can.sgn Sign convention

We use the passive sign convention of electrical engineering, defined below and illustrated in Fig. sgn.1.

passive sign convention

Definition can.1: passive sign convention

Power flowing in to a component is considered to be positive and power flowing out of a component is considered negative.

Because power $\mathcal{P} = vi$, this implies the current and voltage signs are prescribed by the convention. For passive elements, the electrical potential must drop in the direction of positive current flow. This means the assumed direction of voltage drop across a passive element must be the same as that of the current flow. For active elements, which supply power to the circuit, the converse is true: the voltage drop and current flow must be in opposite directions. Fig. sgn.2 illustrates the possible configurations. When analyzing a circuit, for each passive element, draw an arrow beside it pointing in the direction of assumed current flow and voltage drop. Try it out on Fig. sgn.3.

passive element

active element

The purpose of a sign convention is to help us interpret the signs of our results. For instance,

interpretation

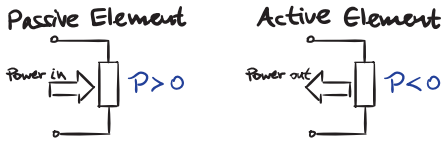

Figure sgn.1: passive sign convention in terms of power $\mathcal{P}$.

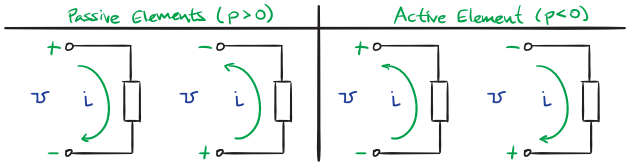

Figure sgn.2: passive sign convention in terms of voltage v and current i.

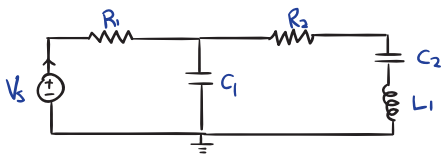

Figure sgn.3: an illustration of the passive sign convention on a circuit.

if, at a given instant, a capacitor has voltage $v_C = 3$ V and current $i_C = -2$ A, we compute $\mathcal{P}_C = -6$ W and we know 6 W of power is flowing from the capacitor into the circuit.
For passive elements, there is no preferred direction of "assumed" voltage drop and current flow. If a voltage or current value discovered by performing a circuit analysis is positive, this means the "assumed" and "actual" directions are the same. For a negative value, the directions are opposite.
For active elements, we don't get to choose the direction. The physical situation prescribes it. For instance, if a positive terminal of a battery is connected to a certain terminal in a circuit, I cannot simply say "meh, I'm going to call that negative." It's positive whether you like it or not, Nancy.