# VI

## Feature Recognition System User Manual

This chapter will explain the installation procedure and operation example of feature recognition CAD (FRCAD) software. The explanation on how to use the software is covered in Chapter II Section 6. This chapter will cover the following:

- 6.1. Outline: The installation procedure and structure of the software. FRCAD software is supplied merged with PCadCam2000 software; however user has to install the software independently.
- 6.2. Drawing Database Registration: The procedure to register data into drawing database to prepare FRCAD operation on two-dimensional CAD system that the user used.
- 6.3. Examples: Several examples will be presented.

### 6.1. Outline

This section will describe the preparation for FRCAD software installation. There are two important files to run FRCAD: *fr:arx* and *frcad.mdb*; and these two files will be set automatically when user installs PCadCam2000 to C:\Program Files\PCadCam folder.

The following section will describe the method to install FRCAD database.

#### 6.1.1. Connecting Database

FRCAD is operational in database administration system using Microsoft Office ACCESS software. The database is connected via ODBC application, which is included automatically when installing Microsoft WINDOWS operating system. User can also download ODBC application from Microsoft.com.

Perform the following operation to set ODBC:

1. Open Control Panel to bring up a display as shown on Figure 6-1. Depends on the operating system; ODBC maybe be located in control system under administrative tool.



Figure 6-1. ODBC display from Windows Control Panel

2. Click on the ODBC icon and the display is switched as Figure 6-2 to display the ODBC data source administrator. Click on "Add" button.

📢 ODBC Data Source Admir	nistrator	? ×
User DSN System DSN	Driver	4 <u>d</u> d
dBASE Files Excel Files FoxPro Files MS Access 97 Database Text Files An ODBC User the indicated d	Microsoft dBase Driver (*.dbf) Microsoft Excel Driver (*.dbf) Microsoft FoxPro Driver (*.dbf) Microsoft Access Driver (*.mdb) Microsoft Text Driver (*.txt; *.csv) data source stores information about how to conn ata provider. A User data source is only visible to	
and con only b	o unad an the auront machine OK キャンセル 更新	τ <u>ω</u> <u>νμ</u> τ*

Figure 6-2. ODBC data source administrator

3. Figure 6-3 will show the next dialog box to select database driver. Select Microsoft Access Driver then click on "FINISH" button.

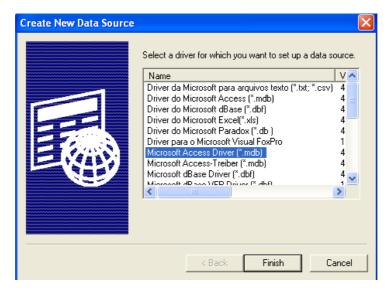


Figure 6-3. Selection on database driver

4. The display will switch into Figure 6-4 for the user to input Data Source Name. The data source name for FRCAD is "frcad". Input the name in small letter. <u>Do not change the name or FRCAD will not run</u>. User can input any description in the lower column. Click on "Select" button.

ODBC Microsoft Ac	cess 97 Setup	<b>X</b>
Diata Source <u>N</u> ame:	fread	OK
Description:	Automatic Feature Recognition	Cancel
Database		
Database:	, di	<u>H</u> elp
Select	<u>Create</u> <u>Repair</u> Compact	<u>A</u> dvanced
– System Database–		
• Non <u>e</u>		
O Database:		
	System Database	<u>O</u> ptions>>

Figure 6-4. Data source input display

5. The system will then ask user to select the database file via a dialog box as shown on Figure 6-5. Select database name "fread.mdb" then click on OK button.

Select Database		×
Database Name frcad.mdb fread.mdb Sft.mdb	Directories: c:¥program files¥pcadcam C:¥ Program Files PCadCam C: FILES C: Support	OK Cancel Help Read Only Exclusive
List Files of Type: Access Databases (*.m 💌	Drives:	Network

Figure 6-5. Database file selection

6. Upon completion of step 1 to 5; the display will return to the first display with an additional "frcad" added in the User Data Sources as shown on Figure 6-6. User should confirm that FRCAD exists on the list. Click on OK then exit Control Panel.

ODBC Data Source Admin	istrator File DSN   ODBC Drivers   Tracing	g About
User Data Sources: Name 3DCAD dBASE Files Excel Files FoxPro Files frcad MS Access 7.0 Database MS Access 97 Database SFT Text Files	Driver Microsoft Access Driver (*.mdb) Microsoft dBase Driver (*.dbf) Microsoft Excel Driver (*.dsf) Microsoft FoxPro Driver (*.dbf) Microsoft Access Driver (*.mdb) Microsoft Text Driver (*.txt; *.csv)	A <u>d</u> d <u>R</u> emove <u>C</u> onfigure
the indicated da	data source stores information about h ita provider. A User data source is or used on the current machine OK キャンセル	

Figure 6-6. Data Sources "frcad" addition

#### 6.2. Drawing Database Registration

This section will explain the method to register the important data into drawing database based on the rule on how the user creates their design drawing using CAD system.

 Start PCadCam software and click on FR Database icon in FR toolbar as shown on Figure 6-7.

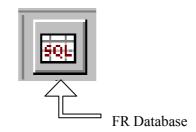


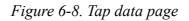
Figure 6-7. FR Database icon

2. The drawing database dialog box will be displayed as shown on Figure 6-8. There are nine data page on the dialog box, and the display shows tap data page.

3. The complete type of tap, including pipe screw (PT type), that is used in the design drawing is registered in.

Tap Line Type:	s(BOTTOM) Sy	stem Configuration	Auxiliary Lines	Ream hole Data
Solid Lines	Hidden Lines	Tap Data Co	unter Bore Data	Tap Line Types(TOP)
Name	Tap Diameter 'D'	Un-Hole Diameter 'd'	Tap Depth 'H'	Un-Hole Depth 'h' 🔺
43	3.000	2.600	8.000	13.000
44	4.000	3.400	10.000	15.000
/15	5.000	4.300	12.000	17.000
/16	6.000	5.100	15.000	20.000
PT1/16	7.700	6.500	12.000	22.000
48	8.000	6.800	20.000	25.000
PT1/8	9.728	8.566	12.000	20.000
/10	10.000	8.600	25.000	30.000
/12	12.000	10.400	30.000	35.000
PT1/4	13.157	11.445	18.000	26.000
/14	14.000	12.200	35.000	40.000
/16	16.000	14.200	40.000	45.000
РТ3/8	16.662	14.500	21.000	29.000
/18	18.000	15.700	45.000	50.000
420	20.000	17.700	50.000	60.000 💌
Record Insertion Always insert	Options : below highlighted record.			Insert Record
C Always insert	above highlighted record.			Delete Record

## B.1. Tap Data



#### **B.2.** Counter Bore Data

Input the standard design data for counter bore

Tap Line Type:	s(BOTTOM)	System Configurat		Auxiliary Lines	,   B	eam hole Data
olid Lines	Hidden Lines	Tap Data	Counte	er Bore Data	Tap L	ine Types(TOP
Name	d		D		Н	
M3	3.500		6.000		4.500	
M4	4.500		8.000		5.500	
M5	5.500		9.000		6.500	
M6	7.000		11.000		7.500	
M8	9.000		14.000		10.000	
M10	11.000		17.000		12.500	
M12	13.000		19.000		15.000	
M14	16.000		23.000		17.500	
M16		18.000		26.000 28.000		
M18		20.000				
M20	22.000		32.000		24.500	
M24	26.000		38.000		29.500	
M27	29.000		42.000		32.500	
•	1				1.	
-Record Inserti	ion Options :				-	
<ul> <li>Always ins</li> </ul>	ert below highlighted rec	ord.	}		L	Insert Record
C Always ins	ert above highlighted rec	ord.	2			Delete Record
					4.00	

Figure 6-9. Counter Bore data page

#### **B.3 Solid** Line Data

The display shows all solid line data that is used in design drawing (Figure 6-10). The line type is managed under Layer Name. User can add this line type data during FRCAD operation automatically, and the same case applies on hidden and auxiliary lines.

Tap Line Types	(BOTTOM)	System Configuration	Auxiliary Lines	Ream hole Data
Solid Lines	Hidden Lines	Tap Data 0	Counter Bore Data	Tap Line Types(TOP)
Layer Name		Layer Type	Layer Color	-
Name		Туре	Color	
Name		Туре	Color	
1		CONTINUOUS	RED	
0		CONTINUOUS	GREEN	
1		CONTINUOUS	CYAN	
2		CONTINUOUS	GREEN	
2		CONTINUOUS	CYAN	
3		CONTINUOUS	CYAN	
3		CONTINUOUS	GREEN	
30		DASHED	GREEN	
30		CONTINUOUS	GREEN	
90		CONTINUOUS	GREEN	
PV		NULL	WHITE	
40		CONTINUOUS	GREEN	
0		NULL	WHITE	×
•				
Record Insertion (	Options :			Insert Record
<ul> <li>Always insert I</li> </ul>	below highlighted rec	ord.		Insert Record
C Always insert a	above highlighted rec	cord.		Delete Record

*Figure 6-10. Solid line data page* 

#### **B.4. Hidden Line Data**

The display shows all solid line data that is used in design drawing (Figure 6-11).

Tap Line Types(BOTTOM) Solid Lines Hidden Line	System Configuration   \$   Tap Data   Cou	Auxiliary Lines nter Bore Data	Ream hole Data Tap Line Types(TOP)
Layer Name	Layer Type	Layer Color	
0	DASHED	GREEN	
D	CONTINUOUS	CYAN	
D	DASHED	CYAN	
1	DASHED	CYAN	
1	DASHED	RED	
2	DASHED	CYAN	
2	DASHED	GREEN	
	DASHED	CYAN	
30	DASHED	CYAN	
30	CONTINUOUS	CYAN	
PV	HIDDEN	WHITE	
90 90	CONTINUOUS	CYAN	
40	DASHED DASHED	GREEN	
40.	DASHED	GREEN	
d			I.N
Record Insertion Options :			
Always insert below highlighted i	record.		Insert Record
C Always insert above highlighted	record		
Miways insert above highlighted	ecord.		Delete Record

Figure 6-11. Hidden line data page

Layer Name         Layer Type           0         DASHDOT           0         DASHDOT           0         DASHDOT           0         DIVIDE           3         DASHDOT           2         DASHDOT           1         DASHDOT           40         DIVIDE           90         DASHDOT           10         DASHDOT	CYAN CYAN CYAN CYAN GREEN
D         DASHDOT           30         DASHDOT           30         DASHDOT           0         DIVIDE           3         DASHDOT           2         DASHDOT           1         DASHDOT           40         DIVIDE           90         DASHDOT           10         DASHDOT	CYAN CYAN CYAN CYAN CYAN GREEN CYAN
30         DASHDOT           0         DIVIDE           3         DASHDOT           2         DASHDOT           1         DASHDOT           40         DIVIDE           90         DASHDOT           10         DASHDOT	CYAN CYAN CYAN GREEN CYAN
0 DIVIDE 3 DASHDOT 2 DASHDOT 1 DASHDOT 40 DIVIDE 90 DASHDOT 10 DASHDOT	CYAN CYAN GREEN CYAN
3         DASHDOT           2         DASHDOT           1         DASHDOT           40         DIVIDE           90         DASHDOT           10         DASHDOT	CYAN GREEN CYAN
2 DASHDOT 1 DASHDOT 40 DIVIDE 90 DASHDOT 10 DASHDOT	GREEN CYAN
1 DASHDOT 40 DIVIDE 90 DASHDOT 10 DASHDOT	CYAN
40 DIVIDE 90 DASHDOT 10 DASHDOT	
90 DASHDOT 10 DASHDOT	CYAN
10 DASHDOT	
40 DASHDOT	
D DIVIDE	GREEN
30 DASHDOT	
90 DIVIDE 20 DIVIDE	CYAN STAN
Record Insertion Options : Always insert below highlighted record. Always insert above highlighted record.	Insert Record Delete Record

#### **B.5.** Auxiliary Line Data

*Figure 6-12. Auxiliary line data page* 

## **B.6. Tap Line Types (TOP) Data**

There is a case when tap exists on both top and bottom surfaces. The data describes herewith regulates the tap hole design on top surface. There are two concentric line symbols for each tap drawn: the tap (Tap LT) and the under hole (Un-Hole LT) symbols. User should fill in the name, type and color data on each as shown on Figure 6-13.

Tap Line Type Solid Lines	Hidden Lines	System Config		Auxiliary Lines	Ream hole Data Tap Line Types(TOP)
Tap LT Name	Tap LT Type	Tap LT Color	Un-Hole LT Na.	. Un-Hole LT Type	e Un-Hole LT Co 🔺
тар ст_мате О		GREEN			
0 N	CONTINUOUS	GREEN	0	CONTINUOUS	GREEN
U 1	CONTINUOUS	CYAN	1	CONTINUOUS	CYAN
-	CONTINUOUS	RED		CONTINUOUS	RED
2	CONTINUOUS	GREEN	2	CONTINUOUS	GREEN
2 3	CONTINUOUS	CYAN	3	CONTINUOUS	CYAN
30	CONTINUOUS	CYAN	30	CONTINUOUS	GREEN
90	CONTINUOUS	CYAN	90	CONTINUOUS	GREEN
30	DASHED	CYAN	30	DASHED	GREEN
PV	NULL	WHITE	PV	NULL	WHITE
0	CONTINUOUS	GREEN	Ó.	CONTINUOUS	GREEN
0	CONTINUOUS	CYAN	30	CONTINUOUS	GREEN
n n	CONTINUOUS	GREEN	30	CONTINUOUS	GREEN
n n	CONTINUOUS	GREEN	30	CONTINUOUS	CYAN
50	CONTINUOUS	CYAN	50	CONTINUOUS	CYAN -I
•1	001111100000	orrine		001111100000	
Record Insertion	Options :		-		
	t below highlighted rec	ord.			Insert Record
C Always inser	t above highlighted rec	cord.			Delete Record
			1		

Figure 6-13. Tap Line Types (TOP) data page

#### **B.7. Tap Line Types (BOTTOM) Data**

]	The dialog	box a	s shown	on	Figure	6-14	is	used	to	input	data	for	the tap	that	t is
designed	on Bottom	surface	e.												

Solid Lines   Hidden Lines Tap Line Types(BOTTOM)		Tap Data	a Counte	r Bore Data	Tap Line Types(TOP)
		System Config	uration	Auxiliary Lines	Ream hole Data
Tap LT_Name	Tap LT_Type	Tap LT_Color	Un-Hole LT_N	a Un-Hole LT_Type	e Un-Hole LT_Color
)	DASHED	CYAN	0	DASHED	GREEN
0	DASHED	GREEN	0	DASHED	CYAN
1	DASHED	RED	1	DASHED	RED
1	DASHED	CYAN	1	DASHED	CYAN
2	DASHED	GREEN	2	DASHED	GREEN
3	DASHED	CYAN	3	DASHED	CYAN
)	DASHED	GREEN	0	DASHED	GREEN
)	DASHED	CYAN	30	DASHED	GREEN
4					[]
Record Insertion	Options : below highlighted rec	cord.	i i		Insert Record
C Always insert	above highlighted red	cord.	;		Delete Record

Figure 6-14. Tap Line Type (BOTTOM) data page

#### **B.8. Ream Hole Data**

Input the standard design data for ream hole in the dialog box as shown on Figure 6-15.

	p Data Counter Bore Data Tap Line Types(TOP Configuration Auxiliary Lines Ream hole Data
Ream Diameter 'D' 6.000 8.000 10.000 12.000 16.000	Ream Depth 'h'           8.000           10.000           12.000           15.000           18.000
20.000	23,000
Record Insertion Options :	
Always insert below highlighted record.	P <sup>ØD</sup> 1 Insert Record
<ul> <li>Always insert above highlighted record.</li> </ul>	Delete Record

Figure 6-15. Ream Hole data page

#### **B.9. System Configuration Data**

Solid Lines	1			Bore Data	Tap Line Types(TOP)
Tap Line Types	(BOTTOM) Syste	m Configuratio	n	Auxiliary Lines	Ream hole Data
System Mode C Automatic C Interactive	Non-tangent arcs in cont Include in Contour fea Separated feature	iture C /	processor — Active Not Active		Point Method: Global Origin Point sht Corner
AutoCAD Link — Not Active Active	<ul> <li>Polyline Generation :-</li> <li>Not Active</li> <li>Active</li> </ul>	C Visib	sign Surface Ile Surface en Surface Ile & Hidden i		Edit Feature : In PCAD/CAM In FRCAD
Tolerance values Connectivity, Tar	igency, normal and parallel :	0.95 ±		Schematic Symbo	1. <u>01</u> ÷
FRCAD Directory	, C*Program Files*PC	Service of the servic	ory as	shown he	Browser

User will conduct system setting based on the data supplied in the dialog box as shown on Figure 6-16.

Figure 6-16. System Configuration data page

#### System Mode:

It is a toggle box to select an automatic recognition of the imaginary workpiece boundary or thru interaction mode for each projection view in the case when FR system has to run on three projection views. Select on "Automatic" for an automatic recognition process. Select "Interactive" for the user to input the data interactively on a dialog box. If the user select "Automatic" but the system fails to run the designated function; the system will switch into "Interactive" promptly.

#### Non-Tangent Arcs in Contour:

It is a toggle box to assign the selection on the inclusion of angle (non-tangent) in polyline. The polyline itself may consist of arc and arc, arc and straight line, or straight line to and straight line. There is a case when angle exists in between the lines, therefore user has to decide whether to include the angle as a different machining feature or it is included in the polyline itself.

#### **Pre-Processor:**

This toggle box will allow the user to activate segment subdivision response in between projection views for a significant automatic looping when dealing with running FR on three projection views. The function will not be run on ONE VIEW operation.

#### Local Origin Point Method:

This toggle box is used to assign the origin on each design surface of a workpiece. "Based on Global Origin Point" means that the origin point on each of design surface is a projection of the origin point on the workpiece. "Lower-Right Corner" means that the origin point will always be on the lower right corner for each design surface. Both selections apply the right hand rule. Based on Global Origin Point is the default option.

### AutoCAD Link:

Set the toggle into "Active" mode so that FRCAD system can download a DXF file automatically when the user clicks on "INPUT DXF FILE" in the earlier stage of PCadCam operation. At that time the DXF file name will be "acad2frcad.dxf" and it should be located in C: Program Files PCadCam folder.

#### **Polyline Generation:**

Set the toggle to allow FRCAD to process any polyline exists in the design drawing. In such a case, FRCAD will generate a DXF file that contains a polyline (or more). It is also possible to process the generated DXF file by PCadCam later on.

## View, Design Surface:

Set this toggle box to perform recognition for the ONE VIEW projection so that either the operation will be done only on the visible surface (Visible Surface), or the hidden surface (Hidden Surface) or both visible and hidden (Visible & Hidden Surfaces). The default will be "Visible & Hidden Surfaces", and in this setting; the feature recognition process will be done on front and back surfaces.

## **Edit Feature:**

It is necessary for the user to correct machining feature data after automatic recognition operation by FR system. The manual correction may be done only in PCadCam or FRCAD.

## **Tolerance Values:**

The value set on the left side (radius, mm) is an allowable error on connectivity, tangency, normal and parallel between the starting and end points of segment data exists in a DXF file. The value on the right is the allowable error (unit mm) on the difference of standard

value for tap data and the actual tap diameter on the drawing. Set the accuracy value by adjusting it to the drawing will undergo feature recognition process.

#### **FRCAD Directory:**

Input the directory where PCadCam2000 software is located, usually it is set to C: Program Files PCadCam.

Click on "OK button once all the nine data have been completed, then close the window.

## 6.3. Examples

It is necessary to revise the setting based on the type of drawing will undergo feature recognition operation. The following section will present several examples of the operation.

## 6.3.1. Recognition on One View with Polyline

Set the following into System Configuration of Figure 6-16.

Polyline Generation	: Set to "Active" for automatic recognition on polyline.
	: Set to "Visible Surface" to run recognition only on the front surface or set on "Visible & Hidden Surfaces to run recognition on both the front and back surfaces.

Select "CONVENTIONAL ONE VIEW" on the dialog box after clicking on feature recognition icon to start the operation. Input the "Material Thickness" data accordingly.

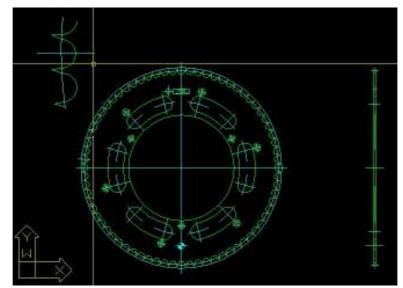


Figure 6-17. Example drawing for ONE VIEW projection with Polyline

### 6.3.2. Recognition on Multi View

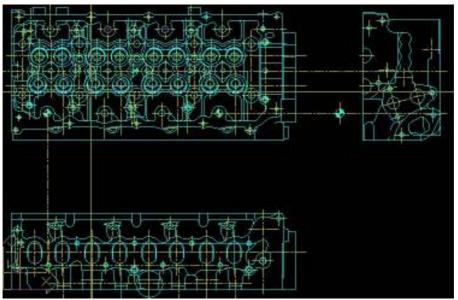


Figure 6-18. Example drawing for MULTI-VIEW

The example shown on Figure 6-18 contains multiple polyline on the boundary of the cast material; however none of them will be machined. Therefore set the System Configuration into:

Polyline Generation	:	Not Active
View, Design Surface	:	Visible Surface

Select "MULTI- VIEW PROCESS" on the dialog box after clicking on feature recognition icon to start the operation. Assign the following surface design name for each projection:

Upper Right : LEFT Projection Upper Left : BACK Projection Bottom Left : TOP Projection

Refer to Chapter II Figure 2-18 to assign a name on projection view.

## 6.3.2. Recognition on Third Quadrant

In this example; the operation will zoom three projection views from the RIGHT View

of the drawing that is positioned on the right bottom as shown on Figure 6-19. Set the following into System Configuration:

Pre-Processor : Active Polyline Generation : Not Active

Select "MULTI- VIEW PROCESS" on the dialog box after clicking on feature recognition icon to start the operation.

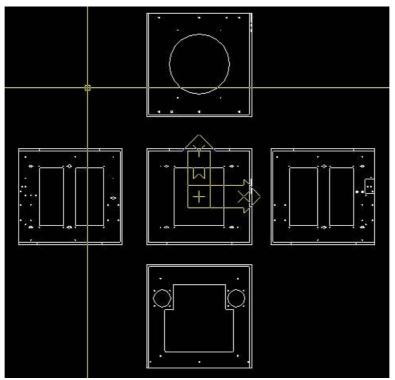


Figure 6-19. Example drawing for THIRD QUADRANT