Motion hexapods catalog
Welcome

Welcome to SYMETRIE! In browsing this catalogue, you will find the best possible dynamic solutions to cater to your demanding applications.

Always looking to increase the performance of our hexapods, our growing team works hand in hand to integrate the latest available technology.

This is why SYMETRIE is first and foremost an R&D company. Thanks to our experience providing hexapods for industry and research laboratories, we will be able to quickly answer your needs.

Olivier Lapierre & Thierry Roux
Co-founders, CEO & CTO

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SYMETRIE company

Design department

SYMETRIE’s engineering office consists of mechanical, electronics and software engineers. Our R&D department is continuously seeking for improvement, with a major effort on control software.

Workshops

All our hexapods and controllers are assembled in our mechanical and electronics workshops using standardized procedures.

Clean room

In our ISO 7 (class 10000) clean room, we mount the hexapods for applications, which are sensible to environmental contamination, such as optics, space or particle accelerators. In a clean room the concentration of particles is controlled and minimized.

Metrology laboratory

To demonstrate high precision performances, SYMETRIE is equipped with a wide range of metrology tools: laser interferometers, laser trackers, coordinate measuring machine (CMM), electronic inclinometers, capacitive sensors, accelerometers.
A promising experience and vision

SYMETRIE’s trusted R&D skills led to the birth of the positioning and motion hexapods

SYMETRIE was created in 2001 with the hexapod technology as a baseline. This innovative system was quickly spotted by the highest research institutions which asked SYMETRIE for a high precision hexapod to position the target of the MegaJoule Laser, a high energy inertial confinement fusion device in France.

The following contracts, still more ambitious, trusted the company to add dynamic motion capabilities to its hexapods systems. SYMETRIE succeeded once again in delivering up to 1g acceleration to slosh 10 ton liquid gas tanks for maritime transportation.

The acquired experience and trust built among a nascent network of customers were the beginning of an involvement in a wide array of technological projects, such as the Gaia satellite and the James Webb Space Telescope among others.

Innovation is a key factor of our development. Our R&D department works every day to improve our technologies and control systems using the latest generation components and techniques for higher quality products.

High precision positioning system of the target of Laser MegaJoule with 1 µm resolution in the convergence center of 176 laser beams. Harsh environment: high vacuum, radiations.

A 4 meter tall swell simulation hexapod with up to 10 ton payload, 1 m/s speed and 1 g acceleration.
From standard hexapods to custom designs

To cater to your needs in the smoothest way, SYMETRIE offers a range of turnkey hexapods.

- Better price and lead time: We look forward to offering hexapods which have already been designed.
- Ease project definition: Offering a coherent range where the hexapods differentiate between each other with unique features allows you to easier select and understand the capabilities that you will get.

SYMETRIE remains a trustworthy designer for customized solutions and can provide custom designs in a short time thanks to an in-house software enabling to quickly create a hexapod geometry with respect to the customer’s input parameters.

With more than 20 years hexapod background, SYMETRIE is experienced in choosing and using the most adapted technologies in terms of motors, encoders, joints… according to the customer’s application.

Our roots: metrology specialists with innovative minds

The two co-founders of SYMETRIE, Olivier Lapierre and Thierry Roux, were previously working for LNE, the French national metrology and testing laboratory. Specialized in dimensional metrology, they were looking for an innovative and efficient 6 DOF measurement system to quickly calibrate machine-tools and thought of the hexapod as a perfect solution.

The dimensional metrology grain remains running through the veins of SYMETRIE at each one of its footsteps. Thanks to an experienced metrology staff, SYMETRIE knows how to qualify and test the hexapods before delivery to validate conformity.
Hexapod technology

6 Degrees Of Freedom

A hexapod is a parallel kinematic structure composed of a mobile platform linked to a fixed platform with 6 actuators.

This design allows to move an object placed on the mobile platform with 6 DOF (Degrees Of Freedom). In other words, the hexapod can move an object along the 3 translations (Tx, Ty, Tz) and the 3 rotations (Rx, Ry, Rz); any combination is possible.

Configurable pivot point

In order to orientate the mobile platform in the desired way, a 3D rotation center has to be defined. This point is not limited to the center of the mobile platform and can be placed wherever the user needs it to be.
## Overview of the product range

<table>
<thead>
<tr>
<th>Name</th>
<th>Payload</th>
<th>Linear travel range</th>
<th>Angular travel range</th>
<th>Speed</th>
<th>Height at midrange</th>
</tr>
</thead>
<tbody>
<tr>
<td>HEGOA</td>
<td>50 kg</td>
<td>± 100 mm</td>
<td>± 23°</td>
<td>0.2 m/s</td>
<td>0.42 m</td>
</tr>
<tr>
<td>NOTUS P</td>
<td>200 kg</td>
<td>± 250 mm</td>
<td>± 20°</td>
<td>0.8 m/s</td>
<td>1.10 m</td>
</tr>
<tr>
<td>NOTUS V</td>
<td>100 kg</td>
<td>± 250 mm</td>
<td>± 20°</td>
<td>1.2 m/s</td>
<td>1.10 m</td>
</tr>
<tr>
<td>MISTRAL 600P</td>
<td>1 000 kg</td>
<td>± 400 mm</td>
<td>± 30°</td>
<td>1 m/s</td>
<td>1.44 m</td>
</tr>
<tr>
<td>MISTRAL 600V</td>
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<td>± 400 mm</td>
<td>± 30°</td>
<td>1.2 m/s</td>
<td>1.44 m</td>
</tr>
<tr>
<td>MISTRAL 800P</td>
<td>1 000 kg</td>
<td>± 460 mm</td>
<td>± 30°</td>
<td>1 m/s</td>
<td>1.77 m</td>
</tr>
<tr>
<td>MISTRAL 800V</td>
<td>500 kg</td>
<td>± 460 mm</td>
<td>± 30°</td>
<td>1.2 m/s</td>
<td>1.77 m</td>
</tr>
<tr>
<td>SIROCCO</td>
<td>2 000 kg</td>
<td>± 600 mm</td>
<td>± 40°</td>
<td>2.5 m/s</td>
<td>2.85 m</td>
</tr>
<tr>
<td>AQUILON</td>
<td>6 000 kg</td>
<td>± 800 mm</td>
<td>± 40°</td>
<td>1.8 m/s</td>
<td>3.31 m</td>
</tr>
</tbody>
</table>
HEGOA *hexapod*

Compact dynamic hexapod

**KEY FEATURES**
- Payload capacity 50 kg
- Angular travel range ± 23°
- Compact height: 420 mm

**APPLICATIONS**
- Motion simulator
- Naval
- Automotive
- Biomedical
- Defense
- Optics

*HEGOA hexapod testing the motion compensation performances of a gyro stabilized platform.*

*HEGOA hexapod with a drone equipped with a camera to test the reactions of the system during flight movements.*
**Motion and positioning**

- Travel range $T_x, T_y$ (mm): ± 100
- Travel range $T_z$ (mm): ± 50
- Travel range $R_x, R_y$ (deg): ± 23
- Travel range $R_z$ (deg): ± 30
- Speed $T_x, T_y$ (mm/s): ± 200
- Speed $T_z$ (mm/s): ± 120
- Speed $R_x, R_y, R_z$ (°/s): ± 50
- Acceleration $T_x, T_y, T_z$ (mm/s²): ± 800
- Acceleration $R_x, R_y, R_z$ (°/s²): ± 200

**Mechanical properties**

- Payload capacity (kg): 50 / 15
- Motor type: Brushless motor with absolute encoder

**Miscellaneous**

- Operating temperature range (°C): + 10 to + 40
- Size mobile platform (mm): Ø 322
- Height in middle position (mm): 420
- Mass (kg): 30
- Cable length (m): 5

**Options**

- Outdoor
- Acquisition (storage of motions)
- API
- External real-time trajectory control (ERTT)

**Controller**

- Interface: Ethernet
- Power supply: 110-240 VAC / 50-60 Hz

*The performances are specified for single axis motions, with all other axes at midrange and for a rotation center in the middle of the mobile platform.*
NOTUS hexapod
Mid-sized dynamic hexapod

KEY FEATURES
- Payload capacity 200 kg
- Linear travel range ± 250 mm
- Angular travel range ± 25°
- Compact

APLICATIONS
- Motion simulator
- Naval
- Swell simulator
- Biomedical
- Defense
- Optics

NOTUS enables testing the gyroscopic platform of a cold atom gravimeter that will be later installed on a ship by ONERA. The hexapod reproduces the swell motions and the ship vibrations.

NOTUS hexapod allows to test the stabilization system of a camera that can be later installed on a tank, a truck or a boat.

NOTUS hexapod helps to characterize and calibrate electro-optics gimbals that will be later installed on helicopters.
The performances are specified for single axis motions, with all other axes at midrange and for a rotation center in the middle of the mobile platform.

<table>
<thead>
<tr>
<th></th>
<th>NOTUS P</th>
<th>NOTUS V</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Motion and positioning</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Travel range $T_x$, $T_y$ (mm)</td>
<td>$\pm 250$</td>
<td>$\pm 250$</td>
</tr>
<tr>
<td>Travel range $T_z$ (mm)</td>
<td>$\pm 200$</td>
<td>$\pm 200$</td>
</tr>
<tr>
<td>Travel range $R_x$, $R_y$ (deg)</td>
<td>$\pm 25$</td>
<td>$\pm 25$</td>
</tr>
<tr>
<td>Travel range $R_z$ (deg)</td>
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<td>$\pm 30$</td>
</tr>
<tr>
<td>Speed $T_x$, $T_y$ (mm/s)</td>
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<td>$\pm 1200$</td>
</tr>
<tr>
<td>Speed $T_z$ (mm/s)</td>
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<td>$\pm 640$</td>
</tr>
<tr>
<td>Speed $R_x$, $R_y$, $R_z$ (°/s)</td>
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<td>$\pm 135$</td>
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<tr>
<td>Acceleration $T_x$, $T_y$ (mm/s²)</td>
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<td>$\pm 10,000$</td>
</tr>
<tr>
<td>Acceleration $T_z$ (mm/s²)</td>
<td>$\pm 6,000$</td>
<td>$\pm 10,000$</td>
</tr>
<tr>
<td>Acceleration $R_x$, $R_y$, $R_z$ (°/s²)</td>
<td>$\pm 1,000$</td>
<td>$\pm 2,000$</td>
</tr>
<tr>
<td><strong>Mechanical properties</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Payload capacity (kg) (vertical orientation only)</td>
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<td>100</td>
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<td>Brushless</td>
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<td></td>
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<tr>
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<td>0 to +40</td>
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<tr>
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<td>Ø 660</td>
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<td>Height in middle position (mm)</td>
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<td>~1080</td>
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<tr>
<td>Mass (kg)</td>
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<td>~120</td>
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<tr>
<td>Cable length (m)</td>
<td>7</td>
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<tr>
<td>Options</td>
<td>Outdoor</td>
<td>Wave basin</td>
</tr>
<tr>
<td></td>
<td>Specific joints for large angles</td>
<td>Extra Rz rotation in the mobile platform (C axis)</td>
</tr>
<tr>
<td></td>
<td>Acquisition (storage of motions)</td>
<td>API</td>
</tr>
<tr>
<td></td>
<td>External real-time trajectory control (ERTT)</td>
<td></td>
</tr>
<tr>
<td><strong>Controller</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interface</td>
<td>Ethernet</td>
<td>Ethernet</td>
</tr>
<tr>
<td>Power supply</td>
<td>400 VAC (three-phase) / 16 A / 50-60 Hz</td>
<td></td>
</tr>
</tbody>
</table>

The performances are specified for single axis motions, with all other axes at midrange and for a rotation center in the middle of the mobile platform.
MISTRAL hexapod
Dynamic hexapod for motion

KEY FEATURES
- Payload capacity up to 1 ton
- Linear travel range ± 460 mm
- Angular travel range ± 30°

APPLICATIONS
- Motion simulator
- High payload positioner
- Driving simulator
- Swell simulator

MISTRAL hexapod reproduces ship motions to test the stabilization performances of large maritime SATCOM antennas.

MISTRAL hexapod simulates the motion of a floating gas production unit to characterize hydrodynamic effects of swell on the chemical reactions in a gas deacidification column. These tests allow to improve performance and robustness of the processing units.

MISTRAL hexapod orients a ship model in a wave basin to reproduce maritime conditions and test the shipbuilding techniques.

The surfers can practice various wave situations played by our Simusurf hexapod and improve their gestures through practice and analysis by recording their movements with additional sensors. Simusurf hexapod can be used as a discovery and learning tool for the casual surfer or as a performance and training tool for the professional surfer.

Credits: Thales, Ifremer, I2M-ENSAM, Total
### Motion and positioning

<table>
<thead>
<tr>
<th></th>
<th>MISTRAL 600</th>
<th>MISTRAL 800</th>
</tr>
</thead>
<tbody>
<tr>
<td>Travel range Tx, Ty (mm)</td>
<td>± 400</td>
<td>± 460</td>
</tr>
<tr>
<td>Travel range Rx, Ry (deg)</td>
<td>± 30</td>
<td>± 30</td>
</tr>
<tr>
<td>Speed Tx, Ty, (mm/s)</td>
<td>± 1 000</td>
<td>± 1 000</td>
</tr>
<tr>
<td>Speed Rx, Ry (°/s)</td>
<td>± 50</td>
<td>± 50</td>
</tr>
<tr>
<td>Acceleration Tx, Ty, (mm/s²)</td>
<td>± 5 000</td>
<td>± 5 000</td>
</tr>
<tr>
<td>Acceleration Rx, Ry (°/s²)</td>
<td>± 500</td>
<td>± 500</td>
</tr>
<tr>
<td>Acceleration Tz (mm/s²)</td>
<td>± 6 000</td>
<td>± 6 000</td>
</tr>
<tr>
<td>Travel range Tz (mm)</td>
<td>± 600</td>
<td>± 600</td>
</tr>
<tr>
<td>Travel range Rx, Ry (deg)</td>
<td>± 40</td>
<td>± 40</td>
</tr>
<tr>
<td>Speed Tz (mm/s)</td>
<td>± 1 000</td>
<td>± 1 000</td>
</tr>
<tr>
<td>Speed Rz (°/s)</td>
<td>± 70</td>
<td>± 70</td>
</tr>
<tr>
<td>Acceleration Tz (mm/s²)</td>
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<td>± 8 000</td>
</tr>
<tr>
<td>Acceleration Rx, Ry (°/s²)</td>
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<td>± 100</td>
</tr>
<tr>
<td>Acceleration Rz (°/s²)</td>
<td>± 1 100</td>
<td>± 1 100</td>
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</table>

### Mechanical properties

<table>
<thead>
<tr>
<th></th>
<th>MISTRAL 600</th>
<th>MISTRAL 800</th>
</tr>
</thead>
<tbody>
<tr>
<td>Payload capacity (kg)</td>
<td>1 000</td>
<td>1 000</td>
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<tr>
<td>Motor type</td>
<td>Brushless</td>
<td>Brushless</td>
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### Miscellaneous

<table>
<thead>
<tr>
<th></th>
<th>MISTRAL 600</th>
<th>MISTRAL 800</th>
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</thead>
<tbody>
<tr>
<td>Operating temperature range (°C)</td>
<td>0 to + 40</td>
<td>0 to + 40</td>
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<tr>
<td>Size mobile platform (mm)</td>
<td>Ø 1 386</td>
<td>Ø 1 386</td>
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<tr>
<td>Height in middle position (mm)</td>
<td>~1 440</td>
<td>~1 765</td>
</tr>
<tr>
<td>Mass (kg)</td>
<td>~ 400</td>
<td>~ 450</td>
</tr>
<tr>
<td>Cable length (m)</td>
<td>10</td>
<td>10</td>
</tr>
</tbody>
</table>

### Options

- Outdoor
- Wave basin
- Specific joints for large angles
- Extra Rz rotation in the mobile platform (C axis)
- Acquisition (storage of motions)
- API
- External real-time trajectory control (ERTT)

### Controller

<table>
<thead>
<tr>
<th></th>
<th>MISTRAL 600</th>
<th>MISTRAL 800</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface</td>
<td>Ethernet</td>
<td></td>
</tr>
<tr>
<td>Power supply</td>
<td>400 VAC (three-phase) / 32 A</td>
<td></td>
</tr>
</tbody>
</table>

*The performances are specified for single axis motions, with all other axes at midrange and for a rotation center in the middle of the mobile platform.*

![Hexapod in middle position](image)
SIROCCO hexapod

Dynamic hexapod with high amplitude

KEY FEATURES

- Payload capacity 2 tons
- Linear travel range ± 600 mm
- Angular travel range ± 40°

APPLICATIONS

- Motion simulator
- High payloads positioner
- Swell simulator
- Vehicle simulator

GTT designs cryogenic membrane containment systems used in the shipbuilding industry for the transport of liquid natural gas (LNG). SIROCCO hexapod allows GTT laboratories to study the impact of moving liquid, also called sloshing, on their insulation.

Naval Group uses SIROCCO hexapods as submarine simulators for training purposes to reproduce the emergency situations that submarine crews might encounter during a mission.

FMC Technologies uses two SIROCCO XL hexapods to test a ¼ scale LNG loading arm. These hexapods simulate the swell motion to qualify the loading arm that will connect a gas carrier to an offshore gas production factory. One hexapod simulates the gas carrier, the other the offshore factory.
The performances are specified for single axis motions, with all other axes at midrange and for a rotation center in the middle of the mobile platform.

<table>
<thead>
<tr>
<th>SIROCCO</th>
</tr>
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<tbody>
<tr>
<td><strong>Motion and positioning</strong></td>
</tr>
<tr>
<td>Travel range Tx, Ty (mm)</td>
</tr>
<tr>
<td>Travel range Tz (mm)</td>
</tr>
<tr>
<td>Travel range Rx, Ry, Rz (deg)</td>
</tr>
<tr>
<td>Speed Tx, Ty, (mm/s)</td>
</tr>
<tr>
<td>Speed Tz (mm/s)</td>
</tr>
<tr>
<td>Speed Rx, Ry (°/s)</td>
</tr>
<tr>
<td>Speed Rz (°/s)</td>
</tr>
<tr>
<td>Acceleration Tx, Ty, Tz (mm/s²)</td>
</tr>
<tr>
<td>Acceleration Rx, Ry, (°/s²)</td>
</tr>
<tr>
<td>Acceleration Rz (°/s²)</td>
</tr>
<tr>
<td><strong>Mechanical properties</strong></td>
</tr>
<tr>
<td>Payload capacity (kg)</td>
</tr>
<tr>
<td>(vertical orientation only)</td>
</tr>
<tr>
<td>Motor type</td>
</tr>
<tr>
<td><strong>Miscellaneous</strong></td>
</tr>
<tr>
<td>Operating temperature range (°C)</td>
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<tr>
<td>Size mobile platform (mm)</td>
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<tr>
<td>Height in middle position (mm)</td>
</tr>
<tr>
<td>Mass (kg)</td>
</tr>
<tr>
<td>Cable length (m)</td>
</tr>
<tr>
<td><strong>Options</strong></td>
</tr>
<tr>
<td>Outdoor</td>
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<tr>
<td>Wave basin</td>
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<tr>
<td>Extra Rz rotation in the mobile platform (C axis)</td>
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<tr>
<td>Acquisition (storage of motions)</td>
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<td>API</td>
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<td>External real-time trajectory control (ERTT)</td>
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<tr>
<td><strong>Controller</strong></td>
</tr>
<tr>
<td>Interface</td>
</tr>
<tr>
<td>Power supply</td>
</tr>
</tbody>
</table>

Hexapod in middle position
AQUILON hexapod
Dynamic hexapod with very high amplitude

KEY FEATURES
- Payload capacity 6 tons
- Linear travel range ± 800 mm
- Angular travel range ± 40°

APPLICATIONS
- Motion simulator
- Heavy payload positioner
- Swell simulator

Hexapod AQUILON for sloshing tests.
Sloshing tests hexapod AQUILON with a 10T payload.
### Motion and positioning

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Travel range T_x, T_y (mm)</td>
<td>± 800</td>
</tr>
<tr>
<td>Travel range T_z (mm)</td>
<td>± 650</td>
</tr>
<tr>
<td>Travel range R_x, R_y, R_z (deg)</td>
<td>± 40</td>
</tr>
<tr>
<td>Speed T_x, T_y, (mm/s)</td>
<td>± 1 800</td>
</tr>
<tr>
<td>Speed T_z (mm/s)</td>
<td>± 1 600</td>
</tr>
<tr>
<td>Speed R_x, R_y (°/s)</td>
<td>± 200</td>
</tr>
<tr>
<td>Speed R_z (°/s)</td>
<td>± 100</td>
</tr>
<tr>
<td>Acceleration T_x, T_y, T_z (mm/s²)</td>
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<tr>
<td>Acceleration R_x, R_y (°/s²)</td>
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</tr>
<tr>
<td>Acceleration R_z (°/s²)</td>
<td>± 600</td>
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</tbody>
</table>

### Mechanical properties

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Payload capacity (kg) (vertical orientation only)</td>
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<tr>
<td>Motor type</td>
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### Miscellaneous

<table>
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</thead>
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<td>Mass (kg)</td>
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<td>Cable length (m)</td>
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</tr>
</tbody>
</table>

### Options

- Outdoor
- ATEX compatibility
- Customized platform design
- Acquisition (storage of motions)
- API
- External real-time trajectory control (ERTT)

### Controller

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface</td>
<td>Ethernet</td>
</tr>
<tr>
<td>Power supply</td>
<td>400 VAC (three-phase) / 250 A</td>
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</tbody>
</table>

The performances are specified for single axis motions, with all other axes at midrange and for a rotation center in the middle of the mobile platform.
SYM_Motion software

SYM_Motion is the main interface software to control our dynamic hexapods. It has to be installed on a control computer.

All functionalities necessary to control the hexapod are included, such as trajectory generation, scenarios management and several configuration features (pivot point, custom limitations ...)

The hexapod control is facilitated by an ergonomic and intuitive graphical user interface (GUI). This software is well suited for the customer who does not need to integrate the hexapod in an external system.

Otherwise, an API is supplied, allowing the user to directly control the hexapod using simple command words.

 Optionally, a real time acquisition feature (up to 500 Hz), and an External Real Time Trajectory (ERTT) control feature (up to 200 Hz) are available. This lets the user control the hexapod in real time using its own trajectory generator that can be coupled to sensors, cameras, remote control systems etc.

The main window of SYM_Motion allows the user to set the target position of the hexapod and provides feedbacks about the current hexapod state.

A trajectory generation module supports the operator in designing and combining simple sinusoidal trajectories. It also provides an importation feature to load some trajectories, designed on third-party software.

SYM_Motion embeds a complete validation module checking the feasibility of any motion commands. A full report, including graphics, allows to identify the reason of a rejection, helping the redesigning of the trajectory.

Once a trajectory is validated, it can be saved as such and stacked in a scenario list, where numerous trajectories can be executed and managed.
Controller technology

The motion controller is integrated with Ethercat compatible drives amplifiers in an industrial control enclosure. It brings a simple and flexible architecture to adapt our embedded software to fulfill your requirements. In particular, the controller:

- **Communication**: communicates with the graphical interface software or a user system through the Application Programming Interface (API) and broadcasts the system status through a UDP server.
- **State machine**: executes a state machine, responsible for the control of the hexapod. The state machine uses the hardware inputs and data received from the Application Programming Interface (API) to determine what to do.
- **Kinematics transformations**: performs the conversion from commanded poses and trajectories, regarding to the defined coordinate systems, to actuators' lengths.
- **Coordinate systems**: transformations are calculated inside the motion controller at a low level.
- **Servo loop closure**: ensures that the position error between the target actuator position and the measured one is kept as low as possible thanks to advanced control laws.
- **Health monitoring**: the motion controller checks the state of hardware inputs and control loop deviations from normal operating conditions.
- **Trajectory profile generation**: the motion controller implements an interpolation algorithm to produce smooth synchronized motions to guarantee a low operational cross-coupling.
- **Validation process**: before each motion the controller checks for its feasibility, considering the hexapod parameters, user-supplied payload information and including safety limits.
- **ERTT real-time control** (Optional): receives external real-time trajectories from the user software to safely control the hexapod motions.
- **Acquisition** (Optional): gathers the hexapod operational poses and write them into saved files.

From the user to motion:

![Controller diagram](image)

The software embedded on the motion controller is developed by SYMETRIE. Thus, it is customizable to integrate the more complex customer application requirements (examples: integrating an additional axis control and/or specific state machine, customize digital outputs, add safety sensors, etc.).
Some applications

Motor test bench
This engine test bench allows to realize de-oiling and de-wetting tests by simulating the inclination of the vehicle.

A major French car manufacturers trusted our hexapods to simulate a vehicle movement, in order to reproduce real conditions in factory.

The hexapod can support up to 500 kg equipment load with angles of +/-51° in roll and pitch.

After equipping the bench, the user launches a series of automatic tests in order to acquire the various engine parameters (temperature, pressure, etc.) according to the different degrees of freedom.

Motion sensor testing
This hexapod has been designed for the control and qualification of high precision inertial motion units.

For this IMU manufacturer, we have integrated a measuring octopod to the hexapod.

This specific assembly allows the qualification and control of the inertial units during various experiments.

This hexapod is adapted to carry out tests embedded in vehicles. Moreover, a servo-control can be carried out thanks to the information coming from the IMU.

Ship simulation
Here, NOTUS hexapod is simulating a ship deck agitated by the swell, on which a helicopter is trying to land.

This system is installed inside a wind tunnel at a research centre in Canada.

Thanks to this hexapod they recreate outdoor conditions in an indoor test centre, allowing more specific tests to be carried out while limiting costs.
Some applications

Wave basin

A wave basin is a research facility for testing ships and offshore structures in the most realistic conditions.

Hexapods are used by maritime laboratories that study the hydrodynamic effects of swell, the phenomena of sloshing or cavitation for example. Wave basins are used by a diversity of naval actors, such as ships and propellers designers, renewable marine energies (floating wind turbines) and offshore (floating production units, anchored or articulated).

The hexapod is attached downwards to a trolley, which moves along the basin. The mobile platform of the hexapod moves the ship model or any other tested component to reproduce the hydrodynamics effects of the swell.

The hexapod is prepared for the maritime environment and the fixed platform is reinforced for upside down use.

Antenna testing

Hexapods are used by the R&D departments developing SATCOM antennas in order to test the stabilization performances of the antennas motorized systems.

These antennas are later installed on boats, trucks or any other kind of vehicles, so the motorization needs to be adjusted in order to enable the highest communication performances between the antenna and the satellite.

These hexapods can be prepared for outdoor and sometimes integrate an extra Rz rotation in the mobile platform to be able to simulate the U-turn of a boat for example.

Sloshing

GazTransport & Technigaz designs containment systems for the transport of LNG (Liquefied Natural Gas). The temperature of LNG is -163°C during transportation so the tanks have to be well isolated to limit LNG evaporation.

GTT is using several dynamic hexapods from SYMETRIE to simulate the impact of sea voyages on their cryogenic membranes. The effects of sloshing, which is the movement of a liquid inside a moving tank, need to be studied by GTT in order to correctly define the width of the membranes and to reinforce them intelligently.

Hexapods have allowed GTT to make great progress in understanding the phenomenon of liquid movements.
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