# ARCHIMEDES DRIVE

PRECISION REIMAGINED

IMSystems

DISCOVER

# ARCHIMEDES DRIVE

Introducing the next evolution in speed reducer technology: **The Archimedes Drive**. This innovative system replaces traditional gears with rollers to enhance performance, precision and safety standards:

- With backlash eliminated. Robots execute movements with **5x greater accuracy and consistency**.
- Equipped with built-in overtorque protection, the Archimedes Drive safeguards actuators against unpredictable conditions, ensuring **reliable performance** even in the most challenging environments.
- With actuators that are **25x stiffer**, the Archimedes Drive enables robots to perform more precise and reliable movements. Experience a new era where machines operate with precision beyond conventional limits, thanks to the Archimedes Drive's advanced capabilities.

## TRUE ZERO BACKLASH

**0 play** between components for ultra- high precision

*READ MORE ON PAGE 12*

## EFFICIENCY

**20%** higher efficiency

*READ MORE ON PAGE 15*

## OVERTORQUE

**No noteworthy damage** caused by exceeding nominal torque

*READ MORE ON PAGE 13*

## STIFFNESS

Highly **accurate** positions

*READ MORE ON PAGE 14*

## QUIET

**32x** less intense noise

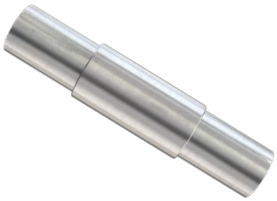
*READ MORE ON PAGE 16*

LEARN MORE ABOUT OUR

# GROUNDBREAKING TECH

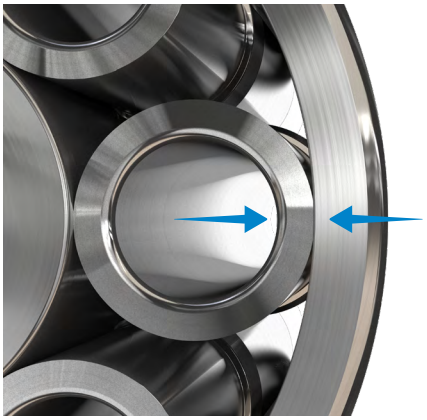
The Archimedes Drive represents a groundbreaking patented drive technology that utilizes smooth and hollow traction rollers (called Flexrollers). These Flexrollers are placed into a **compound planetary drive** arrangement. This innovative technology provides **continuous tractive contact** among the drive components, resulting in superior performance. A radical breakthrough to create a new benchmark in mechatronic precision.

*Archimedes Drive Flexroller*



## SUPERIOR SMOOTH CONTROL

The smooth surfaces without any clearance between the contact patches make the drive **completely backlash-free**. Using rolling contact instead of sliding contact allows superior smooth control. It ensures remarkable precision and speed, offering a guarantee of **efficiency and reliability in operation**.



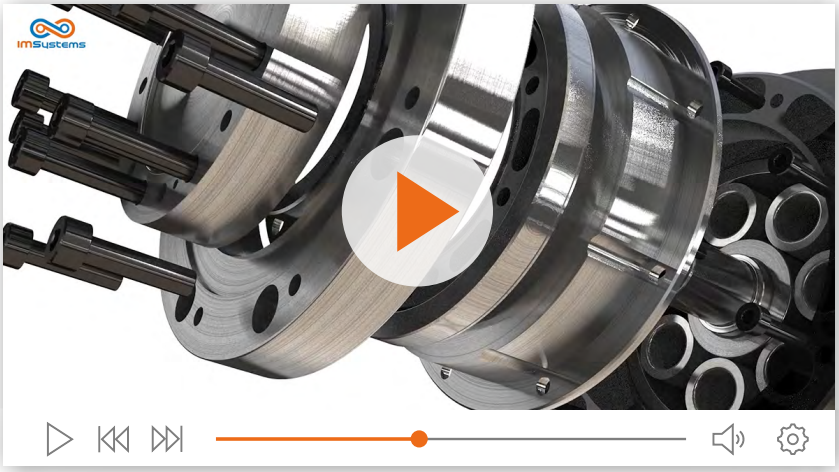
### CONTINUOUS TRACTIVE CONTACT

By eliminating any gaps or clearance between the contact patches, the drive ensures **uninterrupted power transmission**. This seamless flow significantly enhances the accuracy and precision of robotic movements, marking a significant advancement for applications that demand **high precision.**

EXPERIENCE

# THE ONLY TRUE ZERO BACKLASH

Step into the forefront of mechatronics and robotic design with the Archimedes Drive by IMSystems. This groundbreaking innovation redefines speed reducers, elevating precision and performance to unprecedented levels. Join us in this video as we delve into the unique features and capabilities of this **revolutionary technology**.




**CLICK TO WATCH**

EXPLORE OUR TECHNOLOGY

# APPLICATIONS

The Archimedes Drive's versatility and performance make it a valuable technology in various industries, where precise motion control and reliability are essential requirements. Some notable applications include:

## INDUSTRIAL ROBOTICS

LEARN MORE

## HUMANOID ROBOTICS

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## HARSH ENVIRONMENTS

LEARN MORE

## MANUFACTURING EQUIPMENT

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## AGRICULTURAL ROBOTICS

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## HAPTIC TECHNOLOGY

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## MEDICAL DEVICES

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**APPLICATION WEBPAGE**

# EXPERTISE AT HEART

## MANAGEMENT

**Alfons Schure**
CTO

**Jack Schorsch**
Inventor
CEO

**Matthew Corvers**
Co-Founder
Head of Production

**Rory Deen**
Co-Founder
CFO

**Thibaud Verschoor**
Co-Founder
Head of Product

## ENGINEERING - Technical excellence

**Job Neven**
R&D Engineer

**Morteza Abouhamzeh**
FEA Engineer

**John Tan**
Design Engineer

**Matthijs Koornneef**
R&D Engineer

**Dmitrii Sergachev**
Test&Analysis Engineer

**Alexander Storm**
Design Engineer

**Yaron Adar**
Mechatronic Design Engineer

**Yannick van den Berg**
Junior Design Engineer

**Patrik Larsson**
Junior Mechatronic System Designer

## BUSINESS DEVELOPMENT - Dedicated partners

**Sten Lindwall**
VP of Sales

**Rajendra Patel**
Business Developer

## SUPPORT - Operational expertise

**Casper van Eersel**
Marketing Manager

**Cin Yie Chang**
Graphic Designer

**Ilse Kool**
Graphic Designer

**Morgane Chaix**
Marketing Data Analyst

**Tara Uitterlinden**
Office Manager

MEET THE

# ARCHIMEDES DRIVE

PRODUCT PORTFOLIO

# SPECIFICATIONS

| | Unit | DELTA-SERIES | EPSILON-SERIES | SYNOVIAL-SERIES | COMPONENT SET |
|---|---|---|---|---|---|
| Repeated Torque | Nm | 15-250 | 1-500 | 1-250 | 1-500 |
| Nominal Torque | Nm | 8-125 | 0.5-250 | 35 | 0.5-250 |
| Slip Torque | Nm | 18-280 | 1.5-600 | 88 | 1.5-600 |
| Backlash | arcmin | 0 | <0.8 | 0 | 0 |
| Max. Lost Motion | arcmin | 0.2 | 0.8 | 0.2 | 0.2 |
| Torsional Stiffness | Nm/arcmin | 11-50 | 5-200 | 50 | 5-200 |
| Max. Input Speed | rpm | >8,000 | >8,000 | >8,000 | >8,000 |
| Average Input Speed | rpm | 4,000 | 4,000 | 4,000 | 4,000 |
| Efficiency | % | up to 90 | up to 90 | up to 90 | up to 90 |
| Reduction Ratio | {-} | 25:1-35:1 | 25:1-200:1 | 25:1-200:1 | 25:1-200:1 |
| Noise Level | dBA | <50 | <50 | <50 | <50 |
| Output Rotation | deg. | 270 | continuous | continuous | continuous |
| Diameter | mm | 72-120 | tailored | 70 | tailored |
| Length | mm | 60-180 | tailored | 90 | tailored |
| Weight | kg | 1-10 | tailored | 1.1 | tailored |
| Ambiant Temperature | °C | -20 to 60 | -20 to 60 | -20 to 60 | -20 to 60 |
| Back Drive | Y/N | Yes | Yes | Yes | Yes |
| Hollow Shaft | Y/N | No | Yes | Yes | Yes |
| Lubrication | Cycles | For life | For life | For life | For life |
| Service Life | Hours | >20,000 | >20,000 | >20,000 | >20,000 |

VIEW MORE

**SPECIFICATIONS**

BROWSE THE

# PRODUCT CATALOGUE

## DELTA-SERIES

Introducing the DELTA-SERIES Archimedes Drive, the leading edge in compound planetary traction drive technology. The DELTA-SERIES stands out for its exceptional **smooth control**, maintaining performance even under **harsh conditions**. With a **stiffness rating up to 25 times greater** than other drive technologies, it ensures highly controlled movements and enhanced accuracy. This series provides optimal solutions for robots needing high-speed and precise movements, with Delta Robots as the prime application.

| | DELTA-15 | DELTA-250 | DELTA-CUSTOM |
|---|---|---|---|
| Repeated Torque | 15Nm | 250Nm | 250Nm |
| Reduction Ratio | 25:1 | 35:1 | 35:1 |
| Output Rotation | 270° | 270° | 270° |

## EPSILON-SERIES

The EPSILON-SERIES showcases dual-stage Archimedes Drives, meticulously engineered for **continuous rotation**, and designed to meet the rigorous demands of precision, speed, and ongoing operation in industrial robotics applications. Each unit features a hollow shaft and a **motor plate**, offering customizable options to suit specific needs.
The EPSILON-SERIES is known for its **reliable performance** and robustness. It excels in stiffness and efficiency, while operating quietly, making it versatile across various applications.

| | EPSILON-250 | EPSILON-CUSTOM |
|---|---|---|
| Repeated Torque | 250Nm | 15 - 500Nm |
| Reduction Ratio | 100:1 | 25:1 - 200:1 |
| Output Rotation | continuous | continuous |

# SYNOVIAL-SERIES

The SYNOVIAL Archimedes Drive is a lightweight, **high-torque-density** solution designed for applications requiring high precision and minimal weight. This SERIES emphasizes compactness and seamless integration, featuring small dimensions, a **lightweight design**, and an **integrated motor** for straightforward implementation. The SYNOVIAL-SERIES is ideally suited for projects that demand exceptional precision in unpredictable environments.

| | SYNOVIAL-75 | SYNOVIAL-CUSTOM |
|---|---|---|
| Repeated Torque | 75Nm | 15 - 250Nm |
| Reduction Ratio | 30:1 | 25:1 - 200:1 |
| Output Rotation | continuous | continuous |

# COMPONENT SET

The component set of the Archimedes Drive, featuring the core technology **without the housing**, provides exceptional flexibility for seamless integration into your specific applications. This design allows for the **direct incorporation** of high-performance drive technology, maximizing the benefits of precision and efficiency within your systems. Opting for this approach not only **saves space and reduces weight**—key for compact and high-performance applications.

| | COMPONENT SET |
|---|---|
| Repeated Torque | 15 - 500Nm |
| Reduction Ratio | 25:1 - 200:1 |
| Output Rotation | continuous |

## CUSTOM DESIGN

**MAKE REQUEST**

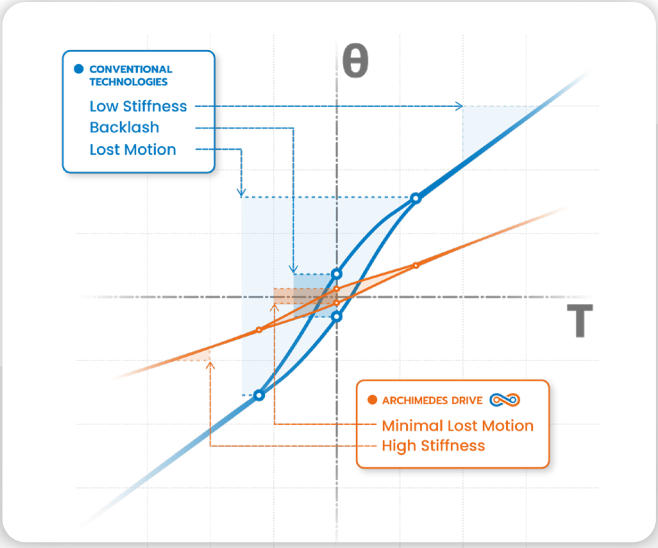
UNDERSTAND THE

# BENEFITS

UTILIZE

# ULTIMATE PRECISION

The Archimedes Drive provides **unparalleled precision** in mechatronics, featuring true zero backlash, actuators that are **25x stiffer** and lost motion reduced to less than 0.2 arcminutes. This enables robots to operate with enhanced precision and increased versatility in industrial tasks such as handling delicate components, navigating complex assembly lines and positioning materials accurately. The plot below illustrates the change in bidirectional rotational position as a function of output torque, when the input of the drive is fixed. In other words, the amount of deviation from the intended target that results from play between a drive's components.




*(X axis – Output Torque (T) in Nm, Y axis – Output rotation (θ) in deg.)*

The performance features unique to the Archimedes Drive are then compared with existing technologies.

1. The Archimedes Drive presents **a low and constant gradient** thanks to its extreme stiffness and smooth controllability. This makes your operations run reliably every time.

2. The center curve showcases the unpredictable backlash that can occur due to space between internal meshing parts. Our drive features **constant tractive contact**, thus removing worries about deviations or vibrations. With the absence of backlash you can innovate with precision.

SET UP

# A NEW LEVEL OF SAFETY

The internal mechanism of the Archimedes Drive is designed to enter a sliding regime in the event of an overtorque (collision, vibration, shockloads). This means that if the drive encounters a shock at the output, its Flexrollers are engineered to slip, allowing the drive to absorb and dissipate the excess force throughout its components. This unique capability makes the Archimedes Drive exceptionally resilient and reliable in situations involving overload or shock loads without significant damage, ensuring safer operation under challenging conditions.

## ADDRESSING INCORRECT OPERATOR MOVEMENTS

Thanks to its high backdrivability, the Archimedes Drive can **effectively manage unintended output forces** caused by operator errors or mispositioning. For instance, if an operator needs to manually adjust the robot's position, the drive accommodates this without damage, swiftly resuming standard functionality.

## IN THE CASE OF HEAVY SHOCKS

When subjected to forces beyond its nominal torque, the Archimedes Drive seamlessly transitions into a sliding regime up to its slip torque limit. Beyond this point, it fully engages the **sliding regime**, allowing the mechanical components to endure the shock and revert to normal operations once the external torque levels normalize.

## ABSOLUTE ACCURACY

The enhanced stiffness of the drive enables robots to perform **exceptionally precise movements** without sacrificing accuracy or performance. This structural rigidity is crucial for preventing deformation during operations, which in turn protects against potential accidents or instability. Consequently, this ensures greater stability and safety during operations. Such robustness makes it possible for robots to undertake sensitive and delicate tasks, such as surgery or product manipulation, without risks.

INCORPORATE THE

# TRANSPARENCY

Gearbox transparency is the ability of a gearbox or speed reducer to effectively transfer and translate the force from the motor to the output shaft without significant loss or alteration. A very rigid speed reducer has a high transparency, providing precise control and accurate performance to your robotic or mechatronic system.

## CONTROLLABILITY

With **great transparency** comes great controllability, as the system is enabled to be precise and stable, with minimized backlash, friction, and vibrations. Plus, the Archimedes Drive **removes backlash completely**.

## PROGRAMMING

Spend **less time programming** since you don't have to account for inefficiencies and errors. **Input commands to the motor closely match the desired output** movements of the robot. Creating control algorithms becomes easier and faster, with fewer errors and inconsistencies.

REAP THE BENEFITS OF

# HIGH EFFICIENCY

The Archimedes Drive is capable of operating at high **efficiencies of up to 95%**. Thanks to its smooth continuous contact surface less energy is wasted through overheating, vibrations, and noise. This provides the drive with a stellar combination of efficiency and accuracy.

| >8.000 rpm | >90% | <0.2 arcmin |
|---|---|---|
| Input speed | Efficiency | Lost motion |

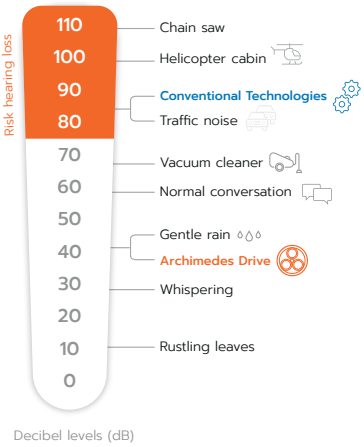
Efficiency is of utmost importance when designing and building machines. Inefficient applications can waste high amounts of energy on redundant losses. By implementing the Archimedes Drive in your mechatronic application you can enjoy several benefits, such as:

1. **LOWER COST & FOOTPRINT**
   *Less energy used to perform the same task*
2. **LONGER LIFESPAN**
   *Reduced wear on internal components*
3. **IMPROVED BATTERY LIFE**
   *Batteries are used more efficiently, making them last longer*
4. **PLEASANT ENVIRONMENT**
   *Decreased heat and noise improve working conditions*
5. **SUPERIOR CONTROL PERFORMANCE**
   *Lower vibration and friction result in smooth control*

ENJOY THE

# QUIET OPERATION

The Archimedes Drive runs with low noise thanks to the lack of backlash and vibrations. As worker health is becoming a growing concern, companies turn to **better noise control** equipment to protect their employees.




! The decibel scale used for measuring noise intensity is logarithmic, creating some interesting principles:

**The 3 dB trading effect =** a 3dB noise increase doubles the level of the sound pressure

**The 5 dB exchange rate =** a 5dB increase halves the permissible exposure time to the sound

To put things in perspective, a typical conversation measures around 60 dB, and a vacuum cleaner runs at 70 dB. In comparison, the Archimedes Drive produces between **36.6-50.2 dB**. This would be the equivalent of a gentle rain, with a frequency similar to that of white noise, making it much more pleasant to the human ear.

During internal sound testing between the Archimedes Drive and an equivalent strain wave gearbox alternative (which is typically quieter than spur or helical gears), the IMSystems Archimedes Drive has produced lower noise levels, the results of which you can see below.

| | Unit | Conventional Technologies | Archimedes Drive setup |
|---|---|---|---|
| Average Noise Level | *dB(A)* | 44.5 | 39.9 |
| Minimum Noise Level | *dB(A)* | 36.7 | 36.6 |
| Maximum Noise Level | *dB(A)* | 65.3 | 50.2 |

MEET WITH

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Schedule meeting

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