

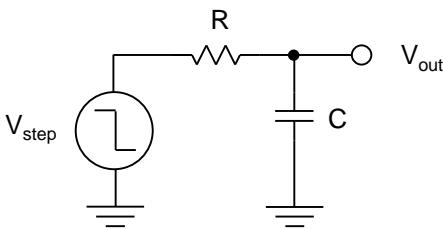
STC Quick Reference Guide

Settling Time Calculator (STC) is a program written for the HP50g calculator that aids in the analysis and design of the step response of a single pole RC filter. STC finds the time it takes (**ts**) for the output voltage to respond to a step input voltage (**Vstep**) and settle to within a specified fraction (**Accu**) of the final value.

Parameters

- Resistance, **R**, in k Ω
- Capacitance, **C**, in nF
- Settling Time, **ts**, in μ s
- Accuracy, **Accu**, in τ
- Accuracy, **Accu**, in PPM
- Accuracy, **Accu**, in %
- Accuracy, **Accu**, in μ V
- Accuracy, **Accu**, in LSB
- Voltage Step Size, **Vstep**, in V
- Resolution, **Res**, in bits
- Time Constant, **τ** , in μ s
- Cutoff Frequency, **Fc**, in kHz
- Rise Time, **tr**, in μ s

The RC Network



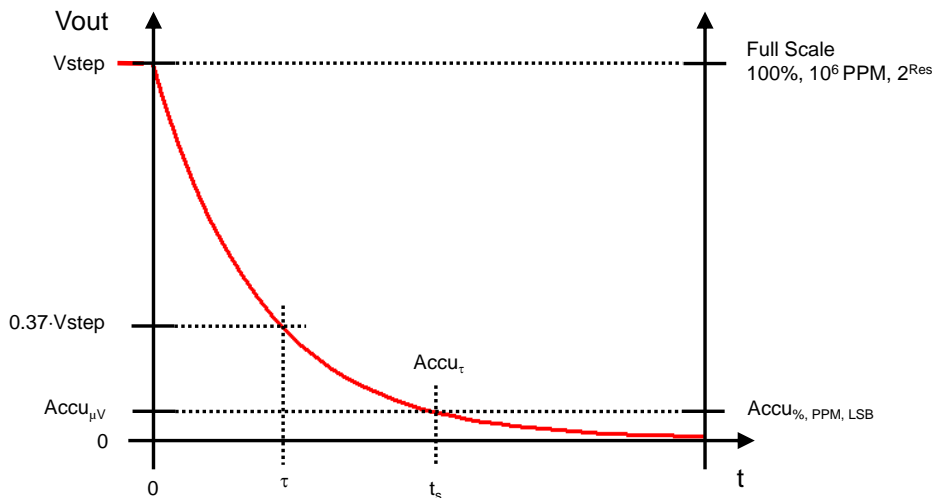
Vout: $V_{OUT} = V_{STEP} \cdot e^{-\frac{t}{\tau}}$

Settling Time: $\tau = R \cdot C$

Rise Time: $t_r = \ln(9)RC$

Bandwidth: $F_c = \frac{1}{2\pi RC}$

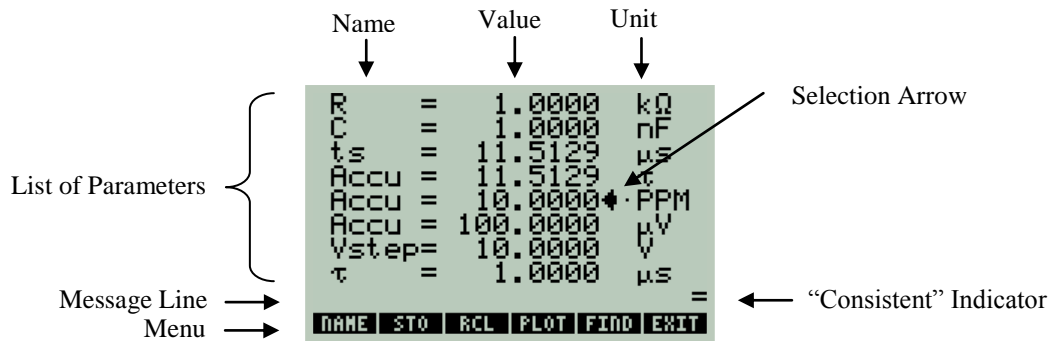
Accuracy vs Settling Time



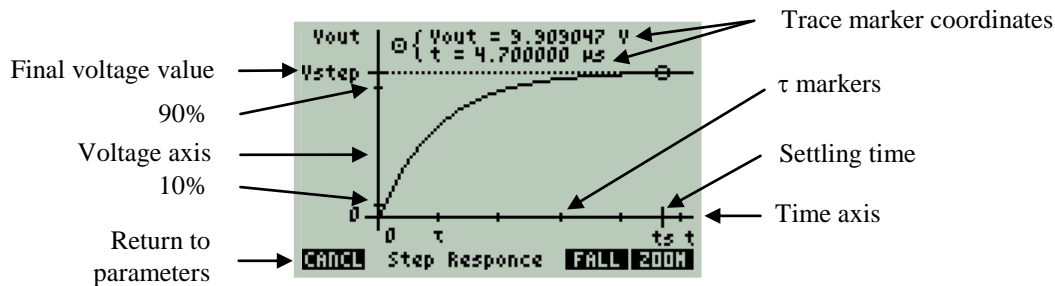
These parameters are related by,

$$e^{-\frac{t_s}{RC}} = e^{-Accu_{\tau}} = \frac{Accu_{\mu V}}{V_{STEP}} = \frac{Accu_{\%}}{100} = \frac{Accu_{PPM}}{1000000} = \frac{Accu_{LSB}}{2^{Res}}$$

Parameter Display



Plot Display



Commands

- ▼ and ▲ select a parameter.
- ▶ display an alternative parameter where a “.” appears right of the selection arrow.
- ◀ (insert) or ◀ (delete) enter or edit a parameter. Press **ENTER** when finished.
- F1** (NAME) display the name of the selected parameter in the message line
- ◀ F1** (NAME) display the full precision of the selected parameter in the message line
- F2** (STO) store all parameters
- F3** (RCL) recall all stored parameters
- F4** (PLOT) plot the step response
- F5** (FIND) find the selected parameter
- F6** (EXIT) or **ON** (Cancel) exit the program
- ◀ F6** (EXIT) launch the previous run calculator (for physical calculators only - requires CALC)
- ▶ ON** turn off the calculator
- NXT F1** (NAME) display the settling time equations used by STC
- NXT F2** (NAME) export the selected parameter to the stack upon exiting
- NXT F3** (NAME) import the number present in level 1 of the stack when STC was launched,
- NXT F4** (NAME) enter all default parameter values.
- F4 F1** (NAME) return to the parameter display
- F4 F5** (NAME) display a falling step
- F4 F5** (NAME) display a rising step
- F4 F6** (NAME) plot the full settling time (0 to ts)
- F4 F6** (NAME) plot the time range between ½·Accu and 2·Accu

The equal sign (=) indicates all the parameters are consistent with each other and will appear following a **F5** (FIND) command. The not equal sign (≠) appears following an entry, indicating that the parameters may not be consistent.