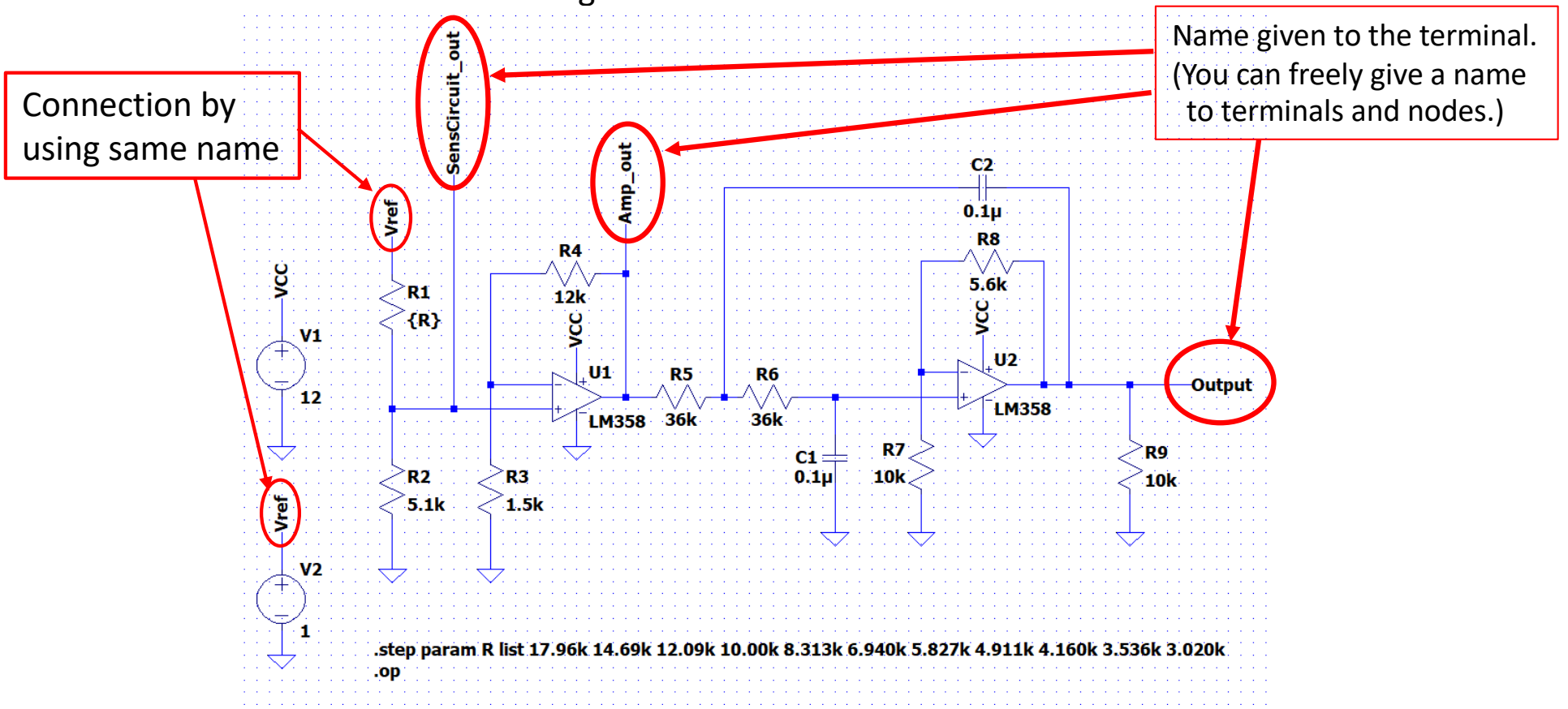
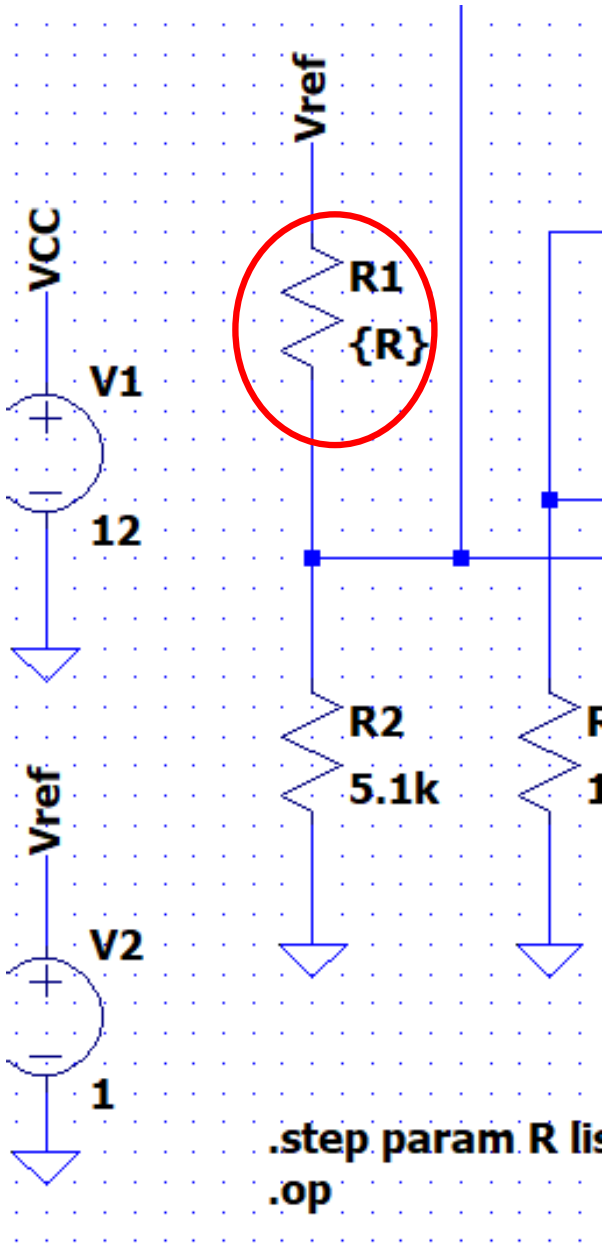
About “Parametric” analysis to confirm the response of measurement circuit with “Resistance type” sensor - In the case of Thermistor -

“Parametric” analysis

- “Parametric” analysis is a method of analyzing how the circuit responds when the values of resistors, capacitors and temperature of circuit are changed arbitrarily.
- “Parametric” analysis is always used with other basic analysis method.
- This time, we analyze the circuit output when the resistance value of thermistor changes depending on the temperature.
- The circuit and SPICE command for “Parametric” analysis is as shown in the figure below.
  * In the example below, “Parametric” analysis is used with basic “.op (“Operating point”) analysis.
  * “.op” analysis can calculate voltage at any nodes and current at any paths and parts under no input to the circuit or under no changes in the circuit.



“Parametric” analysis (Continued)



- Some fixed value resistors are used instead of the thermistor, and those resistance values are changed as a parameter to check the output against some temperature situations.

- To change the resistance value as a parameter of “Parametric” analysis, input the resistance value for R1 as "{R}" to the circuit.
  * Like the part indicated by the red circle in the circuit diagram.

“Parametric” analysis (Continued)

- The resistance value to be changed is obtained from the data sheet of the thermistor "103AT-11" and set as the resistance value to be analyzed.
- The parameter analysis command is ".step param".
- The details of the “.step param” command are as follows.
  * In this time, we use the type2 command format from the following.

”.step param“ command for “Parametric” analysis

Type1:
.step param parameter name start value of parameter end value of parameter increment of parameter

Type2:
.step param parameter name list value1 value2 … valueN
  * In this time, we use this command to simulate thermistor response as follows.

```
.step param R list 17.96k 14.69k 12.09k 10.00k 8.313k 6.940k 5.827k 4.911k 4.160k 3.536k 3.020k
```

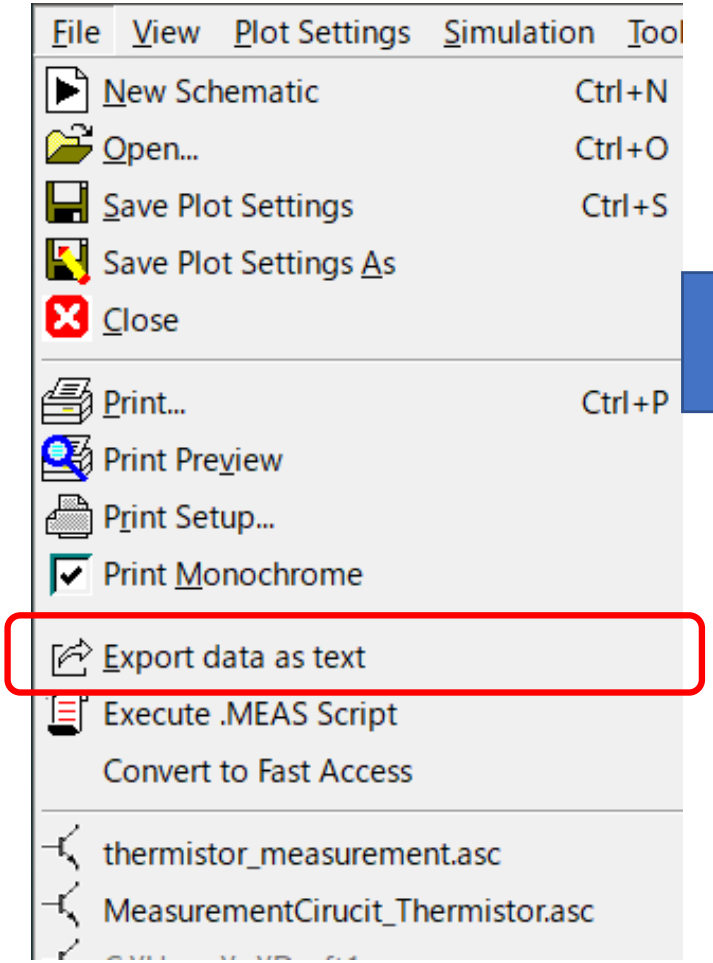
10degc 15degc 20degc 25degc 30degc 35degc 40degc 45degc 50degc 55degc 60degc

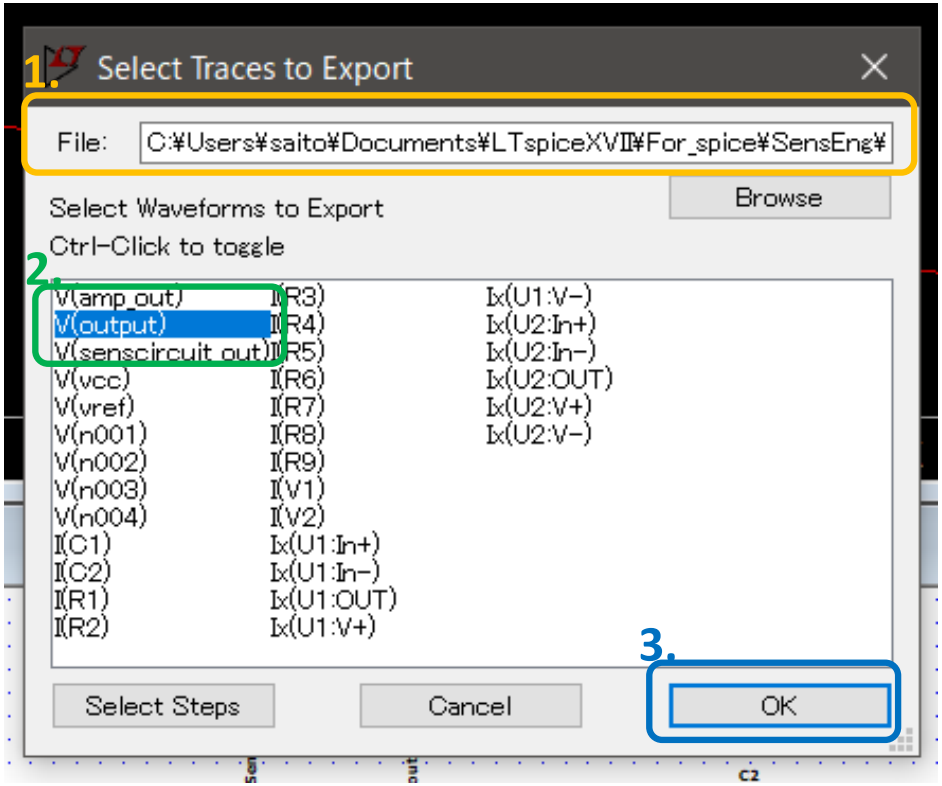
Type3:
.step param temp start value of temperature end value of temperature increment of parameter
  * This command is used for the temperature dependence analysis of a circuit.
    It is an analysis of the temperature characteristics of the circuit itself, not an analysis for temperature sensing.

How to save the simulated results

Select “Export data as text” from “File” menu.

* Data export menu doesn’t appear,
  if graph window wasn’t selected.





1. Check the folder and the file name for saving
2. Select value you want to save like above.
   * You can select plural value at a time.
3. Then, press “OK”

About saved data

Saved data file is text file.
The file can open by excel like below.

C2

	A	B	C	D
1	r	V(output)		
2	3.02E+03	8.82E+00		
3	3.54E+03	8.29E+00		
4	4.16E+03	7.73E+00		
5	4.91E+03	7.15E+00		
6	5.83E+03	6.55E+00		
7	6.94E+03	5.95E+00		
8	8.31E+03	5.34E+00		
9	1.00E+04	4.74E+00		
10	1.21E+04	4.17E+00		
11	1.47E+04	3.62E+00		
12	1.80E+04	3.11E+00		
13				
14				

Insert the additional column “Temperature”
for each resistance value of the column “A”

B1 Temp. [d

	A	B	C	D
1	r	Temp. [degC]	V(output)	
2	3.02E+03	60	8.82E+00	
3	3.54E+03	55	8.29E+00	
4	4.16E+03	50	7.73E+00	
5	4.91E+03	45	7.15E+00	
6	5.83E+03	40	6.55E+00	
7	6.94E+03	35	5.95E+00	
8	8.31E+03	30	5.34E+00	
9	1.00E+04	25	4.74E+00	
10	1.21E+04	20	4.17E+00	
11	1.47E+04	15	3.62E+00	
12	1.80E+04	10	3.11E+00	
13				
14				

The plot by the column “B” and “C” after above procedure
is your circuit’s response against temperature.

Making plots

Perform “Parametric” analysis at the three points in the figure below
and plot the results in the form of output voltage vs. temperature (degreeC).