PID Speed Control

Simply setting a motor's **power level** does not guarantee anything about how fast the motor will **actually turn**. External forces such as friction and gravity constantly **interefere** with its performance – the same motor power can produce wildly different results on a flat surface compared to a slope. **PID (motor) speed control** is designed to ensure that a robot's motors actually turn at the rate you expect them to, even if there is interference from the environment. Effectively, it allows you to issue motor **speed** commands instead of just motor **power** commands.

Using PID in ROBOTC

To enable PID Speed Control in ROBOTC, simply add this command for each motor:

```
nMotorPIDSpeedCtrl[motorX] = mtrSpeedReg;
```

PID is now automatically applied to any motor[] commands issued after this point in the program.

How it Works

GOAL of PID speed control: Make the actual motor speed match the desired motor speed.

When activated, the PID algorithm will use a motor's built-in rotation sensors to monitor its **actual speed**. The actual speed is compared to the **desired speed**, and the PID algorithm will calculate necessary power changes to get the actual speed equal to the desired speed. This robot applies the change and runs with the adjusted power level.

The algorithm then starts over again by comparing the **new actual speed** to the desired speed. Based on the improvement (or lack thereof) that it sees, it will make **further refinements** to the motor's power. This creates a cycle where the motor's speed is constantly being checked against the desired speed, and the power level is always set based on what is needed to achieve the right result.

For more information, see the lesson **Principles of PID** in the Improved Movement section of the Movement unit.

Where the Name Comes From

The mathematical formula that the PID algorithm uses to calculate the necessary adjustment is based on three parameters, called the **Proportional**, **Integral**, and **Derivative** adjustment factors.

	Name	Calculates...
P	Proportional	Adjustment based on the current difference between the actual and desired speeds (referred to as the "error")
I	Integral	Adjustment based on many recent errors
D	Derivative	Adjustment based on rate of change of errors

This weighted sum of these three adjustment factors constitutes the power adjustment that is applied to the motor power to produce the (hopefully) correct actual speed.