CadPack

Import from Zuken CR5000

Software tool for Zuken CR5000 format Cad data import

Technical Info

Version : 2
Code : 81190421.095

SPEA SpA
16, Via Torino
10088 Volpiano - Italy
Tel.: + 39 011 9825 400
Fax: + 39 011 9825 405
E-mail: info@spea.com
Web: www.spea.com

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Introduction

CAD files are the base for the automatic generation of test program for InCircuit of any technology.

In order to generate the ICT test program in a short time and without errors, both Bed of Nails and Flying Probe testers require the circuit information available in CAD format.

The Import from Zuken CR5000 CAD import driver enables to import data present in the Zuken CR5000 CAD file and convert them in SPEA Board data format.

Conventions, symbols and abbreviations

In the document, the ⓘ symbol is used to highlight information or notes useful to the reader.

This manual can be updated in accordance with the evolution of the system and associated software.
It may contain preliminary contents or it may not be entirely updated with the latest versions used in the system.

Any remarks on errors and imperfections, or suggestions, can be addressed to:

SPEA SpA
Ufficio Documentazione
16, Via Torino
10088 Volpiano – Italy
Tel.: +39 011 9825400
Fax: +39 011 9825405
Email: info@spea.com
Web: www.spea.com

1. Zuken CR5000 file data

With the “Zuken CR5000 CAD files” words we refer to the output information generated by the Zuken CR5000 CAD-CAE programs for the electrical diagrams design and PCB development, used to develop a test application (test program and adapter design).

Information stored in the “Zuken CR5000 CAD files” concern an electronic board and can be used by an appropriate program to generate a test program and its test adapter design (Bed of Nails or list of movements for Flying Probes).

Information can be grouped in 4 different categories and typically concern the printed circuit:

Part List
It is the list of all used devices, it must contain: devices drawing reference, part numbers, value, tolerances, device type, etc.
Net List
It is also called wiring list, containing device interconnection data; basically it is presentation of the electrical diagram.
Coordinate and access list
It is the list containing the devices coordinates, concerning their barycentre and pins.
Wiring and Routing list
It is the list containing the path of the Net tracks in the PCB.

For the import of the information above mentioned SPEA has developed the specific program for the translation, stored in a specified format, to its common data bank called “Board Data”.
The name of this type of program is “CAD import driver”.

For the required information, see the list in the following paragraphs.

1.1 Part List

The Part List is an ASCII text file, containing the list of all the parts used to assemble the board; sometimes it can be called **Bill of Material** (BOM).

In the Part List all information concerning the mounted and not mounted parts must be present.
For every part the following information must be defined:

Information	Description
Drawing Reference	Reference designator (e.g. U10, R105, D23, etc.).
Part Number	Device code (e.g. 132549.012, C4QW08, 001-58-AA, etc.).
Value	Device value (e.g. 10KΩ, 10µF, 1mH, etc.).
Tolerance	Positive and negative device tolerances (e.g. 1%, 5%, etc.).
Mounting side	The legal values for this item can be: - **Top** (Component side) - **Bottom** (Soldering side) - **Not mounted Top** - **Not mounted Bottom**
Rotation [1]	Device mounting rotation angle (e.g. 0°, 180°, etc.).
Dimensions [1]	Device dimensions.
Case code [1]	Device package (case) code.

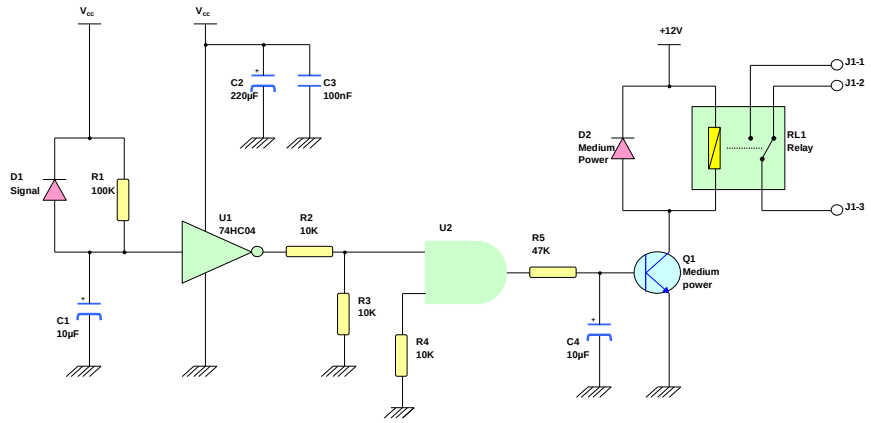
[1] **Optional data (not yet managed)**

1.2 Net List

The Net List is an ASCII text file containing the device interconnection data; it is also called wiring list.
This list must contain the interconnection between devices, including pad and via.
Basically, it is the representation of the electrical diagrams.

For every net the following information must be defined:

Information	Description
Net name	Net identifier (e.g. +5V, RESET, A01, etc.).
Drawing reference	Reference designator of the device connected to the net (e.g. U10, R105, D23, etc.).
Pin name	Name of the device pin connected to the net (e.g. 1, 15, Anode, K, Negative, etc.).
Pin access side	Access side for the device pin, legal values are: - **Top** (Device side access). - **Bottom** (Soldering side access). - **Not accessible** - **All** (both top and bottom side access)



1.3 Coordinates and access list

The Coordinates and access list is an ASCII text file containing the devices coordinates concerning their barycentre and pins. Below, the required information:

Information	Description
Drawing Reference	Reference designator of the device connected to the net (e.g. U10, R105, D23, etc.).
Pin name	Name of the device pin connected to the net (e.g. 1, 15, Anode, K, Negative, etc.).
Pin X position	Pin X-coordinate.
Pin Y position	Pin Y-coordinate.
X barycentre [1]	Device X barycentre.
Y barycentre [1]	Device Y barycentre.

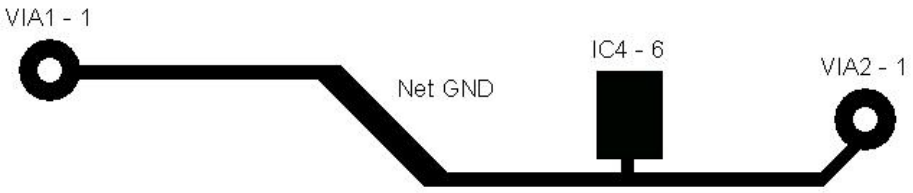
1.4 Wiring and Routing list

The Wiring and Routing list is an ASCII text file that contains all the coordinates of the Net tracks on the PCB and the link with the Net List. So the path of each net on the PCB is described in this file.

The following information must be defined for every net:

Information	Description
Net name	Net identifier (e.g. +5V, RESET, A01, etc.).
X Start	Track segment start X-coordinate.
Y Start	Track segment start Y-coordinate.
X End	Track segment end X-coordinate.
Y End	Track segment end Y-coordinate.
Width	Net segment thickness.
Layer	Layer the segment belongs to.

Example:



[1] **Optional data**

2. Zuken CR5000 file generalities

2.1 Zuken CR5000 file name

The Zuken CR5000 Neutral file name has to have the **.PCF** extension.
It is an ASCII text file and it contains the information concerning board, device and their connections.

2.2 Zuken CR5000 file conversion from Unix to MS-DOS

When the diagram entry has been performed and checked on the Zuken CR5000 CAD workstation, the Zuken CR5000 file **.PCF** should be made available for the SPEA system.

The SPEA system is based on a PC platform operating in a Windows® environment, this means that the CAD import driver can manage ASCII Text file in MS-DOS format.

Due to the fact that the Zuken CR5000 workstation typically uses the Unix operating system, the output ASCII text file has to be converted from Unix to MS-DOS format.

In order to perform the conversion, please refer to appendix A – **Note about the Zuken CR5000 ASCII text file format**.

3. Zuken CR5000 file format

This is a partial extract of an example of a Zuken CR5000 output ASCII text file:

```
(pcf
 ……
  (boardContainer
    (components
      (component (reference R8)
   (gateCount 1)
   (pinCount 2)
   (part R100K5%50V0.063WFSS0603)
   (stockId 44860030)
   (package 1608-R)
   (footprintSpec common)
   (footprint 1608-R-RF)
   (originalReference R8)
   (placed YES)
   (placementSide B)
   (locationLock NO)
   (angleLock NO)
   (placementSideLock NO)
   (packageSymbol YES)
   (outOfBoard NO)
   (outOfBoardLocation
     (pt 1.600000 93.310000)
   )
   (location
     (pt 77.724000 55.372000)
   )
   (angle 0)
   ……
   (pin 1
     (pt 78.574000 55.372000)
     (gate 1 (name A))
     (layout
       (layer (systemLayer (type PADSTACK))
         (padstack R-09X10
      (net VCC)
      (pt 78.574000 55.372000)
      (fromTo 2)
      (conductive
        (layerNumber 2 (status CONNECT))
      )
         )
       )
     )
   )
   (pin 2
     (pt 76.874000 55.372000)
     (gate 1 (name B))
     (layout
       (layer (systemLayer (type PADSTACK))
         (padstack R-09X10
      (net IntP5)
      (pt 76.874000 55.372000)
      (fromTo 2)
      (conductive
        (layerNumber 2 (status CONNECT))
      )
         )
       )
     )
   )
    )
   ……
      (component (reference X2)
   (gateCount 1)
   (pinCount 2)
   (part Y32.768KHZ_CLD_2X6)
   (stockId 43290010)
   (package RD-X21-1)
   (footprint RD-C25-NTC-1)
   (originalReference X2)
   (placed YES)
   (placementSide B)
   (locationLock NO)
   (angleLock NO)
   (placementSideLock NO)
```

```
(packageSymbol YES)
(outOfBoard NO)
(outOfBoardLocation
  (pt 2.150000 93.550000)
)
(location
  (pt 55.880000 51.816000)
)
(angle 0)
……
(pin 1
  (pt 55.880000 51.816000)
  (gate 1 (name A))
  (layout
    (layer (systemLayer (type PADSTACK))
      (padstack T-H08D16
   (net SIGN128)
   (pt 55.880000 51.816000)
   (fromTo 1 2)
   (conductive
     (layerNumber 1 (status NOCONNECT))
     (layerNumber 2 (status CONNECT))
   )
     )
    )
  )
)
(pin 2
  (pt 53.380000 51.816000)
  (gate 1 (name B))
  (layout
    (layer (systemLayer (type PADSTACK))
      (padstack T-H08D16
   (net SIGN127)
   (pt 53.380000 51.816000)
   (fromTo 1 2)
   (conductive
     (layerNumber 1 (status NOCONNECT))
     (layerNumber 2 (status CONNECT))
   )
     )
    )
  )
)
   )
  ……
   (component (reference C13)
(gateCount 1)
(pinCount 2)
(part C220UF20%4VEAS6.3X5.5)
(stockId 43250018)
(package CP-CE4)
(footprintSpec common)
(footprint CP-CE4-RF)
(originalReference C13)
(placed YES)
(placementSide B)
(locationLock NO)
(angleLock NO)
(placementSideLock NO)
(packageSymbol YES)
(outOfBoard NO)
(outOfBoardLocation
  (pt 21.400000 97.150000)
)
(location
  (pt 21.336000 76.708000)
)
(angle 0)
……
(pin 1
  (pt 23.886000 76.708000)
  (gate 1 (name A))
  (layout
    (layer (systemLayer (type PADSTACK))
      (padstack R-12X29
   (net GND)
   (pt 23.886000 76.708000)
   (angle 270)
   (fromTo 2)
   (conductive
     (layerNumber 2 (status CONNECT))
   )
     )
```

```
        )
      )
    )
    (pin 2
      (pt 18.786000 76.708000)
      (gate 1 (name B))
      (layout
        (layer (systemLayer (type PADSTACK))
          (padstack R-12X29
       (net VCC)
       (pt 18.786000 76.708000)
       (angle 270)
       (fromTo 2)
       (conductive
         (layerNumber 2 (status CONNECT))
       )
          )
       )
      )
    )
     )
   )
  ……
   (boardLayout
     (layout
  (layer (conductive 1)
    (line
      (net IntP2)
      (msgTag 56)
      (geometry
        (line
     (vertex
       (pt 69.596000 67.564000
         (width 0.203200)
       )
       (pt 68.834000 66.802000
         (width 0.203200)
       )
       (pt 68.834000 64.389000
         (width 0.203200)
       )
       (pt 63.373000 58.928000
         (width 0.203200)
       )
       (pt 54.575000 58.928000
         (width 0.203200)
       )
       (pt 53.594000 59.909000
         (width 0.203200)
       )
       (pt 53.594000 60.325000
         (width 0.203200)
       )
     )
        )
       )
    )
   ……
  )
  (layer (conductive 2)
    (line
      (net IntP3)
      (msgTag 254)
      (geometry
        (line
     (vertex
       (pt 52.578000 60.198000
         (width 0.203200)
       )
       (pt 52.705000 60.198000
         (width 0.203200)
       )
       (pt 53.540000 59.363000
         (width 0.203200)
       )
       (pt 53.540000 58.440000
         (width 0.203200)
       )
     )
        )
       )
    )
  )
   ……
```

```
    (layer (systemLayer (type PADSTACK))
      (padstack V-H05D08-1
        (net SIGN189)
        (pt 59.000000 77.851000)
        (fromTo 1 2)
        (conductive
          (layerNumber 1 (status CONNECT))
          (layerNumber 2 (status CONNECT))
        )
      )
      (padstack TP10_SMD
        (net SIGN12)
        (side B)
        (pt 49.911000 56.007000)
        (fromTo 2)
        (isTestPad YES
          (side B)
          (id TPSIGN12-01)
        )
        (conductive
          (layerNumber 2 (status CONNECT))
        )
      )
    )
.....
)
```

The Import from Zuken CR5000 CAD driver can correctly identify and use the following labels (identifiers):

- **COMPONENT**
  - PART
  - STOCKID
  - FOOTPRINT
  - PLACEMENTSIDE
  - LOCATION
  - ANGLE
  - PIN
- **BOARDLAYOUT**
  - LAYER
  - PADSTACK
  - LINE

In the next paragraphs, a short description for each label (identifier) is provided.

3.1 COMPONENT

The **COMPONENT** section defines the used components. It contains the part list and mounting data of each single device present in the file CAD.

The **COMPONENT** section is organized into subsections. The “Import from Zuken CR5000” driver manages the following label:

- **PART**
- **STOCKID**
- **FOOTPRINT**
- **PLACEMENT**

3.1.1 PART

Each **PART** label defines a device name or value and tolerance of the component.

The following example shows the syntax used for the **PART** identifier:

1	2	3
Section identifier	Device name	
	Value	Tolerance
part	220UF	20%

Example of **PART** identifier:

```
(part C220UF20%4VEAS6.3X5.5)
```

3.1.2 STOCKID

Each **STOCKID** label defines a part number used to component.

The following example shows the used syntax for the **STOCKID** identifier:

1	2
Section identifier	Part Number
stockId	43250018

Example of **STOCKID** identifier:

```
(stockId 43250018)
```

3.1.3 FOOTPRINT

Each **FOOTPRINT** label defines a package used to component.

The following example shows the syntax used for the **FOOTPRINT** identifier:

1	2
Section identifier	Package name
footprint	CP-CE4-RF

Example of **FOOTPRINT** identifier:

```
.....
(footprint CP-CE4-RF)
.....
```

3.1.4 PLACEMENTSIDE

Each **PLACEMENTSIDE** label defines a mount side of the component.

Where **A** is "Top" side and **B** is "Bottom" side.

The following example shows the syntax used for the **PLACEMENTSIDE** identifier:

1	2
Section identifier	Mount side
placementSide	B

Example of **PLACEMENTSIDE** identifier:

```
.....
(placementSide B)
.....
```

3.1.5 LOCATION

Each **LOCATION** label defines the barycentre of the component.

The following example shows the syntax used for the **LOCATION** identifier:

1	2	3	4
Section identifier	Not used	X Barycentre	Y Barycentre
location	pt	21.336000	76.708000

Example of **LOCATION** identifier:

```
.....
(location (pt 21.336000 76.708000))
.....
```

3.1.6 ANGLE

Each **ANGLE** label defines the rotation of the component.

The following example shows the syntax used for the **ANGLE** identifier:

1	2
Section identifier	Rotate
angle	270

Example of **ANGLE** identifier:

```
(angle 270)
```

3.1.7 PIN

The **PIN** subsection defines the component-to-pin connections. It contains the net list data of each single device present in the file CAD.

The **PIN** subsection is organized into subsections. The “Import from Zuken CR5000” driver manages the following label:

- **PT**
- **NET**
- **FROMTO**

3.1.7.1 PT

Each **PT** label defines the pin coordinates.

The following example shows the syntax used for the **PT** identifier:

1	2	3
Section identifier	Coordinate X	Coordinate Y
pt	18.786000	76.708000

Example of **PT** identifier:

```
(pt 18.786000 76.708000)
```

3.1.7.2 NET

Each **NET** label defines the component-to-net connectivities.

The following example shows the syntax used for the **NET** identifier:

1	2
Section identifier	Net name
net	SIGN189

Example of **NET** identifier:

```
.....
(net SIGN189)
.....
```

3.1.7.3 FROMTO

Each **FROMTO** label defines a part as a surface-mount device or as through-hole device. If this label contains more layers then the package type is TH, otherwise the package type is SMD.

The following example shows the syntax used for the **FROMTO** identifier:

1	2	3	4
Section identifier	Not used	Not used	Package type
fromTo	1	2	TH
fromTo	2		SMD

Example of **FROMTO** identifier:

```
.....
(fromTo 1 2)
(fromTo 2)
.....
```

3.2 BOARDLAYOUT

BOARDLAYOUT describes the circuit wiring diagram, including wiring graphics, signal names and attributes.
The BOARDLAYOUT section consists of a series of **LAYER** subsections, one for each layer.

Inside this subsection the “Import from Zuken CR5000” driver manages the following identifier:

- **LAYER**
- **LINE**
- **PADSTACK**

3.2.1 LAYER

Each **LAYER** subsection defines the typology of the current layer.

Where:

- **PADSTACK** is a layer that contains vias and test points
- **CONDUCTIVE** is an electrical layer that contains the circuit wiring.

Example of **LAYER** identifier:

```
……
(layer (systemLayer (type PADSTACK))
(layer (conductive 2)
……
```

3.2.2 LINE

Each **LINE** subsection contains the track coordinates and width to a point to another. Each coordinate defines a segment of wire.

The following example shows the syntax used for the **LINE** identifier:

1	2	3	4	5
Section identifier	X-Coordinate	Y-Coordinate	Section identifier	Width
pt	69.596000	67.564000	width	0.203200
pt	68.834000	66.802000	width	0.203200
pt	68.834000	64.389000	width	0.203200

Example of **LINE** identifier:

```
……
(line
(pt 69.596000 67.564000 (width 0.203200))
(pt 68.834000 66.802000 (width 0.203200))
(pt 68.834000 64.389000 (width 0.203200))
)
……
```

3.2.3 PADSTACK

Each **PADSTACK** subsection contains the information about test points and vias.
The presence of the “(isTestPad Yes)” identifier indicates a test point, while the “(fromTo 1 2)” identifier indicates a via.

The following example shows the syntax used for the **PADSTACK** identifier:

1	2	3	4	5	6	7	8	9
Not used			Net name	Not used	X-coord.	Y-coord.	Device type identifier	Access side
padstack	V-H0 5 DO 8-1	net	SIGN189	pt	59.000000	77.851000	(from 1 2)	
padstack	TP10_SMD	net	SIGN12	pt	49.911000	56.007000	(isTestPad YES)	B

Example of **PADSTACK** identifier:

```
……
(padstack V-H05D08-1 (net SIGN189) (pt 59.000000 77.851000) (fromTo 1 2))
(padstack TP10_SMD (net SIGN12) (pt 49.911000 56.007000) (fromTo 2) (isTestPad YES (side B)(id TPSIGN12-01)))
……
```

4. Import setting

4.1 Pin function assignment

This assignment table must be filled, in order to correctly execute the CAD file import.

In order to correctly test some polarized devices such as diodes, bipolar transistors, etc., it is basic to identify correctly the pin function (i.e. anode, base, etc.) of each pin.

The fields contained in the table, are described below:

Field	Description
Device Type	Identifies the type of device (example: Resistors, Capacitors, Digital Devices, Diodes etc.).
Pin Function	Function concerning the Pin.
Pin Name	Pin reference.
Cad Pin	Pin reference in Cad file.

4.2 Drawing ref. initials/device type assignment

The Zuken CR5000 file typically contains all information about the devices, such as value, tolerances and type; which are fundamental from the point of view of the test program generation.

The fields contained in the table are described below:

Field	Description
Drawing Reference	Initial letter identifying the **Device Type**.
Device Type	Identifies the type of device (example: Resistors, Capacitors, Digital Devices, Diodes etc.).
Default Tol+, Tol-	Value and tolerance of the device only if required (as for resistors).

It could happen that in the CAD file they are missing. For each drawing reference initial, the displayed table enables to define the following data default values:

- Device type
- Default positive tolerance
- Default negative tolerance

This means that if, for any reason, the CAD file does not contain the information mentioned above, the default values will be used.

A. Note about the Zuken CR5000 ASCII text file format

The Zuken CR5000 CAD-CAE typically runs under Unix operating system and generates its neutral ASCII output file in Unix format.

The Unix ASCII text files use the"$0a_{hex}$" ASCII character as end of line identifier.
The Windows® (MS-DOS) operating system uses the "$0d_{hex}$" and "$0a_{hex}$" ASCII characters as end of line identifiers for ASCII text files.
This means that output ASCII text files may require an ASCII format conversion (from Unix to Windows® format).

This operation can be performed using "WordPad", a standard text file editor.
Open the Zuken CR5000 ASCII file with this editor and save it, this operation will automatically perform the conversion from ASCII Unix format to ASCII Windows® format.