

# CPSHR<sub>3</sub> – CRYO POSITIONING STAGE HIGH RESONANCE 3



## Features

- xyz motion for very stable cavity measurements
- Parallel kinematics for optimized stiffness
- High resonance frequencies
- Coarse motion using Cryo Linear Actuators
- Position feedback option -COE
- Scanning motion integrated
- 20mK to 375K, vacuum compatible
- Compatible with CVIP2 vibration isolator

## Description / Applications

The Cryo Positioning Stage High Resonance (CPSHR) is a XYZ positioning stage developed for operation in a cryo-vacuum environment, especially suited for very stable cavity measurements. Parallel kinematics result in a light and stiff stage with very high internal resonance frequencies, making it less sensitive to floor vibrations. The CPSHR<sub>3</sub> has a large stroke and the aluminum construction offers optimal thermal conductance while maintaining the high resonances.

## Specifications

General info	
Type of motion	xyz with parasitic angular motion
Parasitic angle from xy stroke	17 mrad/mm, about the x and y axis
1st natural frequency	xy: 2,0 kHz / z: 3,7 kHz (xy: 1,5 kHz for the -S models)
Dimensions	See drawings below
Operational environmental conditions	20 mK to 375 K, ambient to UHV
Weight	510 g, -COE adds 30 g
Stepping motion	
Travel range	x ±8,0 mm / y ±9,2 mm / z ±3,0 mm (not simultaneously)
Actuator	CLA2601, see drawings for calculating actuator outputs to system motion
Minimal step size @ 300 K	5 nm
Minimal step size @ 4 K	1 nm
Scanning motion	
Actuator	Piezo actuators, see drawings for calculating piezo outputs to system motion
Scanning range @ 300 K, typical	x 37.5 μm / y 43.3 μm / z 8 μm (not simultaneously)
Scanning range @ 4 K, typical	x ±15 μm / y ±17.3 μm / z ±1,6 μm (not simultaneously)
Minimal step size	Sub-nm
Drive voltage @ 300 K	-30 V to 120 V
Drive voltage @ 4 K	-150 V to 150 V
Forces and load capacity	
Load capacity	200 g
Materials	
Main body	Aluminum
CLA2601	Stainless steel, ceramic, piezo actuator*
Scanner	Piezo actuator*
*Piezo actuator	Low voltage multilayer, ceramic insulated
Model specific information	
-S	xyz scanner added, see above for range
-COE	Optical Encoder on each CLA2601, 850 pulses per revolution, equivalent to 294 nm axial displacement
Electronics CPSC	
Controller Base Cabinet	CAB
Driver for stepping and scanning	CADM or PSM (scanning only)
Position readout	OEM

## Ordering Information

### Available models

CPSHR <sub>3</sub>	Cryo Positioning Stage High Resonance 3
CPSHR <sub>3</sub> -S	Cryo Positioning Stage High Resonance 3-Scanner
CPSHR <sub>3</sub> -COE	Cryo Positioning Stage High Resonance 3-Cryo Optical Encoder
CPSHR <sub>3</sub> -S-COE	Cryo Positioning Stage High Resonance 3-Scanner-Cryo Optical Encoder

### Available Options

-HV	Upgrade to High Vacuum compatibility
-UHV	Upgrade to Ultra High Vacuum compatibility

### Accessories

AKM <sub>1</sub>	Accessory Kit Mechanical 1
AKE <sub>1</sub>	Accessory Kit Electrical 1

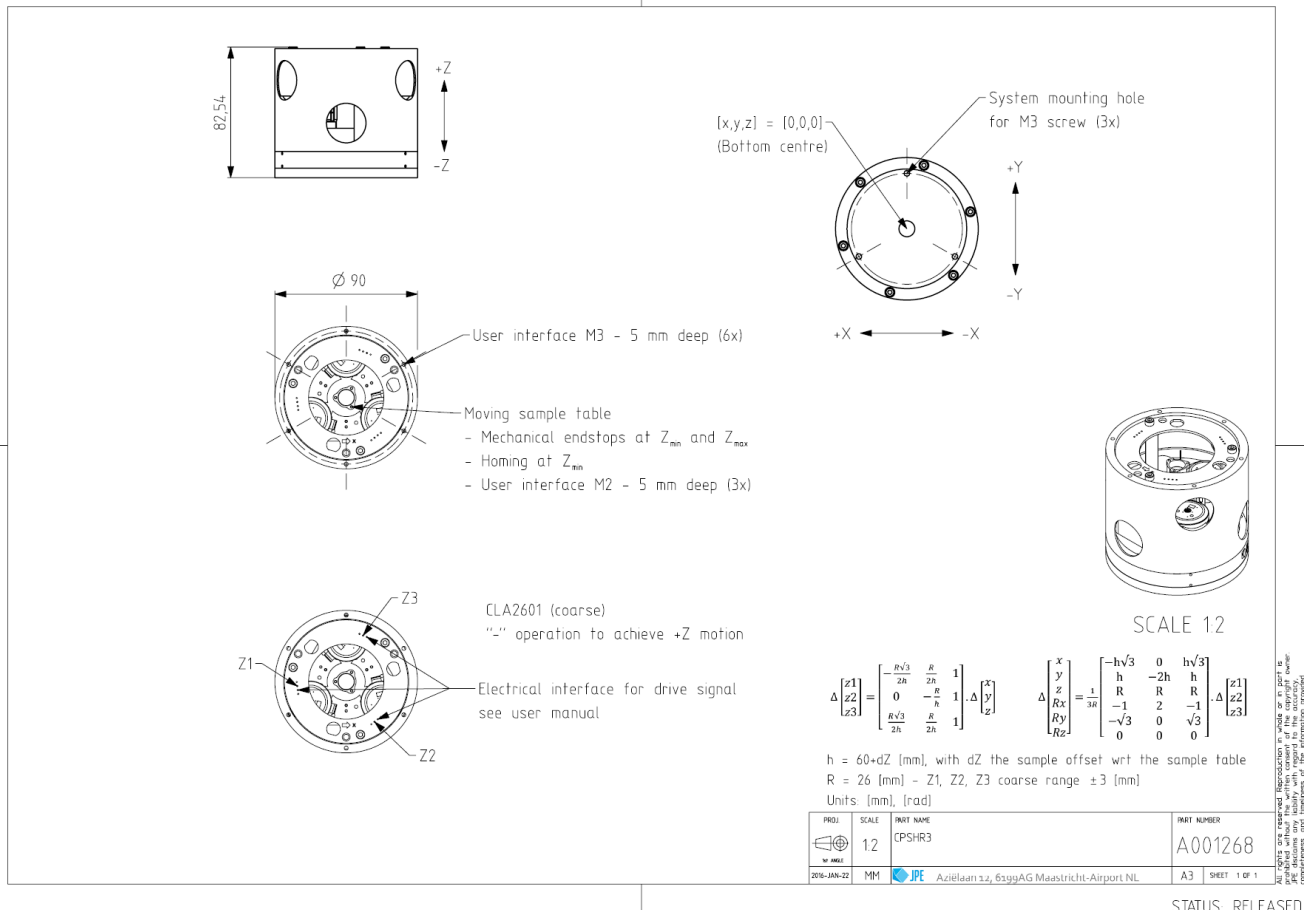
### Mechanical and electrical information

Download 3D step files and manuals from:  
<https://www.jpe-innovations.com/cryo-nano-products/>

### Contact

For quotations, specials, or engineering services, please contact us at:  
<https://www.jpe-innovations.com/contact/>

## Drawings



$[x,y,z] = [0,0,0]$   
(Bottom centre)

System mounting hole for M3 screw (3x)

User interface M3 - 5 mm deep (6x)

Moving sample table  
- Mechanical endstops at  $Z_{min}$  and  $Z_{max}$   
- Homing at  $Z_{min}$   
- User interface M2 - 5 mm deep (3x)

CLA2601 (coarse)  
- "-" operation to achieve +Z motion  
SCANNING  
- A positive voltage will result in +Z motion

Electrical interface for drive signal  
see user manual

$$\Delta \begin{bmatrix} z1 \\ z2 \\ z3 \end{bmatrix} = \begin{bmatrix} -\frac{R\sqrt{3}}{2h} & \frac{R}{2h} & 1 \\ 0 & -\frac{R}{h} & 1 \\ \frac{R\sqrt{3}}{2h} & \frac{R}{2h} & 1 \end{bmatrix} \cdot \Delta \begin{bmatrix} x \\ y \\ z \end{bmatrix}$$

$$\Delta \begin{bmatrix} x \\ y \\ z \\ Rx \\ Ry \\ Rz \end{bmatrix} = \frac{1}{3R} \begin{bmatrix} -h\sqrt{3} & 0 & h\sqrt{3} \\ h & -2h & h \\ R & R & R \\ -1 & 2 & -1 \\ -\sqrt{3} & 0 & \sqrt{3} \\ 0 & 0 & 0 \end{bmatrix} \cdot \Delta \begin{bmatrix} z1 \\ z2 \\ z3 \end{bmatrix}$$

$h = 60+dZ$  [mm], with dZ the sample offset wrt the sample table  
 $R = 26$  [mm] - Z1, Z2, Z3 coarse range  $\pm 3$  [mm]  
Units: [mm], [rad]

$$\Delta \begin{bmatrix} z1 \\ z2 \\ z3 \end{bmatrix} = \begin{bmatrix} -\frac{R\sqrt{3}}{2h} & -\frac{R}{2h} & 1 \\ 0 & \frac{R}{h} & 1 \\ \frac{R\sqrt{3}}{2h} & -\frac{R}{2h} & 1 \end{bmatrix} \cdot \Delta \begin{bmatrix} x \\ y \\ z \end{bmatrix}$$

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$h = 54,85+dZ$  [mm], with dZ the sample offset wrt the sample table  
 $R = 6,75$  [mm] - Z1, Z2, Z3 scan range  $\pm 1,6e-3$  [mm] (at 4K)  
Units: [mm], [rad]

PROJ.	SCALE 1:2	PART NAME CPSHR3-S	PART NUMBER A001288
2016-JAN-22	MM	Aziëlaan 12, 6199AG Maastricht-Airport NL	A3 SHEET 1 OF 1

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$[x,y,z] = [0,0,0]$   
(Bottom centre)

System mounting hole for M3 screw (3x)

User interface M3 - 5 mm deep (6x)

Moving sample table  
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- User interface M2 - 5 mm deep (3x)

CLA2601 (coarse)  
- "-" operation to achieve +Z motion

Optical interface for position feedback  
see user manual

Electrical interface for drive signal  
see user manual

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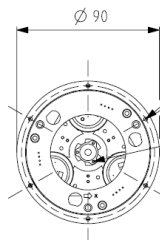
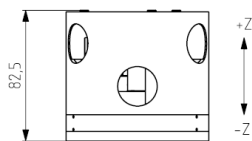
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$h = 54,85+dZ$  [mm], with dZ the sample offset wrt the sample table  
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Units: [mm], [rad]

PROJ.	SCALE 1:2	PART NAME CPSHR3-COE	PART NUMBER A001289
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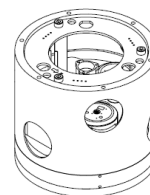
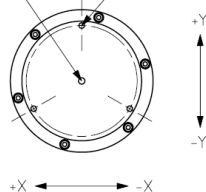
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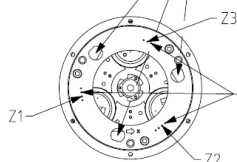


- User interface M3 - 5 mm deep (6x)
- Moving sample table
  - Mechanical endstops at  $Z_{min}$  and  $Z_{max}$
  - Homing at  $Z_{min}$
  - User interface M2 - 5 mm deep (3x)

$[x,y,z] = [0,0,0]$   
(Bottom centre)



Optical interface for position feedback  
see user manual



CLA2601 (coarse)  
- "-" operation to achieve +Z motion  
SCANNING

Electrical interface for drive signal  
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$h = 54.85 + dZ$  [mm], with  $dZ$  the sample offset wrt the sample table  
 $R = 6.75$  [mm] - Z1, Z2, Z3 scan range  $\pm 16e-3$  [mm] (at 4K)  
Units: [mm], [rad]

PROJ	SCALE	PART NAME	PART NUMBER
	1:2	CPSHR3-S-COE	A001270
2016-02-21	MM	 Aziëlaan 12, 6199AG Maastricht-Airport NL	A3 SHEET 1 OF 1

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