

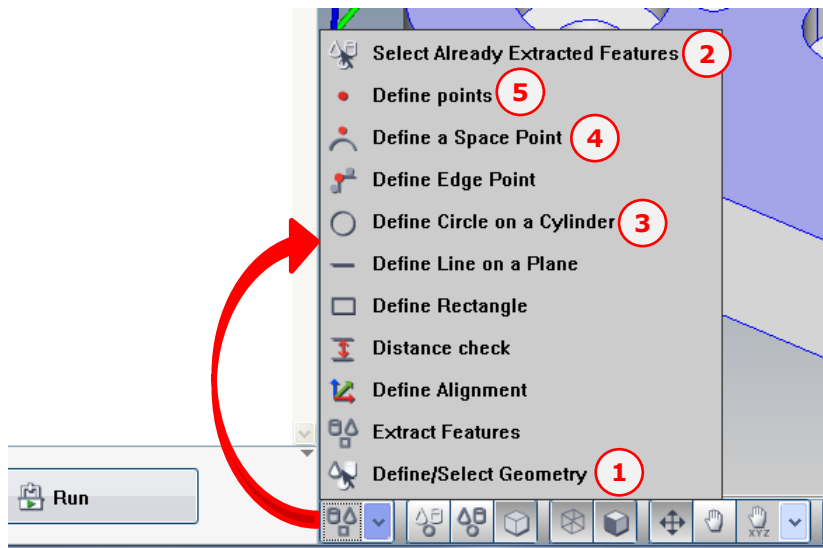
# CALYPSO.

## CAD Programming Overview

Creating a measurement plan from a CAD model is by far the easiest way to program Calypso. Not only is it faster than using “teach-in” but all of your feature and characteristic nominals come directly from the model. This document outlines the CAD programming tools available in Calypso, the steps typically used to create a program with a CAD model, and some additional useful CAD functions.

### CAD Programming Tools

When you are programming off the model, you have to use the mouse to create features in your program. The CAD programming tools are located at the far left of the CAD toolbar. Only the most used tools are described here and the list on the right shows them in order of most used. They will work with a single left click on a surface.



#### 1. Define/Select Geometry

*When clicking on a surface that has not been defined (added to the feature list), a new feature is created. If the surface is already in the feature list, Calypso selects the existing feature.*

#### 2. Select Already Extracted Features

*If the surface clicked on the model is in the feature list Calypso selects it; otherwise nothing happens. This is the default tool when you open a measurement plan.*

#### 3. Define a Circle on a Cylinder

*Instead of creating a cylinder or cone, a circle is created on the surface exactly where it was clicked.*

#### 4. Define a Space Point

*A point feature is created at the location clicked. The vector will be normal to the surface.*

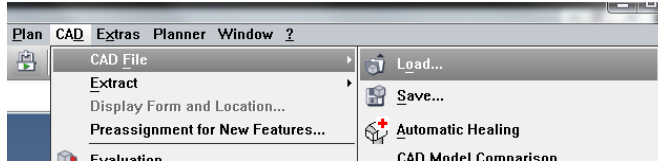
#### 5. Define Points

*Works exactly like manually probing the part with the CMM (auto feature recognition).*

# CAD Programming Steps

## 1. Load the CAD model

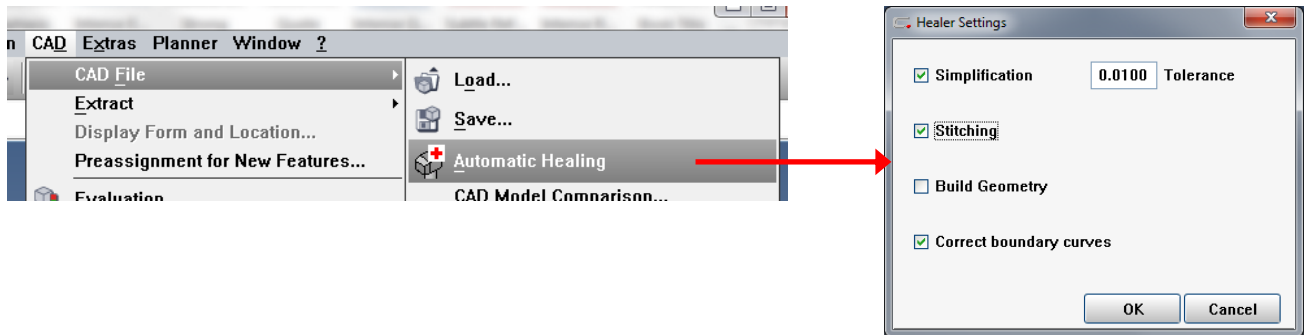
Create a new program and select **CAD>CAD File>Load...**



\*\* The files type pulldown in the File Open dialog will show you what CAD formats you can load into Calypso. This can also be found in **Extras>Settings>Miscellaneous...**

## 2. Heal the model (optional)

Some CAD models (especially IGES) have issues and need some "massaging" before they can be effectively used in Calypso. The healing functions in Calypso attempt to fix these imperfections. To open the healing dialog select **CAD>CAD File>Automatic Healing**.



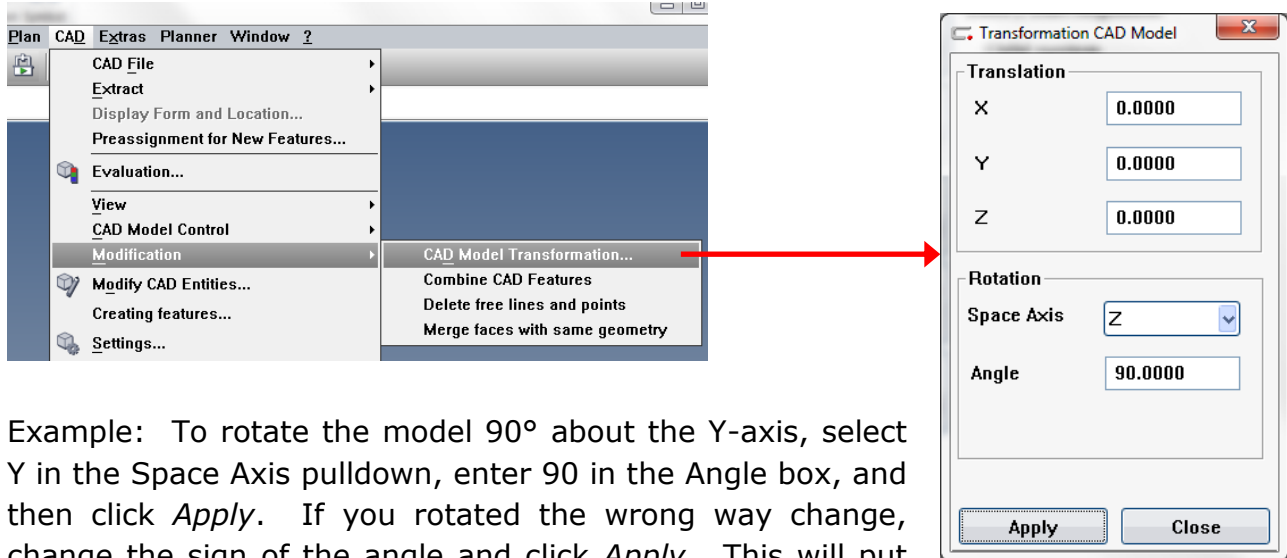
Typically you will only need to do Simplification, Stitching, and Correct Boundary curves.

- **Simplification:** Converts spline geometry into their corresponding analytic forms (e.g. arc, cone, plane, etc.), wherever possible. This will change your model so don't change the tolerance (default is 10µm).
- **Stitching:** Combines sets of faces to form a single sheet or solid body (e.g. 2 halves of the same cylinder).
- **Build Geometry:** A series of geometric operations are performed to improve the precision of face, edge, and vertex data. Essentially the model is completely rebuilt. The only time it is good to use this is if the model is still unusable after simplification & stitching. Typically only IGES models need build geometry, but not always.

\*\* Native CAD files (UG, ProE, Solidworks, Catia, etc.) rarely need to be healed.

### 3. Change the orientation of the model (optional)

More often than not it seems that the easiest way to stage the part on the CMM does not match the orientation of the model. Prior to starting the program you will want to orient your CAD model so that the X, Y, & Z axes match the way the part is setup on the CMM. To change the orientation of the model select **CAD>Modification>CAD Model Transformation...** It is not necessary to shift the model origin since it will be replaced by the Base Alignment once it is defined.



Example: To rotate the model 90° about the Y-axis, select Y in the Space Axis pulldown, enter 90 in the Angle box, and then click *Apply*. If you rotated the wrong way change, change the sign of the angle and click *Apply*. This will put you back to your original location.

\*\* When you click *Apply* the model is both translated & rotated by the values listed. Be cautious of what's in each box before you click *Apply*.

### 4. Setup Default Strategies (optional)

Go into Resources>Save/Load Defaults to setup appropriate measuring strategies for the features you intend to measure. Also activate Filters & Outliers with appropriate settings for your part.

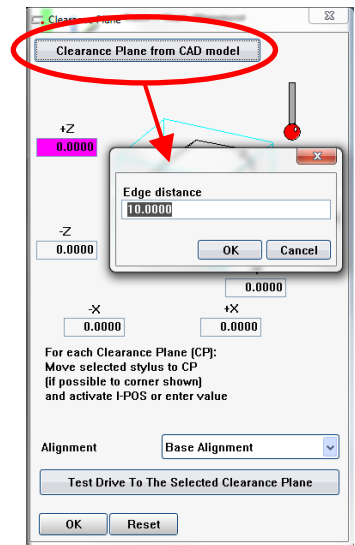
### 5. Create Base Alignment

- From the Measurement Tab, click the button for Base/Start Alignment then click OK to create a new base alignment
- Change you CAD tool to Define/Select Geometry
- Left click on the features in the CAD model that you want to use for the primary, secondary, & tertiary datums in that order. As you click a feature, that feature will be used in as many slots in the template as possible.

\*\* An alternate method is to use the Define/Select Geometry tool to add the datums features to the feature list then manually fill in the Base Alignment template. This is typically recommended is you have constructions as part of the base alignment.

## 6. Create Clearance Planes

- From the Measurement Tab, click the Clearance Planes button.
- Click the button in the upper left of the clearance planes window for "Clearance Plane from CAD Model".
- In the Edge Distance dialog enter a value for how much bigger than the part the clearance planes should be. The default value is 10mm (0.3937") which is usually sufficient. Click OK and the clearance planes are automatically generated.



## 7. Creating Characteristics

- Add a characteristic from either the Size or Form and Location pulldown menu.
- Open the characteristic and, using Define/Select Geometry (or the appropriate) tool, select the feature for the characteristic on the CAD Model.
- If necessary, click the datum features.
- Enter the tolerance and make any necessary changes (name, tolerance type, etc.)

\*\*As it did with the Base Alignment template, selecting features in a characteristic template will cause Calypso to insert that feature into the first appropriate position.

## 8. Edit Measurement Strategies

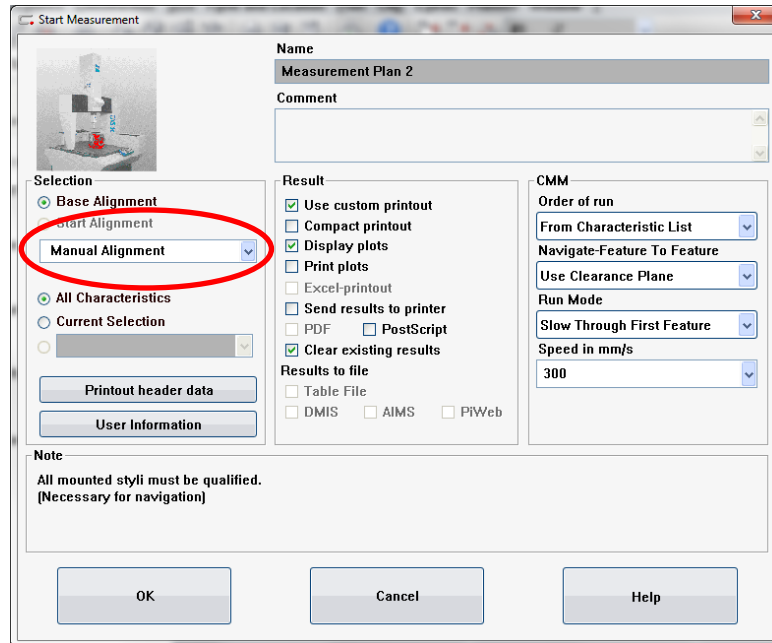
For each feature you create you will want to verify that the measuring strategy automatically created will work. Below are some notes about creating/editing strategy in CAD (most of these work whether or not you loaded a model...remember you always have a CAD model in Calypso).

- Planes
  - Points: When the strategy window is you can click & drag points around the surface. Hover the mouse over the point on the surface (not the arrow, the icon will change to hand) then click and drag the point to its new location.
  - Polylines:
    - With a polyline strategy open, clicking in the model will add those points to the polyline (exactly the same as manual probing with the CMM). Already created points can be moved by clicking and dragging.
    - The "Polyline from Model" button will automatically create a polyline to match the actual shape of the plane. When you click the button you will be prompted for an offset which is how far in from the outer edges the polyline will be created.

- Multi-polyline: When you click this strategy button you are immediately prompted for and edge distance. Calypso will then create a polyline around each edge on the surface.
- Circle Path: You can click and drag the center point (X) of a circle path to reposition it and on the circle itself to change the size.
- Cylinders/Cones: You can click and drag circle paths to move them up/down on the feature.

## 9. Run the Program

Since this program was created using a CAD model the CMM assumes that the Base Alignment of the part is located at machine home (back, upper left corner of the CMM). The first time the program is run you **must select "Manual Alignment"** on the run menu. Once the alignment has been run manually you can run the program as normal.



## Other Useful CAD Functions

---

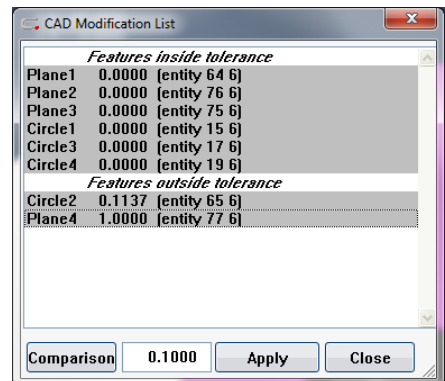
- **Delete the CAD Model**

To delete the CAD model from a program select **CAD>View>Delete**. The model will be immediately removed from the program. Note that there is no undo and closing the program without saving changes will not have an effect.

- **CAD Model Comparison**

Occasionally the link between the features in a program and the CAD model gets broken or never existed to begin with in the case of creating features from the pulldown menus or copying and pasting features between programs. It may also be necessary to delete an existing model and load a new updated model. In this case the features in the program will not be linked to the CAD model. The CAD Model Comparison tool can be used to re-establish the link between features and the model

- Select **CAD>CAD File>CAD Model Comparison...**
- Set the tolerance and click the *Comparison* button. The list will be populated with the features in your program. In parenthesis Calypso will list a CAD entity with which the feature can be linked. It also lists the deviation between the feature and the associated entity. Selecting and feature in the list will highlight the potential associated feature in the model.
- Highlight the features you want to be linked (regardless of in or out of tolerance) then click *Apply* and close the window.



- **Settings**

Under **CAD>Settings...** you can change the look and feel of the CAD model. There are many settings but here is a short list of some of the most common items to change:

- **Display:** Allow you to change the color of the model, background, & selected feature.
  - **Image Quality:** This setting determines how precise the CAD model is drawn on the screen. It does not have anything to do with the accuracy of the model just how much of your computer's resources are being used to draw the model. For small parts it can be advantageous to change this to Fine. Make sure to hit apply after changing the setting.

- **Edges/Curves:** Setting for the color of the wireframe part of the model. It's usually best to pick a color that contrasts with the surface color.
  - **Stylus Path:** Color of the strategy paths, arrow size for single points, point style (x or probe tip), and other options.
  - **Text:** Can turn off feature names in the model and/or change the color
  
- **Evaluation**

This function allows you to display point deviations in the CAD model. It is found under **CAD>Evaluation**. Prior to adjusting the settings it's best to have a calculated characteristic (red or green background) selected so you can see the effects of your changes real time. Everything below refers to the Actuals tab.

  - Check the box next to Actual to turn the evaluation on/off
  - There are 4 ways to displays the deviations: Points, Polyline, Markers, & Triangles.
  - Markers (Whiskers) is a format most people like. A size between 0.25 and 1.0 works well depending on the point density.
  - Activating the Color Gradient will color code each marker based on where the corresponding point fell within the tolerance range. The properties button can be used to modify the colors. Changing the color map to "Color Classes" with 10 steps is a good setting.
  - Magnification exaggerates the deviations making them easier to see on the model.
  
- **Creating Features**

Features can be created directly from elements in the CAD model under **CAD>Creating Features...** It is usually easier to simply extract features using the Define/Select Geometry tool but sometimes that tool is not precise enough. Below are two common things to do under the Creating Features menu.

  - Points
    - Found at the bottom of the Creation tab, this tool allows you to create a point feature at an exact location on the model.
    - To create a point, type in the X, Y, & Z coordinates (relative to the base alignment) and click the point button to the left of the pulldown.
    - If the coordinates typed in don't lie on the CAD model, Calypso will create the point on the closest surface.
  - Section Tab
    - This tab allows you to slice or section the model to create entries to use on the Creation tab.

- The sectioning can be done with a plane or a cylinder. Once you change any of the values the plane/cylinder will appear in the CAD model.
  - Once the section plane/cylinder is located and sized where you want it click the *Section* button. Entities are created on the CAD model everywhere the section plane/cylinder intersects a surface.
- **Importing multiple models**

Multiple models can be imported into a Calypso program. A common scenario for this is separate models for the part and the fixture. This can be done by simply using **CAD>CAD File>Load...** multiple times. If the models don't share the same origin it will be necessary to reposition one or both of the models. This can be done under **CAD>Modify CAD Entities...** There are two ways to move the bodies (models):

    - Transformation Tab (positioning with exact values)
      - Click on one of the bodies (models)
      - Use the X, Y, & Z boxes for translation and the boxes below each for rotation about that axis.
      - After typing in a transformation value a ghosted image of the body will appear in the model window showing you where it will be after the transformation. Click Apply for it to take effect.
    - Positioning Tab (positioning by clicking in the CAD model)
      - Click the Position button in the middle of the page
      - Click a point on the body you want to move
      - Click a second point on the surface where you want the first point located.
      - A ghosted image of the body will appear in the model window showing you where it will be after the transformation. Click Apply for it to take effect.

*\*\* It's important to perform this manipulation prior to healing the model. Prior to healing each model is considered a separate bodies and thus allows you to move each one independently. After healing everything is combined into a single body and cannot be manipulated separately.*