

# HOW DO HUMANOID ROBOTS WORK?

Once considered science fiction, humanoid robots are a reality today. BLDC motor manufacturers are helping advance robotics technologies, making them more sophisticated than ever before.

## THE RISE OF ROBOTS

### 35 MILLION UNITS:

Sales of personal service robots between 2015 & 2018

Of those sold: 1.5 million of them have social robot characteristics

### 1 IN 10

American households will own a consumer robot by 2020

The USA is currently the fourth largest single market for industrial robots in the world

### BY 2019:

More than 1.4 million new industrial robots will be installed in factories around the world

The number of industrial robots deployed worldwide will increase to around 2.6 million units by 2019

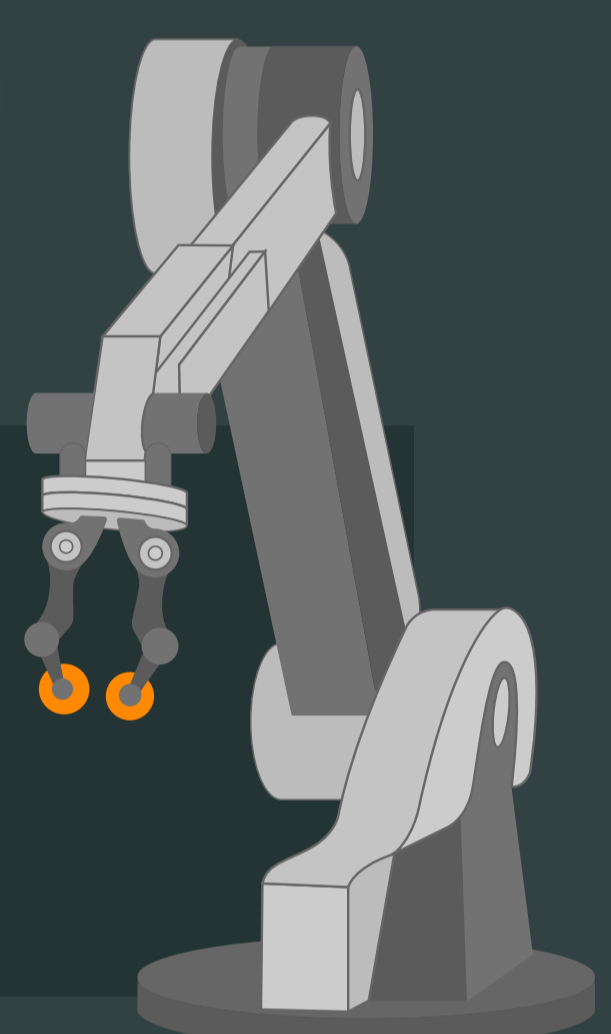
## BLDC MOTORS BEHIND ROBOTIC MOVEMENTS

### HUMANOID ROBOTS HAVE THREE ROBOTICS PRIMITIVES:

## 1. SENSORS:

Proprioceptive sensors in a robot allow it to perceive the orientation, position and speed in its joints and body using accelerometers, tilt sensors, force sensors, speed sensors and position sensors.

Tactels allow a robot to receive data about what it's touching. The sensors also relay information about the torque and force between the humanoid robot and objects with which it interacts.



## 2. ACTUATORS:

Actuators found in BLDC motors make humanoid robots move. They act like joints and muscles to mimic human movements.

Types of actuators used include:



Hydraulic



Electric



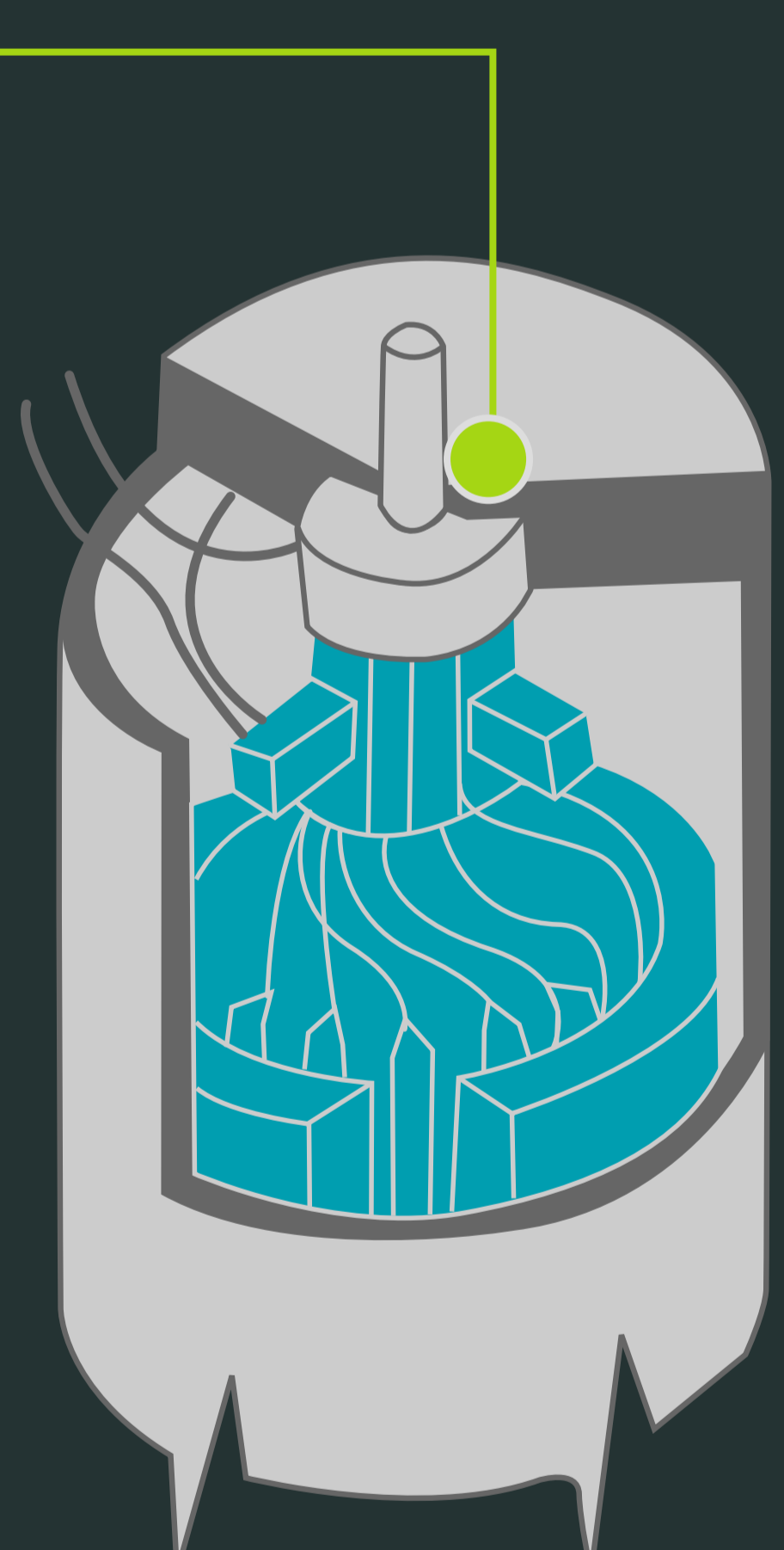
Piezoelectric



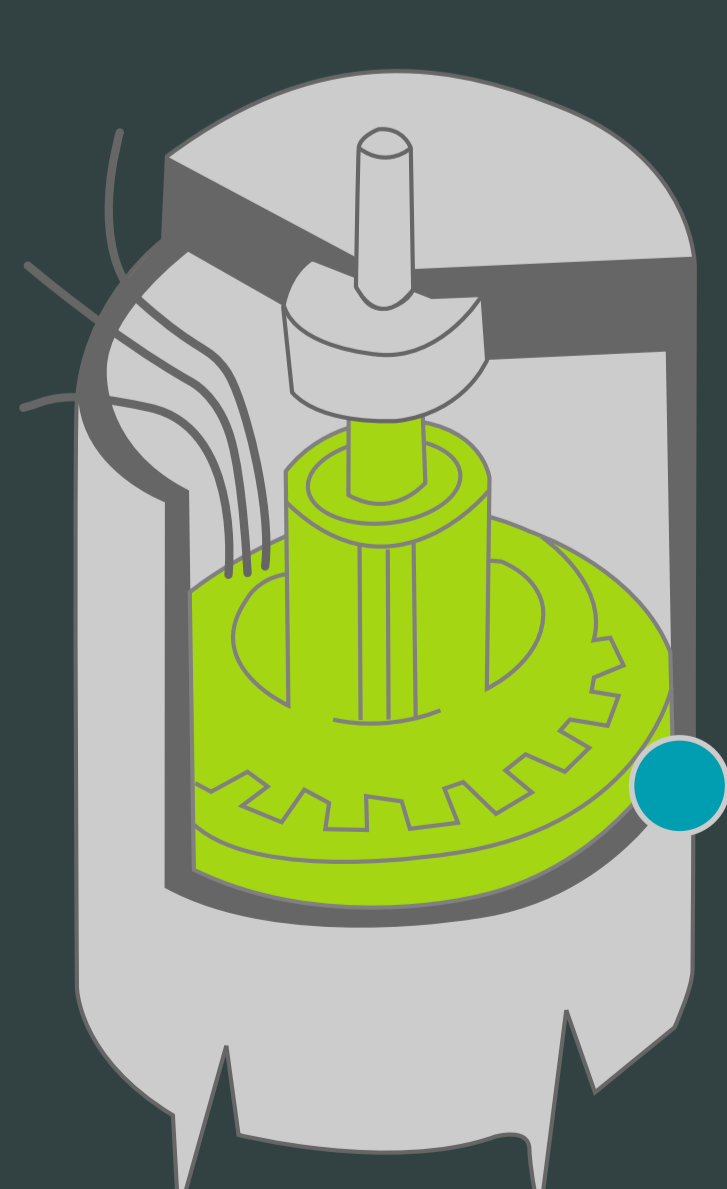
Ultrasonic



Pneumatic



## 3. PLANNING AND CONTROL:



Planning and control defines the difference between humanoid robots and other types of robots because a humanoid robot uses legged locomotion with a biped gait.

Brushless DC motors help ensure the walking motions use energy efficiently while keeping the robot stable.