The equation below is the general equation for the power register. The factor of 5000 was selected by the digital designers to get good range for the INA219. The factor reflects internal register math.

$$\text{Power\_Register} = \frac{\text{Current\_Register} \cdot \text{BusVoltage\_Register}}{5000} \qquad \textbf{Equ 1}$$

The equation below is for the shows how to convert the bus voltage register to an actual analog voltage. It is algebraically rearranged for use later.

$$\text{BusVoltage} = \text{BusVoltage\_Register} \cdot \text{Bus\_Voltage\_LSB}$$

$$\text{Bus\_Voltage\_LSB} := 0.004$$

$$\text{BusVoltage\_Register} = \frac{\text{BusVoltage}}{0.004} \qquad \textbf{Equ 2}$$

The equation below is for the shows how to convert the current voltage register to an actual analog voltage. It is algebraically rearranged for use later.

$$\text{Current} = \text{Current\_Register} \cdot \text{Current\_LSB}$$

$$\text{Current\_Register} = \frac{\text{Current}}{\text{Current\_LSB}} \qquad \textbf{Equ 3}$$

The equation below is for the shows how to convert the current voltage register to an actual analog voltage. It is algebraically rearranged for use later.

$$\text{Power} = \text{Power\_Register} \cdot \text{Power\_LSB}$$

$$\text{Power\_Register} = \frac{\text{Power}}{\text{Power\_LSB}} \qquad \textbf{Equ 4}$$

Substitute Equ 2, 3, and 4 into Equ 1.

$$\frac{\text{Power}}{\text{Power\_LSB}} = \frac{\frac{\text{Current}}{\text{Current\_LSB}} \cdot \frac{\text{BusVoltage}}{0.004}}{5000} \qquad \textbf{Equ 5}$$

Simplify

$$\frac{\text{Power}}{\text{Power\_LSB}} = \frac{\text{Current}}{\text{Current\_LSB}} \cdot \frac{\text{BusVoltage}}{20}$$

Take the recipical

$$\frac{\text{Power\_LSB}}{\text{Power}} = \frac{\text{Current\_LSB} \cdot 20}{\text{Current} \cdot \text{BusVoltage}}$$

Substitute P = V*I

$$\frac{\text{Power\_LSB}}{\text{Power}} = \frac{\text{Current\_LSB} \cdot 20}{\text{Power}}$$

Cancle Power terms on both sides.

$$\text{Power\_LSB} = 20\text{Current\_LSB}$$

Final Result!