

LTspice Automation and Control Commands Reference

Prepared for LTspice Users

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1 Introduction

LTspice provides powerful commands for automating simulations, controlling circuit behavior, and extracting results. This document summarizes the most important automation and control commands with examples.

2 1. .param — Define Parameters

Purpose: Define variables for component values or expressions.

Syntax:

```
.param <name>=<value>
```

Example:

```
1 .param Rval=1k
2 R1 N001 N002 {Rval}
```

Advanced Example:

```
1 .param R1val=1k R2val=2k Rtotal={R1val+R2val}
```

3 2. .step — Parameter Sweeps

Purpose: Automatically run multiple simulations by sweeping parameters or sources.

Syntax:

```
.step param <param_name> <start> <stop> <increment>
```

Examples:

- Sweep resistor:

```
1 .step param Rval 1k 5k 1k
```

- Sweep a source:

```
1 .step V1 1 5 1
```

- Sweep logarithmically:

```
1 .step param Rval 1k 100k decade
```

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4 3. .meas — Automatic Measurements

Purpose: Extract simulation results automatically.

Syntax:

```
.meas <tran/freq> <name> <what_to_measure> <expression>
```

Examples:

- Maximum voltage:

```
1 .meas tran Vmax MAX V(N002)
```

- Rise time (10% to 90%):

```
1 .meas tran Trise TRIG V(N002) VAL=1 TARG V(N002) VAL=4
```

- RMS voltage:

```
1 .meas tran Vrms RMS V(N002)
```

- With parameter sweep:

```
1 .meas tran Vpeak PARAM Rval MAX V(N002)
```

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5 4. .alter — Modify and Re-run

- Allows modifying component values after a simulation.

```
1 .tran 0 1ms  
2 .alter R1=2k
```

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6 5. .ic — Initial Conditions

- Set initial voltages on nodes.

```
1 .ic V(N002)=0
```

- Useful for capacitors and inductors.

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7 6. .nodeset — Solver Hints

- Provides starting guesses for node voltages to help convergence.

```
1 .nodeset V(N002)=2
```

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8 7. .options — Simulation Control

- Adjust solver settings like tolerance or max steps.

```
1 .options abstol=1u reltol=0.001
```

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9 8. .func — Custom Functions

- Define reusable functions.

```
1 .func myfunc(x) = x^2 + 3*x
2 R1 N001 N002 {myfunc(1k)}
```

10 9. .lib / .include — Include External Files

- Include subcircuits, models, or libraries.

```
1 .include mytransistor.lib
```

11 10. Simple Example: Sweep Resistor and Measure Max Voltage

```
1 * Simple Sweep Example
2 V1 N001 0 DC 5
3 R1 N001 N002 {Rval}
4 C1 N002 0 1u
5
6 .param Rval=1k
7 .step param Rval 1k 5k 1k
8 .tran 0 1ms
9 .meas tran Vmax PARAM Rval MAX V(N002)
10 .end
```

12 11. Advanced Example: Sweep Resistor and Capacitor, Measure Multiple Metrics

```

1  * Advanced Automation Example
2  V1 N001 0 DC 5
3  R1 N001 N002 {Rval}
4  C1 N002 0 {Cval}
5
6  .param Rval=1k
7  .param Cval=1u
8
9  .step param Rval 1k 5k 1k
10 .step param Cval 1u 5u 2u
11 .tran 0 5ms
12
13 .meas tran Vpeak PARAM Rval PARAM Cval MAX V(N002)
14 .meas tran Trise PARAM Rval PARAM Cval TRIG V(N002) VAL
    =0.5 TARG V(N002) VAL=4.5
15 .meas tran Vrms PARAM Rval PARAM Cval RMS V(N002)
16 .end

```

13 12. Tips for Automation

- Always use curly braces {} when referencing parameters.
 - ‘.step’ can perform nested sweeps for multiple parameters.
 - ‘.meas’ is flexible for voltage, current, timing, RMS, and derived quantities.
 - Check the SPICE error log to see automatic measurement results.
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14 References

- LTspice User Guide: <https://www.analog.com/en/design-center/design-tools-and-calculators/ltspice-simulator.html>