

AC Basic Electronics

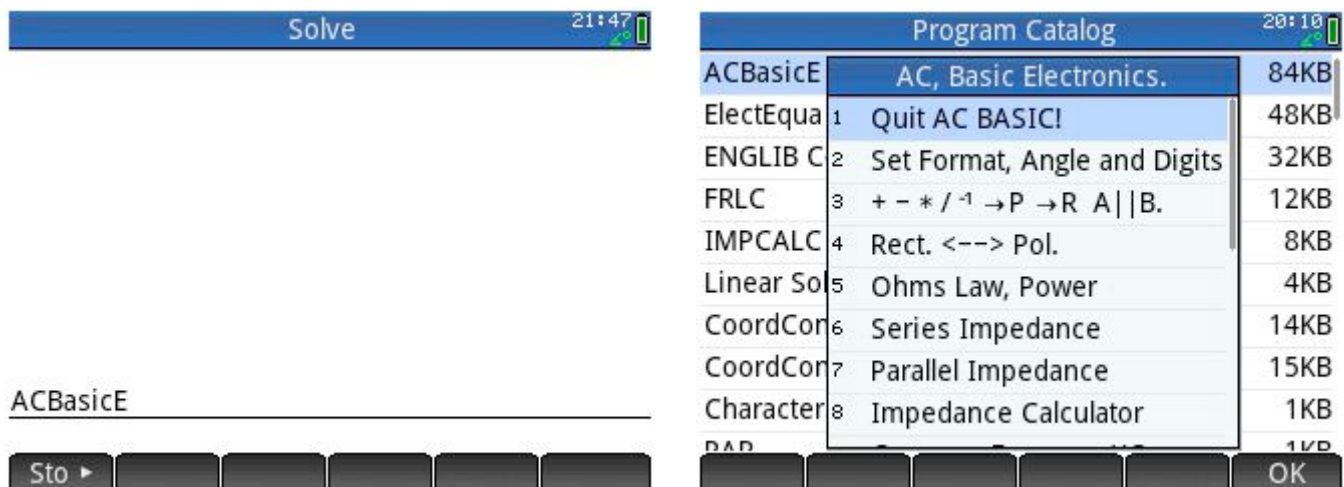
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This program “ACBasicE”, is mainly a revision or update of the previous program I made last year “ACDC2. It contains some extra sections “like RC and RL Transients, and uses some new programming techniques I discovered since I started programming and should thank E.W. Shore and Dante Camargo (SLK3.3) and others from whom I have learned much and used as a platform for my own meager efforts. This version replaces ACDC2 which was a lengthy program, perhaps not so user friendly as ACBasicE as you will experience. There are many topics that can be incorporated in such a program, but due to time limitations I selected a few basic ones from which I will expand in the near future. **Most sections in this program work for DC as well as AC.**

I have started an Equation Library for Electronic using the SOLVER App but I put it on the back burner for now. The reason is, I find the Solver App very cumbersome for at least two reasons. 1- the Solver App or any other Apps for that matter cannot return to the calling program as a subroutine would. The calling program has to be restarted upon exiting the App. 2- The limitations placed on the variables are very restricting and not very motivating in pursuing programming using the Apps, since only a limited set of characters are available such as (A B C D ...etc) which have to be used to represent math symbols extensively used in Physics and Engineering et all. On the other hand, maybe I need to do more research on this attractive and practical HP Prime calculator and be content with it and leave those features to more advanced devices. ACBasicE contains presently 16 topics as seen in the Main Menu. If errors are found, please let me know. Thank you and hope you find this program helpful.



You can type ACBasicE on the command line and press [Enter] or select it from the Program list. Start by pressing '2' and Set Number Format, Angle type and # of digits. See next frame.

Set Format, Digits & Angle 20:16

(Digits, 1 to 10) 2.0...

Standard ☐ Radians ☐

Fixed ☐ Degrees ☒

Eng ☒ Gradians ☐

✓ Box for Degrees

✓ Cancel OK

Enter '2' in the Digit box and press [Enter]. Next TAP the box beside 'ENG twice then TAP 'Degrees twice. You can also navigate to the box and press [Enter] to toggle the check mark. Press OK to activate and go back to the Main Menu.

Program Catalog 20:10

AC, Basic Electronics.		
ACBasicE		84KB
ElectEqua	1 Quit AC BASIC!	48KB
ENGLIB C	2 Set Format, Angle and Digits	32KB
FRLC	3 + - * / ⁻¹ → P → R A B.	12KB
IMPCALC	4 Rect. <--> Pol.	8KB
Linear Sol	5 Ohms Law, Power	4KB
CoordCor	6 Series Impedance	14KB
CoordCor	7 Parallel Impedance	15KB
Character	8 Impedance Calculator	1KB

OK

Pressing 3 will allow you to do basic math in Real or Complex mode without exiting the program itself. Go to next screen. A||B can solve 2 Z,s in Parallel Za||Zb.

Basic Math. 19:39

A= 0.000E0

B= 0.000E0

Add_ ☐ A⁻¹ ☐

Sub_ ☐ A → P_ ☐

Mult_ ☐ A → R_ ☐

Div_ ☐ A || B_ ☐

Enter value. (X,Y) or R∠θ

Edit Cancel OK

Enter # in A and # in B then tap the function box below twice, in this case Add. Tap [OK]. Note also the A||B which solves 2 Res. In Parallel 'Ra||Rb.

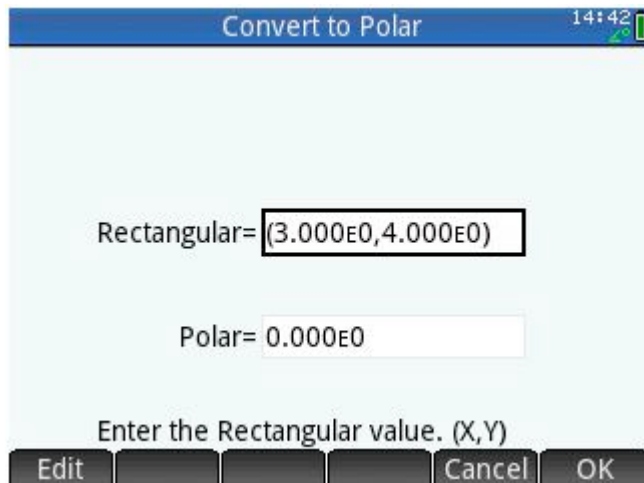
Solve 21:38

AC, Basic Electronics.		
1	Quit AC BASIC!	
2	Set Format, Angle and Digits	
3	+ - * / ⁻¹ → P → R.	
4	Rect. <--> Pol.	
5	Ohms Law, Power	
6	Series Impedance	
7	Parallel Impedance	
8	Impedance Calculator	

ACBasicE ACBasicE

OK

Press 4 for Rect. to Polar conversion. You can also use # 3 Math to do the same.



Enter (3,4), Press [Enter] Next screen.



Polar = [5.00,53.13]

Press [Enter] to continue

The answer is 5.00 @ 53.13 degrees.



ACBasicE
ACBasicE

ACBasicE

You can Repeat Rect to Pol. or 2 for Main Menu.



ACBasicE
ACBasicE

Select '4 for Pol. <--> Rect.



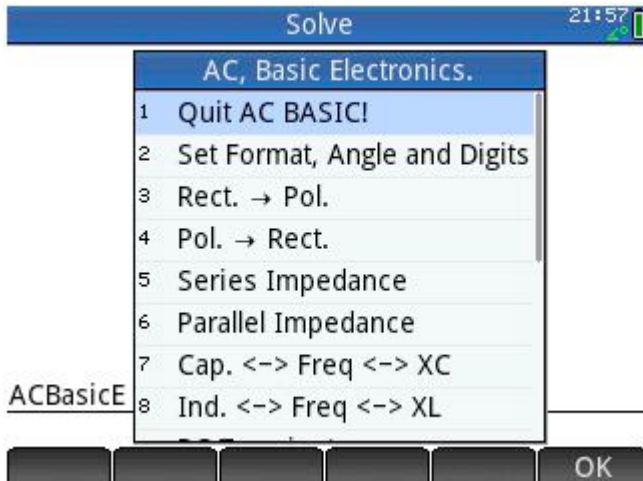
Enter 5 / _53.13 '5 Shift X 53.15' in Polar [Enter].



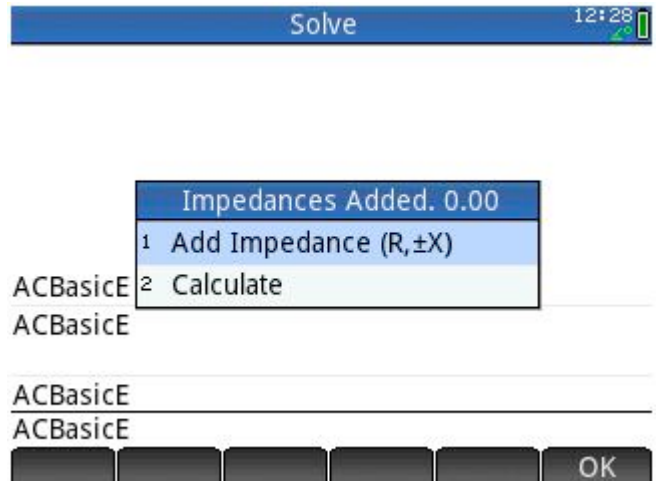
Rectangular = [3.00,4.00]

Press [Enter] to continue

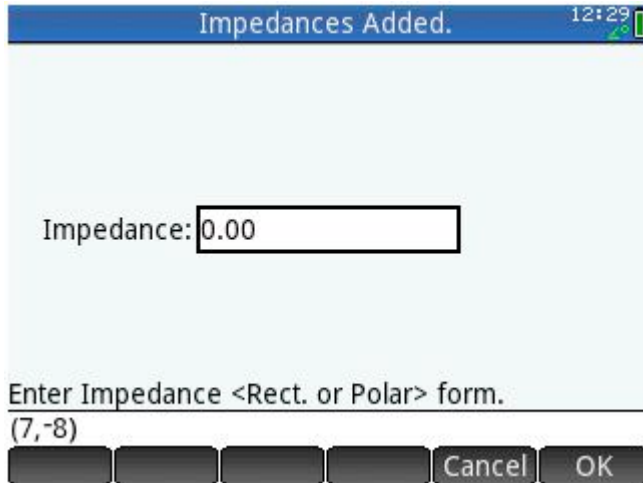
Answer screen.



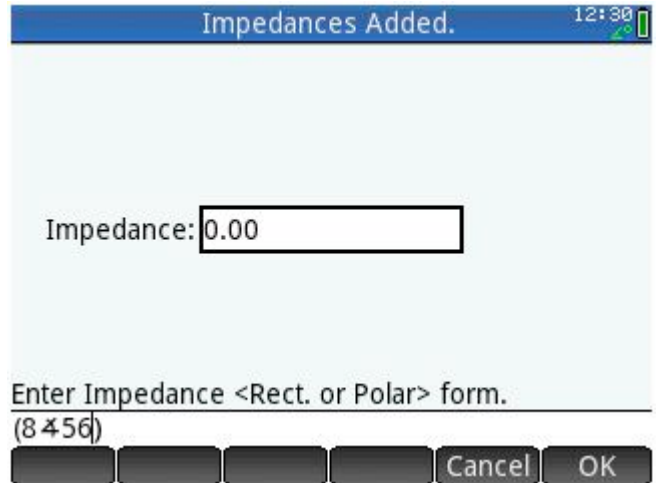
Press '5' for Series Impedance.



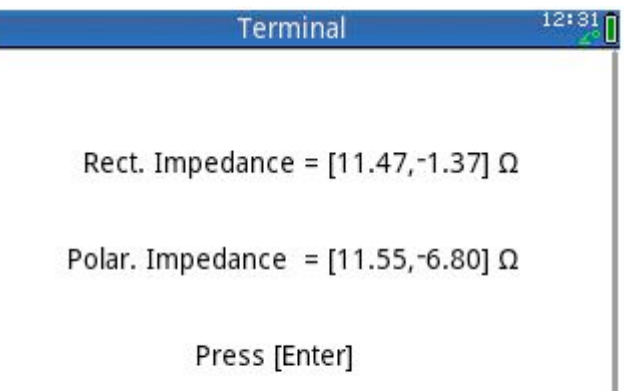
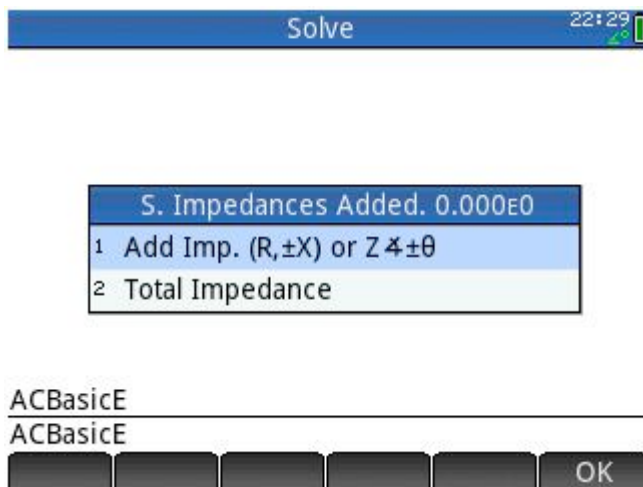
In the screen above press 1 to add the first Impedance in Rect. or Pol. form. See next screen.

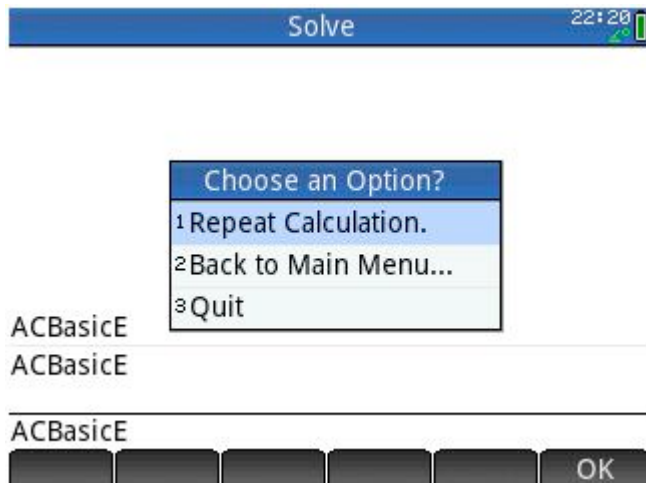


Rectangular form (7,-8), [Enter].

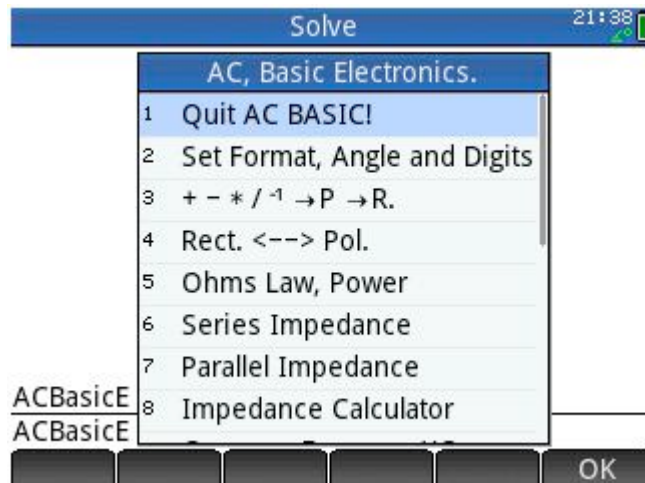


Polar form 8/_56 . [Enter].





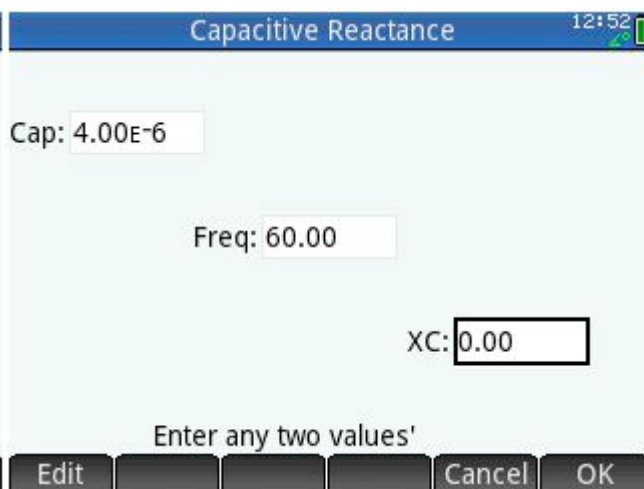
Go back to the Main Menu.



Press 8 for Impedance Calculator.



Start by selecting Series or Parall. By tapping twice on the adjacent box. Enter a frequency of 1200 H. Double Tap on RC box, press [OK]. After pressing OK you can enter a value for R and C, press OK. Result = (R,-XC).



Pressing 9 in the Main Menu will generate this screen which will solve for Cap. Freq. or XC. Enter any two value and solve for the unknown by pressing [OK]. Enter values for Cap. And XC and solve for Freq.

Inductive Reactance 12:56

L 0.02

Freq: 1,200.00

XL 0.00

Enter any two values'

Edit Cancel OK

Press A and you can solve for L, Freq., or XL .

Terminal 12:57

Inductive Reactance =180.96_Ω

Angle = $\angle +90^\circ$

[Enter]

An example is given for solving for XL.

Solve 12:59

' $\tau = R \times C$ '

ACBasicE

ACBasicE

ACBasicE

ACBasicE

OK

Pressing B in the Main Menu will open the RC Transient section as seen above. In the screen above you will enter a voltage Es. For the Storage phase Vi is not required so enter '0'. Enter R=8000, C=4E-6, T= .032ms, Digit limited to 2 so the full number not displayed. Double tap on the Storage box to check. Tap on [OK]

RC Transient 13:07

Es= 40.00 Vi 0.00

Storage= ☒

R= 8,000.00 C= 4.00E-6

Decay= ☐

t= 0.03

Initial Voltage. ☐

Enter final Voltage value Es

Edit Cancel OK

Terminal 13:07

Charging Phase!

VC = 25.28_Volts VR = 14.72_Volts

ic = 1.84E-3_Amps

Press [Enter] to continue

Result for Charging Phase above.

RC Transient 13:09

Es= 40.00 Vi 0.00

Storage= ☐

R= 8,000.00 C= 4.00E-6

Decay= ☒

t= 0.03

Initial Voltage. ☐

Enter final Voltage value Es

Edit Cancel OK

This is the Decay or Discharging Phase.

Terminal 13:09

Discharging Phase!

Vc = 14.72_Volts Vr = 25.28_Volts

Ic = -1.84E-3_Amps

Press [Enter] to continue

Result for Discharging or Decay Phase.

RC Transient 13:11

Es= 24.00 Vi 4.00

Storage= ☐

R= 3,400.00 C= 3.30E-6

Decay= ☐

t= 2.00E-3

Initial Voltage. ☒

Check with Initial Voltage?

This screen indicates that the Capacitor contains an Initial voltage of 4 volts 'Vi'.

Solve 09:53

' τ = L/R1 Storage'

' τ = L/(R1+R2) Decay'

ACBasicE

ACBasicE

For RL Transient Storage Phase enter '0' at R2.

RL Transient 11:40

Es= 50.0E0 I1= 0.00E0

Storage= ☒

R1= 2.00E3 R2= 0.00E0

Decay= ☐

L= 4.00E0 t= 2.00E-3

Initial Current. ☐

Check for Decay Phase.

Terminal 11:40

Storage Phase!

VL = 18.4E0_Volts VR = 31.6E0_Volts

Im = 25.0E-3_Amps iL = 15.8E-3_Amps

Press [Enter] to continue

Result for RL Storage Phase.

RL Transient 11:45

Es= 50.0E0 I1= 0.00E0

Storage= ☐

R1= 2.00E3 R2= 3.00E3

Decay= ☒

L= 4.00E0 t= 800E-6

Initial Current. ☐

Check for Initial Current?

In the Decay circuit we now have R2=3E3, 3K Ω .

Terminal 11:46

Decay PhaseI

$v_L = -46.0E0_Volts$ $i_L = 9.20E-3_Amps$

$v_{R1} = 18.4E0_Volts$ $v_{R2} = -27.6E0_Volts$

$i_m = 25.0E-3_Amps$

Press [Enter] to continue

Result for Decay Phase.

RL Transient 11:54

$E_s = 16.0E0$ $I_1 = 4.00E-3$

Storage=

$R_1 = 2.20E3$ $R_2 = 6.80E3$

Decay=

$L = 100E-3$ $t = 11.1E-6$

Initial Current. ☒

Enter value for Initial Current.

☒ Cancel OK

This is the Initial Current Phase.

Terminal 12:43

Charging Phase with Initial ValueI,

$v_{R1} = 8.80E0_Volts$ $v_{R2} = 27.2E0_Volts$

$V_i = 65.5E0_Volts$ $V_m = -20.0E0_Volts$

$i_F = 1.78E-3_Amps$ $i_L = 1.47E-3_Amps$

$v_L = -7.36E0_Volts$

Press [Enter] to continue

Result for the Charging Phase with Initial current.

Solve 21:41

AC, Basic Electronics.

- C RL Transient
- D Resonant Frequency
- E Series Circuit
- F Parallel Circuit
- G Delta <--> Wye
- H Bridge
- I Thevenin Bridge
- J Mesh Analysis

ACBasicE
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OK

Select E for Series Circuit.

Enter Es or Is 10:55

$E_s = 100.0E0$

$I_s = 0$

Enter Es to solve for Is

Cancel OK

Enter 100 in Es, press Enter then [OK.]

Solve 10:57

Added Impedances. 0.000E0

- 1 Add Impedance (Z)
- 2 Calculate Isource
- 3 Calculate Vsource

ACBasicE
ACBasicE
ACBasicE

OK

Press 1 to add an Impedance.

Add Impedances 10:58

Impedance=

Enter Impedance (R,±X) or R∠θ form.
(3,4)

Solve 10:59

Added Impedances. 2.000E0

1 Add Impedance (Z)
2 Calculate Isource
3 Calculate Vsource

ACBasicE
ACBasicE
ACBasicE

Type (3,4) and Enter. Program returns to screen on the right. Add as many Impedances as you like in Rectangular or Polar form. The Impedances will be accumulated as ZTotal. Lastly press 2 to calculate the total current source Is. By multiplying Is by any of your impedances you can calculate the voltage across any impedances. If you enter Is you can solve for Es instead.

Terminal 11:00

Rect. Impedance = [3.000E0,4.000E0] Ω
Pol. Impedance = [5.000E0,53.13E0] °
Rect. Isource = [12.00E0,-16.00E0] A
Pol. Isource = [20.00E0,-53.13E0] A
Press [Enter]

Result for Series Circuit.

Enter Es or Is 11:08

Es=

Is=

Enter value for Es=

This is the Parallel Circuit version and Is is provided. We can now calculate Es.

Solve 11:10

Added Impedances. 0.000E0

1 Add Impedance (Z)
2 Calculate Isource
3 Calculate Vsource
4 About AC Basic Elect..

ACBasicE
ACBasicE
ACBasicE

Add Impedances 11:17

Impdance:

Enter Impedance (R,±X) or R∠θ form
3.33

Above we entered 3.33Ω and below $(0,2.5)\Omega$ for an inductor. The Parallel $Z = (1.99, 53.1)$

Add Impedances	Terminal
Impedance: <input type="text" value="0.000E0"/>	Rect. Impedance = $[1.200E0, 1.599E0] \Omega$ Pol. Impedance = $[1.999E0, 53.10E0] \Omega$ Esource = $[-2.794E0, 9.598E0] V$ Esource = $[9.996E0, 106.2E0] V$ Press [Enter]
Enter Impedance (R, $\pm X$) or R $\angle \theta$ form (0,2.5)	
<input type="button" value="Edit"/> <input type="button" value="Cancel"/> <input type="button" value="OK"/>	

Bridge	Terminal										
ZB= <input type="text" value="28.00"/> ZA= <input type="text" value="32.00"/> Es= <input type="text" value="18.53"/> ZC= <input type="text" value="10.00"/> Z4= <input type="text" value="30.00"/> Z5= <input type="text" value="15.00"/> Enter value for ZB, (R,X) or Z $\angle \theta$. <input type="button" value="Edit"/> <input type="button" value="Cancel"/> <input type="button" value="OK"/>	<table border="0"> <tr> <td>Rectangular</td> <td>Polar</td> </tr> <tr> <td>Is = $[0.73, 0.00]$</td> <td>$[0.73, 0.00]$</td> </tr> <tr> <td>Va = $[8.05, 0.00]$</td> <td>$[8.05, 0.00]$</td> </tr> <tr> <td>Vb = $[6.99, 0.00]$</td> <td>$[6.99, 0.00]$</td> </tr> <tr> <td>Va - Vb = $[1.06, 0.00]$</td> <td>$[1.06, 0.00]$</td> </tr> </table> Press [Enter] to continue	Rectangular	Polar	Is = $[0.73, 0.00]$	$[0.73, 0.00]$	Va = $[8.05, 0.00]$	$[8.05, 0.00]$	Vb = $[6.99, 0.00]$	$[6.99, 0.00]$	Va - Vb = $[1.06, 0.00]$	$[1.06, 0.00]$
Rectangular	Polar										
Is = $[0.73, 0.00]$	$[0.73, 0.00]$										
Va = $[8.05, 0.00]$	$[8.05, 0.00]$										
Vb = $[6.99, 0.00]$	$[6.99, 0.00]$										
Va - Vb = $[1.06, 0.00]$	$[1.06, 0.00]$										

From the Main Menu press H for Bridge.

Result for Bridge circuit.

Thevenin Bridge	Terminal														
Z1= <input type="text" value="7.00E0"/> Z2= <input type="text" value="5.00E0"/> Es= <input type="text" value="20.0E0"/> ZL= <input type="text" value="100E18"/> Z3= <input type="text" value="4.00E0"/> Z4= <input type="text" value="8.00E0"/> Enter value for Es, (R, $\pm X$). <input type="button" value="Edit"/> <input type="button" value="Cancel"/> <input type="button" value="OK"/>	<table border="0"> <tr> <td>Rectangular</td> <td>Polar</td> </tr> <tr> <td>Zth = $[5.62E0, 0.00E0]$</td> <td>$[5.62E0, 0.00E0]$</td> </tr> <tr> <td>Vr1 = $[12.7E0, 0.00E0]$</td> <td>$[12.7E0, 0.00E0]$</td> </tr> <tr> <td>Vr2 = $[7.69E0, 0.00E0]$</td> <td>$[7.69E0, 0.00E0]$</td> </tr> <tr> <td>Eth = $[-5.03E0, 0.00E0]$</td> <td>$[5.03E0, 180E0]$</td> </tr> <tr> <td>IL = $[-50.3E-21, 0.00E0]$</td> <td>$[50.3E-21, 180E0]$</td> </tr> <tr> <td>VZL = $[-5.03E0, 0.00E0]$</td> <td>$[5.03E0, 180E0]$</td> </tr> </table> Press [Enter] to continue	Rectangular	Polar	Zth = $[5.62E0, 0.00E0]$	$[5.62E0, 0.00E0]$	Vr1 = $[12.7E0, 0.00E0]$	$[12.7E0, 0.00E0]$	Vr2 = $[7.69E0, 0.00E0]$	$[7.69E0, 0.00E0]$	Eth = $[-5.03E0, 0.00E0]$	$[5.03E0, 180E0]$	IL = $[-50.3E-21, 0.00E0]$	$[50.3E-21, 180E0]$	VZL = $[-5.03E0, 0.00E0]$	$[5.03E0, 180E0]$
Rectangular	Polar														
Zth = $[5.62E0, 0.00E0]$	$[5.62E0, 0.00E0]$														
Vr1 = $[12.7E0, 0.00E0]$	$[12.7E0, 0.00E0]$														
Vr2 = $[7.69E0, 0.00E0]$	$[7.69E0, 0.00E0]$														
Eth = $[-5.03E0, 0.00E0]$	$[5.03E0, 180E0]$														
IL = $[-50.3E-21, 0.00E0]$	$[50.3E-21, 180E0]$														
VZL = $[-5.03E0, 0.00E0]$	$[5.03E0, 180E0]$														

On the left the values are entered for the Thevenin Bridge. On the right the result.

Note: The value for ZL above is 100E18 representing an open in order to calculate Zth.

If you then want to replace Z_{th} with a practical value say $5.6K\Omega$, you can change Z_{th} to that value and repeat the calculation. The only change will be the current I_L from $-50.3E-21$ to $-898\mu A$. Again simply divide E_{th} -5.03 by the $5.6K = -898E-6\Omega$. You can do this by returning to the Main Menu, press 3 for the Math function and do this division without leaving the program.

The next section will solve MESH Analysis circuit with 2 Loops and 3 Loops.

Solve

17:33

Mesh Analysis.

1 Quit ACBasicE
2 Mesh Analysis 2 Loops.
3 Mesh Analysis 3 Loops
4 Back to Main Menu

ACBasicE
ACBasicE

OK

Press 2 for a 2 Loop Mesh Analysis.

Mesh Analysis 2 Loops
20:51

Z1=

Z3=

Z2=

E1=

E3=

E2=

Enter value for Z1, (R,±X).

Edit

Cancel

OK

Terminal
20:52

I1 = [-2.000E0,3.000E0] [3.606E0,123.7E0]

I2 = [-4.000E0,2.000E0] [4.472E0,153.4E0]

Press [ENTER] to_continue

Above, the position of the boxes represent the position of the impedances in the circuit (Z_1, Z_2, Z_3). Below, the position of E_2 is assumed to be between E_1 and E_3 . I've tried to make this program without drawing actual circuitry. On the right of course is the result calculation. NOTE: When entering the voltages E_1, E_2 and E_3 , always enter the polarity **at the top** of the voltage symbol whether AC or DC.