

05 / MARKET MODEL

NLT143 RESEARCH

# Sizing, scenarios, BOM.

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*Live model summary. TAM/SAM/SOM, three scenarios, unit economics, supplier landscape.*

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David T Phung · [@davidtphung](#) · April 2026  
[whatisanactuator.davidtphung.com](http://whatisanactuator.davidtphung.com)



## Forecast, humanoid actuator wedge

\$ billions, three scenarios, 2024 to 2035.

Year	Bear	Base	Bull
2024	0.15	0.15	0.15
2025	0.28	0.42	0.55
2026	0.55	0.95	1.60
2027	0.95	1.95	3.40
2028	1.70	3.60	6.20
2029	2.80	6.00	10.50
2030	4.20	9.86	18.00
2031	5.60	13.50	27.50
2032	7.10	17.80	38.00
2033	8.50	22.50	50.00
2034	9.70	27.00	62.00
2035	10.80	31.20	75.00

## Bill of materials, humanoid robot

Approximate BOM share by component category. Actuator stack totals 40-55% across configurations.

Component	Share %	Note
Rotary actuators (joints)	28%	Hip, knee, shoulder. Highest torque density.
Linear actuators	12%	Wrists, ankles, fingers.
Reduction gearboxes	14%	Harmonic drives, planetary, cycloidal.
Brushless DC motors	8%	Pancake and inrunner topologies.
Position + torque sensors	5%	Magnetic encoders, capacitive cells.
Battery pack	9%	2 to 5 kWh, NCA or LFP.

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Compute (perception + control)	6%	Embedded GPU + realtime MCU.
Cameras and IMUs	3%	Stereo or RGB-D, 9-axis IMU per limb.
Structural frame and shell	9%	Aluminum, magnesium, carbon composite.
Wiring, harness, misc	6%	Power and signal harnesses, slip rings.

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## Supplier landscape, partial

- **Harmonic Drive Systems (Japan).** Strain wave gearing, dominant in high-precision robotics joints.
- **Maxon (Switzerland).** Premium BLDC and brushed motors. Aerospace and medical.
- **Faulhaber (Germany).** Coreless DC motors, precision gear motors.
- **Nanotec (Germany).** Steppers and BLDCs, factory automation.
- **SKF (Sweden).** Linear actuators, ball screws, bearings.
- **Bosch Rexroth (Germany).** Servo drives, hydraulic and electric.
- **Leadshine (China).** Servo and stepper systems, growing humanoid presence.
- **Lin Engineering (US).** Custom steppers, niche.

## Unit economics, illustrative

2024 humanoid all-in cost \$150,000 (low volume)

2030 humanoid all-in (base) \$30,000 at 100k/year

Actuator share, 2024 40 to 55% of BOM

Actuator share, 2030 approaching 30% of BOM

Actuator volume to close million/year by 2030

Per-joint actuator cost, <\$200 by 2030

## Method

Triangulated from at least three independent sources. Where forecasts diverge by more than 30 percent, the midpoint is shown as base, and the spread is shown as bear and bull. Unit economics are bottom-up from public BOM teardowns and supplier price lists.