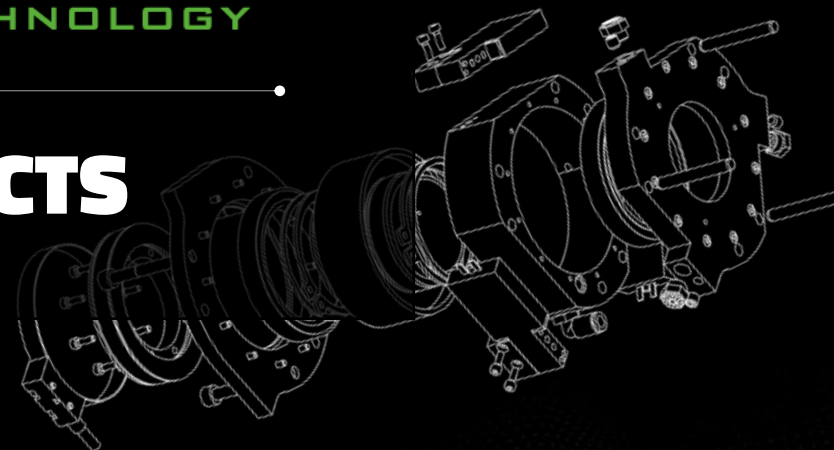


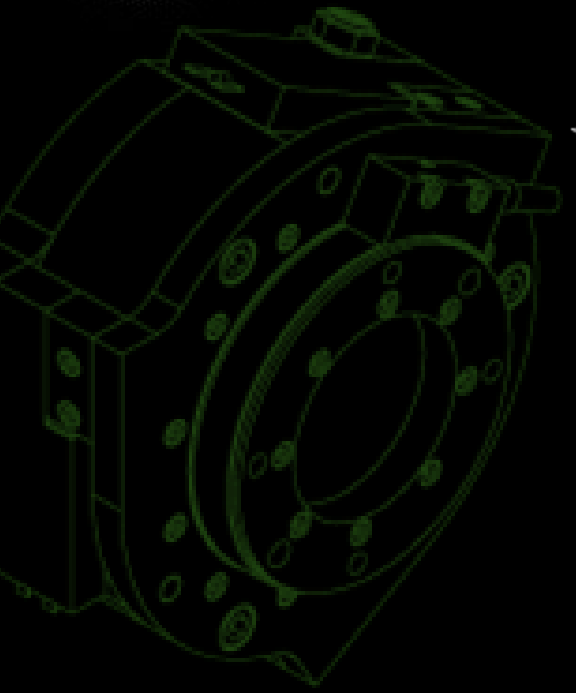
PHI**DRIVE**
DRIVING TECHNOLOGY

PRODUCTS



Gruppo Comestero Sistemi

PRODUCTS PRESENTATION



WHO WE ARE	2
GRIPHI SERIES	3
COR SERIES	10
SPACE ACTUATORS	15
PHI-SS SERIES	18
ACCESSORIES	27
CO-DESIGN	29

WHO WE ARE

Phi Drive is an SME founded in 2013 with patents and highly innovative products, such as piezoelectric rotary motors.

Phi Drive technicians, researchers and engineers offer **consulting and design support** for the creation of customized solutions.



Phi Drive's creativity and technical skills have been awarded with the "**National Award for Innovation**", "**Award of Awards**" and the "**Seal of Excellence H2020 EU Innovation Program**"

OUR ACTIVITIES INCLUDE:



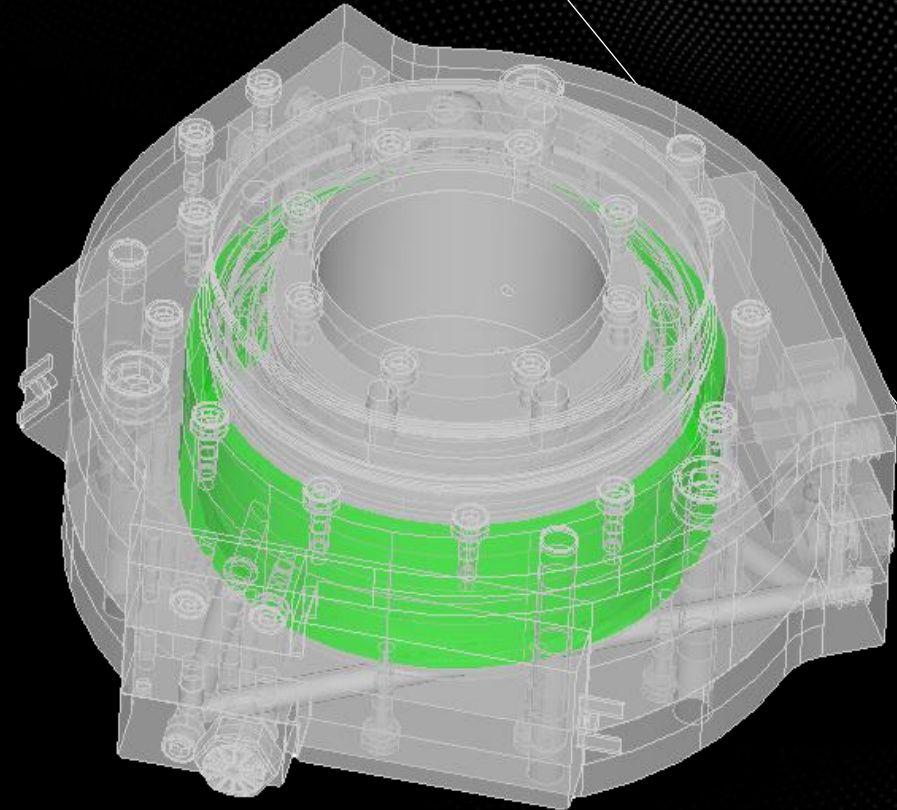
**HIGH PRECISION ROTARY
ACTUATOR AND
POSITIONER DESIGN**



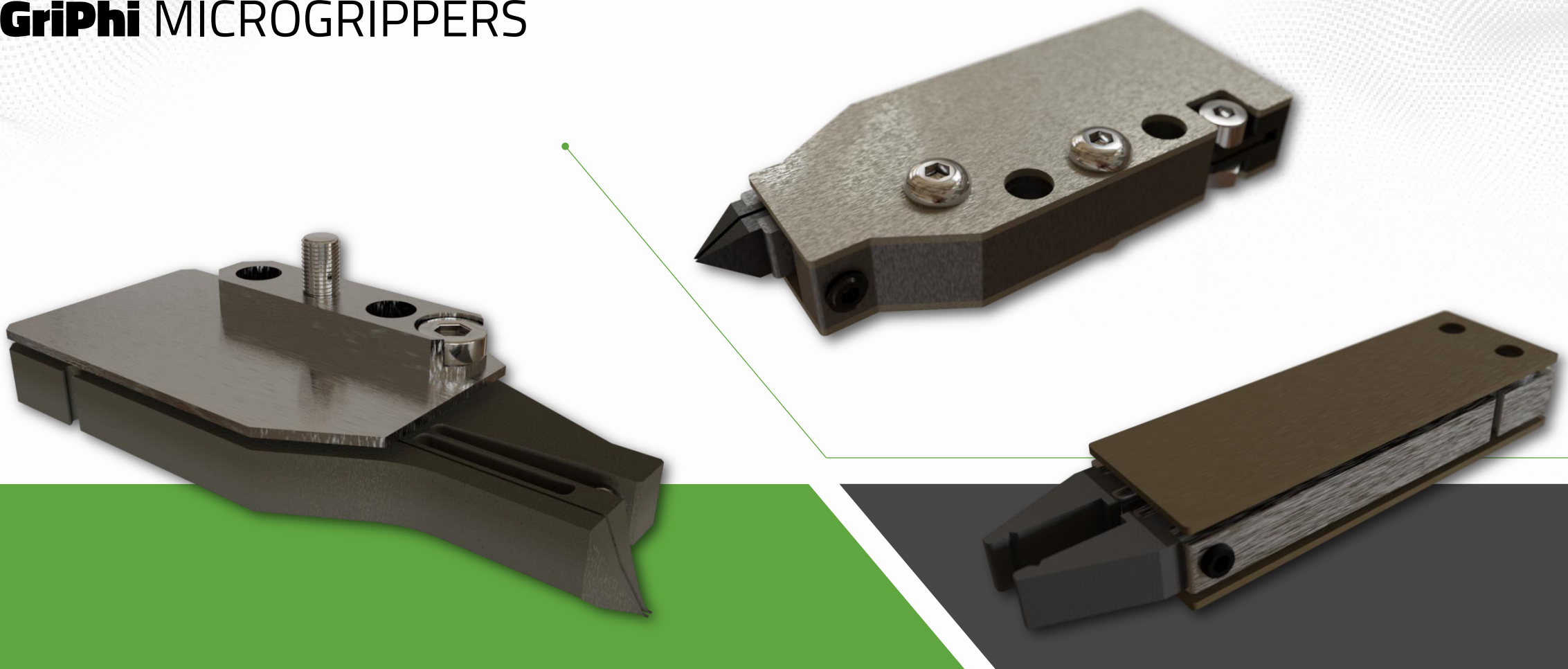
**FEM AND CFD
ANALYSIS**



**MECHANICAL AND
MECHATRONIC
DESIGN**



GriPhi MICROGRIPPERS



GriPhi MICROGRIPPERS

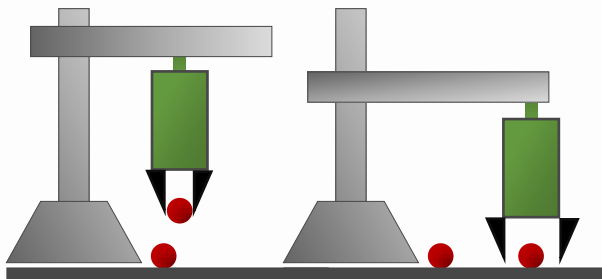


Microgrippers for micromanipulation

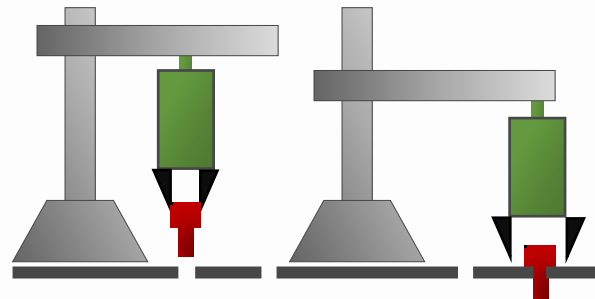
MAIN FEATURES

- Grippers stroke: up to 0,7 mm
- Clamping force: up to 4 N
- Adjustable initial opening
- High dynamic range
- Customizable shape and performance
- Dedicated electronics available
- Closed-loop control available

MOUNTING CHAIN FOR MICRO COMPONENTS

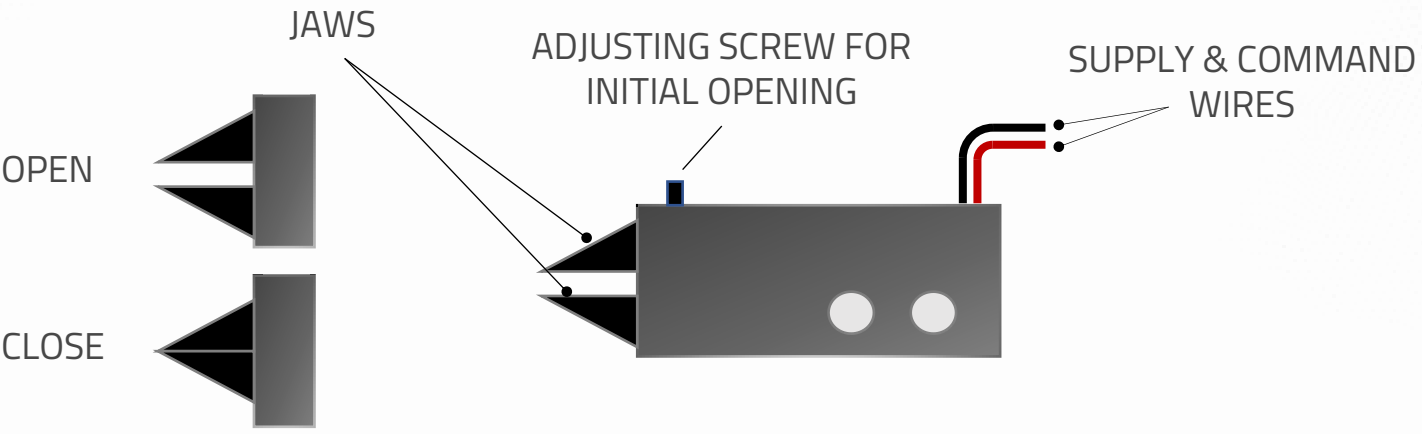


MANIPULATION OF MICRO COMPONENTS



Phi Drive presents the *GriPhi* piezoelectric microgrippers to mount, assembly and manipulate increasingly small objects.

GriPhi MICROGRIPPERS

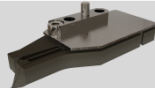

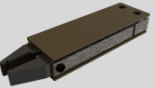


APPLICATIONS:

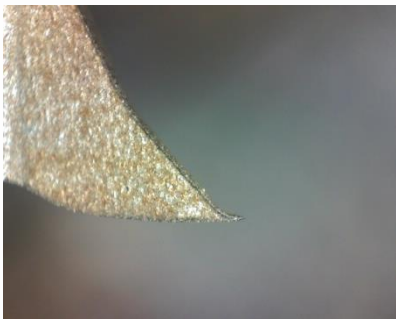
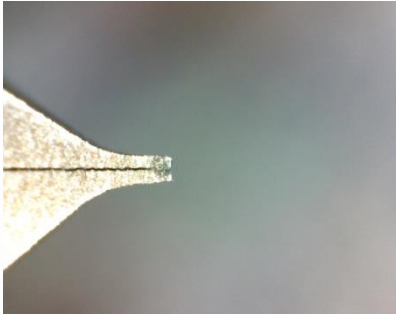
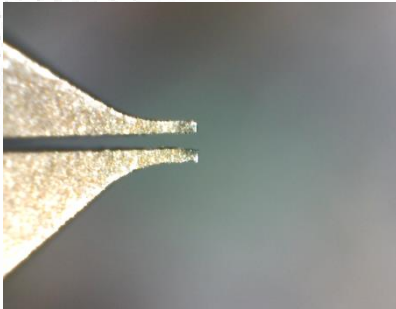


- Micro optics manipulation;
- Fiber optics connection;
- Fiber bundle positioning;
- Precision mounting and adjusting;
- Biological sample manipulation;
- High dynamic applications.

For more details on these products, please follow this [link](#).

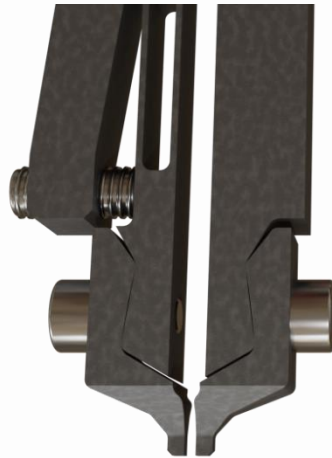
MODEL	PREVIEW	STROKE	SAMPLE SIZE	GRIPPING FORCE @0.5 STROKE	GRIPPING TIME	RATED CYCLES
A		0.8 [mm]	0.02 - 0.2 [mm]	2 [N]	< 50 [ms]	> 40 million
B		1.0 [mm]	0.2 - 1 [mm]	2 [N]	< 50 [ms]	> 40 million
C		1.2 [mm]	1 - 3 [mm]	4 [N]	< 50 [ms]	> 40 million

GriPhi MICROGRIPPERS



CUSTOMIZATION:

- Jaws (shape and size);
- Gripping force;
- Closed-loop control;
- Removable jaws;
- Stroke.



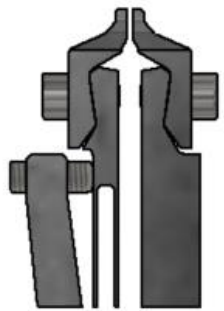
WIDE VARIETY OF JAWS TO CHOOSE FROM:

- Monolithic/interchangeable
- Normally-open/normally-closed
- Parallel/non-parallel
- Single-effect/double-effect

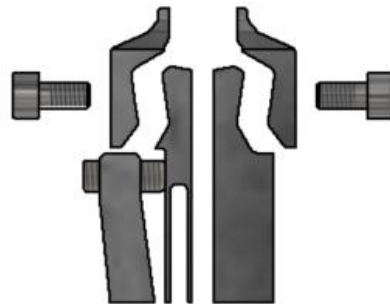
GriPhi MICROGRIPPERS

WIDE RANGE OF JAWS CUSTOMIZATION :

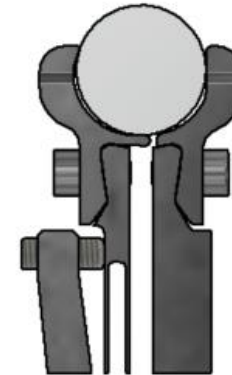
- Customization for different shapes (rounded, squared...)
- Possibility to handle specimen up to 1cm and more.



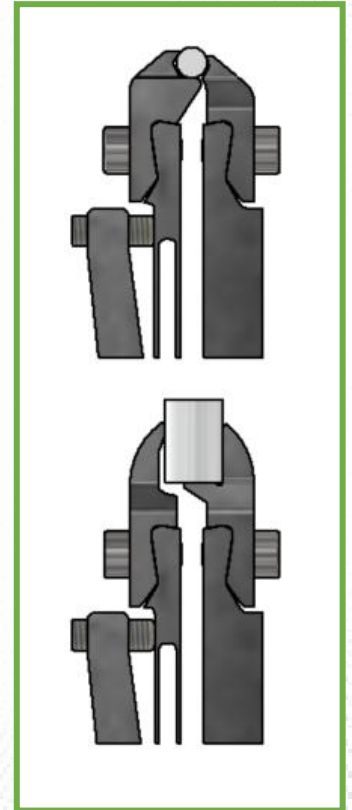
Std. option
From less than
1 mm
specimen



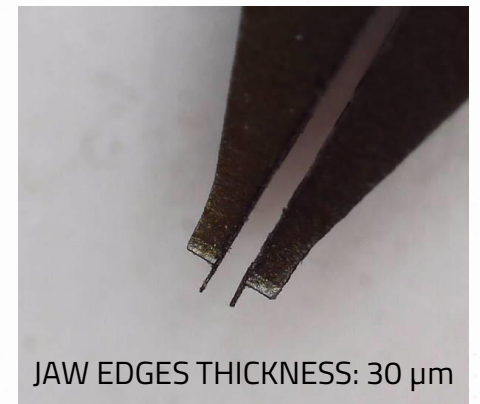
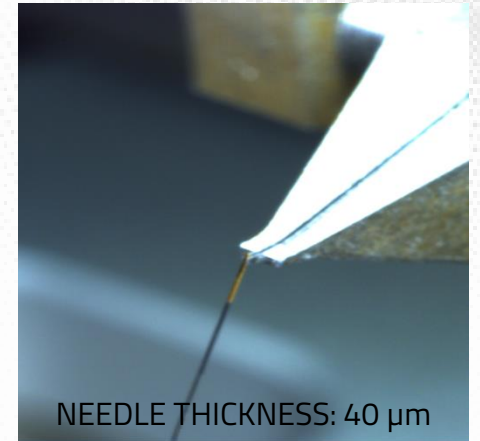
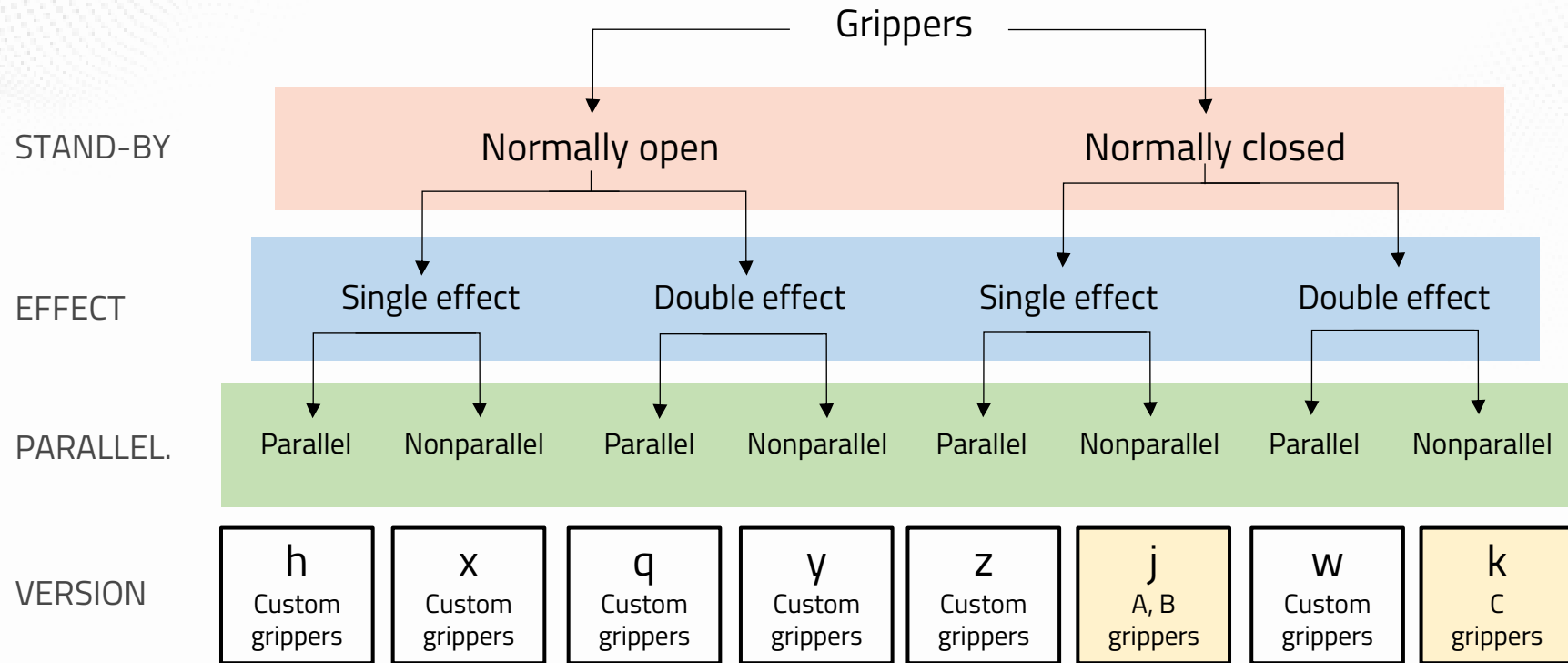
Same body ,
jaws
substitution



Up to more
than 10 mm
specimen



GriPhi MICROGRIPPERS



Grippers come with many options. We can cover all of them.

What happens when power is removed.

One jaw/both move.

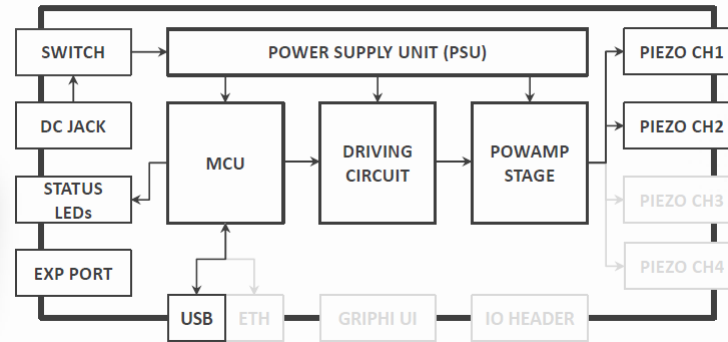
Jaws stay parallel/they don't during grippers operation.

Commercial/custom options available.

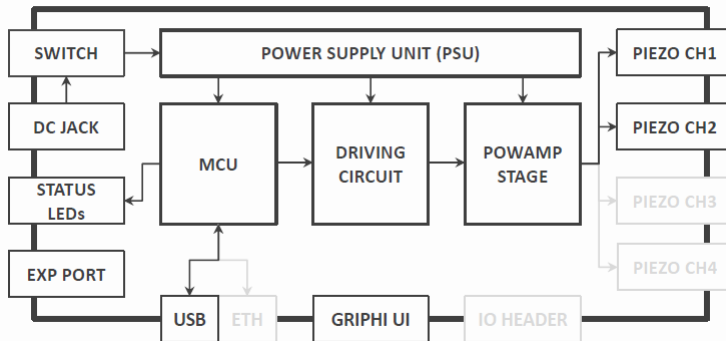
GriPhi Driver GRIPPING DRIVER SYSTEM



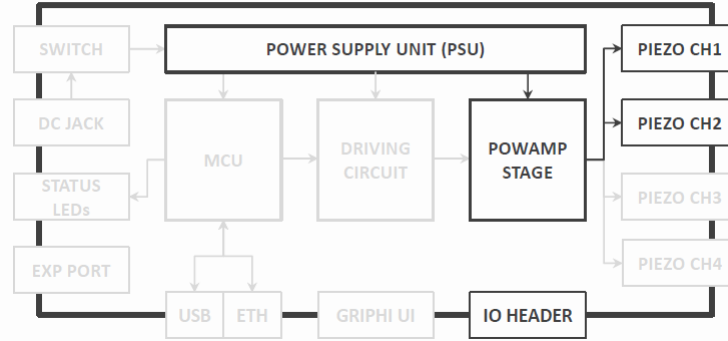
GriPhi Driver **Basic**



GriPhi Driver **Standalone**



GriPhi Driver **Minimal**



Driving solutions for piezoelectric microgrippers

MAIN FEATURES

- ➔ Easy connection to the GriPhi grippers
- ➔ PC interface via USB port
- ➔ Encoder data acquisition
- ➔ Elegant design
- ➔ Expansion port included
- ➔ Available in the *Basic*, *Standalone* and *Minimal* versions

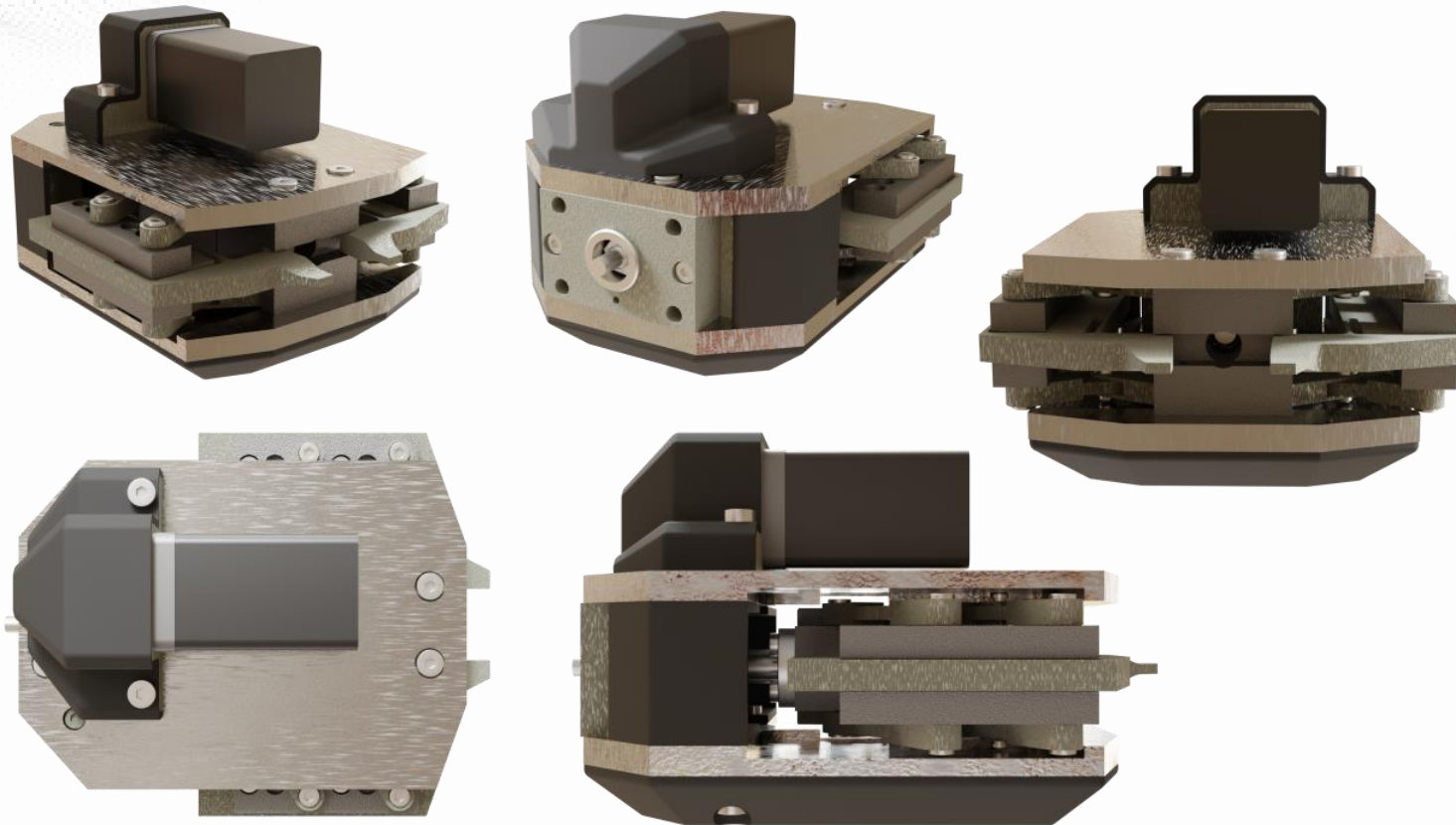
Customizable electronics for piezoelectric microgrippers by Phi Drive.



OPTIONAL: E0018X
MODULE TO CONNECT
GRIPHI DRIVER TO A PLC

GriPhi REC STEPPER/PIEZO HYBRID GRIPPERS

Flexible solution for variable-size gripping

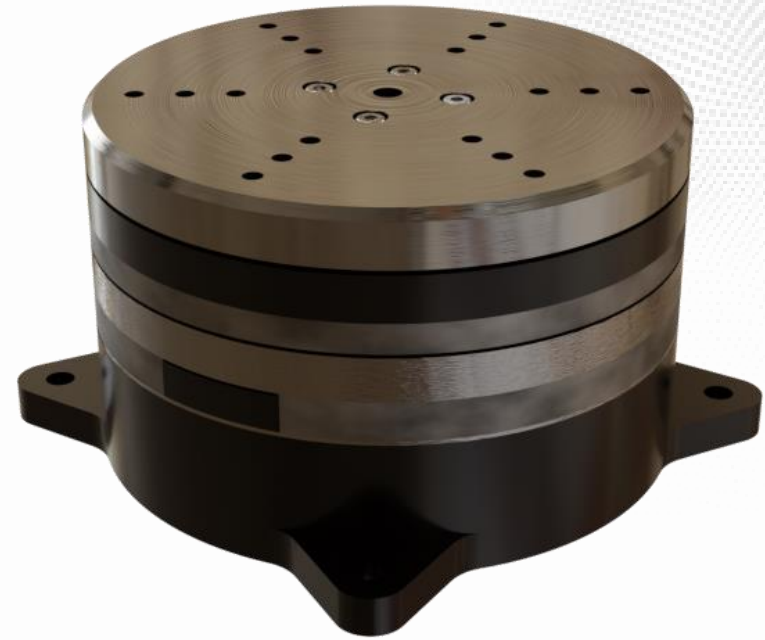
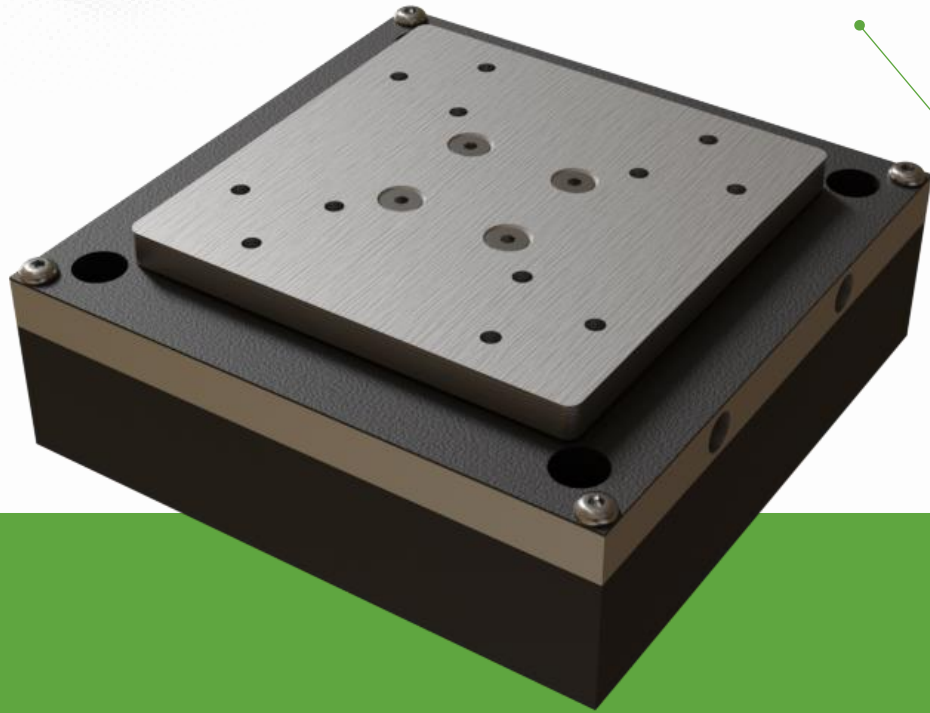


MAIN FEATURES

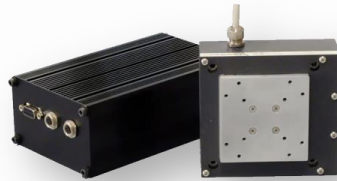
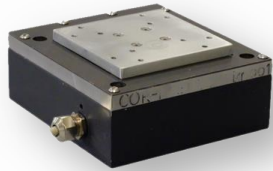
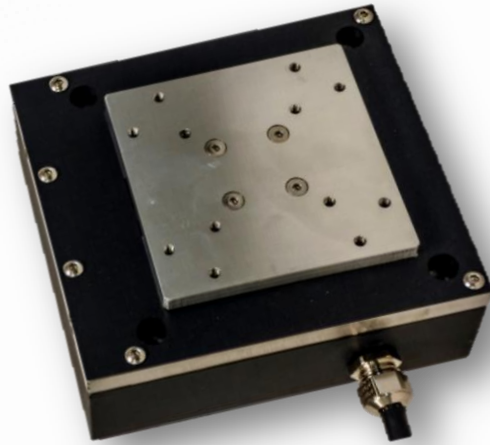
- ➔ Gripper stroke: up to 20 mm
- ➔ Stepper clamping force: up to 235 N
- ➔ Piezo clamping force: up to 4 N
- ➔ Adjustable initial opening
- ➔ High dynamic range
- ➔ Customizable shape and performances
- ➔ Phi Drive's electronics available

A flexible solution to grab samples of varying sizes. *GriPhi REC* joins the advantages of piezo and stepper actuation to provide the best solution.

COR POSITIONERS



COR-PS NANOMETRIC LINEAR POSITIONER

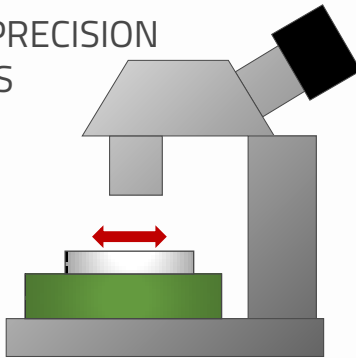


Linear piezo stage for nanometric positioning

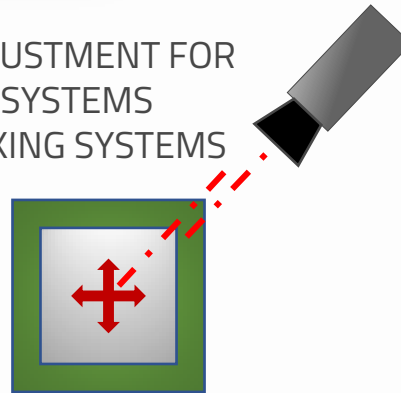
MAIN FEATURES

- ➔ Resolution: 0.18÷15 nm
- ➔ Travel range: up to 160 μm
- ➔ Closed loop available
- ➔ Electronics and PC GUI available

MOVING TABLE FOR PRECISION
OPTICS APPLICATIONS

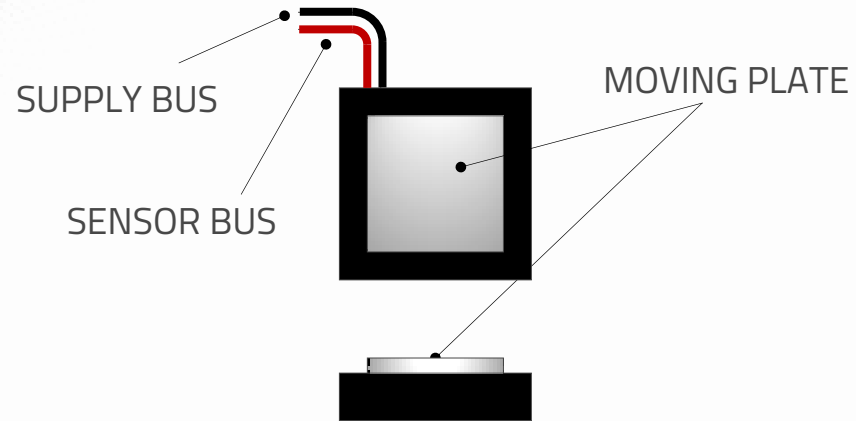


- PRECISE ADJUSTMENT FOR
MEASURING SYSTEMS
- LASER MARKING SYSTEMS



Phi Drive has developed a range of nanometric positioning piezo stages for the industrial, research and metrology market areas where small and very small displacements are necessary.

COR-PS NANOMETRIC LINEAR POSITIONER



COMBINABLE FOR
MULTIPLE AXIS SYSTEMS



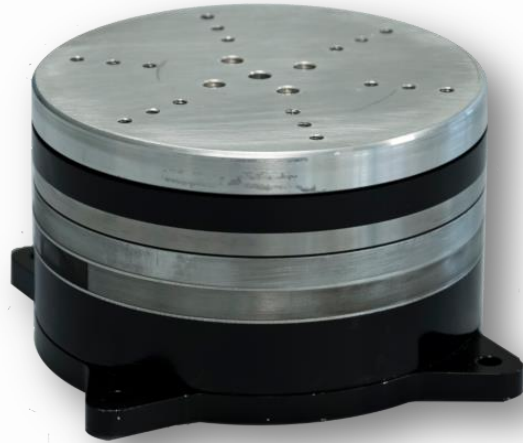
OVERVIEW:

- High precision
- No backlash
- No friction or lubricant
- Integrated closed-loop sensor
- Open loop option available
- High load capability
- High dynamic range
- Sub-nanometric resolution

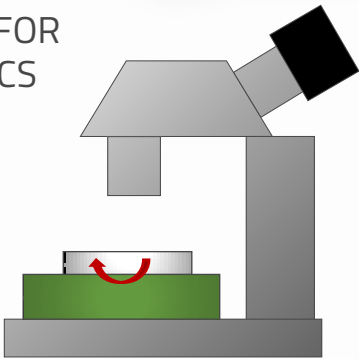
For more details on these products, please follow this [link](#).

MODEL	STROKE	RESOLUTION @OPEN LOOP	MAXIMUM LOAD	SETTNG TIME @UNLOADED
COR.PS.SC	150 [μm]	0.2 [nm]	5 [kg]	0.1 [ms]
COR.PS.HC	135 [μm]	0.2 [nm]	5 [kg]	0.1 [ms]

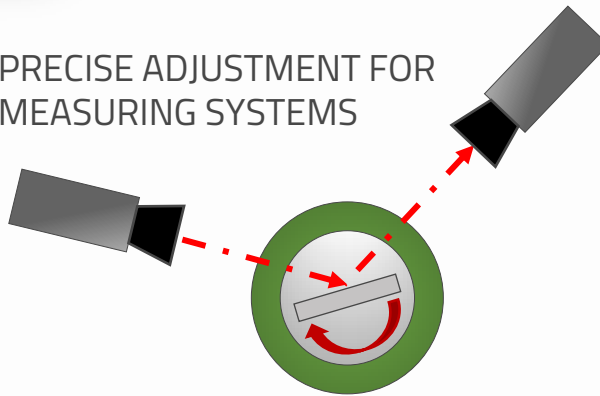
COR-RS ROTARY POSITIONER



MOVING TABLE FOR
PRECISION OPTICS
APPLICATIONS



PRECISE ADJUSTMENT FOR
MEASURING SYSTEMS



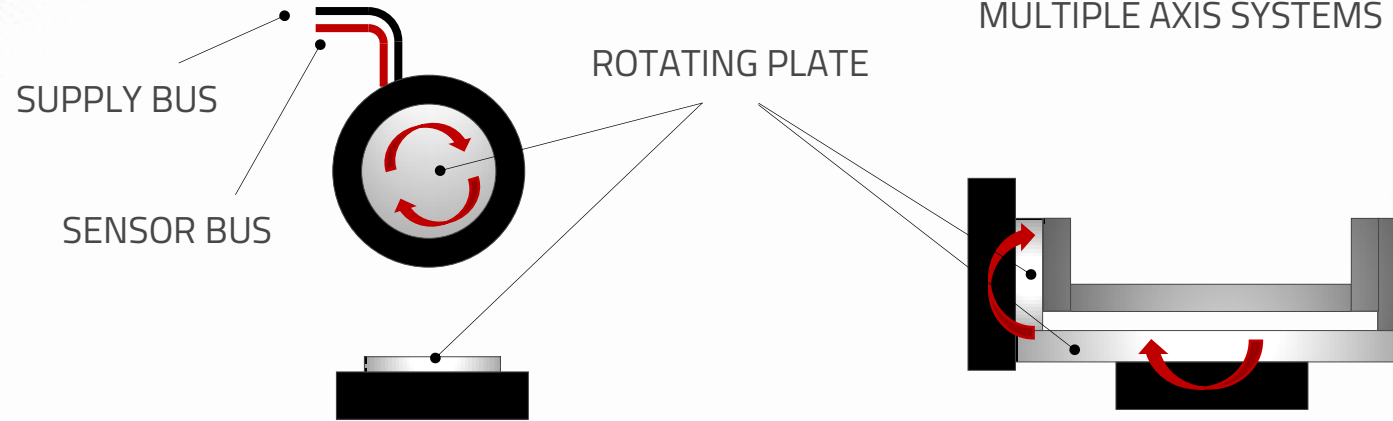
High precision and repeatability rotary positioner

MAIN FEATURES

- ➔ $\pm 360^\circ$ travel range
- ➔ High precision, no backlash, no friction and no lubricant
- ➔ Customizable shape and performances
- ➔ Nanometric resolution
- ➔ Custom electronics available

High resolution and repeatability in the order of nanoradians and short response times that only piezoelectric technology can guarantee.

COR-RS ROTARY POSITIONER



APPLICATIONS :

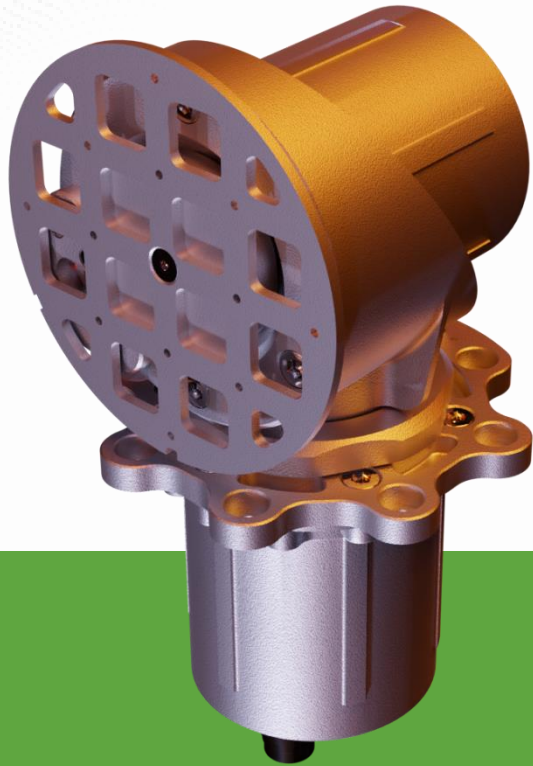


- Micro-optics manipulation;
- Positioning of components;
- High precision assembly and regulation;
- Manipulation of biological samples;
- High dynamic applications.

For more details on these products, please follow this [link](#).

MODEL	MINIMUM STEP	RESOLUTION @OPEN LOOP	MAXIMUM LOAD	ANGULAR SPEED
RS.SS.E0.2	200 [μ rad]	0.3 [nm]	5 [Kg]	1.6 [RPM]
RS.SS.E0.1	60 [μ rad]	0.28 [nm]	5 [kg]	1.7 [RPM]

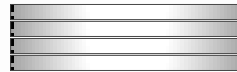
SPACE ACTUATORS



AG-HT PIEZOELECTRIC ROTARY STAGE



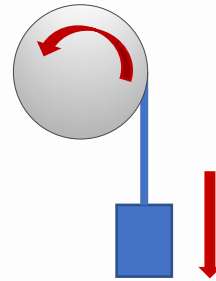
STACKABLE FOR HIGHER PERFORMANCES



For more details on these products, please follow this [link](#).



HOLDING TORQUE
(UNPOWERED) UP TO 45 Nm
IN THE GROUND VERSION



PRECISE ADJUSTMENT FOR
ANTENNAS, SOLAR ARRAYS
AND OTHER APPARATUS



High performance for aerospace applications

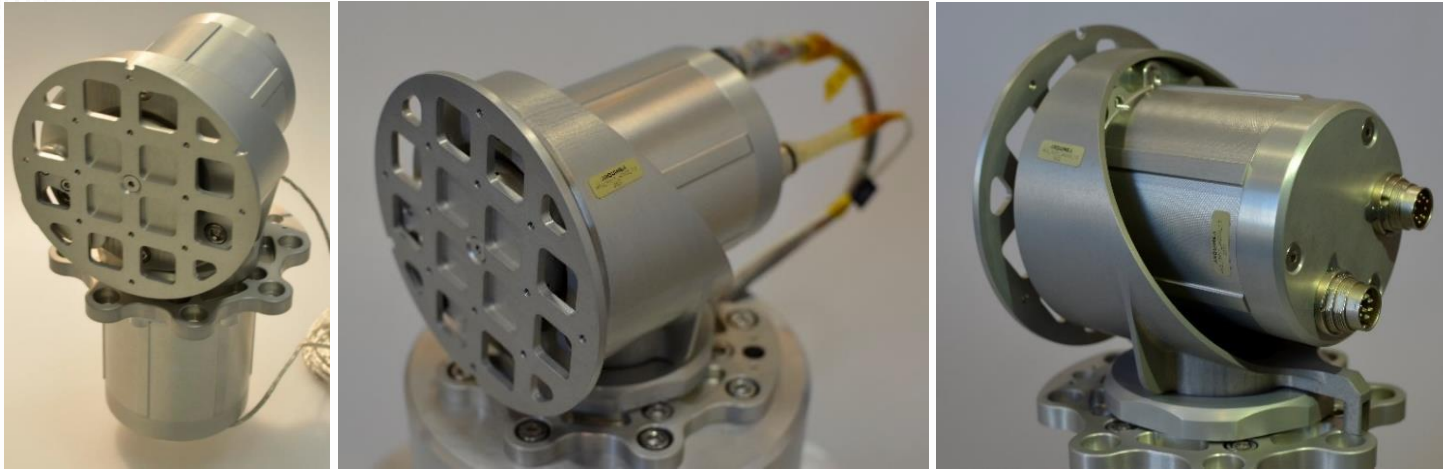
MAIN FEATURES

- ➔ $\pm 360^\circ$ travel range
- ➔ High precision, no backlash, no friction and no lubricant
- ➔ Customizable size, torque, speed, mounting flanges
- ➔ Step down to 0.15 mrad
- ➔ Available in the High Vacuum version

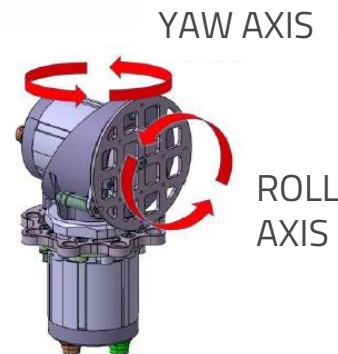
High performances in a low volume and a High Vacuum version make *AG-HT* a valuable solution for aerospace applications.

GIMBAL 2-AXES ROTARY POSITIONER

Ultrasonic AG-LT motor in 2-axes rotary mode



For more details on these products, please follow this [link](#).



AG-LT

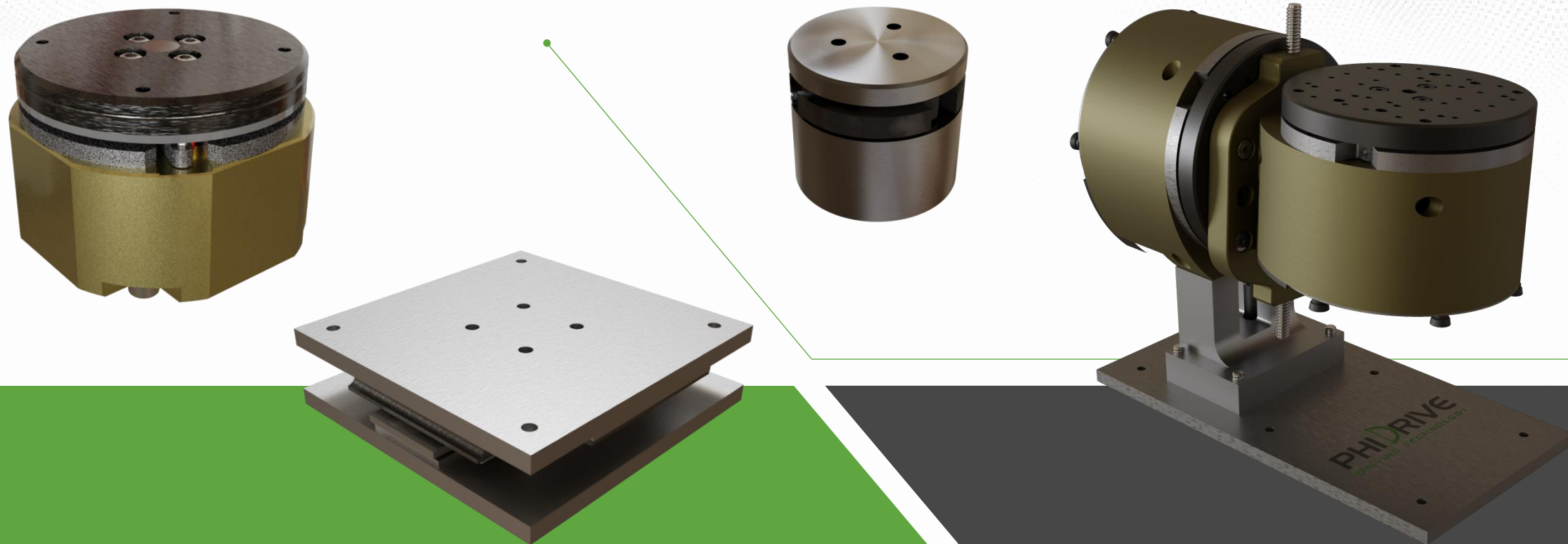


MAIN FEATURES

- ➔ Aluminum monolithic motor
- ➔ High speed
- ➔ No backlash, no lubricant
- ➔ Direct drive
- ➔ High resolution: step < 8 arcsec
- ➔ Stall torque: 1 Nm
- ➔ Locked when unpowered

From the EU-financed Pre2Pos project, aimed at rotating antennas, solar arrays and sensors in satellites. Developed in partnership with Arquimea ES.

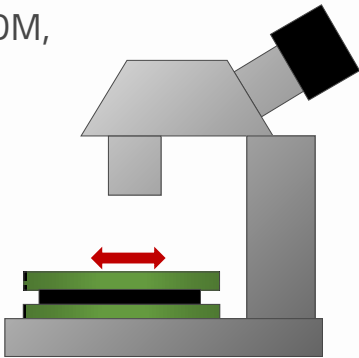
PHI-SS PIEZOELECTRIC ACTUATORS



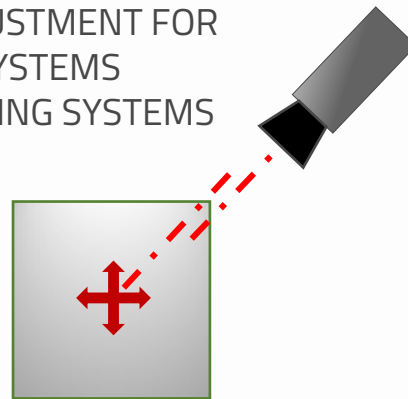
PHI-SS-LI MICROMETRIC LINEAR POSITIONER



MOVING TABLE FOR
PRECISION OPTICS, EDM,
MACHINE TOOLS
APPLICATIONS



- PRECISE ADJUSTMENT FOR
MEASURING SYSTEMS
- LASER MARKING SYSTEMS



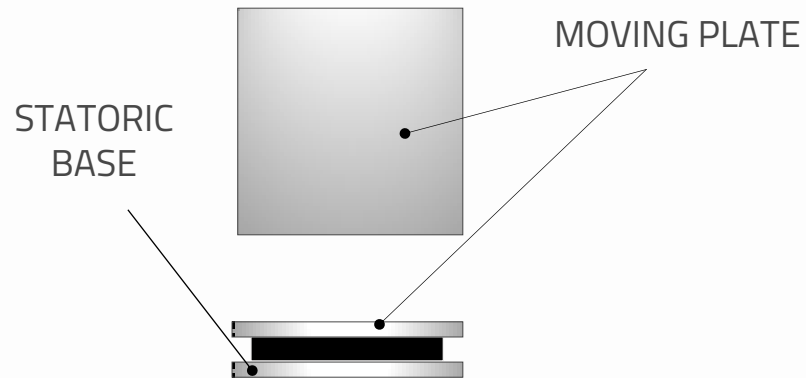
Micro linear piezo stage for precise positioning

MAIN FEATURES

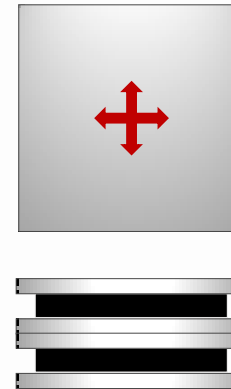
- ➔ Resolution: 0.05 μm
- ➔ Travel range: 10 mm
- ➔ Closed loop available
- ➔ Electronics and PC GUI available

Phi Drive has developed a micrometric positioning piezo stage which is excellent for precision mechanical machining, optics and research.

PHI-SS-LI MICROMETRIC LINEAR POSITIONER



COMBINABLE FOR
MULTIPLE AXIS SYSTEMS
(X-Y-Z DIRECTIONS)



OVERVIEW:

- High precision
- No backlash
- No friction or lubricant
- Open loop option available
- High load capability
- High dynamic range
- Sub-micrometric resolution

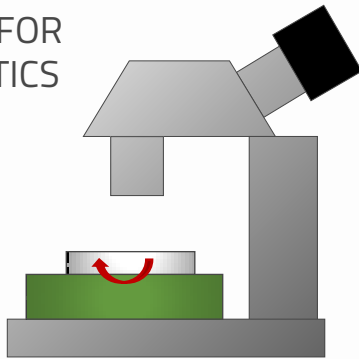
For more details on these products, please follow this [link](#).

MODEL	STROKE	RESOLUTION @OPEN LOOP	MAXIMUM LOAD	SETTNG TIME @UNLOADED
PHI-SS-LI	10 [mm] (STD) 50 [mm] (Custom)	0.05 [μ m]	500 [g] (V RAIL) 2500 [g] (S RAIL)	0.1 [ms]

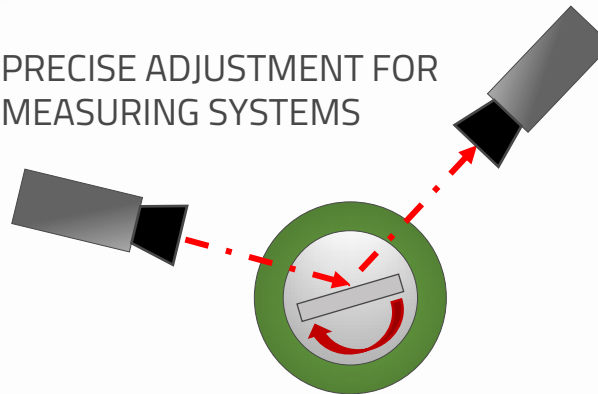
PHI-SS-MI MICRO ROTARY POSITIONER



MOVING TABLE FOR
PRECISION OPTICS
APPLICATIONS



PRECISE ADJUSTMENT FOR
MEASURING SYSTEMS



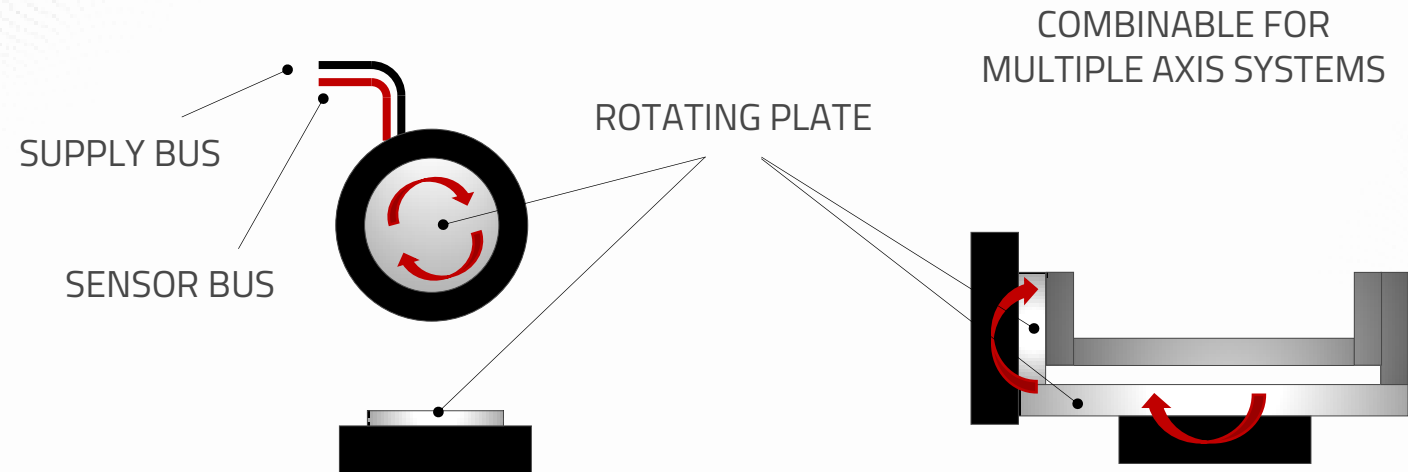
High precision and repeatability rotary positioner

MAIN FEATURES

- ➔ $\pm 360^\circ$ travel range
- ➔ High precision, no backlash, no friction and no lubricant
- ➔ Customizable shape and performances
- ➔ Nanometric resolution
- ➔ Custom electronics available

High resolution and repeatability in the order of nanoradians and short response times that only piezoelectric technology can guarantee.

PHI-SS-MI MICRO ROTARY POSITIONER



APPLICATIONS :



- Micro-optics manipulation;
- Positioning of components;
- High precision assembly and regulation;
- Manipulation of biological samples;
- High dynamic applications.

For more details on these products, please follow this [link](#).

MODEL	MINIMUM STEP	MAXIMUM LOAD	ENGUMBRANCE: MINIMUM DIAMETER	ANGULAR SPEED
M.SS	500 [nrad]	0.5 [kg]	22 [mm]	8 [RPM]

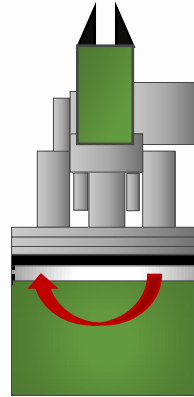
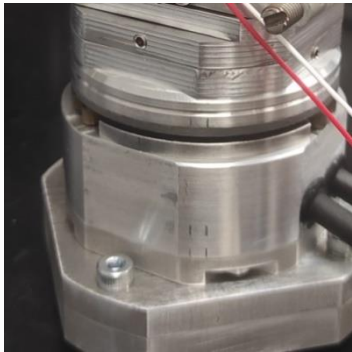
PHI-SS-ME MEDIUM ROTARY POSITIONER



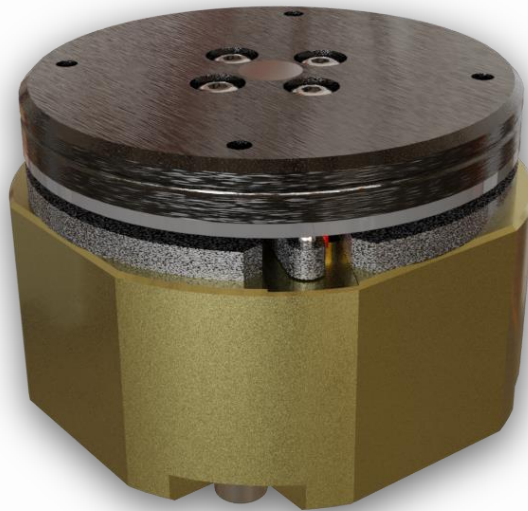
APPLICATIONS :

- Micro-optics manipulation;
- Positioning of components;
- High precision assembly and regulation;
- Manipulation of biological samples;
- High dynamic applications.

For more details on these products, please follow this [link](#).



CAN BE USED IN
PHI DRIVE'S
2-D.O.F.S WRIST



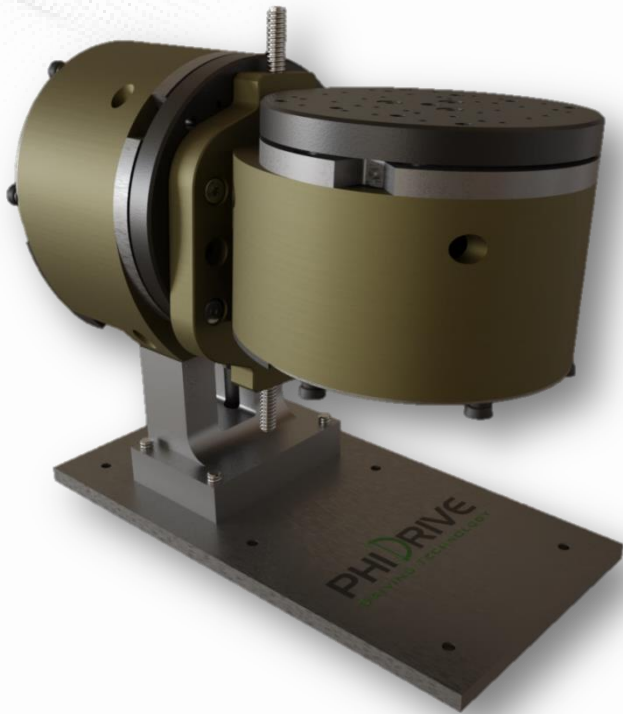
Compact, closed-loop fit rotary positioner

MAIN FEATURES

- ➔ Full rotation
- ➔ High precision, no backlash, no friction and no lubricant
- ➔ Customizable shape and performances
- ➔ 14 bit encoder included
- ➔ Custom electronics available
- ➔ Accuracy of 1 mrad

Compact rotary table with embedded encoder. Can be integrated in Phi Drive's piezoelectric wrist for robotic applications.

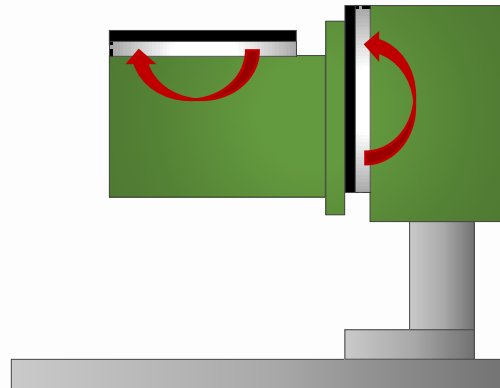
PHI-SS-MA MACRO ROTARY POSITIONER



For more details on these products, please follow this [link](#).



MOVING TABLE FOR ELECTRICAL DISCHARGE MACHINING



2-DOF High precision rotary positioner

MAIN FEATURES

- ➔ 2 degrees of freedom
- ➔ High precision, no backlash, no friction and no lubricant
- ➔ Customizable shape and performances
- ➔ Nanometric resolution
- ➔ Custom electronics available

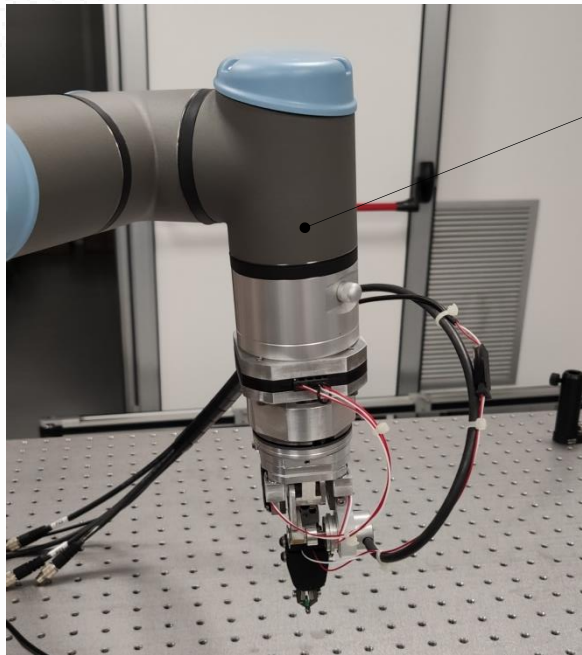
Dual axis mounting suitable for multiple rotational system application. Customizable mounting plate.

PHI-W ROBOT WRIST MULTIPLE PIEZOELECTRIC DEVICE



APPLICATIONS :

- Optics
- Laser systems
- Precise manipulators

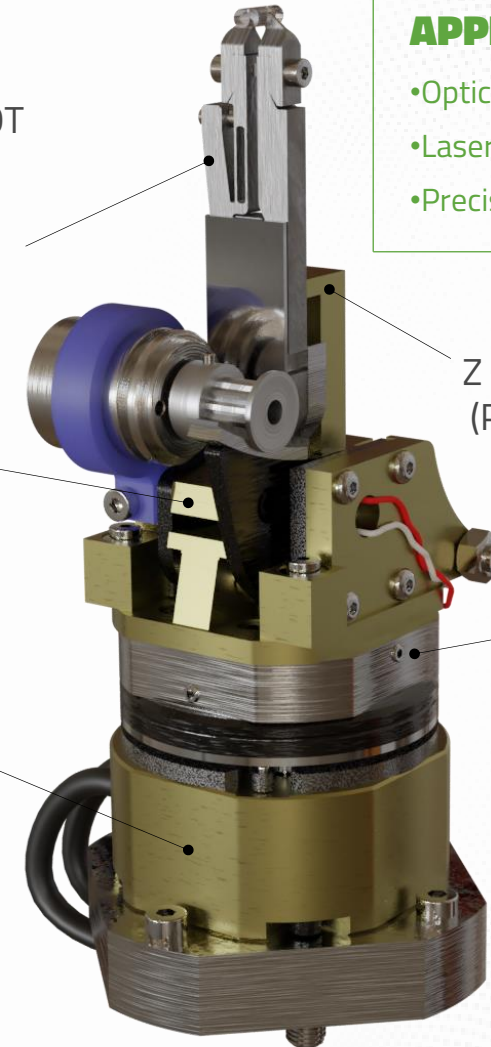


MOUNTED ON A COMMERCIAL COBOT
(UR3e BY UNIVERSAL ROBOTS)

GRIPHI GRIPPER

TILTING STAGE ($\pm 5^\circ$)
A.K.A. PHI-SS-TS

PHI-SS-ME



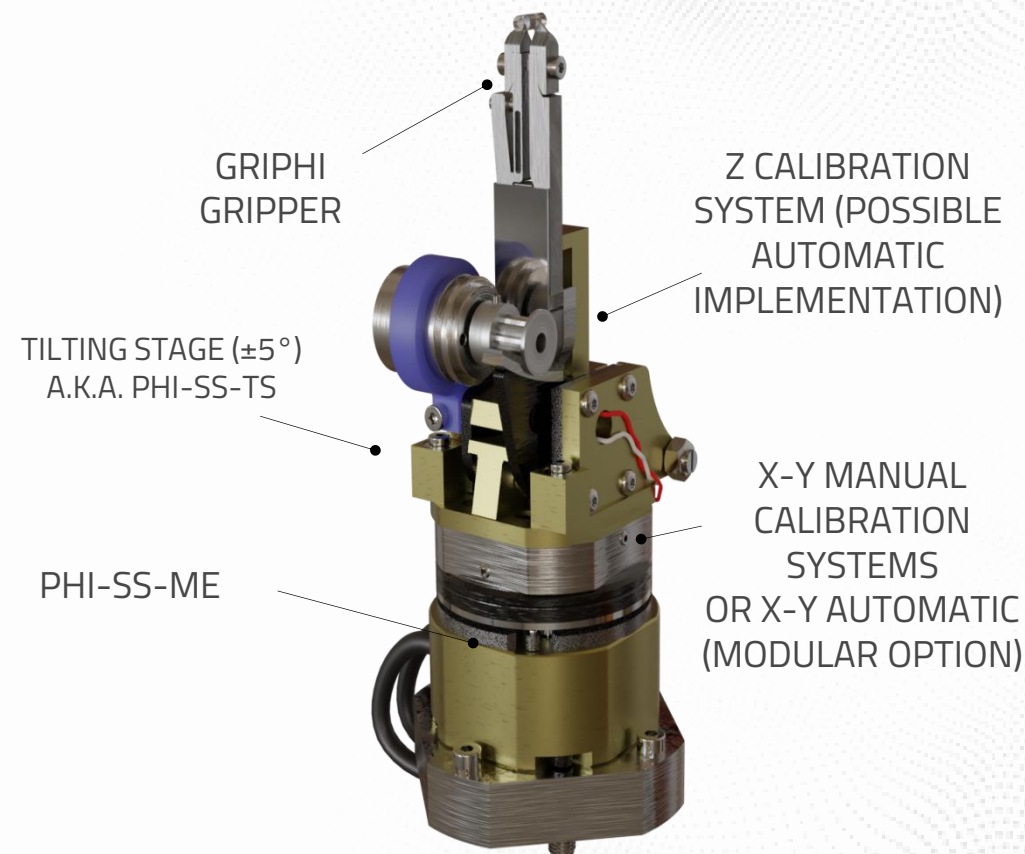
Z CALIBRATION SYSTEM
(POSSIBLE AUTOMATIC
IMPLEMENTATION)

X-Y MANUAL CALIBRATION
SYSTEMS
OR X-Y AUTOMATIC
(MODULAR OPTION)

- ➔ Automatic microassembly stations → customizable micropositioning stages for maximum precision
- ➔ Angular correction resolutions down to $0.5 \mu\text{rad}$

PHI-W ROBOT WRIST MULTIPLE PIEZOELECTRIC DEVICE

COMPONENT	DESCRIPTION	DOF	TRAVEL RANGE	RESOLUTION	CONFIGURATION
PHI-SS-TS	Tilting stage	Tilting (Rot X)	± 5 deg	$17 \mu\text{deg} / 0.3 \mu\text{rad}$	STANDARD (POSSIBLE CUSTOMIZATION FOR DIFFERENT TRAVEL RANGES AND REQUIREMENTS)
PHI-SS-ME	Rotary table	Yaw (Rot Z)	± 180 deg	$34 \mu\text{deg} / 0.6 \mu\text{rad}$	
GRI-PHI	Micro-gripper	-	-	-	
PHI-COR-PM	Manual corrective stage	Longitudinal and Transversal (X-Y)	± 5 mm	-	
PHI-COR-PS-X	Automatic corrective stage	Longitudinal (X)	0-320 μm	0.4 μm	OPTIONAL CUSTOMIZATION FOR DIFFERENT TRAVEL RANGE AND REQUIREMENTS
PHI-COR-PS-Y	Automatic corrective stage	Transversal (Y)	0-320 μm	0.4 μm	
PHI-COR-PS-Z	Automatic corrective stage	Vertical (Z)	0- <u>150μm</u>	-	



PHI-SS TABLES DRIVING SYSTEM



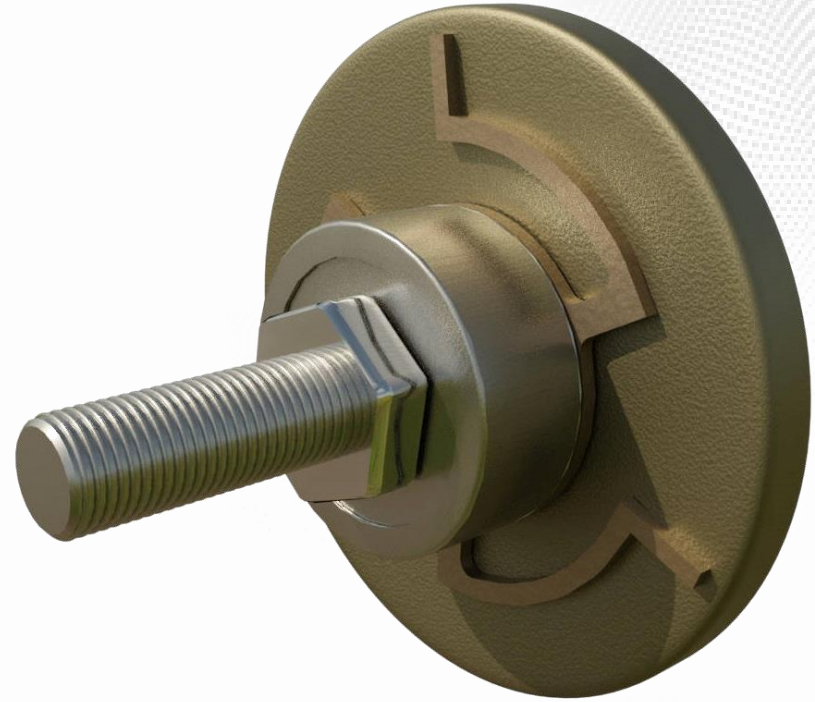
Phi Drive Electronics available for PHI-SS tables

MAIN FEATURES

- ➔ Easy connection to PHI-SS-MI, PHI-SS-ME, PHI-SS-MA, PHI-SS-LI
- ➔ PC interface
- ➔ Encoder data acquisition
- ➔ Elegant design
- ➔ Available in *Driver* and *Amplifier* versions

Customizable electronics for single or multiple-axis systems by Phi Drive.

ACCESSORIES

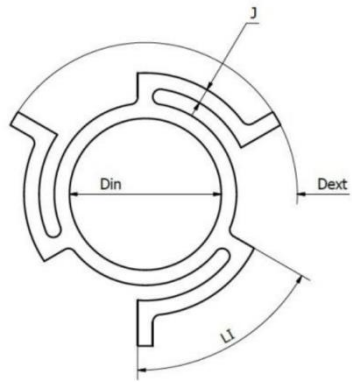


PLANAR SPRINGS

APPLICATIONS :

- Small bearings (preloading)

For more details on these products, please follow this [link](#).



EXAMPLE
APPLICATION

A miniature solution for small bearings preloading

MAIN FEATURES

- ➔ Very low encumbrance
- ➔ Excellent for small bearings preloading
- ➔ Designed via FEM analysis
- ➔ Customizable
- ➔ Available in several sizes

Customizable planar springs designed by Phi Drive via FEM analysis. Excellent for small projects where volume and size matter.

CO-DESIGN

Whether your product or application requires a complex or new actuation, or if a mechatronic solution currently does not exist in the market, please give us a call and we'll be happy to study the best possible solution with you.

*DESIGNING THE PRODUCTS OF THE FUTURE
WITH OUR CUSTOMERS*

MAIN APPLICATION FIELDS:



**PIEZO ELECTRIC
MOTORS**



**ELECTROMAGNETIC
LINEAR MOTORS**



**PNEUMATIC
SOLUTIONS**



**CUSTOM
ELECTRONICS**

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