

Using Primitives

A Primitive is a TMG entity that defines a set of 2-D elements terms of their geometric arrangement, location, orientation, material property table, physical property table, number and placement of elements, element ID, element color, element order (linear or parabolic) and units of measurement.

The Primitives tool creates or modifies these entities. The tool consists of a form that specifies the characteristics of the entity. When you select a *Primitive Type* (basic shape) and a *Creation Method* (create by points or parameters), a graphic appears on the form indicating terms that define the primitive. If you pick the graphic, a web browser window will open, with additional information for the specific Primitive Type and Creation Method depicted, including a diagram identifying the front and reverse side of elements created and their labeling sequence.

Once you have created the primitive, you can position it with the *Translate Primitive* and *Rotate Primitive* commands available through the TMG Model Manager. You can also position the primitive with the Meshing task command *Orient Off Geometry*.

Elements that are part of a primitive are automatically grouped on creation; the group name is identical to the primitive name. If you delete the primitive, you have the option of deleting only the primitive definition, or deleting the elements as well. If you delete the elements, an empty group will remain.

You can also import or export Primitives from or to ESARAD, TSS and Thermica (see *Primitive Import and Export*).

Creating Primitives

You create the elements by selecting a geometric shape and specifying its parameters in terms of the global coordinate system using one of three methods:

- picking points off geometry or FE entities in the graphics region
- specifying points as global coordinates
- specifying parametric values

Before defining the parameters or points, select the primitive type and creation method. Examine the diagram that appears on the form to understand how to fill out the form.

Defining Primitives by Picking Key Points

By Points allows you define the Primitive by specifying key points:

1. In the *Parameters* list, select one of the points (*P1*, *P2* etc.) you want to specify
2. Pick the *Pick* button. The Primitives form disappears.
3. Pick the point off geometry or the FE entity on the Graphics region. You can use mouse button 3 to access any of the standard I-DEAS methods to pick the point. The Primitives form reappears.
4. Repeat steps 1 through 3 until you have defined all the key points (and optional points

if your model requires them).

Defining Primitives by Specifying Global Coordinates

By *Points* allows you define the Primitive by specifying key points using global coordinates:

1. In the *Parameters* list, select one of the points (*P1*, *P2* etc.) you want to specify (see the diagram to understand what point you are defining).
2. In the coordinates field below, enter X, Y and Z coordinates for the point, separated by commas. Press the Enter key or pick the green dot next to the field.
3. Repeat steps 1 and 2 until you have defined all the key points (and optional points if your model requires them).

Defining Primitives by Parameters

The *By Parameters* creation method allows you to specify maximum and minimum values to define the primitive geometry. To define the Primitive by parameters:

1. In the *Parameters* list, select one of the parameters (*XMax*, *AngMax* etc.) you want to specify (see the diagram to understand what parameter you are defining). When you select a parameter, a button labeled *Measure* appears below. You can use this button to measure between key points on the geometry or FE model; the measured distance appears in the List region. This can make it easier to determine the correct values for the parameter.
2. In the parameter field below the list, enter the value for the parameter. Press the Enter key or pick the green dot next to the field.
3. Repeat steps 1 and 2 until you have defined all the parameters (and optional parameters if your model requires them).

Specifying Element Front Sides

When you create a primitive, the front side of the element faces a specific direction by default. Verify default front sides for each primitive type and creation method by clicking on the diagram on the form, or remember the following rules:

- 3-D primitives - Default element front sides face outwards (away from the 3-D volume)
- 2-D primitives created by parameters - Default element front sides face +Z
- 2-D primitives created by points - Default element front sides determined by the right hand rule, using the sequence P1, P2, P3, etc. to define a rotation

To reverse the default element direction for 3-D primitive types (box, sphere, etc.), select *Front side is inward*. To reverse the default element direction for 2-D primitive types (rectangle, triangle, etc.), select *Front side is reversed*.

Positioning a Primitive in the Model

Rarely is a primitive created exactly where you need it. After creation, you must translate and/or rotate it into the proper position in the model. To do so, you can use any of three methods: the Translate and Rotate icons on the form, the TMG Model Manager or the Meshing task command *Orient Off Geometry*.

To position using the icons on the Primitives form:

1. Pick the Translate icon or the Rotate icon on the right side of the form.
2. These commands use the same methods as the Translate and Rotate commands in the Master Modeler task. Use these techniques to position the current primitive.

To position using the Model Manager

1. After the primitive has been created, open the Model Manager (icon) and double-click the Primitives heading to display the list of Primitives.
2. Double-click the name of the Primitive you want to position (or select it and pick *Modify*). The Modify Primitive form opens.
3. Pick *Translate* or *Rotate*, depending on how you want to position or orient the primitive.
4. Enter the XYZ values for the translation, or the XYZ degree values for the rotation.

To position using the *Orient Off Geometry*, switch to the Meshing task, and press Ctrl-M to display the command menu. Pick *Element*, *Orient Off Geometry*, and use any of the commands in the menu.

Modifying Primitive Definition

To modify a Primitive, open the Model Manager (icon), select an existing Primitive from the list and pick *Modify*. The Modify Primitive form opens; pick *Modify Primitive Definition*. The Primitives form opens. Any of the fields or menu picks on the form can be used to modify the Primitive. Previously defined translations and rotations are preserved. However, if you select a different *Primitive Type* (basic shape) or a different *Creation Method* (create by points or parameters), you must redefine the points or parameters from scratch, as well as the translation or rotation.

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