EE_Analysis! Ver.6

Quick Guide

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    7- " ┬ ╥ Band-Pass Filter",
    8- " ┬ ╥ Band-Stop Filter"
9- " Delta <--> Wye.",
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The Guide uses the screenshots provided by the Connectivity Kit, which is the best way to accomplish this task in a timely manner. As time permits the content list will be expanded to incorporate new topics or categories. I will try to give the user an explanation for each of the categories with problems and solutions as depicted in the screen shots and instructions below them.

Before you start the program, I suggest you select the following.

Angle Measure: Degrees
Number Format: Engineering 2
Complex: On

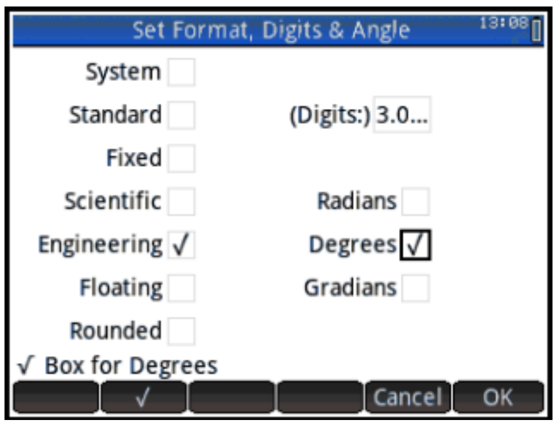
If you desire more accuracy, when the result is displayed in a box on the screen you can then use [Edit] in the soft menu to display the full value in Standard form. If the result is displayed by a print command, the [Edit] soft key is not available.

Category Definition.

1 Quit! EE Analysis.

2 Set Format, Digits & Angle:

In this version I have not imbedded any control directives from this panel into any of the Categories, in order to give the user total control. However selecting greater than 2 Digits as suggested above may cause an erratic display when the program uses the PRINT command.
In some **updated** categories the screen contains **Input** and **Output** boxes on the same screen and the Options are selected by the means of checking the box as in the screen below.
If the result is displayed within Boxes and does not fit, highlight the box and press [Edit] and the number will be displayed in standard form with maximum accuracy.



Navigate to the various boxes and check them by either pressing **[Enter]** or tapping the box twice or tap the check mark in the soft menu [**√**] followed by **[OK]**. In the above screen, **Engineering, 3 Digits** and **Degrees are selected prior to going back to the Main Menu.**
This topic is provided to allow you to make these selections without leaving the program.

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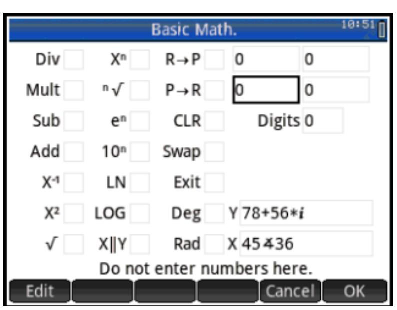
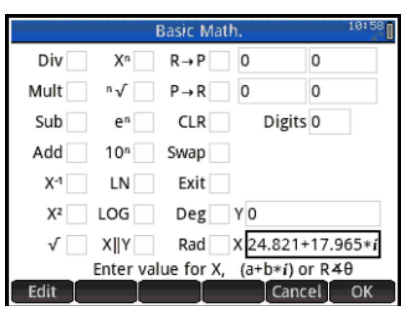
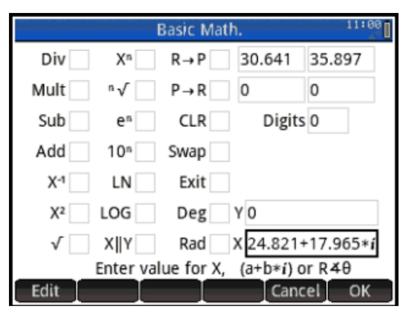
3 In App calculator. + - * / …….A||B. Updated and expanded.



Panel 1



Panel 2



Panel 3

This selection allows you to perform some basic functions without exiting the program.

X & Y boxes can contain either Real or Complex Numbers. Enter 45∡36 in the **X** and 78+56 ***i*** in the **Y** registers. Double tap the **X||Y** box and tap the **[OK]** soft key. The result appears in Panel 2 as **X = 24.821+17.965*i***. Next tap on the **R->P** box and **[OK]** will convert the content of the **X** register to its **Polar form.** Some operations like Add & A||B involves two numbers whereas **R->P** will use the number in the **X** only. Activating the **Exit** [✓] box will return you to the Main Menu. **Swap [✓]** will swap **X** & **Y** registers and **CLR [✓]** will clear all Input and output registers

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Note: You will find throughout this program that the answers are given in **both** *Rectangular* & *Polar Forms*.

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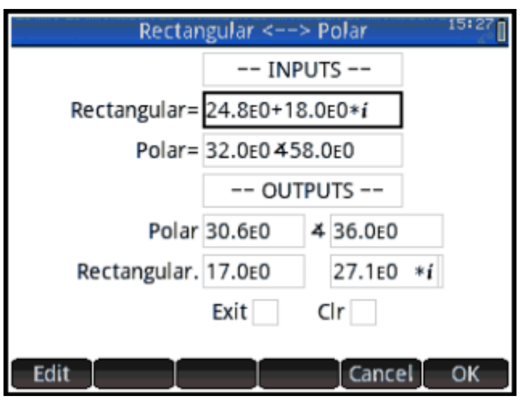
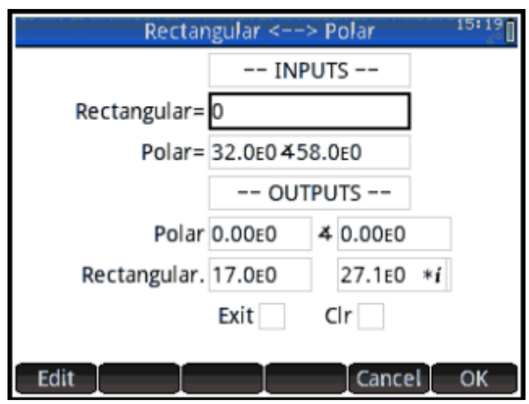
4 Conversion between Polar and Rectangular. Updated



Rectangular AND Polar Inputs



Polar to Rectangular

You can start by Clearing the input registers and then enter a Rectangular or Polar value **or both.** The Rectangular number will be converted to Polar, and the Polar number to Rectangular Simultaneously. **Exit** [✓] return you to the Main Menu and **Clr [✓]** clears the registers.

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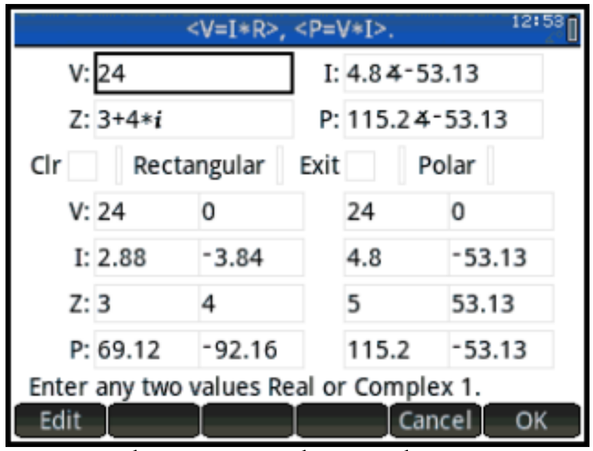
5 Oms Law, Power. Updated

A circuit has a voltage V=24_V and an impedance of 3+4*i*. Find the current and the Power.



Problem **Result in Rectangular & Polar Forms**

In the above screen there are 4 **Input** registers in the top section. In the bottom section the result is displayed in their Rectangular and Polar forms. I entered a voltage of 24 volts in **V**, and an impedance of 3+4 *i* in **Z,** using the **[Enter]** key. Then press **[OK]**

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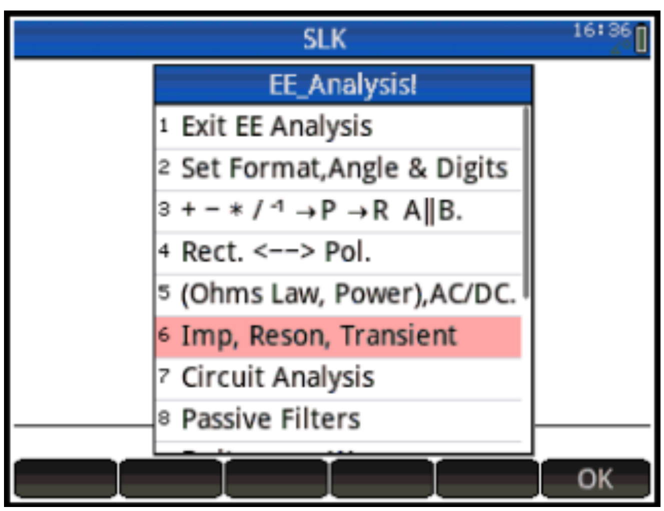
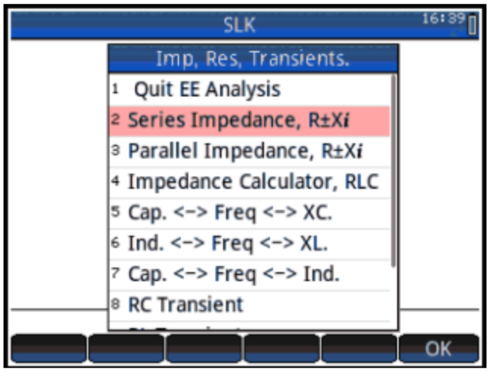
6. Imp. Res, Transients.

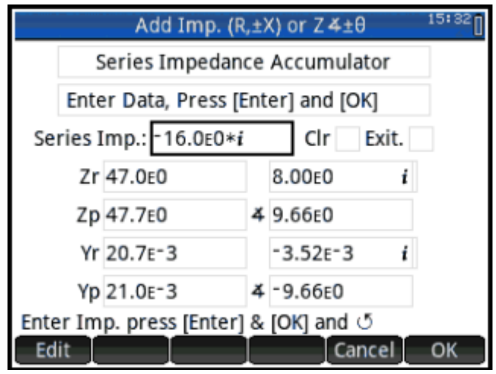
This category has a sub-menu containing a variety of topics dealing with Impedance calculator, a section on Resonance and Transient analysis.



2 Series Impedances. (sub-menu) Updated



Select 2



Enter components

A 47Ω resistor is in series with a 24Ω Inductor and a 16Ω capacitor. Total impedance = 47.68∡9.66.

Sequence: 47 [Enter], [OK]. 24*i* [Enter], [OK]. -16*i* [Enter], [OK]. Total Z = 47+8*i*.

Try <u>three</u> 72 Ω resistors are in series. Total resistance Rt = 216 Ω.

Sequence: 72 [Enter], [OK], [OK], [OK]. Result Rt = 216 Ω.

Try three Impedances in series. 12+16*i*, + 47-68*i* + 72+8*i* = 131-44**i*.

Sequence: 12+16*i* [Enter], [OK] 47-68*i* [Enter], [OK] 72+8*i* [Enter], [OK]. Total Z = 138.19∡-18.57.

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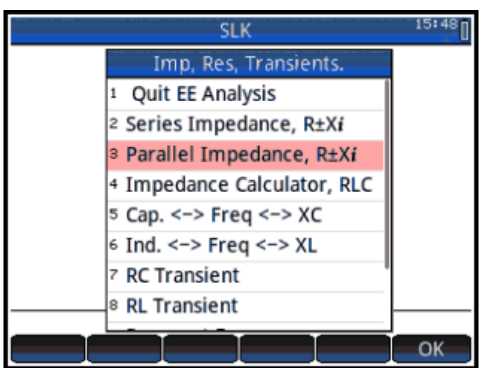
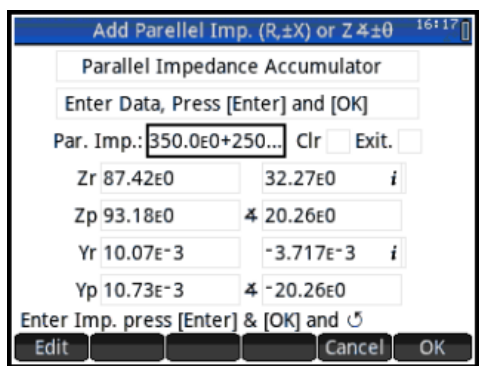
3 Parallel Impedances. (sub-menu) Updated



Select 3



Enter components

A 120+118*i* is in parallel with 210-96*i* and 350+250*i*. Total parallel impedance **Zp = 93.183∡20.264.**

Sequence: 120+118*i* [Enter], [OK] 210-96*i* [Enter], [OK] 350+250*i*. [Enter], [OK] **Zt = 87.4156+32.2736*i**

Yr = 10.07E-3 – 3.717E-3 *i*   Yp = 10.73E-3 ∡-20.26

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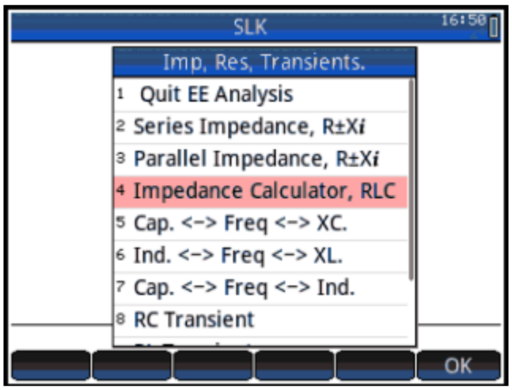
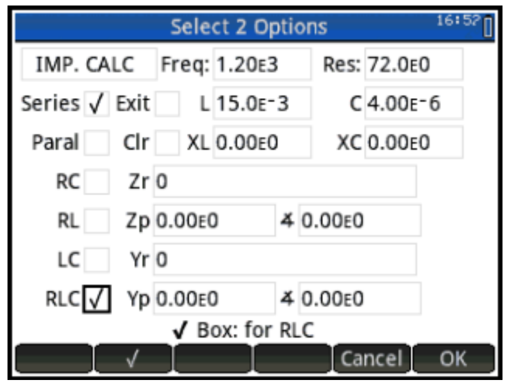
4 Impedance Calculator (sub-menu) Updated

Note: In this section the calculator will choose (L & C) or (XL & XC) by checking the content of the Freq. register. If Freq = 0, (XL & XC) values will be used. If Freq ≠ 0, then (L & C) will be used.

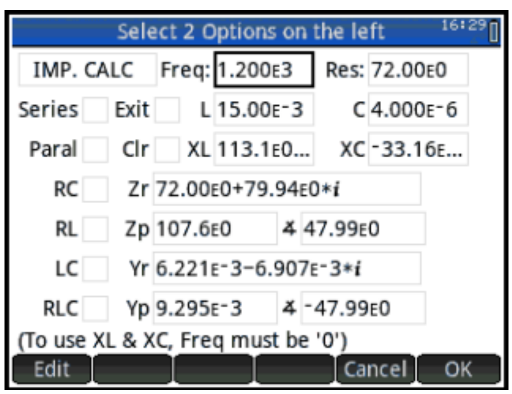
There are 5 Input registers on the screen, **Freq, Res, L, C, XL** and **XC**. Select or check either Series or Paral. box, + one of (RC, RL, LC, or RLC), followed by [OK] to produce the result. Even if all registers have values in them, the choice is made by what you select on the left. Eg. If RC [ ] then L or XL will be ignored. Also notice the Exit and Clr boxes that can be checked to either Clear all data or return to the Main Menu.





Select 4 & Enter a Freq of 1200_Hz. A Res. of 72 Ω, L =15mH and C = 4μF.

Next Check boxes for <u>Series</u> [ ] and <u>RLC</u> [ ] Press [OK]



Result for RLC.

Note: You can clear all registers by activating the **Clr [√]** and **[OK]** or return to the Main Menu by activating **Exit [√]** and **[OK]** .

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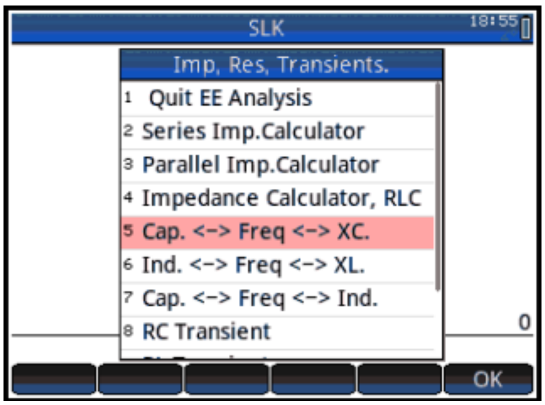
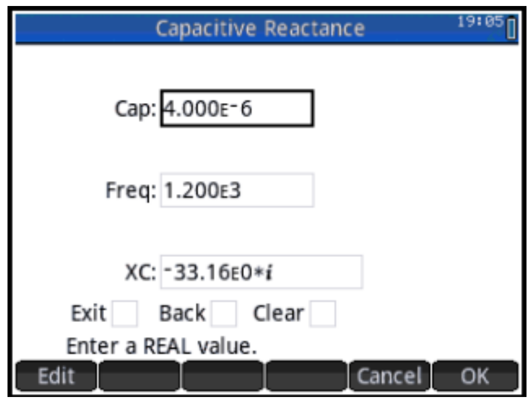
5 Cap <-> Freq <-> XC. (sub-menu) Updated

The updated part here is the on-screen Exit [ ], Back [ ], and Clear [ ].



Select 5



Input Cap=4E-6, Freq=1200Hz.

Here you can select any two values and solve for the third.

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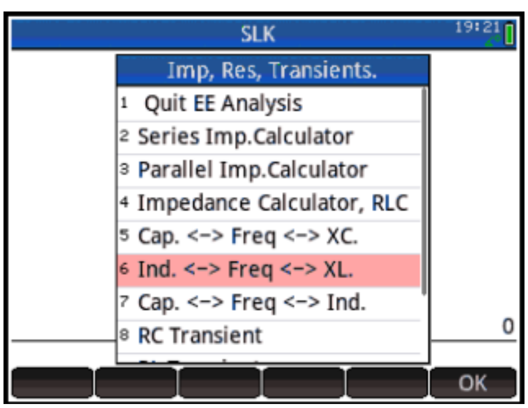
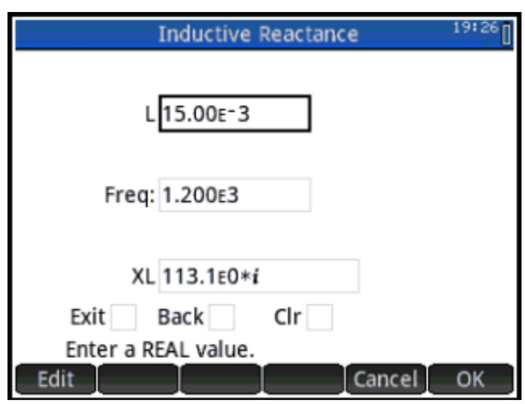
6 L <-> Freq <-> XL. (sub-menu) Updated

The updated part here is also the on-screen Exit [ ], Back [ ], and Clear [ ].



Select 6



Input L = 15E-3, Freq=1200Hz

Here you can select any two values and solve for the third.

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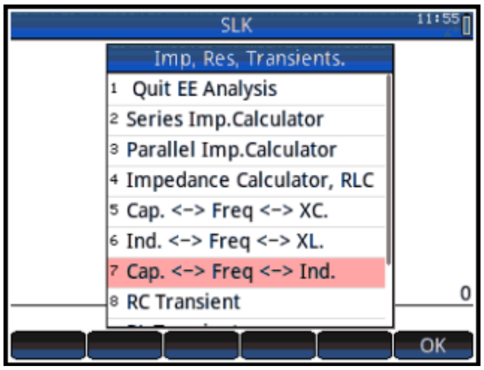
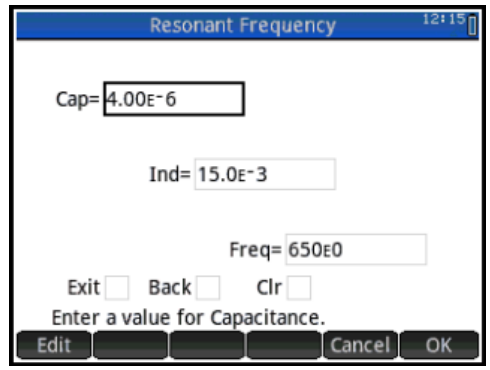
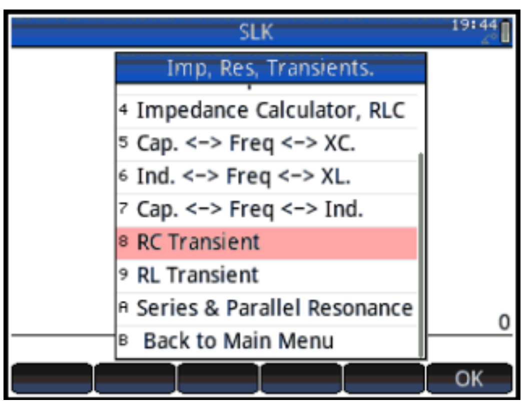
7 Cap <-> Freq <-> Ind. (sub-menu)



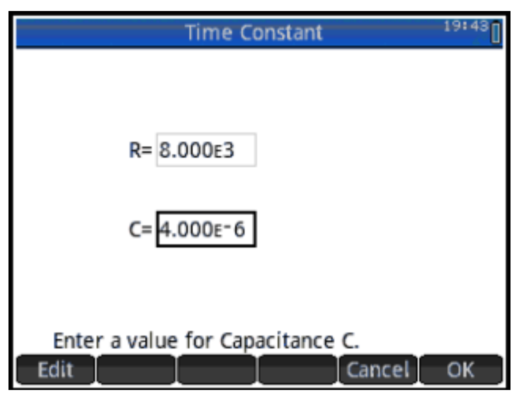


Here you can enter Cap and Ind and solve for the resonant Freq. Or enter any two value and solve for the third unknowed.

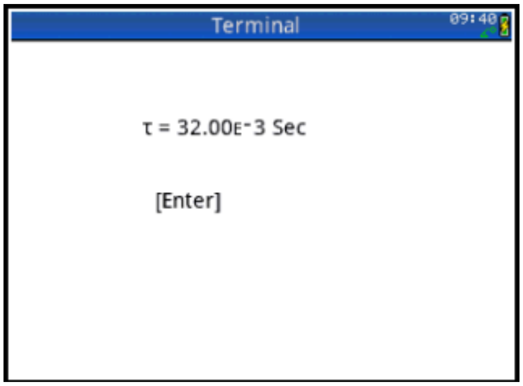
8 RC Transient (sub-menu) no change



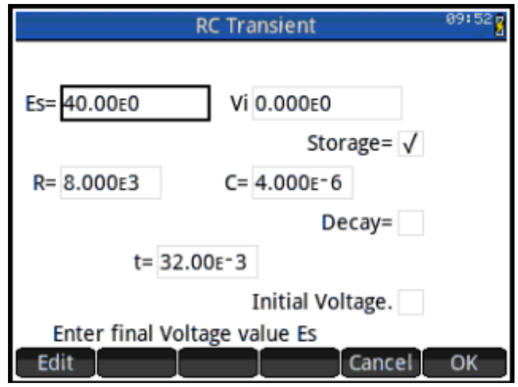
Select. 7. RC Transient



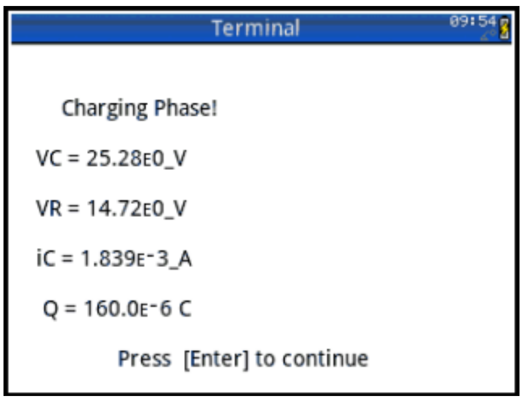
Enter 8E3 for R & 4E-6 for C.



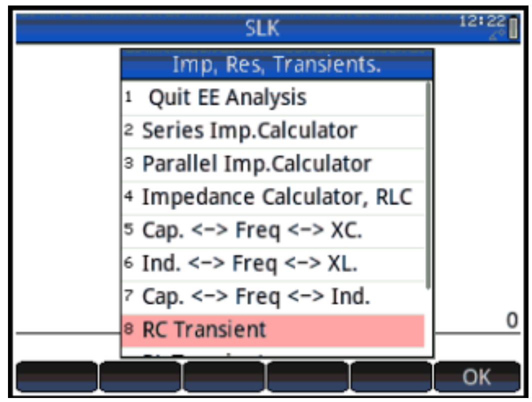
Time Constant = 32mSec



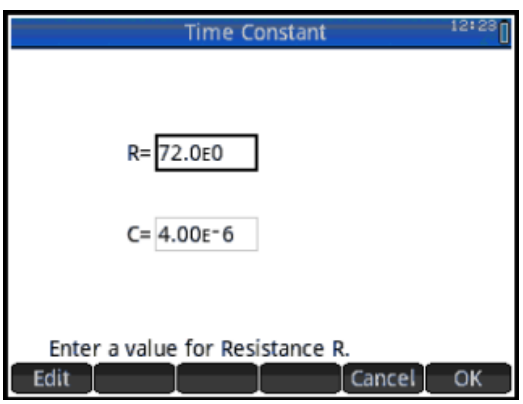
Inputs. Also check Storage Box [OK]



Result at 32mS

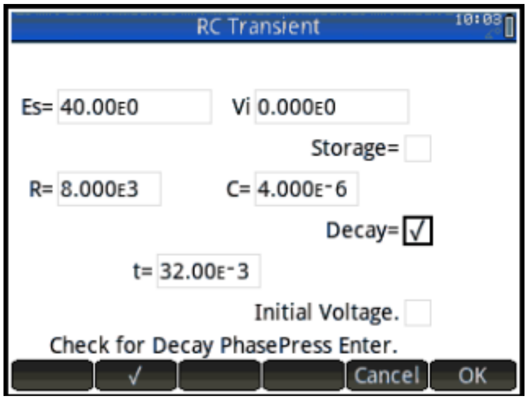


Select 7

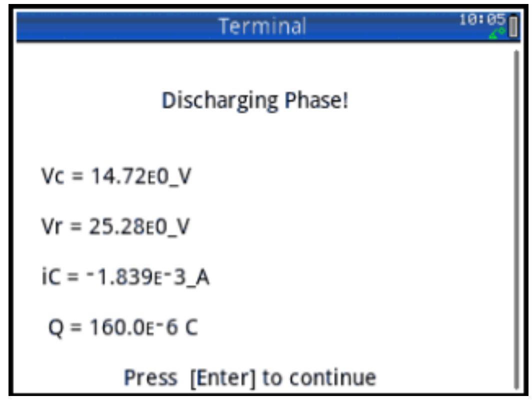


Input. Note: R may = R1+R2 for Discharge

Time Constant 32ms.



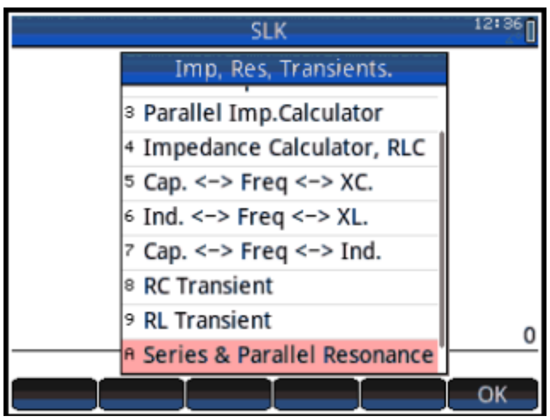
Check Decay Box [OK]



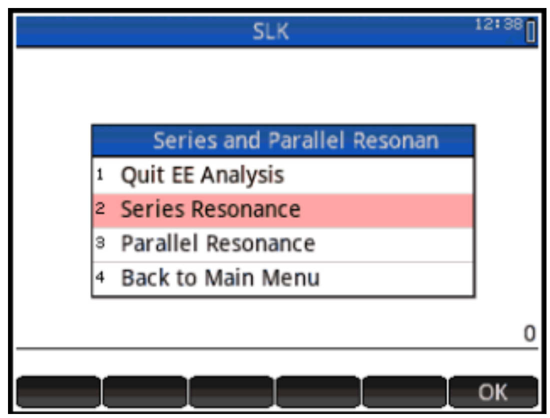
Result

9 RL Transient (sub-menu) Same process as RC Transients

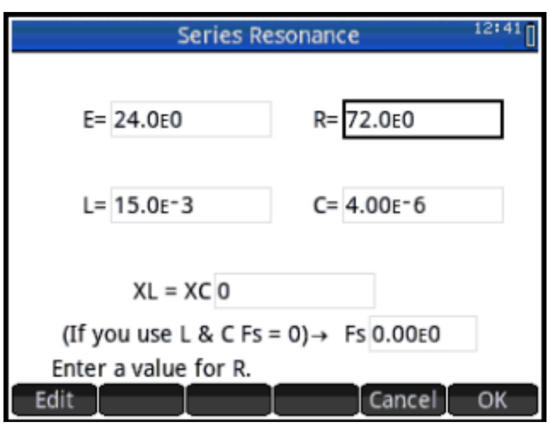
A- Series & Parallel Resonance. And (sub-menu)



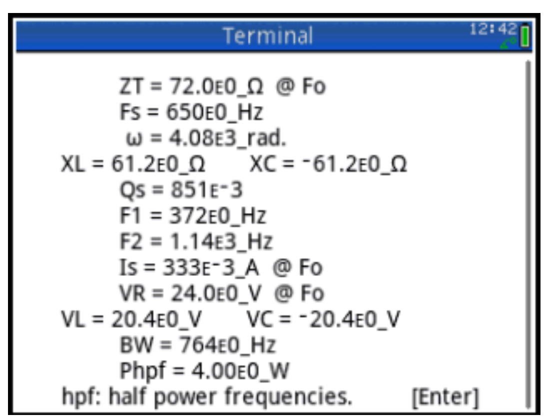
Select A



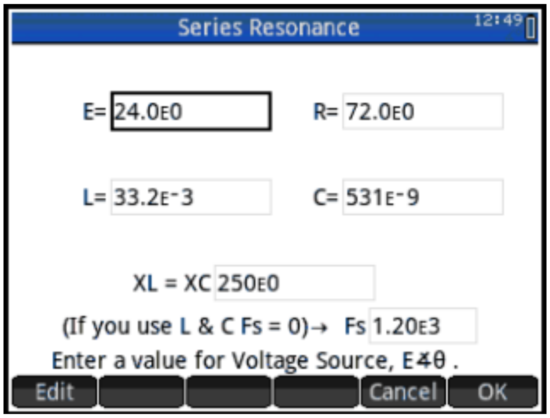
Select 2



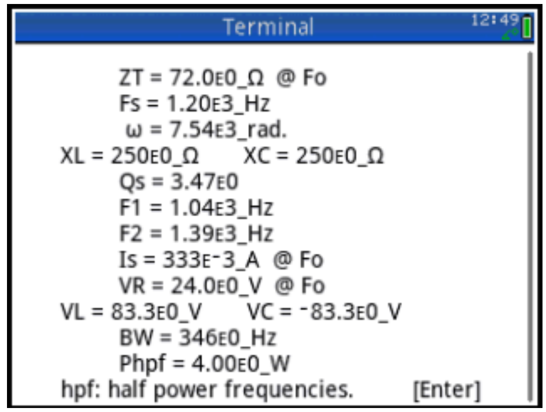
We are using L & C so Fs = 0. Fs, XL, & XC will be calculated.



Result



Here we use XL & XC so we assign 1200 Hz to FS.



Result

Use the same process for Parallel Resonance.

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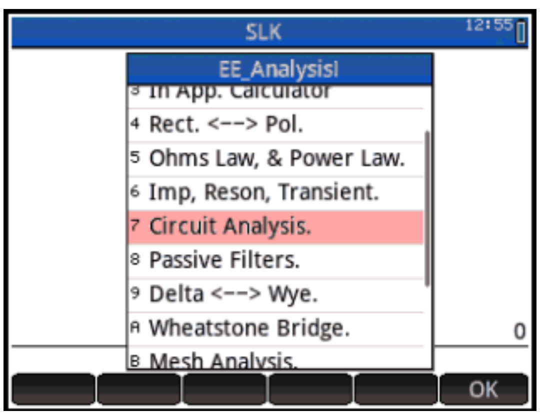
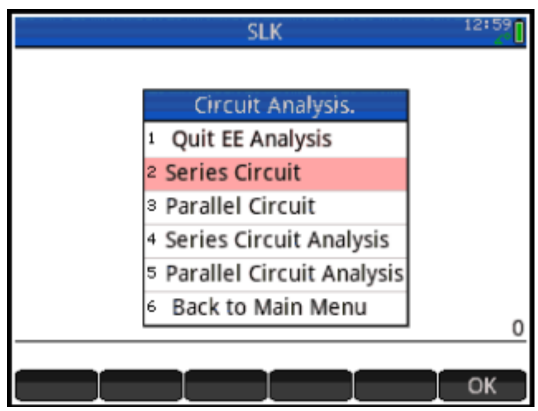
7 Circuit Analysis:

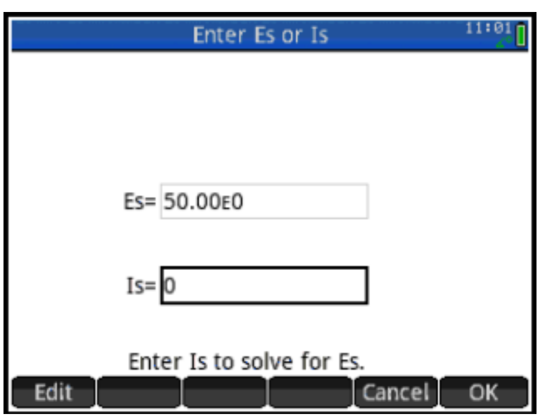
Solve AC or DC circuit with either ESource or Isource and ZTs.



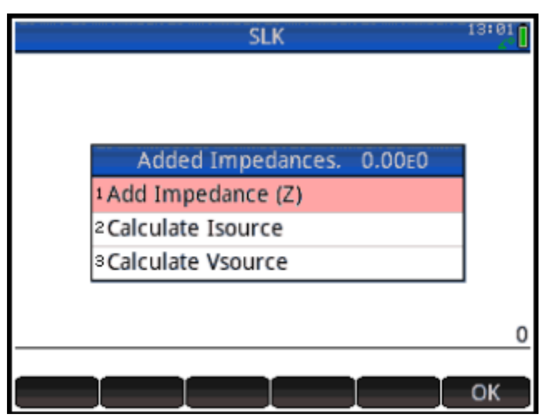
Select 7 Circuit Analysis.



Select 2. Series Circuit

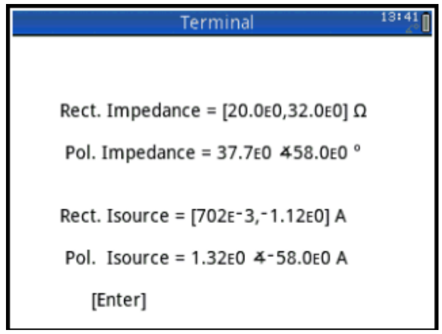


Enter 50 V as ES & Press [OK]



Select 1 to accumulate all Impedances.

The next step is to enter all Series impedances, which will be accumulated. Select 1, enter the first impedance, press enter. The screen will return to prompt you for another impedance and keep recycling until all your impedances are in, then select 2 to Calculate the Current source and total Impedance.



Result of adding 5+8 *i* + 10+15 *i* = 15+23 *i* . with a current of 703E-3-1.12 A

Note: You can enter as many Impedances as you want. The Impedances will be accumulated and added as you go. When you have entered all your Impedances, press [OK], the next step will solve for IS and Total Imp.

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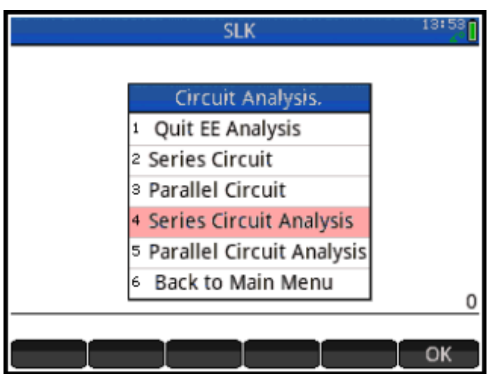
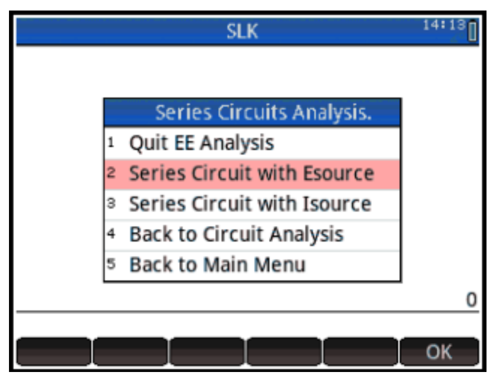
4 Series Circuits Analysis. (sub menu)

This type of circuit analysis varies from the previous one above in that you can enter up to 6 impedances and a voltage and calculate the total current and the voltage drop across each impedances.



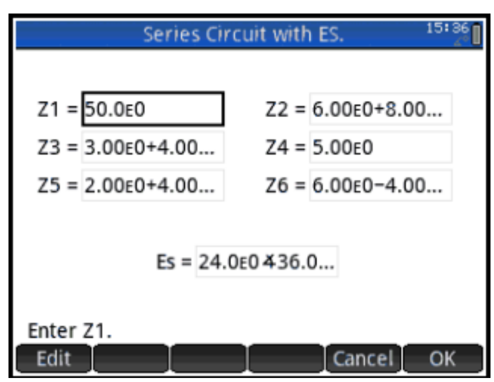
Select 4 Series Circuit Analysis.



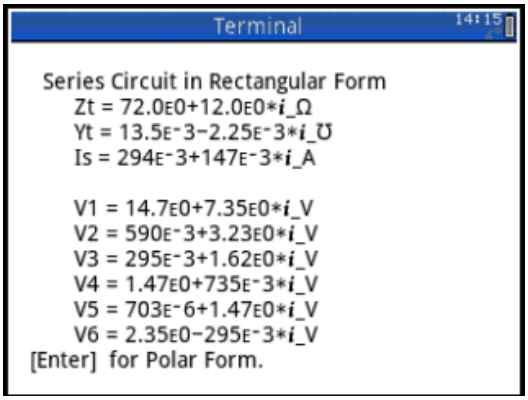
Select 2 Series Circuit with Esource

On the right panel, you can enter up to 6 impedances, and Es 24 V∠36. The result will be displayed in two screens, see below…Rectangular and Polar. You can also choose Isource instead of Esource.

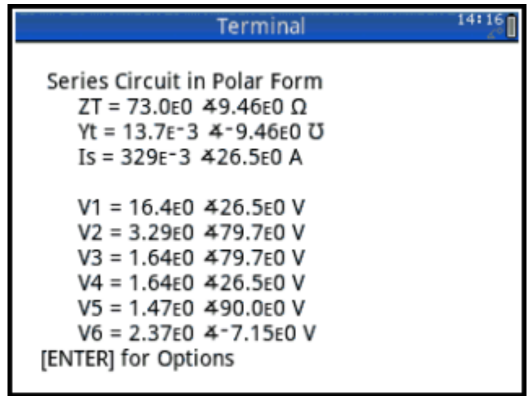
Example



Input data



Result in Rectangular form

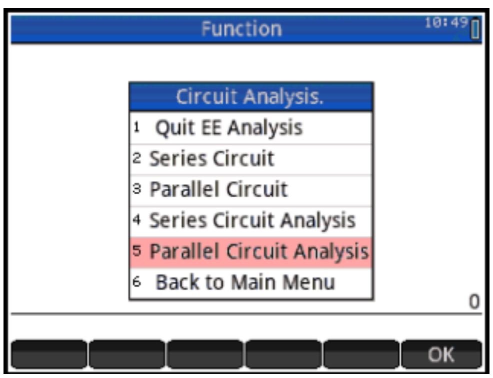


Result in Polar Form

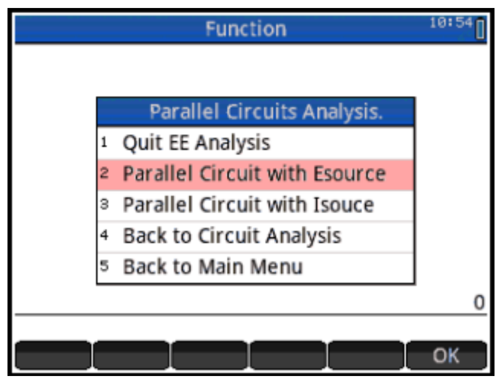
On the right panel, you can enter up to 6 impedances, made up of resistances or reactances or both such as Z2 and Z3 and a voltage like 24_v or 24 V∠36. The result will be displayed in two screens, …Rectangular and Polar.

5 Parallel Circuits Analysis. (sub menu). No change

This type of circuit analysis varies from the previous one above in that you can enter up to 6 impedances and a voltage and calculate the total current and the voltage drop across each impedances.



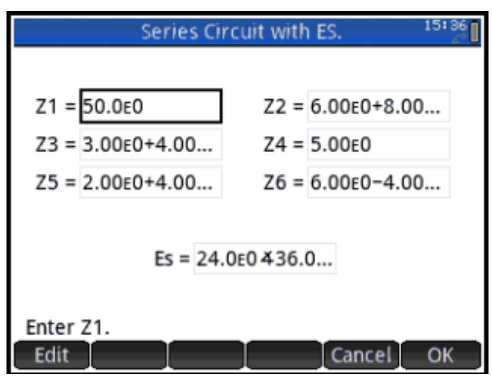
Select 4 Series Circuit Analysis.



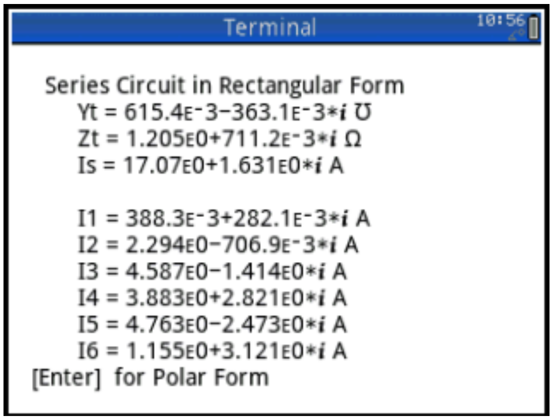
Select 2 Series Circuit with Esource

On the right panel, you can enter up to 6 impedances, displayed in two screens, see below…Rectangular and Polar. You can also choose Isource instead of Esource as in the previous Series Circuit.

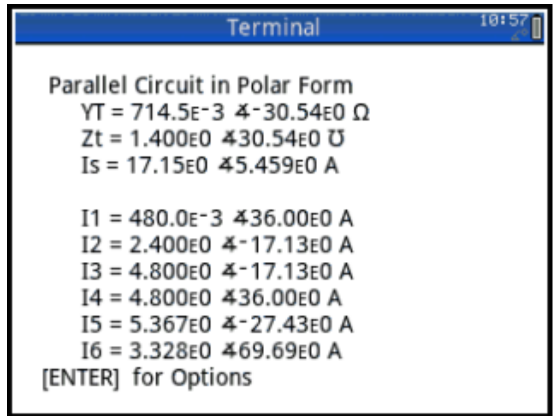
Example



Input data



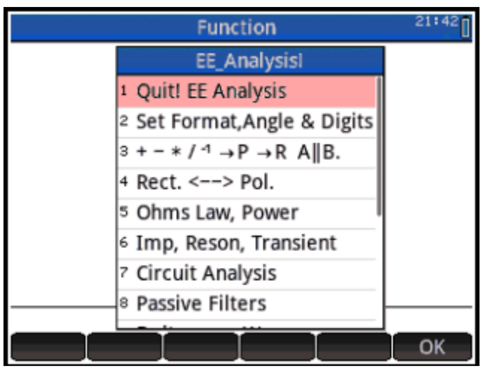
Result in Rectangular form



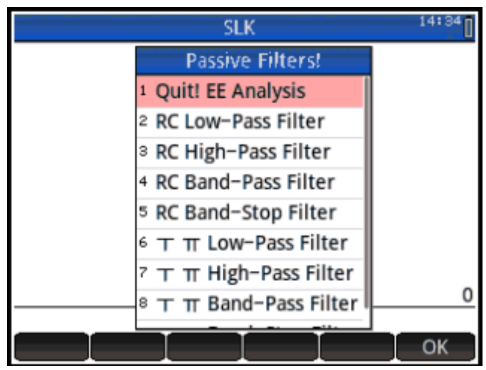
Result in Polar Form

---

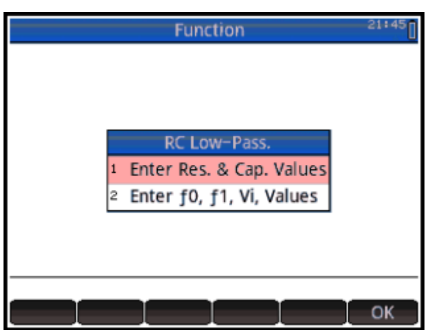
8. Passive Filters Using RC Circuits and (T and Π Circuits New)



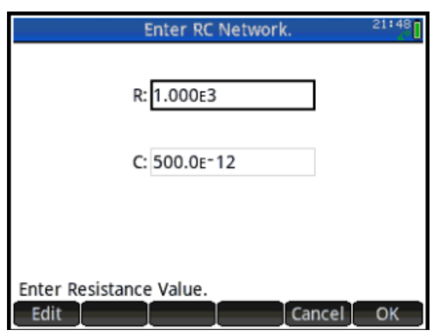
Select 8 Passive Filters



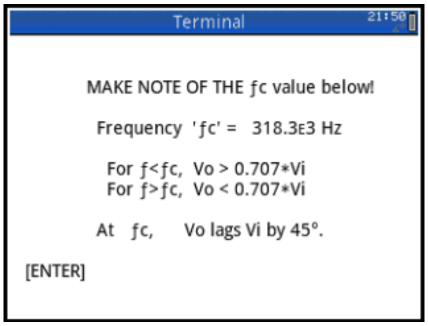
Select 2 RC Low-Pass Filter



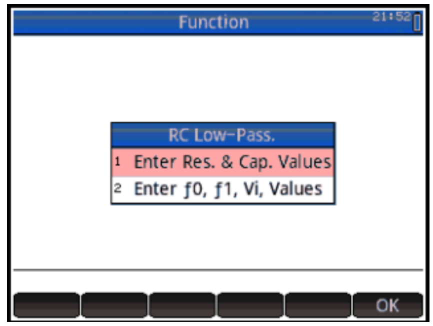
Select 1 Enter Res & Cap…..



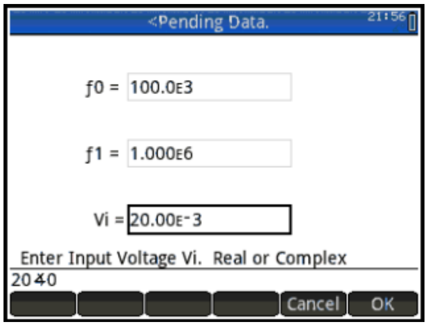
R = 1K. and C = 500_pF. [OK]



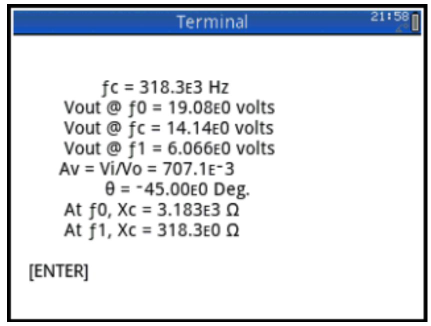
Center Frequency = 318.3_kHz



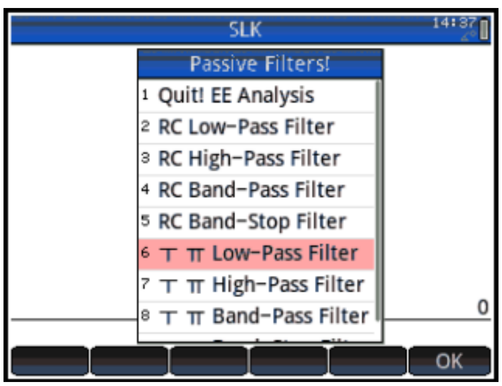
Select 2 Enter f0 and f1 values. [OK]



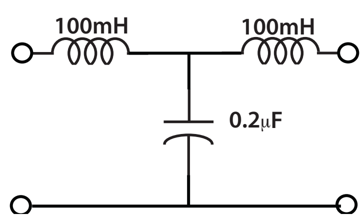
f0 = 1kHz, f1 = 1MHz, Vi = 20E-3V ∠0 [OK].



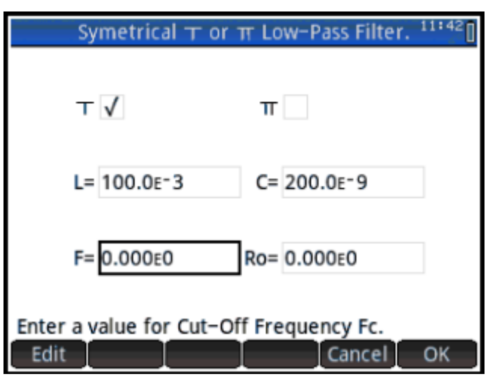
Result for RC Low-Pass Filter. [Enter]



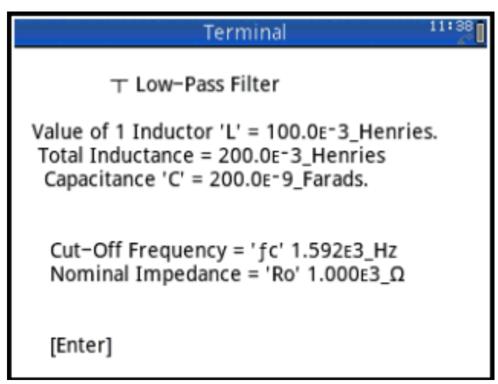
Select 6



T type Low=Pass Filter

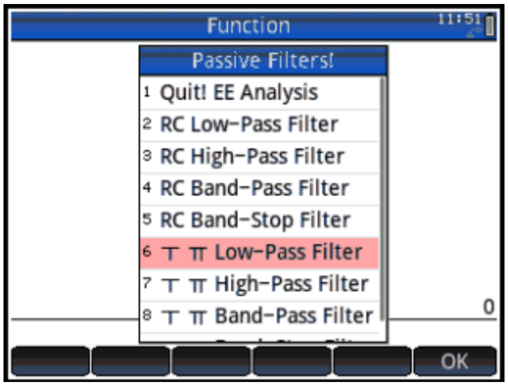


Input value of 1 Ind. & value of the Capacitor.

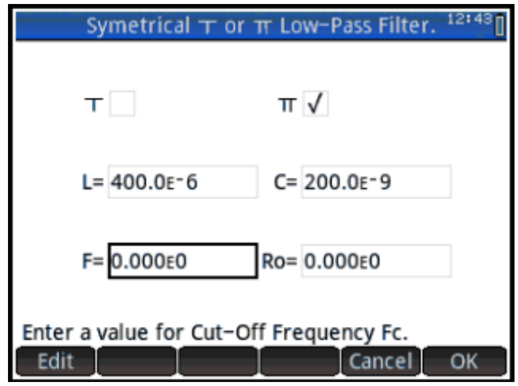


Calculate Cut-Off Frequency and Nominal Ro.

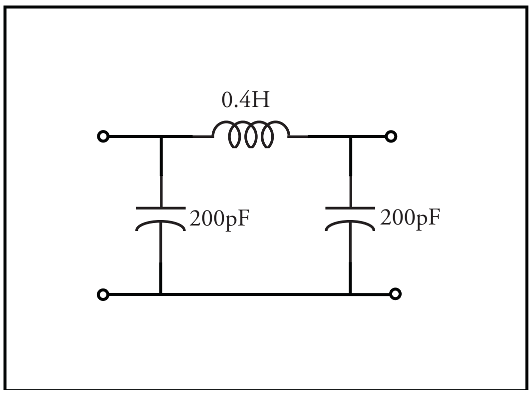
If you enter the Cut-Off Frequency and Ro, L and C will be calculated.



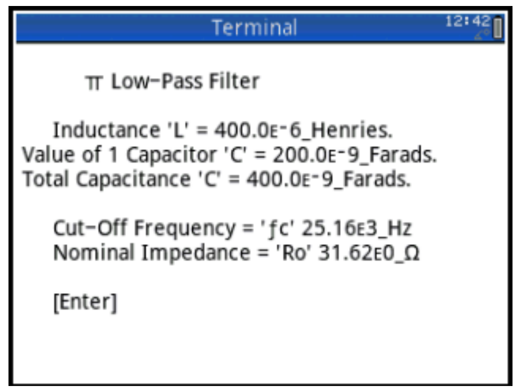
Select 6



Select Π and input L, C and [OK]



Π Low-Pass Filter

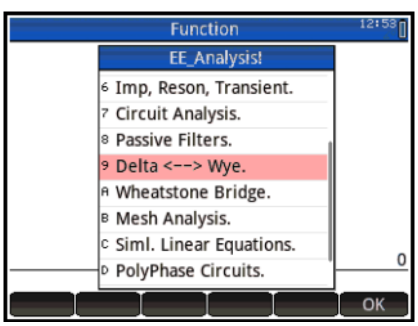


Result Solve for Cut-Off Frequency and Ro.

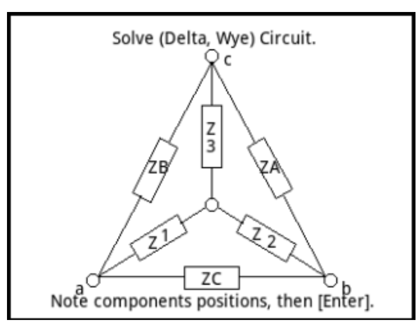
If you enter the Cut-Off Frequency and Ro, L and C will be calculated.

----

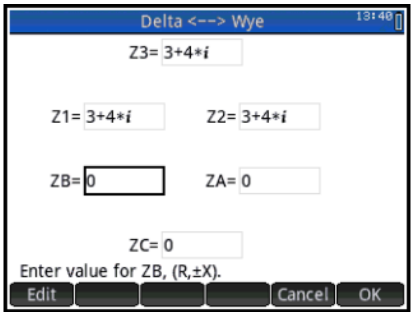
9. Delta to Wye and Wye to Delta transformation.



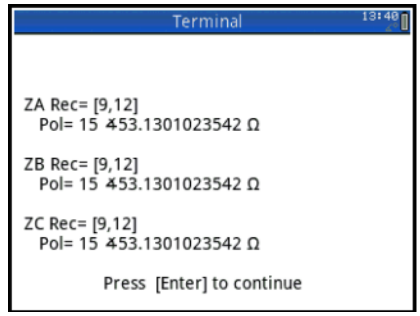
Select 9 Delta<-->Wye



Note: Z1<>ZA, Z2<>ZB & Z3<>ZC

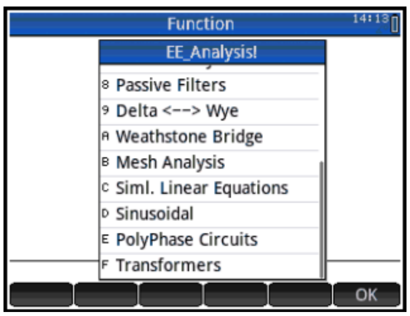


Wye (Z1,Z2,Z3)

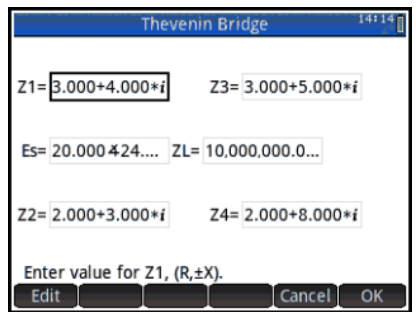


Converted to Delta.

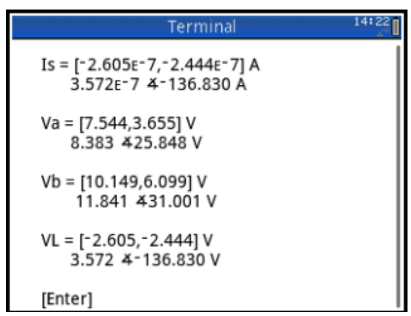
A Wheatstone Bridge



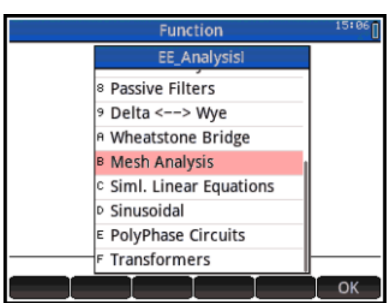
Select A Wheatstone Bridge



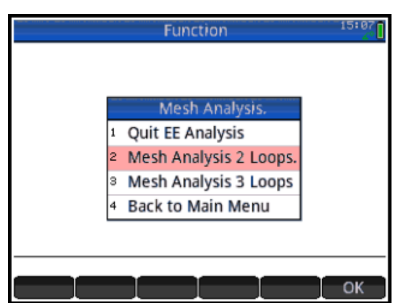
The 10MΩ as ZL, used as an open.



B Mesh Analysis. 2 Loops and 3 Loops.

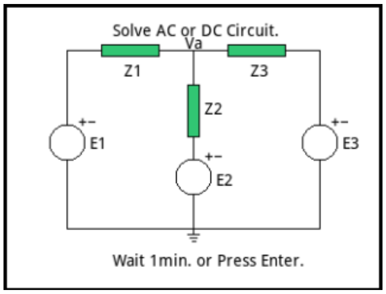


Select B

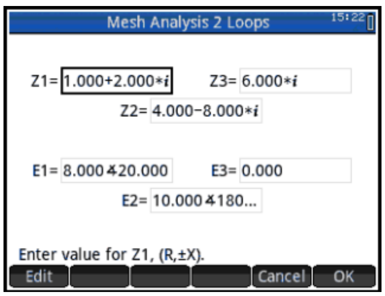


Select 2

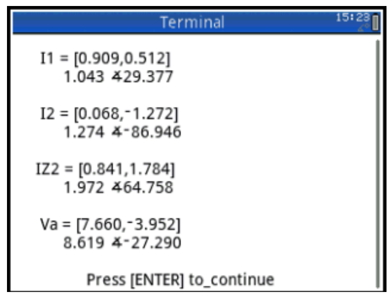
Mesh Analysis 2 Loops.



In the circuit ←, at least one voltage source must be used. Leave the values of the un-used V sources at 0_V. Always used the E polarity at the top side + or – of the Esource.

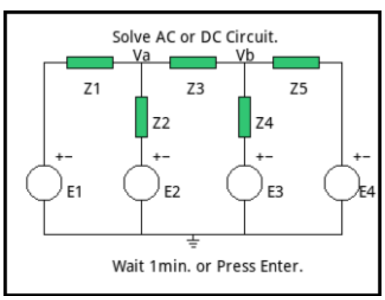


Note: E2, = -10∠0 = 10∠180.

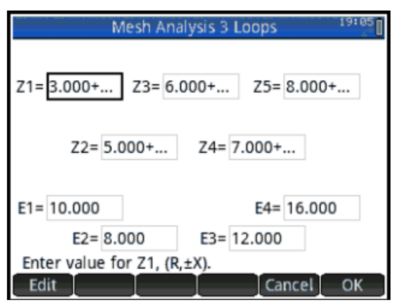


Result

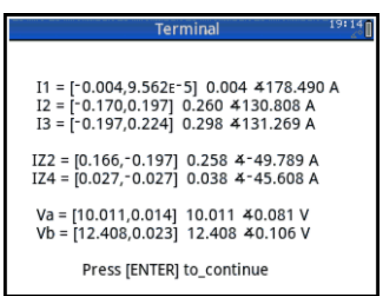
Mesh Analysis 3 Loops



Use 1 to 4 E voltages and enter the top polarity for each voltages. (+ -)



Z_1= 3+4*i*, Z_2= 5+6*i*, Z_3= 6+7*i*, Z_4= 7+8*i*, Z_5= 8+9*i*.
E_1= 10∠0 , E_2=8∠0 , E_3= 12∠0 , E_4= 16∠0

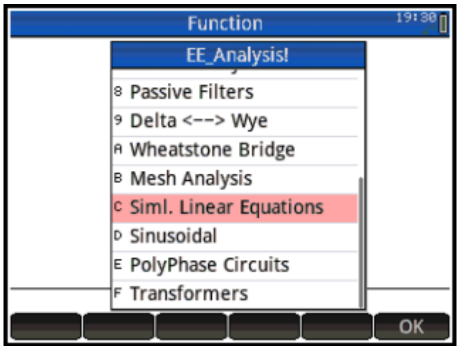


Result

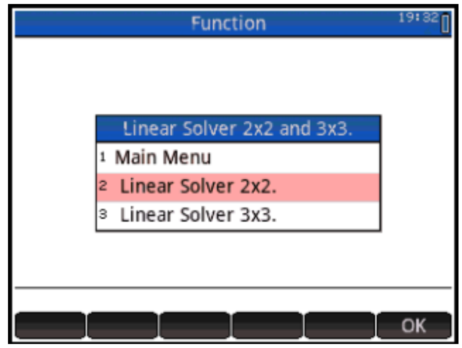
Note:

$Va = Z_2 * I_{Z2}+E_2.$
$Vb = Z_4 * I_{Z4}+E_3.$

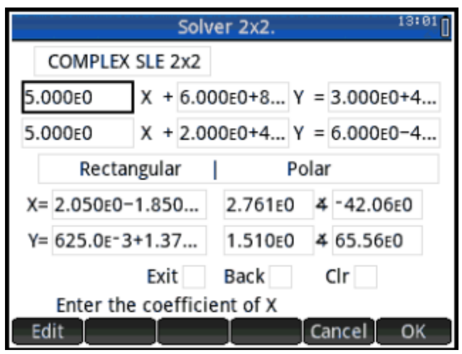
C. Simultaneous Linear Equation Solver 2x2 and 3x3.



Select C.

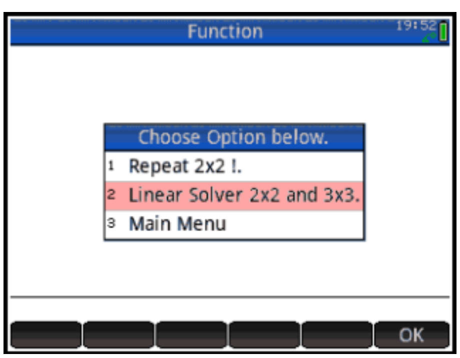


Select 2 SLE 2x2

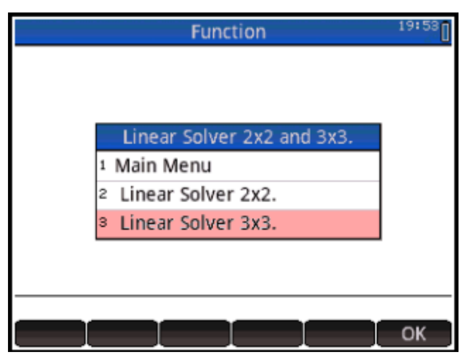


Input **5x + 6+8*iy* = 3+4*i***

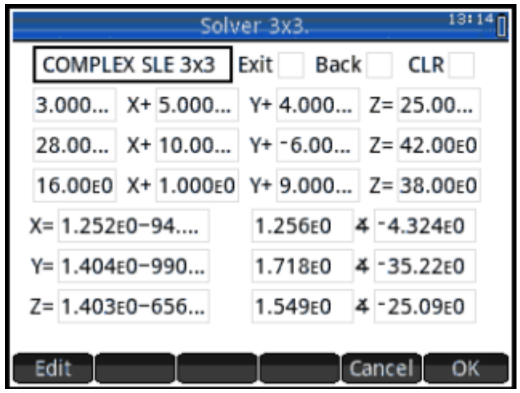
5x + 2+4*iy* = 6-4*i*



Select. 2



Select 3. SLE 3x3

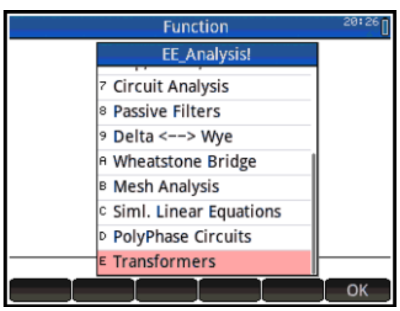


$$3+4ix \quad + \quad 5+6y + 4\angle 36z = 25\angle 22$$
$$28+5ix + 10\angle 24y + \quad 3+4iz = 42$$
$$16x \; + \quad 1y + \quad 9+6z = 38$$

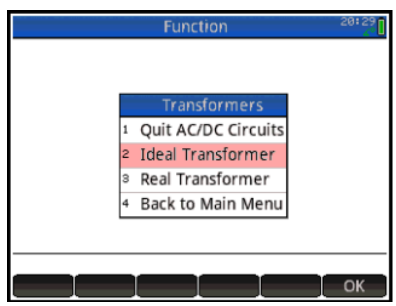
D Polyphase Circuits

For the Polyphase Circuits, download the separate document (.PDF)
https://www.hpmuseum.org/forum/thread-14652.html

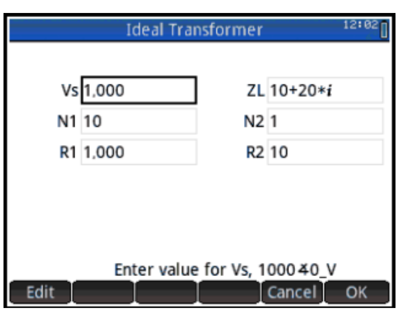
E. Ideal Transformer



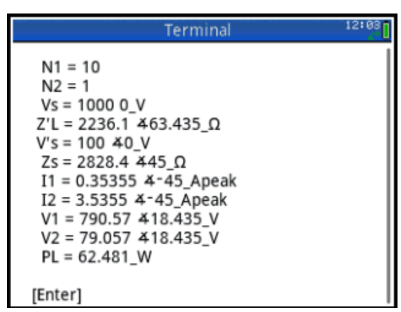
Select E. Transformers



Select 2 Ideal Transformer

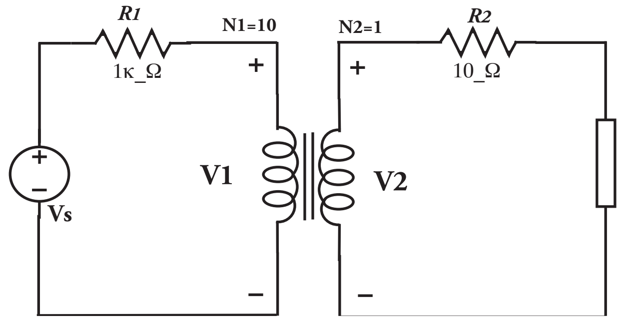


Press [OK]

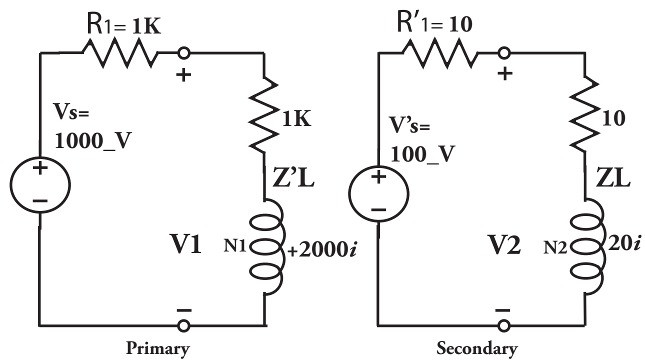


Result

Ideal Transformer

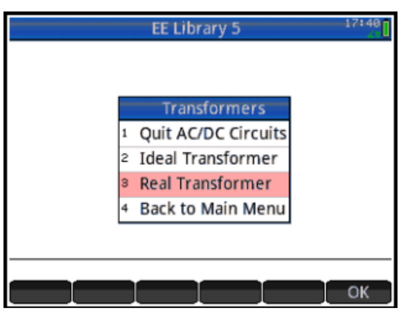


Ideal Transformer. Equivalent Circuit.

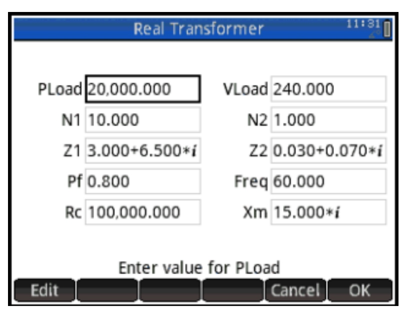


Laminated Iron Core

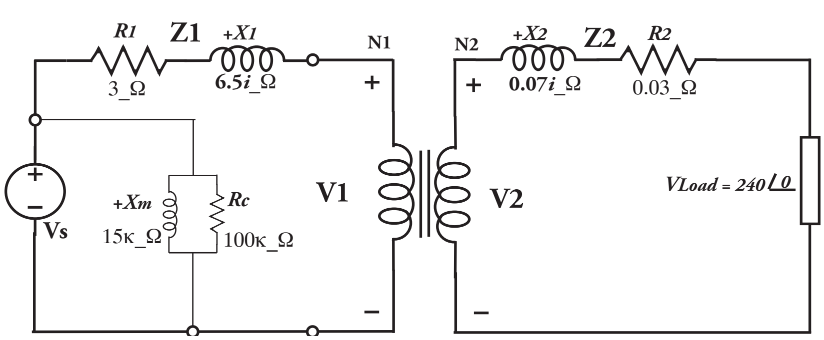
E- Real Transformer



Select 3 Real Transformer

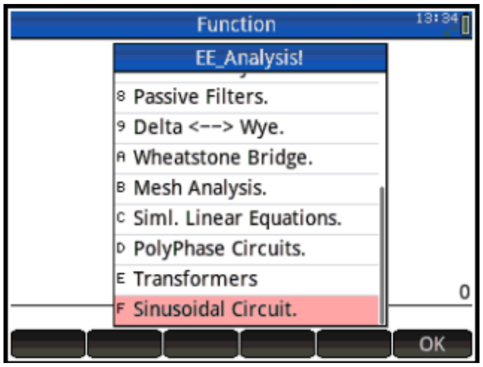


Circuit Inputs

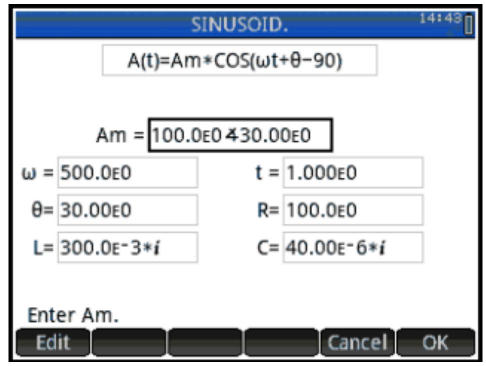


Real Transformer Equivalent Circuit

F. Sinusoid Circuit



Select F



Input Data. A(t)=100*COS(500*1+(30-90))