

# CVNC™-Fastening User Guide and Menu Reference

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CADD5® 5i Release 14

DOC40180-005

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# Preface

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*CVNC-Fastening User Guide and Menu Reference* describes the menus and property sheets on the NC Builder Graphical User Interface for CVNC-Fastening.

This document explains the CVNC-Fastening product which allows you to perform fastening operations.

## Related Documents

The following documents may be helpful as you use *CVNC-Fastening User Guide*:

- *NC Builder User Guide and Menu Reference*
- *Explicit Modeling User Guide*

## Book Conventions

The following table illustrates and explains conventions used in writing about CADD5 applications.

Convention	Example	Explanation
Menu selections and options	List Section option, Specify Layer field	Indicates a selection you must make from a menu or property sheet or a text field that you must fill in.
User-selected graphic location	X, d <sub>1</sub> or P1	Marks a location or entity selection in graphic examples.
User input in CADD5 text fields and on any command line	cvaec.hd.data.param tar -xvf /dev/rst0	Enter the text in a CADD5 text field or on any command line.
System output	Binary transfer complete.	Indicates system responses in the CADD5 text window or on any command line.
Variable in user input	tar -cvf /dev/rst0 filename	Replace the variable with an appropriate substitute; for example, replace filename with an actual file name.
Variable in text	tagname	Indicates a variable that requires an appropriate substitute when used in a real operation; for example, replace tagname with an actual tag name.
CADD5 commands and modifiers	INSERT LINE TANTO	Shows CADD5 commands and modifiers as they appear in the command line interface.
Text string	"SRFGROUPA" or 'SRFGROUPA'	Shows text strings. You must enclose text string with single or double quotation marks.
Integer	n	Supply an integer for the <i>n</i> .
Real number	x	Supply a real number for the <i>x</i> .
#	# mkdir /cdrom	Indicates the root (superuser) prompt on command lines.
%	% rlogin remote_system_name -l root	Indicates the C shell prompt on command lines.
\$	\$ rlogin remote_system_name -l root	Indicates the Bourne shell prompt on command lines.

## Window Managers and the User Interface

According to the window manager that you use, the look and feel of the user interface in CADD5 can change. Refer to the following table:

**Look and Feel of User Interface Elements**

User Interface Element	Common Desktop Environment (CDE) on Solaris, HP, and IBM	Window Manager Other Than CDE on Solaris, HP, IBM, and Windows
Option button	ON — Round, filled in the center OFF — Round, empty	ON — Diamond, filled OFF — Diamond, empty
Toggle key	ON — Square with a check mark OFF — Square, empty	ON — Square, filled OFF — Square, empty

## Online User Documentation

Online documentation for each book is provided in HTML if the documentation CD-ROM is installed. You can view the online documentation in the following ways:

- From an HTML browser
- From the Information Access button on the CADD5 desktop or the Local Data Manager (LDM)

Please note: The LDM is valid only for standalone CADD5.

You can also view the online documentation directly from the CD-ROM without installing it.

From an HTML Browser:

1. Navigate to the directory where the documents are installed. For example,
  - `/usr/apl/cadds/data/html/htmldoc/` (UNIX)
  - `Drive:\usr\apl\cadds\data\html\htmldoc\` (Windows)
2. Click `mainmenu.html`. A list of available CADD5 documentation appears.
3. Click the book title you want to view.

From the Information Access Button on the CADD5 Desktop or LDM:

1. Start CADD5.
2. Choose Information Access, the *i* button, in the top-left corner of the CADD5 desktop or the LDM.
3. Choose DOCUMENTATION. A list of available CADD5 documentation appears.
4. Click the book title you want to view.

From the Documentation CD-ROM:

1. Mount the documentation CD-ROM.
2. Point your browser to:
  - CDROM\_mount\_point/html/doc/mainmenu.html (UNIX)
  - CDROM\_Drive:\html\doc\mainmenu.html (Windows)

## Online Command Help

You can view the online command help directly from the CADDs desktop in the following ways:

- From the Information Access button on the CADDs desktop or the LDM
- From the command line

From the Information Access Button on the CADDs Desktop or LDM:

1. Start CADDs.
2. Choose Information Access, the *i* button, in the top-left corner of the CADDs desktop or the LDM.
3. Choose COMMAND HELP. The Command Help property sheet opens displaying a list of verb-noun combinations of commands.

From the Command Line: Type the exclamation mark (!) to display online documentation before typing the verb-noun combination as follows:

```
#01#!INSERT LINE
```

## Printing Documentation

A PDF (Portable Document Format) file is included on the CD-ROM for each online book. See the first page of each online book for the document number referenced in the PDF file name. Check with your system administrator if you need more information.

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# Overview of CVNC-Fastening

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This chapter gives an overview of the CVNC-Fastening product. It also describes how you can access the NC Builder Graphical User Interface (GUI) for CVNC-Fastening and how you can use special buttons on the property sheets. CVNC-Fastening is available from the CADD5 Explicit Environment.

- Introduction
- Accessing the CVNC-Fastening Options
- Setup Options
- Task Options
- Sequence of Tasks in CVNC-Fastening
- Property Sheets
- The Features Editor
- Animation of the Tool Path

# Introduction

CVNC-Fastening gives you 5-axis control of fastening operations like riveting and bolting. It provides the following tasks:

- Positioning the fastening device
- Approach
- Fastening
- Retract
- Custom tasks

It also gives you the following facilities:

- Path display

CVNC-Fastening uses the NC Builder Graphical User Interface (GUI) which is a method based part programming environment. You can use property sheets to create and edit tasks. You can create groups of tasks (operations) and save them in files for re-use. For details on the NC Builder GUI please see the *NC Builder User Guide and Menu Reference*.

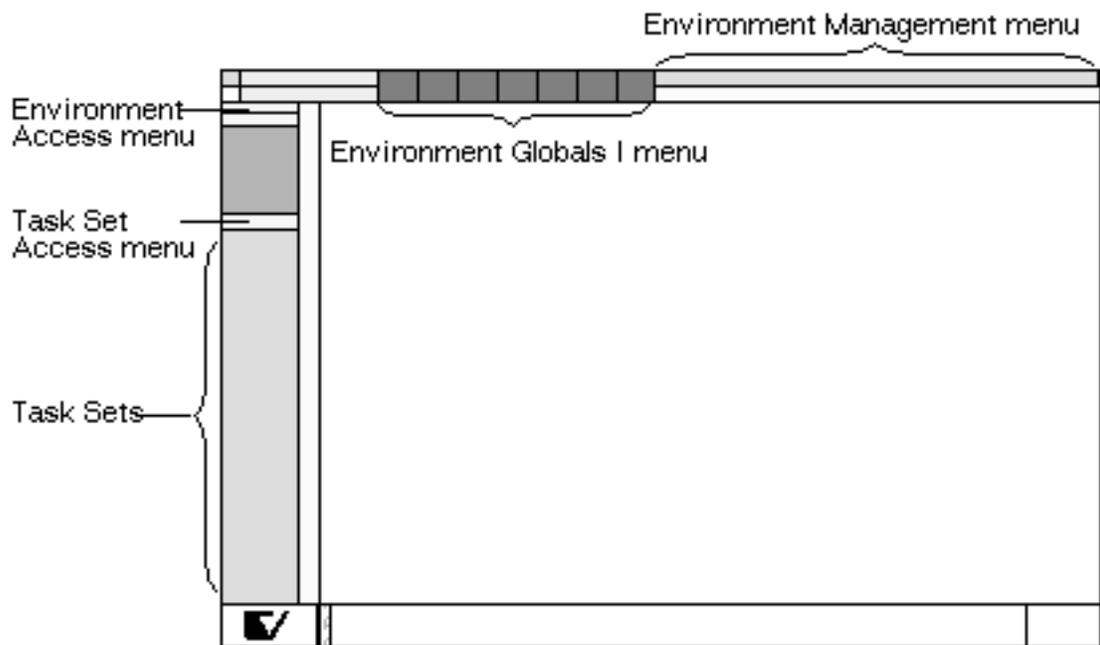
CVNC-Fastening generates text cutter location file (CLFile) output.

# Accessing the CVNC-Fastening Options

CVNC-Fastening options are available from the following user interface locations in the CADD5 Explicit environment:

- The Environment Access menu on the side bar.
- The Task Set Access menu on the side bar.

**Figure 1-1 CADD5 Explicit Environment Window**



There are two types of CVNC-Fastening options:

- Setup options
- Task options

The sections that follow briefly explain these options and show you how to access them.

# Setup Options

CVNC-Fastening Setup options are available from the Environment Access menu and the Task Set Access menu on the side bar.

Use the CVNC-Fastening Setup options to define values for

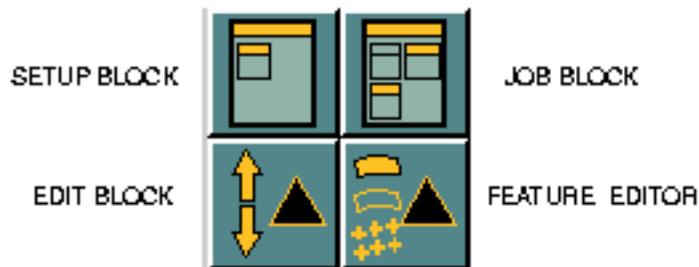
- Machine name
- Home point
- Construction plane (Cplane)
- Anvil parameters
- Output parameters

## Accessing CVNC-Fastening Setup Options

To access CVNC-Fastening Setup options

1. Choose the Manufacture option from the CADDs Environment Access menu.
2. Enter a new or existing Job Control File (JCF) in the fastening mode. The NCBuilder task set for CVNC-Fastening appears.

**Figure 1-2 NCBuilder Task Set**



3. Choose the Setup Block option from the NCBuilder task set.

The first time you use NC Builder in a CADDs session, a system message informs you that NC Builder is being initialized. After initialization, the Setup Sheet appears.

See Chapter 2, “CVNC-Fastening Setup” for a detailed description of the setup options.

4. Choose the Feature Editor option from the NCBuilder task set. The NCBuilder Features property sheet appears. See “The Features Editor” on page 1-12 for more details.

# Task Options

CVNC-Fastening Task options are available from the Environment Access menu and the Task Set Access menu on the side bar.

## CVNC-Fastening Tasks

- Positioning the fastening device  
See Chapter 3, “Positioning the Fastening Device” for a detailed description of this task.
- Approaching  
See Chapter 4, “Approaching Tasks” for a detailed description of these tasks.
- Fastening  
See Chapter 5, “Fastening Tasks” for a detailed description of this task.
- Retracting the fastening device  
See Chapter 6, “Retracting the Fastening Device” for a detailed description of this task.
- Custom tasks  
See Chapter 7, “Creating Custom Tasks” for a detailed description of how to create custom tasks.

## Accessing the Task Options

1. Choose the Manufacture option from the CADDs Environment Access menu.
2. Enter a new or existing Job Control File (JCF) in the fastening mode. The NCBuilder task set appears.



3. Choose the Job Block option from the NCBuilder task set. The NCBuilder property sheet appears.



4. Choose the Add Operation option from the NCBuilder property sheet. The Operation Sheet appears.



5. Choose the Add Task option from the operation sheet. The Task Selector palette appears.



# Sequence of Tasks in CVNC-Fastening

This section describes the order of tasks in CVNC-Fastening. It gives all the steps in the fastening process.

1. Create an assembly in CAMU or CADD5.
2. Mark the fastener locations on the assembly in CADD5.
3. Enter the CVNC-Fastening environment.
4. Define the CVNC-Fastening setup parameters.

Please see Chapter 2, “CVNC-Fastening Setup” for details of this task.

5. Each job is made up of one or more operations and each operation comprises tasks. For each operation, you may create any series of tasks in the following sequence:

- Position the tool insert.

Please see Chapter 3, “Positioning the Fastening Device” for details of this task.

- Approach the fastener feature.

Please see Chapter 4, “Approaching Tasks” for details of this task.

- Perform the fastening task at all fastener locations.

Please see Chapter 5, “Fastening Tasks” for details of this task.

- Retract the tool anvils.

Please see Chapter 6, “Retracting the Fastening Device” for this task.

6. Execute your job.

## Property Sheets

This section describes how to use the special buttons provided on the property sheets. These buttons are used to display a scrolling list of valid selections for a field or to display a property sheet with additional options.

Please note: Basic information about using CADDs property sheets is in the *Explicit Modeling User Guide*.

### List Button

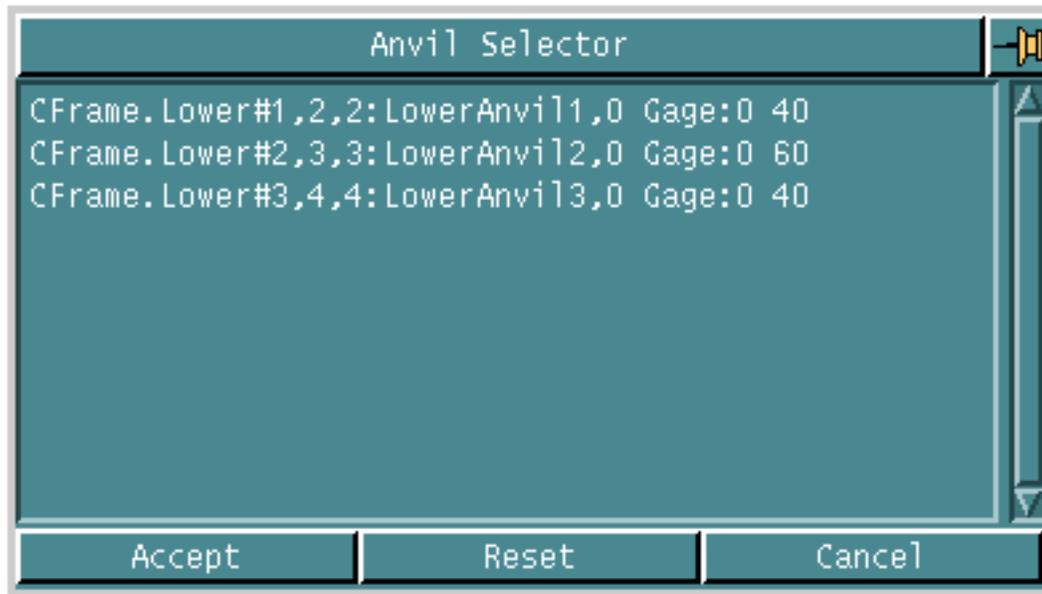
Some fields on the property sheet display a scrolling list of valid selections for that field. To access such a list, a List button (denoted by three dots) is provided next to the field.

For example, the following is a field on a property sheet:



Click the List button to display a scrolling list of lower anvils. When you select an anvil name from the list, and click the **Accept** button, that anvil name is automatically displayed in the field to the left of the List button.

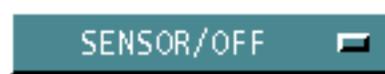
For example, the following is the Anvil Selector scroll list that is displayed when you click the List button.



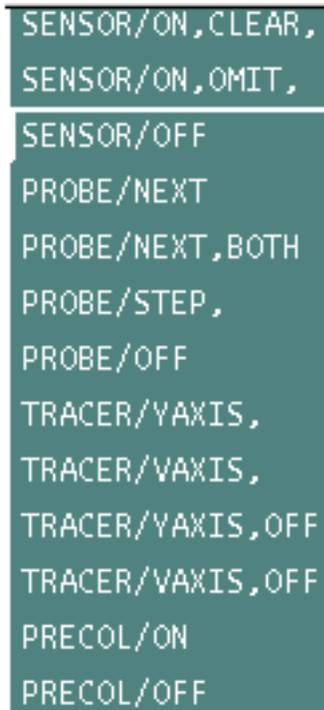
## Option List Button

CVNC-Fastening property sheets have a feature called the Option List button.

When you click this button, a list of valid values appear. For example, the following is an illustration of an Option List button in a property sheet.



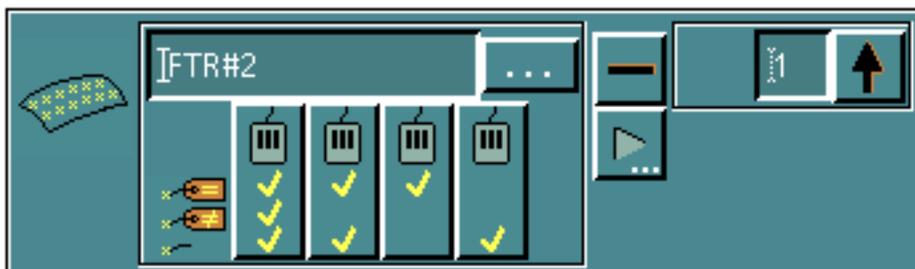
Clicking on the option list button labeled Sensor/Off displays the list. Choose the desired option from the list.



## Forward/Backward Arrow Buttons

These buttons are a special feature of the CVNC-Fastening property sheets. When you click the Forward Arrow button you can access property lists or text boxes to enter additional information or conditions.

For example, the following is a forward arrow button in a property sheet.



Clicking the forward arrow button displays a property sheet for setting conditions or exceptions.

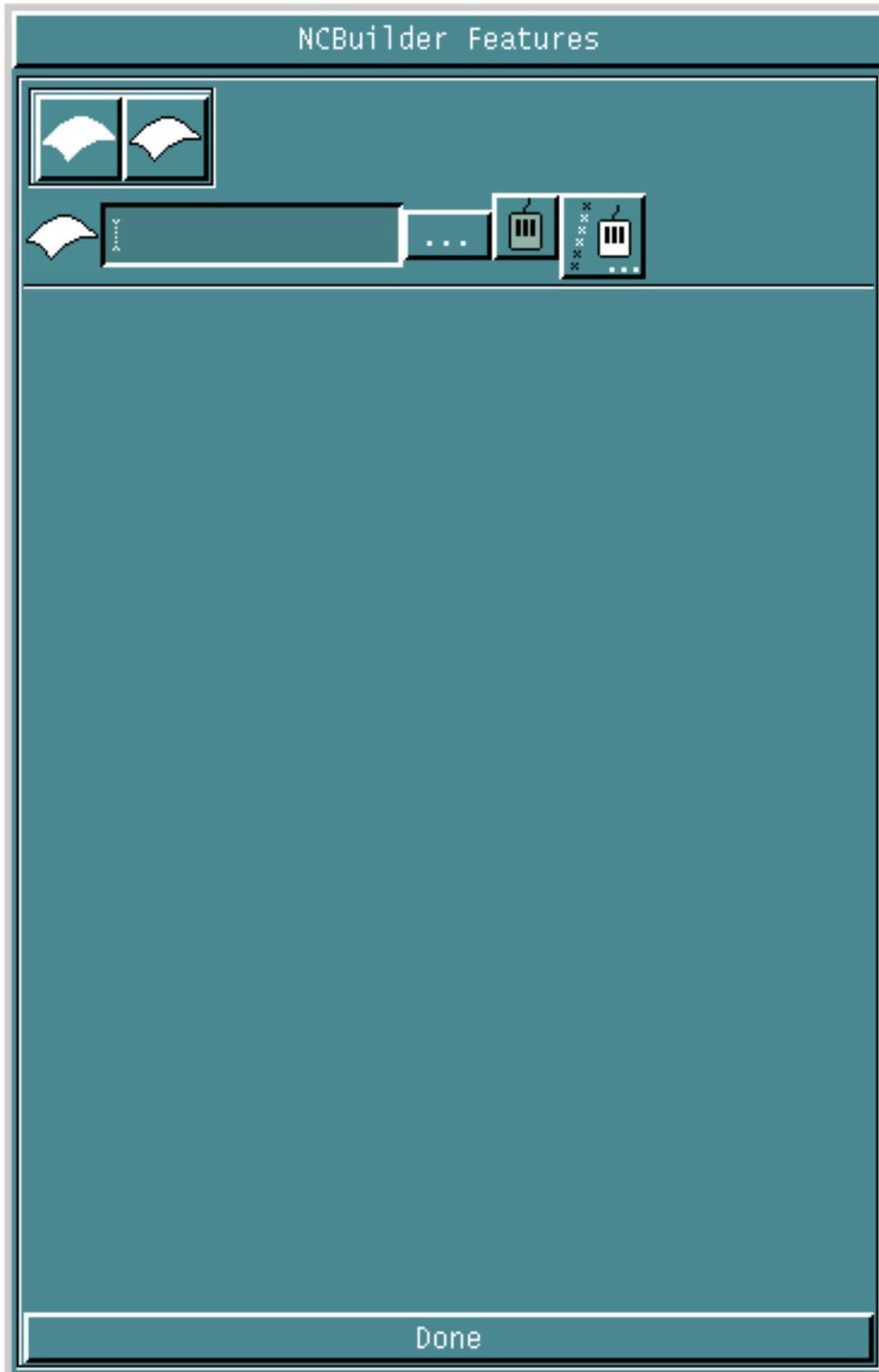
After entering values in this sheet use the Backward Arrow button to go back to the original sheet.

## The Features Editor



Choose the Feature Editor option from the NCBuilder task set to launch the NCBuilder features editor as shown in the following figure.

Figure 1-4 NCBUILDER Feature Editor

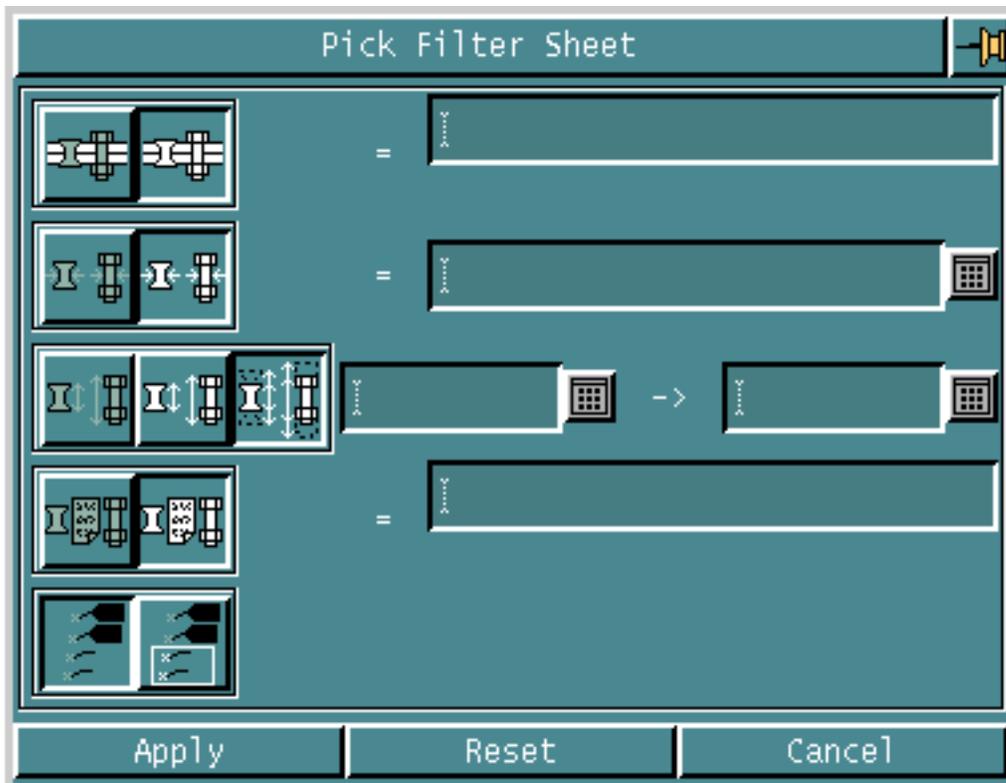


## Options on the Feature Editor



1. Choose the Part Surface option to edit features suitable for part surfaces.
2. Choose the Fastener Locations option to edit features suitable for fastener locations.
  - Specify the name of the feature you want to edit in the Feature Name field. You can also click the List button to select a feature from the scroll list that appears.
  - Click the Attribute Filter option on the NC Builder Feature Editor to launch the Pick Filter sheet where you can specify fastener feature attribute filters for digitization.

Figure 1-5 Pick Filter Sheet



## Accessing Options on the Pick Filter Sheet



1. Choose the Type Unset option to specify that the fastener feature attribute Type filter is to be unset.

OR



Choose the Bolt option to specify that the fastener feature attribute Type filter is to be set to Bolt.

- Specify the value for the fastener feature attribute Type filter in the Type field.



2. Choose the Diameter Unset option to specify that the fastener feature attribute Diameter filter is to be unset.

OR



Choose the Diameter Set option to specify that the fastener feature attribute Diameter filter is to be set.

- Specify the value for the fastener feature attribute Diameter filter in the Diameter field.



3. Choose the Length Unset option to specify that the fastener feature attribute Length filter is to be unset.

OR



Choose the Length Equal option to specify that the fastener feature attribute Length filter is to be set equal.

- Specify the value for the fastener feature attribute Length filter in the Length field.

OR



Choose the Length Range option to specify that the fastener feature attribute Length filter is to be set to a range.

- Specify the minimum value for the fastener feature attribute Length filter in the Minimum Length field.
- Specify the maximum value in the Maximum Length field.



4. Choose the Material Unset option to specify that the fastener feature attribute Material filter is to be unset.

OR



Choose the Material Set option to specify that the fastener feature attribute Material filter is to be set.

- Specify the value for the fastener feature attribute Material filter in the Material field.



5. Choose the NoFeature Unset option to specify that the fastener feature attribute NoFeature filter is to be unset.

OR



Choose the NoFeature Set option to specify that the fastener feature attribute NoFeature filter is to be set.

6. Click Apply.

## Animation of the Tool Path

In the Fastening environment, you can use the ANIMATE PATH command to display the animation of the tool path in a separate graphics window. This window displays the model along with the tools and the tool path specified by you. After animation is complete, you can exit this window and continue working in CADD5.

Please note: The part directories of the anvils, with the `_td` files, must exist in your `machinelib` directory. The `_td` files are created when the part is saved in the CADD5SHADE mode. The `machinelib` directory must be the same as that specified in the template or `template-local` file. Ensure that the path specified in the template file is `/users/jdoe/<your_parts_directory>` and not `$HOME/<your_parts_directory>`.

You can perform the following tasks with tool path animation:

- Display two tools with the tool path of each tool.
- Display tools in shaded mode.
- Dynamically manipulate the model and the tools using a mouse.
- Control the speed of animation.

Please note:

- NC Toolpath Animation does not work for multiple fastening operations. Only the last fastening operation is displayed in the animation window.
- ANIMATE PATH is not a JCF command and is therefore not saved in the JCF.

The following options are available on the tool path animation window:

- Start: Starts the animation.
- Rate \* 2: Doubles the speed of animation.
- Rate / 2: Halves the speed of animation.
- Translate: Pans the model and the tools.
- Rotate: Rotates the model.
- Scale: Scales the model.
- Cancel: Quits the animation window.

Please note: Ensure that you have used the Rate / 2 option at least once before using the Rate \* 2 option.



# CVNC-Fastening Setup

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Before you start a work session in CVNC-Fastening, you must define the values for the machine name, home point, Cplane and parameters for anvils and output. These values are then used in the calculations for the tool path. This chapter describes the CVNC-Fastening Setup options.

- Introduction
- Accessing the Setup Options

# Introduction

Before you can use the fastening tasks, you must define some parameters which the following tasks will subsequently use. These are known as the setup parameters.

In CVNC-Fastening setup, you can define the following parameters:

- Riveting machine

Here you can choose the riveting machine. Before you can do this you have to define the configuration of your machines in the `machinelib` directory by creating a definition file for each machine. You can then choose a machine from this list.

Please note: A sample machine setup file is provided in the `/usr/apl/cadds/data/cam/ncfasten/ncbuilder/machinelib` directory.

- Datum Cplane

Here you can define the orientation of the three axes. This orientation is then used for all jobs in the job control file (JCF).

- Machine datum

Here you can specify the machine datum as an offset from the component datum.

- Home point

Here you can define a starting point where the tool will be positioned before you start any task.

- Anvil

Here you can define some parameters for the lower and upper anvils. You can also choose anvils. Before you can do this you have to define the configuration of your anvils in the `machinelib` directory by creating definition files. You can then choose an anvil definition file from this list.

Please note: A sample anvil definition file is provided in the `/usr/apl/cadds/data/cam/ncfasten/ncbuilder/machinelib` directory.

- Output generation

Here you can specify the output filename. You can also specify whether the output should be a local process or a background process.

## Accessing the Setup Options

1. Choose the Manufacture option from the CADDSS Environment Access menu.
2. Enter a new or existing Job Control File (JCF) in the fastening mode. The NCBuilder task set for CVNC-Fastening appears.



3. Choose the Setup Block option from the NCBuilder task set.

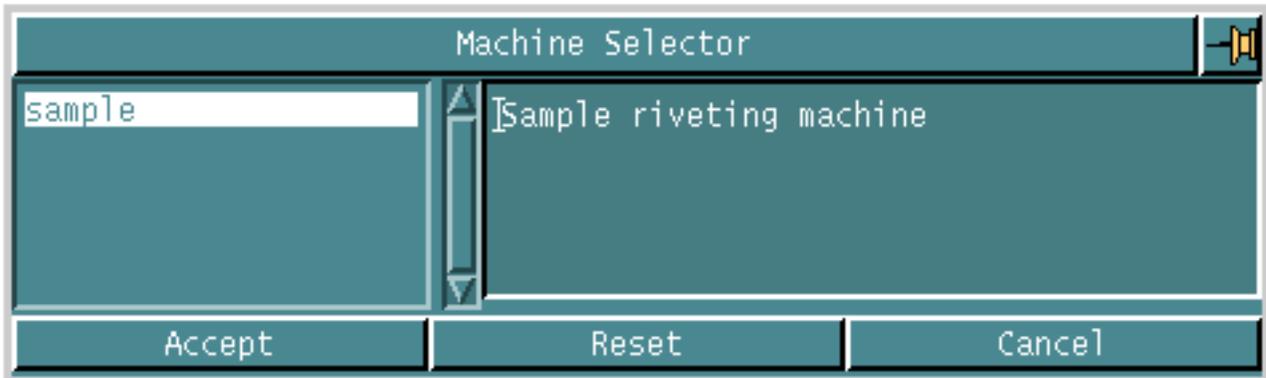
The first time you use NC Builder in a CADDSS session, a system message informs you that NC Builder is being initialized. After initialization, the Setup Sheet appears.

Figure 2-1 Setup Sheet



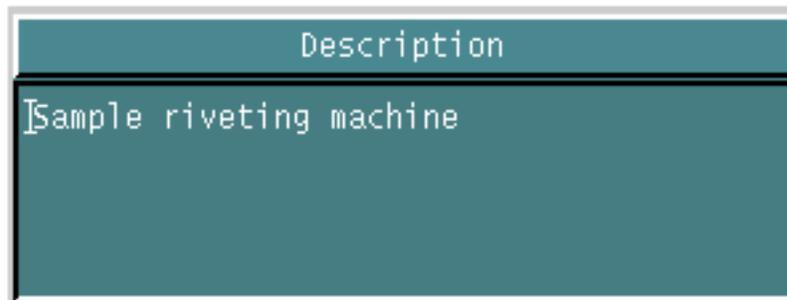
4. Specify the name of the machine name in the Machine Name field.  
To do this, click the list button. The Machine Selector scroll list appears.

**Figure 2-2 Machine Selector Scroll List**



- Choose the machine from the list and click Accept.
- You can also edit the description of the machine using the forward arrow button. The Description text box appears.

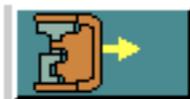
**Figure 2-3 Description Text Box**



Enter the description and click the Backward Arrow button.

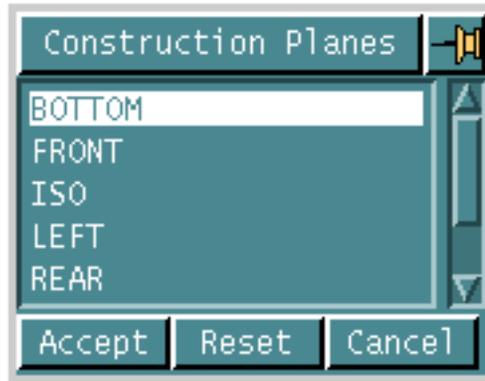
OR

5. Specify a new machine and enter its name in the Machine Name field.  
Enter its description as explained above.



6. Choose the Save Machine Tool Setup option if you want to save the new machine tool setup to a file.
7. Specify the datum construction plane (Cplane) for all jobs in the JCF. To do this, either enter the name of the Cplane in the Cplane field or click the list button. The Construction Planes scroll list appears.

**Figure 2-4 Construction Planes Scroll List**



- Choose the construction plane and click Accept. The selected Cplane appears in the Cplane field of the setup sheet.
8. Specify the machine datum as an offset from the component datum.
  9. Digitize the location of the home point for all jobs in the JCF.
  10. Specify the part number for all jobs in the JCF in the Part Number field.



11. Choose the Anvil Parameters option to define the anvil parameters.
  - Specify the name of the anvil library in the Anvil Library field or click the list button. The Anvil Library Selector scroll list appears.

**Figure 2-5 Anvil Library Selector Scroll List**



Choose the anvil library and click Accept. The selected name appears in the Anvil Library field.

- Specify the full retract distance for the upper anvils in the Upper Anvil Full Retract field.

- Specify the full retract distance for the lower anvils in the Lower Anvil Full Retract field.
- Specify the shallow retract distance for the upper anvils in the Upper Anvil Shallow Retract field.
- Specify the shallow retract distance for the lower anvils in the Lower Anvil Shallow Retract field.
- Specify the close retract distance for the upper anvils in the Upper Anvil Close Retract field.
- Specify the close retract distance for the lower anvils in the Lower Anvil Close Retract field.
- Specify the minimum rotation value for the lower anvils in the Lower Anvil Minimum Rotation field.
- Specify the maximum rotation value for the lower anvils in the Lower Anvil Maximum Rotation field.



**12.** Choose the Fixture Parameters option to define the fixture parameters. The setup sheet changes as shown in the following figure.

Figure 2-6 Setup Sheet for Fixture Parameters



- Specify the number of fixtures for this machine tool in the Fixture Number field.
- Specify the currently displayed fixture number in the Displayed Fixture field, or click the Up Arrow button or the Down Arrow button to increase or decrease the fixture number respectively.
- The Fixture Name field specifies the name of the current fixture. You can edit the description of a fixture using the Forward Arrow button. The Description text box appears. Enter the description and click the Backward Arrow button.
- Specify the home point for the fixture in the Homept field.
- Specify the datum offset for the fixture in the Datum field.
- Specify the angle for the fixture in the Angle field.
- Specify the depth of the fixture, that is, along the machine Y-axis before the applied angle, in the Depth field.
- Specify the height of the fixture, that is, along the machine Z-axis before the applied angle, in the Height field.
- Specify the width of the fixture, that is, along the machine X-axis before the applied angle, in the Width field.



13. Choose the Output Parameters option to define the output generation parameters. The setup sheet changes as shown in the following figure.

Figure 2-7 Setup Sheet for Output Parameters



- Specify the name of the output file in the Output File Name field. Output for all the jobs in the JCF is created in this file.



- Choose the No PQR Output option if you do not want output of the anvil rotation (PQR) vector.



- Choose the PQR Output option if you want to create output of the anvil rotation vector.



- Choose the Local Output option if you want to create local output when you exit the JCF.

OR



- Choose the Background Output option if you want to create the output as a background process when you exit the JCF.



14. Click the Repaint option and set it to ON or OFF.

If you set it to ON, CVNC displays the current machine tool's upper and lower anvils in their deep drop positions. The lower anvil shown is the first anvil from the selected anvil library. You can also see the machine tool at the home point.

15. Click Apply.



# Positioning the Fastening Device

---

This chapter describes how you can use the NC Builder Graphical User Interface (GUI) for positioning a fastening device. You can position the device to a location as well as a CADDSS wireframe geometry. Motion to these locations is straight line, direct point to point motion. The following sections describe the positioning task in detail.

- Introduction
- Accessing the Positioning Options
- Specifying the Positioning Parameters
- Specifying Lower Anvil and Feed Rate Parameters
- Specifying Other Parameters
- Specifying Collision Detection Parameters

## Introduction

Positioning is the first step in the actual fastening process. Before starting to fasten, you have to first position the tool to a location or an entity. This is the location from which the tool will approach the first fastener location. You can also define the orientation of the tool axis at this position. The tool then moves from the home point to the location you have defined.

You can also specify rotation of the lower anvil before and after reaching the position.

## Accessing the Positioning Options

1. Choose the Manufacture option from the CADDSS Environment Access menu.
2. Enter a new or existing Job Control File (JCF) in the fastening mode. The NCBuilder task set appears.



3. Choose the Job Block option from the NCBuilder task set. The NCBuilder property sheet appears.



4. Choose the Add Operation option from the NCBuilder property sheet. The Operation Sheet appears.

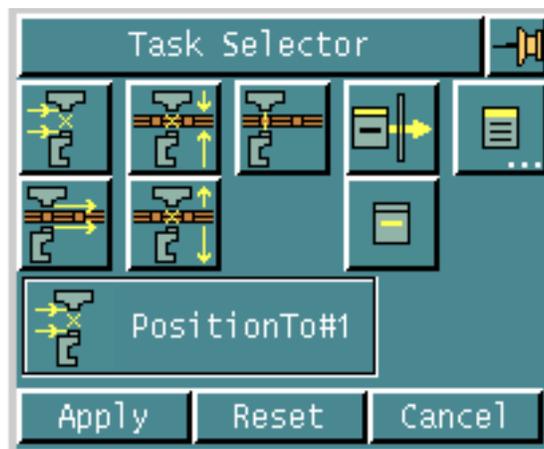


5. Choose the Add Task option from the operation sheet. The Task Selector palette appears.



6. Choose the Position To option from the Task Selector palette. The task name and its icon appear in the Task Selector palette as shown in the following figure. The sequence number of the task also appears. For example, if the task is the first positioning task in the operation, it has the number 1.

**Figure 3-1 Task Selector Palette with Task Name and Icon**



7. Click Apply.  
The task now appears in the operation sheet.

## Specifying the Positioning Parameters

Use the EDIT option on the operation sheet to specify parameters for positioning.

### Using this Option

1. Highlight the task and choose the Edit option on the operation sheet. The Fastening Position Sheet appears.

**Figure 3-2 Fastening Position Sheet**



2. Specify the layer for creating the tool path in the Layer field.

## Options on the Fastening Position Sheet



### **SPECIFYING LOWER ANVIL AND FEED RATE PARAMETERS**

Displays a property sheet that enables you to specify lower anvil and feed rate parameters for the current task.

See “Specifying Lower Anvil and Feed Rate Parameters” on page 3-6 for details.



### **SPECIFYING OTHER PARAMETERS**

Displays a property sheet that enables you to specify other parameters for the current task.

See “Specifying Other Parameters” on page 3-9 for details.



### **SPECIFYING COLLISION DETECTION PARAMETERS**

Displays a property sheet that enables you to specify collision detection parameters for the current task.

See “Specifying Collision Detection Parameters” on page 3-12 for details.

Please note: For each of these options, a different set of parameters appears on the same fastening position sheet.

## Specifying Lower Anvil and Feed Rate Parameters



Use the LOWER ANVIL AND FEED RATE PARAMETERS option to specify lower anvil and feed rate parameters for the current task.

The anvil definitions are stored in the Anvil Definition Library file which has the following format.

**Figure 3-3 Anvil Definition Library File**

```
//LowerAnvil1
-----
(enum LowerAnvil1)
(enum Shape1)
[www]ANVIL LowerAnvil1
[www].LowerAnvil1 Description: ~
[www].GageLength: 0 40 0
[www].ShapeName: Shape1
[www].Twist: 0

// Shape1
-----
[www].Shape1 Name : "Anvil"
[www].Description: ~
[www].PadC : 10
[www].PadD : -10
[www].Points: 0 0 0 0 40 0 20 40 0 20 30 0 10 20 0 10
```

This file is supplied on the CADDs pack in  
/usr/apl/cadd/data/cam/ncfasten/ncbuilder/machinelib along  
with the template and all other configuration files. You must copy it to your  
CVPATH before starting CADDs. You can edit it to add or remove anvils as  
required.

## Using this Option

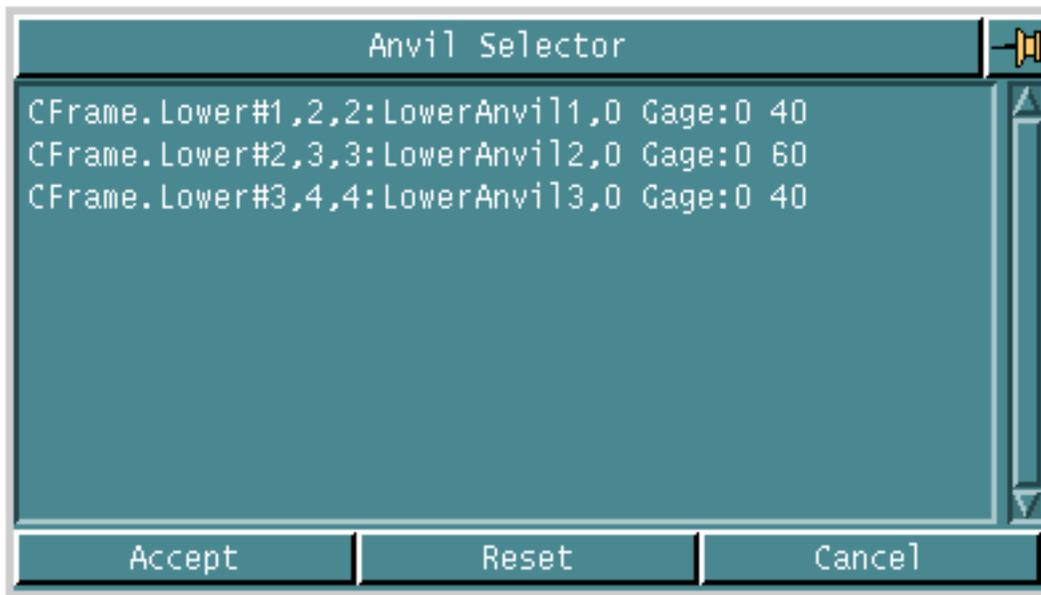
1. Choose the Lower Anvil and Feed Rate Parameters option from the fastening position sheet. The set of parameters for the lower anvils and feed rate appears on the sheet.

**Figure 3-4 Fastening Position Sheet for Lower Anvil and Feed Rate Parameters**



2. Specify the active anvil in the Active Anvil field.  
To do this click the list button. The Anvil Selector scroll list appears.

**Figure 3-5 Anvil Selector Scroll List**



- Choose the anvil and click Accept.



3. Choose the Clear Feed option to set the clear feed units to units/minute and specify the clear feed rate in the adjacent Feed Rate field.

OR



Choose the Rapid option to set the clear feed rate to rapid.

4. Click Apply if you have finished entering all parameters for the task.

## Specifying Other Parameters



Use the OTHER PARAMETERS option to specify other parameters for the current task.

## Using this Option

1. Choose the Other Parameters option from the fastening position sheet. The set of other parameters appears on the sheet.

Figure 3-6 Fastening Position Sheet for Other Parameters



2. Choose the Position by Loc option to position the fastening device to the digitized location.

OR



Choose the Position by Entity option to position the fastening device to a CADDSS wireframe entity and digitize the entity.

- Specify an x-offset for the position of the entity, in the x-offset field.
- Specify a y-offset for the position of the entity, in the y-offset field.



3. Choose the Current Axis Vector option to maintain the current upper/lower anvil axis orientation.

OR



Choose the Anvil Axis Vector option and digitize the vector to orient the upper/lower anvil axis.



4. Choose the Current Rotation option to maintain the current rotation of the lower anvil.

OR



Choose the Anvil Rotation option and specify the rotation of the lower anvil.



- Choose the Before Position option if you want the rotation of the lower anvil before moving to the position.

OR



- Choose the After Position option if you want the rotation of the lower anvil after moving to the position.

5. Click Apply if you have finished entering all parameters for the task.

# Specifying Collision Detection Parameters



Use the COLLISION DETECTION PARAMETERS option to specify collision detection parameters for the current task.

## Using this Option

1. Choose the Collision Detection Parameters option from the fastening position sheet. The set of collision detection parameters appears on the sheet.

**Figure 3-7 Fastening Position Sheet for Collision Detection Parameters**





2. Choose the No Collision option if you do not want collision features to be used for the current task.

OR



3. Choose the Collision Only option if you want only the collision features, and not the fasteners, to be used for collision detection.



- Choose the Upper Anvil Col option if you want collisions to be detected for the upper anvil.

OR



- Choose the Lower Anvil Col option if you want collisions to be detected for the lower anvil.

OR



- Choose the Upper Lower Anvil Col option if you want collisions to be detected for both the upper and the lower anvils.

OR



4. Choose the Collision Fasteners option if you want both collision features and fasteners to be used for collision detection.



- Choose the Upper Anvil Col option if you want collisions to be detected for the upper anvil.

OR



- Choose the Lower Anvil Col option if you want collisions to be detected for the lower anvil.

OR



- Choose the Upper Lower Anvil Col option if you want collisions to be detected for both the upper and the lower anvils.



# Approaching Tasks

---

This chapter describes how you can use the NC Builder Graphical User Interface (GUI) for approaching tasks. You must define the part surface as well as an approach point for the approach task. You can have multiple approach tasks in an operation. The following sections describe these tasks in detail.

- Introduction
- Accessing the Approach Options
- Specifying Part Geometry
- Specifying Collision Geometry
- Specifying the Approach Parameters
- Specifying Lower Anvil and Feed Rate Parameters
- Specifying Tolerance Parameters
- Specifying Other Parameters
- Specifying Collision Detection Parameters

## Introduction

Approaching is the second step in the fastening process. In positioning, you have positioned the tool for approach. Now the approaching task lets you approach the first fastener location.

As the fastener locations lie on or within a tolerance distance of the part surface, you must define the part surface for this task. Further you can specify the exact location or entity to approach.

You can also specify rotation of the lower anvil before and after the approach.

# Accessing the Approach Options

1. Choose the Manufacture option from the CADDs Environment Access menu.
2. Enter a new or existing Job Control File (JCF) in the fastening mode. The NCBuilder task set appears.



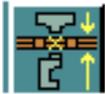
3. Choose the Job Block option from the NCBuilder task set. The NCBuilder property sheet appears.



4. Choose the Add Operation option from the NCBuilder property sheet. The Operation Sheet appears.

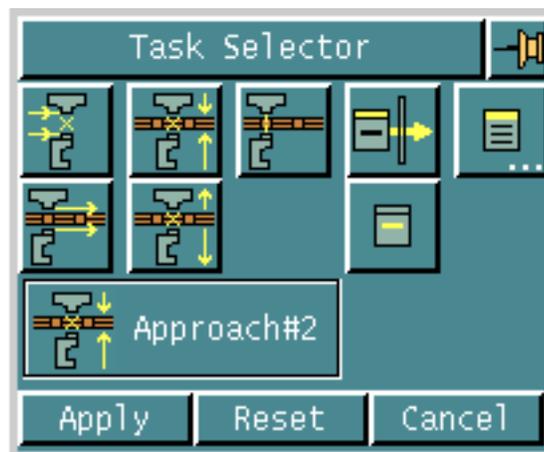


5. Choose the Add Task option from the operation sheet. The Task Selector palette appears.



6. Choose the Approach option from the Task Selector palette. The task name and its icon appear in the Task Selector palette as shown in the following figure. The sequence number of the task also appears. For example, if the task is the second approach task in the operation, it has the number 2.

**Figure 4-1 Task Selector Palette with Task Name and Icon**



7. Click Apply.

The task now appears in the operation sheet which changes when the task is highlighted as shown in the following figure.

Figure 4-2 Operation Sheet after Adding the Approach Task



## Options on the Operation Sheet



### SPECIFYING GEOMETRY

Displays a property sheet that enables you to define geometry for the part.

See “Specifying Part Geometry” on page 4-6 for details.



### **SPECIFYING COLLISION GEOMETRY**

Displays a property sheet that enables you to define collision geometry for the part.

See “Specifying Collision Geometry” on page 4-8 for details.

# Specifying Part Geometry

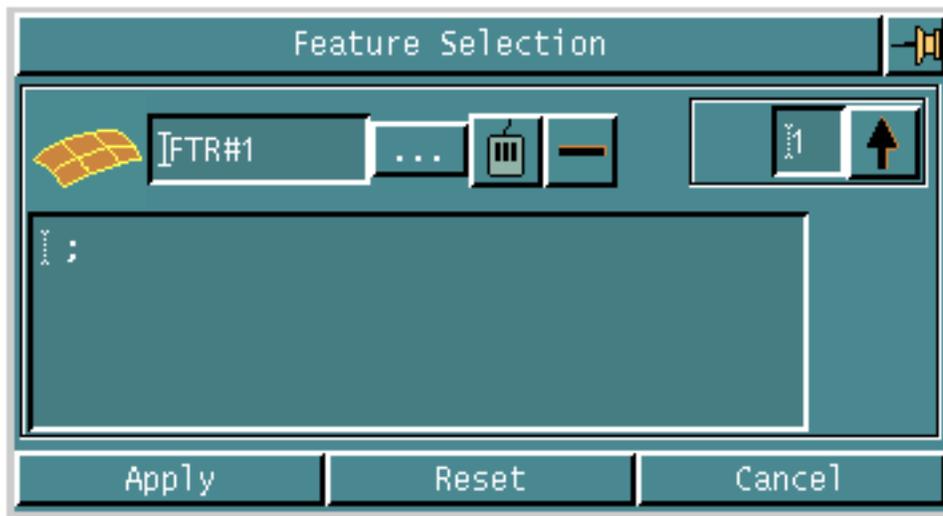


Use the SELECT GEOMETRY option to define geometry for the part.

## Using this Option

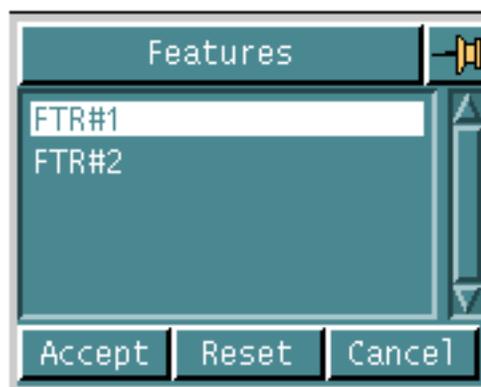
1. Choose the Select Geometry option from the operation sheet. The Feature Selection property sheet appears.

**Figure 4-3 Feature Selection Property Sheet**



2. Click the list button. The Features scroll list appears.

**Figure 4-4 Features Scroll List**



- Choose the feature from the list and click Accept. The selected feature appears in the Part Surface field of the Feature Selection sheet.

OR

- Digitize the feature for the part surface.

Please note: CVNC highlights the part surface feature you select in green, in the graphics window.

3. Click Apply.

# Specifying Collision Geometry



Use the **SELECT COLLISION GEOMETRY** option to define collision geometry for the part.

## Using this Option

1. Choose the Select Collision Geometry option from the operation sheet. The Collision Selection property sheet appears.

**Figure 4-5** Collision Selection Property Sheet



2. Click the list button. Choose a collision surface feature from the Features scroll list that appears and click **Accept**. The selected feature appears in the Collision Surface field of the Collision Selection sheet.

OR

Digitize the feature for the collision surface.

3. In the Safe Distance field, specify the safe distance to stop the anvil from the collision surfaces for all tasks.
4. Click **Apply**.

## Specifying the Approach Parameters

Use the EDIT option on the operation sheet to specify parameters for approach.

### Using this Option

1. Highlight the task and choose the Edit option on the operation sheet. The Fastening Approach Sheet appears.

**Figure 4-6 Fastening Approach Sheet**



2. Specify the layer for creating the tool path in the Layer field.

## Options on the Fastening Approach Sheet



### **SPECIFYING LOWER ANVIL AND FEED RATE PARAMETERS**

Displays a property sheet that enables you to specify lower anvil and feed rate parameters for the current task.

See “Specifying Lower Anvil and Feed Rate Parameters” on page 4-11 for details.



### **SPECIFYING TOLERANCE PARAMETERS**

Displays a property sheet that enables you to specify tolerance parameters for the current task.

See “Specifying Tolerance Parameters” on page 4-14 for details.



### **SPECIFYING OTHER PARAMETERS**

Displays a property sheet that enables you to specify other parameters for the current task.

See “Specifying Other Parameters” on page 4-16 for details.



### **SPECIFYING COLLISION DETECTION PARAMETERS**

Displays a property sheet that enables you to specify collision detection parameters for the current task.

See “Specifying Collision Detection Parameters” on page 4-19 for details.

Please note: For each of these options, a different set of parameters appears on the same fastening approach sheet.

## Specifying Lower Anvil and Feed Rate Parameters



Use the LOWER ANVIL AND FEED RATE PARAMETERS option to specify lower anvil and feed rate parameters for the current task.

## Using this Option

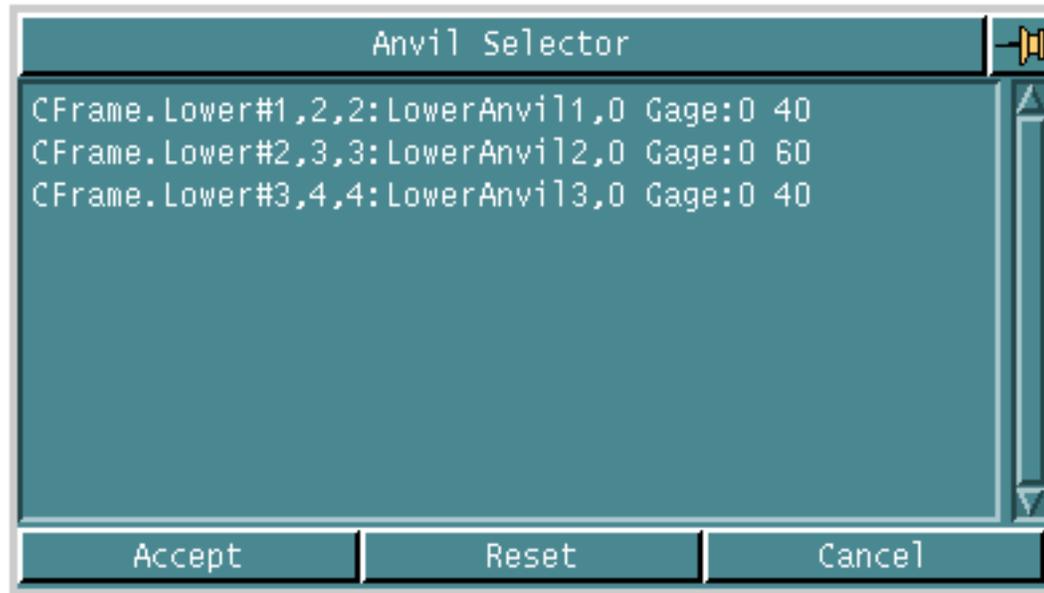
1. Choose the Lower Anvil and Feed Rate Parameters option from the fastening approach sheet. The set of parameters for the lower anvils and feed rates appears on the sheet.

**Figure 4-7 Fastening Approach Sheet for Lower Anvil and Feed Rate Parameters**



2. Specify the active anvil in the Active Anvil field.  
To do this click the list button. The Anvil Selector scroll list appears.

Figure 4-8 Anvil Selector Scroll List



- Choose the anvil and click Accept.



3. Choose the Clear Feed option to set the clear feed units to units/minute and specify the clear feed rate in the adjacent Feed Rate field.

OR



Choose the Rapid option to set the clear feed rate to rapid.

4. Specify the plunge feed rate in the Plunge Feed Rate field.
5. Click Apply if you have finished entering all parameters for the approach task.

# Specifying Tolerance Parameters

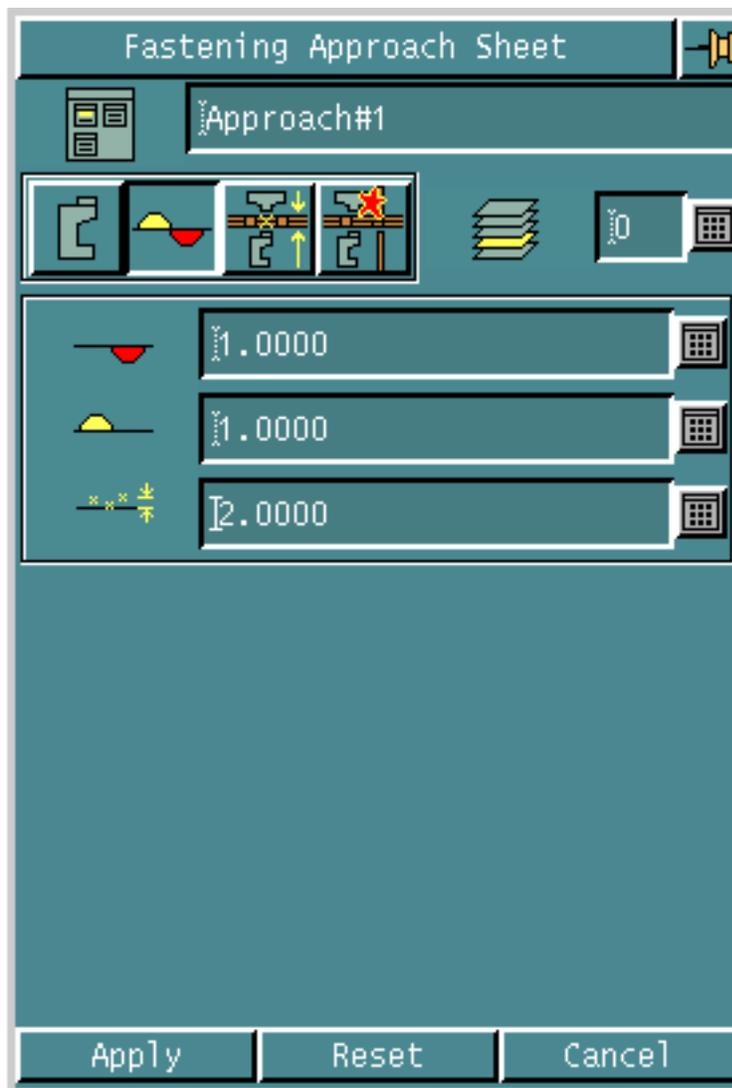


Use the TOLERANCE PARAMETERS option to specify tolerance parameters for the current task.

## Using this Option

1. Choose the Tolerance Parameters option from the fastening approach sheet. The set of parameters for tolerance appears on the sheet.

**Figure 4-9 Fastening Approach Sheet for Tolerance Parameters**



2. Specify the inner tolerance for the current task in the Inner Tolerance field.

3. Specify the outer tolerance for the current task in the Outer Tolerance field.
4. Specify the maximum gap between the fastener locations and the part surfaces in the Gap Tolerance field.

This condition occurs when the specified fastener features do not lie accurately on the specified part surface features. When this happens, CVNC projects the fastener features on to the part surface features. However, if the gap between the two is larger than the maximum gap, you will see an error message.

5. Click Apply if you have finished entering all parameters for the approach task.

## Specifying Other Parameters



Use the OTHER PARAMETERS option to specify other parameters for the current task.

## Using this Option

1. Choose the Other Parameters option from the fastening approach sheet. The set of other parameters appears on the sheet.

Figure 4-10 Fastening Approach Sheet for Other Parameters



2. Choose the Approach by Loc option to digitize a location for the approach point.

OR



3. Choose the Approach by Entity option to digitize a CADDSS wireframe entity for the approach.
  - Specify an x-offset for the position of the entity to approach, in the x-offset field.
  - Specify a y-offset for the position of the entity to approach, in the y-offset field.

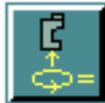


4. Choose the Current Initial Rotation option to maintain the current rotation of the lower anvil before the approach.

OR



5. Choose the Anvil Initial Rotation option and specify the initial rotation of the lower anvil before the approach.



6. Choose the Current Final Rotation option to maintain the current rotation of the lower anvil after the approach.

OR



7. Choose the Anvil Final Rotation option and specify the final rotation of the lower anvil after the approach.
8. Specify the upper anvil offset to the approach position in the Upper Offset field.
9. Specify the lower anvil offset to the approach position in the Lower Offset field.
10. Click Apply if you have finished entering all parameters for the approach task.

# Specifying Collision Detection Parameters



Use the COLLISION DETECTION PARAMETERS option to specify collision detection parameters for the current task.



OR



3. Choose the Collision Only option if you want only the collision features, and not the fasteners, to be used for collision detection.



- Choose the Upper Anvil Col option if you want collisions to be detected for the upper anvil.

OR



- Choose the Lower Anvil Col option if you want collisions to be detected for the lower anvil.

OR



- Choose the Upper Lower Anvil Col option if you want collisions to be detected for both the upper and the lower anvils.

OR



4. Choose the Collision Fasteners option if you want both collision features and fasteners to be used for collision detection.



- Choose the Upper Anvil Col option if you want collisions to be detected for the upper anvil.

OR



- Choose the Lower Anvil Col option if you want collisions to be detected for the lower anvil.

OR



- Choose the Upper Lower Anvil Col option if you want collisions to be detected for both the upper and the lower anvils.



This chapter describes how you can use the NC Builder Graphical User Interface (GUI) for fastening tasks. For this task, you need to define part surface and fastener location features. CVNC generates 5 axis continuous motion between each fastener location projected on to the part surfaces. You can select one of ten different fastening cycles to be output from this task. These cycles can be configured to suit those available on your machine tool. The sections that follow illustrate the fastening parameters in detail.

- Introduction
- Accessing the Fastening Options
- Specifying Fasteners
- Specifying Geometry
- Specifying Collision Geometry
- Specifying the Fastening Parameters
- Specifying Lower Anvil and Feed Rate Parameters
- Specifying Tolerance Parameters
- Specifying Other Parameters
- Specifying Fastening Cycle Parameters
- Specifying Gap Handling Parameters
- Specifying Collision Detection Parameters
- Executing the Job

## Introduction

This is the third step in the fastening process. Here you can actually fasten the fasteners. After approaching the first fastener location, use this task to fasten at that location and then move to the next location and so on till the last fastener in the current operation has been fastened.

For this task, you must specify the part surface as well as the fastener features. You can choose from types of fasteners, such as rivets and bolts which you can define in the fastener definition file. According to the type, you can also choose the type of fastening process or cycle. Before doing this you have to configure the cycles in the clfilegen file.

# Accessing the Fastening Options

1. Choose the Manufacture option from the CADDs Environment Access menu.
2. Enter a new or existing Job Control File (JCF) in the fastening mode. The NCBuilder task set appears.



3. Choose the Job Block option from the NCBuilder task set. The NCBuilder property sheet appears.



4. Choose the Add Operation option from the NCBuilder property sheet. The Operation Sheet appears.

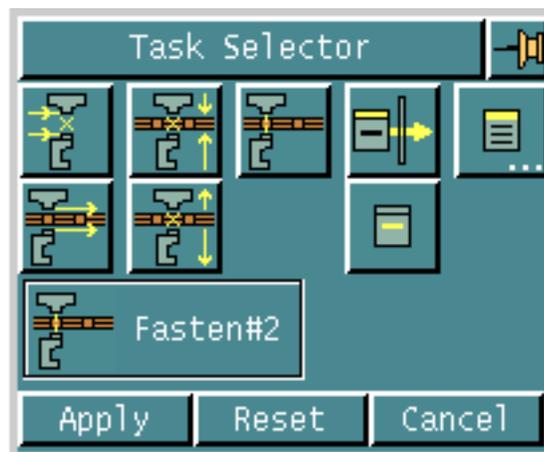


5. Choose the Add Task option from the operation sheet. The Task Selector palette appears.



6. Choose the Fasten option from the Task Selector palette. The task name and its icon appear in the Task Selector palette as shown in the following figure. The sequence number of the task also appears. For example, if the task is the second fastening task in the operation, it has the number 2.

**Figure 5-1 Task Selector Palette with Task Name and Icon**



7. Click Apply.

The task now appears in the operation sheet which changes when the task is highlighted as shown in the following figure.

Figure 5-2 Operation Sheet after Adding the Fastening Task



## Options on the Operation Sheet



### SPECIFYING FASTENERS

Displays a property sheet that enables you to select fasteners for the current fastening task.

See “Specifying Fasteners” on page 5-6 for details.



#### **SPECIFYING GEOMETRY**

Displays a property sheet that enables you to define geometry for the part.

See “Specifying Geometry” on page 5-9 for details.



#### **SPECIFYING COLLISION GEOMETRY**

Displays a property sheet that enables you to define collision geometry for the part.

See “Specifying Collision Geometry” on page 5-18 for details.

# Specifying Fasteners



Choose the **SELECT FASTENERS** option to select the fastener for the current task.

The fastener definitions are stored in a file having the following format.

**Figure 5-3 Fastener Definition File**

```
fasteners

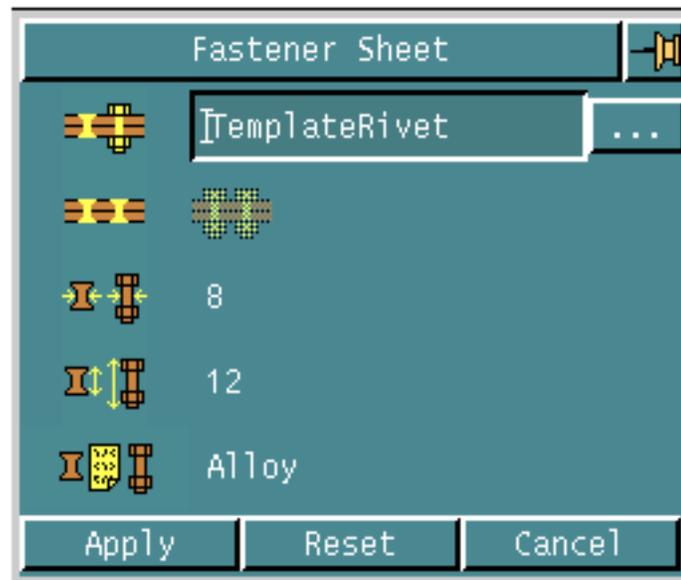
////////////////////////////////////
//          FASTENERS          //
////////////////////////////////////
//  name      type  diameter  length  material
Fastener:"Rivet1"  RIVET  8      20    "Steel"
Fastener:"Rivet2"  RIVET  7      18    "Steel"
Fastener:"Rivet3"  RIVET  6      16    "Steel"
Fastener:"Bolt1"   BOLT   8      20    "Steel"
Fastener:"Bolt2"   BOLT   7      18    "Steel"
Fastener:"Bolt3"   BOLT   6      16    "Steel"
```

This file is supplied on the CADDs pack in `/usr/apl/cadds/data/cam/ncfasten/ncbuilder` along with the template and all other configuration files. You must copy it to your `CVPATH` before starting CADDs. You can edit it to add or remove fasteners as required.

## Using this Option

1. Choose the Select Fastener option from the operation sheet. The Fastener Sheet appears.

**Figure 5-4** Fastener Sheet



2. Specify the name of the fastener in the Fastener Name field. To do this, click the list button. The Fasteners scroll list appears.

**Figure 5-5 Fasteners Scroll List**



- Choose the fastener from the list and click Accept. The selected fastener appears in the Fastener Name field of the Fastener sheet.
3. You can now see the fastener attributes like type, diameter, length and material in the Fastener sheet.
  4. Click Apply.

# Specifying Geometry



Use the **SELECT GEOMETRY** option to define geometry for the part surface and fasteners.

You can select all types of CADDs surface geometry for the part surface features. They may be of mixed types and having allowable gaps between them. CVNC uses the part surface features to determine the part surface normals at each fastener location.

CADDs wireframe geometry is used for fastener features. You can select the following types of entities:

- Points
- Lines
- Arcs

Please note: You can fasten only those points that lie within the domain bounds of a surface. An error message appears if you try to fasten a point that lies outside the domain bounds of the surface. This may also affect tool paths in JCFs created earlier.

You can also choose the order of fastener locations. If you select them out of order (using `win`, `pwin`, `vwin` modifiers in `getdata`) you can order them either by increasing/decreasing values of `x` or `y` or by the nearest neighbor. If you do not sort them, CVNC uses them in the order of selection.

If the fastener features do not lie accurately on the part surface features, CVNC uses the gap tolerance value to decide whether the fastener locations should be fastened. They are fastened only if the gap is less than the gap tolerance value. CVNC uses the surface normals at each of these fastener locations for aligning the upper and lower anvils.

## Using this Option

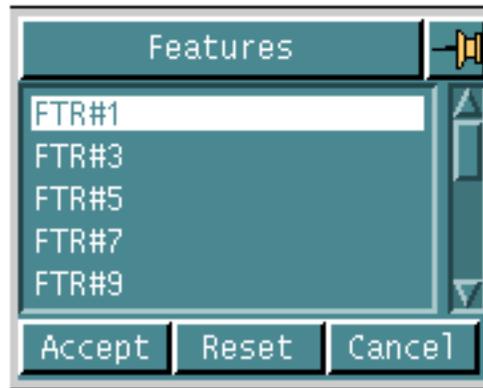
1. Choose the Select Geometry option from the operation sheet. The Feature Selection property sheet appears.

Figure 5-6 Feature Selection Property Sheet



2. Specify the name of the part surface feature for the current operation in the Part Surface field. To do this,
  - Click the list button. The Features scroll list appears.

**Figure 5-7 Features Scroll List**



- Choose the feature from the list and click Accept. The selected feature appears in the Part Surface field of the Feature Selection sheet.

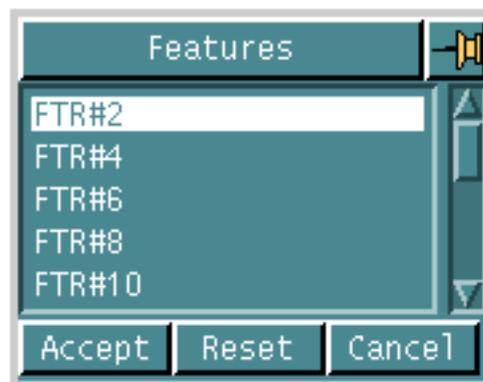
OR

3. Digitize the feature for the part surface.

Please note: When you select a feature for the part surface geometry, CVNC highlights it in green.

4. Specify the name of the fastener locations feature for the current operation in the Fastener Locations Feature field. To do this,
  - Click the list button. The Features scroll list appears.

**Figure 5-8 Features Scroll List**



- Choose the feature from the list and click Accept. The selected feature appears in the Fastener Locations Feature field of the Feature Selection sheet.
5. Use one of the four digitize buttons if you want to specify fastener locations for new fastener locations features. After you specify fastener locations, NC Builder reads the parametric feature attributes on the locations and compares them with the those of the current fastener. The difference between the four buttons is as explained below.



- Use this button to accept all locations, regardless of whether the attributes match or are not specified.

OR



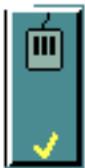
- Use this button to accept only those locations where the attributes match exactly or are not specified. In other words, locations where the attributes are specified but do not match those of the current fastener, are not accepted.

OR



- Use this button to accept only those locations where the attributes match exactly.

OR



- Use this button to accept only those locations where the attributes are totally not specified.

Please note: When you select fastener locations, CVNC highlights them in red. The total number of fastener locations that you can specify in one fastening task is limited by the following equation:

$$\frac{N \times L}{2} < 3800$$

where

N is the total number of fastener locations, and

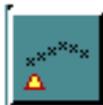
L is the string length of the fastener type parametric feature attribute of the fastener locations.

6. Specify exception commands, if any, as explained in Specifying Fastener Exception Commands.



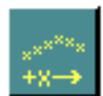
7. Choose the Sort Off option to order the fastener locations in the same sequence as you select them.

OR



Choose the Nearest option to order the fastener locations according to distance from a start point. Digitize the start point in the Start Point field.

OR



Choose the Positive x-direction option to order the fastener locations according to the positive x-direction.

OR



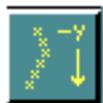
Choose the Negative x-direction option to order the fastener locations according to the negative x-direction.

OR



Choose the Positive y-direction option to order the fastener locations according to the positive y-direction.

OR



Choose the Negative y-direction option to order the fastener locations according to the negative y-direction.



8. Choose the Positive y-direction option to order the fastener locations according to the positive y-direction.

- Specify the seed point for the nearest neighbor calculation in the Seed Point field.
- Specify the next point for the spiral order calculation in the Spiral field.

9. Click Apply.

## Specifying Fastener Exception Commands

Fastener location exceptions are nc tape commands which you can create before, at, or after the fastening cycle for a particular location. They are special commands because they are defined for locations that are exceptions to the majority of locations.

You can configure the list of exception commands by copying the Exception Options entry in the `template` file (please see the following figure for the standard `template` file) to your `template-local` file and then editing it.

**Figure 5-9 ExceptionOptions Entry in the Template File**

```
[www]ExceptionOptions:"SENSOR/ON|SENSOR/ON,CLEAR,|SENSOR/ON,OMIT,|SENSOR/OFF\  
|PROBE/NEXT|PROBE/NEXT,BOTH|PROBE/STEP,|PROBE/OFF|TRACER/YAXIS,|TRACER/VAXIS,\  
|TRACER/YAXIS,OFF|TRACER/VAXIS,OFF|PRECOL/ON|PRECOL/OFF"
```

Please note: The line continuation character in the file is ‘\  
’.

## Using this Option



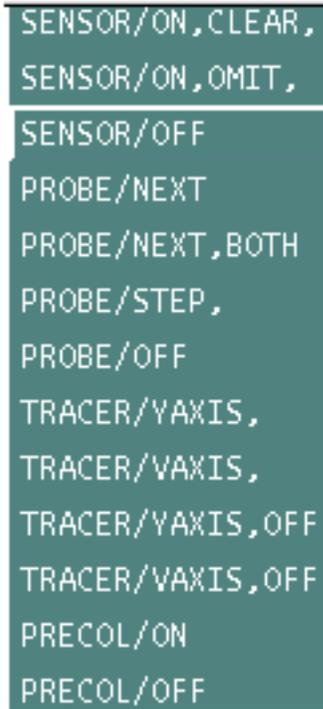
1. Click the Forward Arrow button in the Feature Selection property sheet if you want to create exception commands for the current fastener locations feature. The Fasten Location Exceptions Sheet appears.

**Figure 5-10 Fasten Location Exceptions Sheet**



2. Digitize the fastener locations feature for which you want to create the exception.  
This feature must be the current fastener locations feature that you have selected from the Feature Selection property sheet.
3. Click the option list button. The following list of exception commands appears:

Figure 5-11 Exception Commands Option List



4. Choose the desired command from the list.

The command appears in the text box.

5. Specify the exception command value for the selected fastener location, in the Exception Command Value field. This value and the command from the list make up the entire command. The value can be either numeric or text or both.



6. Choose the Before option if you want to create the exception command before the fastener location.

OR



Choose the At option if you want to create the exception command at the fastener location.

OR



Choose the After option if you want to create the exception command after the fastener location.

7. Click Create.

8. Click the Backward Arrow button to go back to the Feature Selection property sheet.

# Specifying Collision Geometry

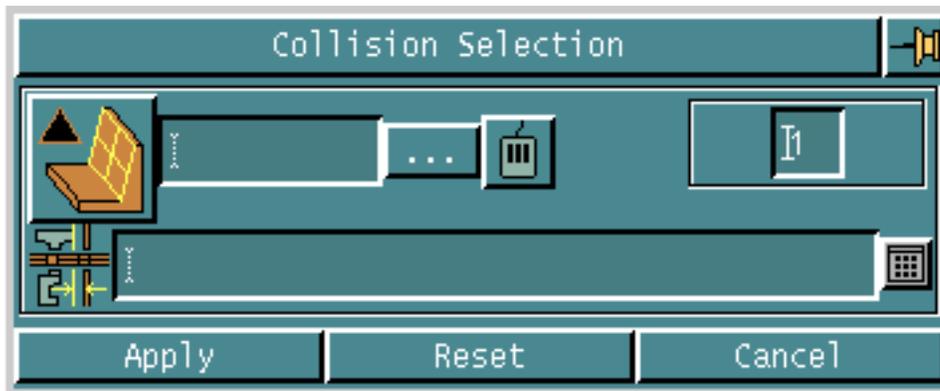


Use the **SELECT COLLISION GEOMETRY** option to define collision geometry for the part.

## Using this Option

1. Choose the Select Collision Geometry option from the operation sheet. The Collision Selection property sheet appears.

**Figure 5-12 Collision Selection Property Sheet**



2. Click the list button. Choose a collision surface feature from the Features scroll list that appears and click **Accept**. The selected feature appears in the Collision Surface field of the Collision Selection sheet.

OR

Digitize the feature for the collision surface.

3. In the Safe Distance field, specify the safe distance to stop the anvil from the collision surfaces, for all tasks.
4. Click **Apply**.

## Specifying the Fastening Parameters

Use the EDIT option on the operation sheet to specify parameters for fastening.

## Using this Option

1. Highlight the task and choose the Edit option on the operation sheet. The Fastening Sheet appears.

Figure 5-13 Fastening Sheet



2. Specify the layer for creating the tool path in the Layer field.

## Options on the Fastening Sheet



### **SPECIFYING LOWER ANVIL AND FEED RATE PARAMETERS**

Displays a property sheet that enables you to specify lower anvil and feed rate parameters for the current task.

See “Specifying Lower Anvil and Feed Rate Parameters” on page 5-23 for details.



### **SPECIFYING TOLERANCE PARAMETERS**

Displays a property sheet that enables you to specify tolerance parameters for the current task.

See “Specifying Tolerance Parameters” on page 5-26 for details.



### **SPECIFYING OTHER PARAMETERS**

Displays a property sheet that enables you to specify other parameters for the current task.

See “Specifying Other Parameters” on page 5-29 for details.



### **SPECIFYING FASTENING CYCLE PARAMETERS**

Displays a property sheet that enables you to specify fastening cycle parameters for the current task.

See “Specifying Fastening Cycle Parameters” on page 5-33 for details.



### **SPECIFYING GAP HANDLING PARAMETERS**

Displays a property sheet that enables you to specify gap handling parameters for the current task.

See “Specifying Gap Handling Parameters” on page 5-36 for details.



### **SPECIFYING COLLISION DETECTION PARAMETERS**

Displays a property sheet that enables you to specify collision detection parameters for the current task.

See “Specifying Collision Detection Parameters” on page 5-40 for details.

Please note: For each of these options, a different set of parameters appears on the same fastening sheet.

## Specifying Lower Anvil and Feed Rate Parameters

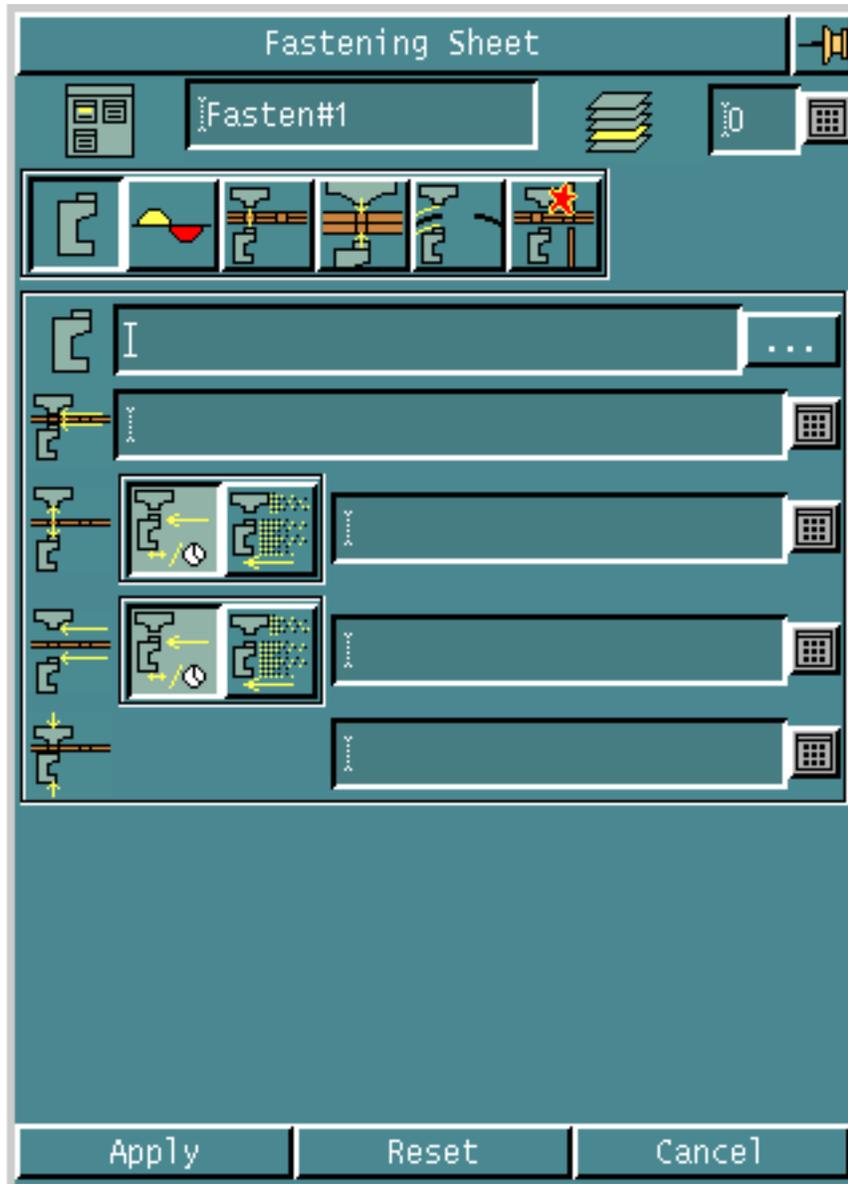


Use the LOWER ANVIL AND FEED RATE PARAMETERS option to specify lower anvil and feed rate parameters for the current task.

## Using this Option

1. Choose the Lower Anvil and Feed Rate Parameters option from the fastening sheet. The set of parameters for the lower anvils and the feed rates appear on the sheet.

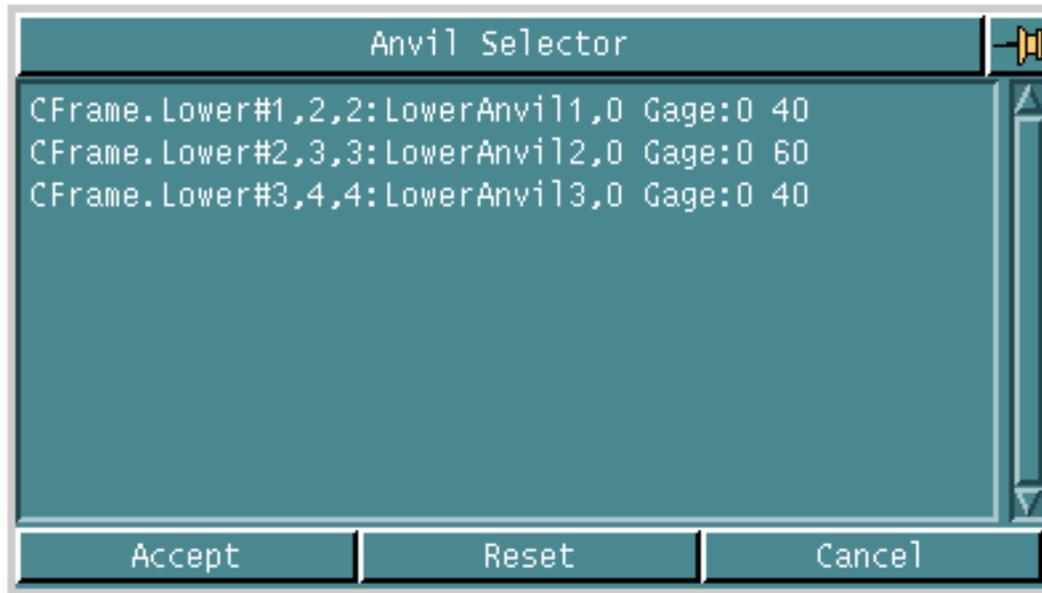
**Figure 5-14 Fastening Sheet for Lower Anvil and Feed Rate Parameters**



2. Specify the active anvil in the Active Anvil field.

To do this click the list button. The Anvil Selector scroll list appears.

**Figure 5-15 Anvil Selector Scroll List**



- Choose the anvil and click Accept.

3. Specify the cut feed rate in the Cut Feed Rate field.



4. Choose the Retract Feed option to set the retract feed units to units/minute and specify the feed rate in the adjacent Feed Rate field.

OR



Choose the Retract Rapid option to set the retract feed rate to rapid.



5. Choose the Approach Feed option to set the approach feed units to units/minute and specify the feed rate in the adjacent Feed Rate field.

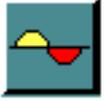
OR



Choose the Approach Rapid option to set the approach feed rate to rapid.

6. Click Apply if you have finished entering all parameters for the task.

## Specifying Tolerance Parameters



Use the TOLERANCE PARAMETERS option to specify tolerance parameters for the current task.

## Using this Option

1. Choose the Tolerance Parameters option from the fastening sheet. The set of parameters for tolerance appears on the sheet.

**Figure 5-16 Fastening Sheet for Tolerance Parameters**



2. Specify the inner tolerance for the current task in the Inner Tolerance field.
3. Specify the outer tolerance for the current task in the Outer Tolerance field.

4. Specify the maximum gap between the fastener locations and the part surfaces in the Gap Tolerance field. See “Specifying Geometry” on page 5-9 for details of the gap tolerance.
5. Click Apply if you have finished entering all parameters for the task.

## Specifying Other Parameters



Use the OTHER PARAMETERS option to specify other parameters for the current task.

## Using this Option

1. Choose the Other Parameters option from the fastening sheet. The set of other parameters appears on the sheet.

Figure 5-17 Fastening Sheet for Other Parameters



2. Specify a value for the ride height for the upper anvil in the Upper Ride Offset field. This is the distance the lower anvil moves to before positioning to each point in a fastening feature.

- Specify a value for the ride height for the lower anvil in the Lower Ride Offset field.



- Choose the Current Rotation option to maintain the current rotation of the lower anvil at each fastener location.

OR



- Choose the Normal Rotation option for the rotation of the lower anvil to be normal to the tool path.

OR



- Choose the Anvil Rotation option and specify the rotation of the lower anvil for all fastener locations.



- Choose the No Clear option to specify no clear move between fastener locations.

OR



Choose the Normal Clear option to specify a clear move normal to the direction of travel between fastener locations.

OR



Choose the X-axis Clear option to specify a clear move in the x-axis direction between fastener locations.

OR



Choose the Y-axis Clear option to specify a clear move in the y-axis direction between fastener locations.

OR



Choose the Clear Vector option and specify the vector for the clear move between fastener locations, in the adjacent field.

- Specify the length of the clear move between fastener locations in the Clear Length field.

Please note: You cannot specify a length for the clear move if you have specified a no clear move between fastener locations.



9. Choose the No Regain option to specify a no regain move between fastener locations.

OR



Choose the Normal Regain option to specify a regain move normal to the direction of travel between fastener locations.

OR



Choose the X-axis Regain option to specify a regain move in the x-axis direction between fastener locations.

OR



Choose the Y-axis regain option to specify a regain move in the y-axis direction between fastener locations.

OR



Choose the Regain Vector option and specify the vector for the regain move between fastener locations, in the adjacent field.

10. Specify the length of the regain move between fastener locations in the Regain Length field.

Please note: You cannot specify a length for the regain move if you have specified a no regain move between fastener locations.

11. Click Apply if you have finished entering all parameters for the task.

## Specifying Fastening Cycle Parameters



Use the FASTENING CYCLE PARAMETERS option to specify fastening cycle parameters for the current task.

## Using this Option

1. Choose the Fastening Cycle Parameters option from the fastening sheet. The set of fastening cycle parameters appears on the sheet.

**Figure 5-18 Fastening Sheet for Fastening Cycle Parameters**



2. Specify a value for the clamp height in the Clamp Height field.
3. Click and choose the type of cycle from the 10 options for cycles. You can define these cycles in the `clfilegen` file. Please refer to "CYCLE" on page A-3 to see the command that CVNC activates when you choose these options.

4. Click and choose the head device for the cycle from Head 0, Head 1, and Head 2.CADDS



5. Choose the Sealant Off option to turn the sealant off during the cycle.  
OR



- Choose the Sealant On option to turn the sealant on during the cycle.
6. Click Apply if you have finished entering all parameters for the task.

## Specifying Gap Handling Parameters



Use the GAP HANDLING PARAMETERS option to specify gap handling parameters for the current task.

## Using this Option

1. Choose the Gap Handling Parameters option from the fastening approach sheet. The set of gap handling parameters appears on the sheet.

**Figure 5-19 Fastening Position Sheet for Gap Handling Parameters**



2. Specify the size of gaps, greater than which, gap crossing options are to be used.



3. Choose the Upper Current Position option to specify that the upper anvil should remain at its current position.

OR



Choose the Full Upper Retract option to specify that the upper anvil should retract to its full retract position.

OR



Choose the Shallow Upper Retract option to specify that the upper anvil should retract to the shallow retract position.

OR



Choose the Close Upper Retract option to specify that the upper anvil should retract to the close retract position.

OR



Choose the Intermediate Upper Retract option and specify an intermediate retract position in the adjacent field.



4. Choose the Lower Current Position option to specify that the lower anvil should remain at its current position.

OR



Choose the Full Lower Retract option to specify that the lower anvil should retract to its full retract position.

OR



Choose the Shallow Lower Retract option to specify that the lower anvil should retract to the shallow retract position.

OR



Choose the Close Lower Retract option to specify that the lower anvil should retract to the close retract position.

OR



Choose the Intermediate Lower Retract option and specify an intermediate retract position in the adjacent field.

5. Specify the distance before and after crossing the gap when the pass thru commands are to be issued, in the Fall Safe Distance field.
6. Specify additional text for the pass thru command to be issued before crossing the gap, in the Fall Off Text field.
7. Specify additional text for the pass thru command to be issued after crossing the gap, in the Fall Regain Text field.
8. Click Apply if you have finished entering all parameters for the task.

## Specifying Collision Detection Parameters

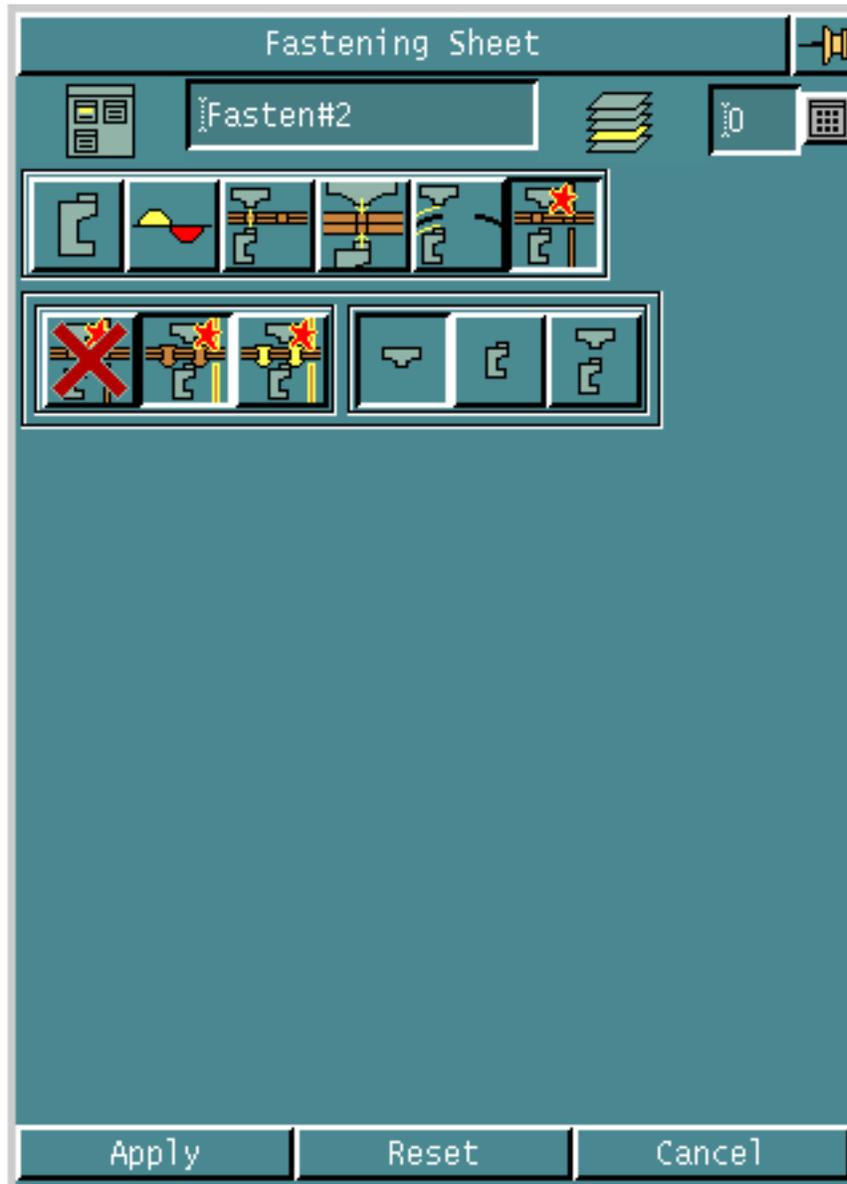


Use the COLLISION DETECTION PARAMETERS option to specify collision detection parameters for the current task.

## Using this Option

1. Choose the Collision Detection Parameters option from the fastening sheet.  
The set of collision detection parameters appears on the sheet.

**Figure 5-20 Fastening Sheet for Collision Detection Parameters**



2. Choose the No Collision option if you do not want collision features to be used for the current task.

OR



Choose the Collision Only option if you want only the collision features, and not the fasteners, to be used for collision detection.



- Choose the Upper Anvil Col option if you want collisions to be detected for the upper anvil.

OR



- Choose the Lower Anvil Col option if you want collisions to be detected for the lower anvil.

OR



- Choose the Upper Lower Anvil Col option if you want collisions to be detected for both the upper and the lower anvils.

OR



Choose the Collision Fasteners option if you want both collision features and fasteners to be used for collision detection.



- Choose the Upper Anvil Col option if you want collisions to be detected for the upper anvil.

OR



- Choose the Lower Anvil Col option if you want collisions to be detected for the lower anvil.

OR



- Choose the Upper Lower Anvil Col option if you want collisions to be detected for both the upper and the lower anvils.

3. Click Apply if you have finished entering all parameters for the task.

## Executing the Job

You have to execute the job after specifying parameters for all tasks in your operation. After you have clicked Apply on the task sheets, use the following steps for executing your job:

1. Click Apply on the operation sheet when you finish specifying all the tasks for your operation.
2. Click Apply on the NCBuilder sheet after you finish specifying all the operations for your job. The following pulldown menu appears:

**Figure 5-21 Pulldown Menu for Executing a Task**



3. Click Create Job and process.

You can now see the tool path and execution of your job.



# Retracting the Fastening Device

---

This chapter describes how you can use the NC Builder Graphical User Interface (GUI) for retracting tasks. The retract task does not need any part surface input; retracts use the current location. You can have multiple retract tasks in an operation. The following sections describe these tasks in detail.

- Introduction
- Accessing the Retract Options
- Specifying the Retract Parameters
- Specifying Lower Anvil and Feed Rate Parameters
- Specifying Other Parameters
- Specifying Collision Detection Parameters

## Introduction

This is the last step in the fastening process. After fastening at all fastener locations, you have to retract the tool from the part surface.

You can retract it either to the full distance, or a short distance, or an intermediate distance.

You can also specify the rotation of the lower anvil before and after the retract.

# Accessing the Retract Options

1. Choose the Manufacture option from the CADDs Environment Access menu.
2. Enter a new or existing Job Control File (JCF) in the fastening mode. The NCBuilder task set appears.



3. Choose the Job Block option from the NCBuilder task set. The NCBuilder property sheet appears.



4. Choose the Add Operation option from the NCBuilder property sheet. The Operation Sheet appears.

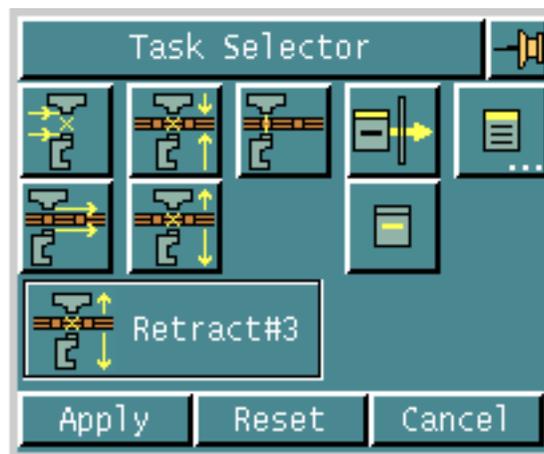


5. Choose the Add Task option from the operation sheet. The Task Selector palette appears.



6. Choose the Retract option from the Task Selector palette. The task name and its icon appear in the Task Selector palette as shown in the following figure. The sequence number of the task also appears. For example, if the task is the third retract task in the operation, it has the number 3.

**Figure 6-1 Task Selector Palette with Task Name and Icon**



7. Click Apply.  
The task now appears in the operation sheet.

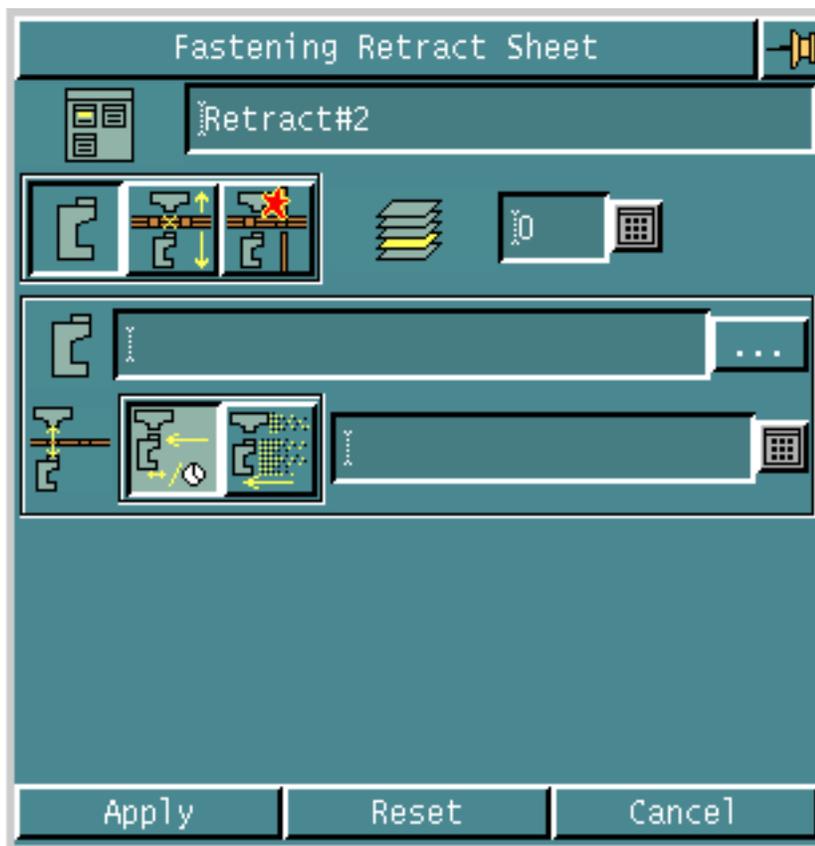
# Specifying the Retract Parameters

Use the EDIT option on the operation sheet to specify parameters for retract.

## Using this Option

1. Highlight the task and choose the Edit option on the operation sheet. The Fastening Retract Sheet appears.

**Figure 6-2 Fastening Retract Sheet**



2. Specify the layer for creating the tool path in the Layer field.

## Options on the Fastening Retract Sheet



### SPECIFYING LOWER ANVIL AND FEED RATE PARAMETERS

Displays a property sheet that enables you to specify lower anvil and feed rate parameters for the current task.

See “Specifying Lower Anvil and Feed Rate Parameters” on page 6-6 for details.



#### **SPECIFYING OTHER PARAMETERS**

Displays a property sheet that enables you to specify other parameters for the current task.

See “Specifying Other Parameters” on page 6-8 for details.



#### **SPECIFYING COLLISION DETECTION PARAMETERS**

Displays a property sheet that enables you to specify collision detection parameters for the current task.

See “Specifying Collision Detection Parameters” on page 6-11 for details.

Please note: For each of these options, a different set of parameters appears on the same fastening retract sheet.

# Specifying Lower Anvil and Feed Rate Parameters

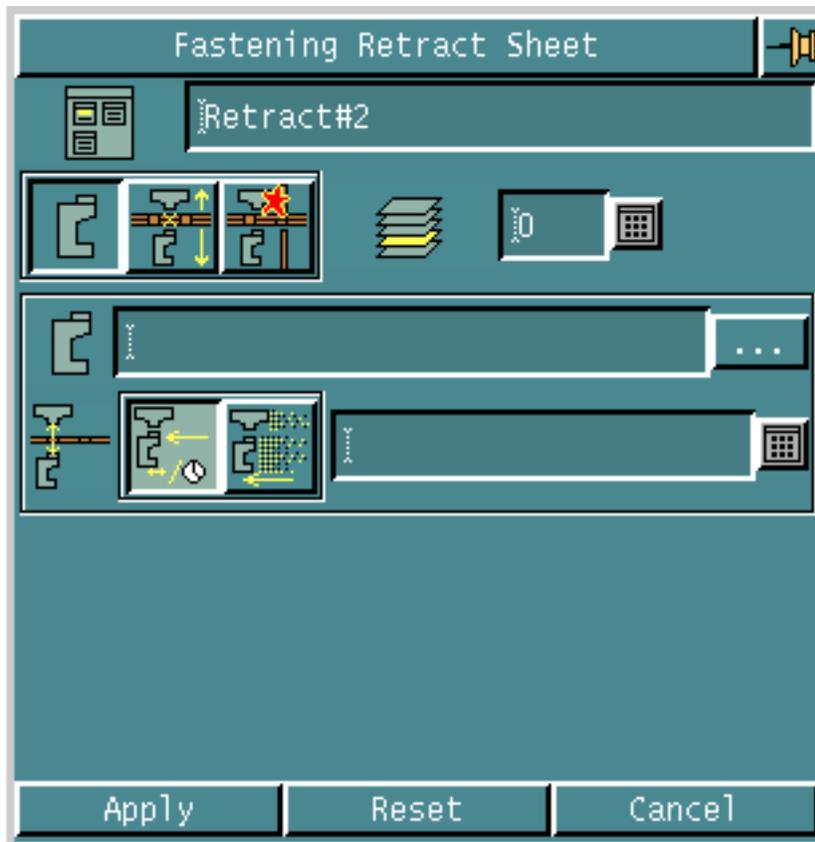


Use the LOWER ANVIL AND FEED RATE PARAMETERS option to specify lower anvil and feed rate parameters for the current task.

## Using this Option

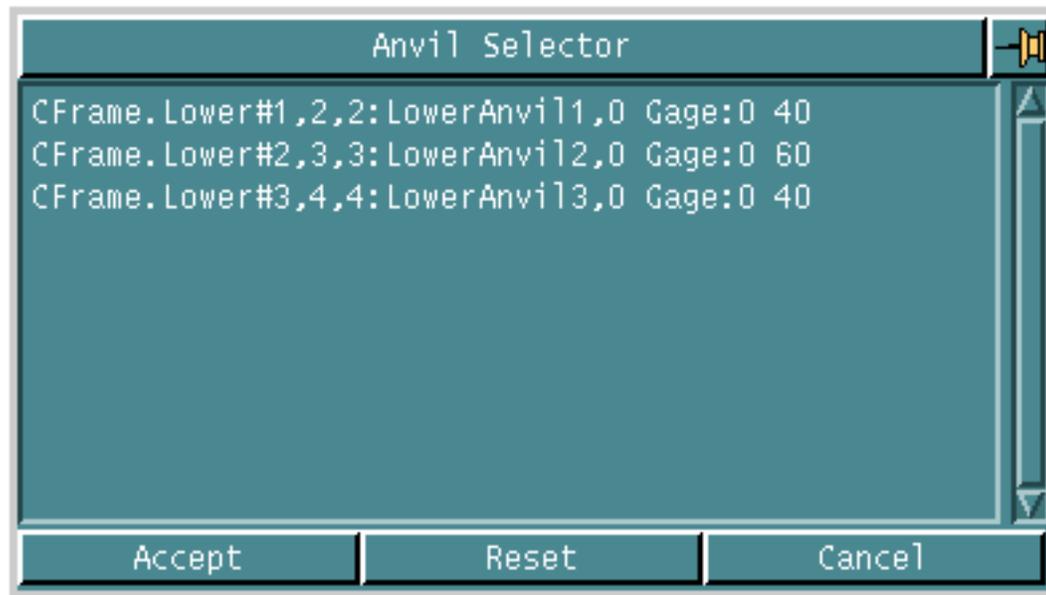
1. Choose the Lower Anvil and Feed Rate Parameters option from the fastening retract sheet. The set of parameters for the lower anvils and feed rates appear on the sheet.

**Figure 6-3** Fastening Retract Sheet for Lower Anvil and Feed Rate Parameters



2. Specify the active anvil in the Active Anvil field.  
To do this click the list button. The Anvil Selector scroll list appears.

Figure 6-4 Anvil Selector Scroll List



- Choose the anvil and click Accept.



3. Choose the Retract Feed option to set the retract feed units to units/minute and specify the feed rate in the adjacent Feed Rate field.

OR



Choose the Retract Rapid option to set the retract feed rate to rapid.

4. Click Apply if you have finished entering all parameters for the retract task.

# Specifying Other Parameters

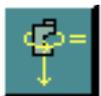
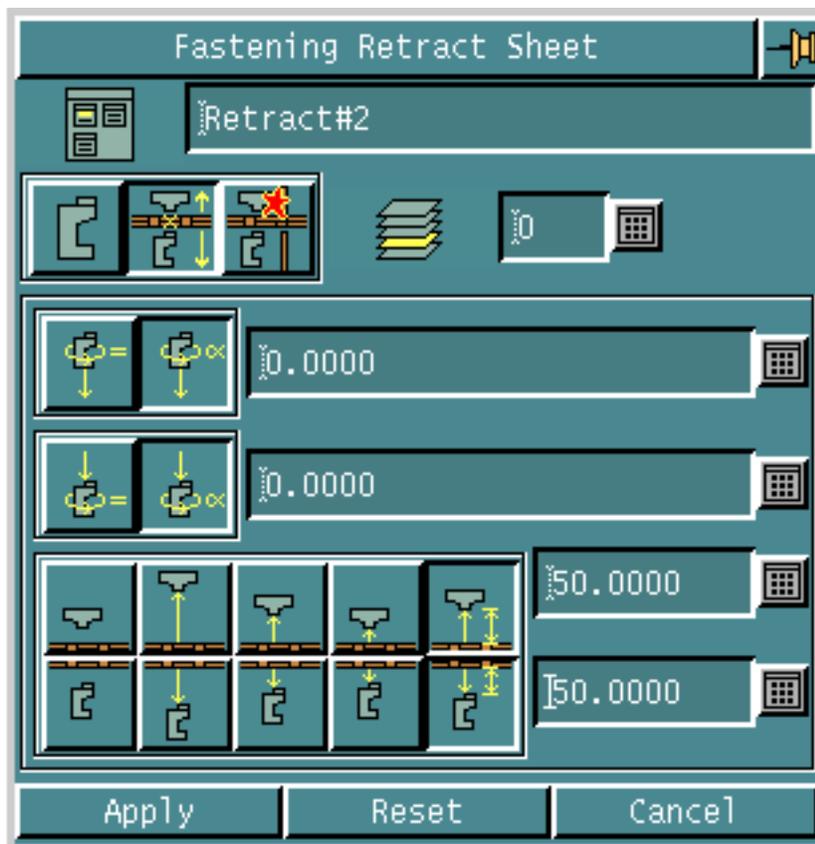


Use the OTHER PARAMETERS option to specify other parameters for the current task.

## Using this Option

1. Choose the Other Parameters option from the fastening retract sheet. The set of other parameters appears on the sheet.

Figure 6-5 Fastening Retract Sheet for Other Parameters



2. Choose the Current Initial Rotation option to maintain the current rotation of the lower anvil before the retract.

OR



Choose the Anvil Initial Rotation option and specify the initial rotation of the lower anvil before the retract.



3. Choose the Current Final Rotation option to maintain the current rotation of the lower anvil after the retract.

OR



Choose the Anvil Final Rotation option and specify the final rotation of the lower anvil after the retract.



4. Choose the Upper Current Position option to specify that the upper anvil should remain at its current position.

OR



Choose the Full Upper Retract option to specify that the upper anvil should retract to its full retract position.

OR



Choose the Shallow Upper Retract option to specify that the upper anvil should retract to the shallow retract position.

OR



Choose the Close Upper Retract option to specify that the upper anvil should retract to the close retract position.

OR



Choose the Intermediate Upper Retract option and specify an intermediate retract position in the adjacent field.



5. Choose the Lower Current Position option to specify that the lower anvil should remain at its current position.

OR



Choose the Full Lower Retract option to specify that the lower anvil should retract to its full retract position.

OR



Choose the Shallow Lower Retract option to specify that the lower anvil should retract to the shallow retract position.

OR



Choose the Close Lower Retract option to specify that the lower anvil should retract to the close retract position.

OR



Choose the Intermediate Lower Retract option and specify an intermediate retract position in the adjacent field.

Please note: Please refer to “HEAD” on page A-4 to see the output command that CVNC activates when you choose the full, close, and intermediate retract options.

6. Click Apply if you have finished entering all parameters for the retract task.

## Specifying Collision Detection Parameters

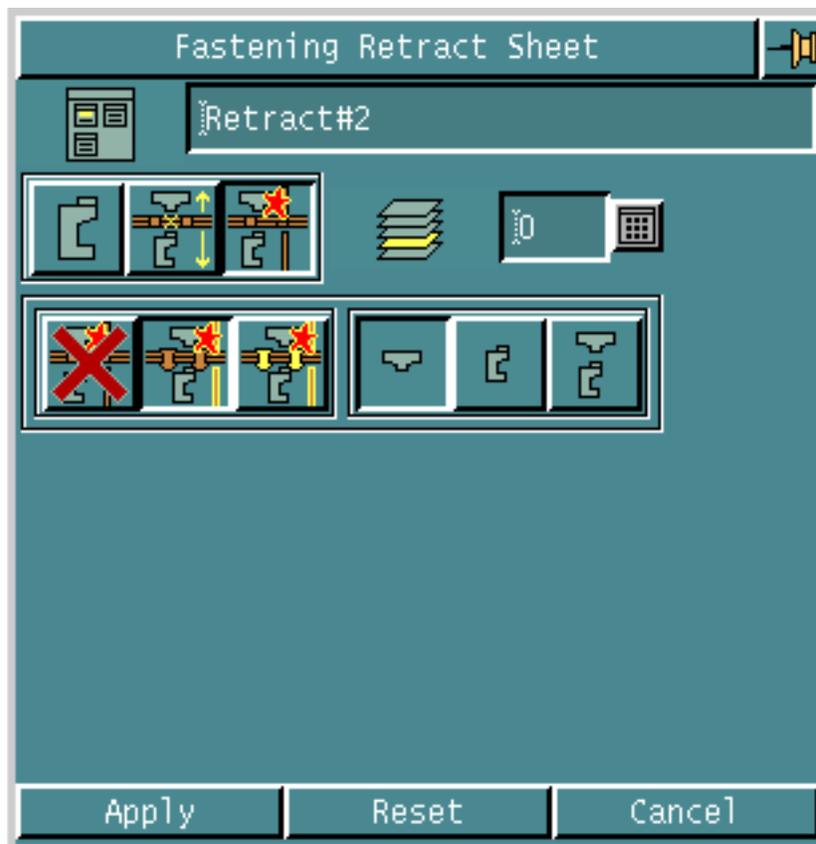


Use the COLLISION DETECTION PARAMETERS option to specify collision detection parameters for the current task.

### Using this Option

1. Choose the Collision Detection Parameters option from the fastening retract sheet. The set of collision detection parameters appears on the sheet.

**Figure 6-6 Fastening Retract Sheet for Collision Detection Parameters**



2. Choose the No Collision option if you do not want collision features to be used for the current task.

OR



3. Choose the Collision Only option if you want only the collision features, and not the fasteners, to be used for collision detection.



- Choose the Upper Anvil Col option if you want collisions to be detected for the upper anvil.

OR



- Choose the Lower Anvil Col option if you want collisions to be detected for the lower anvil.

OR



- Choose the Upper Lower Anvil Col option if you want collisions to be detected for both the upper and the lower anvils.

OR



4. Choose the Collision Fasteners option if you want both collision features and fasteners to be used for collision detection.



- Choose the Upper Anvil Col option if you want collisions to be detected for the upper anvil.

OR



- Choose the Lower Anvil Col option if you want collisions to be detected for the lower anvil.

OR



- Choose the Upper Lower Anvil Col option if you want collisions to be detected for both the upper and the lower anvils.

5. Click Apply if you have finished entering all parameters for the task.

# Creating Custom Tasks

---

This chapter describes how you can use the NC Builder Graphical User Interface (GUI) for creating your own tasks. You can create these tasks using the CVNC commands. The following sections show you how to do so.

- Accessing the Custom Task Options

# Accessing the Custom Task Options

1. Choose the Manufacture option from the CADDs Environment Access menu.
2. Enter a new or existing Job Control File (JCF) in the fastening mode. The NCBuilder task set appears.



3. Choose the Job Block option from the NCBuilder task set. The NCBuilder property sheet appears.



4. Choose the Add Operation option from the NCBuilder property sheet. The Operation Sheet appears.

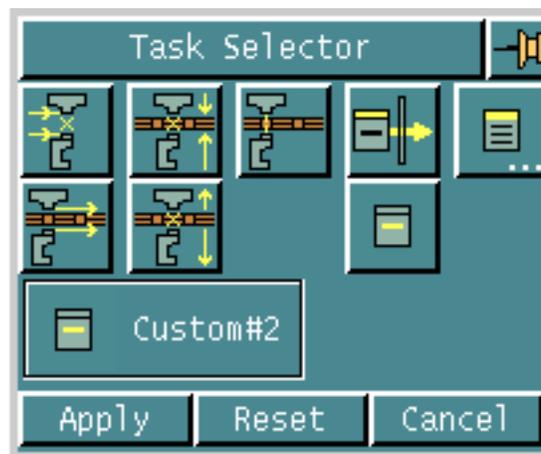


5. Choose the Add Task option from the operation sheet. The Task Selector palette appears.



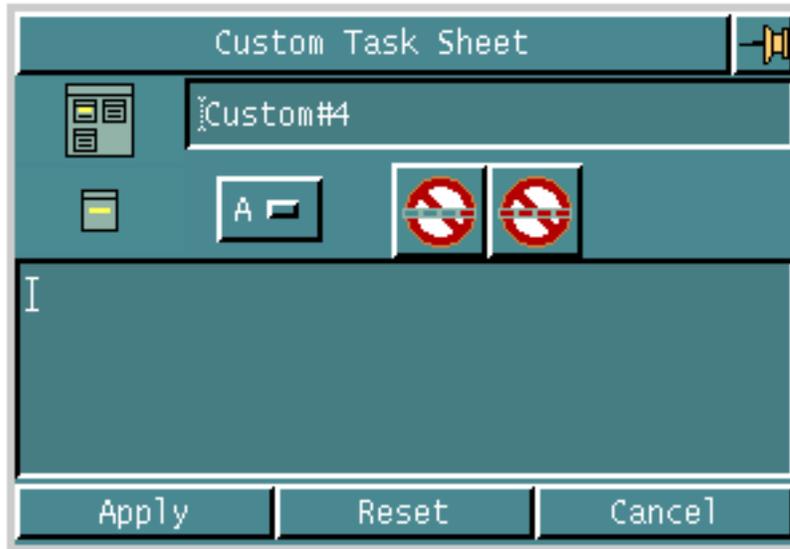
6. Choose the Custom option from the Task Selector palette. The task name and its icon appear in the Task Selector palette as shown in the following figure. The sequence number of the task also appears. For example, if the task is the second custom task in the operation, it has the number 2.

**Figure 7-1 Task Selector Palette with Task Name and Icon**



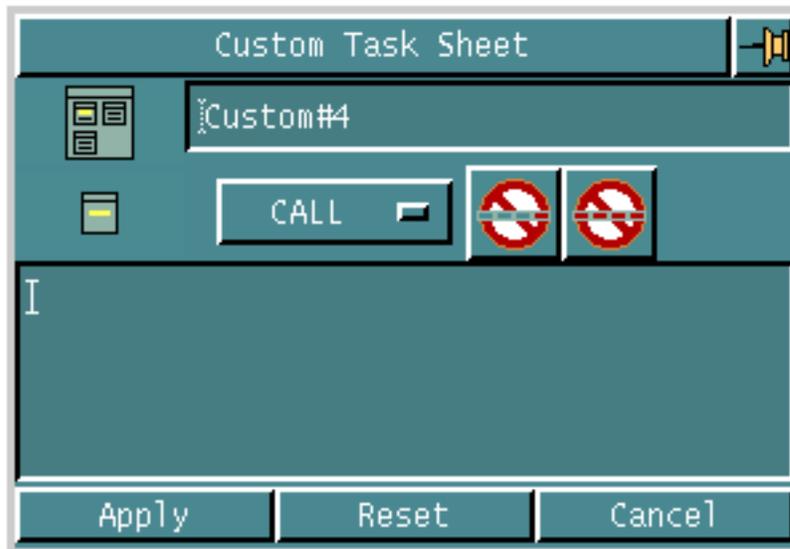
7. Click Apply.  
The Custom Task Sheet appears.

Figure 7-2 Custom Task Sheet



8. Click the option list button and choose the beginning letter for the CVNC command you want. For example, if you choose the letter C, the option list button changes as shown below.

Figure 7-3 Custom Task Sheet after Choosing a Letter



9. Clicking the option list button now shows you a list of CVNC commands beginning with C.

**Figure 7-4 CVNC Commands Option List**



10. Choose the command from this list. The option list button again changes to show a list of first level modifiers for the command. In this way you can successively use the option lists to specify the full syntax of the command. The text box on the custom task sheet shows the command as you create it.



11. Choose the Delete Last Word option if you want to delete the last word entered in the command. The option list also changes accordingly. Thus you can take back your command in steps if you want to make changes.



12. Choose the Delete Whole Command option if you want to delete the entire command and reset the option list to the alphabet.

13. Specify all the commands for the task as explained above.

14. Click Apply if you have finished specifying the commands for the task.

The task now appears in the operation sheet.

# Saving and Loading Method Files for an Operation

---

This chapter describes how you can use the NC Builder Graphical User Interface (GUI) to save and load method files for an operation. You can save an operation and then reload it for subsequent use. The following sections explain the steps to do so.

- Saving an Operation in a Method File
- Loading a Method File for an Operation

# Saving an Operation in a Method File



Use the Save Method option on the operation sheet to save an operation in a method file.

## Using this Option

1. Choose the Manufacture option from the CADDs Environment Access menu.
2. Enter a new or existing Job Control File (JCF) in the fastening mode. The NCBuilder task set appears.

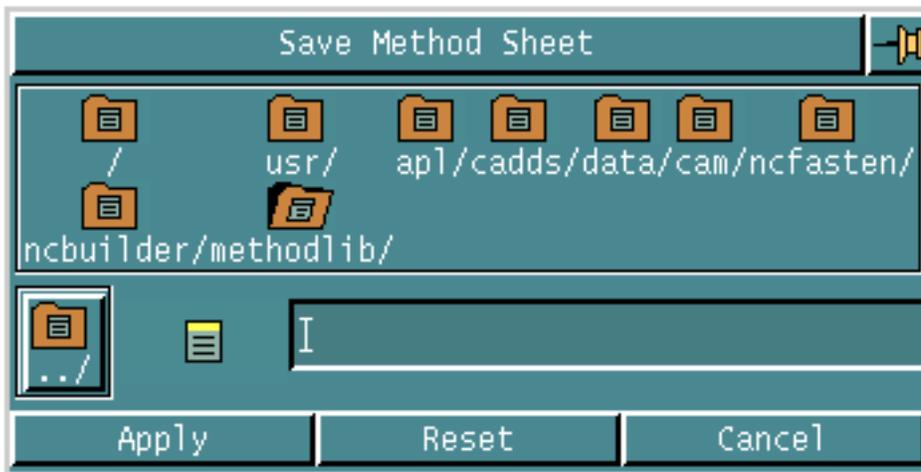


3. Choose the Job Block option from the NCBuilder task set. The NCBuilder property sheet appears.



4. Choose the Add Operation option from the NCBuilder property sheet. The Operation Sheet appears.
5. Choose the Save Method option from the operation sheet. The Save Method Sheet appears.

**Figure 8-1 Save Method Sheet**



6. Click the Change Directory option and choose the directory in which you want to save the file.

7. Specify the name of the file in the Method Filename field.
8. Click Apply.

## Loading a Method File for an Operation



Use the Load Method option from the task selector palette to load a previously saved method file.

### Using this Option

1. Choose the Manufacture option from the CADDs Environment Access menu.
2. Enter a new or existing Job Control File (JCF) in the fastening mode. The NCBuilder task set appears.



3. Choose the Job Block option from the NCBuilder task set. The NCBuilder property sheet appears.

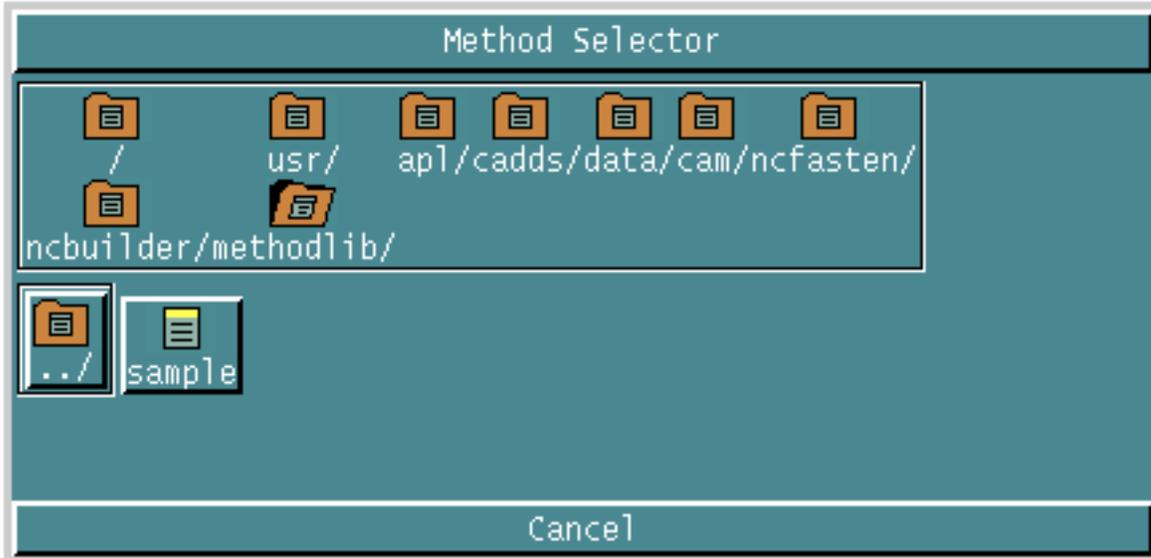


4. Choose the Add Operation option from the NCBuilder property sheet. The Operation Sheet appears.



5. Choose the Add Task option from the operation sheet. The Task Selector palette appears.
6. Choose the Load Method option from the Task Selector palette. The Method Selector sheet appears.

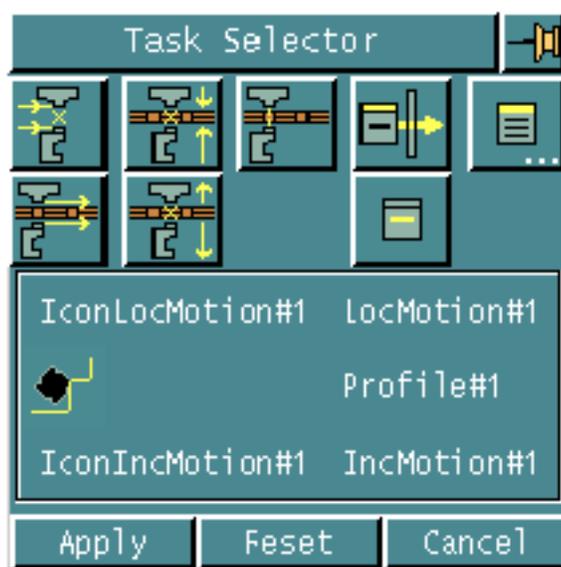
Figure 8-2 Method Selector Sheet



7. Click the Change Directory option and choose the directory from which you want to load the method file.
8. Click the method file you want to load.

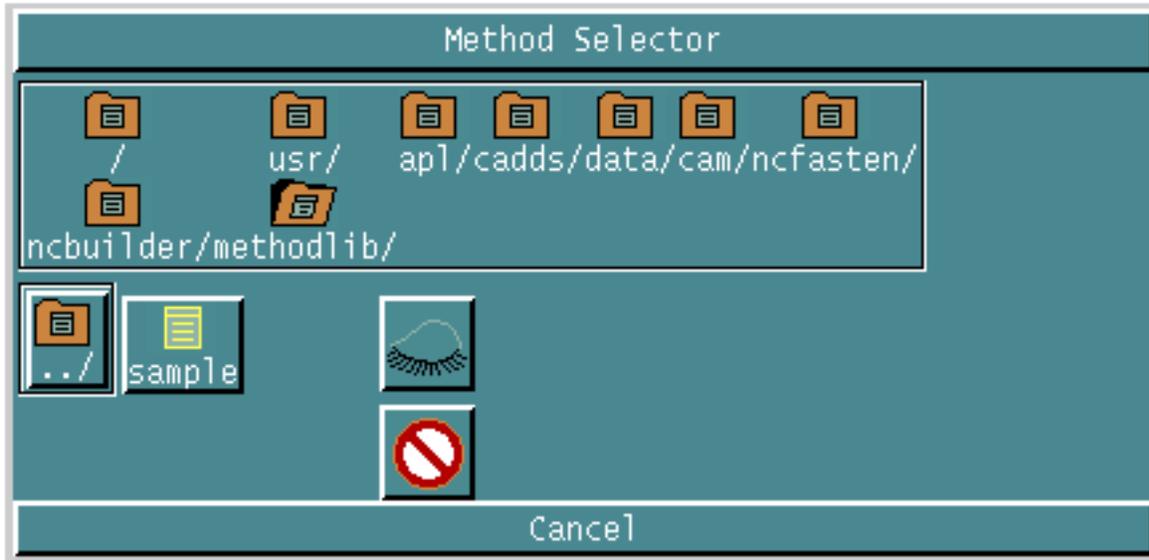
The task names and their icons appear in the Task Selector palette as shown in the following figure.

Figure 8-3 Task Selector Palette with Tasks in the Method File



The Method Selector sheet also changes as shown in the following figure.

**Figure 8-4 Method Selector Sheet after Selecting a Method File**



9. Choose the Viewer option if you want to see the parameters of the tasks.



10. Choose the Delete option if you want to delete a method file.

11. Choose Apply from the Task Selector palette. The tasks in the operation now appear on the operation sheet. You can now edit these tasks as required.

12. Execute your job as described in “Executing the Job” on page 5-43.

# Fastening Commands

---

This appendix describes the commands that CVNC issues when you choose options from the CVNC-Fastening GUI. The following sections describe these commands and their modifiers.

- Command Types
- CYCLE
- HEAD
- PRECOL
- PROBE
- SENSOR
- TRACER

# Command Types

CVNC-Fastening provides the following two types of commands:

- Generic
- Specific

## Generic Commands

These commands are invoked when you select the appropriate options from the property sheets. They are not exception data and can be used with all fastening machines.

## Specific Commands

These commands are invoked from the Fasten Location Exceptions Sheet. They are exception data which modify the final output during the fastening task. These commands depend on the type of fastening machine. Each type of fastening machine may have its own set of specific commands.

# CYCLE

This command defines the type of fastening task. It is a generic command. You can configure this command from the options for cycle type on the fastening sheet for more parameters. CVNC issues it when you click Apply on the NCBuilder sheet. It supports the following primary cycles:

- **CYCLE/RIVET**  
Defines a riveting task.
- **CYCLE/BOLT**  
Defines a bolting task.
- **CYCLE/DRILL**  
Defines a drilling task.
- **CYCLE/CSINK**  
Defines a drill and countersink task.
- **CYCLE/LOCK**  
Defines a lock and bolt task.
- **CYCLE/OFF**  
Cancels the current cycle and returns the machine to 5-axis interpolation motion.
- **CYCLE/ON**  
Reinstates the previously cancelled cycle and returns the machine to cycle operations from 5-axis interpolation motion.

You can customize the options on the fastening sheet to the cycle types you want, by defining them in the `clfilegen` file. Similarly, you can configure the options to represent the modifiers described below.

## Modifiers

**LENGTH, nexp:** Specifies the clamp distance.

**INHIBIT:** Inhibits the swage collar/shave function.

## HEAD

This command defines the retract motion of the upper and lower anvils. You can configure this command from the options on the fastening retract sheet. CVNC issues it when you click Apply on the NCBuilder sheet. It is a generic command.

### Modifiers

BOTH, DEEP: Specifies full retract for both anvils.

UPPER, DEEP: Specifies full retract for the upper anvil.

UPPER: Specifies shallow retract for the upper anvil.

UPPER, nexp: Specifies the retract offset for the upper anvil.

LOWER, DEEP: Specifies full retract for the lower anvil.

LOWER: Specifies shallow retract for the lower anvil.

LOWER, nexp: Specifies the retract offset for the lower anvil.

# PRECOL

This command enables or disables the short drop collar feed. It is a specific command. You can configure it in the template file in `/usr/apl/cadds/data/cam/ncfasten/ncbuilder` and then access it from the Fasten Location Exceptions Sheet.

## Modifiers

ON: Enables the short drop collar feed.

OFF: Disables the short drop collar feed.

# PROBE

This command defines hole probing. It is a specific command. You can configure it in the template file in `/usr/apl/cadds/data/cam/ncfasten/ncbuilder` and then access it from the Fasten Location Exceptions Sheet.

## Modifiers

NEXT: Specifies probing on the next hole only.

STEP, *nexp*: Specifies probing on holes selected in steps defined by *nexp*. For example, if you define *nexp* as 2, every second hole is probed.

NEXT, BOTH: Specifies probing on both sides of the next hole.

STEP, *nexp*, BOTH: Specifies probing on both sides of holes selected in steps.

OFF: Disables hole probing.

# SENSOR

This command defines output data to control the machine tool normality sensors. It is a specific command. You can configure it in the template file in `/usr/apl/cadds/data/cam/ncfasten/ncbuilder` and then access it from the Fasten Location Exceptions Sheet.

## Modifiers

ON: Enables the normality sensor.

CLEAR, *nexp*: Specifies the offset height of the sensor in mm.

OMIT, *nexp*: Omits the sensor specified by *nexp*, from a choice of 4.

OFF: Disables normality sensors.

# TRACER

This command defines output data to control the machine tool tracers. It is a specific command. You can configure it in the template file in `/usr/apl/cadds/data/cam/ncfasten/ncbuilder` and then access it from the Fasten Location Exceptions Sheet.

## Modifiers

YAXIS, `nexp`: Turns on the y-axis tracer with an offset specified by `nexp`.

VAXIS, `nexp`: Turns on the v-axis tracer with an offset specified by `nexp`.

YAXIS OFF: Disables the y-axis tracer.

VAXIS OFF: Disables the v-axis tracer.

---

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