

MAN01-01 – CRYO LINEAR ACTUATOR (CLAXXXX) USER MANUAL

CRYO & NANO POSITIONING PRODUCTS

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RELEVANT DOCUMENTATION

| Ref | Title, Author |
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| [1] | CNP-Products_MAN00_R01_Getting-Started.pdf (JPE) |
| [2] | CNP-Products_MAN02_Rxx_Software-User-Manual.pdf (JPE) |
| [3] | CLA##01_Interface-drawings.pdf (JPE) |
| [4] | CLA##01_Brochure.pdf (JPE) |
| [5] | C181047A_165-001a_CLAxyy-COE_Unpacking-Instructions |

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DEFINITIONS

| Term | Definition |
|------|------------|
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ABBREVIATIONS

| Abbreviation | Full Name |
|--------------|-----------|
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1. INTRODUCTION

Thank you for using JPE's Cryo & Nano Positioning products!

This *User Manual* describes the handling and use of Cryo Linear Actuators "PiezoKnob" (CLAxxy), from here on described as actuator.



Please read this document carefully prior to installation and (initial) operation of the controller, (stand-alone) actuators and systems. Failure to observe the safety regulations results in a risk of mortal electric shock and/or damage to the controller(s), actuator(s) and/or system(s)!

JPE shall not be liable for damage or injury resulting from misuse of the controller system(s), actuator(s) and/or device(s) or unauthorized alterations to either of those.

All products mentioned in this manual are intended for use in a laboratory and/or scientific research environment only and may only be installed, maintained and used by higher educated, technical skilled personnel (from here on described as operators).

Please note that all content in this document is superseded by any new versions of this document. Visit the JPE website (www.jpe.nl) to obtain the most recent version¹. All images in this document are for illustrative purposes only.

1.1 Prerequisites

Before continuing with this user manual, please make sure to read and understand the contents of the (latest version of the) Cryo & Nano Positioning Products Getting Started Guide (MAN00).

1.2 Principle of operation

The CLA is developed for accurate positioning in vacuum environments from ambient down to cryogenic temperatures around a few Kelvin.

It is a spindle / nut drive concept for which the nut is attached to the frame and the spindle will be rotated by this piezo based actuator. The electrical wiring is attached to the rotating part, but decoupled for rotation by means of sliding contacts. With the use of the controller it is possible to realize torque pulses in both directions on the spindle which enables the spindle to rotate with very small steps resulting in nanometer adjustability in a cryogenic environment.

Since the working principle is based on inertia drives, the spindle always needs to be preloaded with a certain force (about 3 [N]).

It is important to know that the heat dissipation in the actuator as well as in the controller is proportional to the stepping frequency and proportional to the square of the applied voltage (step size). For full step

¹ This *User Manual* is intended for products ordered and delivered from **June 2019 onwards**. For products ordered and delivered prior to this date, please refer to the previous User Manual(s).

size an estimate for the dissipated energy in the actuator is about 0.59 mJ / per step at ambient temperature but about 0.055 mJ per step at 4 Kelvin.

Please note that the actuators are driven with a set point profile with a maximum step size of 150 [Vpp] and high peak currents up to 10[A] for a short period of time (up to 30 [μsec])!

Because of design constraints, open voltage contacts are present!

2. INSIDE THE BOX

Actuators will be delivered in a white-colored (membrane) polypropylene box. The inner part of the polypropylene box can be taken out and bend in such way that the actuators and/or systems can be easily unpacked.

Do not cut the membrane plastic. Keep the box in case products need to be returned.

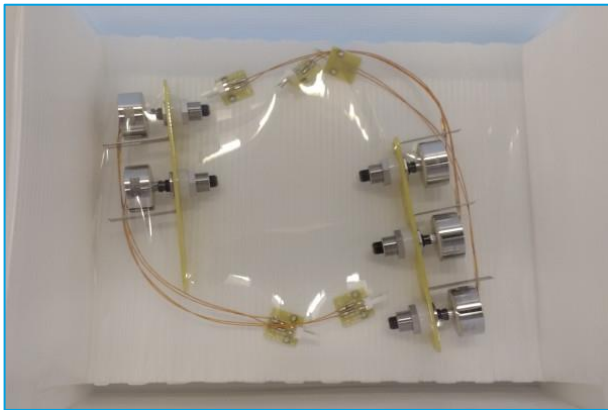


Figure 1: Example packaging with 5x CLA

Actuators equipped with a Cryo Optical Encoder (product type option –COE) are mounted in a dedicated *PCB Transport tool* to guard the encoder grid and optical fiber.

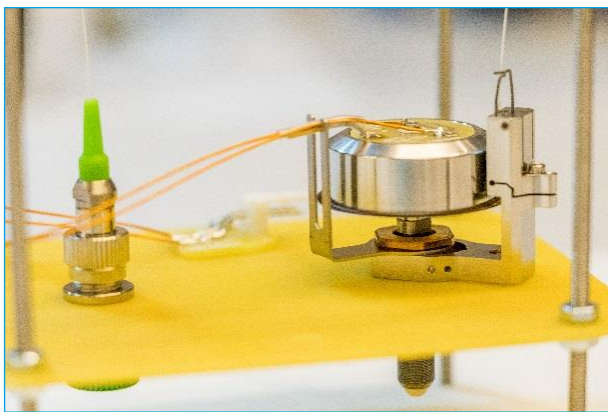


Figure 2: PCB Transport tool for CLA with COE

Please read the (separate) Unpacking Instructions manual for more information on unpacking and handling the CLAxxy-COE.

3. MOUNTING INSTRUCTIONS

View the Interface Drawing for detailed dimensions and mounting interfaces.

By default the actuator is delivered with a spindle and spindle nut that can be mounted in a setup (thread on spindle nut). Additionally, a rotation lock “fork” is supplied that needs to be mounted with the spindle nut as well to lock the rotation of the (top) PCB on the actuator.

If the actuator is equipped with a Cryo Optical Encoder (product type option -COE) make sure that the encoder bracket is mounted correctly. Fixate the FC/APC (male) connector. Take great care not to damage the encoder grid! Use the *Unpacking Instructions manual* (see chapter 2) as a guide / reference.

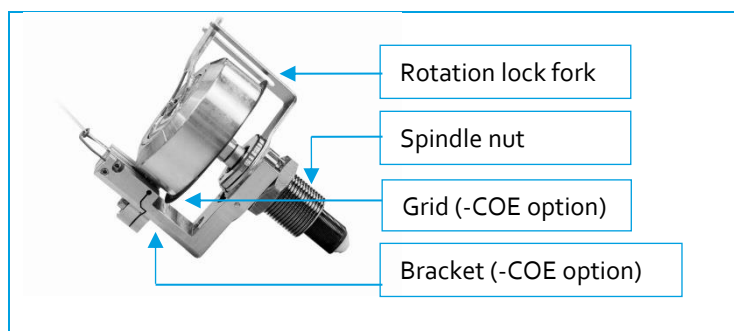


Figure 3: Example of a CLA rotation lock fork, COE encoder bracket and grid

Make sure the wiring does not get damaged or stuck in the setup when mounting the actuator. The Connector Interface PCB must be mounted properly prior to driving the actuator electrically! Make sure the actuator can be rotated by hand (*carefully, and only if applicable and practical*).

4. ELECTRICAL CONNECTIONS

All actuators are assembled with ~150[mm] Kapton coated wire and a Connector Interface PCB at the end with a 2-pin 2.54mm pitch header mounted (*Molex KK 22-05-7028*). There are two mounting holes available for M2 bolts.

The default Ambient Cable (ACL) can be connected directly to the Connector Interface PCB. If any custom cabling is required, please consult the Getting Started Guide (MAN00).

| Pin configuration | | |
|-------------------|----------------|--|
| Pin | Name | Note |
| 1 | (Piezo) Signal | Routes to the pad labeled "S" or "SIG" on the actuator |
| 2 | (Piezo) REF | Routes to the pad labeled "R" or "REF" on the actuator |

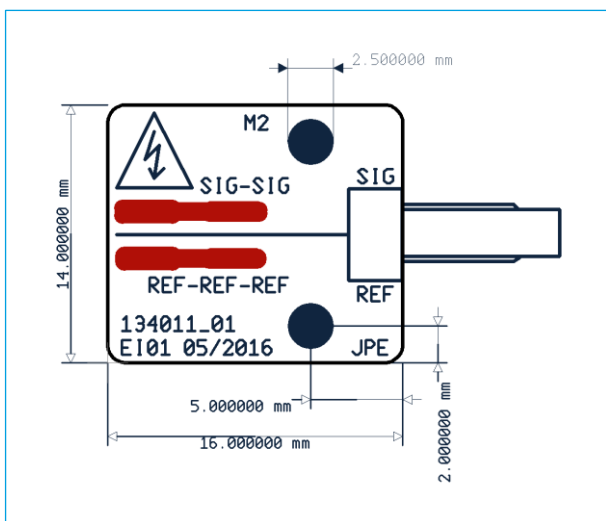


Figure 4: CLA Connector Interface PCB (top view)

Make sure that there is no force applied to the Kapton coated wires connected to the actuator!

Please note that (Piezo) REF is NOT the same as (system) GND or PE, so do not connect these to each other and do not use standard oscilloscope probes!

Because of design constraints, open voltage contacts are present!

5. OPTICAL CONNECTIONS

If the actuator is equipped with a Cryo Optical Encoder (product type option –COE) an optical fiber with a length of ~200[mm] is fixed to the encoder bracket. On the end of the fiber is an *FC/APC narrow key (male)* connector.

The fiber cable and COE are delicate components that need to be handled very carefully. Take great care not to damage the encoder grid. Make sure that no force is applied to the fiber and fixate the FC/APC connector. Please read the Unpacking Instructions manual (see above) as a guide / reference

The default Ambient Fiber (AF5) cable can be connected to the FC/APC narrow key (male) connector only by using the supplied *FC/APC female/female adapter (Molex 106152-3000)*. If not in use, always keep metal screw-on cap on connector and/or adapter. If any custom cabling is required, please consult the Getting Started Guide (MAN00).



Figure 5: FC/APC female/female adapter

6. CONNECTING TO CONTROLLER

| Controller with Plug-in Modules ² | |
|--|--|
| CLA##01 | CADM ₂ Output |
| CLA##01-COE | CADM ₂ Output OEM ₂ Input A |

² For available Modules see CNP-Products MAN01-09 (CPSC).

7. SENSOR CALIBRATION

If the actuator is equipped with a Cryo Optical Encoder (product type option –COE), the device will be delivered pre-calibrated. This calibration is done to determine the correct optical signal levels for the encoder.

Calibration is done in cooperation with the Optical Encoder Module (OEM2). This means that the calibration settings for a specific COE will be stored for a specific input channel of the OEM2.

For that reason, or for a re-calibration, it is also possible to do a (manual) calibration. For this the actuator must be able to move freely. Re-calibration can be done with the user software, please read the *Software User Manual (MANo2)* on how to do this.

8. DECLARATION OF CONFORMITY CLA

Manufacturer : JPE B.V.
Address : Aziëlaan 12
6199 AG Maastricht-Airport
The Netherlands

The manufacturer hereby declares that the product:

Product Name : **Cryo Linear Actuator (CLA)**
Product Description : **Linear motor for cryogenic applications, including non-magnetic version.**
Product Number : **C181047**

Complies with the following European directives:

2014/35/EU Low Voltage Directive
2014/30/EU EMC Directive
2011/65/EU RoHS

A copy of the Technical file for this equipment is available at JPE.

Maastricht-Airport, 29 June 2018



Ir. H. Janssen
Founder & CEO
JPE B.V.
The Netherlands

9. DECLARATION OF CONFORMITY COE

Manufacturer : JPE B.V.
Address : Aziëlaan 12
6199 AG Maastricht-Airport
The Netherlands

The manufacturer hereby declares that the product:

Product Name : **Cryo Optical Encoder (COE)**
Product Description : **Cryogenic Optical Encoder for the CLA.**
Product Number : **C181045**

Complies with the following European directives:

2006/25/EC Artificial Optical Radiation
2011/65/EU RoHS

A copy of the Technical file for this equipment is available at JPE.

Maastricht-Airport, 29 June 2018



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