

Intermediate Data Format

Mechanical Data Exchange Specification for the Design and Analysis of Printed Wiring Assemblies

Version 3.0

**Revision 1
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1.0 Introduction

This specification defines an Intermediate Data Format (IDF) for exchanging data between electrical and mechanical CAD/CAE systems for use in 3D design and analysis of printed wiring assemblies (PWAs), thus allowing users of these systems to participate concurrently in the design of electro-mechanical products. In a typical electro-mechanical design process for example, a mechanical CAE system may require a solid model of a PWA for form fit analysis in designing the enclosure for the final product. The electrical CAE system, on the other hand, requires 2D board outline and critical component placement information to layout and route the PWA design.

1.1 Scope

Limitations inherent in the systems that exchange data using this IDF may affect the interpretation of the data it contains. For example, a receiving system may not contain a data type for simple closed curves that include arcs. As a result, that system's translator may break up the arcs into a series of line segments. As another example, the current version of a translator may not be able to read or write all types of data contained in this version of the IDF. This specification does not attempt to describe these limitations; it is the responsibility of translator developers to communicate any such limitations to their users.

This specification does not address change management or configuration control of the IDF files. Change management and configuration control is the responsibility of the translators that read and write this format.

1.2 Summary of Changes, Version 3.0

A number of changes have been made to the Intermediate Data Format for Version 3.0:

- A new optional file, the Panel File, was added to allow the exchange of manufacturing panel information. The Panel File may contain any of the sections supported by the Board File. This allows panels to have keepouts, keepins, and drilled holes, for example.
- Ten nanometer units (TNM) are no longer supported.
- A new section, .NOTES, was added to the Board and Panel File to allow the exchange of design information and instructions that are not otherwise conveyed by IDF entities. The notes are intended for informational purposes only, not for use in manufacturing drawings.
- A new field was added to the first record of each section (except the drilled holes and notes sections) to specify which system, electrical or mechanical, "owns" that entity.
- A new field was added to the other outline section to specify which side the part represented by the other outline is mounted.
- Circular cutouts can now be represented by an included angle of 360.
- A new record was added to the routing outline section to allow routing outlines to be defined per layer.

- A new record was added to the placement outline section to allow placement outlines to be defined per side.
- New fields were added to the drilled hole record to specify how the hole is used and which system, electrical or mechanical, “owns” the hole.
- A field for representing the mounting offset for a component was added to the placement section.
- New values were added to the placement status field in the placement section to specify which system, electrical or mechanical, “owns” the placement of a particular component.
- A new record, beginning with keyword PROP, was added to the electrical section of the Library File to allow property information for components to be represented.

2.0 Structure of the Intermediate Data Format

The Intermediate Data Format consists of three files: the Board File, the Library File and the Panel File. The Board File contains a description of a single PWA, including the board shape, layout restrictions, and component placement. The Library File contains descriptions of components used by one or more PWAs. The Panel file contains a description of a manufacturing panel including the panel shape, layout restrictions, and the placement of boards and components on the panel.

Data is organized by sections in these files. Each section begins with a keyword indicating the type of data the section contains, and a matching keyword at the end of the section. All data between the section keyword and its corresponding ending keyword pertains to that section. Sections cannot be nested. Unless otherwise noted, sections within a file can be in any order.

Data within the sections is represented by one or more records consisting of one or more fields. Each line in a file is a separate record; fields within a record are separated by one or more blanks. Records within a section and fields within a record must be in a specific order. Records are free format which means that the fields they contain can be any length, and each field can begin in any column as long as the order of fields is maintained.

2.1 General Format Rules

The following general rules apply to the Intermediate Data Format:

- Sections are delimited by keywords beginning with a period (.).
- Records are delimited by a single new line character.
- Fields within a record are delimited by one or more space characters.
- Records and fields can be any length.
- Three data types are supported: string, float, and integer.
- Strings containing blank characters must be delimited by surrounding them with double quotes ("").
- Keyword strings are not case sensitive; they are generally capitalized to enhance readability.
- The case sensitivity of value strings is determined by the sending and receiving systems. Therefore, it is best to maintain the case of value strings.
- The comment character is the pound sign (#). A comment must be a separate line (record) and the comment character must be in column 1. Comments should be located between, but not within sections of the IDF files.

3.0 Board, Panel File Format

The Board File contains the physical description of the PWA itself and the locations of components that are placed on the board. The physical descriptions for the components are contained in the Library File and referenced in the placement section of the Board File.

↑ (: □ The Panel File is an optional file, similar to the Board File, that contains the physical description of a manufacturing step-and-repeat panel and the locations of boards and components on that panel. The Panel File references one or more PWAs described in separate Board Files. Any component placed on the panel itself is referenced in a Library File.

The Board and Panel Files contains the following sections:

- **Header** for information on the Board or Panel File itself
- **Board outline** for defining the outline, cutouts, and thickness of the board, panel
- **Other outline** for defining the outline, cutouts, and thickness of another outline
- **Route outline** for defining an area to route electrical connections within
- **Place outline** for defining an area to place electrical components within
- **Route keepout** for defining an area within which routing is not allowed
- **Via keepout** for defining an area within which vias are not allowed
- **Place keepout** for defining an area within which electrical components are not allowed
- **Place region** for defining an area to place similar electrical components within
- **Drilled holes** for defining drilled holes in the board, panel
- **Notes** for defining annotations to communicate additional information among designers
- **Placement** for defining the locations of components on the board, or boards and components on the panel

The Header section must be the first section in the file, the second section must be the Outline section, and the last section must be the Placement section. All other sections may be in any order.

The following pages describe these sections.

3.1 Header Section

This section contains information on the Board or Panel File itself.

Field, Description	Type	Value
1 Section keyword	string	.HEADER

Record 2

Field, Description	Type	Value
1 (: □ File type	string	BOARD_FILE File contains board information PANEL_FILE File contains panel information
2 IDF version number	float	1.0 First version 2.0 Previous version 3.0 This version
3 Source system identification	string	Any Example: "ACME CAD rel. 5.0"
4 Date	string	format = yyyy/mm/dd.hh:mm:ss
5 Board File version #	integer	Any

Record 3

Field, Description	Type	Value
1 Board name	string	Any
2 Units definition	string	MM millimeters THOU mils (thousandths of an inch)

The units specified in Field 2 apply to all values in the Board or Panel File.

Record 4

Field, Description	Type	Value
1 Section end keyword	string	.END_HEADER

3.2 Board, Panel Outline Section

This section defines the board or panel outline and its internal cutouts as a 2D profile with thickness. The outline and cutouts consist of simple closed curves made up of arcs and lines. Only one outline may be specified, but multiple cutouts are allowed.

Record 1

Field, Description		Type	Value
1 (: <input type="checkbox"/>	1 Section keyword	string	.BOARD_OUTLINE .PANEL_OUTLINE
1 (: <input type="checkbox"/>	2 Outline owner	string	MCAD Outline is owned by the Mechanical system and should not be modified in the Electrical system ECAD Outline is owned by the Electrical system and should not be modified in the Mechanical system UNOWNED Outline can be modified in either system

Record 2

Field, Description		Type	Value
1	Thickness	float	Any

The thickness of a panel should be the same as the boards it contains.

Record 3

Field, Description		Type	Value
1 (: <input type="checkbox"/>	1 Loop label	integer	0 Indicates board outline (points specified in counter-clockwise direction) 1 Indicates board cutout (points specified in clockwise direction) n Indicates additional board cutouts labeled sequentially from one
	2 X coordinate of point	float	Any
	3 Y coordinate of point	float	Any
	4 Include angle (degrees)	float	0 Indicates that a straight line is to be created between X_{N-1} , Y_{N-1} and X_N , Y_N . $\neq 0$ Indicates an arc is to be created between X_{N-1} , Y_{N-1} and X_N , Y_N . If positive, the arc is counter-clockwise. 360 Indicates a circle is to be created with center at X_{N-1} , Y_{N-1} with X_N , Y_N a point on the circle. A circle is considered an entire loop.

Record 3 is repeated for each point that defines the outline or a cutout. For each loop (outline or cutout), the last pair of coordinates should be the same as the first.

Record 4

Field, Description		Type	Value
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1 (: □	1	Section end keyword	string	.END_BOARD_OUTLINE .END_PANEL_OUTLINE
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3.3 Other Outline Section

This section defines an additional outline with cutouts that can be used for other purposes than the board outline such as for defining a heatsink or board core. The outline and cutouts consist of simple closed curves made up of arcs and lines. Multiple other outline sections may be specified.

Record 1

Field, Description		Type	Value
1	Section keyword	string	.OTHER_OUTLINE
2	Outline owner	string	MCAD Outline is owned by the Mechanical system and should not be modified in the Electrical system ECAD Outline is owned by the Electrical system and should not be modified in the Mechanical system UNOWNED Outline can be modified in either system

Record 2

Field, Description		Type	Value
1	Outline identifier	string	Any Unique identifier for the outline, such as a part name or layer name
2	Extrude thickness	float	Any (0)
3	board side	string	TOP Other outline is on top of the board BOTTOM Other outline is on the bottom of the board

Record 3

Field, Description		Type	Value
1	Loop label	integer	0 Indicates outline (points specified in counter-clockwise direction) 1 Indicates cutout (points specified in clockwise direction) n Indicates additional cutouts labeled sequentially from one
2	X coordinate of point	float	Any
3	Y coordinate of point	float	Any
4	Include angle (degrees)	float	0 Indicates that a straight line is to be created between X_{N-1} , Y_{N-1} and X_N , Y_N . $\neq 0$ Indicates an arc is to be created between X_{N-1} , Y_{N-1} and X_N , Y_N . If positive, the arc is counter-clockwise. 360 Indicates a circle is to be created with center at X_{N-1} , Y_{N-1} with X_N , Y_N a point on the circle. A circle is considered an entire loop.

Record 3 is repeated for each point that defines the outline or its cutouts. For each loop (outline or cutout), the last pair of coordinates should be the same as the first.

Record 4

Field, Description	Type	Value
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1	Section end keyword	string	.END_OTHER_OUTLINE
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3.4 Routing Outline Section

This section defines a routing outline for the board or panel. Each routing outline specifies a region within which routing must be confined, and consists of a simple closed curve made up of arcs and lines. Portions of routing outlines on a panel that lie on a board in the panel are inherited by that board. Multiple routing outlines may be defined.

Record 1

Field, Description	Type	Value
1 Section keyword	string	.ROUTE_OUTLINE
2 Outline owner	string	MCAD Outline is owned by the Mechanical system and should not be modified in the Electrical system ECAD Outline is owned by the Electrical system and should not be modified in the Mechanical system UNOWNED Outline can be modified in either system

Record 2

Field, Description	Type	Value
1 Routing layers	string	TOP Outline applies to top routing layer only BOTTOM Outline applies to bottom routing layer only BOTH Outline applies to both top and bottom routing layers only INNER Outline applies to the inner routing layers of the board only ALL Outline applies to all routing layers

Record 3

Field, Description	Type	Value
1 Loop label	integer	0 Indicates points specified in counter-clockwise direction 1 Indicates points specified in clockwise direction
2 X coordinate of point	float	Any Relative to the board or panel origin
3 Y coordinate of point	float	Any Relative to the board or panel origin
4 Include angle (degrees)	float	0 Indicates that a straight line is to be created between X_{N-1} , Y_{N-1} and X_N , Y_N . $\neq 0$ Indicates an arc is to be created between X_{N-1} , Y_{N-1} and X_N , Y_N . If positive, the arc is counter-clockwise. 360 Indicates a circle is to be created with center at X_{N-1} , Y_{N-1} with X_N , Y_N a point on the circle. A circle is considered an entire loop.

Record 3 is repeated for each point that defines the routing outline. The last pair of coordinates should be the same as the first.

Record 4

Field	Description	Type	Value
1	Section end keyword	string	.END_ROUTE_OUTLINE

3.5 Placement Outline Section

This section defines a placement outline for the board or panel. Each placement outline specifies a region within which components must be placed, and consists of a simple closed curve made up of arcs and lines plus a height restriction. Portions of placement outlines on a panel that lie on a board in the panel are inherited by that board. Multiple placement outlines may be defined.

Record 1

Field, Description	Type	Value
1 Section keyword	string	.PLACE_OUTLINE
2 Outline owner	string	MCAD Outline is owned by the Mechanical system and should not be modified in the Electrical system ECAD Outline is owned by the Electrical system and should not be modified in the Mechanical system UNOWNED Outline can be modified in either system

Record 2

Field, Description	Type	Value
1 Board side	string	TOP Outline applies to top side of board only BOTTOM Outline applies to bottom side of board only BOTH Outline applies to both sides of board
2 Outline height	float	Any (≥ 0)

The outline height is used to exclude components from the outline that, when mounted, exceed this height. If this field is missing, there is no height restriction on the outline.

Record 3

Field, Description	Type	Value
1 Loop label	integer	0 Indicates points specified in counter-clockwise direction 1 Indicates points specified in clockwise direction
2 X coordinate of point	float	Any Relative to the board or panel origin
3 Y coordinate of point	float	Any Relative to the board or panel origin
4 Include angle (degrees)	float	0 Indicates that a straight line is to be created between X_{N-1} , Y_{N-1} and X_N , Y_N . $\neq 0$ Indicates an arc is to be created between X_{N-1} , Y_{N-1} and X_N , Y_N . If positive, the arc is counter-clockwise. 360 Indicates a circle is to be created with center at X_{N-1} , Y_{N-1} with X_N , Y_N a point on the circle. A circle is considered an entire loop.

Record 3 is repeated for each point that defines the placement outline. The last pair of coordinates should be the same as the first.

Record 4

Field, Description	Type	Value
1	Section end keyword	string
		.END_PLACE_OUTLINE

3.6 Routing Keepout Section

This section defines a routing keepout for the board or panel. Routing keepouts specify regions where routing is not allowed. Routing keepouts can exist on top, bottom, both top and bottom, or all routing layers. Each keepout consists of a simple closed curve made up of arcs and lines. Portions of routing keepouts on a panel that lie on a board in the panel are inherited by that board. Multiple keepouts are allowed.

Record 1

Field, Description	Type	Value
1 Section keyword	string	.ROUTE_KEEPOUT
2 Keepout owner	string	MCAD Keepout is owned by the Mechanical system and should not be modified in the Electrical system ECAD Keepout is owned by the Electrical system and should not be modified in the Mechanical system UNOWNED Keepout can be modified in either system

Record 2

Field, Description	Type	Value
1 Routing layers	string	TOP Keepout applies to top routing layer only BOTTOM Keepout applies to bottom routing layer only BOTH Keepout applies to both top and bottom routing layers only INNER Outline applies to the inner routing layers of the board only ALL Keepout applies to all routing layers

Record 3

Field, Description	Type	Value
1 Loop label	integer	0 Indicates points specified in counter-clockwise direction 1 Indicates points specified in clockwise direction
2 X coordinate of point	float	Any Relative to the board or panel origin
3 Y coordinate of point	float	Any Relative to the board or panel origin
4 Include angle (degrees)	float	0 Indicates that a straight line is to be created between X_{N-1} , Y_{N-1} and X_N , Y_N . $\neq 0$ Indicates an arc is to be created between X_{N-1} , Y_{N-1} and X_N , Y_N . If positive, the arc is counter-clockwise. 360 Indicates a circle is to be created with center at X_{N-1} , Y_{N-1} with X_N , Y_N a point on the circle. A circle is considered an entire loop.

Record 3 is repeated for each point that defines the routing keepout. The last pair of coordinates should be the same as the first.

Record 4

Field	Description	Type	Value
1	Section end keyword	string	.END_ROUTE_KEEPOUT

3.7 Via Keepout Section

This section defines a via keepout for the board or panel. Via keepouts specify regions where vias are not allowed (although routing is still allowed). Each keepout consists of a simple closed curve made up of arcs and lines. Portions of via keepouts on a panel that lie on a board in the panel are inherited by that board. Multiple via keepouts are allowed. Only through vias (vias that go all the way through the board) are supported.

Record 1

Field, Description		Type	Value
1	Section keyword	string	.VIA_KEEPOUT
2	Keepout owner	string	MCAD Keepout is owned by the Mechanical system and should not be modified in the Electrical system ECAD Keepout is owned by the Electrical system and should not be modified in the Mechanical system UNOWNED Keepout can be modified in either system

Record 2

Field, Description		Type	Value
1	Loop label	integer	0 Indicates points specified in counter-clockwise direction 1 Indicates points specified in clockwise direction
2	X coordinate of point	float	Any Relative to the board or panel origin
3	Y coordinate of point	float	Any Relative to the board or panel origin
4	Include angle (degrees)	float	0 Indicates that a straight line is to be created between X_{N-1} , Y_{N-1} and X_N , Y_N . $\neq 0$ Indicates an arc is to be created between X_{N-1} , Y_{N-1} and X_N , Y_N . If positive, the arc is counter-clockwise. 360 Indicates a circle is to be created with center at X_{N-1} , Y_{N-1} with X_N , Y_N a point on the circle. A circle is considered an entire loop.

Record 2 is repeated for each point that defines the via keepout. The last pair of coordinates should be the same as the first.

Record 3

Field, Description		Type	Value
1	Section end keyword	string	.END_VIA_KEEPOUT

3.8 Placement Keepout Section

This section defines a placement keepout for the board or panel. Placement keepouts specify regions on the board where components cannot be placed. A keepout can apply to all components, or to only those components above a specified height. Placement keepouts can exist on the top, bottom, or both top and bottom of the board or panel. Each keepout consists of a simple closed curve made up of arcs and lines along with a height restriction. Portions of placement keepouts on a panel that lie on a board in the panel are inherited by that board. Multiple keepouts are allowed.

Record 1

Field, Description	Type	Value
1 Section keyword	string	.PLACE_KEEPOUT
2 Keepout owner	string	MCAD Keepout is owned by the Mechanical system and should not be modified in the Electrical system ECAD Keepout is owned by the Electrical system and should not be modified in the Mechanical system UNOWNED Keepout can be modified in either system

Record 2

Field, Description	Type	Value
1 Board side	string	TOP Keepout applies to top side of board only BOTTOM Keepout applies to bottom side of board only BOTH Keepout applies to both sides of board
2 Keepout height	float	Any (≥ 0)

The keepout height is used to exclude components from the keepout that, when mounted, exceed this height. A value of 0.0 indicates that all components are to be excluded from the keepout.

Record 3

Field, Description	Type	Value
1 Loop label	integer	0 Indicates points specified in counter-clockwise direction 1 Indicates points specified in clockwise direction
2 X coordinate of point	float	Any Relative to the board or panel origin
3 Y coordinate of point	float	Any Relative to the board or panel origin
4 Include angle (degrees)	float	0 Indicates that a straight line is to be created between X_{N-1} , Y_{N-1} and X_N , Y_N . $\neq 0$ Indicates an arc is to be created between X_{N-1} , Y_{N-1} and X_N , Y_N . If positive, the arc is counter-clockwise. 360 Indicates a circle is to be created with center at X_{N-1} , Y_{N-1} with X_N , Y_N a point on the circle. A circle is considered an entire loop.

Record 3 is repeated for each point that defines the placement keepout. The last pair of coordinates should be the same as the first.

Record 4

Field	Description	Type	Value
1	Section end keyword	string	.END_PLACE_KEEPOUT

3.9 Placement Group Area Section

This section specifies an area where a group of related components is to be placed. For example, it may be desirable to place all analog components in a particular area for thermal considerations. Each placement group area consists of a simple closed curve made up of arcs and lines along with a name designating the group of components to be placed in that area. Multiple areas are allowed.

Record 1

Field, Description	Type	Value
1 Section keyword	string	.PLACE_REGION
2 Region owner	string	MCAD Region is owned by the Mechanical system and should not be modified in the Electrical system ECAD Region is owned by the Electrical system and should not be modified in the Mechanical system UNOWNED Region can be modified in either system

Record 2

Field, Description	Type	Value
1 Board side	string	TOP Group area applies to top side of board only BOTTOM Group area applies to bottom side of board only BOTH Group area applies to both sides of board
2 Component group name	string	Any

Record 3

Field, Description	Type	Value
1 Loop label	integer	0 Indicates points specified in counter-clockwise direction 1 Indicates points specified in clockwise direction
2 X coordinate of point	float	Any Relative to the board or panel origin
3 Y coordinate of point	float	Any Relative to the board or panel origin
4 Include angle (degrees)	float	0 Indicates that a straight line is to be created between X_{N-1} , Y_{N-1} and X_N , Y_N . $\neq 0$ Indicates an arc is to be created between X_{N-1} , Y_{N-1} and X_N , Y_N . If positive, the arc is counter-clockwise. 360 Indicates a circle is to be created with center at X_{N-1} , Y_{N-1} with X_N , Y_N a point on the circle. A circle is considered an entire loop.

Record 3 is repeated for each point that defines the placement group area. The last pair of coordinates should be the same as the first.

Record 4

Field	Description	Type	Value
1	Section end keyword	string	.END_PLACE_REGION

3.10 Drilled Holes Section

This section specifies holes that are to be drilled in the board. Drilled holes are distinguished from circular cutouts in the board outline in that they are always drilled (as opposed to punched or routed) and may be plated with conductor. This section only appears once in the Board File, but multiple, non-overlapping holes are allowed.

Record 1

Field, Description	Type	Value
1 Section keyword	string	.DRILLED_HOLES

Record 2

Field, Description	Type	Value
1 Hole diameter	float	Any
2 X coordinate of center	float	Any
3 Y coordinate of center	float	Any
4 Plating style	string	PTH Plated (conducting) through hole NPTH Non-plated (non-conducting) through hole
5 Associated part	string	BOARD Indicates that hole is defined in board part NOREFDES Indicates that hole is defined in a non-electrical part PANEL Indicates that hole is defined in panel part Reference Reference designator of the electrical component in which hole is defined Designator
6 Hole type	string	PIN Hole is associated with a component pin VIA Hole is associated with a conductive via MTG Hole is used for mounting purposes TOOL Hole is used for tooling purposes Other User-defined
7 Hole owner	string	MCAD Hole is owned by the Mechanical system and should not be modified in the Electrical system ECAD Hole is owned by the Electrical system and should not be modified in the Mechanical system UNOWNED Hole can be modified in either system

All X and Y coordinate values are absolute (relative to the board or panel origin).

Record 2 is repeated for each drilled hole represented.

Record 3

Field, Description	Type	Value
1 Section end keyword	string	.END_DRILLED_HOLES

3.11 Notes Section

- 1 (: □ This section contains notes for the design that can be displayed in the receiving system, to allow the electrical and mechanical designers to communicate additional information about the design entities beyond that conveyed by the entities themselves. Notes are not intended to be used for rigorous translations of text such as for transferring manufacturing drawings. The association of a note to its subject is inferred by its location.

Record 1

Field, Description	Type	Value
1 Section keyword	string	.NOTES

Record 2

Field, Description	Type	Value
1 X coordinate of text	float	Any Bottom left justification is assumed
2 Y coordinate of text	float	Any Bottom left justification is assumed
3 Text height	float	Any Board or panel units are assumed
4 Text string physical length	float	Any Board or panel units are assumed
5 Text value	string	Any

Record 3

Field, Description	Type	Value
1 Section end keyword	string	.END_NOTES

3.12 Component Placement Section

This section specifies the locations of all components on the board, and boards and components on a panel. A location consists of an X coordinate and Y coordinate relative to the board or panel origin, a mounting offset, a rotation about the component's origin, and a side of the board or panel. Components can be either placed or unplaced. Placed components can be "owned" by the system (electrical or mechanical) that specified their locations to prevent changes to be made to their placement in the receiving system.

The package name and part number fields in Record 2 for each component are used to reference the component's description in the Library File.

Record 1

Field, Description	Type	Value
1 Section keyword	string	.PLACEMENT

Record 2

Field, Description	Type	Value
1 Package name	string	Any Part name for package geometry
2 Part number	string	Any Component part number
3 Reference designator	string	Any Electrical component instance reference designator NOREFDES Indicates that component instance is a mechanical component BOARD Indicates that instance is a board on a panel

1 (: □

Record 3

Field, Description	Type	Value
1 X coordinate of location	float	Any
2 Y coordinate of location	float	Any
3 Mounting offset	float	Any (≥ 0) Mounting offset from board surface
4 Rotation angle (degrees)	float	Any
5 Side of board	string	TOP Component is placed on the top of the board or panel; Board is topside up on panel BOTTOM Component is placed on the bottom of the board or panel; Board is topside down on panel (mirrored about Y axis)
6 Placement status	string	PLACED Component is placed but can be modified in either system UNPLACED Component is currently unplaced MCAD Component location is fixed and can only be modified in the Mechanical system ECAD Component location is fixed and can only be modified in the Electrical system

1 (: □

1 (: □

1 (: □

A component is located by first moving its origin to the specified X,Y coordinates (All X and Y coordinate values are absolute, relative to the board or panel origin). Then, if the component is

on the bottom of the board or panel, it is flipped around its local Y axis. Finally, the component is rotated the specified amount about its origin (positive rotations are counter-clockwise, relative to the component's coordinated system). See Figure 1.

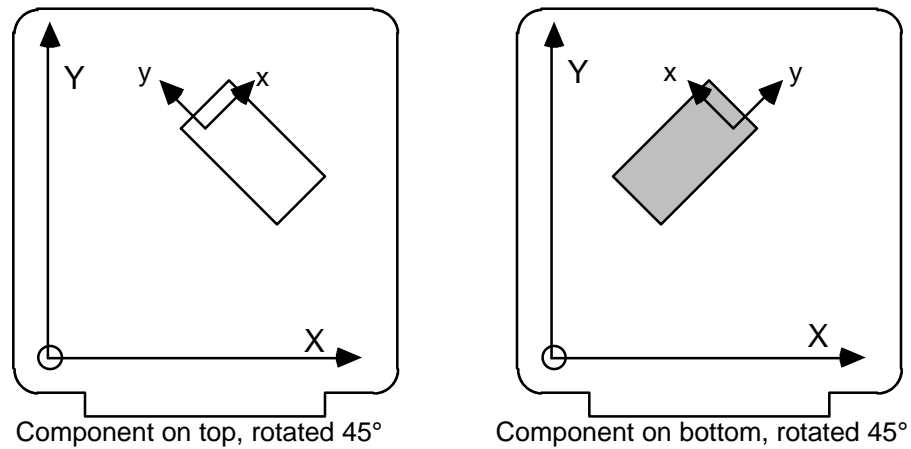


Figure 1

If the value of field 6 of record 3 is "UNPLACED", the values in fields 1-5 are ignored.

Records 2 and 3 are repeated for each component on the board.

Record 4

Field, Description	Type	Value
1 Section end keyword	string	.END_PLACEMENT

4.0 Library File Format

The Library File contains definitions for each unique electrical and mechanical component (based on part number) used in the PWA. The component definitions in the Library File are referenced by their part numbers in the Board File.

Each component definition includes an outline and height which can be used by the receiving mechanical system to extrude approximate solid models of the components. Detailed models of some or all of the components may be substituted for the extruded shapes in the mechanical system. Note that the ability to perform this substitution is a function of the mechanical system, not the IDF itself.

The Library File contains the following sections:

- **Header** for information on the Library File itself
- **Electrical** for defining an electrical component
- **Mechanical** for defining a mechanical component

The Header section must be the first section in the file; Electrical and Mechanical sections can be in any order after the Header section.

The following pages describe these sections.

4.1 Header Section

This section contains information on the Library File itself.

Record 1

Field, Description	Type	Value
1 Section keyword	string	.HEADER

Record 2

Field, Description	Type	Value
1 File type	string	LIBRARY_FILE
2 IDF version number	float	1.0 First version 2.0 Previous version 3.0 This version
3 Source system identification	string	Any Example: "ACME CAD rel. 5.0"
4 Date	string	format = yyyy/mm/dd.hh:mm:ss
5 Library File version #	integer	Any

1 (: □

Record 3

Field, Description	Type	Value
1 Section end keyword	string	.END_HEADER

4.2 Electrical Component Section

This section defines an electrical component that is to be placed on the PCB. An electrical component is defined as being electrically connected to other electrical components in the PWA, such as resistors, connectors and IC components. The outline of an electrical component consists of a simple closed curve made up of arcs and lines. The Library File contains an electrical component section for each electrical part number used in the PWA.

Record 1

Field, Description	Type	Value
1 Section keyword	string	.ELECTRICAL

Record 2

Field, Description	Type	Value
1 Geometry name	string	Any
2 Part number	string	Any
3 Units definition	string	MM millimeters THOU mils (thousandths of an inch)
4 Component height	float	Any

The units definition applies to this component only.

The value contained in field 4 is interpreted as the height of the component at 0 mounting offset.

Record 3

Field, Description	Type	Value
1 Loop label	integer	0 Indicates points specified in counter-clockwise direction 1 Indicates points specified in clockwise direction
2 X coordinate of point	float	Any Relative to the component origin
3 Y coordinate of point	float	Any Relative to the component origin
4 Include angle (degrees)	float	0 Indicates that a straight line is to be created between X_{N-1} , Y_{N-1} and X_N , Y_N . $\neq 0$ Indicates an arc is to be created between X_{N-1} , Y_{N-1} and X_N , Y_N . If positive, the arc is counter-clockwise. 360 Indicates a circle is to be created with center at X_{N-1} , Y_{N-1} with X_N , Y_N a point on the circle. A circle is considered an entire loop.

1 (: □

Record 3 is repeated for each point that defines the component outline. The last pair of coordinates should be the same as the first.

Record 4

Field, Description	Type	Value
--------------------	------	-------

1	Section end keyword	string	.END_ELECTRICAL
---	---------------------	--------	-----------------

4.2.1 Component Property Record

- 1 (: □ This is an optional record that specifies properties for the component. Property records must follow the component outline records (record 3 above) and should be grouped.

Field, Description	Type	Value
1	Property keyword	string
2	Property name	string
		PROP
		CAPACITANCE Capacitance, microfarads
		RESISTANCE Resistance, ohms
		TOLERANCE Tolerance, % deviation
		POWER_OPR Operating power rating, Milliwatts
		POWER_MAX Maximum power rating, Milliwatts
		THERM_COND Thermal conductivity, Watt/meter C
		THETA_JB Junction to board thermal resistance,
		C/Watt
		THETA_JC Junction to case thermal resistance,
		C/Watt
		Other User-defined
3	Property value	Property specific
		Any

4.3 Mechanical Component Section

This section defines a mechanical component that is to be placed on the PCB. A mechanical component has no electrical connectivity to other components in the PWA. Examples of mechanical components include card extractors, stiffeners, and mounting hardware. The outline of a mechanical component consists of a simple closed curve made up of arcs and lines. The Library File contains a mechanical component section for each mechanical part number in the PWA.

Record 1

Field, Description	Type	Value
1 Section keyword	string	.MECHANICAL

Record 2

Field, Description	Type	Value
1 Geometry name	string	Any
2 Part number	string	Any
3 Units definition	string	MM millimeters THOU mils (thousandths of an inch)
4 Component height	float	Any

The units definition applies to this component only.

The value contained in field 4 is interpreted as the height of the component at 0 mounting offset.

Record 3

Field, Description	Type	Value
1 Loop label	integer	0 Indicates points specified in counter-clockwise direction 1 Indicates points specified in clockwise direction
2 X coordinate of point	float	Any Relative to the component origin
3 Y coordinate of point	float	Any Relative to the component origin
4 Include angle (degrees)	float	0 Indicates that a straight line is to be created between X_{N-1} , Y_{N-1} and X_N , Y_N . $\neq 0$ Indicates an arc is to be created between X_{N-1} , Y_{N-1} and X_N , Y_N . If positive, the arc is counter-clockwise. 360 Indicates a circle is to be created with center at X_{N-1} , Y_{N-1} with X_N , Y_N a point on the circle. A circle is considered an entire loop.

1 (: □

Record 3 is repeated for each point that defines the component outline. The last pair of coordinates should be the same as the first.

Record 4

Field	Description	Type	Value
1	Section end keyword	string	.END_MECHANICAL

5.0 Panel File Example

```

.HEADER
PANEL_FILE 3.0 "Sample File Generator" 10/22/96.16:20:19 1
sample_panel THOU
.END_HEADER
.PANEL_OUTLINE          MCAD
62.0
0      0.0      0.0      0.0
0  16000.0      0.0      0.0
0  16000.0 12000.0      0.0
0      0.0 12000.0      0.0
0      0.0      0.0      0.0
.END_PANEL_OUTLINE
.PLACE_KEEPOUT          MCAD
BOTTOM      0.0
0  13500.0      0.0      0.0
0  16000.0      0.0      0.0
0  16000.0 12000.0      0.0
0  13500.0 12000.0      0.0
0  13500.0      0.0      0.0
.END_PLACE_KEEPOUT
.PLACE_KEEPOUT          MCAD
BOTTOM      0.0
0      0.0      0.0      0.0
0  2200.0      0.0      0.0
0  2200.0 12000.0      0.0
0      0.0 12000.0      0.0
0      0.0      0.0      0.0
.END_PLACE_KEEPOUT
.DRILLED_HOLES
  250.0 15500.0 11500.0  NPTH  PANEL  TOOL  MCAD
  250.0  500.0 11500.0  NPTH  PANEL  TOOL  MCAD
  250.0  500.0  500.0  NPTH  PANEL  TOOL  MCAD
.END_DRILLED_HOLES
.PLACEMENT
  sample_board      pn-board      BOARD
  1700.0 3300.0      0.0      0.0      TOP      MCAD
  sample_board      pn-board      BOARD
  14000.0 3300.0      0.0      0.0  BOTTOM      MCAD
.END_PLACEMENT

```

6.0 Board File Example

```

.HEADER
BOARD_FILE 3.0 "Sample File Generator" 10/22/96.16:02:44 1
sample_board THOU
.END_HEADER
.BOARD_OUTLINE          MCAD
62.0
0  5030.5  -120.0    0.0
0  5187.5  -120.0    0.0
0  5187.5  2130.0    0.0
0  5155.0  2130.0    0.0
0  5155.0  2550.0  -180.0
0  5187.5  2550.0    0.0
0  5187.5  4935.0    0.0
0  4945.0  5145.0    0.0
0  4945.0  5420.0    0.0
0  4865.0  5500.0    0.0
0   210.0  5500.0    0.0
0   130.0  5420.0    0.0
0   130.0  5145.0    0.0
0  -112.5  4935.0    0.0
0  -112.5  2550.0    0.0
0   -80.0  2550.0    0.0
0   -80.0  2130.0  -180.0
0  -112.5  2130.0    0.0
0  -112.5  -140.0    0.0
0    45.5  -140.0    0.0
0    45.5  -400.0    0.0
0  2442.5  -400.0    0.0
0  2442.5  -140.0    0.0
0  2631.5  -140.0    0.0
0  2631.5  -400.0    0.0
0  5030.5  -400.0    0.0
0  5030.5  -120.0    0.0
1  2650.0  2350.0    0.0
1  3000.0  2350.0   360.0
.END_BOARD_OUTLINE
.ROUTE_OUTLINE          ECAD
ALL
0  5112.5   150.0    0.0
0  5112.5  2058.2    0.0
0  5112.5  2621.8  -162.9
0  5112.5  4863.2    0.0
0  4878.8  5075.0    0.0
0   226.4  5075.0    0.0
0   138.0  4910.3    0.0
0   138.0  4800.0    0.0
0   -37.5  4662.5    0.0
0   -37.5  2621.8    0.0
0   -37.5  2058.2  -162.9
0   -37.5   150.0    0.0
0   162.5    0.0    0.0
0  4912.5    0.0    0.0
0  5112.5   150.0    0.0
.END_ROUTE_OUTLINE
.PLACE_OUTLINE          MCAD
TOP
0  5080.0  2034.9    0.0
0  5080.0  2645.1  -152.9
0  5080.0  4837.3    0.0
0  4855.3  5042.5    0.0

```

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```

0      252.9  5042.5    0.0
0      170.5  4896.9    0.0
0      170.5  4798.4    0.0
0      -5.0   4659.0    0.0
0      -5.0   2645.1    0.0
0      -5.0   2034.9   -152.9
0      -5.0   182.5     0.0
0      192.0   32.5     0.0
0      4883.1  32.5     0.0
0      5080.0  182.5    0.0
0      5080.0  2034.9    0.0
.END_PLACE_OUTLINE
.PLACE_OUTLINE          UNOWNED
BOTTOM                200.0
0      300.0   200.0     0.0
0      4800.0  200.0     0.0
0      4800.0  4800.0     0.0
0      300.0   4800.0     0.0
0      300.0   200.0     0.0
.END_PLACE_OUTLINE
.ROUTE_KEEPOUT        ECAD
ALL
0      2650.0  2350.0     0.0
0      3100.0  2350.0   360.0
.END_ROUTE_KEEPOUT
.PLACE_KEEPOUT        MCAD
BOTH                  0.0
0      2650.0  2350.0     0.0
0      3100.0  2350.0   360.0
.END_PLACE_KEEPOUT
.PLACE_KEEPOUT        MCAD
TOP                  300.0
0      3700.0  5000.0     0.0
0      3700.0  4300.0     0.0
0      4000.0  4300.0     0.0
0      4000.0  3700.0     0.0
0      5000.0  3700.0     0.0
0      5000.0  4800.0     0.0
0      4800.0  5000.0     0.0
0      3700.0  5000.0     0.0
.END_PLACE_KEEPOUT
.DRILLED_HOLES
30.0  1800.0  100.0   PTH   J1   PIN   ECAD
30.0  1700.0  100.0   PTH   J1   PIN   ECAD
30.0  1600.0  100.0   PTH   J1   PIN   ECAD
30.0  1500.0  100.0   PTH   J1   PIN   ECAD
30.0  1400.0  100.0   PTH   J1   PIN   ECAD
30.0  1300.0  100.0   PTH   J1   PIN   ECAD
30.0  1200.0  100.0   PTH   J1   PIN   ECAD
30.0  1100.0  100.0   PTH   J1   PIN   ECAD
30.0  1000.0  100.0   PTH   J1   PIN   ECAD
30.0  0900.0  100.0   PTH   J1   PIN   ECAD
30.0  0800.0  100.0   PTH   J1   PIN   ECAD
30.0  0700.0  100.0   PTH   J1   PIN   ECAD
30.0  0700.0  200.0   PTH   J1   PIN   ECAD
30.0  0800.0  200.0   PTH   J1   PIN   ECAD
30.0  0900.0  200.0   PTH   J1   PIN   ECAD
30.0  1000.0  200.0   PTH   J1   PIN   ECAD
30.0  1100.0  200.0   PTH   J1   PIN   ECAD
30.0  1200.0  200.0   PTH   J1   PIN   ECAD
30.0  1300.0  200.0   PTH   J1   PIN   ECAD
30.0  1400.0  200.0   PTH   J1   PIN   ECAD
30.0  1500.0  200.0   PTH   J1   PIN   ECAD

```

30.0	1600.0	200.0	PTH	J1	PIN	ECAD
30.0	1700.0	200.0	PTH	J1	PIN	ECAD
30.0	1800.0	200.0	PTH	J1	PIN	ECAD
30.0	4400.0	100.0	PTH	J2	PIN	ECAD
30.0	4300.0	100.0	PTH	J2	PIN	ECAD
30.0	4200.0	100.0	PTH	J2	PIN	ECAD
30.0	4100.0	100.0	PTH	J2	PIN	ECAD
30.0	4000.0	100.0	PTH	J2	PIN	ECAD
30.0	3900.0	100.0	PTH	J2	PIN	ECAD
30.0	3800.0	100.0	PTH	J2	PIN	ECAD
30.0	3700.0	100.0	PTH	J2	PIN	ECAD
30.0	3600.0	100.0	PTH	J2	PIN	ECAD
30.0	3500.0	100.0	PTH	J2	PIN	ECAD
30.0	3400.0	100.0	PTH	J2	PIN	ECAD
30.0	3300.0	100.0	PTH	J2	PIN	ECAD
30.0	3300.0	200.0	PTH	J2	PIN	ECAD
30.0	3400.0	200.0	PTH	J2	PIN	ECAD
30.0	3500.0	200.0	PTH	J2	PIN	ECAD
30.0	3600.0	200.0	PTH	J2	PIN	ECAD
30.0	3700.0	200.0	PTH	J2	PIN	ECAD
30.0	3800.0	200.0	PTH	J2	PIN	ECAD
30.0	3900.0	200.0	PTH	J2	PIN	ECAD
30.0	4000.0	200.0	PTH	J2	PIN	ECAD
30.0	4100.0	200.0	PTH	J2	PIN	ECAD
30.0	4200.0	200.0	PTH	J2	PIN	ECAD
30.0	4300.0	200.0	PTH	J2	PIN	ECAD
30.0	4400.0	200.0	PTH	J2	PIN	ECAD
30.0	3000.0	3300.0	PTH	U3	PIN	ECAD
30.0	3024.2	3203.0	PTH	U3	PIN	ECAD
30.0	3048.4	3105.9	PTH	U3	PIN	ECAD
30.0	3072.6	3008.9	PTH	U3	PIN	ECAD
30.0	3096.8	2911.9	PTH	U3	PIN	ECAD
30.0	3121.0	2814.9	PTH	U3	PIN	ECAD
30.0	3145.2	2717.8	PTH	U3	PIN	ECAD
30.0	3436.2	2790.4	PTH	U3	PIN	ECAD
30.0	3412.1	2887.4	PTH	U3	PIN	ECAD
30.0	3387.9	2984.5	PTH	U3	PIN	ECAD
30.0	3363.7	3081.5	PTH	U3	PIN	ECAD
30.0	3339.5	3178.5	PTH	U3	PIN	ECAD
30.0	3315.3	3275.6	PTH	U3	PIN	ECAD
30.0	3291.1	3372.6	PTH	U3	PIN	ECAD
30.0	2200.0	2500.0	PTH	U4	PIN	ECAD
30.0	2100.0	2500.0	PTH	U4	PIN	ECAD
30.0	2000.0	2500.0	PTH	U4	PIN	ECAD
30.0	1900.0	2500.0	PTH	U4	PIN	ECAD
30.0	1800.0	2500.0	PTH	U4	PIN	ECAD
30.0	1700.0	2500.0	PTH	U4	PIN	ECAD
30.0	1600.0	2500.0	PTH	U4	PIN	ECAD
30.0	1600.0	2200.0	PTH	U4	PIN	ECAD
30.0	1700.0	2200.0	PTH	U4	PIN	ECAD
30.0	1800.0	2200.0	PTH	U4	PIN	ECAD
30.0	1900.0	2200.0	PTH	U4	PIN	ECAD
30.0	2000.0	2200.0	PTH	U4	PIN	ECAD
30.0	2100.0	2200.0	PTH	U4	PIN	ECAD
30.0	2200.0	2200.0	PTH	U4	PIN	ECAD
20.0	2500.0	3100.0	PTH	BOARD	VIA	ECAD
20.0	2500.0	3200.0	PTH	BOARD	VIA	ECAD
20.0	2500.0	3300.0	PTH	BOARD	VIA	ECAD
20.0	2000.0	1600.0	PTH	BOARD	VIA	ECAD
20.0	1100.0	0900.0	PTH	BOARD	VIA	ECAD
20.0	1200.0	1600.0	PTH	BOARD	VIA	ECAD
20.0	3900.0	3800.0	PTH	BOARD	VIA	ECAD
20.0	3900.0	2300.0	PTH	BOARD	VIA	ECAD

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```

100.0 3100.0 -50.0 NPTH J2 MTG ECAD
100.0 4600.0 -50.0 NPTH J2 MTG ECAD
100.0 500.0 -50.0 NPTH J1 MTG ECAD
100.0 2000.0 -50.0 NPTH J1 MTG ECAD
93.0 5075.0 0.0 PTH BOARD MTG UNOWNED
93.0 0.0 4800.0 NPTH BOARD TOOL MCAD
93.0 0.0 0.0 PTH BOARD MTG UNOWNED
.END_DRILLED_HOLES
.NOTES
3500.0 3300.0 75.0 2500.0 "This component rotated 14 degrees"
400.0 4400.0 75.0 3200.0 "Component height limited by enclosure latch"
1800.0 300.0 75.0 1700.0 "Do not move connectors!"
.END_NOTES
.PLACEMENT
cs13_a pn-cap C1
4000.0 1000.0 100.0 0.0 TOP PLACED
cc1210 pn-cc1210 C2
3000.0 3500.0 0.0 0.0 TOP PLACED
cc1210 pn-cc1210 C3
3200.0 1800.0 0.0 0.0 BOTTOM PLACED
cc1210 pn-cc1210 C4
1400.0 2300.0 0.0 270.0 TOP PLACED
cc1210 pn-cc1210 C5
1799.5 3518.1 0.0 0.0 BOTTOM PLACED
conn_din24 connector J1
1800.0 100.0 0.0 0.0 TOP MCAD
conn_din24 connector J2
4400.0 100.0 0.0 0.0 TOP MCAD
plcc_20 pn-pal1618-plcc U1
1800.0 3200.0 0.0 0.0 BOTTOM ECAD
plcc_20 pn-pal1618-plcc U2
3200.0 1800.0 0.0 0.0 TOP PLACED
dip_14w pn-hs346-dip U3
3000.0 3300.0 0.0 14.0 TOP PLACED
dip_14w pn-hs346-dip U4
2200.0 2500.0 0.0 270.0 TOP PLACED
.END_PLACEMENT

```


7.0 Library File Example

```

.HEADER
LIBRARY_file 3.0 "Sample File Generator" 10/22/96.16:41:37 1
.END_HEADER
.ELECTRICAL
    cs13_a          pn-cap      THOU    150.0
0    -55.0         55.0        0.0
0    -55.0         -55.0       0.0
0    135.0         -55.0       0.0
0    135.0         -80.0       0.0
0    565.0         -80.0       0.0
0    565.0         -55.0       0.0
0    755.0         -55.0       0.0
0    755.0         55.0        0.0
0    565.0         55.0        0.0
0    565.0         80.0        0.0
0    135.0         80.0        0.0
0    135.0         55.0        0.0
0    -55.0         55.0        0.0
PROP CAPACITANCE    100.0
PROP TOLERANCE      5.0
.END_ELECTRICAL
.ELECTRICAL
    cc1210          pn-cc1210   THOU    67.0
0    -40.0         56.0        0.0
0    -40.0         -56.0       0.0
0    182.0         -56.0       0.0
0    182.0         56.0        0.0
0    -40.0         56.0        0.0
PROP CAPACITANCE    0.1
PROP TOLERANCE      5.0
.END_ELECTRICAL
.ELECTRICAL
    conn_din24      connector   THOU    435.0
0    -1400.0       -500.0      0.0
0    300.0         -500.0      0.0
0    300.0         150.0       0.0
0    -1400.0       150.0       0.0
0    -1400.0       -500.0      0.0
.END_ELECTRICAL
.ELECTRICAL
    dip_14w         pn-hs346-dip  THOU    200.0
0    350.0         50.0        0.0
0    -50.0         50.0        0.0
0    -50.0         -650.0      0.0
0    350.0         -650.0      0.0
0    350.0         50.0        0.0
.END_ELECTRICAL
.ELECTRICAL
    plcc_20         pn-pal1618-plcc THOU    14.0
0    -200.0        240.0       0.0
0    -240.0        200.0       0.0
0    -240.0        -240.0      0.0
0    240.0         -240.0      0.0
0    240.0         240.0       0.0
0    -200.0        240.0       0.0
.END_ELECTRICAL

```