The ProtoTRAK® Parasolid Converter Operating Manual

Parasolid for Mills
Compatible with offline and
RMX ProtoTRAK Control models

TRAK MACHINE TOOLS

SOUTHWESTERN INDUSTRIES, INC.

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1.0 Introduction

Thank you for your purchase of the ProtoTRAK Parasolid Converter software. In order to avoid repetition, this manual assumes you have basic proficiency with programming a ProtoTRAK CNC.

With the ProtoTRAK Parasolid converter, you may quickly and easily create ProtoTRAK part programs using the data stored in a Parasolid file.

With the ProtoTRAK Parasolid Converter, you are in complete control of the creation of your 2D or 2 ½ D part program. You pick the order of events and the direction you want to machine in an easy, interactive process. The coordinates are loaded into to the part program in the way you direct, leaving you the minimal task of adding the non-dimensional information in the prompted ProtoTRAK format.

1.1   Parasolid Versions

The ProtoTRAK Parasolid converter is only available for use with the ProtoTRAK RMX control used on mills. Its part number is CONV-PARA-RMX.

1.2   Parasolid Extension

Parasolid is a solid model file format owned by Siemens. Most solid graphical CAD systems can output as a Parasolid file. The standard program or file extension and the one that must be used with the ProtoTRAK is .X_T.

1.3   Mouse
You may run the Parasolid Converter on either the ProtoTRAK CNC or the ProtoTRAK Offline system (depending on which system you bought it for). If you run the converter on a non-touchscreen computer then a mouse is required. A mouse is not required on the ProtoTRAK RMX control.

1.4   Virus Protection:
As a device, ProtoTRAK CNCs are not generally susceptible to viral infections. The part "programs" they run are non-executable text files. You can further assure protection by avoiding e-mail programs and web browser programs loaded onto the ProtoTRAK and by using a router with a firewall. An anti-virus program is not necessary since the virus risk is low, and is not recommended because the background tasks may cause damage by interfering with ProtoTRAK real-time operation.

In addition to what is written above, the RX control has what is called a File Based Write Filter (FBWF) implemented. This protects the operating system and our software from malware. Malware includes computer viruses, Trojan horses, ransomware, spyware, etc.

The goal of the write filter is to enable a device to be configured a certain way and then, when it's rebooted, revert to a default clean state, with any writes from the last boot session wiped away.

The FBWF can be disabled via a service code so users can set up a network or commit a driver change (for example for a new USB memory device) to memory. It should be noted that when the FBWF is off, the operating system is vulnerable to malware so a user needs to be extra careful. Viruses that are now introduced will be there forever once the FBWF is turned back on. Our software will turn this FBWF back on automatically once you exit this service code.

1.5   Microsoft Updates:
Please note that the ProtoTRAK control is not designed to be automatically downloading updates from Microsoft, or for that matter any 3rd party software. There is only a limited amount of free

space on the mSATA memory device, and downloading files to it until it is full may result in the ProtoTRAK to stop working properly.

Also note, that administrators must exclude the ProtoTRAK from programs such as Windows Server Update Service, where the software will automatically try to download updates to the control.

2.0 Installing and Activating Parasolid

The Parasolid Converter is optional software that must be purchased from TRAK Machine Tools. If you purchased this option with your machine or control, the software should already be installed and activated. If this is the case, you may skip the rest of this section.

You can tell if your converter is activated on your ProtoTRAK RX CNC by tapping the Status Info Key and looking under Options Activated.

2.1   Installing the Parasolid Software

For ProtoTRAK Offline (all controls):   All current ProtoTRAK offline versions now contain the Parasolid software included in the installation (activation will still be required). You can download the latest version at www.trakmt.com.

2.2   Activating Parasolid
After the software is loaded, you must activate the key (our way of controlling the use of the software) with the following procedure:

1. On your ProtoTRAK control, go to Service Code 318 to Activate Converter (Service Codes are found in the Set Up Mode). Here you should see all active and inactive converters. Inactive converters will be listed in Gray. If the Parasolid Converter is not grayed out (i.e., it is black) it is already activated. Skip the rest of this section and go to 3.0 Loading a Parasolid part program.

2. Select the grayed out Parasolid Converter option and press Install.

3. A different screen will appear on which you will see a Hardware Key serial number, a Converter Serial and a phone number to contact TRAK Machine Tools Sales Support at 800-421-6875. You will also see a blank field labeled "Activation Password". If you already have your activation password, enter that in now and press Inc Set or Abs Set.

4. If you do not already have the activation password, write down the Hardware Key and Converter serial numbers shown on the screen and call TRAK Machine Tools Sales Support at 800-421-6875. After taking the serial numbers, Sales Support will give you your password.

5. After the password is entered, the Parasolid Converter is ready for use.

3.0 Creating a ProtoTRAK Program Using the Parasolid Converter

Creating a ProtoTRAK .PT10 program from a .X_T Parasolid is very straight forward. If you are already familiar with the ProtoTRAK DXF converter you will find Parasolid very easy.

3.1 Opening a Parasolid Part Program

Open the Parasolid file in Program In/Out mode with a X_T extension and then go to program mode to view the Parasolid file.

After the user moves past the program header screen, the following screen will be displayed when you open a file.
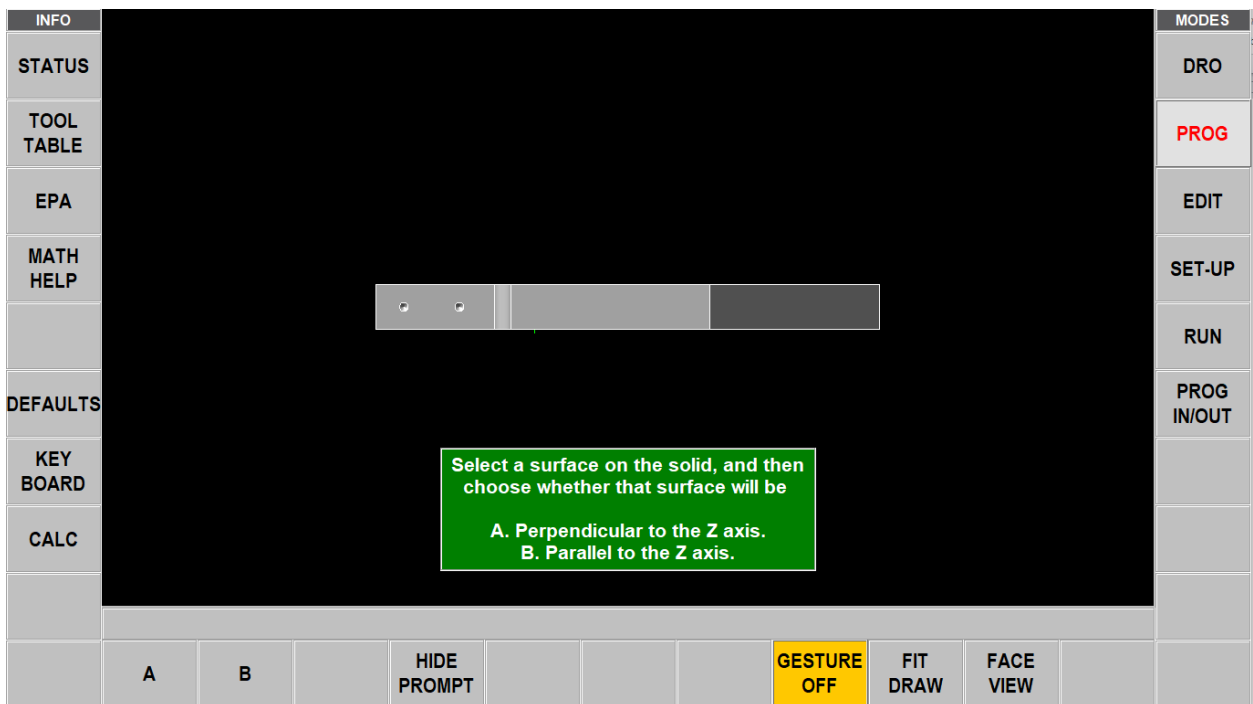
3.2 Gestures

The Parasolid software on the control or a touchscreen desktop computer is operated with the following gestures:

Tap – Tap is used to select an item such as a line or circle. To Tap, lightly touch the screen with one finger.

Swipe – Swipe is used to move from one screen to another, for example you move forward and back through Events in the Program Mode with swipes. To Swipe, touch the screen with one finger and move rapidly in the direction you want to move.

Pan – Pan is used to move content, such as a part drawing, around the screen. To Pan, touch the screen with one finger and move slowly in any direction.

Spread / Pinch - these gestures are used to zoom in or out of a drawing. Use your thumb and finger.

Rotate – Rotate is used to rotate a drawing or a solid model. Touch the screen with 2 fingers and twist to rotate the part along and axis projecting out of the screen. Move

your 2 fingers to the right to rotate around a vertical line on the screen. Move your 2 fingers to the left to rotate around a horizontal line on the screen. Move your 2 fingers CW or CCW on the screen to rotate around a point. Rotate does not work when viewing a 2D drawing screen.

The following mouse commands are used in the Parasolid software when using it on a non-touchscreen desktop computer. Please note that pan and zoom work differently when viewing a 2D representation of the part versus when you are viewing a 3D solid model of the part. See below for the different mouse commands. Please note the mouse behaves differently on the last Parasolid screen when in Solid Mode versus Program mode.

Solid Mode Screen or Any 2D Drawing Screen
- Zoom: Click and hold the right mouse button, and then slide the mouse up to zoom out or down to zoom in.
- Pan: Click and hold the left mouse button, and the slide the mouse in any direction that you wish to move the drawing. You can also pan up and down by using the scroll wheel on your mouse.

**Program Mode or Any Screen With 3D Model**
- Zoom: Use the scroll wheel on your mouse, scroll up to zoom in or scroll down to zoom out. You can also hold the left and right mouse button down together to zoom.
- Pan: Click and hold the right mouse button, and then slide part in direction you want to move the drawing.
- Rotate: Click and hold the left mouse button, and then slide mouse in any direction you wish to rotate your part three dimensionally.

Please also note that the mouse commands are also different in the screen where you set your Z and XY zero. When setting the Z absolute 0, the mouse commands match program mode. When setting the XY zero, the mouse commands match Solid Mode.

When moving from event to event in Solids or Program mode on a non-touchscreen computer, you can use the left and right arrow keys on our keyboard or swipe with your mouse. With the mouse, click somewhere on the event screen with the left mouse button and hold down while moving left to right or right to left.

3.3   Set Z Defaults

The defaults for Z are set under the Defaults Info button. Press this button to change these values at any time.
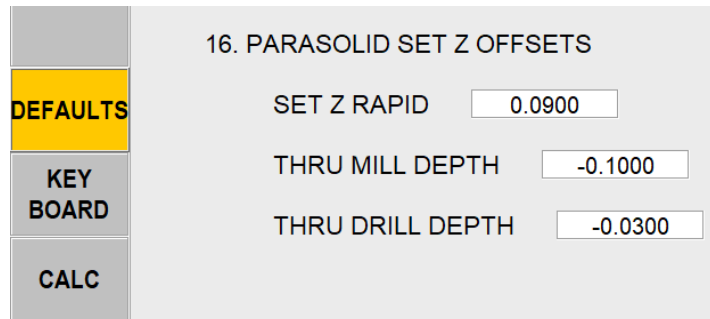
The data within the Parasolid knows the depth of every hole and surface. However, this is often not the depth you want your tool to go to. As you program the part you can choose whether you

want the depth of the tool to be the same as the surface you choose or adjusted by the defaults you input in the Default info screen.

> **Z Rapid:** is the rapid to feed transition distance above the surface to be machined
> **Thru Mill Depth:** is the distance (generally deeper and therefore minus) from the final depth surface. This is typical when machining a little below the bottom of a part when cutting around the part perimeter or through the part profile.
> **Thru Drill Depth:** is the distance (generally deeper and therefore minus) from the final depth surface plus the Z dimension of the drill conical point. This is automatically calculated because the Parasolid knows the hole diameter and assumes a 118° point drill.

3.4   Orientating the Part

From the screen in section 3.1 the Parasolid Converter is asking you to select which side is up on the part you are programming. Nearly always just select A, rotate the part to identify the up surface, click on that surface and click OK. Occasionally the up surface will be sloped (and therefore not perpendicular to Z) so click on B, rotate the part to find a vertical surface (a side or side of a hole), click on it and click OK.

Other Button Definitions:
- GESTURES OFF – turns off gestures and allows the user to select a surface without moving the part.
- FIT DRAW – fits the part in the center of the screen after the part has been moved, rotated or zoomed in or out.
- FACE VIEW – orientates the part back to the original view when the part was opened or the view that was selected with option A or B.
- HIDE PROMPT – hides the green box that is on the screen in case it covers the part.
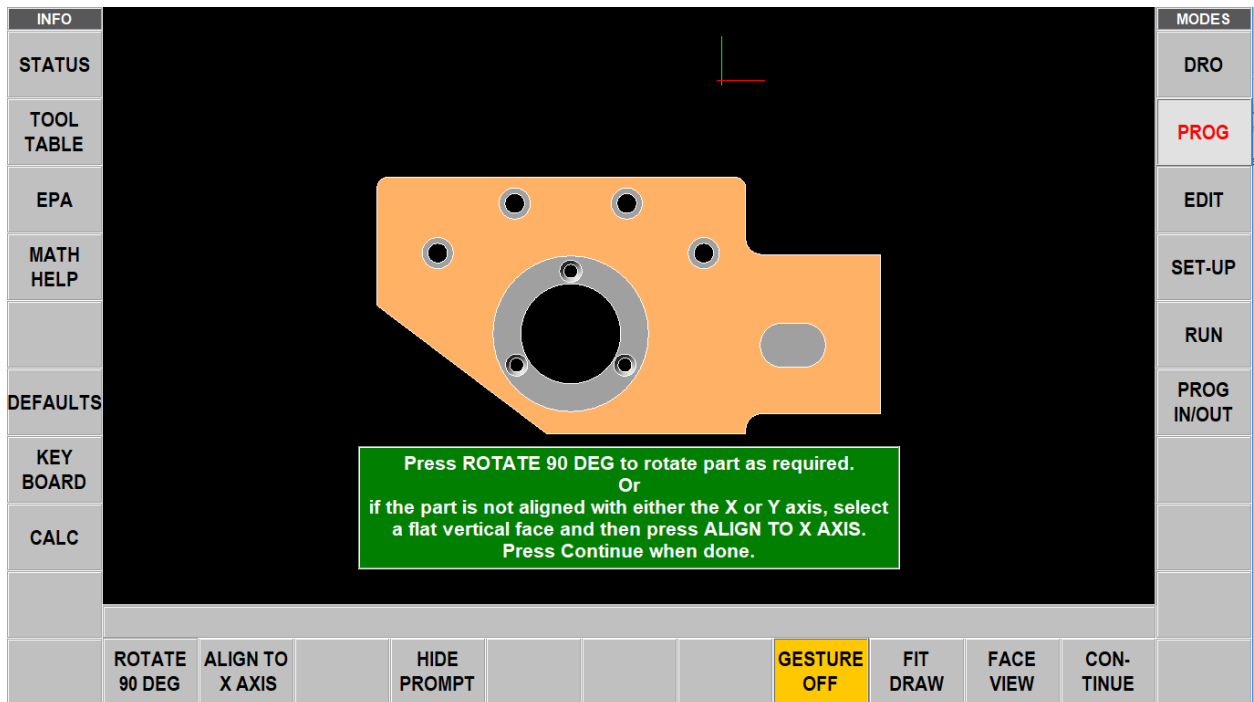
Next, you have the option to align the part relative to your X and Y axis. If needed, you can click on a flat surface to highlight it, and then click on ALIGN TO X AXIS to line up that straight edge

to the X axis. From there, you can rotate the part by clicking on ROTATE 90 DEG. Click Continue when satisfied. This is now your face view.

Note that you do not have to use the Rotate or Align features if you are already satisfied with how your part is oriented.

3.5   Setting Program Absolute Zero

3.5.1   Setting Absolute Zero

When the part is properly oriented, the Parasolid Converter will ask you to set the part absolute zero for Z and X and Y. The following screen shows the solid model on the left for setting the Z zero and the 2D drawing on the right for selecting the XY zero. For the Z absolute zero, rotate the part if necessary to show the Z absolute 0 (for example turn it over if the bottom of the part is your zero), click on the surface and click SET Z ABS 0.
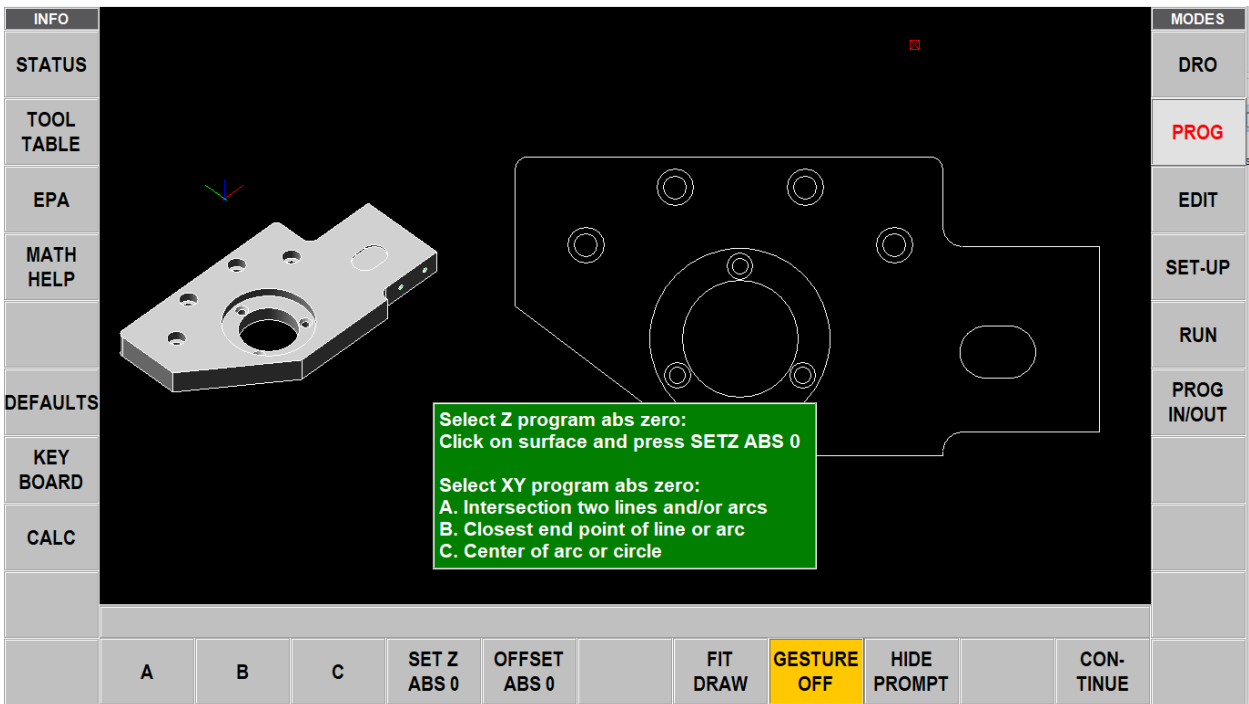
For the X and Y absolute zero, choose from one of the following. Once your X, Y and Z zero have been set, press CONTINUE to move forward.

3.5.2   Choice A: An Intersection

This allows you to use intersecting points, like corners, as the absolute zero reference. The intersecting points can be taken from two lines, two arcs, or a combination of a line and an arc. Circles cannot be used with this choice.

To make an intersection the absolute reference, select choice A, then click on the two pieces of geometry that will intersect at the point you want to use. After you click on the second piece of geometry, a red mark will appear to show you where the absolute zero is now set.

This choice also allows the use of the intersection of two lines that meet off of the given geometry. If this is the case, you may need to zoom out to see the red mark where the new absolute zero reference is set.

3.5.3   Choice B: An End Point

This allows you to the use an end point of a line or an arc. Click on a line or arc close to the end point to be used as the absolute zero reference. Circles cannot be used with this choice.

3.5.4   Choice C: An Arc Center

This allows you to use the center of an arc or circle as the absolute reference point by simply clicking on an arc or circle.

3.6   Editing the Drawing

Sometimes the lines of the drawing aren't exactly what you need to machine. For example, you may want to add a ramp on or off at the beginning or end of a profile. You can easily add lines to the print using the Add Line and New Point feature. Once these lines are added, they may be programmed in exactly the same way as the other features of your part.

Add Line: Creates a line between existing beginning or end points of a line or arc. Click on one line or arc at a place nearest to the point you want to use. A red X will confirm the point that is selected. Next, click on another line or arc. The DXF will add a new line between these points you designated. To remove the line immediately after it is drawn, click the Undo button.

New Point: Creates a line between an existing beginning or end point on the drawing, and a new point you establish by clicking the mouse. Click on one line or arc at a place nearest to the point you want to use. A red X will confirm the point that is selected. Next, click wherever you want the line to end. The DXF will add a new line between these points you designated. To remove the line immediately after it is drawn, click the Undo button.

Hide Geom: Click hide line then click on an unwanted line to hide it. Click UNDO to bring it back.

Break Geom: Allows intersecting lines to be broken into separate line segments. Click on one segment of one of the lines and then on one segment on the other line. Click on UNDO to unsegmentize the lines.

Inquire Geom: Click key then click any line, arc or circle. When clicking a circle the diameter will be shown on a screen to the right as shown in figure below. Press INQUIRE GEOM again to exit this feature. This feature may be useful to determine if you need to break geometry apart to create your part.
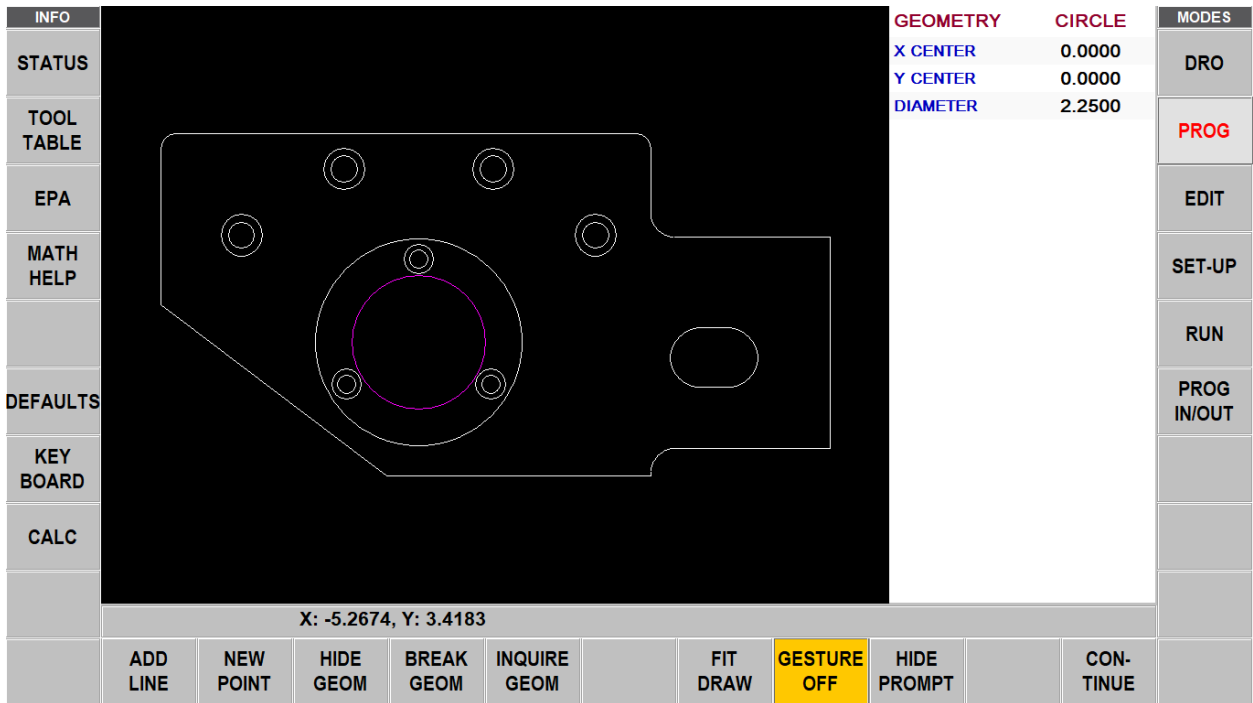
Press or click CONTINUE when editing is complete.

Note – if you continue and go to the next screen and begin to program your part and you realize you need to make an edit, you can go back to this screen by pressing the BACK button and edit without losing your program.

3.7 Converting Geometry into a ProtoTRAK Part Program

Now that the ProtoTRAK Parasolid Converter has the geometry, absolute reference and proper edits for the part, programming is just a matter of selecting the events. With the ProtoTRAK Parasolid Converter, you have total control over how the part is made - just like regular ProtoTRAK programming.

3.7.1 The basic steps are:

1. Pick the event type.

2. Pick the geometry on the drawing (go to the solid if you want a better representation of the part). The X and Y dimensions will be loaded into the event type you choose.

3. Click EVENT button to show the drop down event. Click on the Z RAPID, click View Solid in the status line, click on the surface that Z Rapid is measured from and click WITH OFFSET to load the appropriate value for Z RAPID.

4. Click on Z END (if not already highlighted), click on the surface that is the same as Z END and click WITH OFFSET (for through events) or NO OFFSET (for exact depths). See note below for countersinks.

5. For drill events on the Z END prompt, a button called USE END MILL will appear and allows the user to not apply the drill tip angle into the Z end prompt. Pressing this button will turn it yellow signifying it is active. Now when you click with offset or without offset it will not apply the drill tip compensation. This would be used if you are using an end mill to drill a counterbore. In this case you would not want drill tip compensation applied to this tool. Clicking the button a 2nd time will turn off this feature and the button will turn back to gray.

Drill Tip Compensation: When the USE END MILL button is gray or not selected, it allows the user to compensate for the drill tip assuming the drill has a 118^0 tip angle. When selected, it drives the Z end for the drill event down to the tip of the drill so it will be below the surface you actually picked. If you choose WITH OFFSET, it will also add the offset found in the Defaults Info button.
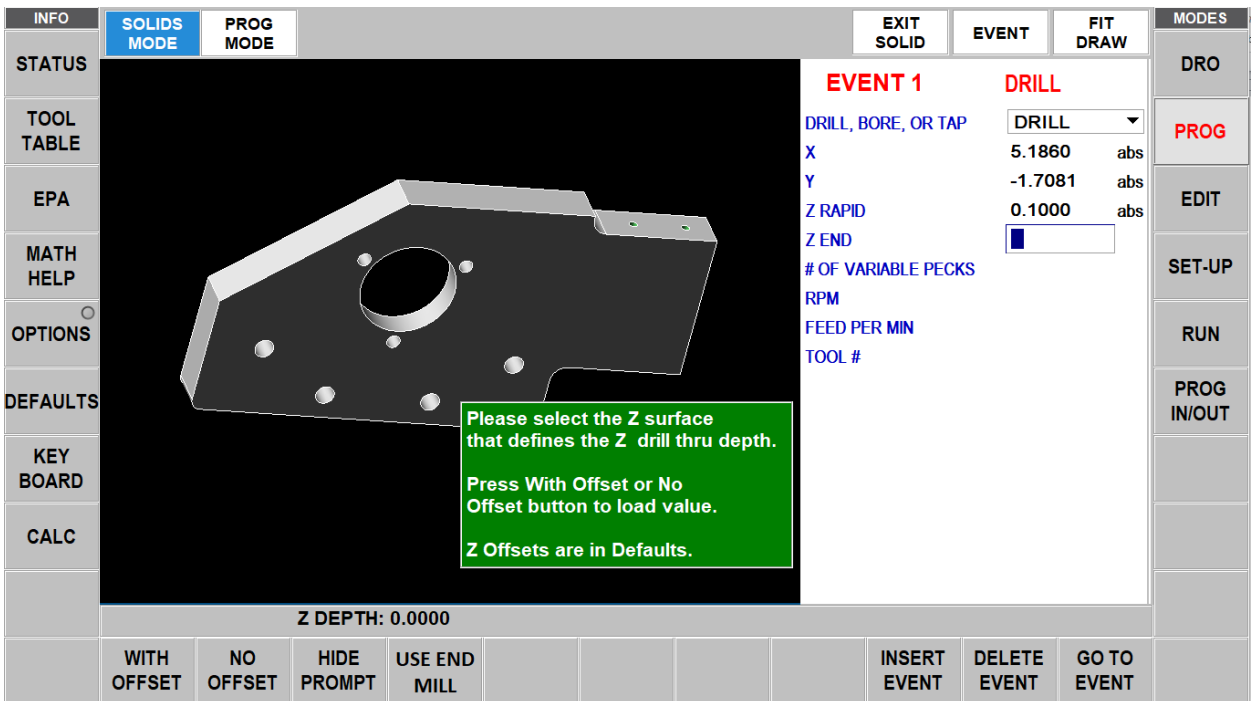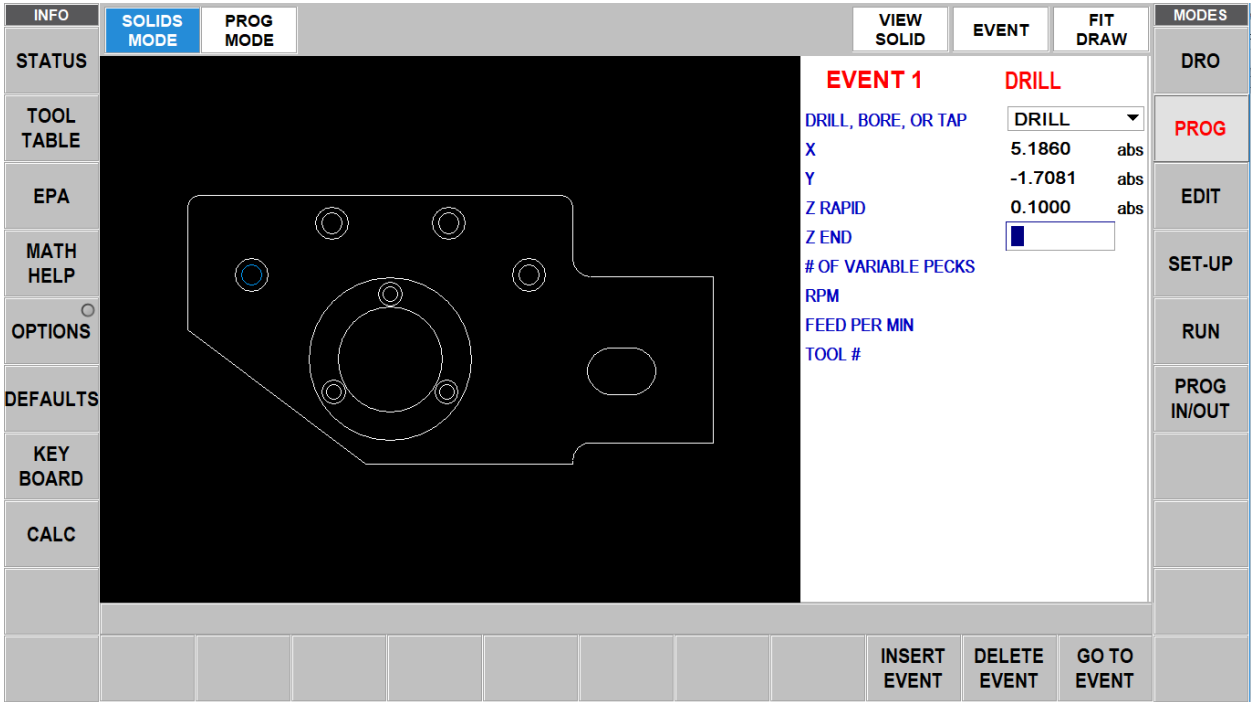
6. Fill in the rest of the prompts to complete the event.

7. Click EVENT to go back to the Select Event screen.

8. Repeat 1 through 7 for all geometry and events.

Countersink Note: For Z end on a countersink, zoom in and click the conical sloped surface. The parasolid knows the diameter and slope angle of the surface and will automatically calculate and load the proper Z dimension for the countersink point into the Z END prompt.

3.7.2   Event Types

Drill. Allows the conversion of any circle into a Drill, bore or tap event. All the same sized drills, bores or taps should be picked at the same time.

Mill. Allows the conversion of any straight line into a Mill event. Click on the end of the line where you want to establish the beginning point (X Beg, Y Beg).

Arc.   Allows the conversion of any arc in the drawing into an Arc event. Click on the end on the arc where you want to establish the beginning point (X Beg, Y Beg).

Profile.   Allows the conversion of any connecting lines and arcs into a Profile event. When selecting a profile event, the first line clicked determines where the profile starts and the second line clicked determines the direction of the profile. Each line or arc segment in the profile must be connected to each other but the profile may be open-ended.

Pocket. Allows the conversion of any connecting lines and arcs into a Pocket event. When selecting a pocket event, the first two lines clicked determine the direction of the Pocket (Clockwise or Counterclockwise). Pocket segment geometry must be connected to each other and must be closed – it needs to end where it began.

3.7.2   Functions active in this screen

Undo. The undo feature is active in this screen. Tapping this will undo one step for each time it is tapped while still in the same event group (event groups are described in section 3.7.3 below). The Undo button will only work on the current event type. For example, if you are selecting a group of drill events, you can undo as many drill events while the drill event is still active. Once you leave the event, you cannot undo the selections you made under the event.

Event. Tapping the Event button will change the screen to show the prompts for the event. This is where you complete the programming of the event by adding data like RPM, Feed Rate, Tool Number and Z-axis dimensions that are not available from the CAD drawing. When you pick your event and geometry, click the Event key to fill in the rest of the data needed.

Tap Event again to return to the Select and Event screen.

SOLIDS MODE. Select this key to be in the process of using the Parasolid file to select the geometries for programming.

PROG MODE. Select this key to go into the Program Mode (within the Parasolid process). You would want to do this if you wanted to program something that was not on the drawing file, for example a Face Mill to clean up the stock or a Position move to clear a clamp.

3.7.3   Event Groups

You create event groups out of items on the drawing that you want to machine the same way. Click on an event and then click all the similar pieces of geometry. When you press the Event key, the Parasolid Converter will automatically fill in the data in all the

events in the event group by using the data you enter in the first event of an event group.

For example, say you have 5 holes to drill that are all the same size. To program these, select Drill and click on each of the five circles on the drawing that represent the drill locations. By doing this, you have created an event group made up of these five drill events. Now click on the Event button. The screen will change to show the prompts for the first event of this event group. When you fill in the blank prompts (the X and Y data is already there for you), the data you fill in will automatically be inserted into the other four events in the event group.

You can tell you are selecting items for the same event group by the color. When each item is selected, it turns purple.

If you want to separate event groups, simply select a different event between them. The other way to signal that you have finished selecting items for the event group is to click on the Event button. When you do either of these things, the items will go from purple to blue, showing that you are no longer picking items for the event group.

Continuing with the example above, say that you want to counterbore the same five locations. The locations are the same, but you want to use a different tool, different RPMs and different Z dimensions. Therefore, you will establish a different event group. After you establish the first event group you can either click the Event button and program the data for the first group, click on the drill softkey again, or click on something other than Drill, and then select Drill again. You will now be working on a new event group.

3.7.4 Chaining

Chaining is a powerful feature of the Parasolid Converter that enables you to program pockets and profiles quickly and easily. You will be asked if you want to chain when you select Pocket or Profile. To use chaining select Yes, then click on the first line in the pocket or profile. The first line you select will determine where the ProtoTRAK begins to machine. You will then be prompted to continue. This second line tells the ProtoTRAK which direction to go.

Once the chaining begins, it will continue in the direction you choose until it encounters one of the following:

- An end point that is the same as the beginning of the profile or pocket event. This signals the completion of an enclosed shape.

- An intersection or branch that requires a decision from you. If this is encountered, the system will prompt you to select the direction by clicking the next line or arc segment you want included in the pocket or profile.

3.7.5 Color Schemes and Status Flags

Through out the conversion process on the 2D presentation the geometry changes colors from white, to purple, to blue to green.

White – Geometry not yet associated with any ProtoTRAK event.

Purple - Geometry has been associated with a ProtoTRAK event; the event type is still current and the Undo feature active for that event.

Blue - Geometry has been associated with a ProtoTRAK event; the event type is no longer current (you changed event types) or the Event button has been pressed. Additional information needs to be entered before the event is complete. Undo feature does not work on the event.

Green - The event has been completely defined, no further input is needed.

### 3.7.6   Completing the Event

Once you choose the event type and then click on the features on the print, you can fill in the event data in Solids mode or program mode. We recommend you do so in Solids Mode.

We have two reasons for this recommendation. First, we have noticed that when we use the Parasolid Converter with large programs, we find that answering the prompts right away makes it a bit easier to keep things straight. Defining the event in its entirety before moving to the next event makes it unnecessary to remember event numbers later on.

The second reason is that using the Parasolid Converter allows you to establish event groups (event groups are described above). Event groups make it easy to program like pieces of geometry. For example, say you wanted to machine five holes the same size. Within the Parasolid Converter you would select Drill, then select each of the holes to add them to your event group. Then you would click on Event and fill in the prompts. The information that you put in the prompts for the first of the Drill events would be copied to the rest of the events in the event group. In contrast, if you go to Program mode and fill in the prompts, you would have to fill in the same information for every drill event.

3.8   Sample Exercise

This exercise programs the part shown in this manual using the ProtoTRAK Parasolid Converter.
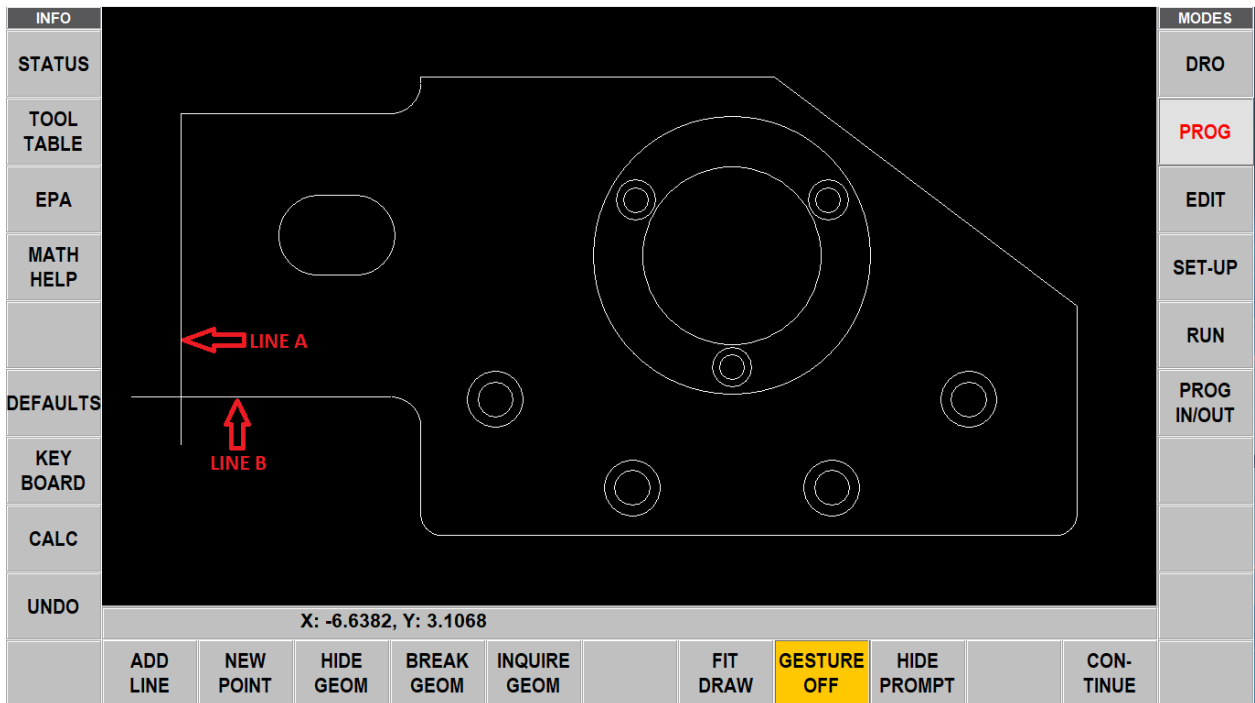
1. Open part number 15974 mod.X_T located in the X_T Sample program folder on the C drive of the ProtoTRAK.
2. Click A.
3. Rotate part to show side with 4 counterbored holes.
4. Click on top surface with the counterbored holes to declare it is up.

5. Click the ROTATE 90 DEG button 3 times to orientate part as shown in the figure above.
6. Click CONTINUE button.
7. Click on the top surface of the solid model on the left of the screen and press the SET Z ABS 0 button.
8. On the 2D drawing to the right, click C.
9. Click on either large circle line. Notice a red box at center of large circles. This is the X and Y absolute zero.
10. Click CONTINUE.
11. Click NEW POINT.
12. Click near bottom of line marked A, then drag a line down to form a ramp on move for machining the perimeter as shown in the figure above.
13. Click near the left side of line marked B, then drag a line to the left to form a ramp off move for machining the perimeter as shown in the figure above.
14. Click CONTINUE.
15. Click PROFILE to mill around the outer perimeter.
16. Click YES to chain.
17. Click the ramp on line created in step 12, then click the vertical line above it marked A above. The entire profile should now be purple.
18. Click EVENT to activate the drop down event box.
19. Touch or press with a mouse the the Z RAPID prompt.
20. Click View Solid key in the status line at the top of the screen.
21. Click the top surface as the reference from which Z RAPID is measured.
22. Click WITH OFFSET. The Z rapid prompt is filled in with 0.1000 abs (our Set Z default).
23. Rotate the part to show the bottom of the part.
24. Click the bottom surface.
25. Click WITH OFFSET because we want to machine a little lower than the bottom.
26. Click EXIT SOLID model to get back to the 2D screen.
27. Load in rest of the event information as you would in ProtoTRAK programming. Use tool offset – LEFT and Tool 1.
28. Click EVENT to eliminate the drop down box.
29. Click POCKET.
30. Click YES to chain.
31. Click a line and an adjacent arc in the oval pocket.
32. Click EVENT drop down box.
33. Touch or press with a mouse to get to the Z RAPID prompt.
34. Click View Solid, rotate to see the top of the part.
35. Click the top surface and click WITH OFFSET.
36. Click the bottom surface of the pocket (zoom if you need to) and click NO OFFSET because this is the exact depth that you want.
37. Load in the rest of the event information and use Tool 1.
38. Click EVENT to retract box.
39. Click POCKET, and NO to chain.
40. Click the larger circle around X/Y abs zero.
41. Click EVENT.
42. Touch or press with a mouse the Z RAPID prompt and just input 0.1000 because you know where the top of the part is.
43. Click View Solid and zoom in a bit.
44. Click the surface that is at the bottom of the larger circle which is the same as top of the 3 countersink holes, then click NO OFFSET.
45. Load in the rest of the event information and use Tool 1. Notice the radius was input automatically because the Parasolid model knows this.

46. Click EVENT to retract the box.
47. Click PROFILE and NO to chain.
48. Click the smaller through hole around X/Y abs zero.
49. Click EVENT.
50. Touch or press with a mouse to get to the Z RAPID prompt.
51. Click View Solid, click on the surface at the top of the 3 countersink holes and click WITH OFFSET.
52. Fill in the Z end prompt by rotating the part to see the bottom, click on the bottom surface and click WITH OFFSET to go a little deeper.
53. Load in the rest of the event information and use Tool 1.
54. Click EVENT to retract the box.
55. Click DRILL.
56. Click the 3 inner circles in a bolt hole pattern around X/Y abs zero that represents the drilled holes.
57. Click EVENT and press SET for drill.
58. Touch or press with a mouse to get to the Z RAPID prompt.
59. Click View Solid, click on the top surface of the holes/countersink and click WITH OFFSET.
60. Fill in the Z end prompt by rotating to see the bottom, click on the bottom and click WITH OFFSET to drill through the 0.030" offset plus the drill point length. Notice the total depth of the drill point is -1.1231 in a 1" plate.
61. Load in the rest of the event information and use Tool 2.
62. Click EVENT to retract the box.
63. Click DRILL.
64. Click the 3 outer circles in the bolt hole pattern around X/Y abs zero that represent the countersink holes.
65. Click EVENT and press SET for drill.
66. Touch or press with a mouse to get to the Z RAPID prompt and View Solid.
67. Click the top surface of the countersink and click WITH OFFSET.
68. For Z end, click on the sloped conical surface of one of the countersinks, as shown below, and click NO OFFSET. Notice the Z END dimension is where the tip of the countersink must go.

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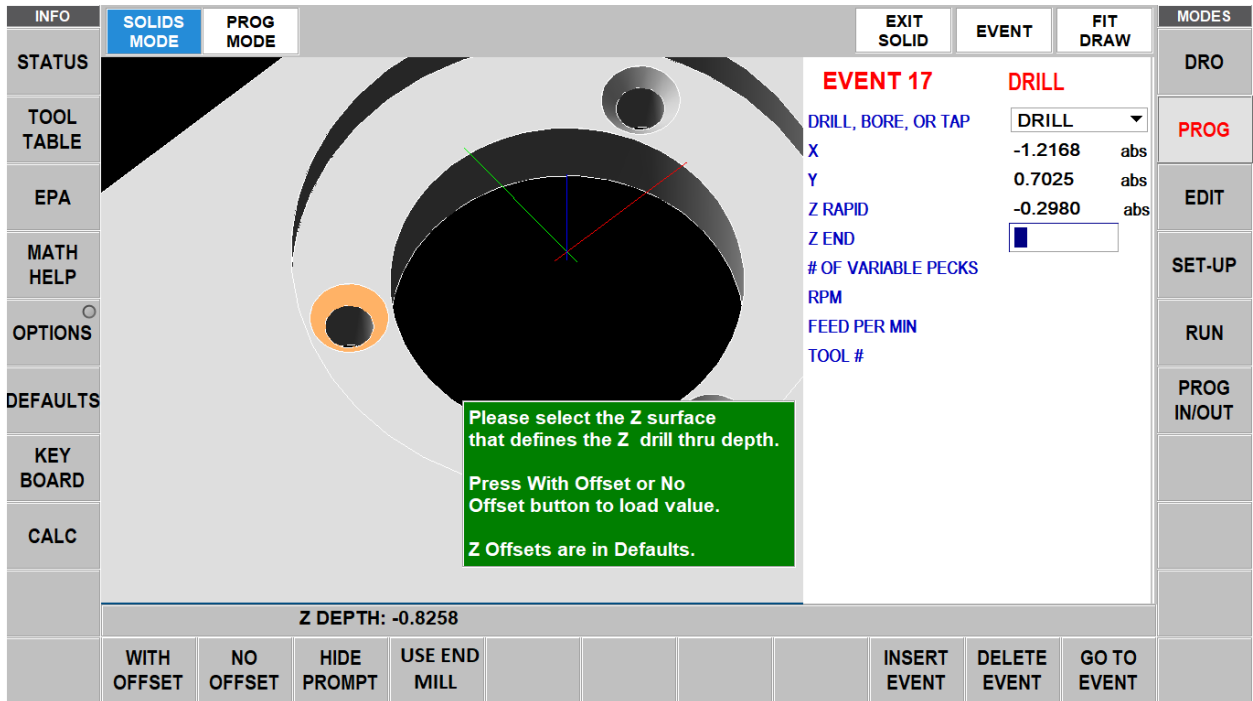
Note the softkey labeled as USE END MILL. This can be used to toggle whether the system will compensate for the conical tip of the drill bit (common 118° is assumed). Toggling this will display the difference in depth where the Z DEPTH is displayed. When this button is highlighted in YELLOW (not shown above) it will assume you are using an end mill and do not want to compensate for the drill tip.

69. Load in the rest of the event information and use Tool 3.

I'll bet you have a good feel for this by now. Finish up the part by drilling and then counterboring (perhaps with a circle profile) the four holes.