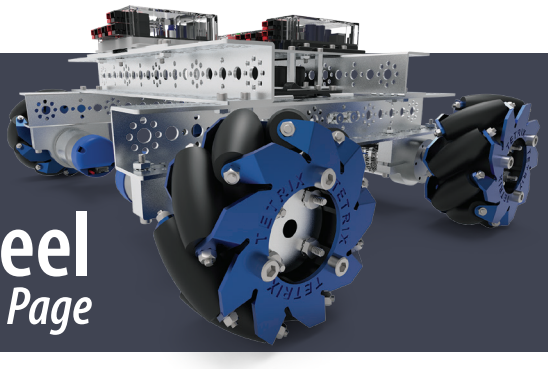
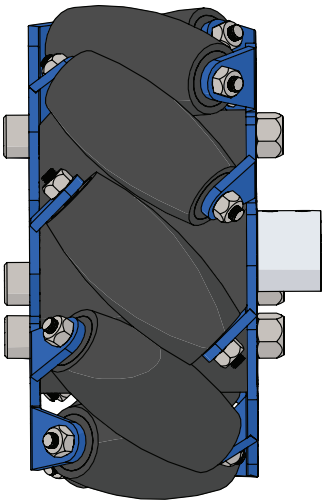
TETRIX® MAX Mecanum Wheel
Resource Page



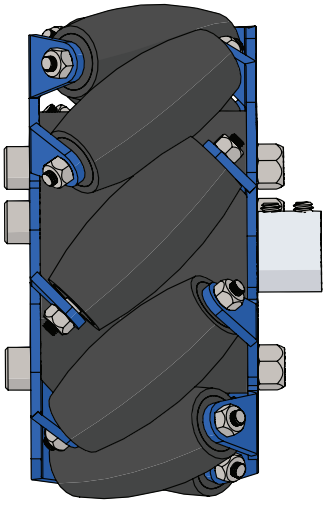
What are Mecanum wheels?

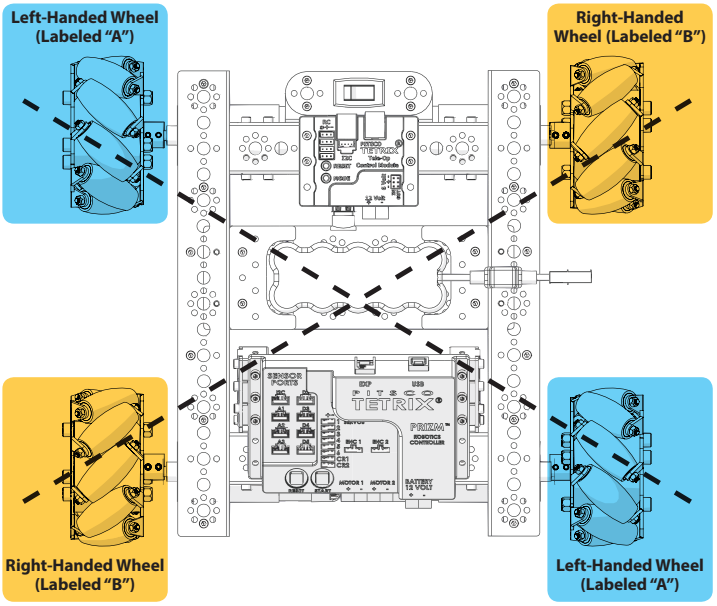
The Mecanum wheel is a specially designed wheel created specifically to allow movement in any direction as required in a holonomic drive. Although it is not the only type of wheel that can be used in holonomic drive systems, it is becoming more and more popular because of its ease of use and practicality. Invented by Bengt Erland Ilon when he worked for the Swedish company Mecanum AB, it was patented in the United States in 1972. It is a conventional wheel with a series of rollers attached to its circumference. These rollers are mounted in very specific way, parallel to the axis of rotation of the wheel and with a specific axis of rotation for the roller to the plane of the wheel. When the wheels are combined in sets of two (two left-handed and two right-handed rollers) and applied to a standard four-wheel robot chassis in opposing corners, conditions are in place for a drive system that qualifies as a holonomic drive. See the following diagrams:

Left-Handed Wheel (Labeled "A")



Right-Handed Wheel (Labeled "B")





Tip: When you look at the wheel as if it was moving away from you, a left-handed roller, or Wheel A, will have the high side of the rollers on the left, while a right-handed roller, or Wheel B, will have the high side of the rollers on the right.

What is a holonomic drive?

In today's realm of robotics, a holonomic drive refers to a drive system that enables robot movement in all directions without requiring chassis rotation as part of that movement. It does provide the ability for chassis rotation, but this is not necessary for a change in the direction of motion. In traditional drive systems using standard wheels or track mechanisms, the robot body must rotate to some degree either prior to, or as part of, a directional change in movement. The ability to rotate independently of the action required to change directions might sound subtle, but it results in a huge difference in maneuverability.

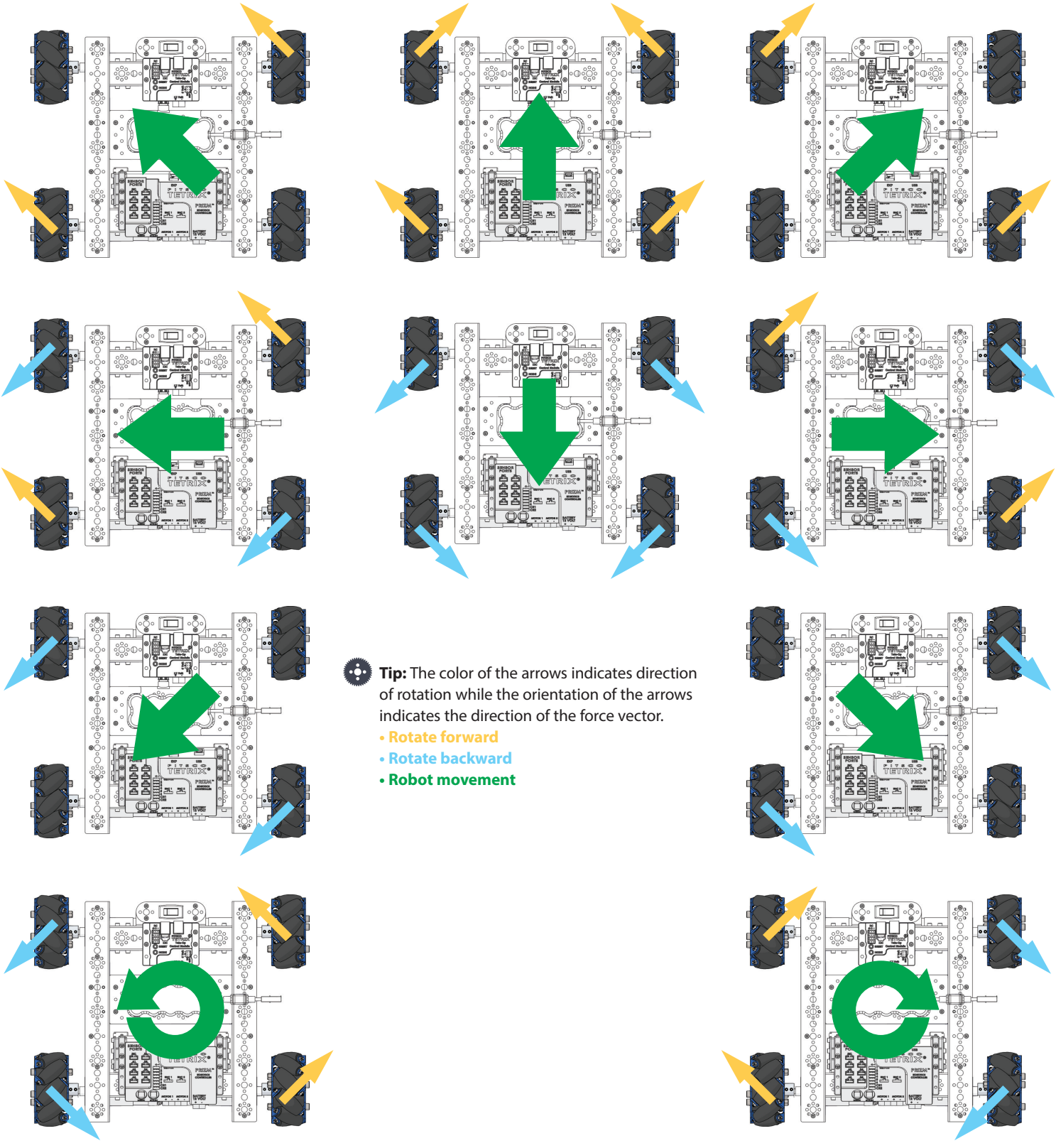
How are holonomic drives used in industry today?

The US Navy bought the patent from Ilon in the 1980s, and in 1997 several companies paid for the rights to the technology to build omnidirectional forklift trucks that can maneuver in very tight places, such as the limited space available on the deck of an aircraft carrier. Other types of drive systems that utilize a similar method for turning typically drag across the ground while turning and sometimes do damage to soft or fragile surfaces as well as require high-torque engines to overcome the high friction due to larger areas of surface contact. The advantages Mecanum wheels offer in minimal ground friction – and lower overall torque requirements – have made this system become more and more implemented not only in vehicles requiring maximum maneuverability but also in specialty loading applications, such as container loaders used for loading and unloading cargo on aircraft.

For downloadable example code for TETRIX® MAX Mecanum Wheels working on a modified PRIZM® TaskBot build or a simple TETRIX PRIZM with a Tele-Op module build, go to https://www.pitsco.com/TETRIX-MAX-Mecanum-Wheels.

How do Mecanum wheels work in a holonomic drive?

In a typical four-wheel configuration, by alternating wheels with left- and right-handed rollers in such a way that each wheel applies force roughly at right angles to the wheelbase diagonal the wheel is on, the robot or vehicle not only is stable but also can be made to move in any direction and turn by varying the speed and direction of rotation for each wheel. Moving all four wheels in the same direction results in forward or backward movement. Moving the wheels on one side in the opposite direction of those on the other side results in rotational movement, while moving the wheels on one diagonal in the opposite direction to those on the other diagonal results in sideways movement. Combinations of these wheel motions results in robot or vehicle motion in any direction with or without any robot or vehicle rotation. To help visualize this, please see the following movement diagram:



Tip: The color of the arrows indicates direction of rotation while the orientation of the arrows indicates the direction of the force vector.

- **Rotate forward**
- **Rotate backward**
- **Robot movement**