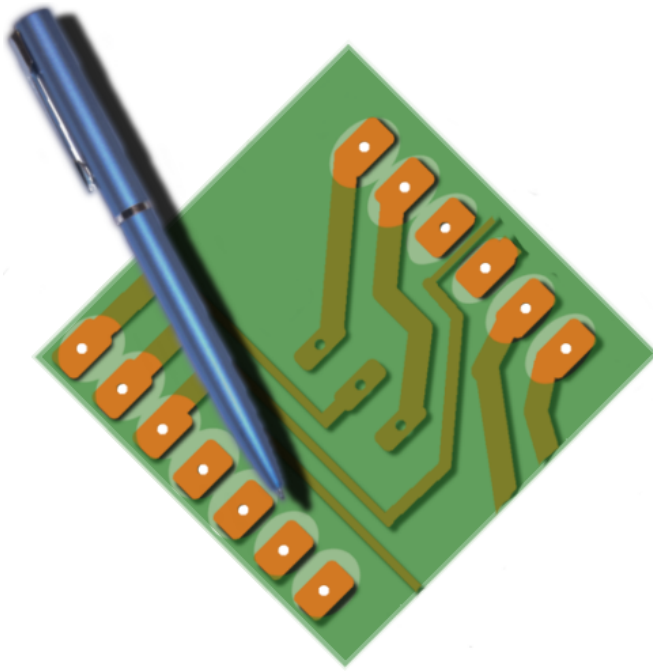


FidoCadJ 0.24.3 user manual

Davide Bucci



November 5, 2013

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Abstract

This document is the FidoCadJ official user manual. After a short introduction of the history and the birth of this software, we will describe the basic use of FidoCadJ. Our goal is to learn how to draw very simple electronic schematics and their printed circuit boards. The manual will end with a detailed description of the FidoCadJ (and thus FidoCAD) format. Finally, we will give some hints about downloading and installing FidoCadJ using the most widespread operating systems: Linux, MacOSX and Windows.

Acknowledgements

A number of people used this software from its first versions and helped me by providing their advices. I thus want to thank the `it.hobby.elettronica` newsgroup participants for their very fruitful discussions.

This software has been very carefully tested on Linux thanks to Stefano Martini's patience. He is a very attentive alpha and beta tester! I would like to thank Olaf Marzocchi and Emanuele Baggetta for their tests on MacOSX.

I would like to thank "F. Bertolazzi" who has given very useful advices about the usability of this software. He also assembled the CadSoft Eagle compatibility library, useful to export FidoCadJ drawings to Eagle. Many thanks to "Celsius", who tested the software functionalities for PCB realization, as well as its libraries. Thanks to Andrea D'Amore, for his advice concerning FidoCadJ visual aspect on the Apple Macintosh, from the 0.21.1 version. I would like to thank Roby IZ1CYN for the useful discussions about libraries and to have written section [A.2](#) of this manual, about the Linux installation. Macintosh users can use FidoCadJ well integrated in the look of their operating system thanks to the Quaqua look and feel, from Werner Randelshofer. Werner has given several useful advices about FidoCadJ's user interface: thanks!

This manual has been translated to English by "Pasu". I would like to thank him for his work. I would like to thank Miles "qhg007" as well, for the careful check and his very useful remarks.

In April 2010, FidoCadJ has been integrated in the well known Italian web site www.electroyou.it. It silently runs on the server and it is used to automagically convert drawings posted by users of the forum. I would like to express my gratitude to the admin Zeno Martini and webmaster Nicolò Martini and to all other users of this site as they gave me a lot of very useful ideas about batch controlling FidoCadJ: a very promising path has been traced which deserves to be fully explored. More recently, the FidoReadPHP class has been prepared in order to read and interpret FidoCadJ drawings on a PHP server. It has been used by the popular www.grix.it website thanks to Arniek and Sstrix. Kudos to them!

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
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1. Introduction

In this chapter, we will briefly introduce FidoCadJ. In particular, we will give a description of the philosophy behind this software, as well as a brief history of its development.

1.1. FidoCadJ's philosophy

FidoCAD (without the J at the end) was a vectorial drawing software particularly suited for electrical schematics as well as printed circuit boards. It is widespread in particular in the Italian Usenet community from the late 1990s.

It can be freely downloaded (a Windows version nationalized in Italian language) from Lorenzo Lutti's page:

<http://www.enetsystems.com/~lorenzo/fidocad.asp>

The output files generated by this software are a very compact textual description. This feature makes it very easy to include drawings in text messages, such as those used in non binary Usenet groups.

Unfortunately, FidoCAD exists only in a Windows version. Who uses Linux can run it using WInE, but for those using other platforms like me (I use MacOSX) have to find a different solution. I thus decided to give a small contribution to the Usenet community by writing FidoCadJ (with the final J, this time). This editor is written in pure Java and it is completely multi-platform. FidoCadJ allows showing and modifying a drawing using the FidoCAD file format.

Whoever used FidoCAD in the past should become acquainted with FidoCadJ very quickly, since many commands and procedures are quite similar to the original application. At the time of writing, to the best of my knowledge, FidoCadJ is almost completely compatible with the original FidoCAD, apart from a few details. The goal of a complete compatibility has been pursued until possible, but recently the needs of the new users have pushed towards some extensions to the original format.

Among the features offered by FidoCadJ and not present in the original FidoCAD are the export possibilities offered. Since I am a \LaTeX user, I decided to include an export feature for a number of vectorial formats, including Encapsulated PostScript (EPS). Of course, FidoCadJ can export towards the very well known PDF format. Another file format useful for electronic schematics is the CadSoft Eagle script, which is available from version 0.21 of FidoCadJ. In this way, a schematic drawn with FidoCadJ can be exported to Eagle. The appendix [A](#) briefly describes how to install FidoCadJ on the most widespread operating systems.

1. Introduction

1.2. History of this software

I have long been interested in electronic circuits. When I began following several dedicated Italian Usenet newsgroups, I noticed that many schematics were provided using the FidoCAD for Windows format. This avoided awkward ASCII drawings. Since I do not use Windows since a few years ago, it was almost impossible for me to look at them and I wanted to try to do something to solve this problem.

By the way, I think that it is better to work at a solution rather than claim that an operating system is different from Windows lacks in software

The first thing I did was to study the file format used by FidoCAD and write a Java applet called FidoReadJ, able to parse the circuit and to show it in a web page. I started searching more or less everywhere (old posts, web pages), doing a lot of reverse engineering from existing FidoCAD files. I downloaded the FidoCAD sources, written in a pretty neat C++ by Lorenzo Lutti.

I did this work more or less around March 2007. A few months later, the applet was on line and it was being tested by part of the community gravitating around it.hobby.elettronica and it.hobby.fai-da-te.¹

Since I had an interpreter of the FidoCAD format, it was interesting to continue the work in order to obtain a complete editor. The most part of the work was done in several steps, between January and July 2008. FidoCadJ is not an adaptation or a porting of FidoCAD for Windows, but it is a completely rewritten program.

To be honest, I made a first attempt at writing a 2D vectorial drawing system around 1993.

The choice of using Java is due to the fact that in the last few years I changed a lot of operating systems. Spending time and energies on something which is not completely portable does not appeal to me anymore. The effort of learning the Cocoa framework would have probably given a better result on MacOSX, but it would have made FidoCadJ completely non-portable. I am not a computer guy. The time I spend to program is time taken away from my electronics interests. In fact, a simple analysis of the FidoCadJ code source shows that I am not a very Java and object oriented programming purist and I am sure that several solutions could be found that are more practical than elegant.

What matters is the end user impressions while using the program, more than the choice of a particular language. For this reason, I am always listening to your suggestions, in order to understand how to further develop this project. To summarize, I am aware that Java is not the perfect choice or the solution to every problem. However I am sure that its bad name derives mostly from badly written applications which are not very well integrated with the user desktop.

Without aiming for perfection and knowing my programming skills limitations, my intent is to make sure that FidoCadJ will NOT be another poor quality application. For this reason any bug report or comment on the program's usability will be more than welcome.

Since November 2009, I opened a SourceForge project dedicated to FidoCadJ. From this page, you can download all executables, manuals as well as the source code. You can actively participate to FidoCadJ development working on the source code using Subversion (SVN), or the SVN browser provided by SourceForge:

¹FidoReadJ is still available at the address:

<http://davbucci.chez-alice.fr/index.php?argument=elettronica/fidoreadj/fidoreadj.inc>.

<http://fidocadj.svn.sourceforge.net/viewvc/fidocadj/>

If you want to help the community with FidoCadJ, do not worry: you do not need to be an expert Java programmer. You can for example translate the user interface or the manuals in a new language, check carefully the existing manuals for inconsistencies, typos and errors. FidoCadJ is currently available in Italian, French, English, Spanish, German, Chinese, Japanese, Dutch and Czech. It is quite easy to translate menus and commands, so if you would like to see FidoCadJ in your native language, please let me know! There is also work to be done to translate the libraries (at least the standard ones) and of course this manual. You can also work on the standard library. . . Consider that only half of the spare time I dedicate to FidoCadJ is in reality dedicated to the coding activity. The rest is spent answering questions from users, writing and improving the documentation and so on. On SourceForge, you can participate to the forums, write a program review as well as suggest improvements or give a bug report:

<http://sourceforge.net/projects/fidocadj/>

1.3. FidoCadJ and the future

In april 2010, I stumbled almost accidentally on a thread in a well known italian website www.electroyou.it. An user, Piercarlo Boletti, proposed to integrate a schematic capture tool directly inside the forum. Something similar has already been done with L^AT_EX equations. Since FidoCadJ was cited in his intervention, I inscribed myself to the forum and I offered to collaborate. I interacted with the very nice webmaster for a few days, and then the system was ready: a simple copy and paste in a post of the code describing the drawing, with a couple of tags. The forum software runs FidoCadJ on its servers and obtains an image, directly from the code. This image is then shown in the forum post, but its source code remains available. This way, who is reading the discussion does not need to have anything installed, but if he desires to change something, he can obtain the code with a few clicks.

Figure 1.1 shows part of one of my posts done on www.electroyou.it. This system is so powerful and flexible that I have been the first to be astonished of the enthusiasm demonstrated by the users!² FidoCadJ has shown to be useful also for drawings not directly related to electronics (see appendix B to see what I mean).

The success that FidoCadJ has had on www.electroyou.it has stimulated some requests to implement a similar system on other platforms, and in particular on www.grix.it, another well known Italian electronics-dedicated website. FidoCadJ is also used by the **Matematicamente** community. In the case of www.grix.it, the server could not run a Java program and so the FidoReadPHP class has been written. It can be run on a PHP interpreter to obtain the images from the FidoCadJ source code. The FidoReadPHP project is open source and it is available on SourceForge:

<https://sourceforge.net/projects/fidoreadphp/>

The result is somewhat similar to what it has been obtained on www.electroyou.it,

²If you read Italian, here is an article I wrote:

<http://www.electroyou.it/darwinne/wiki/fidocadj>

1. Introduction

[12] Re: Orologi e orologiai

Di DarwinNE il 25 mag 2011, 1:36

“ TardoFreak ha scritto:
Beh ... ecco ... timidamente potrei offrirti di sviluppare il firmware (a disposizione di tutti) per fare l'orologio di EY. 😊

Penso proprio che i ragazzi abbiano intenzione di lasciare fuori i microcontrollori, per fare un ottimo esercizio di stile. Perché non utilizzare un contatore analogico? Anni fa ne avevo realizzato uno per un tracciacurve, è un circuito un bel po' critico, ma abbastanza affascinante. Penso che parte della criticità venga dal fatto che ho simulato degli unigiunzione programmabili con una coppia di transistor NPN+PNP (Q2 e Q3, Q7 e Q8). Inoltre, i generatori di corrente che ho adottato sono probabilmente migliorabili.

Sorgente FidoCadJ | Ingrandisci | Cos'è FidoCad

Figure 1.1.: Part of one of my posts on www.electroyou.it. With just one click you can zoom on the schematic. With a second one, you can obtain immediately the source code that you can paste on FidoCadJ to modify it.

1.3. FidoCadJ and the future

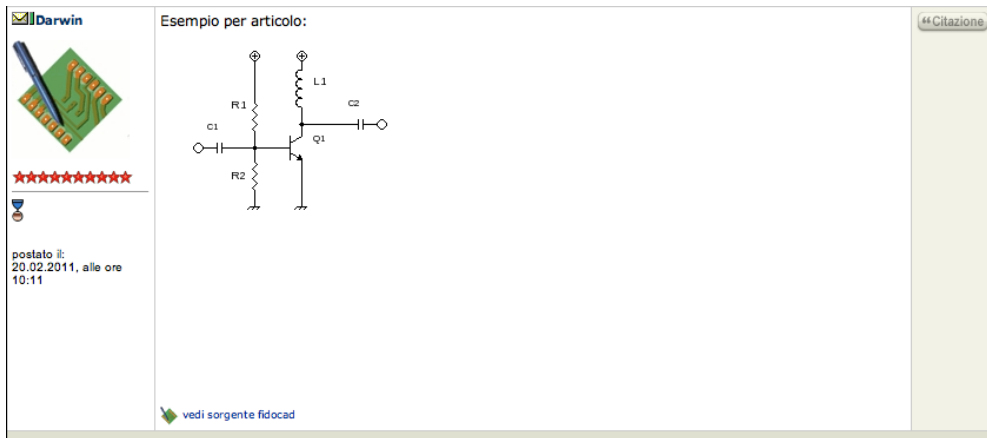


Figure 1.2.: An example of a FidoCadJ drawing integrated in a www.grix.it forum post. You can obtain the source code of the drawing with just a mouse click.

even if the graphical capabilities of PHP are quite limited in comparison with Java. ³ Figure 1.2 shows an example of a drawing obtained with FidoReadPHP.

I think that the future of FidoCadJ is not to become more complex, as a complete CAD for electronics. Probably, those possibilities of integration with discussion groups and forums deserve to be developed. Experience has shown that this is possible and the enthusiasm of the users has been tantalizing.

³Once again, if you read Italian, here is an article:
<http://www.grix.it/viewer.php?page=9335>

2. Drawing with FidoCadJ

The use of FidoCadJ should be quite intuitive for those who already used a vectorial drawing application. A screenshot of the program running on MacOSX is shown in Fig. 2.1; A few details may be different when running on other operating systems (for example Fig. 2.2 shows the result with Look and Feel Metal on Sun/Oracle), but the philosophy remains the same. We will see what the features of the program are, and its basic elements (the primitives) which compose a FidoCadJ drawing.

*Expert Mac-users will notice
that all the menus are at
their own place!*

2.1. Drawing Tools

In the toolbar (on the top of the window), we can find the most used features that allow the creation and the editing of a drawing. Table 2.1 shows a brief summary of the functionalities and the commands and describes the possible actions. You will notice that once a button is pressed, it will remain in that position until another function from the toolbar will be selected. From the toolbar we can select which drawing primitive will be used.¹ On the right, a drop-down menu will show the current working layer (see 2.3 for more information).

*This behavior is inspired to
the old vacuum tube radios
and to the switches very
fashionable in the '70s.*

The command bar can be partially customized. In particular, we can choose whether we want to see the icon on each button or the icon and its text description. Icons are also available in two selectable formats. To change these settings we can select the menu “File/Options”.² Any change in the settings will be applied at the restart of the application, since it is arguably something that we may want to change every day. Figures 2.1 and 2.2 show the command bar (right below the window’s title), configured to show text and icons in their smallest version. On the second row, starting from the left we can see the zoom settings and the buttons “Fit”, “Show grid” e “Snap to grid”. The first allows us to automatically select the most suitable zoom settings in order to show the whole drawing on the screen. The second toggles between visible and invisible grid, while when we press the third button the elements added will stick to the nearest step of the grid. If you need to align carefully the elements, you may find useful to keep pressed Alt, while using the cursor keys.

On the right are shown in a tree list the symbols (also called macros) of the loaded libraries. To insert in the drawing an element from the library, we only need to select it from the list and click on the drawing. FidoCAD libraries include all standard symbols used in electrical schematics and a wide selection of footprints for drawing PCBs.

You can also do quick research inside the libraries charged in FidoCadJ. You just need to type something in the text field which appears just over the tree representing

¹For more information on the drawing elements, see 3.3.

²Except on MacOSX, where this item is found in the FidoCadJ’s menu and it is called “Preferences”.

2.1. Drawing Tools

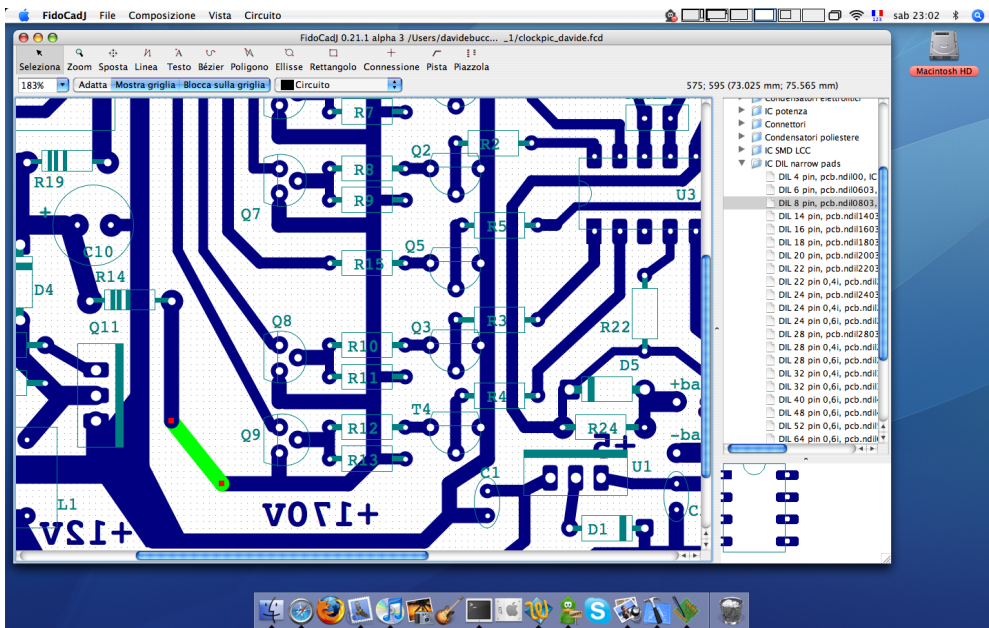


Figure 2.1.: A typical FidoCadJ session running on MacOSX Tiger. Appendix A describes the peculiarities of the version specific for Macintosh.

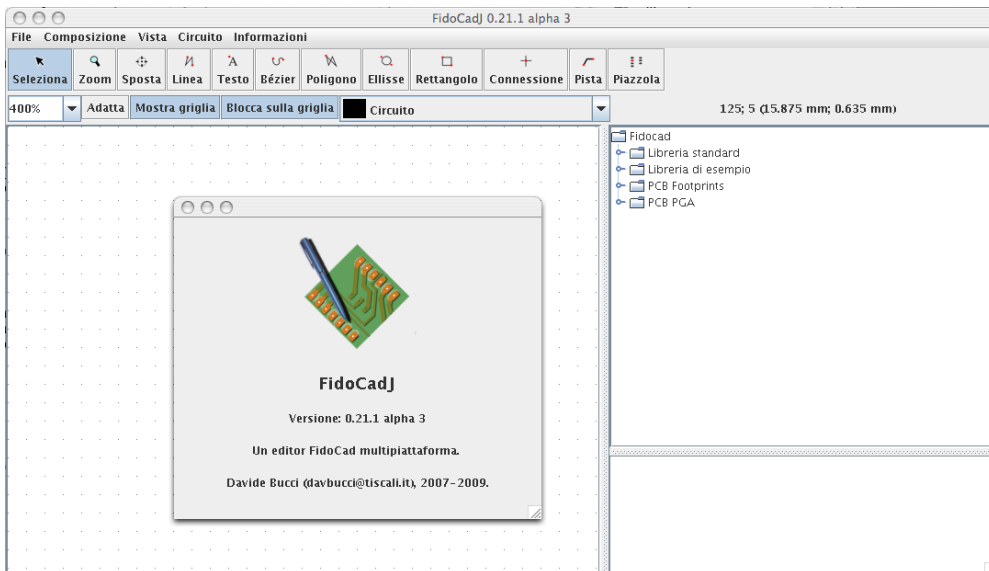


Figure 2.2.: FidoCadJ with the Look and Feel Metal.

2. Drawing with FidoCadJ














Key	Comando	Use
A or Spacebar	 SELECT	Selects one or more graphic elements. Press Control (Command only on MacOSX) for multiple selections or to deselect only one element. Click and drag to select several elements in an area. Press R to rotate the selected elements. Press S to mirror the selected elements. Double-click on an element to modify its properties.
	 ZOOM	Left-click to increase the level of zoom. Right-click to decrease it.
	 MOVE	Click on the drawing and move the mouse to move the drawing.
L	 LINE	Inserts a line or a series of lines. Press Esc or double-click to terminate the insertion
T	 TEXT	Inserts a text string.
B	 BÉZIER	Draws a Bézier curve
P	 POLYLINE	Draws a polyline filled or empty. Double-click or press Esc , to terminate the insertion of new vertices.
K	 CURVE	Open or closed natural cubic spline curve. Double click or press Esc , to terminate the insertion of new vertices.
E	 ELLIPSE	Draws an ellipse filled or empty (hold Control to draw a circle).
G	 RECT.	Draws a rectangle filled or empty.
C	 JUNCTION	Inserts an electrical junction.
I	 PCB TRACK	Draws a PCB track. The default width can be modified through the dialog accessed from the menu "File/Options".
Z	 PCB PAD	Draws a PCB pad. The default dimensions can be modified through the dialog accessed from the menu "File/Options".

Table 2.1.: Summary of the drawing commands available in FidoCadJ. The key shown on the leftmost column allows their rapid selection using the keyboard. A right click in one of the primitive placement modes allows us to access the properties window.

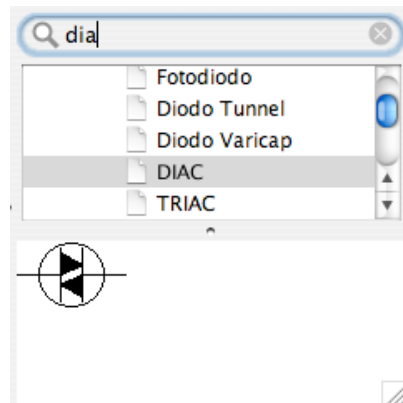


Figure 2.3.: The quick search function in the installed libraries.

the installed libraries (have a look to figure 2.3) By typing up and down arrow keys, you can navigate through the results found.

Figure 2.4 shows an example of what we can obtain by double-clicking, in selection mode, on a drawing element (in this case a text string). Within this window it is possible to modify all the parameters (coordinates, rotation. . .) of any drawing element. The aspect of this window will change because the information that can be modified will depend on the selected element.

2.2. A simple schematic

As an example of use of this application, we will show how to draw the simple electrical schematic of figure 2.5.

Once FidoCadJ is running, let us create a new drawing from the menu “File/New”.

We will then start by placing in the drawing area the symbols for the two transistors, around which our schematic is built. To do so, we will need the macros contained in the standard library, which is loaded by default and is found on the right-hand side of the screen. The macro that we will use is called “NPN transistor” and is included in the “Diodes and transistors” category of the “Standard library”. By clicking on the element’s name to select the desired macro, it will then be possible to place it anywhere in the drawing (FidoCadJ shows a preview), by clicking a second time on the desired location. We should now be at the stage similar to the one shown in figure 2.6.

We may notice that the bipolar transistor on the left is not correctly oriented. To fix the problem is sufficient to click on “Select”, from the toolbar, select the transistor (which will be highlighted in green, with three control points identified by small red squares) and then press **S** to obtain its mirrored version. You may also press **S** when you have selected the symbol in the libraries and you are about to position it in the drawing. We will thus obtain a result similar to the one shown in figure 2.7.

2. Drawing with FidoCadJ

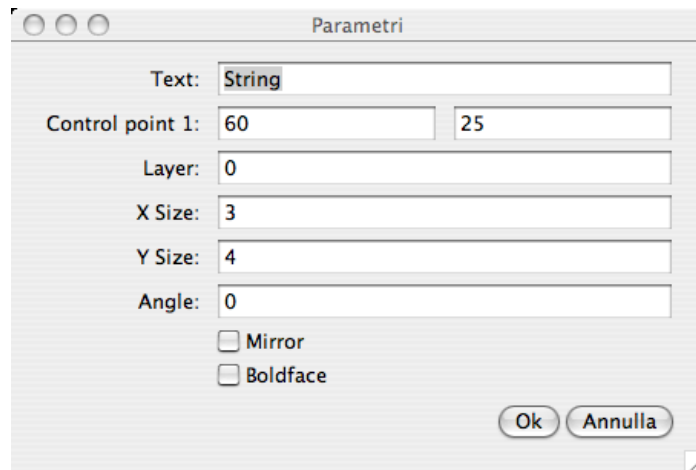


Figure 2.4.: Dialog for the text's parameters in a FidoCadJ drawing.

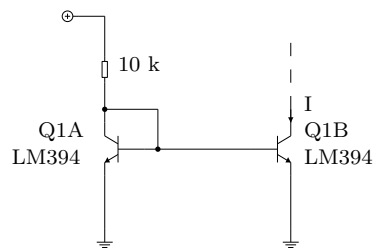


Figure 2.5.: The reference schematic: a current mirror made with NPN transistors.

2.2. A simple schematic

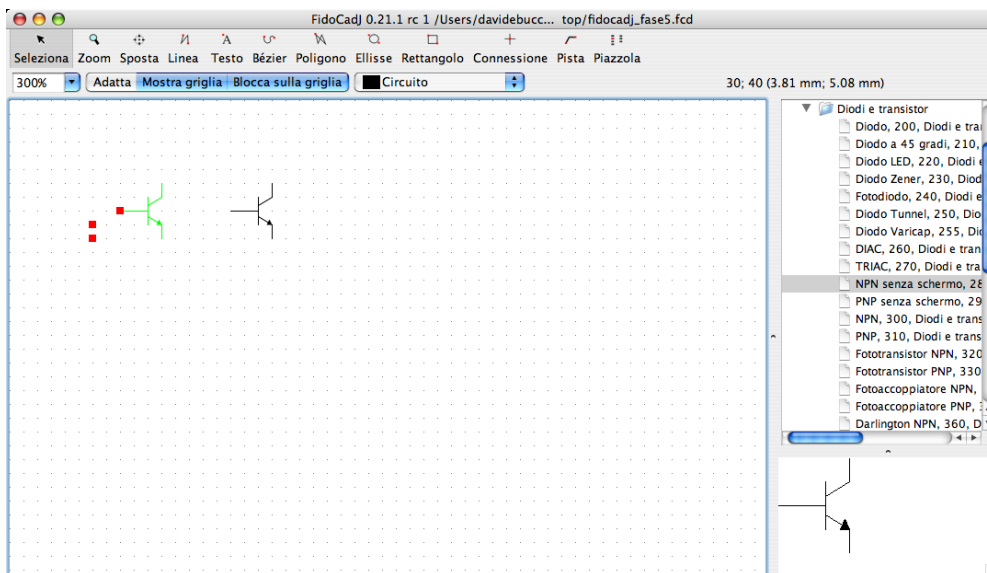


Figure 2.6.: We start by drawing a couple of transistors.

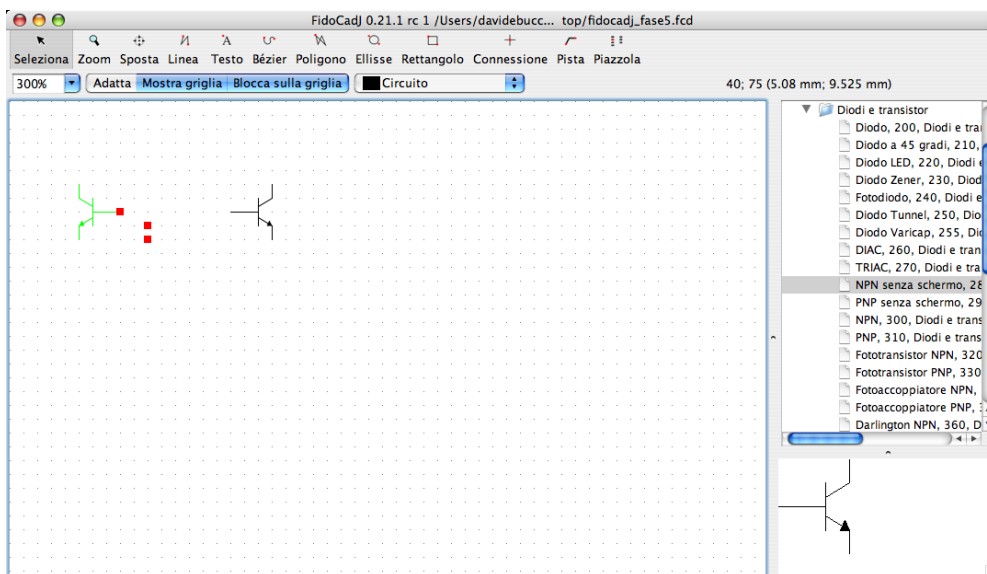


Figure 2.7.: Select and mirror with **S** the transistor on the left.

2. Drawing with FidoCadJ

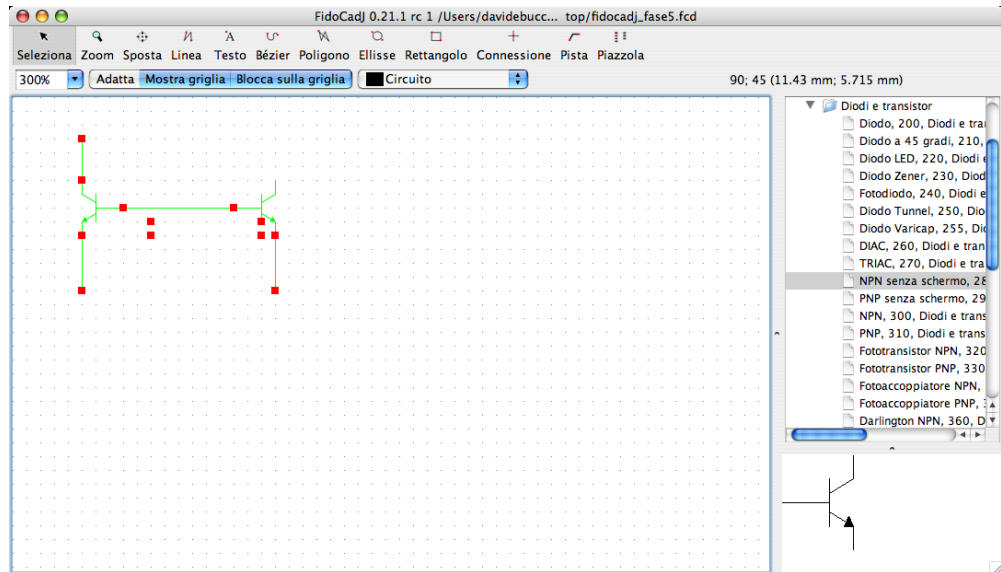


Figure 2.8.: We are too close to the top edge of the sheet: let's select the whole drawing and move it toward the centre.

By using the tool “Line” from the toolbar, we will be able to make a few electrical connections, until we will realize that we started our drawing too close to the edges of the drawing area. The issue can be easily fixed by selecting the whole drawing: in “Select” mode, we can click on the upper left corner of the drawing and, holding the left button of the mouse pressed, drag the cursor up to the lower right corner. A rectangle with a green contour will appear to indicate that we are trying to select all the elements included in it. Since we want to move everything we have drawn so far, we will have to select them all first (see figure 2.8). Now, still in select mode, we can click on any selected element to drag the selection to the desired position.

We can then continue placing the other parts of the circuit, in particular a resistor (Standard Library/Discrete devices/Resistor) and the label for the positive power supply (Standard Library/Basic symbols/Terminal +). We will need to rotate the latter in order to place it in the desired position. Again, we can select it and press **R** until we will obtain the desired result. We should now have a screen similar to the one in figure 2.9.

To complete the schematic we only need to add the text strings and the arrow to indicate the direction of the current. For the latter there is a macro called “Arrow”, contained in “Standard library/Basic symbols”. To place the text, we can press the button “Text” from the toolbar and click in the drawing area on the desired position. As the default text “String” will be introduced, we will need to modify its characteristics by double-clicking in select mode (see figure 2.4). The transistor's part number and

2.2. A simple schematic

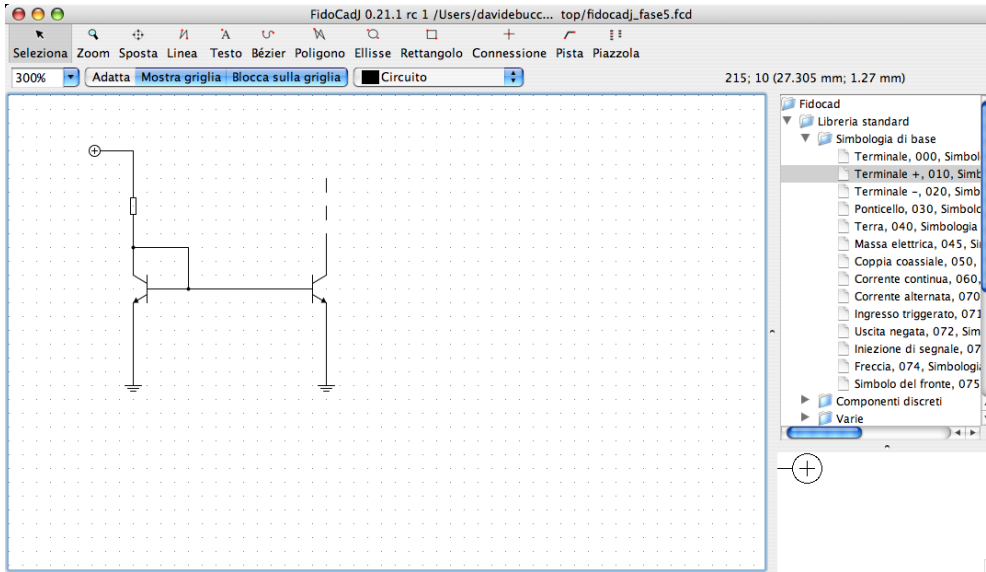


Figure 2.9.: The circuit almost completed.

name used (it is actually a transistor matched pair in our example) are specified in the fields “Name” and “Value” which are accessed in select mode by double-clicking on the macro.³ The suggested dimension to work with electrical circuits is 4 units in vertical and 3 units in horizontal. The complete circuit is shown in figure 2.10.

As a curiosity, this is how the code which describes the circuit of our example looks like. To access this code, it is sufficient to select “Insert Circuit” from the menu “Circuit”. We are now ready to copy and paste our circuit on an e-mail message, in a newsgroup, or in a forum.

```
[FIDOCAD]
MC 95 65 0 0 280
FCJ
TY 115 60 4 3 0 0 0 * Q1B
TY 115 65 4 3 0 0 0 * LM394
MC 55 65 0 1 280
FCJ
TY 20 60 4 3 0 0 0 * Q1A
TY 20 65 4 3 0 0 0 * LM394
LI 55 65 95 65 0
LI 40 75 40 95 0
LI 110 75 110 95 0
LI 40 40 40 55 0
```

³The feature which allows us to add a name and a value to a macro or a component’s symbol is actually an extension introduced with FidoCadJ not present in the original FidoCAD. See section 3.4 for more information on compatibility.

2. Drawing with FidoCadJ

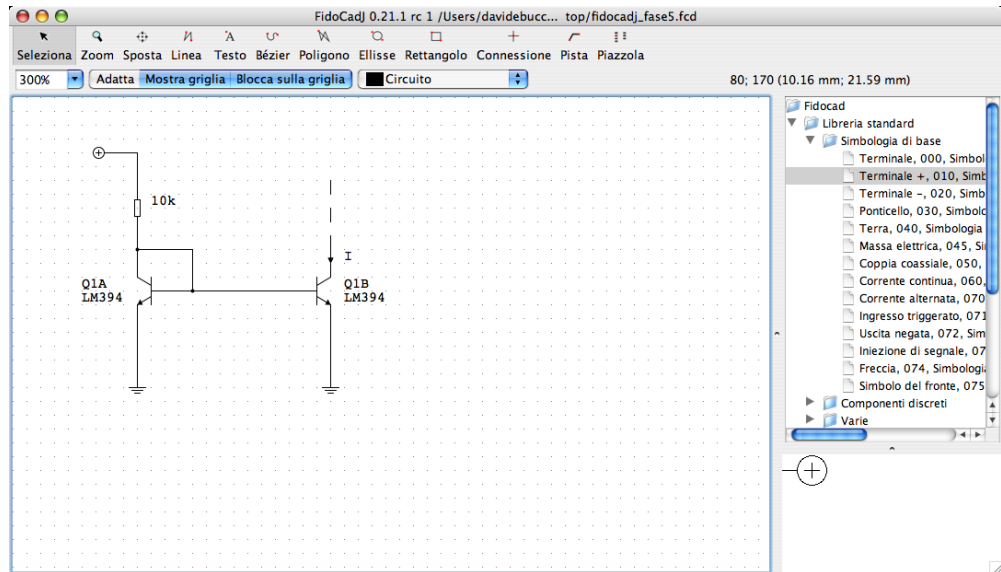


Figure 2.10.: The final circuit.

```

MC 40 30 0 0 115
LI 40 15 40 30 0
LI 30 15 40 15 0
MC 30 15 2 0 010
LI 40 50 60 50 0
LI 60 50 60 65 0
SA 60 65 0
SA 40 50 0
LI 110 45 110 55 0
LI 110 35 110 40 0
LI 110 25 110 30 0
MC 40 95 0 0 040
MC 110 95 0 0 040
TY 45 30 4 3 0 0 0 * 10 k
TY 115 50 4 3 0 0 0 * I
MC 110 50 1 0 074

```

If you are interested in the export format used by FidoCAD, there is a detailed description on chapter 3.

However, there is no need to use the “Insert circuit” dialog; we can simply select the entire drawing, copy it (by selecting “edit/copy” or by pressing `Ctrl+C`) and paste it onto the message we are writing and the code will be added automatically.

Depending on the current settings, FidoCadJ can apply or not a diagonal shift to the copied elements. The x and y width and height are equal to the grid pitch. The default behaviour is to proceed in such a way, in order to differentiate the pasted

2.3. The layers

elements from the original ones. Since in some situations this can be unuseful and problematic, the settings can be changed in the “Options”.

2.3. The layers

A way to picture a layer is that of a drawing made on acetate sheets. The final drawing will be given by the combination of all the layers, which will be superposed like acetates. Every layer is characterized by a different color and can be visible or hidden. This approach is common to many CAD packages, as it allows an easy representation and management of different parts of the drawing that will be superposed, as for example in a PCB design.

FidoCadJ allows up to 16 layers, numbered from 0 to 15. Conventionally, some of the layers have a specific purpose. In particular, layer zero is used for electrical schematics, layer 1 for the copper soldering side, layer 2 for the copper components side and layer 3 for the silk-screen. The remaining layers do not have any pre-defined purpose and can be used freely. Name and color of every layer can be specified using the menu “View/Layer”. From the same menu we can also select the layers that we want to see on screen or that we want to print.

The layers’ ordering is important, as layer with a lower number will be drawn first. That is, drawings on successive layers may cover the ones on lower layers.

2.4. The grid

The logic unit in FidoCadJ is 5 mils (127 micron) and “half units” are not allowed, meaning that the coordinates of any graphic element must be integer numbers. This allows us to obtain a resolution sufficiently fine to draw an electrical schematic and the majority of PCBs. However, for ease of drawing, the application allows us to set a coarser grid and force the mouse to align with the nearest point of the grid. To enable this functionality there are two buttons, “Show Grid” and “Snap”, which allow toggling between visible/hidden grid and force the mouse cursor on the grid or let it move freely, respectively. The grid step can be chosen through a dialog window that can be accessed from the menu “File/Options”.

2.5. A simple PCB

To practice what we learnt so far, we will see how to design a simple PCB. Unlike other software for electronic CAD which are very powerful but sometimes quite hard to manage, FidoCadJ provides in practice an electronic version of the good old R41 transfers. Obviously, working on a computer allows us to benefit from all the flexibility offered by the machine.

It must be noted that the design of a PCB, especially if this is a complex one, is not an easy task. The autoplacer and the autorouter features promise miracles on the publicity flyers from major CAD companies. There is no doubt that these are still a

The reader will find his way through: a few scribbles made with paper and pencil (and a lot of erasers) will result in time saved by obtaining a clear idea to be developed with the use of the computer.

2. Drawing with FidoCadJ

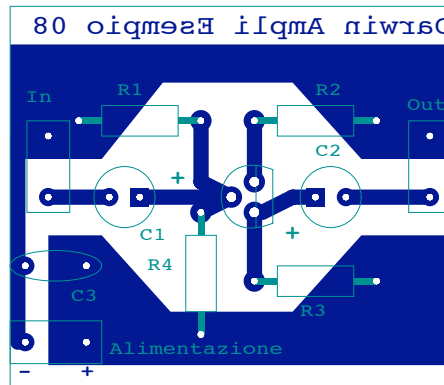


Figure 2.11.: A very simple amplifier stage using an NPN transistor connected in a common emitter configuration.

tasks where the user’s experience still plays an important role. FidoCadJ constitutes a very immediate and fast way to draw small PCBs on a DIY scale. We will see here how to draw a very simple, yet complete, one.

I would suggest to start with a clear idea of where to place each component and how to draw all the tracks so that they will cross each other as less as possible .

Here we will cheat a little and we will start from the result we want to obtain, as shown in figure 2.11. It is a simple common-emitter amplifier built around an NPN transistor, type BC547 or similar. It will be useful to think of the board as it was transparent, by looking from the components side. For this purpose the silk-screen with the components drawing will be very useful, although probably we do not want to print it out onto the actual board for a DIY project.

The first thing I would suggest to do is to place all the components as best as possible. In our example these would be the transistor (from the library “PCB footprints/3 terminals semiconductors/TO92”), the resistors (“PCB footprints/Resistors/Resistor 1/4 W 0,4 i”), and the electrolytic capacitors (“PCB footprints/Electrolytic capacitor/Vert. diam. 5 mm 2.5 mm pitch”). In order to delimitate the board, it may be useful to place an empty rectangle on the silk-screen layer (layer No. 3). To do so we can use the *rectangle* primitive making sure that we selected the appropriate layer first. We should get a result similar to the one shown in figure 2.12.

We can then introduce the copper areas which will provide the positive and negative power supply. These are specified by drawing a polygon (using the *poly line* primitive) and double clicking near its border in selection mode to tell FidoCadJ (through dialog box) that we want a filled polygon. Before placing the polygon, make sure that the current layer is the one where we want to place the copper area (layer No 1, or copper solder side). The use of a filled area for the power supply lines may be useful to ensure that these connections will have a low stray inductance. We should be able to reproduce the result shown in figure 2.13.

2.5. A simple PCB

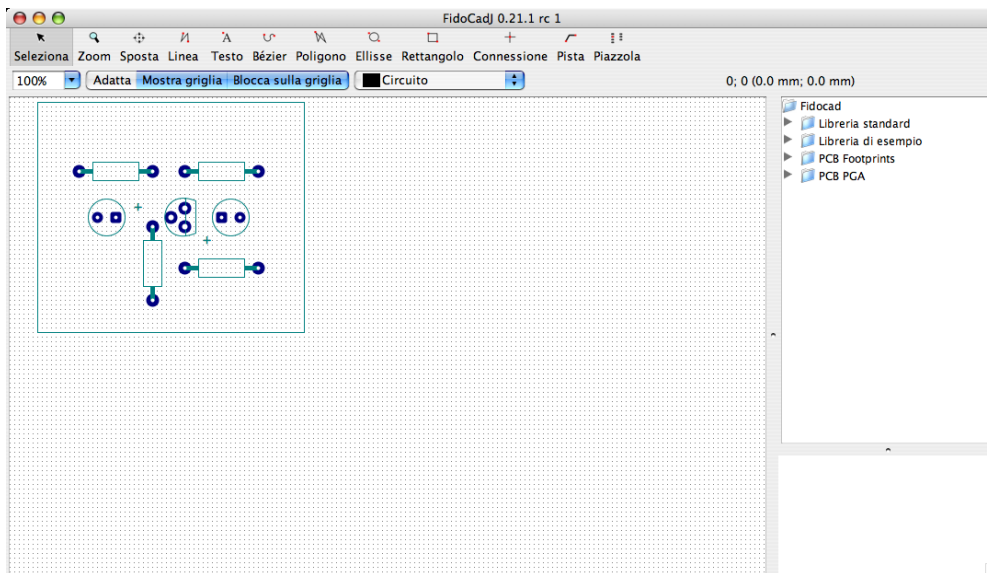


Figure 2.12.: The most important devices are placed on the board.

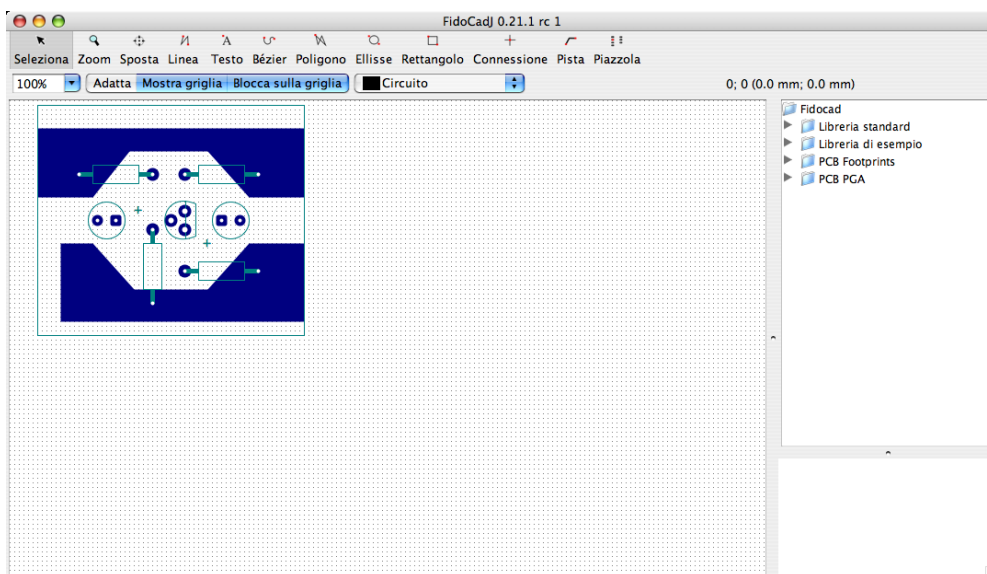


Figure 2.13.: Added the power supply connections using polygonal lines.

2. Drawing with FidoCadJ

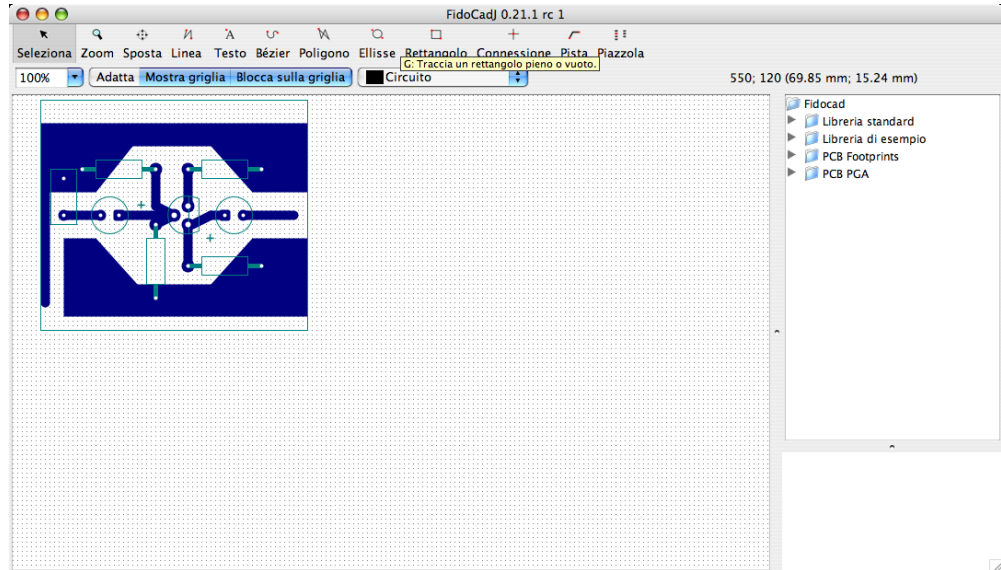


Figure 2.14.: Added the remaining connections PCB tracks.

To complete the electrical connections we can use the *PCB line* primitive. I chose a track thickness of 10 units (1.27 mm), which helps the soldering process.

We realize that we need a few connectors: one for the input, one for the output and one for the power supply. We can use the footprint designed for a polyester capacitor. It will probably have the right dimensions. Let's not forget that FidoCadJ is thought as a replacement for the transfers...

We can also place a “+” and a “-” on the copper layer and place a ceramic capacitor in parallel with the power supply. Let us put the writing on the top side as well. To write on the copper layer, after selecting the proper layer it will also be necessary to mirror all the writings. This is easily done within the usual properties dialog accessed by double-clicking on the string we want to modify when we are in selection mode. It will need a few tries to obtain the right dimensions for the characters. To give an idea it is useful to have a ratio of 3/4 between the horizontal and the vertical dimensions of the characters. Figure 2.15 shows the result obtained using 11 units for the horizontal and 18 units for the vertical dimension of the text.

At this stage the only thing missing is the text with the name of each component, that can be placed on layer 3 (silk-screen). The program with the PCB completed is shown in Figure 2.16.

Once the drawing is completed, we will probably need to print it either on a transparency to use it with a printing box or to use it with other methods such as the “Press&Peel”. To do so we need to make invisible all the layers that we do not want to print. This is done from the dialog window accessed from the menu “Vista/Layer”. In our case it will be sufficient to hide the layer 3 containing the silk-screen. The

Be careful with the track widths: something that looks like a motor-way on the screen will probably be a track so thin that will detach from the board during the soldering.

2.5. A simple PCB

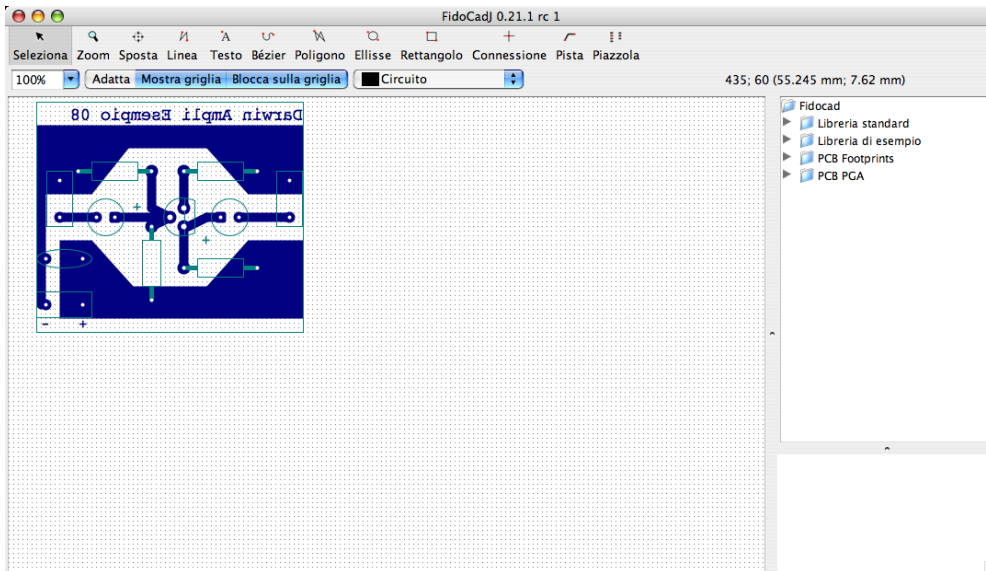


Figure 2.15.: The PCB almost completed.

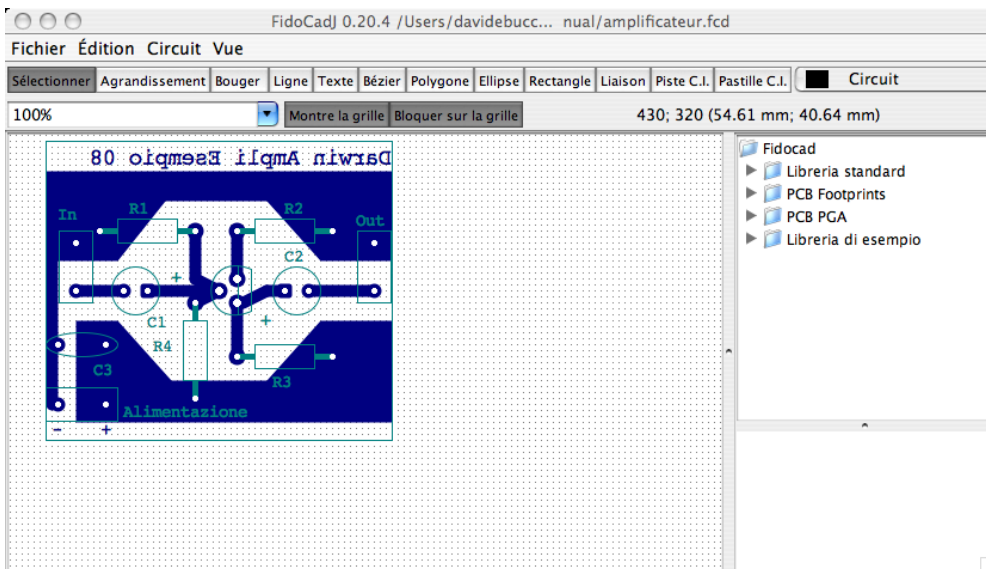


Figure 2.16.: The job completed with the silk-screen.

2. Drawing with FidoCadJ



Figure 2.17.: The PCB, as it appears when printed (mirrored) on a ISO-UNI A4 sheet.

program will show the copper layer only.

We will then print everything that is shown on the screen (obviously NOT adapted to the size of the page, as we want to have the dimensions set in the drawing), taking care of selecting the black and white printing to ensure the maximum contrast. It may be useful to mirror the whole drawing, depending on the technique chosen for the production of the PCB. Since our PCB is quite small, in its real dimensions it will occupy only a small corner of the sheet (assuming a standard ISO-UNI A4), as we can see in Figure 2.17.

For information, below is the code generated for the PCB of the example above (be careful with long lines!):

```
[FIDOCAD]
TY 320 10 18 11 0 4 1 * Darwin Ampli Esempio 08
TY 85 240 12 8 0 5 1 * +
```

```

TY 44 239 12 8 0 5 1 * -
PL 35 90 35 225 10 1
PL 55 130 95 130 10 1
PL 250 130 305 130 10 1
PL 215 130 230 130 10 1
PL 195 140 215 130 10 1
PL 115 130 175 130 10 1
MC 155 220 3 0 PCB.R01
MC 75 80 0 0 PCB.R01
MC 270 185 2 0 PCB.R01
MC 270 80 2 0 PCB.R01
MC 230 130 3 0 PCB.CE00
MC 115 130 1 0 PCB.CE00
MC 40 175 0 0 PCB.CC50
PL 190 80 190 120 10 1
PL 190 140 190 185 10 1
PL 155 80 155 120 10 1
PL 155 120 175 130 10 1
PL 155 140 175 130 10 1
PP 30 30 30 105 90 105 130 55 215 55 260 105 320 105 320 30 1
PP 320 240 320 155 260 155 215 205 135 205 90 155 55 155 55 240 1
MC 190 120 0 0 PCB.T092
MC 305 90 1 0 PCB.CPBX352
MC 55 90 1 0 PCB.CPBX352
MC 80 225 2 0 PCB.CPBX352
TY 290 65 12 8 0 0 3 * Out
TY 40 60 12 8 0 0 3 * In
TY 95 225 12 8 0 0 3 * Alimentazione
TY 70 190 12 8 0 0 3 * C3
TY 230 95 12 8 0 0 3 * C2
TY 115 150 12 8 0 0 3 * C1
TY 120 170 12 8 0 0 3 * R4
TY 220 200 12 8 0 0 3 * R3
TY 230 55 12 8 0 0 3 * R2
TY 100 55 12 8 0 0 3 * R1
RV 30 5 320 255 3

```

2.6. Using the ruler

When drawing a PCB, it is often useful to measure distances in the working area. For example, you can check a track width, the clearance between two tracks or the total size of a card. FidoCadJ offers (from version 0.23.2) a ruler feature which allows you to easily perform those tasks. Just right click and drag. You should obtain a green ruler, like the one shown in figure 2.18. If the right click and drag action is not used in your operating system, you can alternatively left click and drag while pressing the Shift key. The total length measured is shown in FidoCadJ logical units as well as

2. Drawing with FidoCadJ

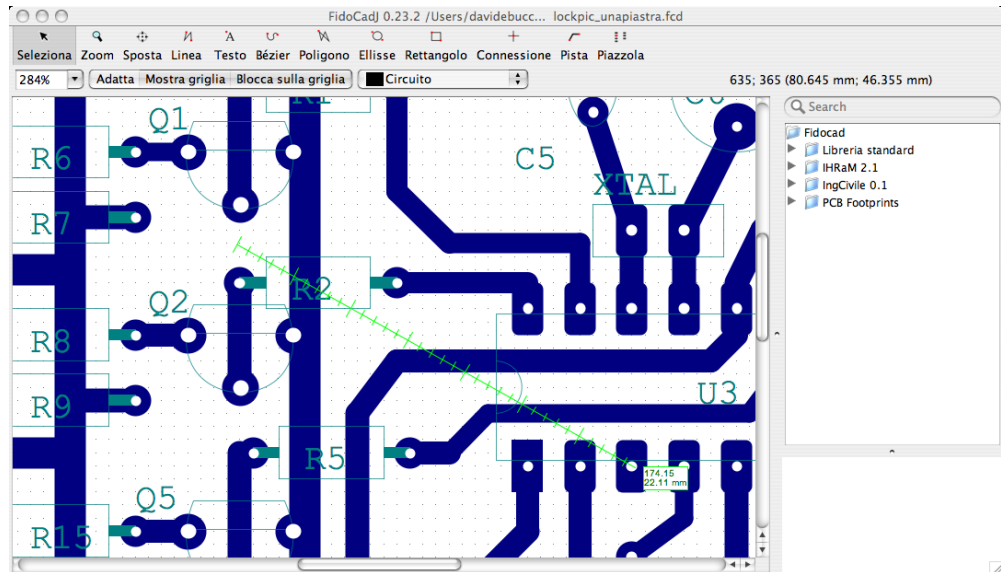


Figure 2.18.: Right click and drag to activate the FidoCadJ ruler.

in millimeter. This is useful when the drawing is printed in the 1:1 mode (such as for PCB's).

2.7. Arrow and stroke styles

FidoCadJ allows to draw arrow heads at the beginning and at the end of lines, Bézier curves and natural cubic splines. It also allows you to specify whether the arrow should be at the beginning or at the end of an element (or both), and offers you a few different arrow styles.

A few stroke styles are now available for technical or mechanical drawings. Figure 2.19 shows an example in which an electrical circuit (a GIC) is enclosed in a dashed rectangle. An arrow at the end of a Bézier curve is also being used. By doing double-click on this element, FidoCadJ shows a parameter window which should be similar to the one shown in figure 2.20. You can notice that the option box “Arrow at start” has been checked. FidoCadJ will thus trace an arrowhead by taking care of his orientation. There are several different drawing styles for the arrow as well for dashing . You may try to play a little bit with them to appreciate their differences.

The possibility of choosing a dashing style and putting arrowheads was not comprised in the original FidoCAD format. This unfortunately means that FidoCadJ drawings using those functionalities are not completely backward compatible with FidoCAD per Windows. When you do chose to use a FidoCadJ extension, you need to know what you are doing. If you need to have a complete FidoCAD compatibility, you can activate the option “Strict FidoCAD compatibility” in the “FidoCadJ exten-

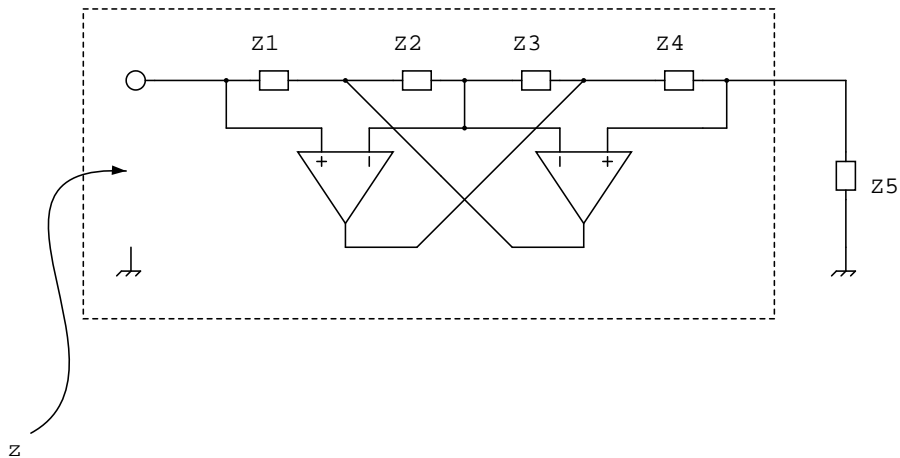


Figure 2.19.: An electrical drawing (an Antoniou's GIC) in which some FidoCadJ extensions have been used.

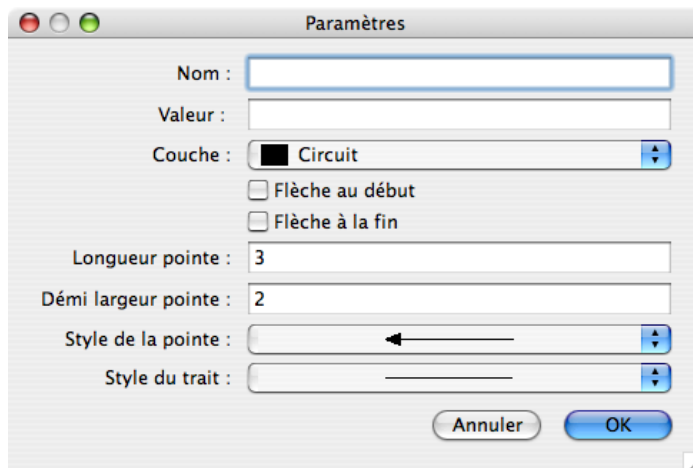


Figure 2.20.: The parameter window of the Bézier curve shown used in the schematics of figure 2.19 (French locale).

2. Drawing with FidoCadJ

sions” tab of the “FidoCadJ preferences” window. In this way, the program will not allow you to introduce graphical elements which would give compatibility problems with FidoCAD. If you need more details about the compatibility of the new graphical elements with FidoCAD, have a look at section 3.4.

2.8. Exporting

One of the most important thing to me about FidoCadJ is the possibility to create simple schematics for typographic use. For this reason I introduced a feature that allows the exportation of drawings through a number of different file formats.

A vectorial format stores the elements that compose the drawing. A bitmap format works on a matrix of pixels.

To export the current drawing, select the command “Export” from the menu “File”. The Table 2.2 shows a list of graphic file formats currently available. For every file format, the Table (but also the export dialog in FidoCadJ) specifies whether it is vectorial or bitmap. Whenever possible it is better to choose a vectorial format to obtain the best results.⁴

For the bitmap file formats it may be useful to enable the option “Anti aliasing”, to reduce the annoying effect of the quantization, visible especially on diagonal lines. The resolution and the “Anti aliasing” options are not used when exporting to a vectorial file format. In this case, you may instead specify a scaling factor.

The option “Black&White” allows the printing of any visible layer in solid black. This is important for the preparation of films to be used for typographic purposes or with a printing box.

2.9. Command line options

The application is distributed as a file `.jar`, which is a Java archive.⁵ In many operating systems, to run the application it should be enough to double-click on the file, provided that a recent version of Java is installed on the machine. Using Sun’s terminology, the so called JRE, or the Java Runtime Environment, is all that is needed to run a program written in Java (but not to write it: in that case the SDK would be necessary...). The minimum Java version needed to run FidoCadJ is the 1.5, which has been around for a few years now.

In some cases, it may be useful to run FidoCadJ from a command line (the terminal in the Unix systems, or the MS-DOS Prompt in Windows). To do so, it is sufficient to run the command `java`, with the option `-jar`:

```
java -jar fidocadj.jar
```

If a file is specified in the command line, FidoCadJ will try to open it. For example (on a Unix machine):

```
java -jar fidocadj.jar ~/FidoCadJ/test.fcd
```

⁴The code structure of FidoCadJ allows the addition of other file format quite easily. Please contact me if you like to participate to the project.

⁵Except for the Macintosh version, which is a stand alone application.

2.9. Command line options

Format	Comment
JPG	Very widespread bitmap format. Since the compression used is lossy, it is not suitable for exporting FidoCadJ schematics. It is made available due to its diffusion.
PNG	Compressed bitmap format, suitable for exporting schematics. This is probably the best way to export a FidoCadJ drawing when a vectorial format cannot be used.
SVG	W3C standard vectorial format. Some internet browsers (such as the recent versions of Safari) allow its visualization within a web page. Very good format for graphics and schematics, it enables the use in applications such as Inkscape to modify the drawings made with FidoCadJ. There are currently some limitations with the exportation of rotated and mirrored text.
EPS	Encapsulated Postscript vectorial format. Very useful to those who use professional graphics applications, or want to use a FidoCadJ drawing in a \LaTeX document. The drawings exportation should be fully working. This is the option used to obtain Figure 2.11, page 16 in this manual (passing through a PDF conversion, since I use PDF \LaTeX).
PGF	Vectorial format to be used directly in a \LaTeX document, when using the <i>pgf</i> package, available in the CTAN archive. This exportation option was thought in particular to export schematics and uses an easily editable script. The text attributes will not be translated. This allows the introduction of \LaTeX code directly into the drawing and it is the technique used in this manual to obtain Figure 2.5, page 10.
SCR	FidoCadJ allows the exportation of a drawing to a script that can be imported in CadSoft Eagle. To use this feature, it is necessary to install the library <code>FidoCadJLIB.1br</code> into the directory <code>1br</code> of the current installation of Eagle. The library can be downloaded from FidoCadJ's website. At the time of writing, this option works only with schematics containing only the most common symbols. Some drawing elements such as pads and tracks are not available yet. These will not be exported to the Eagle script.

Table 2.2.: List of all the export file formats available in FidoCadJ.

2. Drawing with FidoCadJ

FidoCadJ will be run and it will try to open the file `~/FidoCadJ/test.fcd` (provided that this exists).

There are some other interesting things FidoCadJ can do. Option `-h` shows a listing of the FidoCadJ options:

```
[davidebucci@Darwin]$ java -jar fidocadj.jar -h
This is FidoCadJ, version 0.24.3.
By Davide Bucci, 2007-2013.

Use: java -jar fidocadj.jar [-options] [file]
where options include:

-n      Do not start the graphical user interface (headless mode)

-d      Set the extern library directory
        Usage: -d dir
        where 'dir' is the path of the directory you want to use.

-c      Convert the given file to a graphical format.
        Usage: -c sx sy eps|pdf|svg|png|jpg|fcd|sch outfile
        If you use this command line option, you *must* specify a FidoCadJ
        file to convert.
        An alternative is to specify the resolution in pixels per logical unit
        by preceding it by the letter 'r' (without spaces), instead of giving
        sx and sy.

-s      Print the size of the specified file in logical coordinates.

-h      Print this help and exit.

-t      Print the time used by FidoCadJ for the specified operation.

-p      Do not activate some platform-dependent optimizations. You might try
        this option if FidoCadJ hangs or is painfully slow.

-l      Force FidoCadJ to use a certain locale (the code might follow
        immediately or be separated by an optional space).

-k      Show the current locale, as specified by the operating system

[file]  The optional (except if you use the -d or -s options) FidoCadJ file to
        load at startup time.

Example: load and convert a FidoCadJ drawing to a 800x600 pixel png file
        without using the GUI.
        java -jar fidocadj.jar -n -c 800 600 png out1.png test1.fcd

Example: load and convert a FidoCadJ drawing to a png file without using the
        graphic user interface (the so called headless mode).
        Each FidoCadJ logical unit will be converted in 2 pixels on the image.
        java -jar fidocadj.jar -n -c r2 png out2.png test2.fcd

Example: load FidoCadJ forcing the locale to simplified chinese (zh).
        java -jar fidocadj.jar -l zh

[davidebucci@Darwin]$
```

The most simple option is `-n`, with which the software... does nothing, i.e. it does not activate the GUI and just exits. In this case, the Java environment variable `java.awt.headless` is set to true. Obviously, this option is not so much useful alone, but it will be precious when using in combination with other functionalities we are about to describe. Option `-d` allows to specify the directory where FidoCadJ will seek

2.9. Command line options

for libraries to be loaded at startup. Option `-c` allows to make FidoCadJ convert a FidoCAD file (which must be specified) into an image in a vector or raster format. This can be very useful, as FidoCadJ can be used as a converter in a non interactive way (along with the `-n` option)

We can thus have a look at the first example given in the help:

```
java -jar fidocadj.jar -n -c 800 600 png out1.png test1.fcd
```

FidoCadJ will run without activating the GUI and will export in the png format the file `test1.fcd`. The output file will be called `out1.png` and will have a 800x600 pixel size. There is an alternative version of the `-c` option, which will allow to specify how many pixels should be used to convert one logical unit (we will call this factor r_p). FidoCadJ does not deal with half logical units (they are always integers), by choosing, let's say, r_p equal to two pixels per logical unit ensures that schematics will be always understandable (even if probably a little bit small). The r_p factor can be non integer, as in the following example:

```
java -jar fidocadj.jar -n -c r1.25 png out2.png test2.fcd
```

To know the total size (in logical units) of a schematic, you can use the `-s` option. Remember anyway that, during the exports, FidoCadJ adds always a $t_{\text{margin}} = 3$ logical units margin for each side of the drawing. So, if t_w is the width of the drawing in logical units given by `-s`, you might expect that p_w the width of your drawing in pixel is calculated as follows:

$$p_w = r_p(t_w + 2t_{\text{margin}}) \quad (2.1)$$

Another interesting option, although a feature due to Java more than FidoCadJ, is the possibility to modify the look of the application (in the jargon of Java called look & feel). You can choose the look&feel that you like without modifying a single line of code. Here is something that Linux users appreciate, the GTK+ look:

```
java -Dswing.defaultlaf=com.sun.java.swing.plaf.gtk.  
GTKLookAndFeel -jar fidocadj.jar
```

There is also the classic Motif look & feel, shown in Figure 2.21⁶:

```
java -Dswing.defaultlaf=com.sun.java.swing.plaf.motif.  
MotifLookAndFeel -jar fidocadj.jar
```

Obviously, the commands listed above are meant to be sent from a terminal, making sure that the current directory contains the file `fidocadj.jar` and writing everything on the same line.

⁶This style may somehow shock those well acquainted with very refined graphical interfaces such as Aqua, with MacOSX. However, I saw a few years ago a synchrotron control system which had a graphical interface based on Motif. Pretty though stuff!

2. Drawing with FidoCadJ

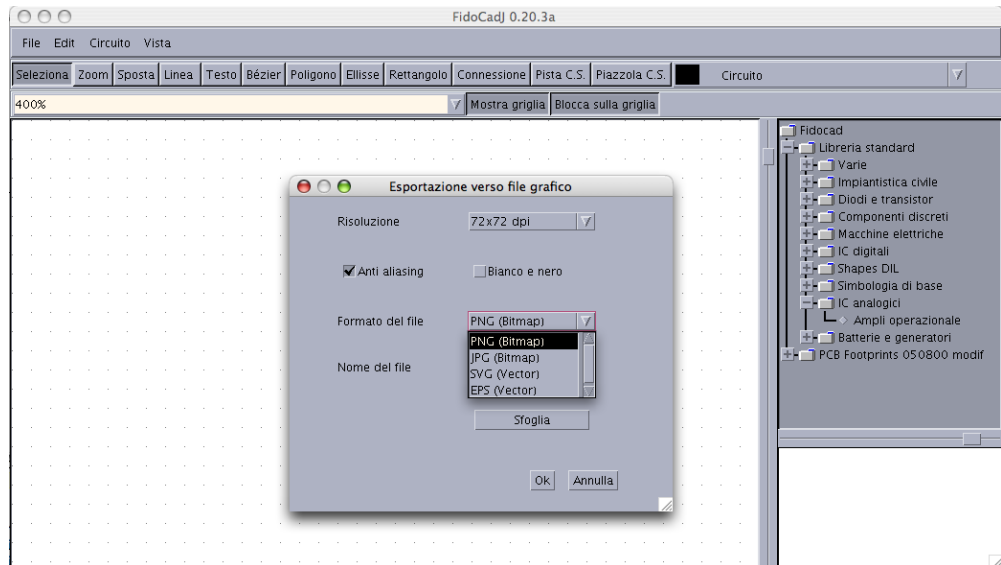


Figure 2.21.: The appearance of the program on MacOSX, using the Motif look & feel.

2.10. Library management

2.10.1. Using library files

A library is a collection of symbols which the user can include in his drawings. There is a collection of libraries included in the FidoCadJ packet, as well as the possibility of defining new symbols and libraries. In fact, FidoCadJ allows us to specify a directory in which all the user library files are placed (with the file extension `.fcl`). This can be done through the menu “File/Options”.

In some very special cases (or for testing), the libraries included in the FidoCadJ packet can be replaced by external ones. If a file named `FCDstdlib.fcl` is present, its content will supersede the standard library directly available in the application. Analogously, if a file named `PCB.fcl` is present, its content will replace the PCB library⁷.

From version 0.23, thanks to Roby IZ1CYN, I could include the IHRaM 3.1 library directly inside the FidoCadJ distribution. I have done this because among all the libraries I have seen, this one has appeared to be one of the most complete and rationally constructed. Exactly as it happens for the other libraries embedded in FidoCadJ, if there is a file called `IHRAM.FCL` in the current library search path, this one will be loaded at the place of the version embedded in the program. You also have an electrical symbols library whose file is called `elettrotecnica.fcl`.

Other files with `.fcl` extension in the library search path will be considered as

⁷Pay attention to the use of capital letters, in particular if your operating system distinguish upper-case and lowercase letters in the files management.

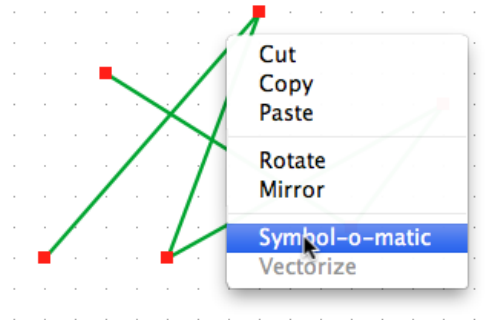


Figure 2.22.: The pop-up menu appearing with a right click allows to transform drawing elements into a symbol

libraries and FidoCadJ will try to load them when it is starting. This is done when the application starts, when the user change the library search path, or when the “Update libraries” option in the “Circuit menu” is chosen.

FidoCadJ allows to split non standard macros (as the original FidoCAD does). This can be very useful when posting a drawing in a newsgroup, since in this way each macro not belong to the standard FidoCAD libraries is expanded into its graphic primitives. Who reads your post, thus, does not need to have the very same libraries you have installed in your system. For copy/pasting, a command and a shortcut are available in the “Edit” menu, called “Copy, split non standard macros” (or $\boxed{\text{Control}} + \boxed{\text{M}}$ ⁸), in order to make sort that the copied drawing will have all the non standard macros split. You might also save a file with the non standard macros split, by choosing ‘Save as..., split non standard macros’ from the “File” menu. A dialog will appear to let you choose a new file name, since usually you do not want to overwrite the one you are working with.

2.10.2. Defining new symbols

FidoCadJ allows to create new libraries and new symbols. The adopted technique has been chosen in order to be as intuitive as possible. Here are the steps to follow:

- Make sure that a directory containing the user libraries has already been defined. If not, define it in the FidoCadJ user settings.
- Draw what you want to convert into a new symbol.
- Select what you just drawn and right click on it. A popup menu will appear, such as in figure 2.22.

⁸On MacOSX systems, the shortcut is $\boxed{\text{Command}} + \boxed{\text{M}}$

2. Drawing with FidoCadJ

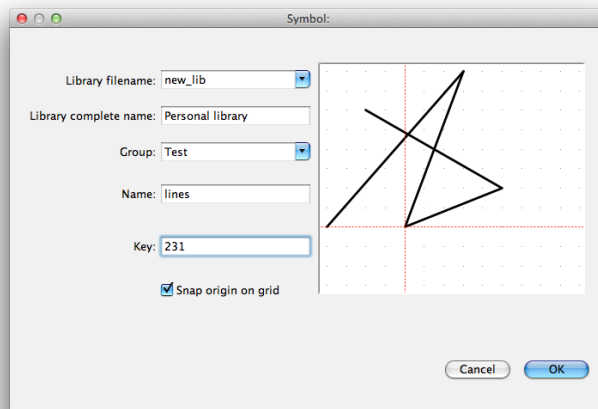


Figure 2.23.: The new symbol definition dialog. Here you can set up all the important characteristics of the symbol. Note the origin defined by the two red axis.

- Choose “Symbol-o-matic” and a dialog for the definition of the details of the newly created symbol will appear (see figure 2.23).
- In the first field “Library filename” you find the file name of the library in which the new symbol must be included. If you type a new name there, FidoCadJ will create a new file.
- The second field “Library complete name” is the complete name of the library, the one which is shown in the library tree. You might write what you want there, but it is better to choose a short and meaningful one.
- The third field “Group” allows you to choose in which group you want to put the new symbol, inside the library. Once again, if you type a new name, a new group will be created.
- The fourth field “Name” is the name of the symbol, what it is shown in the library tree. Once again, choose a short but meaningful symbol.
- The fifth field “Key” is a very short tag which will identify the symbol in the code. It should be unique inside each library and should not contain spaces as well as characters such as parenthesis, dots, and so on. FidoCadJ will propose a short numerical code for you, but you might use mnemonic tags as well.
- By clicking in the field on the right, you must choose the origin of the symbol, the point which will be used for placing the symbol inside the drawing. You

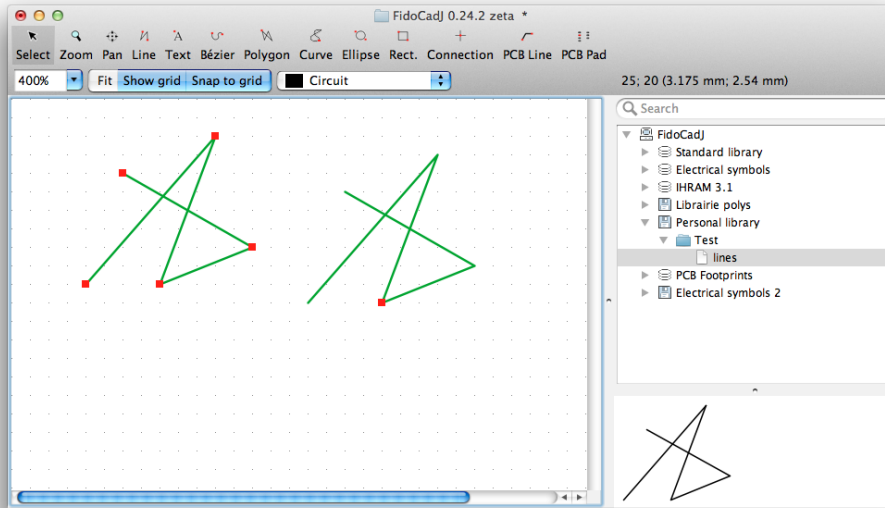


Figure 2.24.: The freshly created symbol, shown in the symbol list and in the drawing. On the left, there is still the drawing which has been used for the symbol definition. Notice that just one control point is present for the new library symbol in the drawing.

might choose to snap on the grid the position you choose by clicking on “Snap origin on grid”.

- Once you click on “OK”, you should find your newly created symbol in the user library in the library tree in the main FidoCadJ window.

An example of an user symbol employed in a drawing is shown in figure 2.24. Note the difference between the selected part of the drawing on the left (actually what it has been used for defining a new symbol) and the new symbol placed on the right. In fact, just one control point is available for the placement of the symbol and this control point corresponds to the choice of the origin while doing the symbol definition. It is thus useful to choose for that a point which has some relevance in your symbol. You can split a symbol again in its primitives by selecting it and clicking on “Vectorize”.

2.10.3. Modifying existing symbols

A few menu actions are available on symbols in the library tree and the drag and drop is also supported there. Once you select a symbol in an user library and do a right-click on it, a popup menu appears, as shown in figure 2.25. Here you have several options:

2. Drawing with FidoCadJ

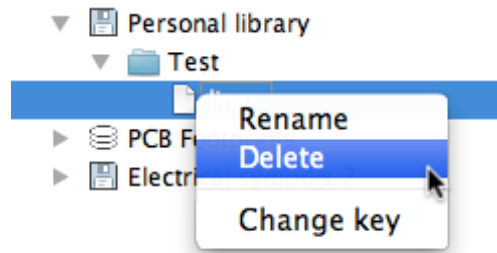


Figure 2.25.: The popup menu used for modifying symbol properties in an user library.

- “Rename” will change the displayed name of the symbol.
- “Delete” will throw away the symbol. Be careful with this: if a drawing contains the symbol, it will be invalidated and disappear.
- “Change key” is useful to modify the key associated to the symbol. Once again, this is something which must be done when the symbol has not been used in the drawing.

By using drag and drop , you might change the library or the category on which a symbol is categorized. Take into account that a symbol complete identification tag is composed by the library name, followed by the key of the symbol. Thus, moving a symbol from one library to another will invalidate drawings containing it.

All library operations are undoable, exactly as drawing operations. Bear in mind that empty libraries or groups are not shown.

3. Drawing format, macros and FidoCAD libraries

This chapter contains a detailed description of the format used by FidoCAD and, as a consequence, by FidoCadJ to store a drawing. It is a simple text format which has the advantage of being very compact and efficient. Since the format has never been described in detail in a document, I will try to summarize all that I learnt about it. Since I added a few extensions which are only available on FidoCadJ, I will try to describe them here as well. Remember that from version 0.23.4, FidoCadJ uses only the UTF-8 encoding on all platforms.

3.1. Header description

All the files containing a drawing in the FidoCAD format must start with the tag *[FIDOCAD]*. A program can therefore recognize the presence of FidoCAD commands by reading this tag. In this regard, FidoCadJ is more tolerant than the original FidoCAD and it recognizes and correctly interprets a file that does not contain the standard header. Even commands containing text can therefore be interpreted correctly as long as the number of incorrect lines does not exceed a value set internally in the program (approx. 100). This ensures that FidoCadJ does not waste time working for a few minutes for example trying to open a very large binary file.

3.2. Coordinates system

FidoCadJ works on a very simple coordinates system. In practice, it has at its disposal a very large area identified only by whole and positive coordinates. The length of every unit in x and in y is fixed at $127\ \mu\text{m}$, a value that allows us to obtain a good resolution for even the smallest SMD package without being too fine for everyday use. In typographical terms, the FidoCadJ resolution is 200 dots per inch.

The original FidoCAD had two different modes of operation: PCB and electrical schematic. In FidoCadJ this difference has been blurred and appears only at the moment of printing the drawing. It would therefore be advisable to set the program to resize an electrical schematic to make better use of the size of the page, otherwise the printed result will have the size of a postage stamp.

3.3. Drawing elements

FidoCadJ can manage 12 drawing elements as follows

- Line
- Filled or empty rectangle
- Simple text (obsolete)
- Advanced text
- Filled or empty polyline
- Filled or empty ellipse
- Bézier curve
- Natural cubic spline curve
- Electrical junction
- PCB pad
- PCB track
- Macro

We will proceed by analyzing each of them. In general, every element is identified by a command and a number of parameters (usually integer numbers or text strings) placed on the same line and separated by a space character.

Line

The line primitive is identified by the command **LI** and its definition requires only the begin and end coordinates and the layer:

```
LI x1 y1 x2 y2 l
```

the points (x_1, y_1) and (x_2, y_2) represent respectively the initial and final coordinates, while l is the layer, characterized by an integer number between 0 and 15.

FidoCadJ extension: starting from FidoCadJ version 0.23, **LI** can be followed in the next line by an extension:

```
FCJ a b c d e nv
```

where a is an integer which represent the presence or not of the arrow heads at the extremes of the segment (have a look at table 3.1), b represents the arrow head style (as table 3.2). Parameters c and d give respectively the total length and the half width of the arrow head, while e is an integer which gives the dash style. If nv is equal to 1, the **FCJ** command should be followed by two **TY** commands giving the name and the value associated to this element.

Mathematicians would probably find the term "segment" more appropriate.

a	Arrow head
0	none
1	at the start side
2	at the end side
3	both sides

Table 3.1.: Meaning of the a parameter for the presence of an arrow head at the sides of a line or Bézier primitive.

b	Arrow head style
0	filled standard arrow head
1	filled standard arrow head with quota line
2	empty arrow head
3	empty arrow head with quota line

Table 3.2.: Meaning of the b parameter for the arrow head style.

Filled or empty rectangle

A rectangle filled or empty is identified by the commands `RP` and `RV` respectively, followed by the coordinates of the two vertices on one of the two diagonals, and the layer.

```
RP x1 y1 x2 y2 l
RV x1 y1 x2 y2 l
```

the points (x_1, y_1) and (x_2, y_2) represent the two vertices and l is the layer, characterized by a whole number between 0 and 15.

FidoCadJ extension: starting from FidoCadJ version 0.23, `RP` and `RV` can be followed in the next line by an extension:

```
FCJ e nv
```

where e is an integer giving the dashing style. If nv is equal to 1, the `FCJ` command should be followed by two `TY` commands giving the name and the value associated to this element.

Simple text (obsolete)

The simple text was the first primitive provided with the early versions of FidoCAD. FidoCadJ recognizes it and simply writes text with size 12, regardless the current zoom.

Since this primitive was considered obsolete by Lorenzo Lutti, the creator of FidoCAD, FidoCadJ does exactly the same and, although this is correctly interpreted, it is not available on the toolbar. FidoCadJ will store this element exactly as it was advanced text and it will use the command `TY` when saving the file.

3. Drawing format, macros and FidoCAD libraries

Bit	Weight	Behavior
0	1	text in bold
2	4	mirrored text

Table 3.3.: Function of the bits in the text style term.

The command is **TE** and the format is as follows:

```
TE x1 y1 text to be written
```

the point (x_1, y_1) is where the string “text to be written” will be positioned. Notice that the layer information is missing. FidoCadJ will treat this object as it was placed on layer zero (circuit).

Advanced Text

The primitive advanced text offers much more flexibility with respect to simple text introduced above.

It is identified by the command **TY**, followed by a number of parameters to determine the text orientation (rotated or mirrored), as well as dimensions along x and y and the font used. Due to the quantity of information to provide, the resulting command string is quite complex:

```
TY x1 y1 sy sx a s l f text to be written
```

The point (x_1, y_1) is where the string “text to be written” will be positioned. The value of s_y and s_x indicates the horizontal and vertical dimensions of the text in logical units. I chose to let FidoCadJ respect the vertical dimension starting from the horizontal one, and that aspect ratio will be chanced only if this is strictly necessary. The text rotation is managed by the term a , expressed in sexagesimal degrees, while the value of s determines the text style, following table 3.3. The layer is given by the usual term l , and f indicates the font to be used, or it can be an asterisk, to indicate the use of the standard Courier New font. If the font name contains spaces these must be replaced with the symbol $+$.

The maximum length of the text is about 80 words. The counting is done in words and not in characters because in the internal structure of the program the words (and command terms) are separated when a line is being interpreted.

Filled or Empty polyline

A polyline filled or empty is indicated with the commands **PP** and **PV** respectively, followed by the coordinates of the vertices that define the polyline, and the layer. The commands are

```
PP x1 y1 x2 y2 ... l  
PV x1 y1 x2 y2 ... l
```

3.3. Drawing elements

where the points $(x_1, y_1), (x_2, y_2) \dots$ are the vertices that define the polyline and l is the layer, characterized by a whole number between 0 and 15. The length of the command line can thus vary depending on the number of vertices used. The maximum number of vertices available has been arbitrarily fixed at 20, to avoid very long command lines.

FidoCadJ extension: starting from FidoCadJ version 0.23, **PP** and **PV** can be followed in the next line by an extension:

```
FCJ e nv
```

where e is an integer giving the dashing style. If nv is equal to 1, the **FCJ** command should be followed by two **TY** commands giving the name and the value associated to this element.

Filled or Empty ellipse

An ellipse filled or empty is identified by the commands **EP** e **EV** respectively, followed by the coordinates of the two vertices on the diagonal and the layer number.

```
EP x1 y1 x2 y2 l
EV x1 y1 x2 y2 l
```

the point (x_1, y_1) represents the first vertex on the diagonal, (x_2, y_2) is the second vertex, and l is the layer, identified by a whole number between 0 and 15.

FidoCadJ extension: starting from FidoCadJ version 0.23, **EP** and **EV** can be followed in the next line by an extension:

```
FCJ e nv
```

where e is an integer giving the dashing style. If nv is equal to 1, the **FCJ** command should be followed by two **TY** commands giving the name and the value associated to this element.

Bézier curve

A Bézier curve segment, in its cubic variant, is identified by four vertices, which are thus required by its associated command **BE**:

```
BE x1 y1 x2 y2 x3 y3 x4 y4 l
```

where $P_1 \equiv (x_1, y_1)$, $P_2 \equiv (x_2, y_2)$, $P_3 \equiv (x_3, y_3)$ e $P_4 \equiv (x_4, y_4)$ are the four control points of the Bézier curve segment, while l is the layer, identified by a whole number between 0 and 15. Given the four points defined above, the curve segment is computed through the expression

$$B(t) = (1 - t)^3 P_1 + 3t(1 - t)^2 P_2 + 3t^2(1 - t) P_3 + t^3 P_4, \quad (3.1)$$

where $t \in [0, 1]$ is a parameter.

FidoCadJ extension: starting from FidoCadJ version 0.23, **BE** can be followed in the next line by an extension:

3. Drawing format, macros and FidoCAD libraries

```
FCJ a b c d e nv
```

where a is an integer which represent the presence or not of the arrow heads at the extremes of the curve (have a look at table 3.1), b represents the arrow head style (as table 3.2). Parameters c and d give respectively the total length and the half width of the arrow head, while e is an integer which gives the dash style. If nv is equal to 1, the **FCJ** command should be followed by two **TY** commands giving the name and the value associated to this element.

Natural cubic spline (complex curve)

A natural cubic spline is defined by a certain number of vertices. The curve crosses each vertex and it is calculated in such a way that it is very smooth.¹ In the FidoCadJ format, a spline is identified by commands **CV** and **CP**:

```
CV aa x1 y1 x2 y2 ... l
CP aa x1 y1 x2 y2 ... l
```

the aa parameter is equal to 1 if the curve is closed, or it is 0 otherwise. Vertices $(x_1, y_1), (x_2, y_2) \dots$ define the spline and l is the layer, an integer ranging from 0 to 15. The length of the command line can thus vary depending on how much vertices are considered. As for polygons, the maximum number of vertices available is internally fixed to more or less 100, to avoid having to do with very long lines. This primitive has been introduced in version 0.24 and is not present in the original FidoCAD.

FidoCadJ extension: **CV** and **CP** can be followed in the following line by an extension:

```
FCJ a b c d e nv
```

where a is an integer which represent the presence or not of the arrow heads at the extremes of the curve (have a look at table 3.1), b represents the arrow head style (as table 3.2). Parameters c and d give respectively the total length and the half width of the arrow head, while e is an integer which gives the dash style. If nv is equal to 1, the **FCJ** command should be followed by two **TY** commands giving the name and the value associated to this element.

Electrical junction

The electrical junction primitive is simply a filled circle of constant dimensions and it is used to represent a connection in an electrical schematic. It is identified by the command **SA** and it only requires its coordinates and layer:

```
SA x1 y1 l
```

With FidoCadJ, the diameter of the circle is fixed internally into the program to two logical units.

¹ <http://www.cse.unsw.edu.au/~lambert/splines/natcubic.html>

If **SA** is followed by **FCJ**, the **FCJ** command should be followed by two **TY** commands giving the name and the value associated to this element.

PCB pad

A PCB pad is identified by the command **PA** and it is characterized by its style (round, rectangular, rectangular with smoothed corners) and the diameter of its internal hole:

```
PA x1 y1 dx dy si st l
```

where the point (x_1, y_1) represents the position of the pad, d_x is the pad's width (along the x axis), d_y is the height (along the y axis). The value s_i is the diameter of the pad's hole, while s_t is the pad's style:

- 0 oval pad
- 1 rectangular pad
- 2 rectangular pad with smoothed corners

The value of l must be a whole number to indicate the layer where the pad is to be placed. If **PA** is followed by **FCJ**, the **FCJ** command should be followed by two **TY** commands giving the name and the value associated to this element.

PCB track

The PCB track is essentially a segment, the width of which can be specified. The corners at the extremes of the segment are always rounded to facilitate the connection with other PCB tracks or pads. The command to be used is **PL**, with the following format:

```
PL x1 y1 x2 y2 di l
```

The track is drawn between the points (x_1, y_1) and (x_2, y_2) , with total width d_i , and the layer used is l . If **PL** is followed by **FCJ**, the **FCJ** command should be followed by two **TY** commands giving the name and the value associated to this element.

Macro call

A macro is a drawing or a symbol contained in a library. Generally, this is the way frequently used electrical symbols are represented. The command used to call a macro is **MC**, and the call is done as follows:

```
MC x1 y1 o m n
```

The macro is drawn using position (x_1, y_1) as the reference, and the orientation is defined by the value of o (multiplied by 90° clockwise) and if m is equal to 1 the macro is mirrored. The last parameter, n , is the macro's name within the library, specified as *library.code*.

If **MC** is followed by **FCJ**, the **FCJ** command should be followed by two **TY** commands giving the name and the value associated to this element.

3.4. FidoCadJ extensions

Since version 0.21, FidoCadJ has started to introduce a few refinements over the original FidoCAD format. The FidoCadJ extensions are represented in the code by the command **FCJ**. This command is not used alone, but means that FidoCadJ needs to specify additional information on what it is specified in the previous line. Here is an example:

```
[FIDOCAD]
MC 40 30 0 0 080
FCJ
TY 50 35 4 3 0 0 0 * R1
TY 50 40 4 3 0 0 0 * 47k
```

The presence of the **FCJ** command indicates that the name and the value of the macro specified in the first line are given by the two **TY** commands which follow. Only the coordinates and the fonts are taken into account for the text rendering.

FidoCadJ allows to activate a “strict FidoCAD compatibility mode”, in which all extensions are disabled. This way, FidoCadJ will be perfectly compatible with the original FidoCAD, except that FidoCadJ will continue using the UTF-8 encoding instead of the old CP-1252 used by FidoCAD. FidoCAD for Windows is unable to understand the additional informations carried by the **FCJ** command. When reading with the original FidoCAD a FidoCadJ drawing containing some extension, the program will prompt a few errors and will give a result which is different from the original FidoCadJ drawing. The results will depend on what extension has been used: a dashed line will be rendered as continuous, the arrow heads will be not drawn. The text associated to the name and the value of a macro will instead be perfectly rendered.

Figure 3.1 shows what can be obtained using FidoCAD to read the FidoCadJ file which describes 2.19. After ignoring the FidoCAD errors, there are some details missing (the dashing and the arrow), but the overall drawing is still understandable.

An important difference from the original FidoCAD is that FidoCadJ allows to save a certain number of configuration hints in the output files. The command which is used for that is **FJC** and it should normally be placed at the very beginning of the file. The next paragraphs will describe the cases which are treated.

3.4.1. Layer setup

The layer setup is specified with the command **FJC L**. FidoCadJ saves data only if the corresponding layer has been modified from its default state. The syntax is as follows:

```
FJC L n xxxx yy
```

where n represents the layer number (ranging from 0 to 15), $xxxx$ is a 32 bit integer containing settings about the RGB color to be used. The red component is contained in bits 16-23, the green one in bits 8-15 and the blue one in bits 0-7. The value yy is a single precision floating point constant which gives the layer transparency, comprised between 0.0 (completely transparent) and 1.0 (completely opaque).

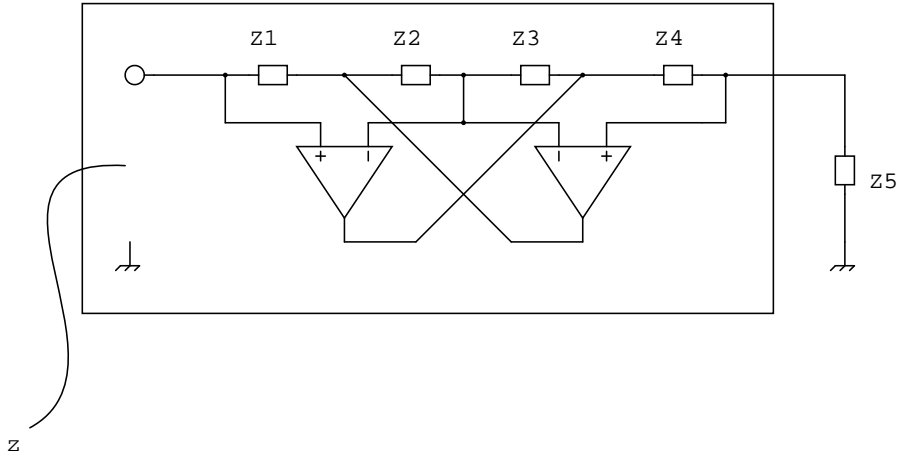


Figure 3.1.: Figure 2.19 as it would appear on FidoCAD for Windows.

A second important information is the name of the layer, specified (if the user has changed it) as follows:

```
FJC N n aaaaa
```

where n is the number of the layer (integer from 0 to 15), whereas *aaaa* is the name of the layer to be considered. If this command is not present, the name of the layer will be the one used by default by FidoCadJ, depending on the language and on the local configuration of the operating system.

3.4.2. Electrical connection setup

The size of the black circle used to indicate an electrical connection can be modified by the user. When the FidoCadJ extensions are active, the selected value is saved in the file with the **FJC C** command as follows:

```
FJC C aaaa
```

where *aaaa* is a double precision floating point value (positive) which gives the diameter of the electrical connection, in FidoCadJ logical units.

3.4.3. Stroke width

The stroke width for the “pen” used during the drawing of electrical schematics can be modified. FidoCadJ adopts the command **FJC A** to specify the stroke width of the lines, ovals, Bézier, splines, rectangles and polygons. The width can be a double precision constant.

3. Drawing format, macros and FidoCAD libraries

```
FJC A aaaa
```

Where *aaaa* represents the stroke width (in logical units). The default width is internally defined to 0.5 logical units. In older versions of FidoCadJ, a command `FJC B bbbb` was used to specify the stroke width of curved lines (ovals, Bézier) From version 0.23.6, this differentiation has been eliminated and this command is no longer adopted.

3.5. Syntax errors tolerance

FidoCadJ is designed to tolerate errors or or certain syntax errors in the commands passed to the program. Obviously, unless you have a crystal ball connected as a USB device, the program will not be able to correct errors but it will simply skip (and delete) all the lines involved.

An exception to this behavior is that a number of elements can be specified without the layer, which will be considered part of the layer 0 (schematics). This is for backward compatibility with FidoCAD.

3.6. Libraries format

The file structure of a library file is quite simple:

```
[FIDOLIB Librairie de base]
{Syboles de base}
[000 Terminal]
LI 100 100 102 100
EV 102 98 106 102
[010 Terminal +]
LI 100 100 102 100
EV 102 98 106 102
LI 103 100 105 100
LI 104 99 104 101
[020 Terminal -]
LI 100 100 102 100
EV 102 98 106 102
LI 103 100 105 100
...
```

The first line contains, between square brackets, the library's name (preceded by FIDOLIB). The second line must contain, between curly brackets, the library category under which the macros, specified later on in the file, will be stored.

Each macro is composed by a header (between square brackets) and a sequence of commands. The header is constituted by a *part name* (which must be unique within the library) and its description. The part name will be used within a FidoCadJ script, while the description helps the user while browsing all the macros contained in the file. The commands are nothing else than FidoCadJ drawings, where the coordinate point

(100,100) is used as the origin. This is the point that will be used as the reference when the macro will be called. In a FidoCadJ script a macro is identified by “library.macro” used with the MC command.

Nothing prevents the calling of a macro within another macro. However, recursion (i.e. a macro that calls itself) must be avoided.

A library *must not contain* among the macro definitions any information about the FidoCadJ configuration. In other words, commands **FJC** should *never* appear inside a library file.

3.7. Standard Libraries

FidoCadJ already contains two libraries traditionally supplied with FidoCAD. In particular these are the standard library and the library that contains the PCB symbols. Another library which has been developed for FidoCAD and which has been proved so useful that it has been included as part of FidoCadJ is the IHRAM one. IHRAM stands for `it.hobby.radioamatori.moderato` and it is an italian Usenet discussion group.

However, it is possible to override the content of these internal libraries by specifying (“File/Options/Libraries Directory” menu) a directory containing the libraries to be loaded. If a file named `FCDstdlib.fc1` is present in this directory, its content will be used instead of the standard library. If a file named `PCB.fc1` is present, its content will be used instead the internal PCB library. Other libraries having different file names (but still with extension `fc1`) will be loaded together with the standard libraries. If there is a file called `IHRAM.FCL` in the current library search path, this one will be loaded at the place of the version embedded in the program. You also have an electrical symbols library whose file is called `elettrotecnica.fc1`.

FidoCadJ considers the libraries above as part of the standard set. In other words, it will not split the symbols contained in drawings, if they belong to those libraries, except when the option “Strict compatibility with FidoCAD” is active. In this case, only the original FidoCAD library is considered as standard, exactly how it used to do the original software.

4. Conclusion

We have seen in this manual how to use FidoCadJ to draw an electrical schematic or a simple PCB. At this stage the reader should possess all the elements necessary to use FidoCadJ effectively for his needs.

FidoCadJ should not be considered uniquely for the electronics design. It can be used for any type of 2D drawing and in many situations, provided that specific libraries are available.

The advantages of a free program is that it is completely open to its user community. For this reason, your feedback is very important (at least to understand if the project is worth to be developed further, and in which direction). To contact me, you can participate to the forum of SourceForge dedicated to FidoCadJ.¹

¹<https://sourceforge.net/projects/fidocadj/forums/forum/997486>

A. Platform-specific information

A.1. MacOSX

One of the most frequent criticisms raised against the early versions of FidoCadJ from Macintosh users (like me, by the way) was the poor integration of the program on MacOSX. Starting from version 0.21.1, FidoCadJ is making specific efforts to comply better with the look and the philosophy of Mac's native applications. For this reason, some details in the program are slightly different when FidoCadJ is run on an Apple platform:

- by default FidoCadJ uses the Quaqua¹ look and feel when the complete application (FidoCadJ.app instead of fidocadj.jar) is run. Since Quaqua may slow down the performance on not so recent machines, it is possible to disable it through the settings of the Preferences menu
- The menu bar is shown at its place, that is the top of the screen
- The menu items "Preferences" and "About FidoCadJ" are at their place, which is under the FidoCadJ menu.
- The program tells the operating system that it can open .fcd files; These are associated to a specific icon, which should be sufficiently evocative.

A.1.1. How to download and execute FidoCadJ on MacOSX

FidoCadJ can work with a MacOSX version more recent than 10.3.9 (Panther). The reason is that under the hood FidoCadJ needs at least the 1.5 version of Java, which Apple once provided with this operating system. For marketing reasons, Apple does not seem to be prone to install Java with the last versions of MacOSX. This is an essential piece of software needed for running FidoCadJ, so you might download and install it. By the way, Apple does not allow to distribute his App Store software based on Java or distributed under GPL. This is one of the most important reasons for which it is improbable that FidoCadJ will be ported to iPad and iPhone.

Even if you can use directly the Java archive `fidocadj.jar` as you would do on other operating systems, on MacOSX you can use the specifically tailored application. Everything works just like a native application: you can download the disk image at the following link:

http://sourceforge.net/projects/fidocadj/files/FidoCadJ_MacOSX.dmg/download

You can then open the disk image and move `FidoCadJ.app` in the `Applications` folder,

¹<http://www.randelshofer.ch/quaqua/>

A. Platform-specific information

where you can use it exactly like any other Macintosh application. To uninstall FidoCadJ, just drag FidoCadJ.app in the trash bin.

A.2. Linux

by Roby IZICYN

Prerequisite: JRE 6 from Sun and/or OpenJDK 6 JRE (o previous versions compatible with the program's specifications) must be installed. In paragraph A.2.1 the installation of the program using only commands from a terminal will be described. In paragraph A.2.2, the interaction with a graphical environment will be used instead. A poor configuration of your Java runtime environment will determine poor performances of FidoCadJ²

A.2.1. Using any platform, from terminal

Download the program using the wget command:

```
$ wget http://downloads.sourceforge.net/project/fidocadj/fidocadj
.jar?use_mirror=garr
--00:48:18-- http://downloads.sourceforge.net/project/fidocadj/
fidocadj.jar?use_mirror=garr
=> 'fidocadj.jar?use_mirror=garr'
Resolution of downloads.sourceforge.net is being done...
216.34.181.59
Connection to downloads.sourceforge.net|216.34.181.59:80...
connected.
HTTP request sent, waiting for answer... 302 Found
URL: http://garr.dl.sourceforge.net/project/fidocadj/fidocadj.jar
--00:48:24-- http://garr.dl.sourceforge.net/project/fidocadj/
fidocadj.jar
=> 'fidocadj.jar'
Resolution of garr.dl.sourceforge.net is being done...
193.206.140.34
Connection to garr.dl.sourceforge.net|193.206.140.34:80...
connected.
HTTP request sent, waiting for answer... 200 OK
Length: 343,207 (335K) [application/java-archive]

100%[=====>] 343,207      422.48K/
s

00:48:30 (420.55 KB/s) - "fidocadj.jar" saved [343207/343207]
$
```

²N.d.c. I swear, it is true! *Please*, do not insult me if your favorite Linux distribution comes with an highly unreliable version of Java.

Alternatively, or if you are experiencing problems, you can download the file from any browser from the following URL:

<http://sourceforge.net/projects/fidocadj/files/fidocadj.jar/download>
and save the file in your `/home/` directory.

Let's create a new directory (but at first we will become a superuser by using `su` or `sudo -s`):

```
# mkdir /usr/bin/fidocadj
```

... and we can move there the downloaded file (substitute `<user>` with the user name of the account where the file has been downloaded):

```
# mv /home/<user>/fidocadj.jar /usr/bin/fidocadj
```

Let's make the file an executable

```
# chmod +x /usr/bin/fidocadj/fidocadj.jar
```

And we must not forget to come back to be normal users:

```
# exit
```

And now, we can execute the program:

```
$ /usr/bin/fidocadj/fidocadj.jar
```

A.2.2. On a graphical system

In the example, it will be an Ubuntu 8.04, but things does not change so much for older or newer versions:

- Let's download the file from the browser, or with Gwget or similar tools.
- We can then launch our File Manager (Nautilus, Konqueror...) as a root (if we do not have a specific command in the menu, we just need to launch it from the console by using `sudo nautilus`). We can create the following directory:

```
/usr/bin/fidocadj
```

and then move there the file we just downloaded. It will be somewhere in:

```
/home/<user>/
```

- Let's do right click on the file, from the window we select the tab "rights", we add the check mark in front of the "Allow the execution of the file as a program", as shown in the figure [A.1](#)
- We can select the tab "Open as" and select "OpenJDK Java 6 Runtime" or "Sun Java 6 Runtime", as it can be seen in figure [A.2](#).

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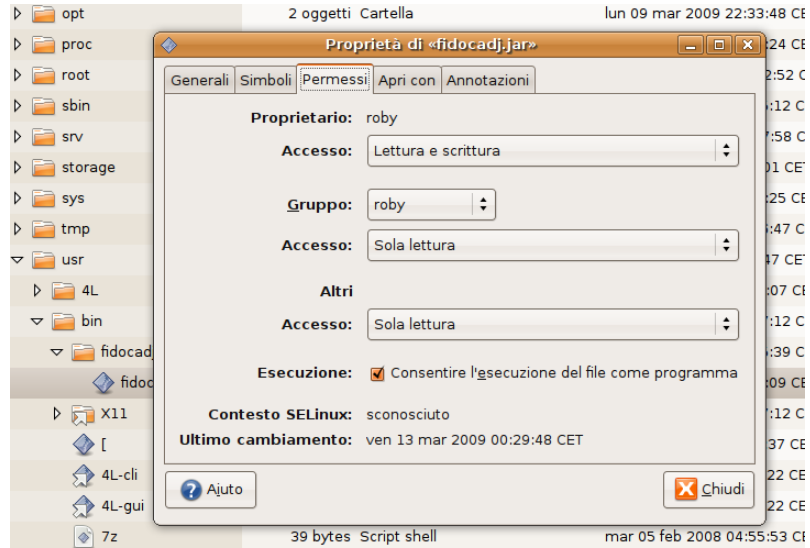


Figure A.1.: The setting of file rights, on Ubuntu 8.04.

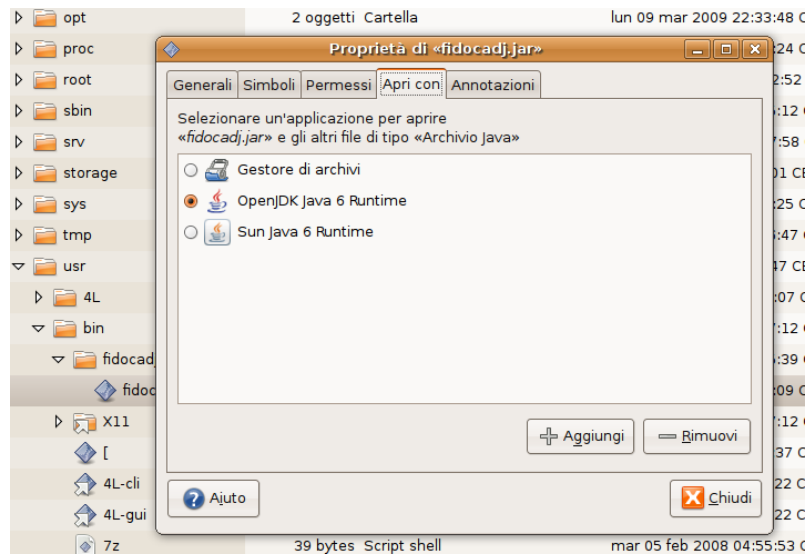


Figure A.2.: Set the execution with the Java virtual machine, on Ubuntu 8.04.

A.3. Windows

- Let's click on "Close" and we are now ready to execute FidoCadJ: a double click on the executable, or we can add it to the main menu. The command to add is just `/usr/bin/fidocadj/fidocadj.jar`.

A.3. Windows

Since version 0.23, when FidoCadJ recognizes a Windows platform, it will try to use the native Look and Feel.

A.3.1. How to download and execute FidoCadJ

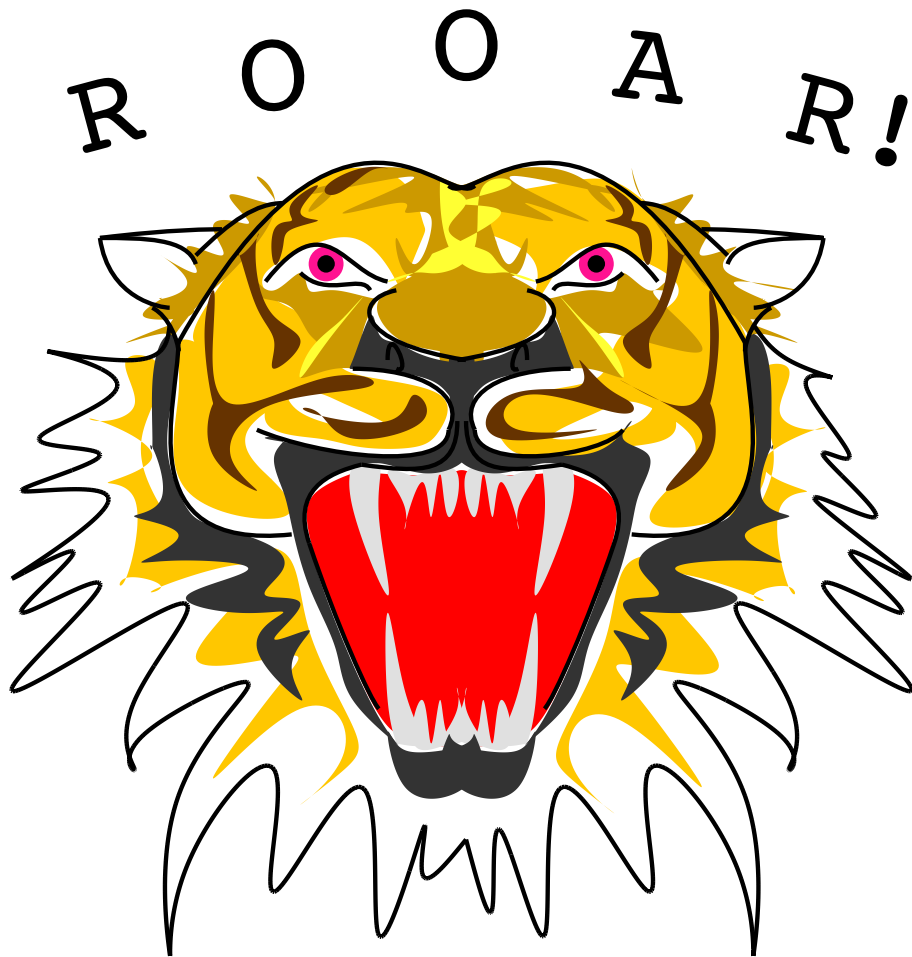
Very often, if you have Java installed, you just have to download the `fidocadj.jar` file and run it with a double click. If after the download your operating system sees it as a zip archive, probably Java is not available on your computer. Oracle allows to freely download and install an up to date version of the Java runtime:

<http://www.java.com/it/download/>

B. FidoCadJ art



One of the fathers of circuit analysis, in a portrait by Zeno Martini.



Tiger, tiger, burning bright... By Igor Arbanas "elettrodomus".

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This manual has been written using `PDFLATEX` on MacOSX. Listings have been composed by using the `listings` packet. The `pgf` packet has been used for the figure 2.5 as well for the picture at page 50. All those packets are available on the CTAN archive.