

Reference

Synching Motors

There are times when a robot's movement must be perfectly straight. In other words, the wheels need to be moving at the **exact same speed** so that the robot isn't inadvertently turning off its path. To achieve this high level of accuracy the programmer can **synchronize** (synch) the motors so that when the motors are not perfectly aligned, the program makes adjustments to their power to bring them together again.

In ROBOTC, synchronization is accomplished by declaring **pairs of motors** to keep together. One of the two motors is chosen as the **master**, and the second as its **slave**. This does not affect the ability or "willingness" of either motor to stay synchronized with the other, it is merely used to establish the speed relationship between them. The master motor will be assigned a **desired speed**, and the slave motor's speed will be defined as a **percentage of the master motor's speed**. The percentage, known as the **Turn Ratio**, ranges from -100 to 100.

Example Code for Synchronizing Motor B & C to Move Straight

To use Motor Synchronization in ROBOTC, simply type in this command to enable synching:

```
nSynchedMotors = synchBC;
```

You can also use "synchAB", "synchAC", "synchCB", "synchCA", and "synchBA". The next command is the Turn Ratio command which identifies the percentage of slaves motor's speed compared to the master motor.

```
nSynchedTurnRatio = 100;
```

```
1 task main()
2 {
3     nSynchedMotors = synchBC; //Synch motors B & C, B is the master
4     nSynchedTurnRatio = 100; //the wheels will be 100% synched
5     motor[motorB] = 50; //the robot's power level is 50%
6     wait1Msec(5000); //the robot will move for five seconds
7 }
```

Example Code for Un-synchronizing Motor B & C

It is nice to be able to synchronize the motors, but you also need to be able to unsynchronize them when you complete a behavior. ROBOTC's command to unsynchronize motors is:

```
nSynchedMotors = synchNone;
```

```
1 task main()
2 {
3     nSynchedMotors = synchBC; //Synch motors B & C, B is the master
4     nSynchedTurnRatio = 100; //the wheels will be 100% synched
5     motor[motorB] = 50; //the robot's power level is 50%
6     wait1Msec(5000); //the robot will move for five seconds
7     nSynchedMotors = synchNone; //Turn off the synch motors function
8     motor[motorB] = 50; //Turn on motor B at 50%
9     wait1Msec(500); //Wait for one half second
10 }
```

Reference

Using the Synchronizing Motor Command for Point Turns

You can also use the Motor Synchronize command to execute perfect turns. The simplest turn is a point turn. In order to execute a point turn change your **Turn Ratio** to a **negative 100**.

```

1 task main()
2 {
3     nSyncedMotors = synchBC; //Synch motors B & C, B is the master
4     nSyncedTurnRatio = -100; //the wheels will spin in opposite directions
5     motor[motorB] = 50; //the robot's power level is 50%
6     wait1Msec(5000); //the robot will move for five seconds
7 }

```

Using the Synchronizing Motor Command for other types of Turns

You are able to program your robot to execute any type of turn, but it will take experimentation to write code to complete the type of turn that you want. There are a couple of rules to keep in mind

1. The slave motor can be set to any power less than or equal to the master.
2. Because the limit of the Turn Ratio is 100% of the Master Motor's power, the motor which requires the **higher power setting** must always be the Master Motor.
3. Remember to unsynch your motors once you've completed the synchronizing task. To unsynch your motors use the `nSyncedMotors = synchNone;` command.

Below are examples of a Slave Motor's speed if the Master Motor had a speed of 100 and 60.

| Master Motor Speed | 100 | | | | | 60 | | | | |
|--------------------|------|-----|----|------|-------|------|-----|----|------|-------|
| Turn Ratio | 100% | 50% | 0% | -25% | -100% | 100% | 50% | 0% | -25% | -100% |
| Slave Motor Speed | 100 | 50 | 0 | -25 | -100 | 60 | 30 | 0 | -15 | -60 |

The equation used to calculate the Slave Motor Speed is given below.

Slave Motor Power Formula

$$\text{Slave Motor Power} = \text{Master Motor Power} \times \text{Turn Ratio}^*$$

* Turn Ratio in this equation is equal to its value in the program divided by 100.

Synchronizing Motor Command Review

To use Motor Synchronization in ROBOTC, simply type in this command to enable synching:

```
nSyncedMotors = synchBC;
```

This enabled B to be the Master motor, and C to be the Slave. You can also use "synchAB", "synchAC", "synchCB", "synchCA", and "synchBA".

Then you must set the ratio:

```
nSyncedTurnRatio = -100;
```

To unsynch the motors add the following line to your code>

```
nSyncedMotors = synchNone;
```