Signals and Units

Many commands allow you to specify arguments in terms of well-known physical quantities. This page gives an overview of each quantity and its unit.

Time

time: ms

All time and duration values are measured in milliseconds (ms).

For example, the duration of motion with `run_time`, and the duration of `wait` are specified in milliseconds.

Angles and angular motion

angle: deg

All angles are measured in degrees (deg). One full rotation corresponds to 360 degrees.

For example, the angle values of a `Motor` or the `GyroSensor` are expressed in degrees.

rotational speed: deg/s

Rotational speed, or *angular velocity* describes how fast something rotates, expressed as the number of degrees per second (deg/s).

For example, the rotational speed values of a `Motor` or the `GyroSensor` are expressed in degrees per second.

While we recommend working with degrees per second in your programs, you can use the following table to convert between commonly used units.

	deg/s	rpm
1 deg/s =	1	1/6=0.167
1 rpm =	6	1

rotational acceleration: deg/s/s

Rotational acceleration, or *angular acceleration* describes how fast the rotational speed changes. This is expressed as the change of the number of degrees per second, during one second (deg/s/s). This is also commonly written as deg/s^2.

For example, you can adjust the rotational acceleration setting of a `Motor` to change how smoothly or how quickly it reaches the constant speed set point.

Distance and linear motion

distance: mm

Distances are expressed in millimeters (mm) whenever possible.

For example, the distance value of the `UltrasonicSensor` is measured in millimeters.

While we recommend working with millimeters in your programs, you can use the following table to convert between commonly used units.

	mm	cm	inch
1 mm =	1	0.1	0.0394
1 cm =	10	1	0.394
1 inch =	25.4	2.54	1

dimension: mm

Dimensions are expressed in millimeters (mm), just like distances.

For example, the diameter of a wheel is measured in millimeters.

speed: mm/s

Linear speeds are expressed as millimeters per second (mm/s).

For example, the speed of a robotic vehicle is expressed in mm/s.

linear acceleration: mm/s/s

Linear acceleration describes how fast the speed changes. This is expressed as the change of the millimeters per second, during one second (deg/s/s). This is also commonly written as mm/s^2.

For example, you can adjust the acceleration setting of a `DriveBase` to change how smoothly or how quickly it reaches the constant speed set point.

Approximate and relative units

percentage: %

Some signals do not have specific units. They range from a minimum (0%) to a maximum (100%). Specifics type of percentages are relative distances or brightness.

Another example is the sound volume, which ranges from 0% (silent) to 100% (loudest).

relative distance: %

Some distance measurements do not provide an accurate value with a specific unit, but they range from very close (0%) to very far (100%). These are referred to as relative distances.

For example, the distance value of the `InfraredSensor` is a relative distance.

brightness: %

The perceived brightness of a light is expressed as a percentage. It is 0% when the light is off and 100% when the light is fully on. When you choose 50%, this means that the light is perceived as approximately half as bright to the human eye.

Force

force: N

Force values are expressed in newtons (N).

While we recommend working with newtons in your programs, you can use the following table to convert to and from other units.

	mN	N	lbf
1 mN =	1	0.001	$2.248 \cdot 10^{-4}$
1 N =	1000	1	0.2248
1 lbf =	4448	4.448	1

Electricity

voltage: mV

Voltages are expressed in millivolt (mV).

For example, you can check the voltage of the battery.

current: mA

Electrical currents are expressed in milliampere (mA).

For example, you can check the current supplied by the battery.

energy: J

Stored energy or energy consumption can be expressed in Joules (J).

power: mW

Power is the rate at which energy is stored or consumed. It is expressed in milliwatt (mW).

Ambient environment

frequency: Hz

Sound frequencies are expressed in Hertz (Hz).

For example, you can choose the frequency of a beep to change the pitch.

temperature: °C

Temperature is measured in degrees Celcius (°C). To convert to degrees Fahrenheit (°F) or Kelvin (K), you can use the following conversion formulas:

$$^\circ F = {}^\circ C \cdot \frac{9}{5} + 32.$$

$$K = {}^\circ C + 273.15.$$