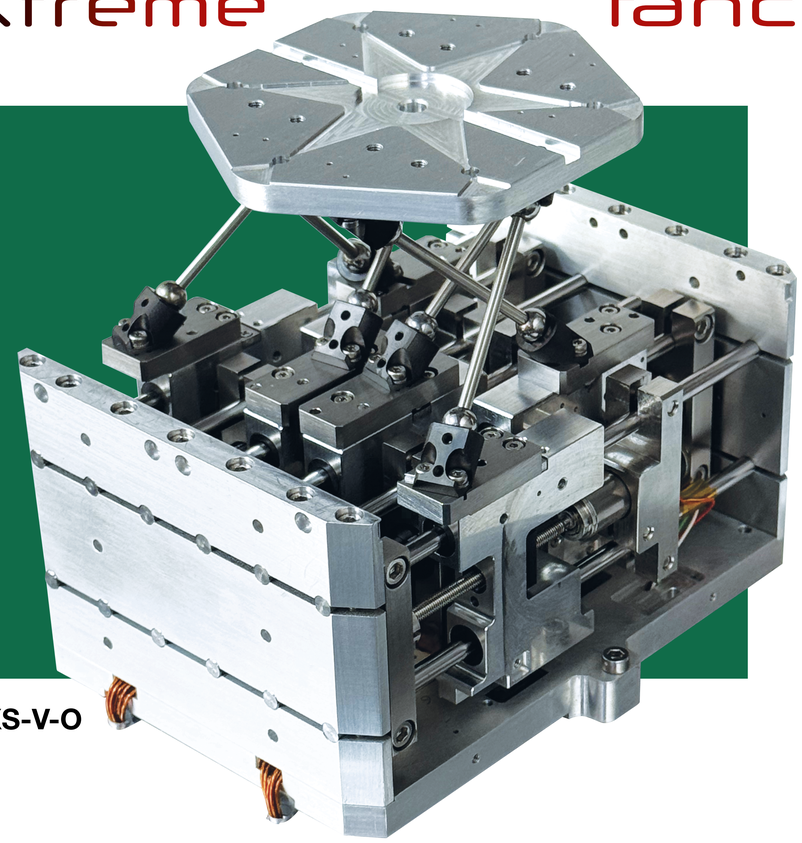
HEXANT eXtreme



fancy footwork

6DOF positioning robot
for eXtreme environment

- Compact
- Three sizes available, M, S and XS
- Wide linear and angular travel range
- High resolution and repeatability
- High Load capacity
- UHV compatible and Dry lubrication option
- Cryo temperature optional preparation
- “Free pivot point” setting
- Stand-alone controller with web-server and web-services



HAX-XS-V-O

HexAnt is a six axis manipulator based on a proprietary design of FAB Crea, the parallel kinematic hexaglide concept: 6 parallel sliders are moving an end effector connected with 6 stiff legs and zero-play spherical joints.

The main difference of this design compared with the Stewart Platform, commonly known as hexapod, are:

- low profile,
- possibility to extend indefinitely the stroke in the X direction and
- flexibility to use a wide variety of linear translation stages which are available for any possible needs and environmental condition.

HexAnt
(Open & Closed Loop)

HexAnt eXtreme are based on Vacuum FAB’s miniature linear translation stages for eXtreme environment, compatible with UHV and cryogenic temperature upon request. The precision of these sliders, combined with zero-play spherical joints, make this 6DOF robot accurate and stiff but still very compact: the design was made to fit standard vacuum flanges with diameter 250mm for the M size, 200mm for the S size and 150mm for the XS size. Where accuracy is mandatory we can integrate in the mechanics optical measurement scales and perform a robot calibration in working conditions upon request.

FAB CREA

HexAnt eXtreme environmental options

model	vacuum	bake out t	Remark
V	**10^{-6} mbar**	**80°C**	
HV	**10^{-7}mbar**	**110°C**	
UHV	**10^{-9} mbar**	**150°C**	
UHVS	**<10^{-9} mbar**	**200°C**	dry lubrication
UHVC	**77K**	**40°C**	only S and M

Hexant series Ordering Information

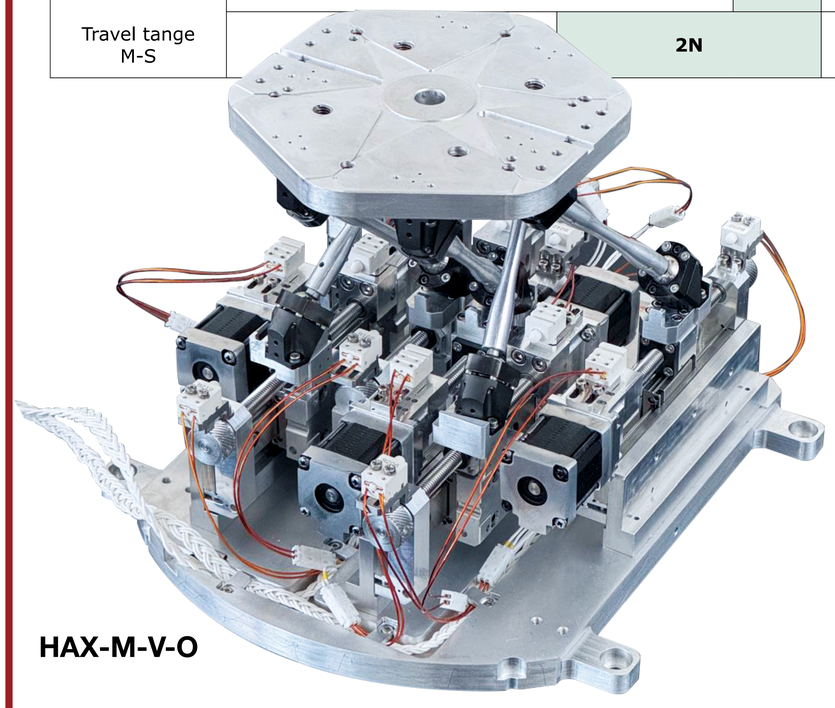
HexAnt	Travel Tange	Environment	Loop
HAX	M - S - XS	V	O
			C
	M - S - XS	HV	O
			C
	M - S - XS	UHV	O
			C
	M - S - XS	UHVS	O
			C

e.g.:
HAX-HV-O *= HexAnt eXtreme, prepared for HV 10^{-7} mbar, Open Loop;*
HAX-UHVS-C *= HexAnt eXtreme, prepared for UHV <10^{-9} mbar (dry lubrication), Closed Loop*

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HexAnt eXtreme
Open and Closed Loop

Degrees of freedom	Axis						pivot point coordinates freely settable via software
Specification	**X**	**Y**	**Z**	**THX**	**THY**	**THZ**	**Remark**
Travel tange **M**	**± 25mm**	**± 35mm**	**+ 15mm - 40mm**	**± 20°**	**± 20°**	**± 15°**	extra stroke for X axis, every degree of freedom limit the others: variable upon working conditions
Travel tange **S**	**± 12,5mm**	**± 15mm**	**+ 7mm - 20mm**	**± 10°**	**± 10°**	**± 7°**	
Travel tange **XS**	**± 12,5mm**	**± 15mm**	**+ 7mm - 20mm**	**± 10°**	**± 10°**	**± 7°**	
				FX	**FY**	**FZ**	
Holding Force						**50N**	per M e S (20 any orientation)
Travel tange M-S				**10N**			per XS (2N any orientation)
Holding Force						**20N**	per M e S (20 any orientation)
Travel tange M-S				**2N**			per XS (2N any orientation)



HAX-M-V-O

Technical note: specifications depend on load and dynamics of the application, these are typical values.
We can measure actual performances in working conditions upon request. Fill in the questionnaire at the end of this data-sheet.

HexAnt eXtreme - Open Loop

Degrees of freedom	Axis						pivot point coordinates freely settable via software
	X	**Y**	**Z**	**RX**	**RY**	**RZ**	
Resolution	**1 µm**	**10 µm**	**1 µm**	**0.01 °**			minimum incremental motion, single axis in open loop
Repeatability	**± 1 µm**	**± 10 µm**	**± 1 µm**	**± 0.01 °**			uni-directional, single axis in open loop
Speed	**5 mm/s**	**5 mm/s**	**5 mm/s**	**2 °/s**			x axis represent the maximum speed, all of the other axis move by interpolation of 6 actuators therefore the achievable speed is a result of the motion required

HexAnt eXtreme - Closed Loop

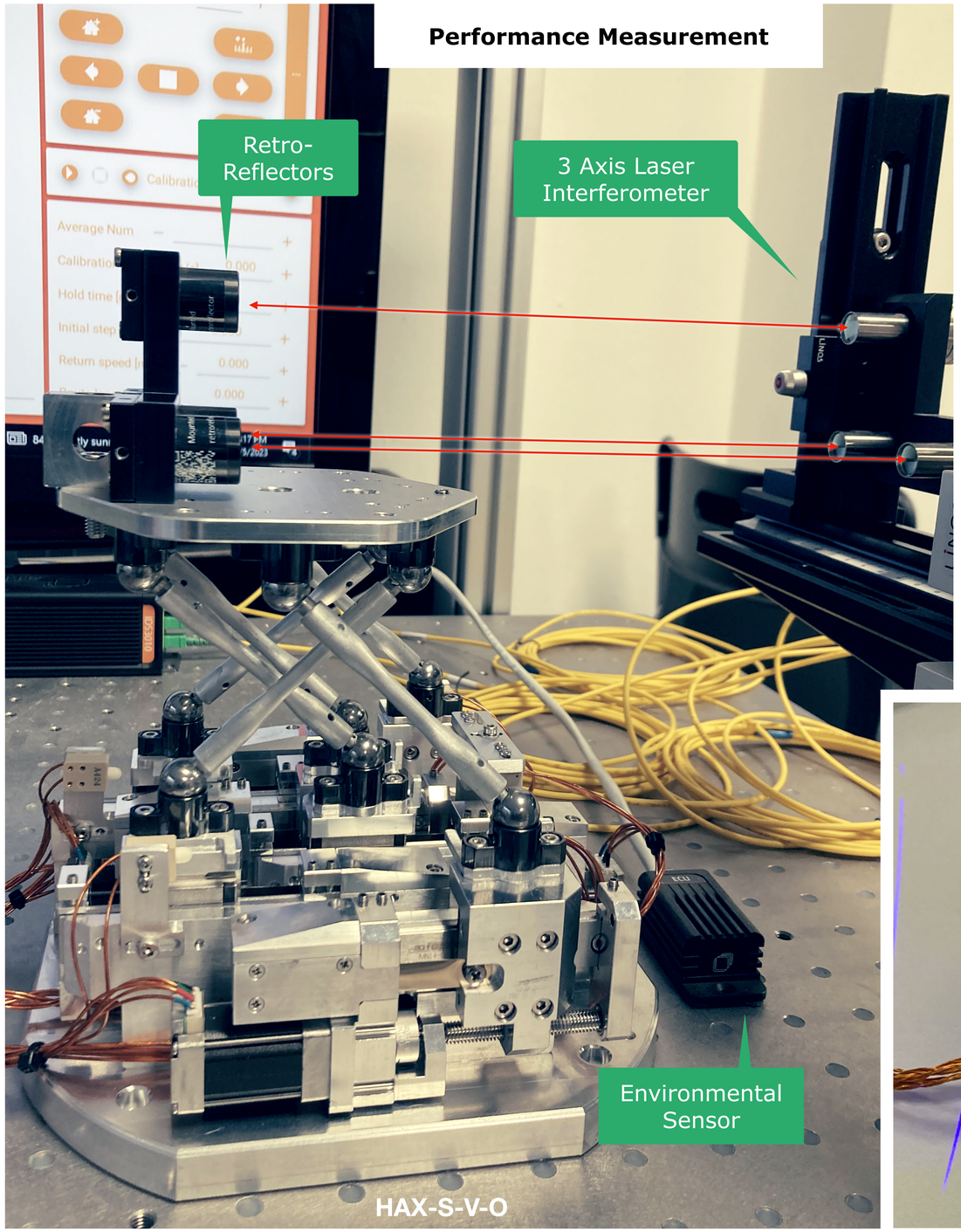
Degrees of freedom	Axis						pivot point coordinates freely settable via software
	X	**Y**	**Z**	**RX**	**RY**	**RZ**	
Resolution	**0.1 µm**	**< 1 µm**	**0.1 µm**	**0.001 °**			minimum incremental motion, single axis in closed loop
Repeatability	**< 1 µm**	**< 1 µm**	**< 1 µm**	**<= 0.001 °**			uni-directional, single axis in closed loop
Speed	**5 mm/s**	**5 mm/s**	**5 mm/s**	**2,5 °/s**			x axis represent the maximum speed, all of the other axis move by interpolation of 6 actuators therefore the achievable speed is a result of the motion required

Control

Contoller	***6 axis stand alone controller***	DC-Step motor smooth drive with current/load optimization
Motor type	**2 phase stepper motor Open or Closed Loop**	point to point precision positioning with integrated mathematics algorithm for interpolation
Control Interface	**Wi-Fi and ETHERNET**	compatible with any operating system and device
GUI	**Web Server**	no need of any software installation, includes access to Web Services for integration in customer's' application software
Power supply	**24 VDC**	included

Mechanical Properties

Material	**Stainless Steel, Aluminium, Copper, ceramic, PEEK**	uncoated Aluminium, Ultratherm200 lubricant (or Dry lubrication upon request)
Surface Tretment	**Vacuum cleaning**	ultrasound washing procedure and handling in clean environment
Vacuum	**UHV 1 x 10^{-9} mbar**	Bake-out temperature 180 °C
Fixing	**metric screws**	stainless steel, vented wherever it is necessary



There is a special care in the production of the HexAnt robots which are singularly measured in order to achieve the best possible quality and performance.

Mechanics 3D measurement

Once finished the robot assembly we do a 3D non contact precision measurement in order to detect the actual position of every spherical joint as well as the homing sensor position.

These data are then stored in the controller software for a perfect kinematic computation.

Performance measurement

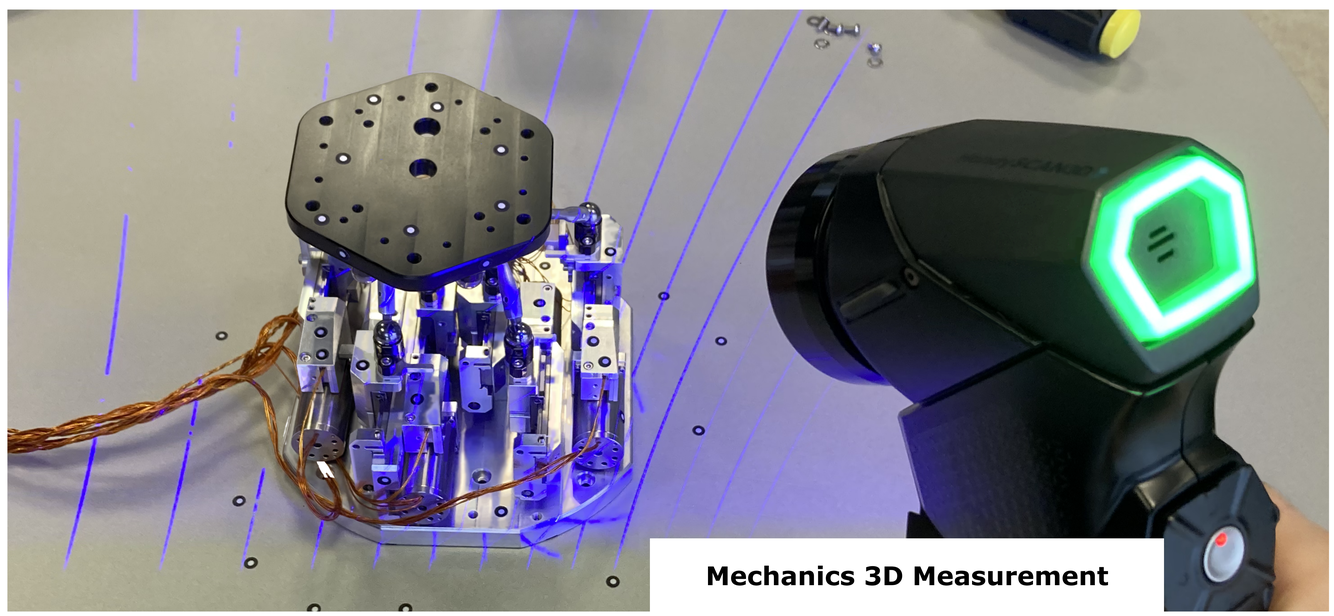
After the mechanics 3D measurement and software parameters settings we measure the actual mechanics performances with a 3 axes laser interferometer and eventually an electronic autocollimator.

As a first step the leadscrew pitch is measured carefully and the actual value is stored in the software parameters.

The typical measurement includes per each degree of freedom:

- homing repeatability
- triangular wave
  - uni and bidirectional repeatability
  - backlash
- staircase
  - motion linearity
  - minimum incremental motion

Accuracy calibration upon request



Mechanics 3D Measurement

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Depending on the specific application requirements, a user can decide to express absolute coordinates with respect to the robot base frame, to the home position, or to the world frame, i.e. the absolute origin of the setup.

Actual hexapod coordinates are computed in real time by applying forward kinematics computation to measured motor coordinates, and are shown in the interface with respect to both the user-chosen reference system, and to the base reference system.

Relative movements can be done either in a moving or in a fixed reference frame. Moving and fixed frame coordinates should be defined by the user with respect to the end-effector system and to the world system, respectively.
In the same panel it is also possible to define the coordinates of the base frame (with respect to the world reference) and of the hexapod home position (with respect to the base).



HexAnt system offers an easy to use web interface which allows to perform positioning tasks.
Robot target position can be set either by the specification of absolute rototranslational coordinates (*), or as the result of a relative movement in a user defined reference system.

(*) Each particular hexant configuration can be unequivocally described by a set of six rototranslational coordinates representing the pose of a reference system integral to the end-effector platform, with respect to a reference system integral to the base of the robot, assuming that a specific rotation sequence among the 24 possible existing conventions (Euler or Tait Bryan angles, intrinsic or extrinsic rotations) has been chosen.
In our system, rotation coordinates always stick to Tait-Bryan XYZ extrinsic rotation convention, meaning that, given a set of coordinates (x, y, z, thx, thy, thz) describing the pose of system {B} with respect to system {A}, {B} final position is coincident with the one obtained by the following sequence of steps (starting from a configuration coincident with the one of frame {A}):

1. Rotation of thx degrees around fixed X axis
2. Rotation of thy degrees around fixed Y axis
3. Rotation of thz degrees around fixed Z axis
4. Translation of the origin of {B} to the point of coordinates (x, y, z) in {A}

This convention is used when describing either the coordinates of the end-effector with respect to a given reference system, or the coordinates of a reference system with respect to another.

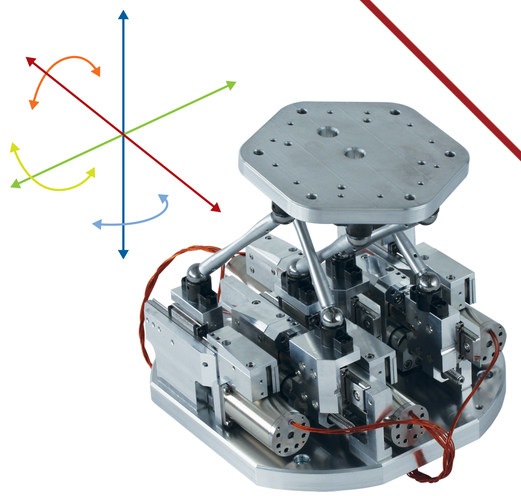
If a relative movement leads to a forbidden position, a shorter displacement is suggested as an alternative solution.
Obtained final coordinates can be selected to perform a movement, or can be stored as absolute coordinates in a list of saved positions, and used in a second time.

Web services are available for customer's software integration.
For any further details please do not hesitate to contact us, we are willing to support you in the analysis of your positioning task in order to propose the best possible solution.

Write to:
ufficiovendite@fabcrea.it

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Questionnaire



Fill in this questionnaire and mail it to ufficiovendite@vacuumfab.it to get our consultancy for the positioning system design, free of charges:

CUSTOMER'S REFERENCE

Name, surname: Institute/company:
Phone Number: Email:

WEIGHT/SPECIMEN INFORMATION

Dimensions (mm): lenght width height
Shape: (description or better attach drawing)
Weight (g):
Center of gravity coordinates from the center of the carrier (mm): X Y Z

Notes:

POSITIONING REQUIREMENT

Travel range required (mm):
Positioning resolution required (µm): X Y Z Rx Ry Rz
Repeatability required (µm): uni-directional bi-directional
Applied force (N): Fx Fy Fz
Applied Moment (Nm): Mx My Mz
Speed required (mm/s):
Acceleration required (mm/s²):
Duty Cycle:
Other degrees of freedom required: please specify and possibly add a sketch and a description f the application

WIRING REQUIREMENT

Cable lenght in air from the mechanics to the controller (m):

CONTROLLER REQUIREMENT

Motion control type: point to point linear interpolation contouring
Positioning application type: high resolution high repeatability
Computer connection port: Ethernet USB other (specify)
Software compatibility: DLL LabVIEW EPICS TANGO

Notes:

• please specify the environment: laboratory, industrial, vacuum… temperature

Date and signature: