01.5 fun.load Output and input resistance and circuit loading

When considering a circuit from the perspective of two terminals—either as *input* or *output*—it is often characterized as having a Thévenin/Norton **equivalent resistance** and, if it is considered as an output, as having an equivalent (Thévenin or Norton) source.
If the terminals are considered to be an *output*, its **output resistance** is just the Thévenin/Norton equivalent resistance. Other names for this output resistance are *source* or *internal resisistance*.[4] Fig. load.1 illustrates this model.
If the terminals are considered to be an *input*, its **input resistance** is the is the Thévenin/Norton equivalent resistance of the circuit. Another term for this input resistance is the *load resistance*.

4. Sometimes, instead of *resistance*, the term *impedance* is substituted. In these situations, there is no difference in meaning.

Loading the source

Loading a source means to connect another circuit to it that draws power. Let's explore what happens when we connect the load to the source for the circuit in Fig. load.1.
Before connecting, the source output voltage is

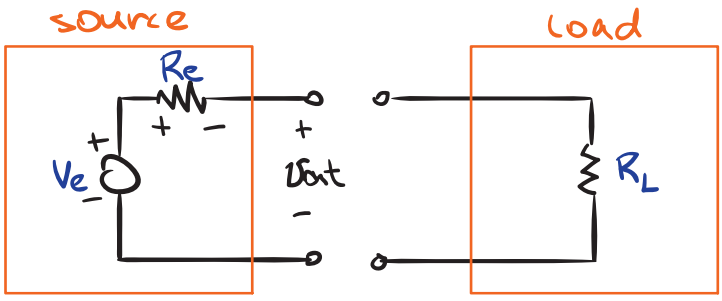

Figure load.1: source with Thévenin equivalent source voltage V_e and output/internal resistance R_e and a load with input resistance R_L.

This is equivalent to connecting a load with an infinite resistance. After connecting, we have a voltage divider, so

So, as $R_e/R_L \to 0$, $v_{out} \to V_e$. Also, as $R_e/R_L \to \infty$, $v_{out} \to 0$.
So, relatively small output resistance and large input resistance yield a "loaded" voltage nearer nominal. Some sources are labeled with nominal values assuming no load and others assuming a **matching load**[5]—a load equal to the output impedance. For this reason, it is best to measure the actual output of any source.

5. A matching load can be shown to have maximum power transfer.