

COR-RS CORRECTIVE ROTARY PIEZO STAGE

ABSTRACT

The DS describes the main features of the COR-RS corrective rotary piezo stage. It includes technical data and drawings.

COR-RS is a highly customizable rotating table for heavy operation, a load of about 10Kg (5kg in the standard version) can be rotate and positioned with a very high resolution.

Author(s): De Sanctis O.; Cau N.
Release Date: 06 Oct. 2022
Last Revision: 20 Nov. 2023

REVISION HISTORY

List of changes from original release to current revision.

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

CONTENTS

1. FEATURES	4
2. APPLICATIONS	4
3. DESCRIPTION	4
4. DIMENSIONS	5
5. VARIANTS	5
5.1. Stage type.....	5
5.1.1. <i>SS option</i>	5
5.1.2. <i>FS option</i>	5
5.1.3. <i>CS option</i>	5
5.2. Encoder	5
5.2.1. <i>A option</i>	5
5.2.2. <i>B option</i>	5
5.2.3. <i>C option</i>	6
5.2.4. <i>0 option</i>	6
5.2.5. <i>M option</i>	6
5.3. Stage resolution.....	6
5.3.1. <i>1 option</i>	6
5.3.2. <i>2 option</i>	6
6. TECHNICAL DATA	7
6.1. <i>1 option</i>	7
6.2. <i>2 option</i>	8

LIST OF FIGURES

Fig. 1: Main dimensions of the COR-RS piezo stage.....	5
--	---

LIST OF TABLES

Tab 1: Main dimensions of the COR-RS piezo stage (0 encoder option)	5
Tab 2: Main dimensions of the COR-RS piezo stage (M encoder option)	5
Tab 3: Mechanical data, 1 option	7
Tab 4: standard close loop specification, only for M type.....	7
Tab 5: Command law, 1 option.....	7
Tab 6: CS option	7
Tab 7: Electrical data, 1 option	8
Tab 8: Mechanical data, 2 option	8
Tab 9: standard close loop specification, only for M type.....	8
Tab 10: Command law, 2 option.....	9
Tab 11: CS option.....	9
Tab 12: CS option.....	9

1. Features

- Travel range – $\pm 360^\circ$
- High precision
- No backlash
- No need for lubricant
- High load capability – Up to 5 kg
- High dynamic range
- Sub-nanometric resolution – Step 60-700 μrad
- High Vacuum (HV) version available
- Closed-loop control – Available on request

2. Applications

- Manipulation of micro-optics
- Components positioning
- Assembly and precise adjustments
- Manipulation of biological samples
- High-dynamics applications

3. Description

The COR-RS corrective rotary piezo stage can rotate to extremely precise angles. It is specifically designed to withstand external noise and to offer robust positioning. The hybrid layout with steel and aluminum provides high inertia and stability to mechanical vibrations. The electronics as well can provide additional robustness by minimizing the effect of the external noises and disturbances.

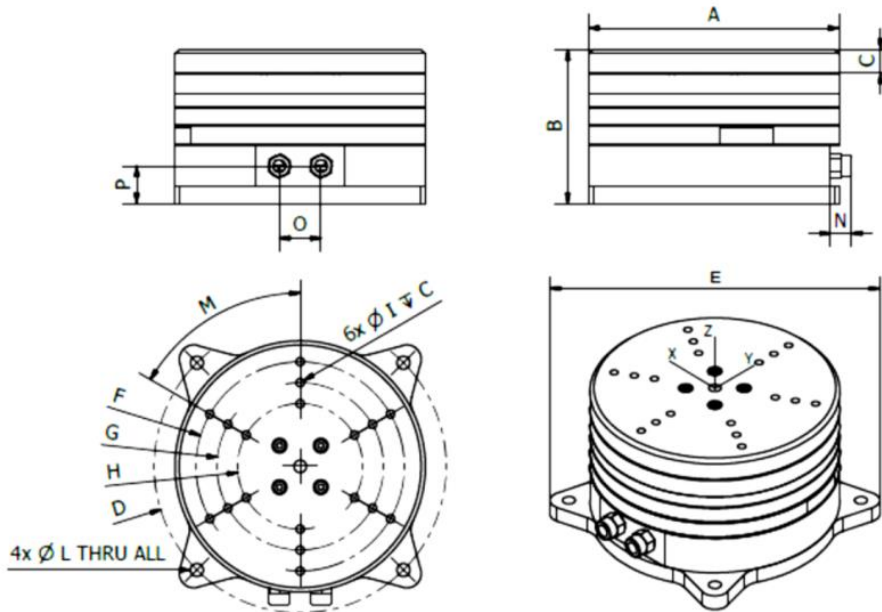
The COR-RS system can be customized:

- The travel range can change
- The stage can be integrated in multi-axis solutions
- The resolution can be tuned on request
- The encumbrance can be changed
- Flanges for mounting the stage and loads on top of it can be added as desired

Calibration is performed by Phi Drive. Calibration provides a way to minimize linearity errors basing on requests from the customer.

4. Dimensions

Fig. 1: Main dimensions of the COR-RS piezo stage



Tab 1: Main dimensions of the COR-RS piezo stage (0 encoder option)

A	B	C	D	E	F	G	H	I	L	M	N	O	P
120	36	11	38	160	50	40	30	M4	6	30	10	20	18

Tab 2: Main dimensions of the COR-RS piezo stage (M encoder option)

A	B	C	D	E	F	G	H	I	L	M	N	O	P
120	58	11	38	160	50	40	30	M4	6	30	10	20	18

5. Variants

5.1. Stage type

5.1.1. SS option

The Stick-Slip stage type (SS) grants a complete rotation of $\pm 360^\circ$.

5.1.2. FS option

The flexure mechanism stage type (FS) can provide only small angular corrections.

5.1.3. CS option

The full Stick-Slip and flexure mechanism stage type (CS) includes both a SS stage and a FS stage.

5.2. Encoder

There exist five different possibilities for the encoder.

5.2.1. A option

In the A option there are one encoder for the SS (Stick-Slip) mechanism and another measuring system for the rotary flexure mechanism. The stage type must be only CS.

5.2.2. B option

In the B option the encoder is located on the SS mechanism only. The stage type must be CS or SS.

5.2.3. C option

In the C option the encoder is located on the rotary flexure mechanism only. The stage type must be CS or FS.

5.2.4. 0 option

In the 0 option there is no encoder.

5.2.5. M option

In the M option the encoder is external and chosen from the market.

5.3. Stage resolution

The stage resolution can be chosen between two possibilities.

5.3.1. 1 option

The 1 option provides higher accuracy.

5.3.2. 2 option

The 2 option provides lower accuracy.

6. Technical data

The followings technical data refers to the standard version, the COR-RS is an highly customizable product and all data can be adapted according to customer needs.

6.1. 1 option

The "1 Option" has a particular desing that allows better resolution

Tab 3: Mechanical data, 1 option

		SS 0 1 variant	SS M 1 variant	Unit
Axis of rotation		Z	Z	
Travel range		±360	±360	deg
Step ^[1]		60-400	60-400	μrad
Angular speed ^[2]		1.7	1.7	RPM
Repeatability/accuracy (closed-loop)		-	See Tab 4	μrad
Wobble ^[3]		±5	±5	μrad
Straightness/flatness ^[3]		±5	±5	μm
Rotating plane inertia ^[4]		834	834	kg·mm ²
Maximum load		5	5	kg
Stall torque ^[5]		0.28	0.28	Nm
Holding torque		0.30	0.30	Nm
Maximum imbalance of mass/torque (horizontal)		2000	2000	g·cm
Materials ^[6]	Body	Steel	Steel	
	Actuator	PZT ceramic	PZT ceramic	
	Case	Aluminum	Aluminum	
Stage dimensions	Footprint	160	160	mm
	Height	58	58	mm
Recommended operating temperature		+20	+20	°C
Recommended storage temperature range		+10 to +40	+10 to +40	°C

Tab 4: standard close loop specification, only for M type

	Value			
Resolution	20	bit	0.35	mdeg
Accuracy	±4	mdeg	±70	μrad

Tab 5: Command law, 1 option

^[7]	SS 0 1 variant	SS M 1 variant	Unit
Wave shape	Sawtooth	Sawtooth	
Operating frequency range	0 to 450	0 to 450	Hz
Rise time	0 to 0.5	0 to 0.5	% of the period
Maximum voltage	150	150	V

Tab 6: CS option

	SS 0 1 variant	SS M 1 variant	Unit
Resolution	100	100	nRad
Accuracy in close loop	-	±200	nRad

Tab 7: Electrical data, 1 option

Power supply	Included in PHI-SS driver
Drive type	PHI-SS driver

^[1] Limited by electronic noise and measurement system, adjustable by tuning voltage

^[2] Maximum angular speed with no load when driving stage at frequency 450 Hz, rising time <10% of the period, max. voltage 150 V

^[3] To be defined by customer

^[4] Can change according to customer's load

^[5] Stall torque with no load when driving stage at frequency 450 Hz, rising time <10% of the period, max. voltage 150 V

^[6] Design with other materials on request

^[7] The chosen command law parameters modify speed and torque. Performances are calculated basing on the electronics by Phi Drive

6.2. 2 option

The "2 Option" is the most standard configuration

Tab 8: Mechanical data, 2 option

	SS 0 2 variant	SS M 2 variant	Unit
Axis of rotation	Z	Z	
Travel range	±360	±360	deg
Step ^[1]	200-700	200-700	μrad
Angular speed ^[2]	1.6	1.6	RPM
Repeatability/accuracy (closed-loop)	-	See Tab 9	μrad
Wobble ^[3]	±5	±5	μrad
Straightness/flatness ^[3]	±5	±5	μm
Rotating plane inertia ^[4]	834	834	kg·mm ²
Maximum load	5	5	kg
Stall torque ^[5]	0.15 to 0.30	0.15 to 0.30	Nm
Holding torque	0.30	0.30	Nm
Maximum imbalance of mass/torque (horizontal)	3000	3000	g·cm
Materials ^[6]	Body	Steel	Steel
	Actuator	PZT ceramic	PZT ceramic
	Case	Aluminum	Aluminum
Stage dimensions	Footprint	160	160
	Height	58	58
Operating temperature range	+18 to +25	+18 to +25	°C
Recommended operating temperature	+20	+20	°C
Storage temperature range	+10 to +40	+10 to +40	°C

Tab 9: standard close loop specification, only for M type

	Value			
Resolution	20	bit	0.35	mdeg
Accuracy	±4	mdeg	±70	μrad

Tab 10: Command law, 2 option

[7]	SS 0 2 variant	SS M 2 variant	Unit
Wave shape	Sawtooth	Sawtooth	
Operating frequency range	1 to 150	1 to 150	Hz
Rise time	0 to 5	0 to 5	% of the period
Maximum voltage	150	150	V

Tab 11: CS option

	SS 0 1 variant	SS M 1 variant	Unit
Resolution	300	300	nRad
Accuracy in close loop	-	±600	nRad

Tab 12: CS option

Power supply	Included in PHI-SS driver
Drive type	PHI-SS driver

^[1] Limited by electronic noise and measurement system, adjustable by tuning voltage

^[2] Maximum angular speed with no load when driving stage at frequency 310 Hz, rising time <10% of the period, max. voltage 150 V

^[3] To be defined by customer

^[4] Can change according to customer's load

^[5] Stall torque with no load when driving stage at frequency 310 Hz, rising time <10% of the period, max. voltage 150 V

^[6] Design with other materials on request

^[7] The chosen command law parameters modify speed and torque. Performances are calculated basing on the electronics by Phi Drive

NOTES:

IMPORTANT NOTICE AND DISCLAIMER

Phi Drive S.r.l. makes every effort in ensuring accurate and reliable technical information contents in this document and in every other kind of shared documentation, including datasheets, application notes or other design resources and advice.

However, the information in this document is subject to changes and provided "AS IS". Phi Drive S.r.l. reserves the right to make changes without further notice to any specifications or products mentioned herein to improve reliability.

This document is property of Phi Drive S.r.l. and by furnishing this information, Phi Drive S.r.l. grants no license, expressed or implied under any patents, copyrights, trademarks, trade secrets or other intellectual property rights. Phi Drive S.r.l. owns the copyrights associated with the information contained in this document and gives consent for copies to be made of the information only for use within your organization with respect to other products of Phi Drive S.r.l. This consent does not extend to other copying such as copying for general distribution, advertising or promotional purposes or for creating any work for resale.
