What is error? Explain the category of errors.

The aim of measurement is to find the true value x_0 of the measured parameter. Different circumstances, such as inaccuracy of measuring device, external interference, human carelessness etc. affect the measurement and the operator obtains an experimental value x_{exp} as a result. Note: $x_{exp} \neq x_0$.

Category of errors:

The absolute error is a modulus of the difference between the experimental and true values:

$$\Delta = \left| x_{\text{exp}} - x_o \right|$$

Relative error characterizes the proportion of absolute error from the true value:

$$\eta = \frac{\left| x_{\text{exp}} - x_o \right|}{\left| x_o \right|} = \frac{\Delta}{\left| x_o \right|}$$

Percent error is the relative error, expressed in terms of percents:

$$\delta = \frac{\left| x_{\text{exp}} - x_o \right|}{\left| x_o \right|} \cdot 100\% = \frac{\Delta}{\left| x_o \right|} \cdot 100\% = \eta \cdot 100\%$$

Also, when in calculus approximations are used instead of the real data (e.g., 5.4 instead of 5.389), to find the errors we operate with the real value x_0 and approximated x_{app}.

As you can see from above, error characterizes the deviation of the real data from its true value.