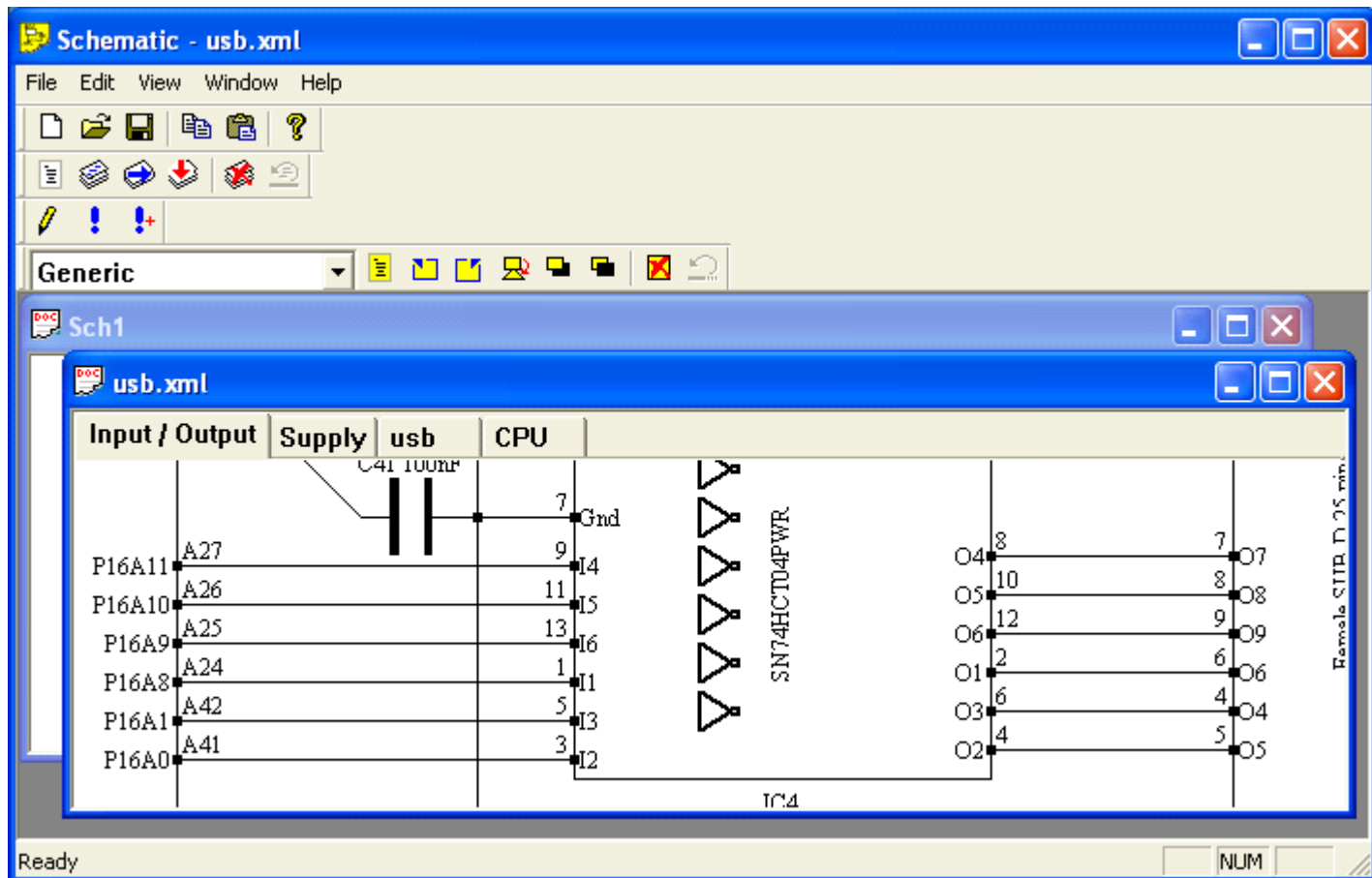


## Introduction to the Schematic program



First, it is much useful to describe the Objects that are manipulated through the program.

### Document:

The program is multi-document. Documents are not related to each other and can be opened, modified and saved independently. Each opened document is hosted in one Window inside the Main window of the application. See the photo 2 documents opened, 1 new document Sch1 and 1 saved document usb.xml



Here is the main toolbar with functions "Create New document", "Open document", "Save document" etc. The file format of the application is XML. Export formats include pdf and Metafile picture.

### Page:

Each document is possibly multi-page. The user can divide one schematic into multiple independent drawings. When a document is opened or saved, all the pages of the document are opened or saved altogether. Also, when a document is exported as pdf, all pages are combined in a multi-page pdf document.



Here is the the page and document toolbar with functions like "Page property" (name , dimension etc) "Document property" (Also name and dimension, and font size) , "Change page order", "Add page" , "Delete page" , "Undo delete page".

See the photo, document usb.xml is composed of 4 pages with name "Input /Output", "Supply", "Usb" and "CPU". The page are accessed with the page selection tab which appear at the top of the document window when they is more than 1 page in the document. Adding a page to a document is as easy as pressing the "Add page" toolbar button. Also the "Delete page" toolbar button can remove the current page, and the delete action can be undone at any time with the "Undo delete page" toolbar button which returns the page and all it's content including the modification log.

Inside the pages , are these type of object **components , components connection points , vertices , connections**

### **Component and Connection point:**

Components are the main element of the schematic. They have text property and connection points. Adding a component to a page is as simply as selecting the current component type on the component toolbar then doubleclick on the page at the location where a component have to be added.



The components are of many type. The components type and drawings are loaded by the software from a component library when the program starts. The properties that are loaded from the library are :  
-Size of the component (width, height) and Whether this component is of fixed size or variable size  
-Drawing of the component  
-Whether this component has fixed connections that cannot be changed (For example "Resistor" has 2 connections that cannot be changed), Or "Generic" that create connection as simply as drag a vertex on a any unconnected location on the component.

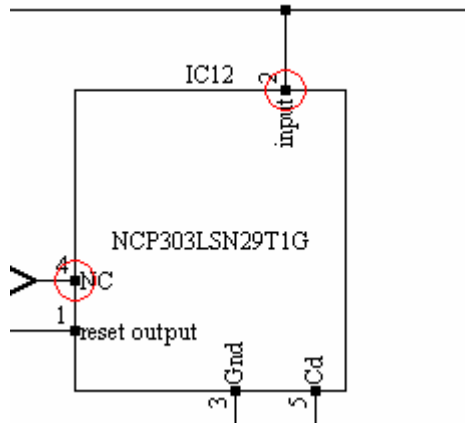
The component type is a text name that must be unique in the library.  
The component library components.lib must be located on the same folder as the executable program sch.exe

- The Combo box at the left specify what component from the library is added on the page when the user double-click to add a component. Other toolbar buttons are
- Show object property dialog box
- Rotate component or set of objects left or right
- Change Z-order ie bring to front or back
- Delete selected items (not only components but also connections and vertices)
- Undo the last action. (Any action on a page can be undone , reversing to previous content)

The "Generic" component from the library has a variable number of connection points. For this component, the connection points are shown by small black square and they can be selected, moved with the mouse and even displaced from one Generic component to another Generic component, helping in building the desired schamatic drawing.

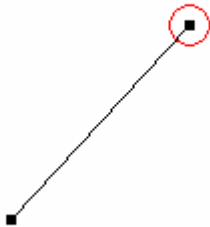
Also , the connection points on the Generic component has a property dialog box where one can define the pin name and function text that appear next to each pin.

Creating a new connection point on a Generic component is as easy as dragging a Vertex on a unused location on the component or dragging a Connection point from another Generic component. One can also delete the connection point (and the connection on it) just with the delete key on toolbar button.



### Connection and Vertices :

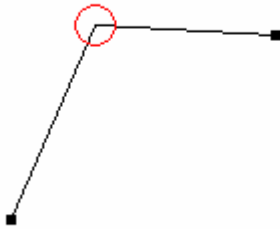
Connection are created on a page by just dragging the mouse with the left button pressed. Two vertices are also created at the extremity of the **New** connection.



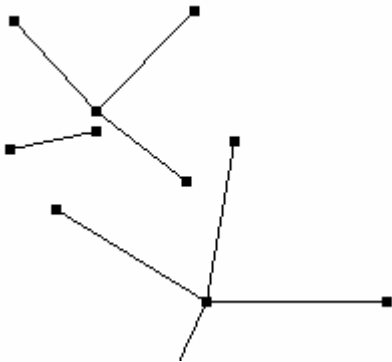
Now you can drag the vertex extremity to another vertex or component connection point, they will fuse altogether to extend the connection.



On this image , 5 connections have been created the joined together by just dragging the extremity of one the the extremity of another.



The user can also point with the mouse a point in the middle of a connection the press the left button of the mouse connection, the connection will be split with a new vertex at the middle that can be dragged anywhere.

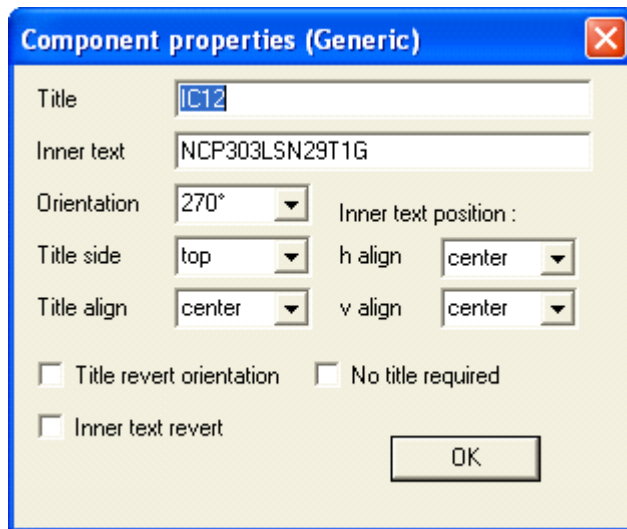


Connections and they vertices can be arranged in complex network in a very fast and efficient way, only with the mouse. Vertices automatically fuse when connected . Connections are also split and new vertices created only by dragging any intermediate point of a connection.

After connections are joined, they can be moved by dragging they vertices or the mid-point of connections (this operation create a new vertex on the mid-point as nescessary).

After connection are joined or Inked together, they cannot be separated and they move together when dragging one point. The only way to change the connection arrangement is to select existing vertices or connections, delete them with toolbar button or DEL key, and create new connections with the "drag and create link" function.

### **Component property dialog box**



The component property Dialog box can be shown by double click of the object or click the object to select then press the "Object property" toolbar button.

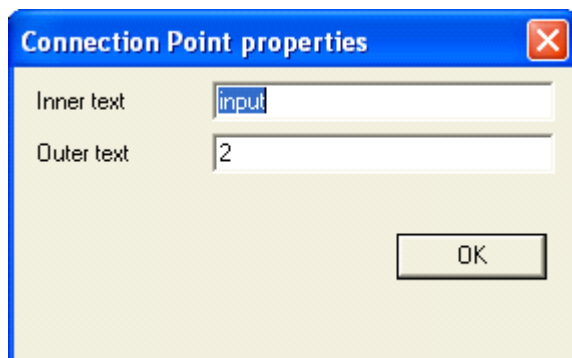
This include:

Title which is shown on the border of the component

Inner text which is shown in the inside. The inner text is not displayed for components with a drawing.

Many orientation property that define where and how the text is placed

### **Component connection point property dialog box**



The Component Connection point property is shown by double clicking on a component connection point (which is created by dragging a connection to the border of the component). It is also showable with the toolbar.

This include:

Inner text which is normally a functional description of the pin

Outer text which is normally the pin number

### **Viewing and zooming on the page**

Place the mouse cursor where the view should be centered , on a place or component of interest then

- CTRL "+" or "Page Up" : Zoom in (multiply view scale factor x 1.5)
- CTRL "-" or "Page Down" : Zoom out (multiply view scale factor x 0.75)
- Space key " " : Center the view without modifying the view scale

Also : panning and toolbar zoom button is available



- + : Zoom in with toolbar button without changing screen alignment
- : Zoom out with toolbar button without changing screen alignment
- <-> : Pan allow to move the view with as simple as drag the mouse (Press the Pan toolbar button to enter pan mode)

## **Adding Components and connections**

**Adding components** : Select the desired component type in the component list box then double click with the mouse at the location on the page where the component should be created

**Adding a free connection** : Drag the mouse from a place to another create a connection segment. The segment can then be joined to other existing connection vertices or components

**Adding a connection vertex on existing connection** : Drag any middle point of the connection will create automatically a new vertice

## **Selecting, moving , rotating and deleting groups of objects (components, vertices and component connections points)**

**To select an object (Vertice , connection, component and component connection point ):** click on the object

**To select multiple objects** : while holding the CTRL key click on any object to invert the selection state

**To select all objects in a region** : while holding the CTRL, start to drag the mouse on a not occupied place on the page, a selection rectangle (dashed rectangle will follow the mouse and select all the objects inside).

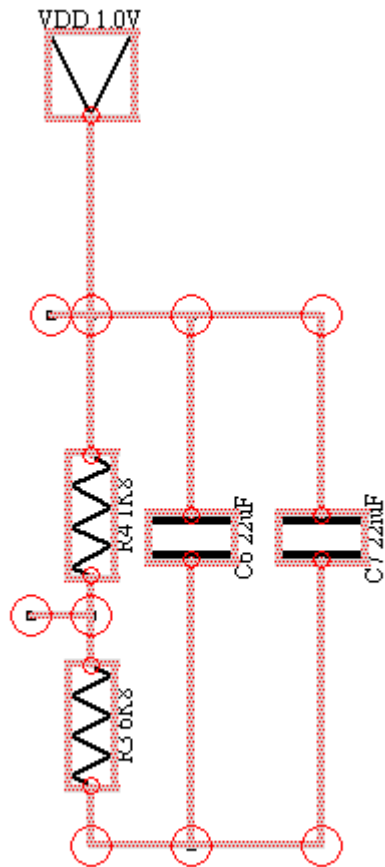
After selecting multiple components and object it is possible to:

**Delete all the selected components** : DELETE key or delete objects toolbar button

**Move all the selected components** : Hold the CTRL key and start to drag the mouse on a location occupied by one of the selected components

**Rotate all the selected components** : Use the toolbar button rotate left / rotate right

**Size the component (if sizeable)** : Drag the mouse starting from one of the top, left, right or bottom border of the component



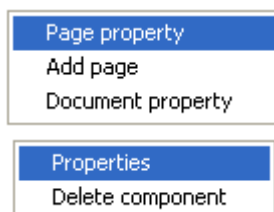
### **Move and resize components from the keyboard**

- Select a component or a group of component then use the keyboard :
- right, left , top or bottom arrow of the keypad to move the components
  - SHIFT + right, left , top or bottom arrow to resize the component

### **Alignment of components**

All feature (Connection points, Vertices and components ) are automatically aligned on a 5 document unit step, so alignment of all the features are automatically simplified, even when using the mouse

### **Context menu with right-click the mouse**



## **Copy and paste action**

Copy and paste action is supported (Menu Edit/Copy and Edit/Paste). and can be used between source and destination in different or same document.

## **Undo action**

The undo button on the component toolbar can all or part of 100 last modification transaction . Any action on an object, or group of object is seen as a single transaction log that can be undone at once.

For example, select all the page area, and press delete: all the page content will be removed , the press CTRL-Z or edit/undo menu only once and the full deletion will be canceled, ie all page content come again.

The last 100 modification are recorded and can be canceled at any time , whichever was the size of any of these transaction (full page delete of simple component title modification)

The "Paste" command is also included by the Undo functionality like any modification to the document.

## **Exporting Schematic drawings**

Two document export format are supported . Both of them are Vectorial drawing (ie support lossless image representation)

### **Pdf:**

The menu command File/Export PDF produce a multi-page pdf .

Each page in the pdf correspond to page in the document.

The Pages in the Pdf document have the size that have been chosen in the Document and page property dialog . (Can choose a square format like A4 =2100 x 2970 or a square display area for example 1100x1100

### **Emf :**

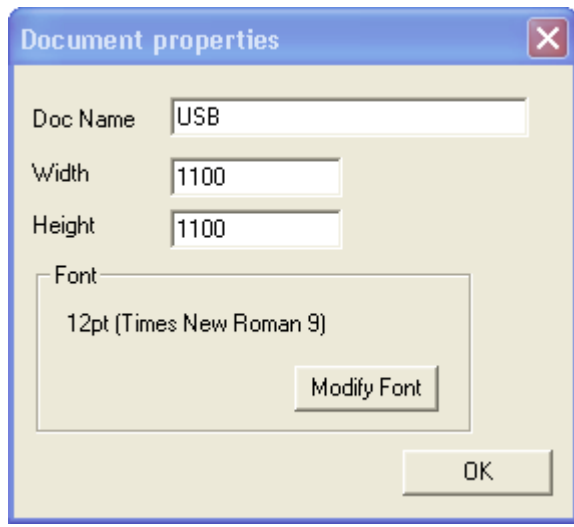
The Emf format of "Enhanced Windows Metafile" is vector drawing format supported on Windows. It is a format suited for Vector and Diagram drawings. And is fully supported on Windows for Preview and printing.

The menu command "Export Metafile " export the currently displayed page , and the menu "Export all metafile" export the full document with as many file as pages, named with the pages name or "Page 1..n" if the name was not specified .

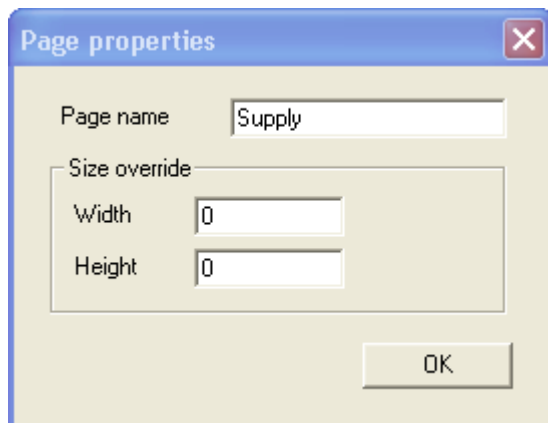
## **Document dimension and property**

The font size should be choose according to the size of standard components. For example 12pt font and 20pt for the component.





A width and height of 0 on the page mean to apply the same dimension as stored in the document property



## **Adding new components in the component Library**

Adding a new component is as simple as adding a new entry in the component library which is a text file with an XML format tags.

For example, the entry for the common resistor component is as follow :

```
<Component name="resistor" NoSelConnection=true fixedSize=true
fixedConnection=true width=60 height=20 drawing="2 w 0 0.5 m 0.08333 0 0.25 1
0.41666 0 0.58333 1 0.75 0 0.91666 1 1 0.5 p s" drawBorder=false>
<Connection rx=0 ry=0.5/>
<Connection rx=1 ry=0.5/>
```

</Component>

The description tells the software of the property and drawing of the resistor.

name="resistor" : The unique name that appear in the choose component listbox

NoSelConnection=true : The editor should preferably enter the "Move" mode when clicking on the component

fixedSize=true : The component has a specific width and height aspect ratio

fixedConnection=true : The component has predefined connection points

width=60 height=20 : Dimension when created

drawing="2 w 0 0.5 m 0.08333 0 0.25 1 0.41666 0 0.58333 1 0.75 0 0.916666 1 1 0.5 p s" : The drawing of the component in pdf postscript all the coordinate are relative to the width and height of the component

drawBorder=false : no stroke the box around

Connection rx=0 ry=0.5 : they is a fixed connection at relative coordinnate x=0\*width and y=0.5\*height

## **Installation of the program on Windows**

Just copy Sch.exe and components.lib in a folder, then Start sch.exe

Some sample schematics document may be available. The default file extension for Sch document is .XML

The components.lib and Sch documents are all xml tagged files and may be edited with a simple text editor.

Their format is really easy to understand. The undo log is also in xml format , but is not currently saved with the document or accessible to the user.

## **Special functions**



Other special functions include :

### **-Check page and Check document**

=>This function check for unconnected component connection points , single vertice that are not connected , middle vertice that are on a straight line. All this features are highlighted and a report indicating how many of these feature where detected. The document designer should : delete useless vertices, connect all connection points to other nets or to cable termination components (included in the library).

### **-Manual edit connections**

=> The "Manual edit connection" dialog box is displayed when pressing the "Edit connections" toolbar button. The Dialog box allow to edit a listing file and directly enter and modify all the text features of the page (Title of components and connections). This allow the designer to enter and complete all text information directly in a text file more rapidly than with the object properties dialog box.

The OK button then allow the text listing to be compiled and all the text properties to be updated at once. The Edit/Undo command still make it possible to reverse all change in one transaction shot.

