

## PASSIVE CIRCUIT GUIDE

This program Analyses Circuits with Resistors, Capacitors & Inductors, as well as Active components modelled as Voltage controlled Voltage or Current sources. Circuit nodes (32 Max.) must be numbered consecutively from 1, Earth 0 or last. Then each component must be entered using either the built in Editor or another with Passive components in the following format:

<b>1</b>	<b>R1</b>	<b>1</b>	<b>2</b>	<b>1M</b>	<b>R</b>	<b>1K</b>	<b>10</b>
Optional] Line No.]	Component Type/Ref.	First Node	Second Node	Component Value	[Optional [Parameter	Parameter Value	Optional Tolerance

Parameters may be separated by Spaces, Tabs or One Comma, in any combination.

Passive Component Types are R, L, C. Optional Tolerance Ignored at present.

Optional Parameter/Value = Series/Parallel R for L/C also Ignored at present.

Comments may be added in place of, or at the end of a line, pre-fixed by " ' ".

Component Values ( $\pm 1E-18$  to  $\pm 1E18$ ) may include standard suffixes as follows:

f/F=1E-15, p/P=1E-12, n/N=1E-9, u/U=1E-6, m=1E-3,  
k/K=1E3, M=1E6, g/G=1E9, t/T=1E12

Units (Ohms, Henries & Farads) must not be used, unless prefixed by the above.

Mutually coupled inductors with one end common may be modelled as a T network, where the arm inductors have values L1-M, L2-M and centre inductor value is M.

A 1:1 100% coupled inverting transformer has L1=L2=L, M=-L. Arms 2L, Centre -L.

Floating inputs can be modelled using a Voltage or Current source (Next Page).

## ACTIVE CIRCUIT GUIDE

Active component entry requires two lines of data. The first line specifies the type of model as either the Voltage or Current source, both voltage controlled.

The second line must be the normal passive definition of the output resistance.

For Voltage sources the resistance is effectively in series with the output but

for Current sources it is effectively in parallel:

<b>1</b>	<b>V1</b>	<b>1</b>	<b>2</b>	<b>1000</b>	<b>10</b>
Optional] Line No.]	Amplifier Type/Ref.	Input +Node	Input -Node	Amplifier Gain	[Optional [Gain Tolerance

<b>2</b>	<b>Rout</b>	<b>3</b>	<b>4</b>	<b>10</b>	<b>10</b>
Optional] Line No.]	Resistor Reference	Output +Node	Output -Node	Output Impedance	[Optional [Res. Tolerance

Active Component Types are V or I. Optional Tolerance Ignored at present.

For Voltage sources such as Operational Amplifiers the Gain must be put in V/V,

but for Current sources such as Transconductance Amplifiers it is given in A/V.

Transistors and FETs should be treated as Current sources. Both invert so have Collector or Drain as Output -Node, and Output +Node connected to Input -Node.

Transistor gain=40mA/V \* Collector current in mA. FET gains are quoted in mA/V.

Transistors need an extra line for input impedance= $25 \cdot h_{fe} / \text{Collector current mA}$ .

## TRANSMISSION LINE GUIDE

Transmission Line entry requires two lines of data. The first line specifies the Input Centre and Shield nodes of the line & its Effective Length in Metres. The second line specifies the Output Centre and Shield nodes and the Impedance. Open or Short circuit Stubs require the same data but Output nodes are ignored.

<b>1</b>	<b>T1</b>	<b>1</b>	<b>2</b>	<b>10</b>	<b>10</b>
Optional] Line	Input	Input	Effective	[Optional	
Line No.]	Type/Ref.	Centre	Shield	Length(M)	[Len. Tolerance
<b>2</b>	<b>T1</b>	<b>3</b>	<b>4</b>	<b>50</b>	<b>10</b>
Optional] Line	Output	Output	Line	[Optional	
Line No.]	Type/Ref.	Centre	Shield	Impedance	[Imp. Tolerance

T = Transmission Line. S = Shorted, O = Open Stub. Optional Tolerance Ignored. Although Stub Output Nodes are ignored they must still be in the range of 0-32. Effective Length (in Metres) equals Physical Length divided by Velocity Factor.

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The algorithm used in this program is an improved version, rewritten in Pascal, of that given in the EDN magazine dated Feb 4th 1981, under the title "NET-80". ( This algorithm, though vital, now forms less than 10% of the final program! )

## EDITOR GUIDE

The Editor provided is a simple text editor which can be used on any text files such as CONFIG.SYS and AUTOEXEC.BAT, as well as the circuit files needed here. The only restrictions are the maximum of 100 lines and 79 characters per line.

Most normal cursor movement commands are implemented, including:  
"Home" and "End" move the cursor to the start and end of the line respectively.  
CONTROL + "Home" and "End" move the cursor to the top and bottom of the screen.  
"PgUp" and "PgDn" act as expected. With CONTROL they move to start/end of file.

The action of the editing commands depends on the insert mode which is toggled by pressing the "Insert" key, and indicated by a block rather than line cursor.  
"Tab" moves over the text or inserts spaces to the next position (8 columns).  
"Del" deletes the character at the cursor and moves the rest of the line left.  
"Back" deletes the character to the left of the cursor but otherwise as above.  
"Return" inserts a carriage return or just moves cursor to start of next line.  
CONTROL+Y deletes the whole line containing the cursor, moving lines below up.

Pressing "Escape" ends an editing session but the cursor position is remembered as an aid to rapid optimisation of a circuit design. The only exception to this is if an error is found when attempting to analyse a circuit, in which case the cursor is left at the erroneous parameter as an indication for your correction.

## **FILE SAVING GUIDE**

Circuit files are normally saved with the default DOS file extension of ".CKT"  
This default will be superseded by the extension of any currently loaded file.  
The current extension is added automatically to filenames entered without one.  
However, filenames with any other extension can be used if entered explicitly.

The "Insert" key may be used to toggle between the insert and overwrite modes.

By default the current filename will be offered, however if this or any new filename entered already exists then the message "Replace Y/N" is displayed.  
This arrangement allows the user to avoid overwriting a wanted current file:

Pressing the "Y" key will cause the file to be overwritten.

Pressing the "N" key will allow re-entry of the filename.

Change of Directory or File Mask is by a suitable entry in place of a filename:  
Directory names are entered as for DOS CD, but must end with "\" so they do not look like file names. Simple drive changes should be entered as normal eg "D:".  
File Masks can use "\*" and "?" as usual. Initial Directory will be current one.

AC.EXE must be in the same directory or in one specified by the "PATH" command.  
(This may be put in your AUTOEXEC.BAT file. See the MS-DOS Manual for details.)

## **FILE LOADING GUIDE**

All filenames in the current directory with the current extension are displayed but this may be changed as described below. Initial extension is always ".CKT".  
The current extension is added automatically to filenames entered without one.  
Any new extension will become the automatic default for the "File Save" option.  
Alternatively any other text file in the current directory may be loaded simply by entering a full filename. (Remember 100 line / 79 characters per line limit)

The "Insert" key may be used to toggle between the insert and overwrite modes.

If the name of an existing file is entered as a parameter, on the command line, when the Circuit Analysis program "AC" is first run, then this will be loaded.  
If the program is run under Windows and the file extension .CKT is associated with AC.EXE then clicking on a .CKT file will run the program & load the file.

Change of Directory or File Mask is by a suitable entry in place of a filename:  
Directory names are entered as for DOS CD, but must end with "\" so they do not look like file names. Simple drive changes should be entered as normal eg "D:".  
File Masks can use "\*" and "?" as usual. Initial Directory will be current one.

AC.EXE must be in the same directory or in one specified by the "PATH" command.  
(This may be put in your AUTOEXEC.BAT file. See the MS-DOS Manual for details.)

## ANALYSIS PARAMETERS GUIDE

Certain natural Default Values are offered:

The Input Node defaults to the First Non-Ground Node and is thus always Node 1.  
The Output Node is the Last Node if Ground=0, Next to Last Node if Ground=Last.  
Logical numbering of a circuit will make these defaults correct in most cases.

The Up and Down cursor keys operate as expected, except during parameter entry.  
"Home" moves the cursor to the top of the screen to the "Accept/Escape" block.  
"End" moves the cursor to the bottom of the screen to the "Data Points" block.

During Analysis Parameter Entry the "Escape" key allows editing to be aborted and original values replaced. The "Enter" key is used to confirm a parameter.  
Once entry of a parameter has started no other control or editing keys operate.  
Parameter Values may be entered using normal suffixes as follows:

f/F=1E-15, p/P=1E-12, n/N=1E-9, u/U=1E-6, m=1E-3,  
k/K=1E3, M=1E6, g/G=1E9, t/T=1E12

Units (decibels, Seconds & Hertz) must not be used unless prefixed by the above.  
On Analysis labelled options the "Space" bar is used to view the alternatives.  
"Return" will confirm the new choice. "Escape" will leave the choice unchanged.

NOTE: The Editor "Insert" mode is not available on Analysis Parameter entry.