The Connectivity List is used to specify the nodes that compose each element. When working with nodal variables, the numbering of the nodes is implicitly defined when the variables are declared. The first value of each variable is for node one, the second value for node two, and so on.

Because this zone contains two quadrilateral elements, we must supply 8 values in the connectivity list. The first four values define the nodes that form Element 1. Similarly, the second four values define the nodes that form Element 2.

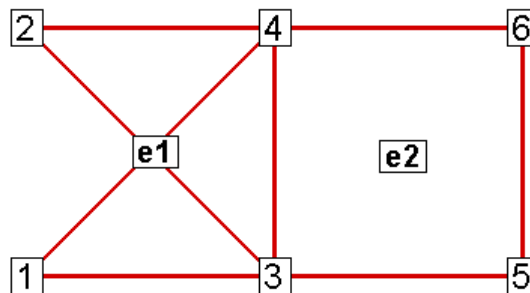
```

INTEGER4 ConnList[8] = {1, 3, 4, 2,
                        3, 5, 6, 4
                        };
I = TECNOD142(ConnList);

```



It is important to provide the node list in either a clockwise or counter-clockwise order. Otherwise, your elements will be misshapen. For example, if the first two numbers in the above connectivity list were switched, the zone would appear as follows:



## Step 6 Define the face neighbor connections for Zone 1

Now that TECNOD or TECNOD142 has been called, the creation of Zone 1 is complete. However, in this example, we will define a face neighbor between Zone 1 and Zone 2 (to be created later in the example). Face Neighbor connections are used to define connections that are not created via the connectivity list. For example, local face neighbors may need to be defined when a zone wraps onto itself and global face neighbors may need to be defined to smooth edges across zones. Face Neighbors are used when deriving variables and drawing contours.

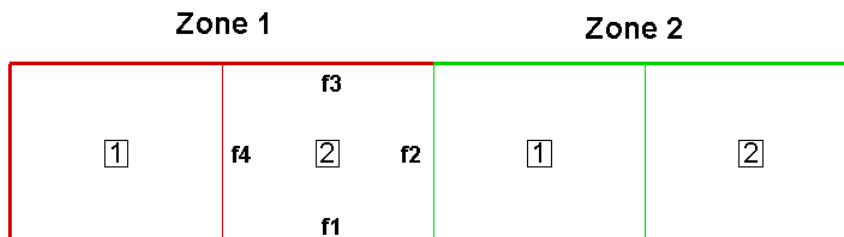
In this example, we are creating a face neighbor connection between Cell 2 in Zone 1 and Cell 1 in Zone 2. The information required when specifying face neighbors depends upon the type of connection. Refer to [Section "TECFACE142"](#) on page 28 for details.

In this case, we must supply the following information (in the order provided):

- the cell number in the current zone that contains the face neighbor
- the number of the face in that cell that contains the face neighbor

- the number of the other zone to which the face is connected
- the number of the cell in the other zone to which the face is connected

The face numbering for cell-based finite elements is defined using [Figure 3-1 on page 30](#). In this example, Face 2 in Cell 2 in the current zone is connected to Cell 1 in Zone 2.



```
INTEGER4 FaceConn[4] = {2, 2, 2, 1};
I = TECFACE142(FaceConn);
```

## Step 7 Create Zone 2

The creation of Zone 1 is complete. We are ready to create Zone 2. For simplicity, Zone 2 is a copy of Zone 1 shifted along the X-axis. As such, many of the variables used to create Zone 1 are re-used here.

```
/* Call TECZNE to create Zone 2 */
I = TECZNE142((char*)"Zone 2",
    &ZoneType,
    &NumPts,
    &NumElems,
    &NumFaces,
    &ICellMax,
    &JCellMax,
    &KCellMax,
    &SolTime,
    &StrandID,
    &ParentZn,
    &IsBlock,
    &NFCnns,
    &FNMode,
    &TotalNumFaceNodes,
    &NumConnectedBoundaryFaces,
    &TotalNumBoundaryConnections,
    NULL,
    ValueLocation,
    NULL,
    &ShrConn);
```

## Step 8 Define the variables for Zone 2

Because Zone 2 is a copy of Zone 1, shifted along the X-axis, we can share the Y variable definition used to Zone. We will also create a second pressure variable for Zone 2 (P2).

```
float *X2 = new float[NumPts];
float *P2 = new float[NumPts];

for (INTEGER4 ii = 0; ii < NumPts; ii++)
{
```

```

    X2[ii] = X[ii] + 2;
    P2[ii] = 2 * (float)ii;
}

I = TECDAT142(&NumPts, &X2[0], &DIsDouble);
I = TECDAT142(&NumPts, &Y[0], &DIsDouble);
I = TECDAT142(&NumPts, &P2[0], &DIsDouble);

delete X;
delete Y;
delete P;
delete X2;
delete P2;

```

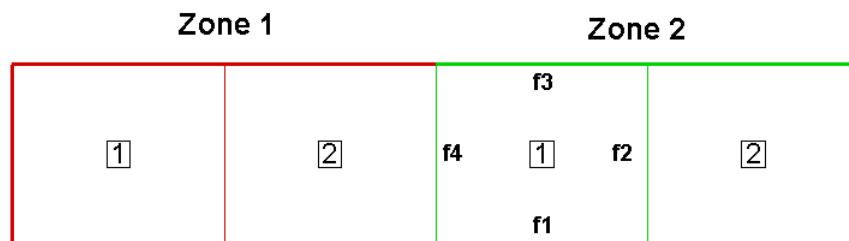
## Step 9 Define the connectivity list for Zone 2

As with Zone 1, we must define the connectivity list for Zone 2. Because, the node numbering restarts at one for each new zone and the nodal arrangement is identical between the two zones, we may reuse the connectivity list from Zone 1.

```
I = TECNOD142(ConnList);
```

## Step 10 Define the face neighbor connections for Zone 2

We will now specify the face neighbor connection with respect to our new current zone of Zone 2.



```

INTEGER4 FaceConn2[4] = {1, 4, 1, 2}; /* cell 1, face 4 in
                                         * current zone is a
                                         * neighbor to cell 2 in
                                         * zone 1.
                                         */
I = TECFACE142(FaceConn2);

```

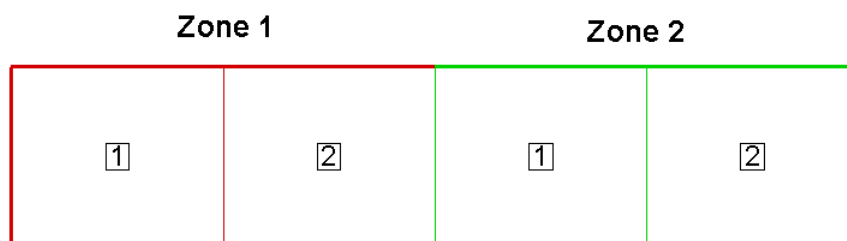
## Step 11 Close the file

Call TECEND to close the file.

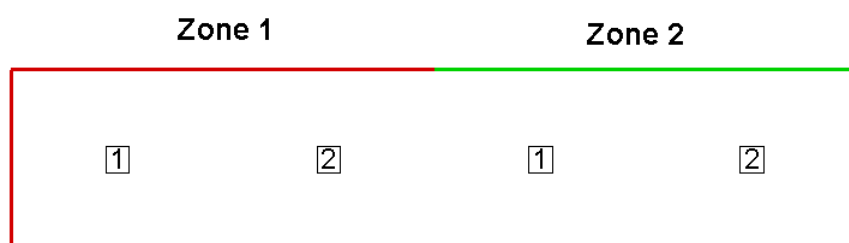
```
I = TECEND142();
```

## Summary

When the preceding code is compiled and built, the data file will look as follows (with the Mesh and Edge layers turned-on):



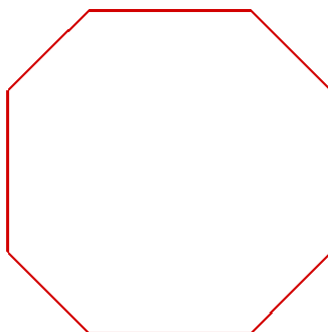
With the Mesh layer deactivated, the data set will look as follows:



If we had not included face neighbor connections, an Edge line would be drawn in between the two zones.

## 3 - 10.2 Polygonal Example

The following example (written in C++) illustrates how to create a single octagonal cell using the TecIO library.



In order to keep the example as simple as possible, error checking is not included. If you plan to compile this example, be sure to include TECIO.h.

For complete details on the parameters used and the function syntax for each TecIO function, refer to [Section 3 - 8 "Binary Data File Function Reference"](#). When creating a binary data file using the TecIO library, the functions must be called in a specific order. Refer to [Section 3 - 5 "Binary Data File Function Calling Sequence"](#) for details.



Remember that Tecplot Focus cannot load face-based (polygonal or polyhedral) data.

## Step 1 Initialize the data file using TECINI

TECINI is required for all data files. It is used to: open the data file and initialize the file header information (name the data file, the variables for the data file, and the file type).

```
INTEGER4 Debug      = 1;
INTEGER4 VIsDouble  = 0;
INTEGER4 FileType   = 0;
INTEGER4 FileFormat = 0; // 0 == PLT, 1 == SZPLT; Only PLT is currently
                        // supported for polygonal zones.
INTEGER4 I;          /* used to check return codes */

/*
 * Open the file and write the Tecplot datafile
 * header information
 */

I = TECINI142((char*)"Octagon",
              (char*)"X Y P", /* Defines the variables for the data
                               * file. Each zone must contain each
                               * of the vars listed here. The order
                               * of the variables in the list is
                               * used to define the variable number
                               * (e.g. X is Variable 1). When
                               * referring to variables in other
                               * TecIO functions, you will refer to
                               * thevariable by its number.
                               */
              (char*)"Octagon.plt",
              (char*)"", /* scratch directory */
              &FileFormat,
              &FileType,
              &Debug,
              &VIsDouble);
```

## Step 2 Create Zone 1

After TECINI is called, call TECZNE to create one or more zones for your data file.

```
/* In this example, we will create a single octagonal cell in
 * Tecplot 360's polyhedral file format.
 */
INTEGER4 ZoneType = 6; /* FEPolygon */
INTEGER4 NumNodes = 8; /* Number of nodes in the octagon.*/
INTEGER4 NumElems = 1; /* Number of octagonal elements. */
INTEGER4 NumFaces = 8; /* Number of faces in the octagon.*/
INTEGER4 ICellMax = 0; /* Not Used */
INTEGER4 JCellMax = 0; /* Not Used */
INTEGER4 KCellMax = 0; /* Not Used */
double SolTime = 360.0;
INTEGER4 StrandID = 0; /* Static Zone */
INTEGER4 ParentZn = 0; /* No Parent Zone */
INTEGER4 IsBlock = 1; /* Block */
INTEGER4 NFConns = 0;
INTEGER4 FNMode = 0;

/* For polygonal zones, the total number of face nodes is equal
 * to twice the number of nodes. This is because, each face
 * has exactly two nodes.
 */
INTEGER4 NumFaceNodes = 2 * NumNodes;
```

```

/* Boundary Faces and Boundary Connections are not used in this
 * example.
 */
INTEGER4 NumBFaces      = 0;
INTEGER4 NumBConnections = 0;

INTEGER4 ShrConn        = 0;

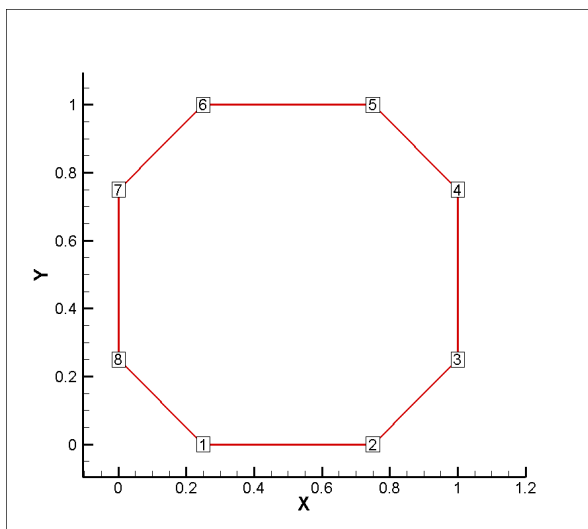
I = TECZNE142((char*)"Octagonal Zone",
              &ZoneType,
              &NumNodes,
              &NumElems,
              &NumFaces,
              &ICellMax,
              &JCellMax,
              &KCellMax,
              &SolTime,
              &StrandID,
              &ParentZn,
              &IsBlock,
              &NFConns,
              &FNMode,
              &NumFaceNodes,
              &NumBFaces,
              &NumBConnections,
              NULL,
              NULL, /* When Value Location is not specified,
                   * Tecplot will treat all variables as
                   * nodal variables.
                   */
              NULL,
              &ShrConn);

```

### Step 3 Define node numbering

For this example, we will create a single octagonal cell. Before defining your variables, you must establish a consistent node numbering scheme for your data. Once the node numbers are defined, supply the variable values in the node numbering order. In this example, Node 1 is defined at  $X = .25$  and  $Y = 0$ . As such, the first value supplied for  $X$  (i.e.  $X[0]$ ) is  $.25$ . Similarly, the first value supplied for  $Y$  is  $0$ .

It is important that you refer to node numbers consistently. The node numbers will be used later to define the connectivity for each element.



## Step 4 Set up the variable values

Write the variable values to the file using TECDAT. Because we are specifying nodal variables (as specified via the ValueLocation parameter in TECZNE), each variable is dimensioned by the number of points (NumPts) in the Zone. You have the option to specify some variables with nodal values and some with cell-centered values. Refer to [Section “TECZNE142”](#) on page 52 for details.

The order of the values supplied for each nodal variable is determined by the node numbering established in Step 3. The first value for each variable is for Node 1, the second value for each variable is for Node 2 and so forth.

$V1 = \{\text{ValueAtNode1}, \text{ValueAtNode2}, \dots, \text{ValueAtNodeN}\}$

*where N is the total number of nodes*

```
float *X = new float[NumNodes];
float *Y = new float[NumNodes];
float *P = new float[NumNodes];

//Define the grid values.
X[0] = 0.25;
Y[0] = 0.0;

X[1] = 0.75;
Y[1] = 0.0;

X[2] = 1.0;
Y[2] = 0.25;

X[3] = 1.0;
Y[3] = 0.75;

X[4] = 0.75;
Y[4] = 1.0;

X[5] = 0.25;
Y[5] = 1.0;

X[6] = 0.0;
Y[6] = 0.75;

X[7] = 0.0;
Y[7] = 0.25;

for (INTEGER4 ii = 0; ii < 8; ii++)
    P[ii] = .5;

/* Write out the field data using TECDAT */
INTEGER4 DIsDouble = 0; /* set IsDouble to 0 to use float
                        * variables. */

I = TECDAT142(&NumNodes, X, &DIsDouble);
I = TECDAT142(&NumNodes, Y, &DIsDouble);
I = TECDAT142(&NumNodes, P, &DIsDouble);

delete X;
delete Y;
delete P;
```

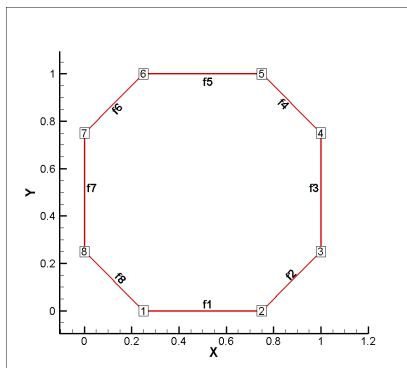


## Step 5 Define the Face Nodes

The FaceNodes array is used to indicate which nodes define which face. As mentioned earlier, the number of the nodes is implicitly defined by the order in which the nodal data is provided. The first value of each nodal variable describes Node 1, the second value describes Node 2, and so on.

The face numbering is also implicitly defined. Because there are two nodes in each face of any polygonal zone, the first two nodes provided define Face 1, the next two define Face 2 and so on. If there was a variable number of nodes used to define the faces, the array would be more complicated. Refer to [Section 3 - 10.4 “Multiple Polygonal Zones”](#) for an example.

The following picture describes the face numbering for this example:



As you can see, Face 1 is defined by Nodes 1 and 2, Face 2 is defined by Nodes 2 and 3, and so forth. Because of this simple arrangement, we can use a for-loop to define all but the end points of the face nodes array.

```
INTEGER4 *FaceNodes = new INTEGER4[NumFaceNodes];

/*
 * Loop over number of sides, and set each side to two
 * consecutive nodes.
 */
for (INTEGER4 ii = 0; ii < 8; ii++)
{
    FaceNodes[2*ii] = ii + 1;
    FaceNodes[2*ii+1] = ii + 2;
}
FaceNodes[15] = 1;
```

## Step 6 Define the right and left elements of each face

The last step for writing out the polygonal data is to define the right and left neighboring elements for each face. The neighboring elements can be determined using the right-hand rule. For each face, place your right-hand along the face with your fingers pointing the direction of incrementing node numbers (i.e. from Node 1 to Node 2). The right side of your hand will indicate the right element, and the left side of your hand will indicate the left element. Refer to [Section 3 - 9.3 “FaceRightElems and FaceLeftElems”](#) for details.

The number zero is used to indicate that there isn't an element on that side of the face (i.e. the face is on the edge of the data set). This is referred to as “no neighboring element”.

Because of the way we numbered the nodes and faces, the right element for every face is the element itself (Element 1) and the left element is "no-neighboring element" (Element 0).

```
INTEGER4 *FaceLeftElems = new INTEGER4[NumFaces];
INTEGER4 *FaceRightElems = new INTEGER4[NumFaces];

for (INTEGER4 ii = 0; ii < NumFaces; ii++)
{
    FaceLeftElems[ii] = 0;
    FaceRightElems[ii] = 1;
}
```

## Step 7 Write the face nodes to the file

We can now call [TECPOLYFACE142](#) to write the face nodes to the file. Since we do not have any boundary connections in this data set, there is no need to call [TECPOLYBCONN142](#). We could have also used [TECPOLY142](#) since all the needed data is in memory.

```
I = TECPOLYFACE142(&NumFaces,
                  NULL,
                  FaceNodes,
                  FaceLeftElems,
                  FaceRightElems);

delete FaceNodes;
delete FaceLeftElems;
delete FaceRightElems;
```

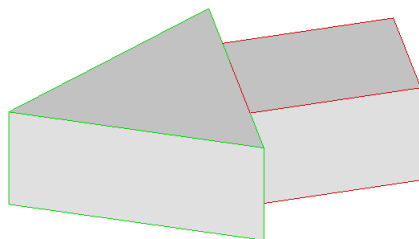
## Step 8 Close the file

Call TECEND to close the file.

```
I = TECEND142();
```

## 3 - 10.3 Multiple Polyhedral Zones

The following example demonstrates how to create two polyhedral zones, a rectangular solid and a prism. The resulting image is a three-dimensional arrow (shown below).



This example covers the following topics: polyhedral data, working with multiple zones, and specifying partially obscured faces. In order to keep the example as simple as possible, error checking is not included. If you plan to compile this example, be sure to include: *TECIO.h*.

For complete details on the parameters used and the function syntax for each TecIO function, refer to [Section 3 - 8 "Binary Data File Function Reference"](#). When creating a binary data file using the TecIO

library, the functions must be called in a specific order. Refer to [Section 3 - 5 “Binary Data File Function Calling Sequence”](#) for details.



Remember that Tecplot Focus cannot load face-based (polygonal or polyhedral) data.

## Step 1 Initialize the data file using TECINI

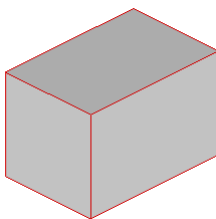
TECINI is required for all data files. This function opens the data file and initializes the file header information (names the data file, the variables for the data file, and the file type)

```
INTEGER4 Debug      = 1;
INTEGER4 VIsDouble = 1;
INTEGER4 FileFormat = 0; // 0 == PLT, 1 == SZPLT; Only PLT is currently
                        // supported for polyhedral zones
INTEGER4 FileType   = 0;
INTEGER4 I;

/* Open the file and write the Tecplot datafile
 * header information
 */
I = TECINI142((char*)"Multiple polyhedral zones", /* Name of the entire
                                                * dataset.
                                                */
              (char*)"X Y Z P", /* Defines the variables for the data
                                * file. Each zone must contain each of
                                * the variables listed here. The order
                                * of the variables in the list is used
                                * to define the variable number (e.g.
                                * X is Var 1).
                                */
              (char*)"Arrow.plt",
              (char*)".", /* Scratch Directory */
              &FileFormat,
              &FileType,
              &Debug,
              &VIsDouble);
```

## Step 2 Create Zone 1 (rectangle)

After TECINI is called, call TECZNE to create one or more zones for your data file. In this example, Zone 1 contains a single rectangular solid created as a face-based finite element (i.e. polyhedral zone). The zone has eight points (or nodes), six faces and one element.



```
/* TECZNE Parameters */
INTEGER4 ZoneType          = 7; /* sets the zone type
                                * to polyhedral */
INTEGER4 NumPts_Rect       = 8;
INTEGER4 NumElems_Rect     = 1;
```

```

INTEGER4 NumFaces_Rect      = 6;
INTEGER4 ICellMax           = 0; /* not used */
INTEGER4 JCellMax           = 0; /* not used */
INTEGER4 KCellMax           = 0; /* not used */
double   SolutionTime       = 0.0;
INTEGER4 StrandID           = 0;
INTEGER4 ParentZone         = 0;
INTEGER4 IsBlock            = 1;
INTEGER4 NumFaceConnections = 0; /* not used */
INTEGER4 FaceNeighborMode   = 1; /* not used */
INTEGER4 SharConn           = 0;

/* In a rectangular solid, each face is composed of four nodes.
 * As such, the total number of face nodes is twenty-four (four
 * nodes for each of the six faces).
 */
INTEGER4 TotalNumFaceNodes_Rect = 24;

/* There is one connected boundary face in this zone (the face on
 * the rectangle adjacent to the arrowhead). Refer to the Data
 * Format Guide for additional information. */
INTEGER4 NumConnBndryFaces_Rect = 1;

/* The connected boundary face has one connection, the face on
 * the bottom of the arrowhead. A connection is an element-zone
 * tuple that indicates a neighboring element (and its zone) when
 * the neighboring element is in a different zone. Generally,
 * there will be one boundary connection for each boundary face.
 */
INTEGER4 TotalNumBndryConns_Rect = 1;

/* For illustrative purposes, the grid variables (X, Y, and Z)
 * are nodal variables (i.e. ValueLocation = 1), and the pressure
 * variable (P) is a cell-centered variable (i.e.
 * ValueLocation = 0).
 */
INTEGER4 ValueLocation[4] = { 1, 1, 1, 0 };

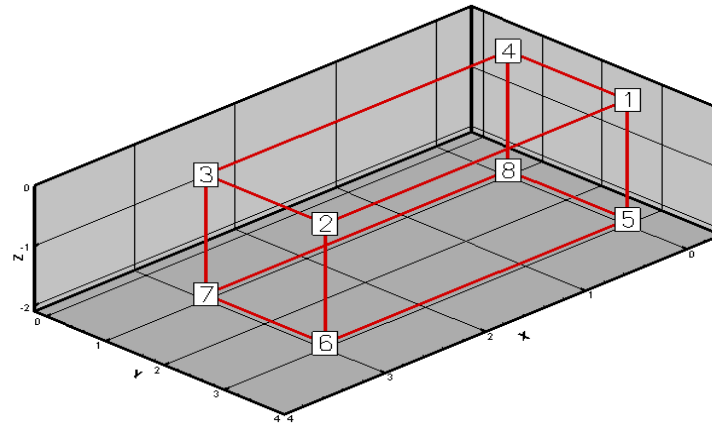
I = TECZNE142((char*)"Zone 1: Rectangular Solid",
              &ZoneType,
              &NumPts_Rect,
              &NumElems_Rect,
              &NumFaces_Rect,
              &ICellMax,
              &JCellMax,
              &KCellMax,
              &SolutionTime,
              &StrandID,
              &ParentZone,
              &IsBlock,
              &NumFaceConnections,
              &FaceNeighborMode,
              &TotalNumFaceNodes_Rect,
              &NumConnBndryFaces_Rect,
              &TotalNumBndryConns_Rect,
              NULL,
              ValueLocation,
              NULL,
              &SharConn);

```

### Step 3 Set variable values for Zone 1 (rectangle)

Now that the zone has been created, write the variable values to the file by calling TECDAT. While there are more elegant ways to define the grid coordinates for the rectangle, the values are defined explicitly for simplicity.

Using the picture below, define the variable values.



For nodal variables, provide the values for each variable in nodal order. Similarly, for cell-centered values, provide the variable values in cell order. The location of each variable is specified with TECZNE.

```
//set variable values (X_Rect, Y_Rect, Z_Rect & P_Rect)
double *X_Rect = new double[NumPts_Rect];
double *Y_Rect = new double[NumPts_Rect];
double *Z_Rect = new double[NumPts_Rect];
double *P_Rect = new double[NumElems_Rect];

for (INTEGER4 ii = 0; ii <= NumPts_Rect / 2; ii += 4)
{
    X_Rect[ii]    = 0;
    X_Rect[ii+1] = 3;
    X_Rect[ii+2] = 3;
    X_Rect[ii+3] = 0;

    Y_Rect[ii]    = 3;
    Y_Rect[ii+1] = 3;
    Y_Rect[ii+2] = 1;
    Y_Rect[ii+3] = 1;
}

for (INTEGER4 ii = 0; ii < 4; ii++)
    Z_Rect[ii] = 0;

for (INTEGER4 ii = 4; ii < NumPts_Rect; ii++)
    Z_Rect[ii] = -2;

P_Rect[0] = 10;

INTEGER4 IsDouble = 1;
I = TECDAT142(&NumPts_Rect, X_Rect, &IsDouble);
I = TECDAT142(&NumPts_Rect, Y_Rect, &IsDouble);
I = TECDAT142(&NumPts_Rect, Z_Rect, &IsDouble);
I = TECDAT142(&NumElems_Rect, P_Rect, &IsDouble);
```

## Step 4 Define the facemap data for Zone 1

Using the following figure, specify which nodes define which face.

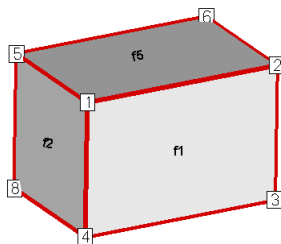


Figure 3-3. Zone 2 of the sample data. Node 7 is obscured from view and located in the back-left hand corner. Face 6 is the bottom face. Face 3 is opposite Face 1 and Face 4 is opposite Face 2.

In order to specify the face map data, you must first specify how many nodes are in each face using the FaceNodeCounts array. After defining the FaceNodeCounts array, use the FaceNodes array to identify the nodes that compose each face. Refer to [Section 3 - 9.2 “FaceNodeCounts and FaceNodes”](#) for additional information.

```
/* The FaceNodeCounts array is used to describe the number of
 * nodes in each face of the zone. The first value in the array
 * is the number of nodes in Face 1, the second value is the
 * number of nodes in Face 2 and so forth. In this example, each
 * face of the zone has four nodes.
 */

INTEGER4 *FaceNodeCounts_Rect = new INTEGER4[NumFaces_Rect];
//For this particular zone, each face has the 4 nodes
for (INTEGER4 ii = 0; ii < NumFaces_Rect; ii++)
    FaceNodeCounts_Rect[ii] = 4;

/* The FaceNodes array is used to specify the nodes that compose
 * each face. For each face (n of N), the number of nodes used
 * to define the face is specified by the nth value in the
 * FaceNodeCounts array. For example, if the first value in the
 * FaceNodeCounts array is 4 (indicating Face 1 is composed of
 * four nodes), the first four values in the FaceNodes array are
 * the node numbers of the nodes in Face 1.
 *
 * -----
 * WARNING
 * When providing the node numbers for each face, you must
 * provide the node numbers in a consistent order (either
 * clockwise or counter-clockwise. Providing the node numbers
 * out of order results in contorted faces.
 * -----
 */

INTEGER4 *FaceNodes_Rect = new INTEGER4[TotalNumFaceNodes_Rect];

//Nodes for Face 1
FaceNodes_Rect[0] = 1;
FaceNodes_Rect[1] = 2;
FaceNodes_Rect[2] = 3;
FaceNodes_Rect[3] = 4;

//Nodes for Face 2
FaceNodes_Rect[4] = 1;
FaceNodes_Rect[5] = 4;
```

```

FaceNodes_Rect[6] = 8;
FaceNodes_Rect[7] = 5;

//Nodes for Face 3
FaceNodes_Rect[8] = 5;
FaceNodes_Rect[9] = 8;
FaceNodes_Rect[10] = 7;
FaceNodes_Rect[11] = 6;

//Nodes for Face 4
FaceNodes_Rect[12] = 2;
FaceNodes_Rect[13] = 6;
FaceNodes_Rect[14] = 7;
FaceNodes_Rect[15] = 3;

//Nodes for Face 5
FaceNodes_Rect[16] = 6;
FaceNodes_Rect[17] = 2;
FaceNodes_Rect[18] = 1;
FaceNodes_Rect[19] = 5;

//Nodes for Face 6
FaceNodes_Rect[20] = 3;
FaceNodes_Rect[21] = 7;
FaceNodes_Rect[22] = 8;
FaceNodes_Rect[23] = 4;

```



When providing the node numbers for each face, you must provide the node numbers in a consistent order (either clockwise or counter-clockwise. Providing the node numbers out of order results in contorted faces.

## Step 5 Specify the neighboring elements for Zone 1

The next step for writing out the polyhedral data is to define the right and left neighboring elements for each face. The neighboring elements can be determined using the right-hand rule. For each face, place your right-hand along the face with your fingers pointing the direction of incrementing node numbers (i.e. from Node 1 to Node 2). The right side of your hand will indicate the right element, and the left side of your hand will indicate the left element. Refer to [Section 3 - 9.3 "FaceRightElems and FaceLeftElems"](#) for details.

The number zero is used to indicate that there isn't an element on that side of the face. A negative number is used when the neighboring element is in another zone. The value of the negative number along with the FaceBndryConnectionCounts array points to the position in the FaceBoundaryConnectionElems and FaceBoundaryConnectionZones arrays that defines the element and zone numbers of the neighboring element. Refer to Step 6 for details.

Because of the way we numbered the nodes and faces, the right element for every face (except the face connected to the arrowhead) is the element itself (Element 1) and the left element is "no-neighboring element" (Element 0).

```

INTEGER4 *FaceLeftElems_Rect = new INTEGER4[NumFaces_Rect];
INTEGER4 *FaceRightElems_Rect = new INTEGER4[NumFaces_Rect];

/* Since this zone has just one element, all leftelems are
 * NoNeighboring Element and all right elems are itself
 */
for (INTEGER4 ii = 0; ii < NumFaces_Rect; ii++)
{
    FaceRightElems_Rect[ii] = 1;
}

```

```

    FaceLeftElems_Rect[ii] = 0;
}

/* The negative value in the FaceLeftElems array indicates that
 * the face is connected to an element in another zone. In this
 * case, Face 4 is connected to a face in Zone 2 (to be defined
 * later in the example). The FaceBoundaryConnectionElems array
 * lists all of the element numbers in other zones that the
 * current zone shares boundary connections with. Similarly, the
 * FaceBoundaryConnectionZones array lists all of the zone numbers
 * with which the current zone shares boundaries. A negative
 * value in the FaceLeftElems or FaceRightElems array indicates
 * the position within these arrays that defines the neighboring
 * element and zone for a face.
 *
 * For example, if the FaceBoundaryConnectionElems array is:
 * [1 8 2] and the FaceBoundaryConnectionZones array is: [2 5 3],
 * a FaceLeftElems or FaceRightElems value of -2 indicates that
 * the face in question has a boundary connection with Element 8
 * in Zone 5.
 */
FaceLeftElems_Rect[3] = -1;

I = TECPOLYFACE142(&NumFaces_Rect,
                  FaceNodeCounts_Rect,
                  FaceNodes_Rect,
                  FaceLeftElems_Rect,
                  FaceRightElems_Rect);

```

After defining the face nodes, we call TECPOLYFACE to write it to the file.

## Step 6 Define boundary connections for Zone 1

The last step for defining the rectangular solid is to describe the boundary connections and call TECPOLYBCONN.

```

/* The FaceBndryConnectionCounts array is used to define the
 * number of boundary connections for each face that has a
 * boundary connection. For example, if a zone has three boundary
 * connections in total (NumConnectedBoundaryFaces), two of those
 * boundary connections are in one face, and the remaining
 * boundary connection is in a second face, the
 * FaceBndryConnectionCounts array would be: [2 1].
 * In this example, the total number of connected boundary faces
 * (specified via TECZNE) is equal to one, so the
 * FaceBoundaryConnectionCounts array contains a single value (1).
 */
INTEGER4 *FaceBndryConnCounts_Rect = new
INTEGER4[NumConnBndryFaces_Rect];
FaceBndryConnCounts_Rect[0] = 1;

/* The value(s) in the FaceBndryConnectionElems and
 * FaceBndryConnectionZones arrays specify the element number and
 * zone number, respectively, that a given boundary connection is
 * connected to. In this case, the boundary connection face is
 * connected to Element 1 in Zone 2.
 */
INTEGER4 *FaceBndryConnElems_Rect = new
INTEGER4[TotalNumBndryConns_Rect];
INTEGER4 *FaceBndryConnZones_Rect = new
INTEGER4[TotalNumBndryConns_Rect];

FaceBndryConnElems_Rect[0] = 1;
FaceBndryConnZones_Rect[0] = 2;

```



```

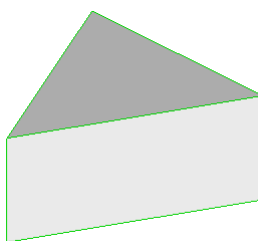
I = TECPOLYBCONN142(&NumConnBndryFaces_Rect,
                    FaceBndryConnCounts_Rect,
                    FaceBndryConnElems_Rect,
                    FaceBndryConnZones_Rect);

/* cleanup */
delete X_Rect;
delete Y_Rect;
delete Z_Rect;
delete P_Rect;
delete FaceNodeCounts_Rect;
delete FaceNodes_Rect;
delete FaceLeftElems_Rect;
delete FaceRightElems_Rect;
delete FaceBndryConnCounts_Rect;
delete FaceBndryConnElems_Rect;
delete FaceBndryConnZones_Rect;

```

## Step 7 Create Zone 2

The data for Zone 1 has been written to the data file, so we are ready to create Zone 2. For simplicity, we will reuse many of the variables from that are not relevant to this tutorial.



Zone 2 (the arrowhead or prism) has a single element composed of six nodes and five faces.

```

//TECZNE Parameters
INTEGER4 NumPts_Prism           = 6;
INTEGER4 NumElems_Prism        = 1;
INTEGER4 NumFaces_Prism        = 5;

/* The prism is composed of two triangular faces and three
 * rectangular faces. The total number of face nodes is the sum
 * of the nodes in each triangular face (2 times 3) and the nodes
 * in each rectangular face (3 times 4).
 */
INTEGER4 TotalNumFaceNodes_Prism = 18;

/* As with Zone 1, Zone 2 has one connected boundary face, the
 * face that is connected to Zone 1.
 */
INTEGER4 NumConnBndryFaces_Prism = 1;

/* In this case, we have set the total number of boundary
 * connections for the connected face to two. The first boundary
 * connection is the connection to Zone 1. The second boundary
 * connection is used to indicate that the face is only partially
 * obscured by the face from Zone 1. If we omitted the second
 * boundary connection, the connected face of the prism would
 * disappear if the rectangular zone was deactivated.
 */
INTEGER4 TotalNumBndryConns_Prism = 2;

```

```

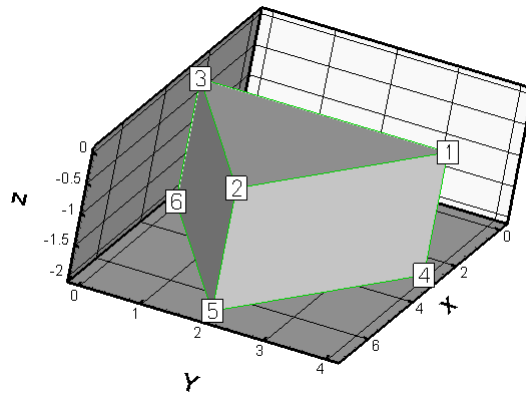
I = TECZNE142((char*)"Zone 2: Prism",
              &ZoneType,
              &NumPts_Prism,
              &NumElems_Prism,
              &NumFaces_Prism,
              &ICellMax,
              &JCellMax,
              &KCellMax,
              &SolutionTime,
              &StrandID,
              &ParentZone,
              &IsBlock,
              &NumFaceConnections,
              &FaceNeighborMode,
              &TotalNumFaceNodes_Prism,
              &NumConnBndryFaces_Prism,
              &TotalNumBndryConns_Prism,
              NULL,
              ValueLocation,
              NULL,
              &SharConn);

```

## Step 8 Specify the variable values for Zone 2

Now that the zone has been created, we must write the variable values to the file by calling TECDAT. While there are more elegant ways to define the grid coordinates for the prism, the values are defined explicitly in order to keep the example relatively simple.

Using the picture below, define the variable values.



```

double *X_Prism = new double[NumPts_Prism];
double *Y_Prism = new double[NumPts_Prism];
double *Z_Prism = new double[NumPts_Prism];

/* Set the X and Y variable values, one z-plane at a time */
double ZVal = 0;
for (INTEGER4 ii = 0; ii < 2; ii++)
{
    // triangle in Z=ZVal plane
    X_Prism[3*ii] = 3;
    Y_Prism[3*ii] = 4;
    Z_Prism[3*ii] = ZVal;

    X_Prism[3*ii+1] = 7;
    Y_Prism[3*ii+1] = 2;
}

```

```

    Z_Prism[3*ii+1] = ZVal;

    X_Prism[3*ii+2] = 3;
    Y_Prism[3*ii+2] = 0;
    Z_Prism[3*ii+2] = ZVal;

    ZVal = ZVal - 2;
}

/* When we called TecZne, we specified that the variable 4
 * (pressure) is cell-centered. As such, only NumElements number
 * of values needs to be written to the data file for the pressure
 * variable.
 */
double *P_Prism = new double[NumElems_Prism];
P_Prism[0] = 20;

I = TECDAT142(&NumPts_Prism, X_Prism, &IsDouble);
I = TECDAT142(&NumPts_Prism, Y_Prism, &IsDouble);
I = TECDAT142(&NumPts_Prism, Z_Prism, &IsDouble);
I = TECDAT142(&NumElems_Prism, P_Prism, &IsDouble);

```

## Step 9 Define the face map for the arrowhead

Before creating the data set, we have defined the node numbers, face numbers and element numbers. Using the following figure, specify the nodes that define each face.

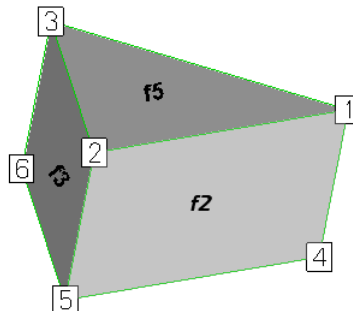


Figure 3-4. The arrowhead with three faces visible (Face 2, Face 3 and Face 5). The remaining rectangular face is Face 1, and the remaining triangular face is Face 4).

The faces are created from the data file format using the FaceNodeCounts and FaceNodes array. The FaceNodeCounts array specifies the number of nodes contained in each face. The first value in the array is the number of nodes in Face 1, followed by the number of nodes in Face 2, and so forth. The FaceNodes array lists the node numbers in each face. The FaceNodes array first lists all of the nodes in Face 1, followed by all of the nodes in Face 2, and so forth.

In this example, Face 1 is composed of four nodes (Node 1, Node 3, Node 6 and Node 4). As such, the first value in the FaceNodeCounts array is “4” and the first four values in the FaceNodes array are [1, 3, 6, 4].

```

INTEGER4 *FaceNodeCounts_Prism = new INTEGER4[NumFaces_Prism];
INTEGER4 *FaceNodes_Prism      = new INTEGER4[TotalNumFaceNodes_Prism];

/* Because of the way we chose to number our faces, the first
 * three faces are rectangular and the last two are triangular.
 * The numbering of the faces is arbitrary, but the faces must
 * be referred to consistently.
 */

```

```

for (INTEGER4 ii = 0; ii < 3; ii++)
    FaceNodeCounts_Prism[ii] = 4;

for (INTEGER4 ii = 3; ii < NumFaces_Prism; ii++)
    FaceNodeCounts_Prism[ii] = 3;

//Nodes for Face 1
FaceNodes_Prism[0] = 1;
FaceNodes_Prism[1] = 3;
FaceNodes_Prism[2] = 6;
FaceNodes_Prism[3] = 4;

//Nodes for Face 2
FaceNodes_Prism[4] = 1;
FaceNodes_Prism[5] = 4;
FaceNodes_Prism[6] = 5;
FaceNodes_Prism[7] = 2;

//Nodes for Face 3
FaceNodes_Prism[8] = 3;
FaceNodes_Prism[9] = 2;
FaceNodes_Prism[10] = 5;
FaceNodes_Prism[11] = 6;

//Nodes for Face 4
FaceNodes_Prism[12] = 5;
FaceNodes_Prism[13] = 4;
FaceNodes_Prism[14] = 6;

//Nodes for Face 5
FaceNodes_Prism[15] = 1;
FaceNodes_Prism[16] = 2;
FaceNodes_Prism[17] = 3;

```

## Step 10 Specify the neighboring elements for Zone 2

Now that we have defined the nodes that compose each face, we must specify the element on either side of each face. The neighboring elements can be determined using the right-hand rule. For each face, place your right-hand along the face with your fingers pointing the direction of incrementing node numbers (i.e. from Node 1 to Node 2). The right side of your hand will indicate the right element, and the left side of your hand will indicate the left element. Refer to [Section 3 - 9.3 "FaceRightElems and FaceLeftElems"](#) for details.

The number zero is used to indicate that there isn't an element on that side of the face. A negative number is used when the neighboring element is in another zone. The value of the negative number points to the position in the FaceBoundaryConnectionElems and FaceBoundaryConnectionZones arrays that defines the element and zone numbers of the neighboring element. Refer to Step 11 for details.

Because of the way we numbered the nodes and faces, the right element for every face (except the face connected to the rectangular solid) is the element itself (Element 1) and the left element is "no-neighboring element" (Element 0).

```

/* Since this zone has just one element, all leftelems are
 * NoNeighboring Element and all right elems are itself.
 */
INTEGER4 *FaceLeftElems_Prism = new INTEGER4[NumFaces_Prism];
INTEGER4 *FaceRightElems_Prism = new INTEGER4[NumFaces_Prism];

for (INTEGER4 ii = 0; ii < NumFaces_Prism; ii++)
{
    FaceRightElems_Prism[ii] = 1;
}

```

```

    FaceLeftElems_Prism[ii] = 0;
}

/* The negative value in the FaceLeftElems array indicates that
 * the face is connected to an element in another zone. In this
 * case, Face 1 is connected to a face in Zone 1 (as indicated in
 * Line 6). The FaceBoundaryConnectionElems array lists all of
 * the element numbers in other zones that the current zone shares
 * boundary connections with. Similarly, the
 * FaceBoundaryConnectionZones array lists all of the zone numbers
 * with which the current zone shares boundaries. A negative
 * value in the FaceLeftElems or FaceRightElems array indicates
 * the position within these arrays that defines the neighboring
 * element and zone for a face.
 */
FaceLeftElems_Prism[0] = -1;

I = TECPOLYFACE142(&NumFaces_Prism,
                  FaceNodeCounts_Prism,
                  FaceNodes_Prism,
                  FaceLeftElems_Prism,
                  FaceRightElems_Prism);

```

## Step 11 Specify boundary connections for Zone 2

The last step for creating Zone 2 is to specify the boundary connections.

```

INTEGER4 *FaceBndryConnCounts_Prism = new
INTEGER4[NumConnBndryFaces_Prism];
FaceBndryConnCounts_Prism[0] = 2;

INTEGER4 *FaceBndryConnElems_Prism = new
INTEGER4[TotalNumBndryConns_Prism];
INTEGER4 *FaceBndryConnZones_Prism = new
INTEGER4[TotalNumBndryConns_Prism];

/* As previously mentioned, a connected boundary face is a face
 * that has either multiple neighboring faces or neighbor(s) that
 * belong to another zone. Those cases are sufficient when the
 * combination of all of the face's neighbors completely cover the
 * face. However, there are some cases (such as the bottom of the
 * arrowhead) where the face is not completely covered by its
 * neighbors. In those cases the face is referred to as "partially
 * obscured". A partially obscured face is indicated by
 * incrementing the value in TotalNumConnectedBoundaryFaces and
 * entering a value of 0 in both the FaceBndryConnectionElems and
 * FaceBoundaryConnectionZones arrays for the boundary connection
 * for the partially obscured face.
 */
FaceBndryConnElems_Prism[0] = 0;
FaceBndryConnZones_Prism[0] = 0;

/* Indicates that Face 1 is connected to Element 1 in Zone 1. */
FaceBndryConnElems_Prism[1] = 1;
FaceBndryConnZones_Prism[1] = 1;

I = TECPOLYBCONN142(&NumConnBndryFaces_Prism,
                   FaceBndryConnCounts_Prism,
                   FaceBndryConnElems_Prism,
                   FaceBndryConnZones_Prism);

/* cleanup */
delete X_Prism;

```

```

delete Y_Prism;
delete Z_Prism;
delete P_Prism;
delete FaceNodeCounts_Prism;
delete FaceNodes_Prism;
delete FaceLeftElems_Prism;
delete FaceRightElems_Prism;
delete FaceBndryConnCounts_Prism;
delete FaceBndryConnElems_Prism;
delete FaceBndryConnZones_Prism;

```

## Step 12 Close the file

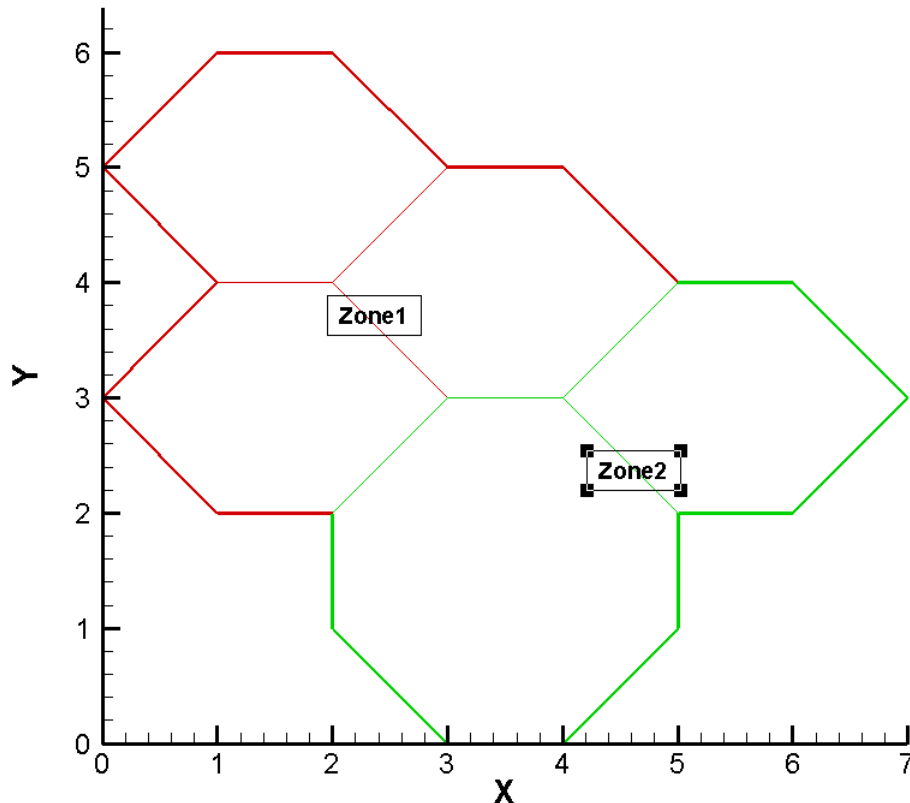
Call TECEND to close the file.

```
I = TECEND142();
```

## 3 - 10.4 Multiple Polygonal Zones

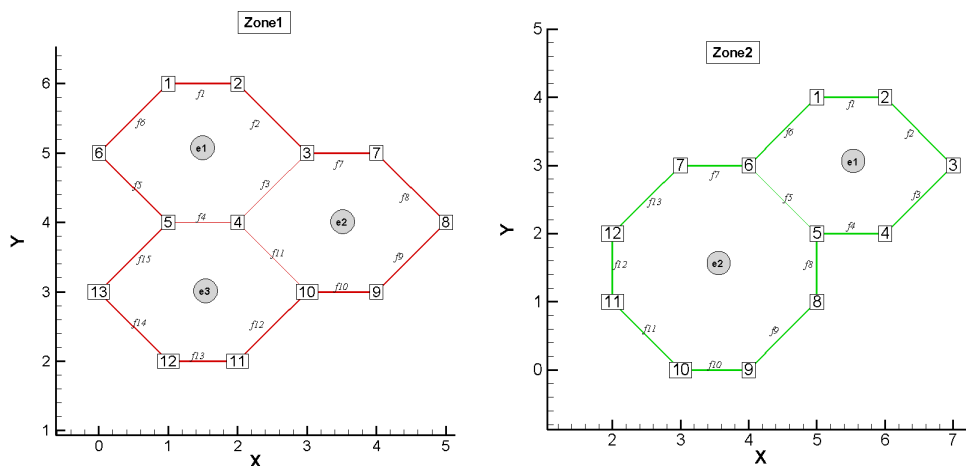
The following example demonstrates how to create multiple polygonal zones. The example covers: creating a zone where each element contains a different number of nodes, boundary connections and varying variable locations (cell-centered versus nodal).

The code in this example produces the following plot:



Before beginning to create a polyhedral data file, you should assign a number to each node, face, element and zone. The numbering system is used to determine the order that the information is supplied to Tecplot. You may assign any order you would like. However, once you have supplied information to

Tecplot, you cannot change the number configuration. For this example, we have selected the numbering system shown below:



Zone 1 has a total of three elements, thirteen unique nodes and fifteen faces. Zone 2 has two elements, twelve nodes and thirteen faces.

In order to keep the example as simple as possible, error checking is not included. If you plan to compile this example, be sure to include: TECIO.h.

For complete details on the parameters used and the function syntax for each TecIO function, refer to [Section 3 - 8 "Binary Data File Function Reference"](#). When creating a binary data file using the TecIO library, the functions must be called in a specific order. Refer to [Section 3 - 5 "Binary Data File Function Calling Sequence"](#) for details.

## Step 1 Initialize the Data File

The first step for creating a binary data file using the TecIO library is to initialize and open the data file by calling TECINI

```

INTEGER4 I; /* use to check return values */

INTEGER4 Debug      = 1;
INTEGER4 VIsDouble  = 0;
INTEGER4 FileType   = 0;
INTEGER4 FileFormat = 0; // 0 == PLT, 1 == SZPLT

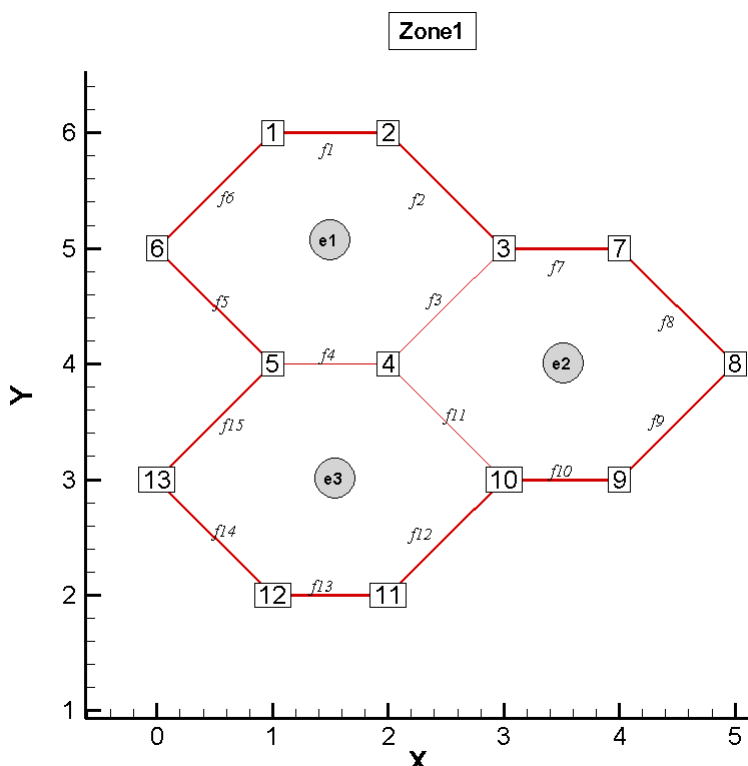
I = TECINI142((char*)"Example: Multiple polygonal zones",
              (char*)"X Y P", /* Defines the variables for the data
file.

                                * Each zone must contain each of the vars
                                * listed here. The order of the variables
                                * in the list is used to define the
                                * variable number (e.g. X is Variable 1).
                                * When referring to variables in other
                                * TecIO functions, you will refer to the
                                * variable by its number.
                                */
              (char*)"HexagonsAndOctagon.plt",
              (char*)"", /* scratch directory */
              &FileFormat,
              &FileType,
              &Debug,
              &VIsDouble);

```

## Step 2 Create Zone 1 (3 Hexagons)

The first step toward creating Zone 1 is to call TECZNE. TECZNE is used to initialize the zone and specify parameters that apply to the entire zone (e.g. number of nodes, number of elements and variable location).



```

/* TECZNE Parameters */
INTEGER4 ZoneType      = 6; /* FE Polygon */
INTEGER4 NumPts_Z1     = 13; /* the number of unique
                               * nodes in the zone.
                               */
INTEGER4 NumElems_Z1   = 3;
INTEGER4 NumFaces_Z1   = 15; /* the number of unique
                               * faces in the zone.
                               */
INTEGER4 ICellMax      = 0; /* not used */
INTEGER4 JCellMax      = 0; /* not used */
INTEGER4 KCellMax      = 0; /* not used */
double  SolutionTime   = 0.0;
INTEGER4 StrandID      = 0;
INTEGER4 ParentZone    = 0;
INTEGER4 IsBlock       = 1;
INTEGER4 NumFaceConnections = 0;
INTEGER4 FaceNeighborMode = 1;
INTEGER4 SharConn      = 0;

INTEGER4 ValueLocation[3] = { 1, 1, 0 };

/* For a polygonal zone, the total number of face nodes is
 * twice the total number of faces. This is because each face
 * is composed of exactly two nodes.
 */
INTEGER4 TotalNumFaceNodes_Z1 = 2 * NumFaces_Z1;

/* A boundary face is a face that is neighbored by an element

```



```

/* or elements in another zone or zone(s). In Zone 1, Face 9,
* Face 10 and Face 12 have a neighbor in Zone 2. Therefore,
* the total number of boundary faces is ??
*/
INTEGER4 TotalNumBndryFaces_Z1 = 3;

/* Each boundary face has one or more boundary connections. A
* boundary connection is defined as another element in another
* zone. Face 9 has a boundary connection with Element 1 in
* Zone 2. In this example, each boundary face is connected to
* one other element, so the total number of boundary
* connections is equivalent to the total number of boundary
* faces (3).
*/
INTEGER4 TotalNumBndryConns_Z1 = 3;

I = TECZNE142((char*)"Zone 1: 3 Hexagons", /* Specifies the name of
* the entire dataset. When
* the file is loaded into
* Tecplot, the value is
* available via the Data
* Set Info dialog.
*/
&ZoneType,
&NumPts_Z1,
&NumElems_Z1,
&NumFaces_Z1,
&ICellMax,
&JCellMax,
&KCellMax,
&SolutionTime,
&StrandID,
&ParentZone,
&IsBlock,
&NumFaceConnections,
&FaceNeighborMode,
&TotalNumFaceNodes_Z1,
&TotalNumBndryFaces_Z1,
&TotalNumBndryConns_Z1,
NULL,
ValueLocation,
NULL,
&SharConn);

```

### Step 3 Specify the variable values for Zone 1

The variable values are written to the data file via the TECDAT function. For each variable you must provide either a total number of values equivalent to NumPts (if the variables are nodal) or a total number of values equivalent to NumElements (if the variables are cell-centered). The variable location is specified by the VarLocation parameter in TECZNE. In this example, X and Y are nodal variables and P is cell-centered.

The order in which the variable values must be provided is established by the numbering scheme (specified at the beginning of the example). The first value for each nodal variable (X and Y) corresponds to Node 1, the second value corresponds to Node 2 and so forth. The first value for the cell-centered value is for Element 1, the second value is for the second element or cell and so forth.

In order for the example to be easily followed, the grid coordinates are explicitly defined. When working with larger data sets, you will likely wish to use equations to define your coordinates. Refer to the picture in Step 2 for the X and Y coordinate values for Zone 1.

```

/* TECDAT Parameters */
double *X_Z1 = new double[NumPts_Z1];
double *Y_Z1 = new double[NumPts_Z1];

X_Z1[0] = 1;
Y_Z1[0] = 6;

X_Z1[1] = 2;
Y_Z1[1] = 6;

X_Z1[2] = 3;
Y_Z1[2] = 5;

X_Z1[3] = 2;
Y_Z1[3] = 4;

X_Z1[4] = 1;
Y_Z1[4] = 4;

X_Z1[5] = 0;
Y_Z1[5] = 5;

X_Z1[6] = 4;
Y_Z1[6] = 5;

X_Z1[7] = 5;
Y_Z1[7] = 4;

X_Z1[8] = 4;
Y_Z1[8] = 3;

X_Z1[9] = 3;
Y_Z1[9] = 3;

X_Z1[10] = 2;
Y_Z1[10] = 2;

X_Z1[11] = 1;
Y_Z1[11] = 2;

X_Z1[12] = 0;
Y_Z1[12] = 3;

double *P_Z1 = new double[NumElems_Z1];
P_Z1[0] = 2;
P_Z1[1] = 4;
P_Z1[2] = 5;

INTEGER4 IsDouble = 1;
I = TECDAT142(&NumPts_Z1, X_Z1, &IsDouble);
I = TECDAT142(&NumPts_Z1, Y_Z1, &IsDouble);
I = TECDAT142(&NumElems_Z1, P_Z1, &IsDouble);
delete X_Z1;
delete Y_Z1;
delete P_Z1;

```

## Step 4 Specify the face map data for Zone 1

Use the picture in Step 2 to specify the nodes that compose each face. The first two values in the face node array define Face 1, the next two define Face 2, and so on.

```
/* TecPolyFace Parameters */

/* Create a FaceNodes array, dimensioned by the total number
 * of face nodes in the zone.
 */
INTEGER4 *FaceNodes_Z1 = new INTEGER4[TotalNumFaceNodes_Z1];

/* Face Nodes for Element 1 */
FaceNodes_Z1[0] = 1;
FaceNodes_Z1[1] = 2;

FaceNodes_Z1[2] = 2;
FaceNodes_Z1[3] = 3;

FaceNodes_Z1[4] = 3;
FaceNodes_Z1[5] = 4;

FaceNodes_Z1[6] = 4;
FaceNodes_Z1[7] = 5;

FaceNodes_Z1[8] = 5;
FaceNodes_Z1[9] = 6;

FaceNodes_Z1[10] = 6;
FaceNodes_Z1[11] = 1;

/* Face Nodes for Element 2 */
FaceNodes_Z1[12] = 3;
FaceNodes_Z1[13] = 7;

FaceNodes_Z1[14] = 7;
FaceNodes_Z1[15] = 8;

FaceNodes_Z1[16] = 8;
FaceNodes_Z1[17] = 9;

FaceNodes_Z1[18] = 9;
FaceNodes_Z1[19] = 10;

FaceNodes_Z1[20] = 10;
FaceNodes_Z1[21] = 4;

/* Face Nodes for Element 3 */
FaceNodes_Z1[22] = 10;
FaceNodes_Z1[23] = 11;

FaceNodes_Z1[24] = 11;
FaceNodes_Z1[25] = 12;

FaceNodes_Z1[26] = 12;
FaceNodes_Z1[27] = 13;

FaceNodes_Z1[28] = 13;
FaceNodes_Z1[29] = 5;
```

## Step 5 Specify the neighboring elements for Zone 1

Now that we have defined the nodes that compose each face, we must specify the element on either side of each face. The neighboring elements can be determined using the right-hand rule. For each face, place your right-hand along the face with your fingers pointing the direction of incrementing node numbers (i.e. from Node 1 to Node 2). The right side of your hand will indicate the right element, and the left side of your hand will indicate the left element. Refer to [Section 3 - 9.3 "FaceRightElems and FaceLeftElems"](#) for details.

The number zero is used to indicate that there isn't an element on that side of the face. A negative number is used when the neighboring element is in another zone. The value of the negative number points to the position in the FaceBoundaryConnectionElems and FaceBoundaryConnectionZones arrays that defines the element and zone numbers of the neighboring element. Refer to Step 6 for details.

Because of the way we numbered the nodes and faces, the right element for every face is the element itself. The left element will either be: another element in the zone, "no neighboring element", or an element in Zone 2. The term "no neighboring element" is used to describe a face that is on the edge of the entire data set (not just the zone).

```
INTEGER4 *FaceLeftElems_Z1 = new INTEGER4[NumFaces_Z1];
INTEGER4 *FaceRightElems_Z1 = new INTEGER4[NumFaces_Z1];

/* Left Face Elems for Element 1 */
FaceLeftElems_Z1[0] = 0;
FaceLeftElems_Z1[1] = 0;
FaceLeftElems_Z1[2] = 2;
FaceLeftElems_Z1[3] = 3;
FaceLeftElems_Z1[4] = 0;

/* Left Face Elems for Element 2 */
FaceLeftElems_Z1[5] = 0;
FaceLeftElems_Z1[6] = 0;
FaceLeftElems_Z1[7] = 0;
FaceLeftElems_Z1[8] = -1;
FaceLeftElems_Z1[9] = -2;
FaceLeftElems_Z1[10] = 3;

/* Left Face Elems for Element 3 */
FaceLeftElems_Z1[11] = -3;
FaceLeftElems_Z1[12] = 0;
FaceLeftElems_Z1[13] = 0;
FaceLeftElems_Z1[14] = 0;

/* Set Right Face Elems. Because of the way we numbered the
 * nodes and faces, the right element for every face is the
 * element itself.
 */
for (INTEGER4 ii = 0; ii < 6; ii++)
    FaceRightElems_Z1[ii] = 1;

for (INTEGER4 ii = 6; ii < 11; ii++)
    FaceRightElems_Z1[ii] = 2;

for (INTEGER4 ii = 11; ii <= 14; ii++)
    FaceRightElems_Z1[ii] = 3;

I = TECPOLYFACE142(&NumFaces_Z1,
    NULL, /* Not used for polygon zones */
    FaceNodes_Z1,
    FaceLeftElems_Z1,
    FaceRightElems_Z1);
```

```
delete FaceNodes_Z1;
delete FaceLeftElems_Z1;
delete FaceRightElems_Z1;
```

## Step 6 Specify the boundary connections for Zone 1

The final step for creating Zone 1 is to define the boundary connections.

```
/* TecPolyBConn Parameters */

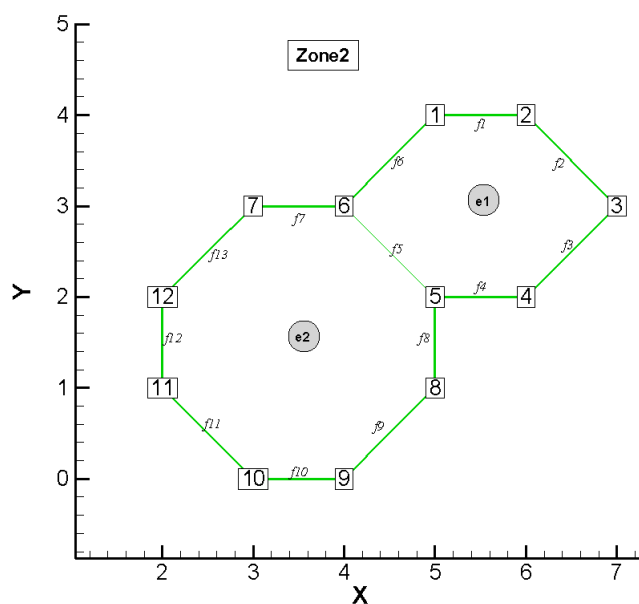
/* The FaceBndryConnectionCounts array is used to define the
 * number of boundary connections for each face that has a
 * boundary connection. For example, if a zone has three
 * boundary connections in total (NumConnectedBoundaryFaces),
 * two of those boundary connections are in one face, and the
 * remaining boundary connection is in a second face, the
 * FaceBndryConnectionCounts array would be: [2 1].
 */
/* In this example, the total number of connected boundary
 * faces (specified via TECZNE) is equal to three. Each
 * boundary face is connected to only one other element,
 * so the FaceBoundaryConnectionCounts array is (1, 1, 1).
 */
INTEGER4 FaceBndryConnectionCounts_Z1[3] = {1, 1, 1};

/* The value(s) in the FaceBndryConnectionElems and
 * FaceBndryConnectionZones arrays specifies the element number
 * and zone number, respectively, that a given boundary
 * connection is connected to. In this case, the first
 * boundary connection face is connected to Element 1 in Zone 2
 * and the remaining connection is to Element 2 in Zone 2.
 */
INTEGER4 FaceBndryConnectionElems_Z1[3] = {1, 2, 2};
INTEGER4 FaceBndryConnectionZones_Z1[3] = {2, 2, 2};

I = TECPOLYBCONN142(&TotalNumBndryFaces_Z1,
                    FaceBndryConnectionCounts_Z1,
                    FaceBndryConnectionElems_Z1,
                    FaceBndryConnectionZones_Z1);
```

## Step 7 Create Zone 2

Now that Zone 1 is complete, we are ready to begin creating Zone 2 by calling TECZNE. For simplicity, we are reusing many of the variables that were defined for Zone 1.



```

INTEGER4 NumPts_Z2      = 12; /* number of unique
                             * nodes in the zone
                             */
INTEGER4 NumElems_Z2    = 2;
INTEGER4 NumFaces_Z2    = 13; /* number of unique
                             * faces in the zone
                             */
INTEGER4 NumFaceConnections_Z2 = 0;
/* In polygonal zones, each face has exactly two nodes */
INTEGER4 TotalNumFaceNodes_Z2 = NumFaces_Z2 * 2;

/* A boundary face is a face that is neighbored by an element or
 * elements from another zone or zone(s). In Zone 2, Face 6,
 * Face 7 and Face 13 have a neighbor in Zone 1. Therefore, the
 * total number of boundary faces is ??
 */
INTEGER4 TotalNumBndryFaces_Z2 = 3;

/* Each boundary face has one or more boundary connections. In
 * this example, each boundary face is connected to one other
 * element (i.e. the number of boundary faces and the number of
 * boundary connections is one-to-one).
 */
INTEGER4 TotalNumBndryConns_Z2 = 3;

I = TECZNE142((char*)"Zone 2: 1 Hexagon and 1 Octagon",
              &ZoneType,
              &NumPts_Z2,
              &NumElems_Z2,
              &NumFaces_Z2,
              &ICellMax,
              &JCellMax,
              &KCellMax,
              &SolutionTime,
              &StrandID,

```

```

    &ParentZone,
    &IsBlock,
    &NumFaceConnections_Z2,
    &FaceNeighborMode,
    &TotalNumFaceNodes_Z2,
    &TotalNumBndryFaces_Z2,
    &TotalNumBndryConns_Z2,
    NULL,
    ValueLocation,
    NULL,
    &SharConn);

```

## Step 8 Specify the variable values for Zone 2

The variable values are written to the data file via the TECDAT function. For each variable you must provide either a total number of values equivalent to NumPts (if the variables are nodal) or equivalent to NumElements (if the variables are cell-centered). The variable location is specified by the VarLocation parameter in TECZNE. In this example, X and Y are nodal variables and P is cell-centered.

The order in which the variable values must be provided is established by the numbering scheme specified at the beginning of the example. The first value for each nodal variable (X and Y) corresponds to Node 1, the second value corresponds to Node 2 and so forth. The first value for the cell-centered value is for Element 1, the second value is for the second element or cell and so forth.

In order for the example to be easily followed, the grid coordinates are explicitly defined. When working with larger data sets, you will likely wish to use equations to define your coordinates. Refer to the picture in Step 7 for the X and Y coordinate values for Zone 2.

```

double *X_Z2 = new double[NumPts_Z2];
double *Y_Z2 = new double[NumPts_Z2];

X_Z2[0]      = 5;
Y_Z2[0]      = 4;

X_Z2[1]      = 6;
Y_Z2[1]      = 4;

X_Z2[2]      = 7;
Y_Z2[2]      = 3;

X_Z2[3]      = 6;
Y_Z2[3]      = 2;

X_Z2[4]      = 5;
Y_Z2[4]      = 2;

X_Z2[5]      = 4;
Y_Z2[5]      = 3;

X_Z2[6]      = 3;
Y_Z2[6]      = 3;

X_Z2[7]      = 5;
Y_Z2[7]      = 1;

X_Z2[8]      = 4;
Y_Z2[8]      = 0;

X_Z2[9]      = 3;
Y_Z2[9]      = 0;

```

```

X_Z2[10]    = 2;
Y_Z2[10]    = 1;

X_Z2[11]    = 2;
Y_Z2[11]    = 2;

/* In the call to TecZne, P was set to a cell centered variable.
 * As such, only two values need to be defined.
 */
double *P_Z2 = new double[NumPts_Z2];

P_Z2[0] = 8;
P_Z2[1] = 6;

I = TECDAT142(&NumPts_Z2, X_Z2, &IsDouble);
I = TECDAT142(&NumPts_Z2, Y_Z2, &IsDouble);
I = TECDAT142(&NumElems_Z2, P_Z2, &IsDouble);

delete X_Z2;
delete Y_Z2;
delete P_Z2;

```

## Step 9 Specify the face map for Zone 2

Use the picture in Step 7 to specify which nodes compose which face. The first two values in the face node array define Face 1, the next two define Face 2, and so on.

```

INTEGER4 *FaceNodes_Z2;
FaceNodes_Z2 = new INTEGER4[TotalNumFaceNodes_Z2];

/* Face Nodes for Element 1 */
FaceNodes_Z2[0] = 1;
FaceNodes_Z2[1] = 2;

FaceNodes_Z2[2] = 2;
FaceNodes_Z2[3] = 3;

FaceNodes_Z2[4] = 3;
FaceNodes_Z2[5] = 4;

FaceNodes_Z2[6] = 4;
FaceNodes_Z2[7] = 5;

FaceNodes_Z2[8] = 5;
FaceNodes_Z2[9] = 6;

FaceNodes_Z2[10] = 6;
FaceNodes_Z2[11] = 1;

/* Face Nodes for Element 2 */
FaceNodes_Z2[12] = 7;
FaceNodes_Z2[13] = 6;

FaceNodes_Z2[14] = 5;
FaceNodes_Z2[15] = 8;

FaceNodes_Z2[16] = 8;
FaceNodes_Z2[17] = 9;

FaceNodes_Z2[18] = 9;
FaceNodes_Z2[19] = 10;

```



```

FaceNodes_Z2[20] = 10;
FaceNodes_Z2[21] = 11;

FaceNodes_Z2[22] = 11;
FaceNodes_Z2[23] = 12;

FaceNodes_Z2[24] = 12;
FaceNodes_Z2[25] = 7;

```

## Step 10 Specify the neighboring elements for Zone 2

Now that we have defined the nodes that compose each face, we must specify the element on either side of each face. The neighboring elements can be determined using the right-hand rule. For each face, place your right-hand along the face with your fingers pointing the direction of incrementing node numbers (i.e. from Node 1 to Node 2). The right side of your hand will indicate the right element, and the left side of your hand will indicate the left element. Refer to [Section 3 - 9.3 "FaceRightElems and FaceLeftElems"](#) for details.

The number zero is used to indicate that there isn't an element on that side of the face. A negative number is used when the neighboring element is in another zone. The value of the negative number points to the position in the FaceBoundaryConnectionElems and FaceBoundaryConnectionZones arrays that defines the element and zone numbers of the neighboring element. Refer to Step 11 for details.

Because of the way we numbered the nodes and faces, the right element for every face is the element itself. The left element will either be: another element in the zone, "no neighboring element", or an element in Zone 2. The term "no neighboring element" is used to describe a face that is on the edge of the entire data set (not just the zone).

```

/* Specify the right and left neighboring elements.
 * The neighboring elements can be determined using the
 * right-hand rule. For each face, place your right-hand along
 * the face with your fingers pointing the direction of
 * incrementing node numbers (i.e. from Node 1 to Node 2). The
 * right side of your hand will indicate the right element,
 * and the left side of your hand will indicate the left
 * element. A value of zero indicates that there is no
 * neighboring element on that side. A negative value
 * indicates that the neighboring element is in another zone.
 * The number is a pointer into the FaceBndryConnectionElems
 * and FaceBndryConnectionZones arrays.
 */

INTEGER4 *FaceLeftElems_Z2 = new INTEGER4[NumFaces_Z2];
INTEGER4 *FaceRightElems_Z2 = new INTEGER4[NumFaces_Z2];

/* Left Face Elems for Element 1 */
FaceLeftElems_Z2[0] = 0;
FaceLeftElems_Z2[1] = 0;
FaceLeftElems_Z2[2] = 0;
FaceLeftElems_Z2[3] = 0;
FaceLeftElems_Z2[4] = 2;
FaceLeftElems_Z2[5] = -1;

/* Left Face Elems for Element 2 */
FaceLeftElems_Z2[6] = -2;
FaceLeftElems_Z2[7] = 0;
FaceLeftElems_Z2[8] = 0;
FaceLeftElems_Z2[9] = 0;
FaceLeftElems_Z2[10] = 0;
FaceLeftElems_Z2[11] = 0;
FaceLeftElems_Z2[12] = -3;

```

```

/* Set Right Face Elems. Because of the way we numbered the
 * nodes and faces, the right element for every face is the
 * element itself. */
for (INTEGER4 ii = 0; ii < 6; ii++)
    FaceRightElems_Z2[ii] = 1;

for (INTEGER4 ii = 6; ii < 13; ii++)
    FaceRightElems_Z2[ii] = 2;

I = TECPOLYFACE142(&NumFaces_Z2,
                  NULL,
                  FaceNodes_Z2,
                  FaceLeftElems_Z2,
                  FaceRightElems_Z2);

delete FaceNodes_Z2;
delete FaceLeftElems_Z2;
delete FaceRightElems_Z2;

```

## Step 11 Specify the Boundary Connections for Zone 2

The final step for creating Zone 2 is to define the boundary connections

```

/* The FaceBndryConnectionCounts array is used to define the
 * number of boundary connections for each face that has a
 * boundary connection. In this example, the total number of
 * connected boundary faces (specified via TECZNE) is equal to
 * three. Each boundary face is connected to only one other
 * element, so the FaceBoundaryConnectionCounts array is
 * (1, 1, 1).
 */
INTEGER4 FaceBndryConnectionCounts_Z2[3] = {1, 1, 1};

/* The value(s) in the FaceBndryConnectionElems and
 * FaceBndryConnectionZones arrays specifies that element
 * number and zone number, respectively, that a given boundary
 * connection is connected to. In this case, the first boundary
 * connection face is connected to Element 2 in Zone 1 and the
 * remaining connections are Element 3 in Zone 1.
 */
INTEGER4 FaceBndryConnectionElems_Z2[3] = {2, 3, 3};
INTEGER4 FaceBndryConnectionZones_Z2[3] = {1, 1, 1};

I = TECPOLYBCONN142(&TotalNumBndryFaces_Z2,
                   FaceBndryConnectionCounts_Z2,
                   FaceBndryConnectionElems_Z2,
                   FaceBndryConnectionZones_Z2);

```

## Step 12 Close the file using TECEND

Call TECEND to close the file.

```
I = TECEND142();
```

### 3 - 10.5 Polyhedral Example

The following example (written in C) illustrates how to create a single polyhedral cell using the TecIO library.

```
#include "TECIO.h"
#include "MASTER.h" /* for definition of NULL */

int main()
{
    /* Call TECINI142 */
    INTEGER4 FileType = 0; /* 0 for full file */
    INTEGER4 FileFormat = 0; // 0 == PLT, 1 == SZPLT; Only PLT is
    currently supported for polyhedral zones
    INTEGER4 Debug = 0;
    INTEGER4 VIsDouble = 1;
    INTEGER4 I = 0; /* use to check return codes */

    I = TECINI142((char*)"Pyramid", /* Data Set Title */
                 (char*)"X Y Z", /* Variable List */
                 (char*)"pyramid.plt", /* File Name */
                 (char*)".", /* Scratch Directory */
                 &FileFormat,
                 &FileType,
                 &Debug,
                 &(VIsDouble));

    /* Call TECZNE142 */
    INTEGER4 ZoneType = 7; /* 7 for FEPolyhedron */
    INTEGER4 NumNodes = 5; /* number of unique nodes */
    INTEGER4 NumElems = 1; /* number of elements */
    INTEGER4 NumFaces = 5; /* number of unique faces */

    INTEGER4 ICellMax = 0; /* Not Used, set to zero */
    INTEGER4 JCellMax = 0; /* Not Used, set to zero */
    INTEGER4 KCellMax = 0; /* Not Used, set to zero */

    double SolTime = 12.65; /* solution time */
    INTEGER4 StrandID = 0; /* static zone */
    INTEGER4 ParentZone = 0; /* no parent zone */

    INTEGER4 IsBlock = 1; /* block format */

    INTEGER4 NfConns = 0; /* not used for FEPolyhedron
    * zones
    */
    INTEGER4 FNMode = 0; /* not used for FEPolyhedron
    * zones
    */

    INTEGER4 *PassiveVarArray = NULL;
    INTEGER4 *ValueLocArray = NULL;
    INTEGER4 *VarShareArray = NULL;

    INTEGER4 ShrConn = 0;

    /* The number of face nodes in the zone. This example creates
    * a zone with a single pyramidal cell. This cell has four
    * triangular faces and one rectangular face, yielding a total
    * of 16 face nodes.
    */
    INTEGER4 NumFaceNodes = 16;
    INTEGER4 NumBConns = 0; /* No Boundary Connections */
}
```

```

INTEGER4 NumBItems      = 0; /* No Boundary Items */

I = TECZNE142((char*)"Polyhedral Zone (Octahedron)",
              &ZoneType,
              &NumNodes,
              &NumElems,
              &NumFaces,
              &ICellMax,
              &JCellMax,
              &KCellMax,
              &SolTime,
              &StrandID,
              &ParentZone,
              &IsBlock,
              &NFConns,
              &FNMode,
              &NumFaceNodes,
              &NumBConns,
              &NumBItems,
              PassiveVarArray,
              ValueLocArray,
              VarShareArray,
              &ShrConn);

/* Initialize arrays of nodal data */
double *X = new double[NumNodes];
double *Y = new double[NumNodes];
double *Z = new double[NumNodes];

X[0] = 0;
Y[0] = 0;
Z[0] = 0;

X[1] = 1;
Y[1] = 1;
Z[1] = 2;

X[2] = 2;
Y[2] = 0;
Z[2] = 0;

X[3] = 2;
Y[3] = 2;
Z[3] = 0;

X[4] = 0;
Y[4] = 2;
Z[4] = 0;

/* Write the data (using TECDAT142) */
INTEGER4 DIsDouble = 1; /* One for double precision */
I = TECDAT142(&NumNodes, X, &DIsDouble);
I = TECDAT142(&NumNodes, Y, &DIsDouble);
I = TECDAT142(&NumNodes, Z, &DIsDouble);

delete X;
delete Y;
delete Z;

/* Define the Face Nodes.
 *
 * The FaceNodes array is used to indicate which nodes define
 * which face. As mentioned earlier, the number of the nodes is
 * implicitly defined by the order in which the nodal data is

```

```

* provided. The first value of each nodal variable describes
* node 1, the second value describes node 2, and so on.
*
* The face numbering is implicitly defined. Because there are
* two nodes in each face, the first two nodes provided define
* face 1, the next two define face 2 and so on. If there was
* a variable number of nodes used to define the faces, the
* array would be more complicated.
*/

INTEGER4 *FaceNodeCounts = new INTEGER4[NumFaces];
/* The first four faces are triangular, i.e. have three nodes.
* The fifth face is rectangular, i.e. has four nodes. */
FaceNodeCounts[0] = 3;
FaceNodeCounts[1] = 3;
FaceNodeCounts[2] = 3;
FaceNodeCounts[3] = 3;
FaceNodeCounts[4] = 4;

INTEGER4 *FaceNodes = new INTEGER4[NumFaceNodes];
/* Face Nodes for Face 1 */
FaceNodes[0] = 1;
FaceNodes[1] = 2;
FaceNodes[2] = 3;

/* Face Nodes for Face 2 */
FaceNodes[3] = 3;
FaceNodes[4] = 2;
FaceNodes[5] = 4;

/* Face Nodes for Face 3 */
FaceNodes[6] = 5;
FaceNodes[7] = 2;
FaceNodes[8] = 4;

/* Face Nodes for Face 4 */
FaceNodes[9] = 1;
FaceNodes[10] = 2;
FaceNodes[11] = 5;

/* Face Nodes for Face 5 */
FaceNodes[12] = 1;
FaceNodes[13] = 5;
FaceNodes[14] = 4;
FaceNodes[15] = 3;

/* Define the right and left elements of each face.
*
* The last step for writing out the polyhedral data is to
* define the right and left neighboring elements for each
* face. The neighboring elements can be determined using the
* right-hand rule. For each face, place your right-hand along
* the face which your fingers pointing the direction of
* incrementing node numbers (i.e. from node 1 to node 2).
* Your right thumb will point towards the right element; the
* element on the other side of your hand is the left element.
*
* The number zero is used to indicate that there isn't an
* element on that side of the face.
*
* Because of the way we numbered the nodes and faces, the
* right element for every face is the element itself
* (element 1) and the left element is "no-neighboring element"
* (element 0).

```

```

    */

    INTEGER4 *FaceLeftElems = new INTEGER4[NumFaces];
    FaceLeftElems[0] = 1;
    FaceLeftElems[1] = 1;
    FaceLeftElems[2] = 0;
    FaceLeftElems[3] = 0;
    FaceLeftElems[4] = 0;

    INTEGER4 *FaceRightElems = new INTEGER4[NumFaces];
    FaceRightElems[0] = 0;
    FaceRightElems[1] = 0;
    FaceRightElems[2] = 1;
    FaceRightElems[3] = 1;
    FaceRightElems[4] = 1;

    /* Write the face map (created above) using TECPOLYFACE142. */
    I = TECPOLYFACE142(&NumFaces,
                      FaceNodeCounts, /* The face node counts array */
                      FaceNodes,      /* The face nodes array */
                      FaceLeftElems,  /* The left elements array */
                      FaceRightElems); /* The right elements array */

    delete FaceNodeCounts;
    delete FaceNodes;
    delete FaceLeftElems;
    delete FaceRightElems;

    I = TECEND142();
    return 0;
}

```

### 3 - 10.6 IJ-ordered zone

The following example illustrates how to create a simple IJ-ordered zone. [TECZNE142](#) is called first to initialize the zone.

```

#include "TECIO.h"
#include "MASTER.h" /* for definition of NULL */

int main()
{
    INTEGER4 Debug      = 1;
    INTEGER4 VIsDouble  = 0;
    INTEGER4 FileType   = 0;
    INTEGER4 FileFormat = 0; // 0 == PLT, 1 == SZPLT
    INTEGER4 I          = 0; /* Used to track return codes */

    /*
     * Open the file and write the tecplot datafile
     * header information
     */
    I = TECINI142((char*)"IJ Ordered Zones", /* Name of the entire
                                           * dataset.
                                           */
                 (char*)"X Y P", /* Defines the variables for the data
                                * file. Each zone must contain each of
                                * the variables listed here. The order
                                * of the variables in the list is used
                                * to define the variable number (e.g.
                                * X is Var 1).
                                */
                 (char*)"ij_ordered.plt",
                 (char*)"", /* Scratch Directory */

```

```

        &FileFormat,
        &FileType,
        &Debug,
        &VisDouble);

float X1[4];
float Y1[4];
float P1[4];
float X2[4];
float Y2[4];
float P2[4];

INTEGER4 ICellMax           = 0;
INTEGER4 JCellMax           = 0;
INTEGER4 KCellMax           = 0;
INTEGER4 DIsDouble          = 0;
double   SolTime            = 360.0;
INTEGER4 StrandID           = 0;      /* StaticZone */
INTEGER4 ParentZn           = 0;
INTEGER4 IsBlock            = 1;      /* Block */
INTEGER4 NFConns            = 0;
INTEGER4 FNMode             = 0;
INTEGER4 TotalNumFaceNodes  = 1;
INTEGER4 TotalNumBndryFaces = 1;
INTEGER4 TotalNumBndryConnections = 1;
INTEGER4 ShrConn            = 0;

/*Ordered Zone Parameters*/
INTEGER4 IMax = 2;
INTEGER4 JMax = 2;
INTEGER4 KMax = 1;

X1[0] = .125;
Y1[0] = .5;
P1[0] = 5;

X1[1] = .625;
Y1[1] = .5;
P1[1] = 7.5;

X1[2] = .125;
Y1[2] = .875;
P1[2] = 10;

X1[3] = .625;
Y1[3] = .875;
P1[3] = 7.5;

X2[0] = .375;
Y2[0] = .125;
P2[0] = 5;

X2[1] = .875;
Y2[1] = .125;
P2[1] = 7.5;

X2[2] = .375;
Y2[2] = .5;
P2[2] = 10;

X2[3] = .875;
Y2[3] = .5;
P2[3] = 7.5;

```

```

/* Ordered Zone */
INTEGER4 ZoneType = 0;
I = TECZNE142((char*)"Ordered Zone",
              &ZoneType,
              &IMax,
              &JMax,
              &KMax,
              &ICellMax,
              &JCellMax,
              &KCellMax,
              &SolTime,
              &StrandID,
              &ParentZn,
              &IsBlock,
              &NFConns,
              &FNMode,
              &TotalNumFaceNodes,
              &TotalNumBndryFaces,
              &TotalNumBndryConnections,
              NULL,
              NULL,
              NULL,
              &ShrConn);
INTEGER4 III = IMax * JMax * KMax;
I = TECDAT142(&III, X1, &DIsDouble);
I = TECDAT142(&III, Y1, &DIsDouble);
I = TECDAT142(&III, P1, &DIsDouble);

I = TECZNE142((char*)"Ordered Zone2",
              &ZoneType,
              &IMax,
              &JMax,
              &KMax,
              &ICellMax,
              &JCellMax,
              &KCellMax,
              &SolTime,
              &StrandID,
              &ParentZn,
              &IsBlock,
              &NFConns,
              &FNMode,
              &TotalNumFaceNodes,
              &TotalNumBndryFaces,
              &TotalNumBndryConnections,
              NULL,
              NULL,
              NULL,
              &ShrConn);

I = TECDAT142(&III, X2, &DIsDouble);
I = TECDAT142(&III, Y2, &DIsDouble);
I = TECDAT142(&III, P2, &DIsDouble);

I = TECEND142();
return 0;
}

```



### 3 - 10.7 Switching Between Two Files

In this simplified example, information is written to two separate files. First, one file is created and a zone is written to the file. Then, a second file is created and a zone and auxiliary data are written to the file. The second file is closed and the auxiliary data is written to the first file. `INTEGER4 DemoTecFil(void)`

```
#include "TECIO.h"
#include "MASTER.h" /* for definition of NULL */
#include <string.h>

int main()
{
    /*
     * Open the file and write the tecplot datafile
     * header information
     */
    INTEGER4 Debug      = 1;
    INTEGER4 VIsDouble  = 0;
    INTEGER4 FileType   = 0;
    INTEGER4 FileFormat = 0; // 0 == PLT, 1 == SZPLT
    INTEGER4 I          = 0; /* Used to check the return value */

    I = TECINI142((char*)"SIMPLE DATASET", /* Name of the entire
dataset.*/

                (char*)"X1 Y1 P1", /* Defines the variables for the
data
                                * file. Each zone must contain
                                * the variables listed here. The
                                * of the variables in the list is
                                * to define the variable number
                                * X1 is Var 1).
                                */
                (char*)"file1.plt",
                (char*)".", /* Scratch Directory */
                &FileFormat,
                &FileType,
                &Debug,
                &VIsDouble);

    /* Set the parameters for TecZne */
    INTEGER4 ZoneType = 0; /* sets the zone type to
                            * ordered
                            */
    INTEGER4 IMax      = 2; /* Create an IJ-ordered zone,
                            * by using IMax and JMax
                            * values that are greater
                            * than one, and setting KMax
                            * to one.
                            */
    INTEGER4 JMax      = 2;
    INTEGER4 KMax      = 1;

    double SolTime     = 0;
    INTEGER4 StrandID   = 0; /* StaticZone */
    INTEGER4 ParentZn   = 0; /* used for surface streams */

    INTEGER4 ICellMax   = 0; /* not used */
    INTEGER4 JCellMax   = 0; /* not used */
    INTEGER4 KCellMax   = 0; /* not used */
}
```

```

INTEGER4 IsBlock          = 1; /* Block */

INTEGER4 NFConns          = 0; /* this example does not use
    * face neighbors */

INTEGER4 FNMode           = 0;
INTEGER4 TotalNumFaceNodes = 1;
INTEGER4 TotalNumBndryFaces = 1;
INTEGER4 TotalNumBndryConn = 1;
INTEGER4 ShrConn          = 0;

/* Create an Ordered Zone */
I = TECZNE142((char*)"Ordered Zone",
    &ZoneType,
    &IMax,
    &JMax,
    &KMax,
    &ICellMax,
    &JCellMax,
    &KCellMax,
    &SolTime,
    &StrandID,
    &ParentZn,
    &IsBlock,
    &NFConns,
    &FNMode,
    &TotalNumFaceNodes,
    &TotalNumBndryFaces,
    &TotalNumBndryConn,
    NULL,
    NULL,
    NULL,
    &ShrConn);

/* Set the variable values for the ordered zone. */
float X1[4];
float Y1[4];
float P1[4];

X1[0] = 0.125;
Y1[0] = 0.5;
P1[0] = 7.5;

X1[1] = 0.625;
Y1[1] = 0.5;
P1[1] = 10.0;

X1[2] = 0.125;
Y1[2] = 0.875;
P1[2] = 5.0;

X1[3] = 0.625;
Y1[3] = 0.875;
P1[3] = 7.5;

INTEGER4 DIsDouble = 0; /* set DIsDouble to 0, for float
    * values.
    */

INTEGER4 III = IMax * JMax * KMax;
I = TECDAT142(&III, X1, &DIsDouble);
I = TECDAT142(&III, Y1, &DIsDouble);
I = TECDAT142(&III, P1, &DIsDouble);

```

```

/* Open a new data file. note: the first file is still open
 * because TecEnd was not called.
 */
I = TECINI142((char*)"Auxiliary Data",
              (char*)"X1 Y1 P1",
              (char*)"file2.plt",
              (char*)".",
              &FileFormat,
              &FileType,
              &Debug,
              &VIsDouble);

/* Switch the active file to the newly created data file
 * (file2.plt) which is the second file opened with TECINI142
 * so we use 2.
 */
INTEGER4 WhichFile = 2;
I = TECFIL142(&WhichFile);

/* Create a second zone, using many of the values from the first
 * zone, and write it to the second data file.
 */

I = TECZNE142((char*)"Ordered Zone2",
              &ZoneType,
              &IMax,
              &JMax,
              &KMax,
              &ICellMax,
              &JCellMax,
              &KCellMax,
              &SolTime,
              &StrandID,
              &ParentZn,
              &IsBlock,
              &NFConns,
              &FNMode,
              &TotalNumFaceNodes,
              &TotalNumBndryFaces,
              &TotalNumBndryConn,
              NULL,
              NULL,
              NULL,
              &ShrConn);

/* set the variable values for the second zone */
float X2[4];
float Y2[4];
float P2[4];

X2[0] = 0.375;
Y2[0] = 0.125;
P2[0] = 5;

X2[1] = 0.875;
Y2[1] = 0.125;
P2[1] = 7.5;

X2[2] = 0.375;
Y2[2] = 0.5;
P2[2] = 10;

Y2[3] = 0.5;
X2[3] = 0.875;

```

```

P2[3] = 7.5;

III = IMax * JMax * KMax;
I = TECDAT142(&III, X2, &DIsDouble);
I = TECDAT142(&III, Y2, &DIsDouble);
I = TECDAT142(&III, P2, &DIsDouble);

/* Switch to the first file. */
WhichFile = 1;
I = TECFIL142(&WhichFile);

/* Create an auxiliary data value and write it to the file */
char DeformationValue[128];
strcpy(DeformationValue, "0.98");

I = TECAUXSTR142((char*)"DeformationValue",
                DeformationValue);
/* Close the first file */
I = TECEND142();

/* The remaining file will become the active file. As such,
 * TecFil does not need to be called again to close the second
 * file.
 */
I = TECEND142();

return 0;
}

```

### 3 - 10.8 Text Example

The following example creates a data file with a single text box reading "Sample Text".

```

#include "TECIO.h"
#include <string.h>

int main()
{
    /* Open the file & write the datafile header information */
    INTEGER4 Debug      = 1;
    INTEGER4 VIsDouble = 0;
    INTEGER4 FileFormat = 0; // 0 == PLT, 1 == SZPLT
    INTEGER4 FileType   = 0;
    INTEGER4 I          = 0; /* used to check the return value */

    I = TECINI142((char*)"Text",
                (char*)"X Y P",
                (char*)"text.plt",
                (char*)".",
                &FileFormat,
                &FileType,
                &Debug,
                &VIsDouble);

    /* Specify the X, Y and Z position of the anchor point */
    double  XPos      = 0.0;
    double  YPos      = 1.0;
    double  ZPos      = 0.0; /* N/A for 2D text */

    INTEGER4 PosCoordMode = 0; /* use grid coordinates */

    /* opt not to attach the text to a given zone. When text is
     * attached to a given zone, it is displayed only when the zone
     * is displayed.
    */
}

```

```

*/
INTEGER4 AttachToZone      = 0;
INTEGER4 Zone              = 2;

/* Specify the font values */
INTEGER4 Font              = 1; /* Helvetica Bold */
INTEGER4 FontHeightUnits   = 2; /* in grid coordinates */
double   FontHeight        = 18;

/* Set the box style parameters */
INTEGER4 BoxType           = 1; /* filled box */
double   BoxMargin         = .5; /* margin between the text
* and the text box
*/

double   BoxLineThickness  = .1;
INTEGER4 BoxColor          = 0; /* set the box line color
* to black.
*/

INTEGER4 BoxFillColor      = 1; /* set the box fill color
* to red.
*/

/* set the font properties */
double   Angle             = 30; /* angle of the text */
INTEGER4 Anchor            = 1; /* set the anchor point to
* the center of the text
* box.
*/

double   LineSpacing        = 1.5;
INTEGER4 TextColor         = 7; /* set the font color to
* white
*/

INTEGER4 Scope             = 1; /* set the text to "local",
* i.e. available in the
* current frame only.
*/

INTEGER4 Clipping          = 1;

char      Text[60];
char      MFC[24];
strcpy(Text, "Sample Text");
strcpy(MFC, "My Macro");

I = TECTXT142(&XPos,
              &YPos,
              &ZPos,
              &PosCoordMode,
              &AttachToZone,
              &Zone,
              &Font,
              &FontHeightUnits,
              &FontHeight,
              &BoxType,
              &BoxMargin,
              &BoxLineThickness,
              &BoxColor,
              &BoxFillColor,
              &Angle,
              &Anchor,
              &LineSpacing,
              &TextColor,

```

```

        &Scope,
        &Clipping,
        Text,
        MFC);

    I = TECEND142();

    return 0;
}

```

### 3 - 10.9 Partitioned Data Examples

The `brickpartitioned` example uses the partitioned data writing capability of TecIO to write a FE brick zone in three partitions. It can be used either with the standard TecIO library or with TecIO-MPI (by adding `#define MPI 1` to the top of the file and running it using `mpiexec`). Unlike the other examples, it is written in C++ (a FORTRAN 90 version is also provided). If you have followed the other examples, then you will find the data-writing in this example to be straightforward, and the unfamiliar code will be that dealing with the partition-related function calls: [TECMPIINIT142](#), [TECZNEMAP142](#), and [TECFEPTN142](#).

The following notes may help you find your way around:

- Add `#define MPI 1` to the top of the file to use the MPI version, and link against *libtecoimpi.dll*, *libteciompi.so*, or *libteciompi.dylib* as appropriate to your platform.
- In MPI mode, the `MPI_COMM_WORLD` communicator is used, and the main rank is designated as 0 (the first rank), both of which should be typical.
- The zone is partitioned using pseudo-IJK indices. This is for demonstration purposes only; you will likely need a different strategy in real solver code. The partitioning is defined (along with the data) in the function `createData`.

The `ijkpartitioned` example writes IJK-indexed data using the TecIO-MPI API. Similarly to the `brickpartitioned` example, the main additions are the partition-related calls: [TECMPIINIT142](#), [TECZNEMAP142](#), and in this case [TECIJKPTN142](#).

# ASCII Data

Files exported into Tecplot's data format may be either ASCII or binary. However, we strongly recommend using Tecplot's binary file format (\*.plt). The ASCII file format is provided to illustrate how data is structured in Tecplot. ASCII data format is useful only for very small data files. Reading an ASCII data file into Tecplot 360 can be much slower than reading a binary data file, as binary data files are structured for more efficient data access, and Tecplot 360 must convert from ASCII to binary prior to loading the data. Refer to [Chapter 3: "Binary Data"](#) for information on creating files in Tecplot's binary format.

## 4 - 1 Converting ASCII to Binary

Tecplot 360 or Preplot can be used to convert ASCII data files to binary as part of a post-processing step, before the data is presented for interactive visualization. See [Section 4 - 16 "Tecplot-Format Loader"](#) in the [User's Manual](#) for converting with Tecplot 360, or [Section 4 - 6 "ASCII Data File Conversion to Binary"](#) for converting with Preplot. A description of the binary format is included in [Appendix A: Section "Binary Data File Format"](#). If your data is generated in FORTRAN or C, you may be able to generate binary data files directly using the utilities described in [Chapter 3: "Binary Data"](#).

## 4 - 2 Syntax Rules & Limits

An ASCII data file begins with a file header defining a title for the data file and/or the names of the variables. The header is followed by zone records containing the plot data. Zone records may contain ordered or finite element data. You may also include text, geometry, and custom-label records that create text, geometries, and/or custom labels on plots. The records in the file may be in any order.

ASCII data files have the following limits:

- **Number of Records** - Each data file may have ten custom label records, and any number of text and geometry records.
- **Maximum Characters per Line** - The maximum length of a line in a data file is 32,000 characters.

There are additional limits specific to some of the record types and parameters. These limits are discussed in the section for the associated record type or parameter.

When writing an ASCII data file, please keep the following syntax rules in mind:

- **Character Strings** - Double quotes must be used to enclose character strings with embedded blank spaces or other special characters.
- **Multiple Lines** - Any line may be continued onto one or more following lines (except for text enclosed in double quotes [""]).
- **Escape Characters** - A backslash (\) may be used to remove the significance of (or escape) the next character (that is, \" produces a single double-quote).
- **Comments** - Any line beginning with an # is treated as a comment and ignored.

The following simple example of a Tecplot 360 ASCII data file has one small zone and a single line of text:

```
TITLE="Simple Data File"
VARIABLES="X" "Y"
ZONE I=4 DATAPACKING=POINT
1 1
2 1
2 2
1 2
TEXT X=10 Y=90 T="Simple Text"
```

## 4 - 3 ASCII File Structure

An ASCII data file begins with a file header defining a title for the data file and or the names of the variables. The header is followed by optional zone records containing the plot data. Zone records may contain ordered or finite element data. Refer to [Chapter 3: "Data Structure"](#) in the [User's Manual](#) for a complete description of ordered and finite element data. You may also include text, geometry, and custom-label records, in any order.

The first line in a zone, text, geometry, custom label, data set auxiliary data record or variable auxiliary record begins with the keyword ZONE, TEXT, GEOMETRY, CUSTOMLABELS, DATASETAUXDATA, or VARAUXDATA.

The primary components of ASCII data files are:

- [File Header](#)
- [Zone Record](#)
- [Text Record](#)
- [Geometry Record](#)
- [Custom Labels Record](#)
- [Data Set Auxiliary Data Record](#)
- [Variable Auxiliary Data Record](#)

### 4 - 3.1 File Header

The File Header is an optional component of an ASCII data file. It may contain a [TITLE](#), [FILETYPE](#) and/or a [VARIABLES](#) list. If the file header occurs in a place other than at the top of the data file, a warning is printed and the header is ignored. This allows you to concatenate two or more ASCII data files before using Tecplot 360 (provided each data file has the same number of variables per data point).



## File Header Components

Token	Syntax	Notes
<b>TITLE</b>	= "<string>"	The title will be displayed in the headers of Tecplot 360 frames.
<b>FILETYPE</b>	=FULL, GRID or SOLUTION	Specifies the data file type. A full data file contains both grid and solution data. If omitted, the FILETYPE will be treated as "FULL".
<b>VARIABLES</b>	= "VARIABLE1", "VARIABLE2", "VARIABLE3", ..., "VARIABLEN"	You may also assign a name to each of the variables by including a line that begins with VARIABLES=, followed by each variable's name enclosed in double quotes. Tecplot 360 calculates the number of variables (N) from the list of variable names. If you do not specify the variable names (and your first zone has POINT data packing), Tecplot 360 sets the number of variables equal to the number of numeric values in the first line of zone data for the first zone, and names the variables V1, V2, V3, and so forth. Initially, Tecplot 360 uses the first two variables in data files as the X- and Y-coordinates, and the third variable for the Z-coordinate of 3D plots. However, you may order the variables in the data file any way you want, since you can interactively reassign the variables to the X-, Y-, and/or Z-axes via the <b>Select Variables</b> dialog (accessed via <b>Plot&gt;Assign XYZ</b> ).

### Example Grid File

The following example displays a very simple 2D grid file.

```
#"Grid" files look like standard Tecplot data files with no solution variables.
TITLE = "Example Grid File"
FILETYPE = GRID
VARIABLES = "X" "Y"
ZONE
I = 3, J = 3, K = 1
ZONETYPE = Ordered, DATAPACKING = BLOCK
0.0      0.5      1.0      0.00.51.00.00.51.0
0.0      0.0      0.0      0.50.50.51.01.01.0
```

### Example Solution File

The following example displays a very simple solution file (to be used with the [Example Grid File](#)).

```
TITLE = "Example Solution File"
FILETYPE = SOLUTION
VARIABLES = "Pressure"
ZONE
I = 3, J = 3, K = 1
ZONETYPE = Ordered, DATAPACKING = BLOCK
2.0      2.0      2.0      0.00.00.02.02.02.0
```

## 4 - 3.2 Zone Record

A zone record consists of a control line that begins with the keyword ZONE, followed by the zone header, followed by a set of numerical data called the zone data. The contents of the zone footer depend upon the type of zone. Refer to the following table for an overview of the contents of a zone record.

Component	Notes
<b>ZONE</b>	The keyword "ZONE" is required at the start of every zone record
<a href="#">Zone Header</a>	The Zone Header is used to specify the type of data in the zone, the structure of the data, the names of the variables in the zone, and more. Refer to <a href="#">"Zone Header"</a> on page 115 for details.

<a href="#">Data</a>	<p>The data section follows the zone header. The arrangement of the data is dependent upon the values of <a href="#">DATA PACKING</a> and <a href="#">VAR LOCATION</a> (specified in the <a href="#">Zone Header</a>). Refer to “<a href="#">Data</a>” on page 117 for details.</p>
<a href="#">Zone Footer</a>	<p>The contents required for the Zone Footer depend upon the <a href="#">ZONETYPE</a> (specified in the <a href="#">Zone Header</a>).</p> <p>For ordered zones, the Zone Footer contains the <a href="#">Face Neighbor Connections List</a> information (if any).</p> <p>For cell-based finite element zones (FETRIANGLE, FEQUADILATERAL, FETETRAHEDRAL and FEBRICK), the Zone Footer contains <a href="#">Connectivity</a> information, followed by <a href="#">Face Neighbor Connections List</a>.</p> <p>For face-based finite element zones (FEPOLYHEDRAL, FEPOLYGON), the Zone Footer contains <a href="#">Facemap Data</a>, followed by <a href="#">Boundary Map Data</a>. Remember that Tecplot Focus cannot load this type of zone.</p> <p>Refer to “<a href="#">Zone Footer</a>” on page 119 for additional information.</p>

**Zone Header**

Keyword	Syntax	Required (Y/N)	Default	Notes
<b>ZONE</b>		Y		Keyword required to start a zone record
<b>T</b>	= <string>	N		Zone Title. This may be any text string up to 128 characters in length. If you supply a longer text string, it is automatically truncated to the first 128 characters. The titles of zones appear in the <b>Zone Style</b> and other dialogs, and, optionally, in the XY- plot legend.
<b>ZONETYPE</b>	= <zonetype>	N	ORDERED	The zone data are of the type specified by the ZONETYPE parameter in the control line. There are two basic types of zones: ordered and finite element. ORDERED is presumed if the ZONETYPE parameter is omitted. See <a href="#">Section 4 - 4 "Ordered Data"</a> for more information on ordered zones, and <a href="#">Section 4 - 5 "Finite Element Data"</a> for details on finite element data.  When specifying your ZoneType, please note that Tecplot Focus cannot read FEPOLYGON or FEPOLYHEDRON zones.
<b>I</b>	= <integer>	Y		Specify the maximum number of points in the I- J- or K- direction. Use only when <a href="#">ZONETYPE</a> is ORDERED.
<b>J</b>	= <integer>	Y		
<b>K</b>	= <integer>	Y		
<b>NODES</b>	= <integer>	Y		Use for finite element zone types only (that is, not ordered zones). Specify the total number of NODES and ELEMENTS in the data file. Refer to <a href="#">Section 4 - 5 "Finite Element Data"</a> for additional information.
<b>ELEMENTS</b>	= <integer>	Y		
<b>FACES</b>	= <integer>	Y (for face-based finite element zones)		Use for face-based finite element zones types (polygonal and polyhedral) only. Specify the number of FACES in the data file. See <a href="#">Section 4 - 5 "Finite Element Data"</a> for more information.
<b>TOTALNUMFACENODES</b>	= <integer>	Y (for polyhedral zones)		For face-based finite element zones only. Total number of nodes in the <a href="#">Facemap Data</a> section for all faces. This is optional for polygons as TotalNumFaceNodes = 2*NumFaces.
<b>NUMCONNECTEDBOUNDARYFACES</b>	= <integer>	Y		For face-based finite element zones only. Total number of boundary faces listed in the <a href="#">Facemap Data</a> section. Set to zero if boundary faces aren't used.
<b>TOTALNUMBERBOUNDARYCONNECTIONS</b>	= <integer>	Y		For face-based finite element zones only. Total number of entries for boundary items listed in the <a href="#">Facemap Data</a> section. Set to zero if boundary faces aren't used.
<b>FACENEIGHBORMODE</b>	= [LOCALONETOONE,  LOCALONETOMANY,  GLOBALONETOONE,  GLOBALONETOMANY]	N	LOCALONETOONE	For ordered or cell-based finite element zones only. Used to indicate whether the neighboring faces are within the current zone or in another zone (i.e. local or global), as well as whether the connections are one-to-one or one-to-many. When this token is used, both the <a href="#">FACENEIGHBORCONNECTIONS</a> token and the FaceNeighbor Connections List are required. Refer to <a href="#">Section "Face Neighbor Connections List"</a> on page 120 for details.
<b>FACENEIGHBORCONNECTIONS</b>	= <integer>	Y, if <a href="#">FACENEIGHBORMODE</a> is in use.		For ordered or cell-based finite element zones only. Used to indicate the total number of connections for all elements in the zone. For example, if you have two cells with three connections each, the number of face neighbor connections is equal to six. When this token is used, both the <a href="#">FACENEIGHBORMODE</a> token and the FaceNeighbor Connections List are required. Refer to <a href="#">Section "Face Neighbor Connections List"</a> on page 120 for details.

Keyword	Syntax	Required (Y/N)	Default	Notes
DT	= ( <a href="#">&lt;datatype&gt;</a> for var1, <a href="#">&lt;datatype&gt;</a> for var2, ..., <a href="#">&lt;datatype&gt;</a> for varn)	N	SINGLE	Each variable in each zone in the data file may have its own data type. The data type determines the amount of storage Tecplot 360 assigns to each variable. Therefore, the lowest level data type should be used whenever possible. For example, imaging data, which usually consists of numerical values ranging from zero to 255, should be given a data type of BYTE. By default, Tecplot 360 treats numeric data as data type SINGLE. If any variable in the zone uses the BIT data type, the <a href="#">DATA PACKING</a> must be BLOCK. Refer to <a href="#">"Data"</a> on page 117 for details.
DATA PACKING	= <a href="#">&lt;datapacking&gt;</a>	N	BLOCK	In POINT format, the values for all variables are given for the first point, then the second point, and so on. In BLOCK format, all of the values for the first variable are given in a block, then all of the values for the second variable, then all of the values for the third, and so forth. BLOCK format must be used for cell-centered data and polyhedral zones (FEPOLYGON/ FEPOLYHEDRAL), as well as for all binary data.
VAR LOCATION	=( <a href="#">[set-of-vars]</a> <a href="#">=&lt;varlocation&gt;</a> <a href="#">[set-of-vars]</a> <a href="#">=&lt;varlocation&gt;</a> , ...)	N	NODAL	Each variable in each zone in a data file may be located at the nodes or the cell-centers. Each variable is specified as NODAL or CELLCENTERED in the VARLOCATION parameter array. All cell-centered variables must list one value for each element. With nodal variables, one value must be listed for each node. Zones with cell-centered variables must be in BLOCK data packing format.
VAR SHARELIST	=( <a href="#">[set-of-vars]</a> <a href="#">=&lt;zone&gt;</a> , <a href="#">[set-of-</a> <a href="#">vars]</a> <a href="#">=&lt;zone&gt;</a> )	N	If zone number is omitted, the variables are shared from the previous zone.	Used for variables that are exactly the same for a set of zones. Specify the integer value of the source zone. Ordered zones may only share with ordered zones having the same dimensions. Finite element zones may share with any zone having the same number of nodes, for nodal variables, or the same number of cells, for cell-centered data.
NV	= <a href="#">&lt;integer&gt;</a>	N		Specifies the variable number of the variable representing the "Node" value in finite element data. The NV parameter is used infrequently. It is mostly used when the order in which nodes are listed in the data file does not match the node numbering desired in the plot. Refer to <a href="#">Section "Finite Element Zone Node Variable Parameters Example"</a> on page 143 for an example using the NV parameter.
CONNECTIVI TYSHAREZON E	= <a href="#">&lt;zone&gt;</a>	N		Specify the number of the zone from which the connectivity is shared. The connectivity list (cell-based finite element only) and face-neighbors may be shared between zones using the CONNECTIVITYSHAREZONE parameter in the control line of the current zone. Alternatively, the parameter may be used to share the <a href="#">Facemap Data</a> for face-based finite element zones. To use connectivity sharing, the zone must have the same number of points and elements (and faces, if the zone is face-based), and be the same zone type.
STRANDID	= <a href="#">&lt;integer&gt;</a>	N		Each zone can optionally specify an integer value associating itself with a particular strand. More than one zone can associate itself with a particular strand and differentiate itself from other zones by assigning different <a href="#">SOLUTIONTIME</a> values. StrandID's must be positive integer values greater than or equal to 1. By convention strandID's are successive integer values.
SOLUTIONTI ME	= <a href="#">&lt;double&gt;</a>	N		Specify a floating point time value representing the solution time. Zones can be organized together by associating themselves to the same <a href="#">STRANDID</a> .

Keyword	Syntax	Required (Y/N)	Default	Notes
PARENTZONE	= <zone>	N		Scalar integer value representing the relationship between this zone and its parent. A value of zero indicates that this zone is not associated with a parent zone. A value greater than zero is considered this zone's parent. A zone may not specify itself as its own parent. With a parent zone association, Tecplot 360 can generate a surface streamtrace on a no-slip boundary zone. Refer to <a href="#">Section 15 - 2 "Surface Streamtraces on No-slip Boundaries"</a> in the <a href="#">User's Manual</a> for additional information.
PASSIVEVAR LIST	= [set of vars]	N	All variables non-passive	Use this option to make variables passive. For example, to make variables 4, 5, and 20 passive, use this syntax: PASSIVEVARLIST=[4-5,20] See <a href="#">Section 1 - 3 "Best Practices"</a> , <a href="#">Section 7. "Passive Variables"</a> for information on passive variables.
AUXDATA	NAME = <string>	N		Auxiliary data strings associated with the current zone are specified with the AUXDATA parameter in the control line. This auxiliary data may be used in dynamic text, equations, macros, or add-ons. There may be multiple AUXDATA parameters in the control line for a zone, but names must be unique. NOTE: The NAME portion of the string cannot contain spaces. Auxiliary data is provided as named strings: AUXDATA EXPERIMENTDATE ="October 13, 2007, 8 A.M."

## Data

Tecplot 360 supports the following six data types:

- DOUBLE (eight-byte floating point values).
- SINGLE (four-byte floating point values).
- LONGINT (four-byte integer values).
- SHORTINT (two-byte integer values).
- BYTE (one-byte integer values, from zero to 255).
- BIT

The arrangement of ASCII data depends upon the combination of datapacking (BLOCK or POINT), variable location (NODAL or CELL-CENTERED). The zone type also plays a role in that not all forms of datapacking and variable locations are supported by all zone types. In BLOCK data, the data is arranged by variable, while in POINT data the data is arranged by point (node or data point, depending upon the zone type). In NODAL data the variable values are defined at every node (FE data) or point (ORDERED data). In CELLCENTERED data, the variable values are defined at the center of every cell (ORDERED data) or element (FE data).

The available combinations of datapacking and variable location parameters are:

- Block - Nodal
- Block - Cell-centered
- Point - Nodal

The combination of POINT and CELLCENTERED is not available.

## BLOCK - NODAL

In block data with nodal values, the data is arranged by variable and each variable is defined at the nodes. The data arrangement is as follows:

```

A11      A12      ...   A1P
A21      A22      ...   A2P
.
```



- To repeat a particular number in the data, precede it with a repetition number as follows:  
*"Rep\*Num,"* where *Rep* is the repetition factor and *Num* is some numeric value to be repeated.  
 For example, you may represent 37 values of 120.5 followed by 100 values of 0.0 as follows:  
 37\*120.5, 100\*0.0

## Variable Sharing

Frequently, some variables are exactly the same for a set of zones. For example, a series of zones may contain measurement or simulation data at the same XYZ-locations, but different times. In this case, Tecplot 360's memory usage may be dramatically reduced by sharing the coordinate variables between the zones. The zones that variables are shared from are specified in the VARSHARELIST in the control line of the current zone. The format is:

```
VARSHARELIST=([set-of-vars]=zzz, [set-of-vars]=zzz)
```

where *set-of-vars* is the set of variables that are shared and *zzz* is the zone they are shared from. If *zzz* is omitted, the variables are shared from the previous zone.

For example:

```
VARSHARELIST=([4-6,11]=3, [20-23]=1, [13,15])
```

specifies that variables four, five, six and 11 are shared from zone three, variables 20, 21, 22, and 23 are shared from zone one, and variables 13 and 15 are shared from the previous zone. For variable sharing, ordered zones may only share with ordered zones having the same dimensions. Finite element zones may share with any zone having the same number of nodes (for nodal variables) or the same number of cells (for cell-centered data).

## Zone Footer

The contents required for the Zone Footer depend upon the [ZONETYPE](#) (specified in the [Zone Header](#)).

- **Ordered zones** - the Zone Footer contains the [Face Neighbor Connections List](#) (if any).
- **Cell-based finite element zones** (FETRIANGLE, FEQUADILATERAL, FETETRAHEDRAL and FEBRICK) - the Zone Footer contains [Connectivity](#) information, followed by [Face Neighbor Connections List](#) (if any).
- **Face-based finite element zones** (FEPOLYHEDRAL, FEPOLYGON) - the Zone Footer contains [Facemap Data](#), followed by [Boundary Map Data](#).



Remember that Tecplot Focus cannot load face-based (polygonal or polyhedral) data.

## Connectivity

For cell-based finite element zones (FETRIANGLE, FEQUADILATERAL, FETETRAHEDRAL, and FEBRICK), the nodal data is followed by the connectivity information. The connectivity list is not preceded by a token or keyword. It is simply a list of numbers.

The connectivity list details the node numbers of all of the nodes included in each element. When providing the connectivity list, please keep in mind the following guidelines:

- Each row in the connectivity list corresponds to an element, where the first row corresponds to the first element, and so forth.
- The node numbers must be provided in order, either clockwise or counter-clockwise.

- You must provide the same number of nodes as are included in an element. For example, you must provide eight numbers for BRICK elements and three numbers for TRIANGLE elements. If you are using repeated nodes, provide the node number of the repeated node multiple times.

See also: [“Connectivity Sharing”](#) on page 123.

The connectivity for face-based zones (FEPOLYGON and FEPOLYHEDRAL) is defined by the [Facemap Data](#) (refer to [“Facemap Data”](#) on page 121 for details).



Remember that Tecplot Focus cannot load face-based (polygonal or polyhedral) data.

## Face Neighbor Connections List

For ordered zones, the data section may be followed with face neighbor connections. For cell-based finite element zones, the data section and connectivity list may be followed by the face neighbor connection information.

Use face neighbors to specify connections between zones (global connections) or connections within zones (local connections). Face neighbor connections are used by Tecplot when deriving variables or drawing contour lines. Specifying face neighbors, typically leads to smoother connections. NOTE: face neighbors have expensive performance implications. Use face neighbors to manually specify connections that are not defined via the connectivity list.

Face neighbor connections are defined by the [FACENEIGHBORMODE](#) and [FACENEIGHBORCONNECTIONS](#) tokens along with the Face Neighbor Connections list. The FACENEIGHBORMODE token is used to specify the type of face neighbor connection used. The FACENEIGHBORCONNECTIONS token is used to define the total number of face neighbor connections included in the zone.

The nature of the data arranged in the Face Neighbor Connections list depends upon the FACENEIGHBORMODE, described in the table below. To connect the cells along one edge to cells on another edge of the same zone, use LOCAL. To connect cells of one zone to cells of another zone or zones, use GLOBAL. If the points of the cells are exactly aligned with the neighboring cell points, use ONETOONE. If even one cell face is neighbor to two or more other cell faces, use ONETOMANY.

Mode	Number of Values	Order of Data in the Face Neighbor Connections List
LOCALONETOONE	3	<i>cz, fz, nc</i>
LOCALONETOMANY	$nz+4$	<i>cz, fz, oz, nz, nc1, nc2, ..., ncn</i>
GLOBALONETOONE	4	<i>cz, fz, zr, cr</i>
GLOBALONETOMANY	$2*nz+4$	<i>cz, fz, oz, nz, zrl, crl, zr2, cr2, ..., zrn, crn</i>

In this table,

- *cz* -the cell number in the current zone
- *fz* - the number of the cell face in the current zone
- *nc* -the cell number of the neighbor cell in the current zone
- *oz* - face obscuration flag (zero for face partially obscured, one for face entirely obscured)
- *nz* - the number of neighboring cells for the ONETOMANY options
- *ncn* - the number of the *n*<sup>th</sup> local zone neighboring cell in the list



- *zr* - the remote zone number
- *cr* - the cell number of the neighboring cell in the remote zone
- *zrn* - the zone number of the *n*th neighboring cell in the GLOBALNETOMANY list
- *crn* - the cell number in the remote zone of the *n*th neighboring cell in the GLOBALNETOMANY list.

The *cz*, *fz* combinations must be unique; multiple entries are not allowed. The face numbers for cells in the various zone types are defined in [Figure 4-1](#).

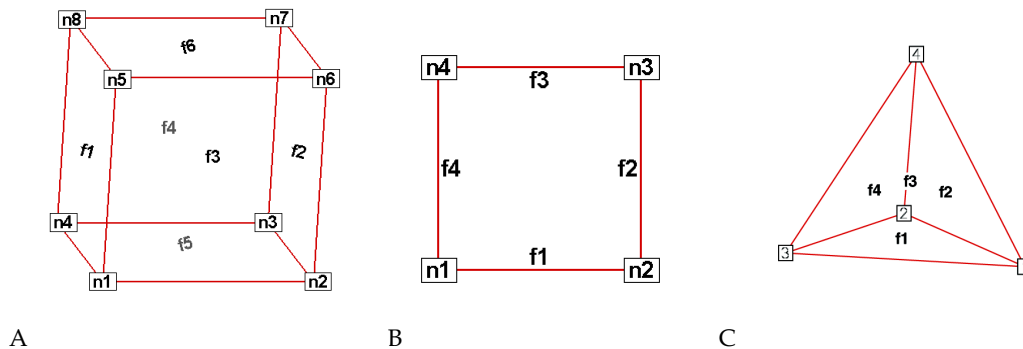


Figure 4-1. **A:** Example of node and face neighbors for an FE-brick cell or IJK-ordered cell. **B:** Example of node and face numbering for an IJ-ordered/ FE-quadrilateral cell. **C:** Example of tetrahedron face neighbors.

A connection must be specified for two matching cell faces to be effective. The nature of the Face Neighbor Connections list depends upon its FACENEIGHBORMODE.

For example, for data with a FACENEIGHBORMODE of GLOBALNETOONE, if cell six, face two in zone nine should be connected to cell one, face four in zone 10, the connections for zone nine must include the line:

```
6 2 10 1 (cell#, face#, connecting zone#, connecting cell#)
```

And the connections for zone 10 must include this line:

```
1 4 9 6 (cell#, face#, connecting zone#, connecting cell#)
```

Global face neighbors are useful for telling Tecplot 360 about the connections between zones. This could be used, for example, to smooth out the crease in Gouraud surface shading at zone boundaries. For cell-centered data, they can make contours and streamtraces more continuous at zone boundaries.

## Facemap Data

For face-based finite element zones (FEPOLYGON and FEPOLYHEDRAL), the data section is followed by the Facemap Data section. If boundary faces are used, the Facemap Data section is followed by the [Boundary Map Data](#) data section. Otherwise, the facemap data section marks the end of the zone record.



Remember that Tecplot Focus cannot load face-based (polygonal or polyhedral) data.

The face map data (in four major groupings) is defined by the following list:



Like the Data section of the zone record, the data region of the Face Map section does not include tokens. It includes a list of data. The descriptors TotalNodesInFace, WhichNodesInFace, LeftNeighborForFace and RightNeighborForFace should not be included in your data file.

1. **TotalNodesInFace** - A space-separated list of the total number of nodes in each face:

*NodesInFace<sub>1</sub> NodesInFace<sub>2</sub> ...NodesInFace<sub>F</sub>*

where F is equal to the total number of faces.

NOTE: The TotalNodesInFace section is not used for polygonal zones, as each face of a polygon always has two nodes.

2. **WhichNodesInFace** - A list of the node numbers for each node in each face. Use a separate line for each face.

*Face<sub>1</sub>Node<sub>1</sub> Face<sub>1</sub>Node<sub>2</sub> ...Face<sub>1</sub>Node<sub>TotalNodesInFace1</sub>*

*Face<sub>2</sub>Node<sub>1</sub> Face<sub>2</sub>Node<sub>2</sub> ...Face<sub>2</sub>Node<sub>TotalNodesInFace2</sub>*

...

*Face<sub>F</sub>Node<sub>1</sub> Face<sub>2</sub>Node<sub>2</sub> ...Face<sub>2</sub>Node<sub>TotalNodesInFaceF</sub>*

3. **LeftNeighborForFace** - A list of left neighboring elements for each face:

*LeftElementForFace<sub>1</sub> LeftElementForFace<sub>2</sub> ... LeftElementForFace<sub>F</sub>*

4. **RightNeighborForFace** -A list of right neighboring elements for each face:

*RightElementForFace<sub>1</sub> RightElementForFace<sub>2</sub> ... RightElementForFace<sub>F</sub>*



The face map may be shared between zones in the same file by specifying the zone number of the sharing zone in place of the [CONNECTIVITYSHAREZONE](#) value.

## Defining Neighboring Elements

The left element and right element are determined by the left-hand versus right-hand winding rule. The left and right neighboring elements represent elements within the current zone, and they are always "one-to-one". That is, each face represents a complete interface between two elements. A negative value (-t) in either of the neighboring faces lists indicates that the neighboring element(s) are defined in the boundary face section at the t<sup>th</sup> boundary face. Refer to [Section "Boundary Map Data"](#) for details.

Any face that has no neighboring element for either its right or left adjacent element, will use a value of zero for the element value.

See also ["Connectivity Sharing"](#) on page 123.

## Boundary Map Data

If the [NUMCONNECTEDBOUNDARYFACES](#) is greater than zero, the boundary map data section is required. The boundary map data section should immediately follow the [Facemap Data](#) section. This section does not need to be "one-to-one". One face can link up to multiple elements in other zones.

The boundary map data section need only be used for global or one-to-many connections. Local, one-to-one connections should be defined as left/right elements.

The number of adjacent elements is listed for each of the boundary faces. Then each boundary face lists the element number for each of its adjacent elements. Then each boundary face lists the zone number for each of its adjacent elements (0 can be used to refer to the current zone). The number of the face is not specified but is implicit (first face listed is 1 and corresponds to -1 in the left/right neighbor list, the second is 2 and corresponds to -2, etc.).

## Connectivity Sharing

The connectivity list and face neighbor connections (for cell-based finite element zones) or the facemap data (for face-based finite element zones) may be shared between zones by using the CONNECTIVITYSHAREZONE parameter in the control line of the current zone. The format is:

CONNECTIVITYSHAREZONE=*nnn*

where *nnn* is the number of the zone that the connectivity is shared from. To use connectivity sharing, the zone must have the same number of points and elements, and be the same zone type.

## 4 - 3.3 Text Record

Text records are used to import text directly from a data file. Text can also be imported into Tecplot 360 using a macro file. You may create data files containing only text records and read them into Tecplot 360 just as you would read any other data file. You may delete and edit text originating from data files just like text created interactively.

The text record consists of a single control line. The control line starts with the keyword TEXT and has one or more options:

### Text Record:

Token	Syntax	Required (Y/N)	Default	Notes
TEXT		Y		Keyword required to start a text record
T	= <string>	Y		The text string is defined in the required T (text) parameter. To include multiple lines of text in a single text record, include \\n in the text string to indicate a new line.
ZN	= <integer>	N		Use the ZN (zone) parameter to attach text to a specific zone or XY mapping. For further information, see <a href="#">Section 18 - 1.3 "Text Box"</a> in the <a href="#">User's Manual</a> .
X	= <double>	Y		Specify the x-origin, y-origin and z-origin of the object. The x-origin and y-origin should be in <a href="#">CS</a> (coordinatesys) units. The z-origin of object must always in GRID units.
Y	= <double>	Y		
Z	= <double>	Y		
R	= <double>	Y		r-origin (in <a href="#">CS</a> units) of the object
THETA	= <double>	Y		theta-origin (in <a href="#">CS</a> units) of the object
CS	= <coordinatesys>	N	FRAME	Text coordinate system. If you specify the frame coordinate system, the values of the <a href="#">X</a> (xorigin) and <a href="#">Y</a> (yorigin) parameters are in frame units; if you specify grid coordinates, <a href="#">X</a> and <a href="#">Y</a> are in grid units (that is, units of the physical coordinate system). Specify <a href="#">X</a> , <a href="#">Y</a> and <a href="#">Z</a> for GRID3D coordinates. For Polar Line plots, you may specify <a href="#">THETA</a> and <a href="#">R</a> instead of <a href="#">X</a> and <a href="#">Y</a> .
A	= <double>	N		Use the A parameter to rotate the text box at an angle counter-clockwise from horizontal. The angle is in units of degrees.

Token	Syntax	Required (Y/N)	Default	Notes
<b>S</b>	= <a href="#">&lt;scope&gt;</a>	N		Scope of the text box. <b>GLOBAL</b> scope attaches the text box to all frames using the same data set. It is the same as selecting the check box <i>Show in "Like" Frames</i> in the <b>Text Options</b> dialog.
<b>BX</b>	= <a href="#">&lt;boxtype&gt;</a>	N	NOBOX	Draw a box around the text string using the <b>BX</b> (boxtype) parameter. The parameters <b>BXO</b> (boxoutlinecolor), <b>BXM</b> (boxmargin), and <b>LT</b> (linethickness) are used if the boxtype is <b>HOLLOW</b> or <b>FILLED</b> . The parameter <b>BXF</b> (boxfillcolor) is used only if the boxtype is <b>FILLED</b> . The default boxtype, <b>NOBOX</b> , ignores all other box parameters.
<b>BXF</b>	= <a href="#">&lt;color&gt;</a>	N		Box Fill Color; <b>BX</b> (boxtype) must be set to <b>FILLED</b> .
<b>BXM</b>	= <a href="#">&lt;double&gt;</a>	N		When <b>BX</b> (boxtype) is set to <b>HOLLOW</b> or <b>FILLED</b> , use the <b>BXM</b> token to specify the margin around text in box as fraction of <b>H</b> (text height).
<b>BXO</b>	= <a href="#">&lt;color&gt;</a>	N		When <b>BX</b> (boxtype) is set to <b>HOLLOW</b> or <b>FILLED</b> , use the <b>BXO</b> token to specify the color of the box outline.
<b>LT</b>	= <a href="#">&lt;double&gt;</a>			When <b>BX</b> (boxtype) is set to <b>HOLLOW</b> or <b>FILLED</b> , use the <b>LT</b> token to specify the thickness of the box outline.
<b>F</b>	= <a href="#">&lt;font&gt;</a>	N		Use the <b>F</b> parameter to specify the font family.
<b>C</b>	= <a href="#">&lt;color&gt;</a>	N		Font color.
<b>AN</b>	= <a href="#">&lt;textanchor&gt;</a>			Use the <b>AN</b> (textanchor) parameter to specify the position of the anchor point relative to the text. There are nine possible anchor positions, as shown in <a href="#">Figure 4-2</a> .
<b>LS</b>	= <a href="#">&lt;double&gt;</a>	N	1	Assign the line spacing for multi-line text using the <b>LS</b> (linespacing) parameter. The default value, 1, gives single-spacing. Use 1.5 for line-and-a-half spacing, 2 for double-spacing, and so on.
<b>H</b>	= <a href="#">&lt;double&gt;</a>			Specify the height, measured in the units defined by <b>HU</b> .
<b>HU</b>	= <a href="#">&lt;heightunits&gt;</a>			Units for character heights. If the <b>CS</b> parameter is <b>FRAME</b> , you can set <b>HU</b> to either <b>FRAME</b> or <b>POINT</b> . If the <b>CS</b> parameter is <b>GRID</b> , you can set <b>HU</b> to either <b>GRID</b> or <b>FRAME</b> .
<b>MFC</b>	= <a href="#">&lt;string&gt;</a>			Attach a macro function to the text. The macro function must be a retained macro function that was either set during the current Tecplot session or included in the <i>tecplot.mcr</i> file. Refer to <a href="#">Section 18-3 "Linking Text and Geometries to Macros"</a> in the <i>User's Manual</i> and <a href="#">"\$!MACROFUNCTION...\$!ENDMACROFUNCTION"</a> in the <i>Scripting Guide</i> for additional information.
<b>CLIPPIN G</b>	= <a href="#">&lt;clipping&gt;</a>			Plot the geometry within to the viewport or the frame.

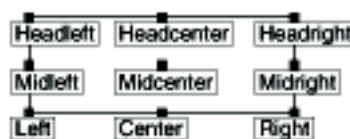


Figure 4-2. Text anchor positions—values for the [AN](#) parameter.

## Text Record Examples

Some simple examples of text records are shown below. The first text record specifies only the origin and the text. The next text record specifies the origin, color, font, and the text. The third text record specifies the origin, height, box attributes, and text. Note that the control line for the text can span multiple file lines if necessary (as in the third text record below). The last text record is an example of using 3D text in Tecplot 360.

```

TEXT X=50, Y=50, T="Example Text"
TEXT X=10, Y=10, F=TIMES-BOLD, C=BLUE, T="Blue Text"
TEXT X=25, Y=90, CS=FRAME, HU=POINT, H=14,

```

```
BX=FILLED, BXF=YELLOW, BXO=BLACK, LS=1.5,  
T="Box Text \\n Multi-lined text"  
TEXT CS=GRID3D, X=0.23,Y=0.23,Z=0.5, T="Well 1"
```

## 4 - 3.4 Geometry Record

Geometry records are used to import geometries from a data file. Geometries are line drawings that may be boundaries, arrows, or even representations of physical structures. You may create data files containing only geometry and text records and read them into Tecplot 360. You may delete and edit geometries originating from data files just like the geometries that you create interactively.

The geometry record control line begins with the keyword GEOMETRY.

## Geometry Record Contents

Token	Available Values	Notes
GEOMETRY		Keyword required to start a geometry record
T	= <a href="#">&lt;geomtype&gt;</a>	Geometry type
F	= <a href="#">&lt;datapacking&gt;</a>	Geometry data format
DT	= <a href="#">&lt;datatype&gt;</a>	Data type
ZN	= <a href="#">&lt;integer&gt;</a>	Attach text to a specific zone or XY mapping. For further information, see <a href="#">Section 18 - 1.3 "Text Box"</a> in the <a href="#">User's Manual</a> .
X	= <a href="#">&lt;double&gt;</a>	Specify the x-origin, y-origin and z-origin of the object. The x-origin and y-origin should be in <a href="#">CS</a> (coordinatesys) units. The z-origin of object is for LINE3D geometries only and must always in GRID units. Refer to <a href="#">"Origin positions"</a> for additional information regarding the origin location for each type of geometry.
Y	= <a href="#">&lt;double&gt;</a>	
Z	= <a href="#">&lt;double&gt;</a>	
R	= <a href="#">&lt;double&gt;</a>	Specify the r-origin and theta-origin of the object. The origins should be in <a href="#">CS</a> units. Refer to <a href="#">Section "Origin positions"</a> on page 127 for additional information.
THETA	= <a href="#">&lt;double&gt;</a>	
CS	= <a href="#">&lt;coordinatesys&gt;</a>	Geometry coordinate system . If you specify the frame coordinate system, the values of the <a href="#">X</a> (xorigin) and <a href="#">Y</a> (yorigin) parameters are in frame units; if you specify grid coordinates, <a href="#">X</a> and <a href="#">Y</a> are in grid units (that is, units of the physical coordinate system). Specify <a href="#">X</a> , <a href="#">Y</a> and <a href="#">Z</a> for GRID3D coordinates. For Polar Line plots, you may specify <a href="#">THETA</a> and <a href="#">R</a> instead of X and Y.
DRAWORDER	= <a href="#">&lt;draworder&gt;</a>	Draw order.
S	= <a href="#">&lt;scope&gt;</a>	The <a href="#">S</a> ( <i>scope</i> ) parameter specifies the text scope. GLOBAL scope attaches the text box to all frames using the same data set. It is the same as selecting the check box <i>Show in "Like" Frames</i> in the Geometry Options dialog.
C	= <a href="#">&lt;color&gt;</a>	Geometry outline color.
L	= <a href="#">&lt;linetype&gt;</a>	Line type
PL	= <a href="#">&lt;double&gt;</a>	Pattern length (in frame units).
LT	= <a href="#">&lt;double&gt;</a>	Line thickness (in frame units)
EP	= <a href="#">&lt;integer&gt;</a>	Number of points used to approximate circles or ellipses
FC	= <a href="#">&lt;color&gt;</a>	Fill Color. Any geometry type except LINE3D may be filled with a color by using the FC (fillcolor) parameter. Each polyline of a LINE geometry is filled individually (by connecting the last point of the polyline with the first). Not specifying the FC (fillcolor) parameter results in a hollow, or outlined, geometry drawn in the color of the C (color) parameter.
AST	= <a href="#">&lt;arrowheadstyle&gt;</a>	Arrowhead style
AAT	= <a href="#">N&lt;arrowheadattach&gt;</a>	Arrowhead attachment along the line geometry
ASZ	= <a href="#">&lt;double&gt;</a>	Size of arrowhead in frame units
AAN	= <a href="#">&lt;double&gt;</a>	Angle of arrowhead in degrees
MFC	= <a href="#">&lt;string&gt;</a>	You may attach a macro function to the text with the MFC parameter. The macro function must be a retained macro function that was either set during the current Tecplot session or included in the <i>tecplot.mcr</i> file. Refer to <a href="#">Section 18 - 3 "Linking Text and Geometries to Macros"</a> in the <a href="#">User's Manual</a> and <a href="#">"\$!MACROFUNCTION...\$!ENDMACROFUNCTION"</a> on page 157 in the <a href="#">Scripting Guide</a> for additional information.
CLIPPING	= <a href="#">&lt;clipping&gt;</a>	plot the geometry within the viewport or the frame.

## Data for Geometry Record

The control line of the geometry is followed by geometry data. For SQUARE, the geometry data consists of just one number: the side length of the square.

For RECTANGLE, the geometry data consists of two numbers: the first is the width (horizontal axis dimension), and the second is the height (vertical axis dimension).

For CIRCLE, the geometry data is one number: the radius. For ELLIPSE, the geometry data consists of two numbers: the first is the horizontal axis length and the second is the vertical axis length. For both circles and ellipses, you can use the EP (*numellipsepts*) parameter to specify the number of points used to draw circles and ellipses. All computer-generated curves are simply collections of very short line segments; the EP parameter allows you to control how many line segments Tecplot 360 uses to approximate circles and ellipses. The default is 72.

For LINE and LINE3D geometries, the geometry data is controlled by the F (*format*) parameter. These geometries may be specified in either POINT or BLOCK format. By default, POINT format is assumed. Each geometry is specified by the total number of polylines, up to a maximum of 50 polylines, where each polyline can have up to 32,000 points. Each polyline is defined by a number of points and a series of XY- or XYZ- coordinate points between which the line segments are drawn. In POINT format, the XY- or XYZ- coordinates are given together for each point. In BLOCK format, all the X-values are listed, then all the Y-values, and (for LINE3D geometries) all the Z-values. All coordinates are relative to the X, Y, and Z specified on the control line. You can specify points in either single or double precision by setting the DT (*datatype*) parameter to either SINGLE or DOUBLE.

## Origin positions

Geometry types are selected with the T (*geomtype*) parameter. The available geometry types are listed below:

- SQUARE - A square with lower left corner at X, Y.
- RECTANGLE - A rectangle with lower left corner at X, Y.
- CIRCLE - A circle centered at X, Y.
- ELLIPSE - An ellipse centered at X, Y.
- LINE - A set of 2D polylines (referred to as multi-polylines) anchored at X, Y.
- LINE3D - A set of 3D polylines (referred to as multi-polylines) anchored at X, Y, Z.

## Geometry Record Examples

- **Rectangle** - The following geometry record defines a rectangle of 40 width and 30 height:

```
GEOMETRY T=RECTANGLE
40 30 #WIDTH HEIGHT
```

- **Circle** - The following geometry record defines an origin and a red circle of 20 radius, with an origin of (75, 75) that is filled with blue:

```
GEOMETRY X=75, Y=75, T=CIRCLE, C=RED, FC=BLUE,CS=FRAME
20 #RADIUS
```

- **Polyline** - The following geometry record defines an origin and two polylines, drawn using the Custom 3 color. The first polyline is composed of three points, the second of two points.

```
GEOMETRY X=50, Y=50, T=LINE, C=CUST3
2 #Number of polylines
3 #Number of points in polyline 1
0 1 #X, Y coordinates of the point 1 in polyline 1
0 0 #X, Y coordinates of the point 2 in polyline 1
2 0 #X, Y coordinates of the point 3 in polyline 1
2 #Number of points in polyline 2
0 0 #X, Y coordinates of the point 1 in polyline 2
1 2 #X, Y coordinates of the point 2 in polyline 2
```

In BLOCK format, the same geometry appears as:

```
GEOMETRY X=50, Y=50, T=LINE, C=CUST3, F=BLOCK, CS=FRAME
2 #Number of polylines
3 #Number of points in polyline 1
0 0 2 #X position of each point in polyline 1
1 0 0 #Y position of each point in polyline 1
2 #Number of points in polyline 2
0 1 #X position of each point in polyline 2
0 2 #Y position of each point in polyline 2
```

- **Ellipse** - The next geometry record defines a purple ellipse with a horizontal axis length of 20 and a vertical axis length of 10, with an origin of (10, 70), that is filled with yellow.

```
GEOMETRY X=10, Y=70, T=ELLIPSE, C=PURPLE, FC=YELLOW
20 10 #Horizontal Axis, Vertical Axis
```

- **3D polyline** - The final geometry record is a 3D polyline with four points that is composed of one polyline using the default origin of (0, 0, 0):

```

GEOMETRY T=LINE3D
1          #Number of polylines
4          #Number of points in polyline 1
0 0 0      #X, Y, Z coordinates of point 1
1 2 2      .
3 2 3      .
4 1 2      #X, Y, Z coordinates of point 4

```

In BLOCK format, this geometry record can be written as follows:

```

GEOMETRY T=LINE3D, F=BLOCK
1          #Number of polylines
4          #Number of points in polyline 1
0 1 3 4    #X position for each point in the polyline
0 2 2 1    #Y position for each point in the polyline
0 2 3 2    #Z position for each point in the polyline

```

## 4 - 3.5 Custom Labels Record

The custom label record is an optional record used to provide custom labels for axes, the contour legend or value labels. A single custom label record begins with the keyword **CUSTOMLABELS**, followed by a series of text strings. The first custom label string corresponds to a value of one on the axis, the next to a value of two, and so forth.

You may have up to ten custom label records in a data file. The custom label set to use is specified via the Tecplot interface. Refer to [Section 17 - 8 "Axis Title Options"](#) in the [User's Manual](#) for details.

A simple example of a custom-label record is shown below. **MON** corresponds to a value of 1, **TUE** corresponds to 2, **WED** to 3, **THU** to 4, and **FRI** to 5. Since custom labels have a wrap-around effect, **MON** also corresponds to the values 6, 11, and so forth.

```
CUSTOMLABELS "MON", "TUE", "WED", "THU", "FRI"
```

You may include `\n` in a custom label to indicate that the following text should start a new line. For example, "Jan\n2012" appears in Tecplot 360 as:

```

Jan
2012

```



You must include a data set in order to use custom labels. You cannot use custom labels in files that contain only text and/or geometries.

## 4 - 3.6 Data Set Auxiliary Data Record

There is frequently auxiliary data (or Metadata) that helps describe the data set. For example, experimental data may have information about the facility and time at which the data was taken, and other parameters that describe the experiment. Likewise, simulation results have auxiliary data (such as reference quantities for non-dimensional data) needed to fully analyze and present the results.

Auxiliary data are name/value pairs that a user can specify and then use in Tecplot 360 with dynamic text, equations, macros, or add-ons. This data may be with respect to the data set as a whole or it can vary from zone to zone. The ASCII file format token for specifying auxiliary data associated with the entire data set is **DATASETAUXDATA**, described here. Auxiliary data for a given variable is defined by **VARAUXDATA**, described in [Section 4 - 3.7 "Variable Auxiliary Data Record"](#). Auxiliary data for a given zone is defined by the **AUXDATA** token within the zone record (refer to ["Zone Header"](#) on page 115 for details).

The data set auxiliary data control line is as follows:

```
DATASETAUXDATA name = "value"
```

where name is a unique character string with no spaces. You may have multiple **DATASETAUXDATA** records. However, the value of name must be unique for each record.



Auxiliary data may be used in text, macros, equations (if it is numeric), and accessed from add-ons. It may also be viewed directly in the *AuxData* page of the **Data Set Information** dialog.

### Data Set Auxiliary Data Examples

The following auxiliary data contain flow field information that might be found in output from a computational fluid-dynamics simulation.

```
DATASETAUXDATA MachNo = "1.2"
DATASETAUXDATA Alpha = "5"
DATASETAUXDATA RefTemperature = "250"
DATASETAUXDATA RefPressure = "101325"
DATASETAUXDATA Configuration = "A2 No. 3"
DATASETAUXDATA Date = "August 5, 2003"
DATASETAUXDATA Region = "NE Quadrant of Sector 47"
```

You may then use the numerical values in equations to modify the variables as follows:

```
{P} = {P_non_dim} * AuxDataSet:RefPressure
```

Similar principles apply when using auxiliary data in text boxes or labels.

### 4 - 3.7 Variable Auxiliary Data Record

Variable auxiliary data is added to Tecplot 360 on a per variable basis. Like data set auxiliary data, multiple items can be added for each variable:

```
VARAUXDATA 1 MyData="Hello"
VARAUXDATA 1 MoreData="World"
VARAUXDATA 2 MyData="More information"
VARAUXDATA 2 MoreData="hi mom"
VARAUXDATA 2 MyExtraData="Some extra data"
```

The variable number with which the auxiliary data is associated immediately follows the VARAUXDATA record. Also note that the data associated with a particular auxiliary data name are unique for each variable. Therefore the same named item can be added to each variable if desired. Conversely a particular auxiliary data item can be added to only one variable. NOTE: The name of an auxiliary data record cannot contain spaces.

### 4 - 3.8 ASCII Data File Parameter Assignment Values

The following parameters assignment values are shared among the following types of ASCII file records: [Zone Record](#), [Text Record](#), and/or [Geometry Record](#). Refer to those sections for details.

Table 4:

<arrowheadstyle>	PLAIN, HOLLOW, FILLED
<arrowheadattach>	NONE, BEGINNING, END, BOTH
<boxtype>	NOBOX, HOLLOW, FILLED
<clipping>	CLIPTOVIEWPORT, CLIPTOFRAME
<color>	BLACK, RED, GREEN, BLUE, CYAN, YELLOW, PURPLE, WHITE, CUST1, ..., CUST8
<coordinatesys>	FRAME, GRID, GRID3D
<datapacking>	BLOCK, POINT
<datatype>	SINGLE, DOUBLE

**Table 4:**

<code>&lt;draworder&gt;</code>	AFTERDATA,BEFOREDATA
<code>&lt;font&gt;</code>	HELV, HELV-BOLD, TIMES, TIMES-ITALIC, TIMES-BOLD, TIMES-ITALIC-BOLD, COURIER, COURIER-BOLD, GREEK, MATH, USER-DEF
<code>&lt;geomtype&gt;</code>	LINE, SQUARE, RECTANGLE, CIRCLE, ELLIPSE
<code>&lt;heightunits&gt;</code>	In FRAME coordinatesys either FRAME or POINT; in GRID coordinatesys either GRID or FRAME.
<code>&lt;linetype&gt;</code>	SOLID, DASHED, DASHDOT, DOTTED, LONGDASH, DASHDOTDOT
<code>&lt;scope&gt;</code>	GLOBAL, LOCAL
<code>&lt;textanchor&gt;</code>	LEFT, CENTER, RIGHT, MIDDLE, MIDLEFT, MIDCENTER, MIDRIGHT, HEADLEFT, HEADCENTER, HEADRIGHT
<code>&lt;varlocation&gt;</code>	NODAL, CELLCENTERED
<code>&lt;zone&gt;</code>	zone number to which this item is assigned (0=all)
<code>&lt;zonetype&gt;</code>	ORDERED, FELINESEG, FETRIANGLE, FEQUADRILATERAL, FETETRAHEDRON, FEBRICK, FEPOLYGON or FEPOLYHEDRAL. Note that Tecplot Focus cannot load FEPOLYGON or FEPOLYHEDRAL zones.

## 4 - 4 Ordered Data

For ordered data, the numerical values in the zone data must be in either POINT or BLOCK format, specified by the DATAPACKING parameter.

### 4 - 4.1 I-Ordered Data

I-ordered data has only one index, the I-index. This type of data is typically used for XY-plots, scatter plots, and irregular (random) data for triangulation or for interpolation into an IJ-or IJK-ordered zone within Tecplot 360.

In I-ordered data, the I-index varies from one to  $IMax$ . The total number of data points is  $IMax$ . For zones with only nodal variables, the total number of values in the zone data is  $IMax*N$  (where  $N$  is the number of variables). For a mixture of nodal and cell-centered variables, the number of values in the zone data is  $IMax*Nn+(IMax-1)*Nc$ , where  $Nn$  is the number of nodal variables and  $Nc$  is the number of cell-centered variables. For data in POINT format,  $IMax$  is calculated by Tecplot 360 from the zone data if it is not explicitly set by the zone control line (using the I-parameter).

### 4 - 4.2 IJ-Ordered Data

IJ-ordered data has two indices: I and J. IJ-ordered data is typically used for 2D and 3D surface mesh, contour, vector, and shade plots, but it can also be used to plot families of lines in XY-plots. Refer to [Chapter 3: "Data Structure"](#) in the [User's Manual](#) for more information on data structure. In IJ-ordered data, the I-index varies from one to  $IMax$ , and the J-index varies from one to  $JMax$ . The total number of data points (nodes) is  $IMax*JMax$ . For zones with only nodal variables, the total number of numerical values in the zone data is  $IMax*JMax*N$  (where  $N$  is the number of variables). For a mixture of nodal and cell-centered variables, the number of values in the zone data is  $IMax*JMax*Nn+(IMax-1)*(JMax-1)*Nc$ , where  $Nn$  is the number of nodal variables and  $Nc$  is the number of cell-centered variables. Both  $IMax$  and  $JMax$  must be specified in the zone control line (with the I and J parameters). The I- and J-indices should not be confused with the X- and Y-coordinates—on occasions the two may coincide, but this is not the typical case.

The I-index varies the fastest. That is, when you write programs to print IJ-ordered data, the I-index is the inner loop and the J-index is the outer loop. Note the similarity between I-ordered data and IJ-ordered data with  $J_{Max}=1$ .

### 4 - 4.3 IJK-Ordered Data

IJK-ordered data has three indices: I, J, and K. This type of data is typically used for 3D volume plots, although planes of the data can be used for 2D and 3D surface plots. See [Section “Ordered Data”](#) in the [User's Manual](#) for more information.

In IJK-ordered data, the I-index varies from one to  $I_{Max}$ , the J-index varies from one to  $J_{Max}$ , and the K-index varies from one to  $K_{Max}$ . The total number of data points (nodes) is  $I_{Max} * J_{Max} * K_{Max}$ . For zones with only nodal variables, the total number of values in the zone data is  $I_{Max} * J_{Max} * K_{Max} * N$ , where  $N$  is the number of variables. For a mixture of nodal and cell-centered variables, the number of values in the zone data is  $I_{Max} * J_{Max} * K_{Max} * N_n + (I_{Max}-1) * (J_{Max}-1) * (K_{Max}-1) * N_c$ , where  $N_n$  is the number of nodal variables and  $N_c$  is the number of cell-centered variables. The three indices,  $I_{Max}$ ,  $J_{Max}$ , and  $K_{Max}$ , must be specified in the zone control line using the I, J, and K-parameters.

The I-index varies the fastest; the J-index the next fastest; the K-index the slowest. If you write a program to print IJK-ordered data, the I-index is the inner loop, the K-index is the outer loop, and the J-index is the loop in between. Note the similarity between IJ-ordered data and IJK-ordered data with  $K_{Max}=1$ .

### 4 - 4.4 Ordered Data Examples

The following examples are provided for your reference:

- [I-Ordered Data - Simple example](#)
- [IJ-Ordered Data - Simple Example](#)
- [IJK-Ordered Data - Simple Example](#)
- [Multi-Zone XY Line Plot](#)
- [Multi-Zone XY Line Plot with Variable Sharing Example](#)
- [Cell-Centered Data](#)
- [Two-Dimensional Field Plots](#)
- [Three-Dimensional Field Plots](#)
- [Polygonal - simple example](#)
- [Polyhedral - complex example](#)

#### ***I-Ordered Data - Simple example***

This data set is plotted in [Figure 4-3](#); each data point is labeled with its I-index.

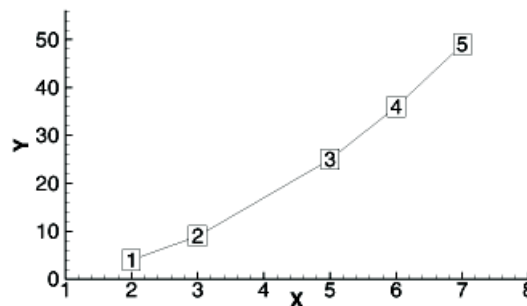


Figure 4-3. An I-ordered data set.

In this example, each column of zone data corresponds to a data point; each row to a variable.

```
VARIABLES = "X", "Y"
ZONE I=5, DATAPACKING=BLOCK
2 3 5 6 7
4 9 25 36 49
```

In BLOCK format all values of each variable are listed, one variable at a time.

## FORTRAN Code

The following sample FORTRAN code shows how to create I-ordered data in BLOCK format:

```
INTEGER VAR
.
.
.
WRITE (*,*) 'ZONE DATAPACKING=BLOCK, I=', IMAX
DO 1 VAR=1, NUMVAR
DO 1 I=1, IMAX
WRITE (*,*) ARRAY(VAR, I)
1 CONTINUE
```

## IJ-Ordered Data - Simple Example

There are four variables (X, Y, Temperature, Pressure) and six data points.

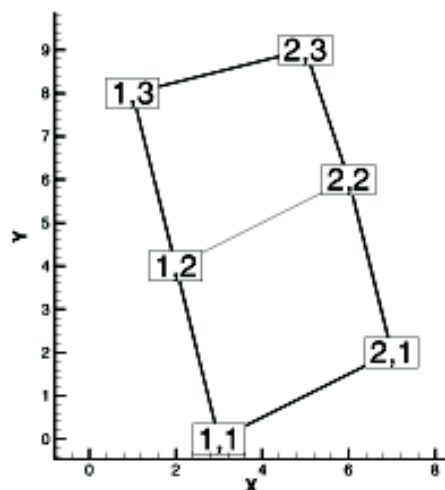


Figure 4-4. An IJ-ordered data set.

In this example, each column of data corresponds to a data point; each row to a variable.

```
VARIABLES = "X", "Y", "Temperature", "Pressure"
ZONE I=2, J=3, DATAPACKING=BLOCK
3 7 2 6 1 5
0 2 4 6 8 9
0 0 1 0 1 1
50 43 42 37 30 21
```

In BLOCK format, all  $IMax * JMax$  values of each variable are listed, one variable at a time. Within each variable block, all the values of a variable at each data point are listed.

## FORTRAN Code

The following sample FORTRAN code shows how to create IJ-ordered data in BLOCK format:

```

      INTEGER VAR
      .
      .
      .
      WRITE (*,*) 'ZONE DATAPACKING=BLOCK, I=', IMAX, ', J=', JMAX
      DO 1 VAR=1,NUMVAR
      DO 1 J=1,JMAX
      DO 1 I=1,IMAX
      WRITE (*,*) ARRAY(VAR,I,J)
1      CONTINUE

```

### IJK-Ordered Data - Simple Example

An example of IJK-ordered data in BLOCK format is listed below. There are four variables (X, Y, Z, Temperature) and twelve data points. This data is plotted in [Figure 4-5](#); each data point is labeled with its IJK-index.

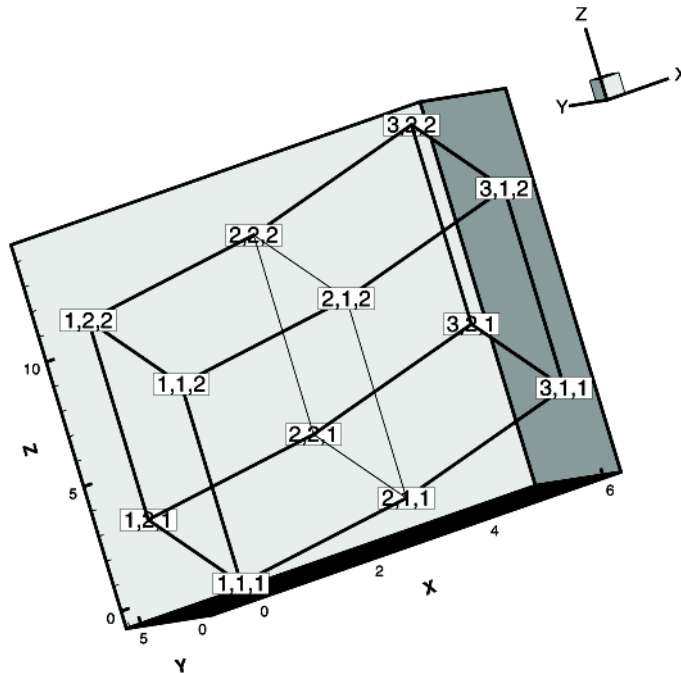


Figure 4-5. An IJK-ordered data set.

For this example, each column of data corresponds to a data point; each row to a variable.

```

VARIABLES = "X" "Y" "Z" "Temp"
ZONE I=3, J=2, K=2, DATAPACKING=BLOCK
0 3 6 0 3 6 0 3 6 0 3 6
0 0 0 6 6 6 0 0 0 6 6 6
0 1 3 3 4 6 8 9 11 11 12 14
0 5 10 10 41 72 0 29 66 66 130 169

```

### FORTRAN Code

The following sample FORTRAN code shows how to create an IJK-ordered zone in BLOCK format:

```

      INTEGER VAR
      .
      .
      .
      WRITE (*,*) 'ZONE DATAPACKING=BLOCK, I=', IMAX, ', J=', JMAX, ', K=', KMAX
      DO 1 VAR=1,NUMVAR
      DO 1 K=1,KMAX

```

```

DO 1 J=1,JMAX
DO 1 I=1,IMAX
WRITE (*,*) ARRAY(VAR,I,J,K)
1    CONTINUE

```

## Multi-Zone XY Line Plot

The two tables below show the values of pressure and temperature measured at four locations on some object at two different times. The four locations are different for each time measurement.

Time = 0.0 seconds:			Time = 0.1 seconds:		
Position	Temperature	Pressure	Position	Temperature	Pressure
71.30	563.7	101362.5	71.31	564.9	101362.1
86.70	556.7	101349.6	84.42	553.1	101348.9
103.1	540.8	101345.4	103.1	540.5	101344.0
124.4	449.2	101345.2	124.8	458.5	101342.2

For this case, we want to set up two zones in the data file, one for each time value. Each zone has three variables (Position, Temperature, and Pressure) and four data points (one for each location). This means that  $IMax=4$  for each zone. We include a text record (discussed in [Section 4 - 3.3 "Text Record"](#)) to add a title to the plot. The plot shown in [Figure 4-6](#) can be produced from this file.

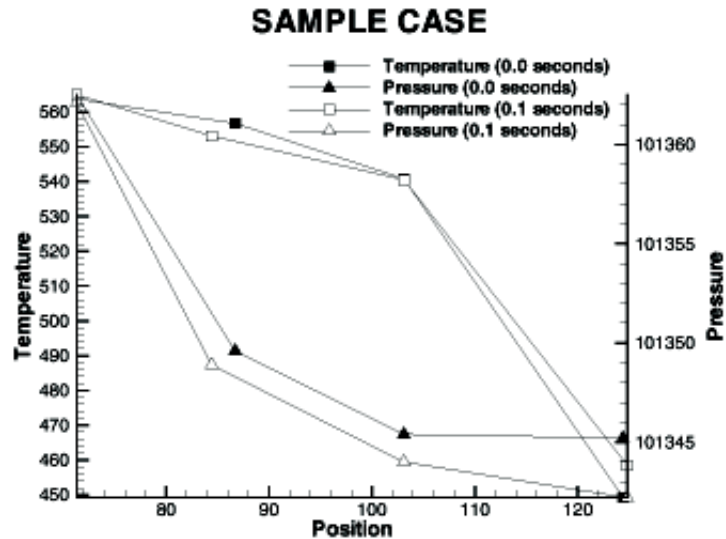


Figure 4-6. A multi-zone XY Line plot.

All of the values for the first variable (Position) at each data point are listed first, then all of the values for the second variable (Temperature) at each data point, and so forth.

```

TITLE = "Example: Multi-Zone XY Line Plot"
VARIABLES = "Position", "Temperature", "Pressure"
ZONE DATAPACKING=BLOCK, T="0.0 seconds", I=4
71.30 86.70 103.1 124.4
563.7 556.7 540.8 449.2
101362.5 101349.6 101345.4 101345.2
ZONE DATAPACKING=BLOCK, T="0.1 seconds", I=4
71.31 84.42 103.1 124.8
564.9 553.1 540.5 458.5
101362.1 101348.9 101344.0 101342.2

```

```
TEXT CS=FRAME, HU=POINT, X=16, Y=90, H=28, T="SAMPLE CASE"
```

### Multi-Zone XY Line Plot with Variable Sharing Example

If the data from the section above was taken at the same position for both times, variable sharing could reduce memory usage and file size. That file appears as:

```
TITLE = "Example: Multi-Zone XY Line Plot with Variable Sharing"
VARIABLES = "Position", "Temperature", "Pressure"
ZONE T="0.0 seconds", I=4
71.30 563.7 101362.5
86.70 556.7 101349.6
103.1 540.8 101345.4
124.4 449.2 101345.2
ZONE T="0.1 seconds", I=4
VARSHARELIST=([1]=1)          #share variable 1 from zone 1
564.9 101362.1
553.1 101348.9
540.5 101344.0
458.5 101342.2
TEXT CS=FRAME, HU=POINT, X=16, Y=90, H=28, T="SAMPLE VARIABLE SHARING CASE"
```

### Cell-Centered Data

An example of IJ-ordered data with cell-centered variables might include four variables (X, Y, Temperature, Pressure), nine data points, and four cells where Temperature and Pressure are cell-centered.

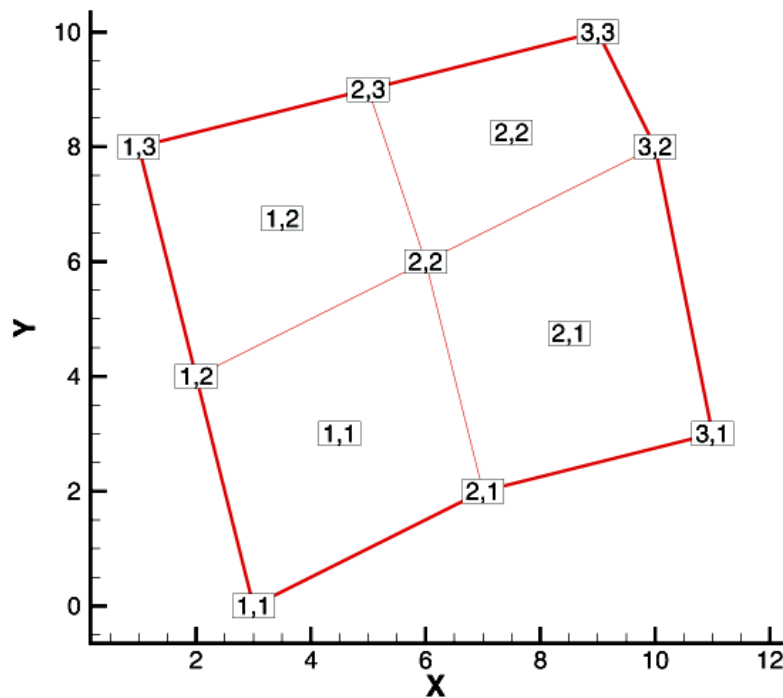


Figure 4-7. An IJ-ordered data set with cell-centered data.

```
VARIABLES = "X", "Y", "Temperature", "Pressure"
ZONE I=3, J=3, DATAPACKING=BLOCK, VARLOCATION=([3,4]=CELLCENTERED)
3 7 11 2 6 10 1 5 9
0 2 3 4 6 8 8 9 10
0 2 1 3
45 60 35 70
```

The nodal variables of X and Y are specified at all nine nodes, and the values of cell-centered variables are specified at the four cells [(IMax-1)\*(JMax-1)]. Zones with cell-centered data must have DATAPACKING=BLOCK.

## Two-Dimensional Field Plots

A 2D field plot typically uses an IJ-ordered or finite element surface data set. However, any data structure can be viewed as a 2D field plot, by simply selecting "2D Cartesian" from the plot-type menu in the Plot sidebar.

An IJ-ordered data file has the basic structure shown below:

```
TITLE = "Example: Multi-Zone 2D Plot"
VARIABLES = "X", "Y", "Press", "Temp", "Vel"
ZONE T="BIG ZONE", I=3, J=3, DATAPACKING=POINT
1.0 2.0 100.0 50.0 1.0
1.0 3.0 95.0 50.0 1.00
1.0 4.0 90.0 50.0 0.90
2.0 2.0 91.0 40.0 0.90
2.0 3.0 85.0 40.0 0.90
2.0 4.0 80.0 40.0 0.80
3.0 2.0 89.0 35.0 0.85
3.0 3.0 83.0 35.0 0.80
3.0 4.0 79.0 35.0 0.80
ZONE T="SMALL ZONE", I=3, J=2, DATAPACKING=POINT
3.0 2.0 89.0 35.0 0.85
3.5 2.0 80.0 35.0 0.85
4.0 2.0 78.0 35.0 0.80
3.0 3.0 83.0 35.0 0.80
3.5 3.0 80.0 35.0 0.85
4.0 3.0 77.0 33.0 0.78
```

This data file has two zones and five variables. The first zone has nine data points arranged in a three-by-three grid (I=3, J=3). Each row of each zone represents one data point, where each column corresponds to the value of each variable for a given data point, i.e. X = 1.0, Y = 2.0, Press = 100.0, Temp = 50.0, and Vel= 1.0 for data point one in zone one (Big Zone).

Similarly, the second zone (Small Zone) has six data points in a three-by-two mesh (I=3, J=2). Reading this data file yields the mesh plot shown in [Figure 4-12](#).

Refer to [Section "Two-Dimensional Field Plots"](#) on page 142 for an presentation of the same data in finite element format.

## Three-Dimensional Field Plots

IJK-ordered data sets have the general form shown below:

```
TITLE = "Example: Simple 3D Volume Data"
VARIABLES = "X", "Y", "Z", "Density"
ZONE I=3, J=4, K=3, DATAPACKING=POINT
1.0 2.0 1.1 2.21
2.0 2.1 1.2 5.05
3.0 2.2 1.1 7.16
1.0 3.0 1.2 3.66
...
```

## 4 - 5 Finite Element Data

The zone header for a finite element zones lists the zone type, along with the number of nodes, elements and faces included in the zone. The following zone types are available for finite element data:

- **FELINESEG** - FE line segments zones contain one-dimensional finite element zones. For the line segment element type, each line of the connectivity list contains two node numbers that define a linear element.



- **FETRIANGLE** - FE triangular zones contain two-dimensional finite elements defined by three nodes. For the triangle element type, each line of the connectivity list contains three node numbers that define a triangular element.
- **FEQUADRILATERAL** - FE quadrilateral zones contain two-dimensional elements defined by four nodes. For the quadrilateral element type, each line of the connectivity list contains four node numbers that define a quadrilateral element.



If you need to mix quadrilateral and triangle elements, either use the polygonal zone type or use the quadrilateral element type with node numbers repeated to form triangles.

- **FEPOLYGON** - FE polygonal zones contain two-dimensional elements defined by a varying number of nodes (three or greater). Note that Tecplot Focus cannot load this type of zone.
- **FETETRAHEDRON** - FE tetrahedral zones contain three-dimensional elements defined by four nodes.
- **FEBRICK** - FE brick zones contain three-dimensional elements defined by eight nodes. Tecplot 360 divides the eight nodes into two groups of four; nodes  $N1_M$ ,  $N2_M$ ,  $N3_M$ , and  $N4_M$  make up the first group, and  $N5_M$ ,  $N6_M$ ,  $N7_M$ , and  $N8_M$  make up the second group (where  $N\#$  is the node number and  $M$  is the element number). Each node is connected to two nodes within its group and the node in the corresponding position in the other group. For example,  $N1_M$  is connected to  $N2_M$  and  $N4_M$  in its own group, and to  $N5_M$  in the second group.

To create elements with fewer than eight nodes, repeat nodes as necessary, keeping in mind the basic brick connectivity just described. [Figure 4-8](#) shows the basic brick connectivity. For example, to create a tetrahedron, you can set  $N3_M=N4_M$  and  $N5_M=N6_M=N7_M=N8_M$ . To create a quadrilateral-based pyramid, you can set  $N5_M=N6_M=N7_M=N8_M$ .

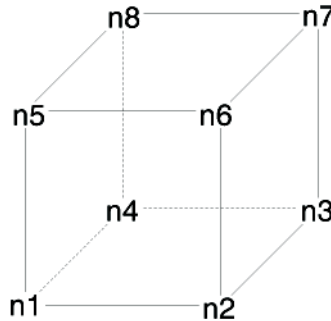


Figure 4-8. Basic brick connectivity.

- **FEPOLYHEDRAL** - FE polyhedral zones contain elements with a varying number of faces. Each element has at least four faces. The faces are defined by any number of nodes (with a minimum of three nodes in each face). Note that Tecplot Focus cannot load this type of zone.

Refer to [Section 4 - 3.2 "Zone Record"](#) for a complete list of the tokens included in the zone header.

After the zone header, the nodal data is listed. The nodal data contains the value of each variable for each node or element. Refer to [Section "Data"](#) on page 117 for details on arranging the data. The information following the nodal data is dependent upon the zone type.

For cell-based finite element zone types (FETRIANGLE, FEQUADRILATERAL, FETETRAHEDRON, and FEBRICK), the nodal data is followed by the connectivity section. The connectivity section describes arrangement of cells, relative to one another. There must be *numelements* lines in the second section; each line defines one element. The number of nodes per line in the connectivity list depends on the element type specified in the zone control line (ZONETYPE parameter). For example, ZONETYPE=FETRIANGLE has three numbers per line in the connectivity list. If nodes five, seven, and eight are connected, one line reads: 5 7 8. Refer to [Section](#)

[“Connectivity”](#) on page 119 for details. You may also define Face Neighbors following the connectivity list. Refer to [Section “Face Neighbor Connections List”](#) on page 120 for details.

For face-based zone type (FEPOLYGON and FEPOLYHEDRAL), the data section ([“Data”](#)) is followed by the zone footer and facemap data sections. Refer to [“Facemap Data”](#) for details.

## 4 - 5.1 Variable and Connectivity List Sharing

The VARSHARELIST in the ZONE record allows you to share variables from specified previous zones. The CONNECTIVITYSHAREZONE parameter in the ZONE record allows you to share the connectivity list from a specified previous zone. The following is an example to illustrate these features. NOTE: Connectivity and/or face neighbors cannot be shared when the face neighbor mode is set to Global.

The table below shows Cartesian coordinates X and Y of six locations, and the pressure measured there at three different times ( $P_1$ ,  $P_2$ ,  $P_3$ ). The XY locations have been arranged into finite elements.

X	Y	$P_1$	$P_2$	$P_3$
-1.0	0.0	100	110	120
0.0	0.0	125	135	145
1.0	0.0	150	160	180
-0.5	0.8	150	165	175
0.5	0.8	175	185	195
0.0	1.6	200	200	200

For this case, we want to set up three zones in the data file, one for each time measurement. Each zone has three variables: X, Y, and P. The zones are of the triangle element type, meaning that three nodes must be used to define each element. One way to set up this data file would be to list the complete set of values for X, Y, and P for each zone. Since the XY-coordinates are exactly the same for all three zones, a more compact data file can be made by using the VARSHARELIST. In the data file given below, the second and third zones have variable sharing lists that share the values of the X- and Y-variables and the connectivity list from the first zone. As a result, the only values listed for the second and third zones are the pressure variable values. Note that the data could easily have been organized in a single zone with five variables. Since

blank lines are ignored in the data file, you can embed them to improve readability. A plot of the data is shown in [Figure 4-9](#).

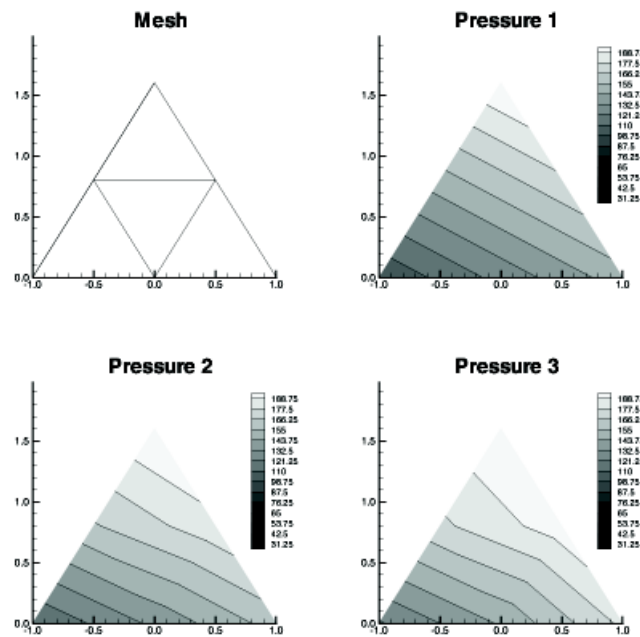


Figure 4-9. A plot of finite element zones.

```
TITLE = "Example: Variable and Connectivity List Sharing"
VARIABLES = "X", "Y", "P"
ZONE T="P_1", DATAPACKING=POINT, NODES=6, ELEMENTS=4, ZONETYPE=FETRIANGLE
-1.0 0.0 100
0.0 0.0 125
1.0 0.0 150
-0.5 0.8 150
0.5 0.8 175
0.0 1.6 200

1 2 4
2 5 4
3 5 2
5 6 4
ZONE T="P_2", DATAPACKING=POINT, NODES=6, ELEMENTS=4, ZONETYPE=FETRIANGLE, VARSHARELIST = ([1,
2]=1), CONNECTIVITYSHAREZONE = 1
110 135 160 165 185 200

ZONE T="P_3", DATAPACKING=POINT, NODES=6, ELEMENTS=4, ZONETYPE=FETRIANGLE, VARSHARELIST = ([1,
2]=1), CONNECTIVITYSHAREZONE = 1
120 145 180 175 195 200
```

## 4 - 5.2 Finite Element Data Set Examples

Creating a finite element data set is generally more complicated than creating a similar-sized ordered data set<sup>1</sup>. In addition to specifying all the data points, you must also specify the connectivity list. Consider the data shown in [Table 4 - 1](#).

Node	X	Y	P	T
A	0.0	1.0	100.0	1.6
B	1.0	1.0	150.0	1.5
C	3.0	1.0	300.0	2.0
D	0.0	0.0	50.0	1.0
E	1.0	0.0	100.0	1.4
F	3.0	0.0	200.0	2.2
G	4.0	0.0	400.0	3.0
H	2.0	2.0	280.0	1.9

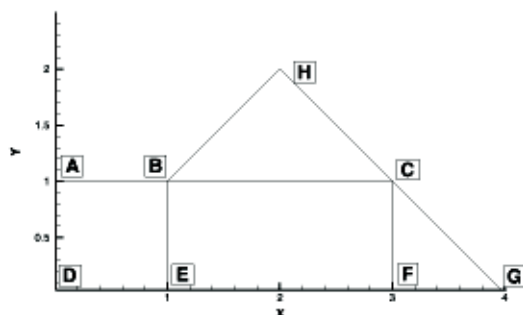
**Table 4 - 1: finite element Data**

You can create a POINT Tecplot 360 data file for this data set as follows (a 2D mesh plot of this data set is shown in [Figure 4-10](#)):

```

TITLE = "Example: 2D Finite Element Data"
VARIABLES = "X", "Y", "P", "T"
ZONE NODES=8, ELEMENTS=4, DATAPACKING=POINT, ZONETYPE=FEQUADRILATERAL
0.0 1.0 100.0 1.6
1.0 1.0 150.0 1.5
3.0 1.0 300.0 2.0
0.0 0.0 50.0 1.0
1.0 0.0 100.0 1.4
3.0 0.0 200.0 2.
4.0 0.0 400.0 3.0
2.0 2.0 280.0 1.9
1 2 5 4
2 3 6 5
6 7 3 3
3 2 8 8

```



*Figure 4-10. A mesh plot of 2D finite element data.*

The ZONE record describes completely the form and format of the data set: there are eight nodes, indicated by the parameter NODES=8; four elements, indicated by the parameter ELEMENTS=4, and the elements are all quadrilaterals, as indicated by the parameter ZONETYPE=FEQUADRILATERAL.

1. Background information for FE data sets is provided in [Section "Indexing Cell-centered Ordered Data"](#) in the [User's Manual](#).

The same data file can be written more compactly in BLOCK format as follows:

```
TITLE = "Example: 2D Finite Element Data"
VARIABLES = "X", "Y", "P", "T"
ZONE NODES=8, ELEMENTS=4, DATAPACKING=BLOCK, ZONETYPE=FEQUADRILATERAL
0.0 1.0 3.0 0.0 1.0 3.0 4.0 2.0
1.0 1.0 1.0 0.0 0.0 0.0 0.0 2.0
100.0 150.0 300.0 50.0 100.0 200.0 400.0 280.0
1.6 1.5 2.0 1.0 1.4 2.2 3.0 1.9
1 2 5 4
2 3 6 5
6 7 3 3
3 2 8 8
```

In BLOCK format, all values for a single variable are written in a single block. The length of the block is the number of data points in the zone. In POINT format, all variables for a single data point are written in a block, with the length of the block equal to the number of variables.



The connectivity list is the same for both POINT and BLOCK formats.

You can change the connectivity list to obtain a different mesh for the same data points. In the above example, substituting the following connectivity list yields the five-element mesh shown in [Figure 4-11](#). (You must also change the ELEMENTS parameter in the zone control line to specify five elements.)

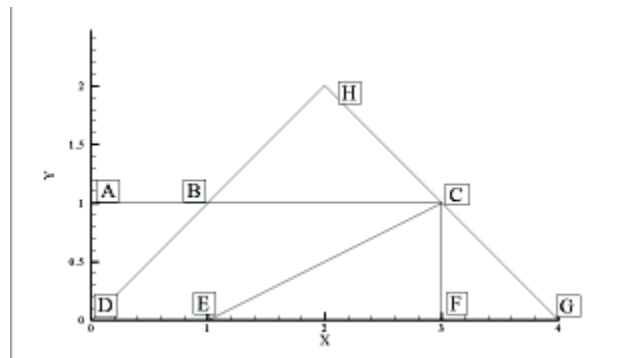


Figure 4-11. Finite element data of [Figure 4-10](#) with a different connectivity list

```
1 2 4 4
4 2 3 5
5 3 6 6
6 7 3 3
3 2 8 8
```

## Two-Dimensional Field Plots

A 2D finite element data file is shown below:.

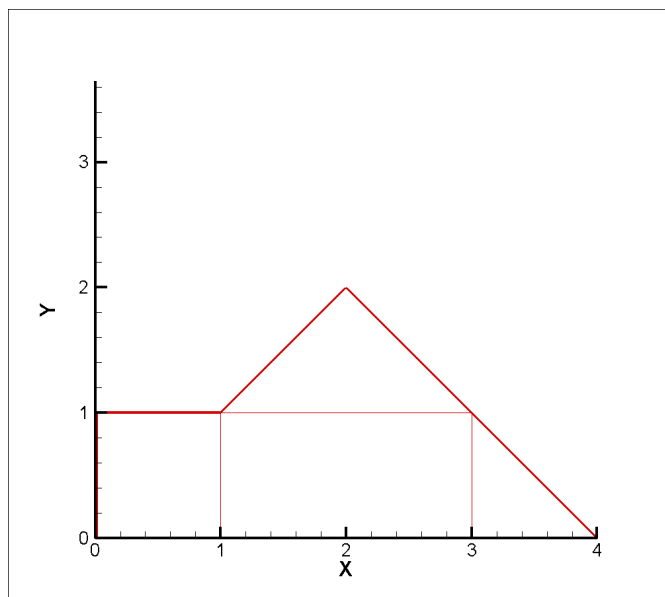


Figure 4-12. A 2D field plot.

```
TITLE = "Example: 2D Finite Element Data"
VARIABLES = "X", "Y", "P", "T"
ZONE NODES=8, ELEMENTS=4, DATAPACKING=POINT, ZONETYPE=FEQUADRILATERAL
0.0 1.0 75.0 1.6
1.0 1.0 100.0 1.5
3.0 1.0 300.0 2.0
0.0 0.0 50.0 1.0
1.0 0.0 100.0 1.4
3.0 0.0 200.0 2.2
4.0 0.0 400.0 3.0
2.0 2.0 280.0 1.9
1 2 5 4
2 3 6 5
6 7 3 3
3 2 8 8
```

The above finite element data file has eight nodes (the first eight rows of the zone) and four elements (the last four rows of the zone). Each row in the node matrix represents a given node. Each column in the row matrix corresponds to the value of each variable at a given node. The order of the variables definition correlates to the order the variables are named in the data set, i.e. for node one,  $X = 0.0$ ,  $Y = 1.0$ ,  $P = 75.0$  and  $T = 1.6$ . The element matrix defines the connectivity of the nodes, i.e. element one is composed of nodes one, two, five and four.

Please refer to [Chapter 3: "Data Structure"](#) in the [User's Manual](#) for information on ordered and FE data sets.

### Triangle Data in BLOCK Format Example

An example of triangle element type finite element data is listed below. There are two variables (X, Y) and five data points. This data set is plotted in [Figure 4-13](#). Each data point is labeled with its node number.

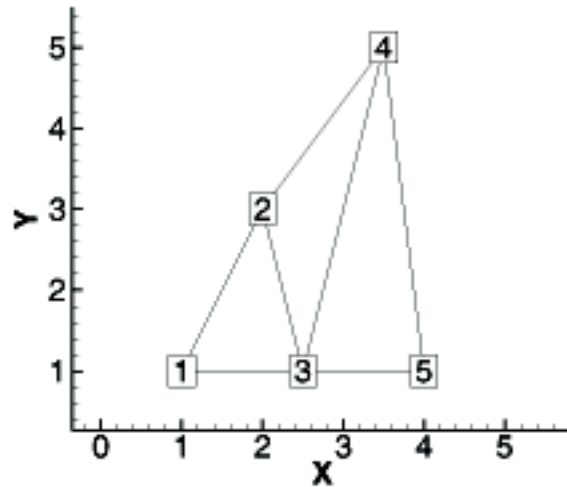


Figure 4-13. A finite element triangle data set.

In this example, each column of the data section corresponds to a node and each row to a variable. Each row of the connectivity list corresponds to a triangular element and each column specifies a node number.

```
VARIABLES = "X", "Y"
ZONE NODES=5, ELEMENTS=3, DATAPACKING=BLOCK, ZONETYPE=FETRIANGLE
1.0 2.0 2.5 3.5 4.0
1.0 3.0 1.0 5.0 1.0
1 2 3
3 2 4
3 5 4
```

### FORTRAN Code

This FORTRAN code creates triangle element type finite element data in BLOCK format:

```
INTEGER VAR
.
.
WRITE (*,*) 'ZONE DATAPACKING=BLOCK, ZONETYPE=FETRIANGLE,NODES=',NNODES,
& ',ELEMENTS=',NELEM
DO 1 VAR=1,NUMVAR
DO 1 NODES=1,NNODES
WRITE(*,*) VARRAY(VAR,NODES)
1 CONTINUE
DO 2 M=1,NELEM
DO 2 L=1,3
WRITE (*,*) NDCNCT(M,L)
2 CONTINUE
```

### Finite Element Zone Node Variable Parameters Example

The node variable parameter allows setting of the connectivity to match the value of the selected node variable. In the example below, the files appear to be identical in Tecplot 360, although the connectivity list has changed to reflect the values of the node order. Notice that the index value of the nodes is not changed by the node variable value.

The original data set:

```
TITLE      = "Data with original node ordering"
```

```

VARIABLES = "X" "Y"
ZONE T="Triangulation"
  NODES=6, ELEMENTS=5,DATAPACKING=POINT, ZONETYPE=FETRIANGLE
DT=(SINGLE SINGLE)
2.00E+000 3.00E+000
2.20E+000 3.10E+000
3.10E+000 4.20E+000
2.80E+000 3.50E+000
2.40E+000 2.10E+000
4.30E+000 3.20E+000
1 2 5
6 4 3
5 4 6
2 3 4
5 2 4

```

The data set with the nodes re-ordered for connectivity:

```

TITLE      = "Data with modified node ordering"
VARIABLES = "X" "Y" "Node-Order"
ZONE T="Triangulation"
  NODES=6, NV = 3, ELEMENTS=5,DATAPACKING=POINT, ZONETYPE=FETRIANGLE
DT=(SINGLE SINGLE)
2.00E+000 3.00E+000 5
2.20E+000 3.10E+000 4
3.10E+000 4.20E+000 1
2.80E+000 3.50E+000 2
2.40E+000 2.10E+000 6
4.30E+000 3.20E+000 3
5 4 6
3 2 1
6 2 3
4 1 2
6 4 2

```

## ***FE surface data***

Finite element surface data specify node locations in three dimensions. Consider the data in [Table 4 - 2](#). Locations are listed for eleven nodes, each having only the three spatial variables X, Y, and Z. We would like to create an finite element surface zone with this data set, where some of the elements are triangles and some are quadrilaterals. All the elements could be organized into one zone of element type Quadrilateral. However, as an illustration of creating 3D surface data, create three zones: one triangular, one quadrilateral, and one a mixture (using quadrilaterals with repeated nodes for the triangles).

X	Y	Z
0.0	0.0	1.0
0.0	0.0	-2.0
1.0	0.0	-2.0
1.0	1.0	0.0
1.0	1.0	-1.0
1.0	-1.0	0.0
1.0	-1.0	-1.0
-1.0	1.0	0.0
-1.0	1.0	-1.0

**Table 4 - 2: Data set with eleven nodes and three variables.**



X	Y	Z
-1.0	-1.0	0.0
-1.0	-1.0	-1.0

**Table 4 - 2: Data set with eleven nodes and three variables.**

A Tecplot 360 data file for the data in [Table 4 - 2](#) is shown below in POINT format and plotted in [Figure 4-14](#):

```

TITLE = "Example: 3D FE-SURFACE ZONES"
VARIABLES = "X", "Y", "Z"
ZONE T="TRIANGLES", NODES=5, ELEMENTS=4, DATAPACKING=POINT, ZONETYPE=FETRIANGLE
0.0 0.0 1.0
-1.0 -1.0 0.0
-1.0 1.0 0.0
1.0 1.0 0.0
1.0 -1.0 0.0
1 2 3
1 3 4
1 4 5
1 5 2
ZONE T="PURE-QUADS", NODES=8, ELEMENTS=4, DATAPACKING=POINT,
      ZONETYPE=FEQUADRILATERAL
-1.0 -1.0 0.0
-1.0 1.0 0.0
1.0 1.0 0.0
1.0 -1.0 0.0
-1.0 -1.0 -1.0
-1.0 1.0 -1.0
1.0 1.0 -1.0
1.0 -1.0 -1.0
1 5 6 2
2 6 7 3
3 7 8 4
4 8 5 1
ZONE T="MIXED", NODES=6, ELEMENTS=4, DATAPACKING=POINT, ZONETYPE=FEQUADRILATERAL
-1.0 -1.0 -1.0
-1.0 1.0 -1.0
1.0 1.0 -1.0
1.0 -1.0 -1.0
0.0 0.0 -2.0
1.0 0.0 -2.0
1 5 2 2
2 5 6 3
3 4 6 6
4 1 5 6

```

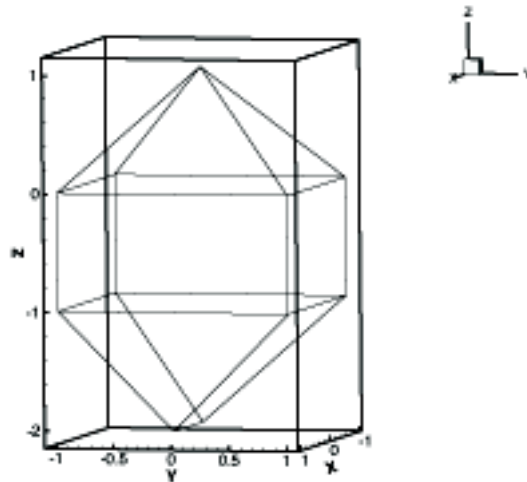


Figure 4-14. Three-dimensional mesh plot of finite element surface data.

### **FE Volume Data Files**

Finite element volume data in Tecplot 360 is constructed from either tetrahedra having four nodes or bricks having eight nodes. Bricks are more flexible, because they can be used (through the use of repeated nodes in the connectivity list) to construct elements with fewer than eight nodes and combine those elements with bricks in a single zone.

### **Finite Element Volume - Brick Data Set**

As a simple example of finite element volume brick data, consider the data in [Table 4 - 3](#). The data can be divided into five brick elements, each of which is defined by eight nodes.

X	Y	Z	Temperature
0.0	0.0	0.0	9.5
1.0	1.0	0.0	14.5
1.0	0.0	0.0	15.0
1.0	1.0	1.0	16.0
1.0	0.0	1.0	15.5
2.0	2.0	0.0	17.0
2.0	1.0	0.0	17.0
2.0	0.0	0.0	17.5
2.0	2.0	1.0	18.5
2.0	1.0	1.0	20.0
2.0	0.0	1.0	17.5
2.0	2.0	2.0	18.0

**Table 4 - 3: Finite Element Volume - Brick Data Set. Data with 14 nodes and four variables.**

X	Y	Z	Temperature
2.0	1.0	2.0	17.5
2.0	0.0	2.0	16.5

**Table 4 - 3: Finite Element Volume - Brick Data Set. Data with 14 nodes and four variables.**

In each element's connectivity list, Tecplot 360 draws connections from each node to three other nodes. You can think of the first four nodes in the element as the "bottom" layer of the brick, and the second four nodes as the "top." Within the bottom or top layer, nodes are connected cyclically (1-2-3-4-1; 5-6-7-8-5); the layers are connected by connecting corresponding nodes (1-5; 2-6; 3-7; 4-8). [Figure 4-8](#) illustrates this basic connectivity. When you are creating your own connectivity lists for brick elements, you must keep this basic connectivity in mind, particularly when using duplicate nodes to create pyramids and wedges. Tecplot 360 lets you create elements that violate this basic connectivity, but the result will probably not be what you want.

The data file in POINT format is shown below:

```
TITLE = "Example: FE-Volume Brick Data"
VARIABLES = "X", "Y", "Z", "Temperature"
ZONE NODES=14, ELEMENTS=5, DATAPACKING=POINT, ZONETYPE=FEBRICK
0.0 0.0 0.0 9.5
1.0 1.0 0.0 14.5
1.0 0.0 0.0 15.0
1.0 1.0 1.0 16.0
1.0 0.0 1.0 15.5
2.0 2.0 0.0 17.0
2.0 1.0 0.0 17.0
2.0 0.0 0.0 17.5
2.0 2.0 1.0 18.5
2.0 1.0 1.0 20.0
2.0 0.0 1.0 17.5
2.0 2.0 2.0 18.0
2.0 1.0 2.0 17.5
2.0 0.0 2.0 16.5
1 1 1 1 2 4 5 3
2 4 5 3 7 10 11 8
4 4 5 5 10 13 14 11
4 4 4 4 9 12 13 10
2 2 4 4 7 6 9 10
```

The same data in BLOCK format is shown below:

```
TITLE = "Example: FE-Volume Brick Data"
VARIABLES = "X", "Y", "Z", "Temperature"
ZONE NODES=14, ELEMENTS=5, DATAPACKING=BLOCK, ZONETYPE=FEBRICK
0.0 1.0 1.0 1.0 1.0 2.0 2.0 2.0 2.0 2.0 2.0 2.0 2.0 2.0
0.0 1.0 0.0 1.0 0.0 2.0 1.0 0.0 2.0 1.0 0.0 2.0 1.0 0.0
0.0 0.0 0.0 1.0 1.0 0.0 0.0 0.0 1.0 1.0 2.0 2.0 2.0 2.0
9.5 14.5 15.0 16.0 15.5 17.0 17.0
17.5 18.5 20.0 17.5 18.0 17.5 16.5
1 1 1 1 2 4 5 3
2 4 5 3 7 10 11 8
4 4 5 5 10 13 14 11
4 4 4 4 9 12 13 10
2 2 4 4 7 6 9 10
```

[Figure 4-15](#) shows the resulting mesh plot from the data set listed in this section.

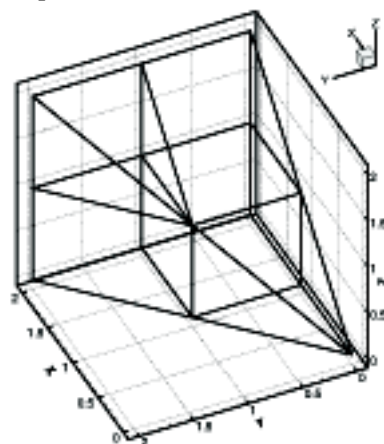


Figure 4-15. A finite element brick zone.

### Finite Element Volume - Tetrahedral Data Set

As a simple example of a finite element volume data set using tetrahedral elements, consider the data in [Table 4 - 4](#). The data set consists of thirteen nodes, with seven variables. The nodes are to be connected to form twenty tetrahedral elements, each with four nodes.

X	Y	Z	C	U	V	W
0	0	-95	-1	1	0	8
0	85	-42	0	-5	-3	9
81	26	-42	2	-22	80	8
50	-69	-42	-6	72	52	9
-50	-69	-42	14	67	-48	9
-81	26	-2	20	-30	-82	9
0	0	0	1	-2	-5	10
50	69	43	14	-68	48	11
81	-26	43	20	31	82	11
0	-85	43	0	84	-3	10
-81	-26	43	2	21	-80	11
-50	69	43	-6	-71	-51	11
0	0	96	1	0	-1	12

**Table 4 - 4: Finite Element Volume - Tetrahedral data set with 13 nodes and seven variables.**

The data file in POINT format for the data in [Table 4 - 4](#) is shown below, and plotted in [Figure 4-16](#):

```

TITLE = "Example: FE-Volume Tetrahedral Data"
VARIABLES = "X", "Y", "Z", "C", "U", "V", "W"
ZONE NODES=13, ELEMENTS=20, DATAPACKING=POINT, ZONETYPE=FETETRAHEDRON
0 0 -95 -1 1 0 8
0 85 -42 0 -5 -3 9
81 26 -42 2 -22 80 8
50 -69 -42 -6 72 52 9
-50 -69 -42 14 67 -48 9
-81 26 -2 20 -30 -82 9
0 0 0 1 -2 -5 10
50 69 43 14 -68 48 11
81 -26 43 20 31 82 11
0 -85 43 0 84 -3 10
-81 -26 43 2 21 -80 11
-50 69 43 -6 -71 -51 11
0 0 96 1 0 -1 12

```

```

50 -69 -42 -6 72 52 9
-50 -69 -42 14 67 -48 9
-81 26 -42 20 -30 -82 9
0 0 0 1 -2 -5 10
50 69 43 14 -68 48 11
81 -26 43 20 31 82 11
0 -85 43 0 84 3 10
-81 -26 43 2 21 -80 11
-50 69 43 -6 -71 -51 11
0 0 96 1 0 -1 12
1 2 3 7
1 3 4 7
1 4 5 7
1 5 6 7
1 6 2 7
2 8 3 7
3 9 4 7
4 10 5 7
5 11 6 7
6 12 2 7
12 2 8 7
8 3 9 7
9 4 10 7
10 5 11 7
11 6 12 7
12 8 13 7
8 9 13 7
9 10 13 7
10 11 13 7
11 12 13 7

```

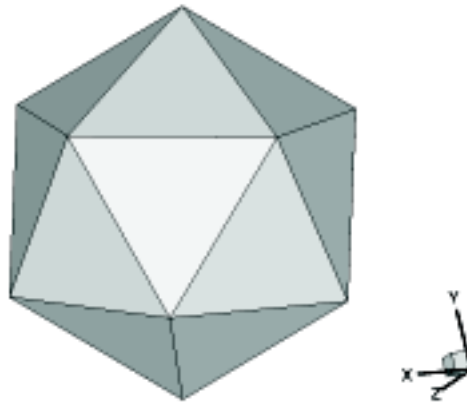


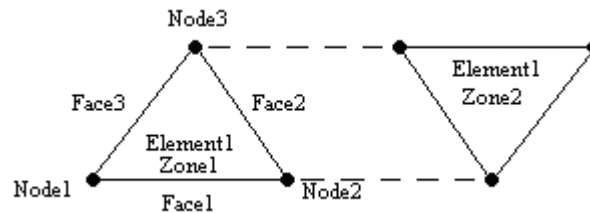
Figure 4-16. Finite element volume tetrahedral data.

## Polygonal - simple example



Remember that Tecplot Focus cannot load face-based (polygonal or polyhedral) data.

A polygonal element in one zone connected to an element in another zone.



```
Zone
ZoneType=FEPolygon
Nodes=3
Faces=3
Elements=1
NumConnectedBoundaryFaces=2
TotalNumBoundaryConnections=1
...variable values in block format...
```

```
#face nodes
1 2
2 3
3 1
#left elements
1 1 1
#right elements (negative indicates boundary connections)
0 -1 0
#boundary connection counts
1
#boundary connection elements
1
#boundary connection zones
2
```

## Polyhedral - complex example



Remember that Tecplot Focus cannot load face-based (polygonal or polyhedral) data.

A single tetrahedron bounded on face two by zone two (elements 13 and 14) and on face three by zone three (element 11).

```
Zone
ZoneType=FEPolyhedron
Nodes=4
Faces=4
Elements=1
TotalNumFaceNodes=12
NumConnectedBoundaryFaces=2
TotalNumBoundaryConnections=3
...variable values in block format...
```

```

#node count per face
3 3 3 3
#face nodes
1 2 3
1 4 2
2 4 3
3 4 1
#left elements (negative indicates boundary connection)
0 -1 -2 0
#right elements
1 1 1 1
#boundary connection counts
2 1
#boundary connection elements
13 14 11
#boundary connection zones
2 2 3

```

## 4 - 6 ASCII Data File Conversion to Binary

Although Tecplot 360 can read and write ASCII or binary data files, binary data files are more compact and are read into Tecplot 360 much more quickly. Even if you write ASCII files, for best performance, we recommend that you convert your data files to binary as a post-processing step, before interactive visualization.

In the *bin* folder of your Tecplot 360 distribution you will find Preplot, which converts ASCII to binary data files. You can also use Preplot to debug ASCII data files that Tecplot 360 cannot read.

### 4 - 6.1 Preplot Options

To use Preplot, type the following command from the UNIX shell prompt, from a DOS prompt, or using the Run command on Windows platforms:

```
preplot infile [outfile] [options]
```

where *infile* is the name of the ASCII data file, *outfile* is an optional name for the binary data file created by Preplot, and *options* is a set of options from the standard set of Preplot options. If *outfile* is not specified, the binary data file has the same base name as the *infile* with a .plt extension. You may use a minus sign ("-") in place of either the *infile* or *outfile* to specify standard input or standard output, respectively.

Any or all of -iset, -jset, and -kset can be set for each zone, but only one of each per zone.

For the standard set of preplot options, see [Section B - 3 "Preplot"](#) in the [User's Manual](#).

### 4 - 6.2 Preplot Examples

If you have an ASCII file named *dset.dat*, you can create a binary data file called *dset.plt* with the following Preplot command:

```
preplot dset.dat dset.plt
```

By default, Preplot looks for files with the .dat extension, and creates binary files with the .plt extension. Thus, either of the following commands is equivalent to the above command:

```
preplot dset
preplot dset.dat
```

Preplot checks the input ASCII data file for errors such as illegal format, numbers too small or too large, the wrong number of values in a data block, and illegal finite element node numbers. If Preplot finds an error, it issues a message displaying the line and column where the error was first noticed. This is only an indication of where the error was *detected*; the actual error may be in the preceding columns or lines.

If Preplot encounters an error, you may want to set the debug option to get more information about the events leading up to the error:

```
preplot dset.dat -d
```

You can set the flag to -d2, or -d3, or -d4, and so forth, to obtain more detailed information.

In the following Preplot command line, the number of points that are written to the binary data file `dset.plt` is less than the number of points in the input file `dset.dat`:

```
preplot dset.dat -iset 3,6,34,2 -jset 3,1,21,1 -iset 4,4,44,5
```

For zone three, Preplot outputs data points with I-index starting at six and ending at 34, skipping every other one, and J-index starting at one and ending at 21. For zone four, Preplot outputs data points with the I-index starting at four, ending at 44, and skipping by five.

In the following Preplot command line, every other point in the I-, J-, and K-directions is written to the binary data file:

```
preplot dset.dat -iset ,,,2 -jset ,,,2 -kset ,,,2
```

The *zone*, *start*, and *end* parameters are not specified, so all zones are used, starting with index one, and ending with the maximum index. The overall effect is to reduce the number of data points by a factor of about eight.



# Glossary

The following terms are used throughout the *Data Format Guide* and are included here for your reference.

<b>2D</b>	Plotting in two dimensions. Line plots of one or more variables (XY and Polar Line plots) are not considered 2D.
<b>2D Cartesian Plot</b>	A plot of some variable by location on a single plane using two axes.
<b>3D</b>	Plotting in three dimensions. Three-dimensional plotting can be subdivided into 3D surface and 3D volume.
<b>3D Cartesian Plot</b>	A plot displaying a 3D scattering of points, surfaces, or volumes using three orthogonal axes.
<b>3D Surface</b>	Three-dimensional plotting confined to a surface. For example, the surface of a wing.
<b>3D Volume</b>	Three-dimensional plotting of data that includes interior data points of a volume, as well as those on the surface. For example, the vector field around a wing.
<b>Active Zone</b>	A zone that is displayed in the current plot, as determined in the Zone Style dialog.
<b>ASCII Data File</b>	A data file composed of human-readable statements and numbers using ASCII characters.
<b>Auxiliary Data</b>	Metadata attached to zones, data sets, and frames.
<b>Binary Data File</b>	A data file composed of machine-readable data. This type of file is created by converting ASCII data files with Preplot, or by directly creating them from an application.
<b>Block</b>	A data file format in which the data is listed by variable. All the point values of the first variable are listed first, then all the point values of the second variable, and so forth.
<b>Boundary Cell Faces</b>	A set of un-blanked cell faces in a 3D volume zone which have only one neighboring volume cell. In contrast, interior cell faces have two neighboring volume cells, one on either side, which share the face. For an IJK-ordered zone the boundary cell faces are on the exterior of the zone. That is, the first and last I-planes, the first and last J-planes, and the first and last K-planes. For a finite element 3D volume zone, boundary cell faces are on the exterior of the zone and the surface of any voids within the zone.

<b>Brick</b>	An element type of finite element volume data composed of eight node points arranged in a hexahedron-like format. This element type is used in 3D volume plotting.
<b>Cell</b>	Either an element of finite element data, or the space contained by one increment of each index of IJ- or IJK-ordered data.
<b>Cell-Centered Values</b>	Values located at the center of the cell (assumed to be the centroid).
<b>Connectivity List</b>	The portion of a finite element data file which defines the elements or cells by listing the relationships between points. The number of points per cell is determined by the element type.
<b>Custom Labels</b>	Text strings contained within a data file or text geometry file which define labels for your axes or contour table. You may select Custom Labels anywhere you can choose a number format, the result is the text strings in place of numbers. The maximum length of a custom label is 1024 characters.
<b>Data File</b>	A file that contains data used for plotting in Tecplot.
<b>Data Format</b>	The type of zone data as specified by the format parameter in a Tecplot data file, such as: BLOCK or POINT.
<b>Data Loader</b>	A Tecplot add-on which allows you to read non-Tecplot data files.
<b>Data Point</b>	An XYZ-point at which field variables are defined.
<b>Data Set</b>	A set of one or more zones. A data set may be plotted in one or more frames. However, a single frame may only plot one data set. A data set may be created by loading one or more data files.
<b>Element Type</b>	<p>The form of individual elements in a finite element zone. There are four types of cell-based finite element zones: Triangle and Quadrilateral (finite element surface types), and Tetrahedron and Brick (finite element volume types). For cell-based finite elements, the element type of a zone determines the number of nodes per element and their orientation within an element.</p> <p>There are two types of face-based finite element zones: polygonal (2D) and polyhedral (3D). For face-based elements, the number of nodes per element is variable. Tecplot Focus cannot load face-based zones.</p>
<b>FE</b>	An abbreviation for finite element, a common means of arranging data for calculations. (Often referred to as “unordered” or “unstructured”.)
<b>FE Surface</b>	A finite element zone of the element type Triangle, Quadrilateral, Polygon. These zones are used for 2D and 3D surface plots.
<b>FE Volume</b>	A finite element zone of the element type Tetrahedron, Brick, Polyhedron. These zones are used for 3D volume plots.
<b>Field Map</b>	A collection of zones for 2D and 3D field plots. A common style can be easily applied to all zones in the selection.
<b>Field Plot</b>	Includes 2D Cartesian and 3D Cartesian plot types. Generally used to display the spacial relationship of data. Mesh, Contour, Vector, Scatter and Shade are all considered field plots. XY and Polar Line plots and the Sketch plot type are not field plots.

<b>Finite Element</b>	A type of data point ordering. Data is arranged by listing the data points (called nodes), and then listing their relationships (called elements). The element type of the zone determines the number of nodes which are contained in each element, as well as the exact relationship of nodes within an element. There are several different element types supported by Tecplot: <a href="#">Triangle</a> , <a href="#">Quadrilateral</a> , <a href="#">Tetrahedron</a> , <a href="#">Brick</a> , <a href="#">Polygonal</a> and <a href="#">Polyhedral</a> . See also: <a href="#">Connectivity List</a> and <a href="#">Node</a>
<b>I-Ordered</b>	A type of data point ordering where each point is listed one at a time (that is, by one index). Used mainly in XY-plots. In 2D or 3D, this type of data point ordering is sometimes called irregular, and is only useful for scatter plots, or for interpolating into 2D, 3D surface, or 3D volume zones. (This type of data can also be used for 2D or 3D vector plots if streamtraces are not required.)
<b>IJ-Ordered</b>	A type of data point ordering where the points are arranged in a 2D array used for 2D and 3D surface plotting.
<b>IJK-Blanking</b>	A feature to include or exclude portions of an IJK-ordered zone based on index ranges.
<b>IJK-Ordered</b>	A type of data ordering where the points are arranged in a 3D array. Used for 3D volume plotting as well as 2D and 3D surface plotting.
<b>I-Plane</b>	In an ordered zone, the connected surface of all points with a constant I-index. In reality, I-planes may be cylinders, spheres, or any other shape.
<b>Irregular Data</b>	Points which have no order, or at least no order which can be easily converted to IJ- or IJK-ordering.
<b>J-Plane</b>	In an ordered zone, the connected surface of all points with a constant J-index. In reality, J-planes may be cylinders, spheres, or any other shape.
<b>K-Plane</b>	In an IJK-ordered zone, the connected surface of all points with a constant K-index. In reality, K-planes may be cylinders, spheres, or any other shape.
<b>Macro</b>	A file containing a list of instructions, called macro commands, which can duplicate virtually any action performed in Tecplot.
<b>Macro Command</b>	An instruction given to Tecplot in a macro file. Macro commands always start with a dollar sign and then an exclamation mark. For example, \$!Redraw refreshes a plot view.
<b>Macro File</b>	A file which contains a series of macro commands. Macro files are run from the command line, or through the Play option of the Macro sub-menu of the File menu.
<b>Macro Function</b>	A self-contained macro sub-routine.
<b>Macro Variable</b>	A holding place for numeric values in a macro file. There are two types of macro variables: user-defined (you set and retrieve the value), or internal (Tecplot sets the value and you may retrieve it).
<b>No Neighboring Element</b>	In polyhedral/polygonal fe data sets, the term “no neighboring element” refers to a face that does not have a neighboring element on either its right or left side.
<b>Node</b>	A point in finite element data.
<b>Number Format</b>	The style of numbers to display for a data or axis label; exponent, integer, float, and so forth.
<b>Ordered Data</b>	A type of data point organization which consists of a parameterized series of points. There are seven types of ordered data: I-, J-, K-, IJ-, JK-, IK-, and IJK-ordered. I-, IJ-, and IJK-ordered are the most common.

<b>Polygonal</b>	A 2D, face-based finite element type. The number of nodes per element is variable. That is, a single polygonal zone may contain triangular, quadrilateral, hexagonal, ..., etc. elements. Tecplot Focus cannot load this type of zone.
<b>Polyhedral</b>	A 3D, face-based finite element type. The number of nodes per element is variable. That is, a single polyhedral zone may contain tetrahedral and brick (and others) elements. Tecplot Focus cannot load this type of zone.
<b>Point</b>	A data file format for an I-, IJ-, or IJK-ordered zone in which the data is listed by point. All of the variable values for the first data point are listed first, then all the variable values for the second data point, and so forth.
<b>Quadrilateral</b>	An element type of finite element surface data which is composed of four node points arranged in a quadrilateral. Used in 2D and 3D surface plotting.
<b>Sharing</b>	Variable sharing allows a single storage location to be used by more than one party. For example, if the X-variable is shared between zones five and seven only one storage location is created. The storage is not freed by Tecplot until the number of parties accessing the data is reduced to zero. Variables and connectivity information may be shared.
<b>Subzone</b>	A portion of a zone,. Also refers to a file format ( <i>.szplt</i> ) introduced in Tecplot 360 EX that allows subzones to be loaded as needed for plots and other operations. In typical use cases, this significantly improves interactive performance and reduces memory footprint compared to <i>.plt</i> files.
<b>Tetrahedron</b>	An element type of finite element volume data which is composed of four node points arranged in a tetrahedron. (Used in 3D volume plotting.)
<b>Triangle</b>	An element type of finite element surface data which is composed of three node points arranged in a triangle. (Used in 2D and 3D surface plotting.)
<b>Unordered or Unorganized Data</b>	(See <a href="#">Irregular Data</a> .)
<b>Zone</b>	A subset of a data set which is assigned certain plot types. Zones may be activated (plotted) or deactivated (not plotted). Each zone has one type of data ordering: I-, IJ-, IJK-, or finite element. Zones are typically used to distinguish different portions of the data. For example, different calculations, experimental versus theoretical results, different time steps, or different types of objects, such as a wing surface versus a vector field around a wing.
<b>Zone Layers</b>	One way of displaying a 2D or 3D plot's data set. The plot is the sum of the active zone layers, which may include mesh, contour, vector, shade, scatter and edge.

# Binary Data File Format

Refer to this section only if you wish to write your own code that writes Tecplot binary-format (*.plt*) files without utilizing the TecIO library. Otherwise, refer to [Section 3 - 1 "Getting Started"](#) for instructions for linking with this library, which is provided at no cost by Tecplot, Inc.



Remember that polygonal zones are not available for Tecplot Focus. Refer to [Section 1 - 2 "Creating Data Files for Tecplot 360 EX and Focus"](#) for details.

The subzone file format (*.szplt*) is not currently documented because we anticipate the need for changes to the file format in the near future. Furthermore, the format is sufficiently complex that we do not expect application developers finding it worthwhile to undertake writing their own code to output in *.szplt* format. If you want your application to write subzone files and find the TecIO library insufficient, please contact us.

```
/*
BINARY FILE FORMAT:
-----
The binary data file format (as produced by the preplot) is described below.
```

The binary datafile has two main sections. A header section and a data section.

```
+-----+
| HEADER SECTION |
+-----+
+-----+
| FLOAT32 |      EOHMARKER, value=357.0
+-----+
+-----+
| DATA SECTION |
+-----+
```

## I. HEADER SECTION

The header section contains: the version number of the file, a title of the file, the names of the variables to be plotted, the descriptions of all zones to be read in and all text and geometry definitions.

i. Magic number, Version number

+-----+   "#!TDV112"  +-----+	8 Bytes, exact characters "#!TDV112". Version number follows the "V" and consumes the next 3 characters (for example: "V75 ", "V101").
-------------------------------------	---

ii. Integer value of 1.

+-----+   INT32   +-----+	This is used to determine the byte order of the reader, relative to the writer.
---------------------------------	--

iii. Title and variable names.

+-----+   INT32   +-----+	FileType: 0 = FULL, 1 = GRID, 2 = SOLUTION
+-----+   INT32*N   +-----+	The TITLE. (See note 1.)
+-----+   INT32   +-----+	Number of variables (NumVar) in the datafile.
+-----+   INT32*N   +-----+	Variable names. N = L[1] + L[2] + .... L[NumVar] where: L[i] = length of the ith variable name + 1 (for the terminating 0 value). (See note 1.)

iv. Zones

+-----+   FLOAT32   +-----+	Zone marker. Value = 299.0
+-----+   INT32*N   +-----+	Zone name. (See note 1.) N = (length of zone name) + 1.
+-----+   INT32   +-----+	ParentZone: Zero-based zone number within this datafile to which this zone is a child.
+-----+   INT32   +-----+	StrandID: -2 = pending strand ID for assignment by Tecplot -1 = static strand ID 0 <= N < 32700 valid strand ID
+-----+   FLOAT64   +-----+	Solution time.
+-----+   INT32   +-----+	Not used. Set to -1.
+-----+   INT32   +-----+	ZoneType 0=ORDERED, 1=FELINESEG, 2=FETRIANGLE, 3=FEQUADRILATERAL, 4=FETETRAHEDRON, 5=FEBRICK, 6=FEPOLYGON, 7=FEPOLYHEDRON
+-----+   INT32   +-----+	Data packing. 0 = Block 1 = Point
+-----+   INT32   +-----+	Specify Var Location. 0 = Don't specify, all data is located at the nodes.

```

1 = Specify
if "specify var location" == 1
+-----+
| INT32*NV | Variable Location (only specify if above is 1).
+-----+ 0 = Node, 1 = Cell Centered (See note 5.)

+-----+
| INT32 | Are raw local 1-to-1 face neighbors supplied?
+-----+ (0=FALSE 1=TRUE). These raw values are a
compact form of the local 1-to-1 face neighbors.
If supplied, Tecplot assumes that the face
neighbors are fully specified. As such, it
will not perform auto face neighbor assignment.
This improves Tecplot's time to first plot.
See the data section below for format details.
ORDERED and FELINESEG zones must specify 0 for
this value because raw face neighbors are not
defined for these zone types. FEPOLYGON and
FEPOLYHEDRON zones must specify 0 for this value
since face neighbors are defined in the face map
for these zone types.

+-----+
| INT32 | Number of miscellaneous user-defined face
+-----+ neighbor connections (value >= 0). This value
is in addition to the face neighbors supplied
in the raw section. FEPOLYGON and FEPOLYHEDRON
zones must specify 0.

if "number of miscellaneous user-defined
face neighbor connections" != 0
+-----+
| INT32 | User defined face neighbor mode
+-----+ (0=Local 1-to-1, 1=Local 1-to-many,
2=Global 1-to-1, 3=Global 1-to-many)

if FE Zone:
+-----+
| INT32 | Indicates if the finite element face neighbors
+-----+ are completely specified by the miscellaneous
face neighbors given: (0=NO, 1=YES). If yes,
then Tecplot will not perform auto assignment
of face neighbors otherwise all faces not
specified are considered boundaries. If no,
then Tecplot will perform auto-assignment of
the face neighbors unless the raw face neighbor
array was supplied. This option is not valid
for ORDERED zones.

if Ordered Zone:
+-----+
| INT32*3 | IMax, JMax, KMax
+-----+

if FE Zone:
+-----+
| INT32 | NumPts
+-----+
if ZoneType is FEPOLYGON or FEPOLYHEDRON:
+-----+
| INT32 | NumFaces
+-----+
+-----+
| INT32 | Total number of face nodes. For FEPOLYGON
+-----+ zones, this is NumFaces*2.
+-----+
| INT32 | Total number of boundary faces. If any
+-----+ boundary faces exist, include one to represent
no neighboring element.
+-----+
| INT32 | Total number of boundary connections.
+-----+

+-----+
| INT32 | NumElements
+-----+

```

+-----+	
INT32*3	ICellDim,JCellDim, KCellDim (for future use; set to zero)
+-----+	

For all zone types (repeat for each Auxiliary data name/value pair):

+-----+	
INT32	1=Auxiliary name/value pair to follow 0=No more Auxiliary name/value pairs.
+-----+	

If the above is 1, then supply the following:

+-----+	
INT32*N	name string (See note 1.)
+-----+	
+-----+	
INT32	Auxiliary Value Format (Currently only allow 0=AuxDataType_String)
+-----+	
+-----+	
INT32*N	Value string (See note 1.)
+-----+	

#### v. Geometries

+-----+	
FLOAT32	Geometry marker. Value = 399.0
+-----+	
+-----+	
INT32	Position CoordSys 0=Grid, 1=Frame, 2=FrameOffset(not used), 3= OldWindow(not used), 4=Grid3D
+-----+	
+-----+	
INT32	Scope 0=Global 1=Local
+-----+	
+-----+	
INT32	DrawOrder 0=After, 1=Before
+-----+	
+-----+	
FLOAT64*3	(X or Theta),(Y or R),(Z or dummy) i.e. the starting location
+-----+	
INT32	Zone (0=all)
+-----+	
+-----+	
INT32	Color
+-----+	
+-----+	
INT32	FillColor
+-----+	
+-----+	
INT32	IsFilled (0=no 1=yes)
+-----+	
+-----+	
INT32	GeomType 0=Line, 1=Rectangle 2=Square, 3=Circle, 4=ellipse
+-----+	
+-----+	
INT32	LinePattern 0=Solid 1=Dashed 2=DashDot 3=DashDotDot 4=Dotted 5=LongDash
+-----+	
+-----+	
FLOAT64	Pattern Length
+-----+	
+-----+	
FLOAT64	Line Thickness
+-----+	
+-----+	
INT32	NumEllipsePts
+-----+	
+-----+	
INT32	Arrowhead Style 0=Plain, 1=Filled, 2=Hollow
+-----+	



+-----+	
INT32	Arrowhead Attachment 0=None, 1=Beg, 2=End, 3=Both
+-----+	
FLOAT64	Arrowhead Size
+-----+	
FLOAT64	Arrowhead Angle
+-----+	
IN32*N	Macro Function Command (string: N = Length+1)
+-----+	
INT32	Polyline Field Data Type
+-----+	1=Float, 2=Double (GTYPE)
+-----+	
INT32	Clipping (0=ClipToAxes, 1=ClipToViewport,
+-----+	2=ClipToFrame)

If the geometry type is line then:

+-----+	
INT32	Number of polylines
+-----+	
INT32	Number of points, line 1.
+-----+	
GTYPE*N	X-block geometry points N=NumPts
+-----+	
GTYPE*N	Y-block geometry points N=NumPts
+-----+	
GTYPE*N	Z-block geometry points N=NumPts (Grid3D Only)
+-----+	
.	
.	
.	

If the geometry type is Rectangle then

+-----+	
GTYPE*2	X and Y offset for far corner of rectangle
+-----+	

If the geometry type is Circle then

+-----+	
GTYPE	Radius
+-----+	

If the geometry type is Square then

+-----+	
GTYPE	Width
+-----+	

If the geometry type is Ellipse then

+-----+	
GTYPE*2	X and Y Radii
+-----+	

vi. Text

+-----+	
FLOAT32	Text marker. Value=499.0
+-----+	
INT32	Position CoordSys 0=Grid, 1=Frame,
+-----+	2=FrameOffset(not used),
	3= OldWindow(not used),
	4=Grid3D(New to V10)
+-----+	
INT32	Scope 0=Global 1=Local

+-----+	
FLOAT64*3	(X or Theta),(Y or R),(Z or dummy)
+-----+	Starting Location
+-----+	
INT32	FontType
+-----+	
INT32	Character Height Units 0=Grid, 1=Frame, 2=Point
+-----+	
FLOAT64	Height of characters
+-----+	
INT32	Text Box type 0=NoBox 1=Hollow 2=Filled
+-----+	
FLOAT64	Text Box Margin
+-----+	
FLOAT64	Text Box Margin Linewidth
+-----+	
INT32	Text Box Outline Color
+-----+	
INT32	Text Box Fill Color
+-----+	
FLOAT64	Angle
+-----+	
FLOAT64	Line Spacing
+-----+	
INT32	Text Anchor. 0=left, 1=center, 2=right, 3=midleft, 4=midcenter, 5=midright, 6=headleft, 7=headcenter, 8=headright
+-----+	
+-----+	
INT32	Zone (0=all)
+-----+	
INT32	Color
+-----+	
INT32*N	MacroFunctionCommand (string: N = Length + 1)
+-----+	
INT32	Clipping (0=ClipToAxes, 1=ClipToViewport, 2=ClipToFrame)
+-----+	
INT32*N	Text. N=Text Length+1
+-----+	

#### vii.CustomLabel

+-----+	
FLOAT32	CustomLabel Marker; F=599
+-----+	
INT32	Number of labels
+-----+	
INT32*N	Text for label 1. (N=length of label + 1) See note 1.
+-----+	
INT32*N	Text for label 2. (N=length of label + 1) See note 1.
+-----+	
.	
.	
.	

+-----+	
INT32*N	Text for label NumLabels.
+-----+	(N=length of label + 1) See note 1.

viii. UserRec

+-----+	
FLOAT32	UserRec Marker; F=699
+-----+	
+-----+	
INT32*N	Text for UserRec. See note 1.
+-----+	

ix. Dataset Auxiliary data.

+-----+	
FLOAT32	DataSetAux Marker; F=799.0
+-----+	
+-----+	
INT32*N	Text for Auxiliary "Name". See note 1.
+-----+	
+-----+	
INT32	Auxiliary Value Format (Currently only allow 0=AuxDataType_String)
+-----+	
+-----+	
INT32*N	Text for Auxiliary "Value". See note 1.
+-----+	

x. Variable Auxiliary data.

+-----+	
FLOAT32	VarAux Marker; F=899.0
+-----+	
+-----+	
INT32*N	Variable number (zero based value)
+-----+	
+-----+	
INT32*N	Text for Auxiliary "Name". See note 1.
+-----+	
+-----+	
INT32	Auxiliary Value Format (Currently only allow 0=AuxDataType_String)
+-----+	
+-----+	
INT32*N	Text for Auxiliary "Value". See note 1.
+-----+	

II. DATA SECTION (don't forget to separate the header from the data with an EOHMARKER). The data section contains all of the data associated with the zone definitions in the header.

i. For both ordered and fe zones:

+-----+	
FLOAT32	Zone marker Value = 299.0
+-----+	
+-----+	
INT32*N	Variable data format, N=Total number of vars 1=Float, 2=Double, 3=LongInt, 4=ShortInt, 5=Byte, 6=Bit
+-----+	
+-----+	
INT32	Has passive variables: 0 = no, 1 = yes.
+-----+	
if "has passive variables" != 0	
+-----+	
INT32*NV	Is variable passive: 0 = no, 1 = yes (Omit entirely if "Has passive variables" is 0).
+-----+	
+-----+	
INT32	Has variable sharing 0 = no, 1 = yes.
+-----+	
if "has variable sharing" != 0	
+-----+	
INT32*NV	Zero based zone number to share variable with (relative to this datafile). (-1 = no sharing). (Omit entirely if "Has variable sharing" is 0).
+-----+	
+-----+	
INT32	Zero based zone number to share connectivity list with (-1 = no sharing). FEPOLYGON and
+-----+	

FEPOLYHEDRON zones use this zone number to share face map data.

Compressed list of min/max pairs for each non-shared and non-passive variable. For each non-shared and non-passive variable (as specified above):

```
+-----+
| FLOAT64 |      Min value
+-----+
+-----+
| FLOAT64 |      Max value
+-----+
+-----+
| xxxxxxxxx|      Zone Data. Each variable is in data format as
+-----+      specified above.
```

ii. specific to ordered zones

```
if "zone number to share connectivity list with" == -1 &&
    "num of misc. user defined face neighbor connections" != 0
+-----+
| INT32*N |      Face neighbor connections.
+-----+      N = (number of miscellaneous user defined
                  face neighbor connections) * P
                  (See note 5 below).
```

iii. specific to fe zones

```
if ZoneType is NOT FEPOLYGON or FEPOLYHEDRON:
    if "zone number to share connectivity lists with" == -1
+-----+
| INT32*N |      Zone Connectivity Data N=L*JMax
+-----+      (see note 2 below ).

    if "zone number to share connectivity lists with" == -1 &&
        "raw local 1-to-1 face neighbors are supplied"
+-----+
| INT32*N |      Raw local 1-to-1 face neighbor array.
+-----+      N = (NumElements * NumFacesPerElement)
                  (See note 3 below).

    if "zone number to share connectivity lists with" == -1 &&
        "num of misc. user defined face neighbor connections" != 0
+-----+
| INT32*N |      Face neighbor connections.
+-----+      N = (number of miscellaneous user defined
                  face neighbor connections) * P
                  (See note 4 below).
```

if ZoneType is FEPOLYGON or FEPOLYHEDRON:

```
    if "zone number to share face map data with" == -1
+-----+
| INT32*F |      Face node offsets into the face nodes array
+-----+      below. Does not exist for FEPOLYGON zones.
                  F = NumFaces+1.

+-----+
| INT32*FN |      Face nodes array containing the node numbers
+-----+      for all nodes in all faces.
                  FN = total number of face nodes.

+-----+
| INT32*F |      Elements on the left side of all faces.
+-----+      Boundary faces use a negative value which is
                  the negated offset into the face boundary
                  connection offsets array. A value of "-1"
                  indicates there is no left element.
                  F = NumFaces.

+-----+
| INT32*F |      Elements on the right side of all faces. See
+-----+      description of left elements above for more
```

details. F = NumFaces.

if "total number of boundary faces" != 0

```
+-----+
| INT32*NBF |
```

Boundary face connection offsets into the boundary face connection elements array and the boundary face connection zones array. The number of elements for a face (F) is determined by  $\text{offset}[-o] - \text{offset}[-o-1]$  where 'o' is the negative value from either the left or right elements arrays above.  $\text{Offset}[0] = 0$ .  $\text{Offset}[1] = 0$  so that -1 as the left or right element always indicates no neighboring element. If the number of elements is 0, then there is no neighboring element.  
NBF = total number of boundary faces + 1.

```
+-----+
| INT32*NBI |
```

Boundary face connection elements. A value of "-1" indicates there is no element on part of the face.  
NBI = total number of boundary connections.

```
+-----+
| INT32*NBI |
```

Boundary face connection zones. A value of "-1" indicates the current zone.  
NBI = total number of boundary connections.

#### NOTES:

1. All character data is represented by INT32 values.

Example: The letter "A" has an ASCII value of 65. The WORD written to the data file for the letter "A" is then 65. In fortran this could be done by doing the following:

```
Integer*32 I
.
.
I = ICHAR('A');
WRITE(10) I
```

All character strings are null terminated  
(i.e. terminated by a zero value)

2. This represents JMax sets of adjacency zero based indices where each set contains L values and L is  
2 for LINESEGS  
3 for TRIANGLES  
4 for QUADRILATERALS  
4 for TETRAHEDRONS  
8 for BRICKS
3. The raw face neighbor array is dimensioned by (number of elements for the zone) times (the number of faces per element), where each member of the array holds the zero-based element neighbor of that face. A boundary face is one that has no neighboring element and is represented by a -1. Faces should only be neighbors if they logically share nodes and they should be reciprocal.
4.

FaceNeighbor Mode	# values	Data
LocalOneToOne	3	cz,fz,cz
LocalOneToMany	nz+4	cz,fz,oz,nz,cz1,cz2,...,czn
GlobalOneToOne	4	cz,fz,ZZ,CZ

GlobalOneToMany      2\*nz+4      cz,fz,oz,nz,ZZ1,CZ1,ZZ2,CZ2,...,ZZn,CZn

Where:

cz = cell in current zone (zero based)  
fz = face of cell in current zone (zero based)  
oz = face obscuration flag (only applies to one-to-many):  
    0 = face partially obscured  
    1 = face entirely obscured  
nz = number of cell or zone/cell associations  
    (only applies to one-to-many)  
ZZ = remote Zone (zero based)  
CZ = cell in remote zone (zero based)

cz,fz combinations must be unique and multiple entries are not allowed. Additionally, Tecplot assumes that with the one-to-one face neighbor modes, a supplied cell face is entirely obscured by its neighbor. With one-to-many, the obscuration flag must be supplied.

Face neighbors that are not supplied are run through Tecplot's auto face neighbor generator (FE only).

5. Cell centered variable (DATA SECTION)

To make reading of cell centered binary data efficient, Tecplot stores IMax\*JMax\*KMax numbers of cell centered values, where IMax, JMax, and KMax represent the number of points in the I, J, and K directions. Therefore extra zero values (ghost values) are written to the data file for the slowest moving indices. For example, if your data's IJK dimensions are 2x3x2, a cell-centered variable will have 1x2x1 (i.e. (I-1)x(J-1)x(K-1)) significant values. However, 2x3x2 values must be written out because it must include the ghost values. Assume that the two significant cell-centered values are 1.5 and 12.5. The ghost values will be output with a zero value.

So if the zone was dimensioned 2x3x2 its cell centered variable would be represented as follows:

1.5 0.0 12.5 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0

If the zone was dimensioned 3x2x2 its cell centered variable would be represented as follows:

1.5 12.5 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0

and if the zone was dimensioned 2x2x3 its cell centered variable would be represented as follows:

1.5 0.0 0.0 0.0 12.5 0.0 0.0 0.0 0.0 0.0 0.0 0.0

For large variables the wasted space is less significant than it is for the small example above.

-----  
\*/

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