Euler's Constant	e	*2.7183*	Numerical constant.
Battery Voltage	V_{bat}		System battery voltage (DC).
Time Elapsed	t		Time elapsed since precharging started.
Pre-charge Time Desired (MAX)	T_{max}		Maximum time acceptable to get the system to the desired level of charge.
% Pre-charge Desired	q		Charge percentage of the system capacitance required before closing the main contactor.
System Capacitance	C		Capacitance of the system load that needs to be precharged.
Number of Time Constants	n	$n = -ln\|1-q\|$	Number of time constants required to precharge the load capacitance to the desired percentage.
Pre-charge Resistance (MAX)	$R_{x_{max}}$	$R_{x_{max}} = \frac{T_{max}}{nC}$	Maximum precharge resistance that will charge the load capacitance to the desired level in the desired time. The actual precharge resistance used can be less than this, which will result in faster precharging, but also higher power dissipation through the resistor.
Chosen Resistor Value	R_x		Chosen precharge resistor value. The maximum resistance calculated above can be used for this. for example, to experiment with resistors that are readily available on the market, or to try precharging faster.
Total Series Resistance in Main Circuit	R_o		Total resistance of the load(s), conductors, contact resistances of switches and connectors, etc. in the main circuit.
Time Constant	τ	$\tau = R_x C$	Time constant for the RC circuit. This is the amount of time it would take to charge the capacitor to 63.2% SOC. Five-time constants are a good rule of thumb for fully charging a capacitor. Anything less could put the main contactor at risk of welding. This can be adjusted by changing the precharging time input T_{max}
Actual Pre-charge Time	T	$T = nR_xC$	The actual time it takes to precharge the system to the desired level using the chosen resistor value. If $R_{x_{max}}$ is used, this time should equal the desired precharge time input.
Pre-charge Circuit Inrush Current	*I(0)*	$I(t) = \frac{V_{bat}}{R_x} e^{-tR_xC}$ = *Evaluated at* $t = 0$ $I(t) = \frac{V_{bat}}{R_x}$	Peak current at $t = 0$, right when the precharge contactor is closed. This is important for checking the capability of the precharge contactor to close under load. The precharge contactor will need to close into this current every time the system is precharged.
Capacitor Voltage	$V_c(t)$	$V_c(t) = V_{bat}(1 - e^{-tR_xC}$	Voltage across the load capacitance at a time t after precharging starts. This increases as the capacitance is charged.
Energy Dissipated by Pre-charge Resistor	$E(T)$	$E(t) = \frac{CV_{bat}^2}{2}(1 - e^{-2tR_xC})$ Evaluated at $t = T$ $E(T) = \frac{CV_{bat}^2}{2}$	Cumulative energy that will be dissipated by the precharge resistor during precharging. If the precharge time is very large (>5 time constants), this will equal to the total energy stored in the capacitance when it is fully charged.
Average Power	P_{avg}	$P_{avg} = \frac{E(T)}{T}$	Total energy dissipated by the precharge resistor divided by the actual precharge time. When selecting a precharge resistor, make sure it can handle P_{avg} for T time.
Peak Power	P_p	$P_p = I(0)^2 R_x$	Peak instantaneous power that the precharge resistor will see. This occurs at the instant when the precharge contactor is closed. When selecting a precharge resistor, make sure it can handle P_p for very short durations
Voltage Delta Remaining After Pre-charge	$dV(T)$	$dV(t) = V_{bat}e^{\frac{-t}{R_xC}}$ Evaluated at $t = T$	Voltage drop remaining across the main contactor after precharging. This, along with the series resistance in the main circuit, will determine the inrush current through the main contactor when it is closed.
Main Contactor Inrush Current After Pre-charging	I	$I = \frac{dV(T)}{R_o}$	Once precharging is complete, this is the inrush current the main contactor will be exposed to when it is closed.