

## About

A precision linear stepper actuator with a threaded interface. An internal M22×0.75 thread allows mating with stages with externally threaded flanges, like the Thorlabs MAX300 and MAX600 series of multi-axis stages. The ACTL2 is compatible with Qontrol's M2 stepper motor controller, and uses Qontrol's CABM6 motor cable interface.

## Contents of this document

Specifications . . . . .	2
Description . . . . .	2
<i>Backlash</i>	3
Installation . . . . .	3
<i>Attaching the actuator to a stage</i>	3
<i>Software setup</i>	4
Wiring and Pin Map . . . . .	5
Notes and disclaimer . . . . .	6
Revision history . . . . .	6



## Specifications

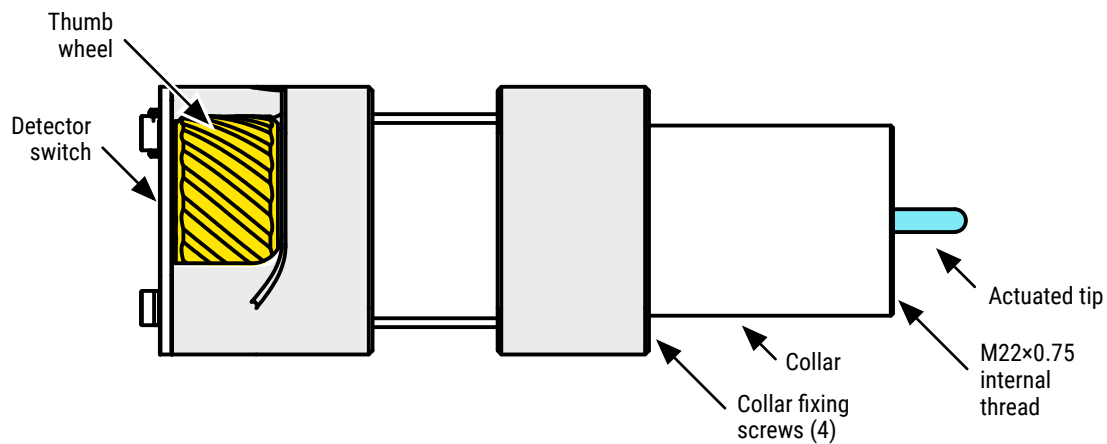
Parameter	Symbol	Value
Travel	$s_{max}$	19.6 mm
Travel (full steps)	$x_{max}$	6200
Full step resolution Maximum speed	$\Delta s$	3.175 $\mu$ m 2.5 mm/s
Maximum speed (full steps)	$v_{max}$	800 Hz
Optimal winding current	$i_{opt}$	0.2 A
Maximum winding current	$i_{max}$	1.0 A
Winding resistance	$R_w$	2.7 $\Omega$
Winding inductance	$L_w$	2.5 mH
Overall length (min)		100 mm
Overall width		35 mm
Overall height		36 mm
Mass		220 g
Positive limit switch		Yes
Negative limit switch		No
Optimal M2 MODE		21
Maximum load	$F_{max}$	TBC <sup>1</sup>

## Description

The ACTL2 couples the motion from an internal stepper motor to a captive linear motion mechanism. It includes a thumb wheel for manual positioning and a visual indication of motion. A single detector switch is included to enable homing and absolute positioning.

The linear motion mechanism actuates a 304L stainless steel tip, with  $s_{max}$  the range of motion. An internally M22 $\times$ 0.75 threaded aluminum collar attaches to the target stage. The collar spins freely for easy stage attachment, and is fixed in place by four M2.5 collar fixing screws.

<sup>1</sup>To be confirmed: contact us at support@qontrol.co.uk for more information.



## Backlash

The effect of backlash—mechanical hysteresis—is a lag in real movement when the motor either starts moving, or changes direction. When the ACTL2 is unloaded, its backlash will be maximal. Most modern stages, however, are spring-loaded by design, to effectively eliminate backlash.

If backlash is a problem in your application, a simple algorithm can often be used in software to address this. This algorithm is outlined in pseudo-code, here:

```
For:
  dxb = backlash distance
  x1 = target position
  x0 = current position
  move(x) = function to move to position x

if (x1 > x0)
  move(x1)

if (x1 < x0)
  move(x1 - dxb)
  move(x1)
```

Simple trial and error can be used to determine dxb, for a particular application.

## Installation

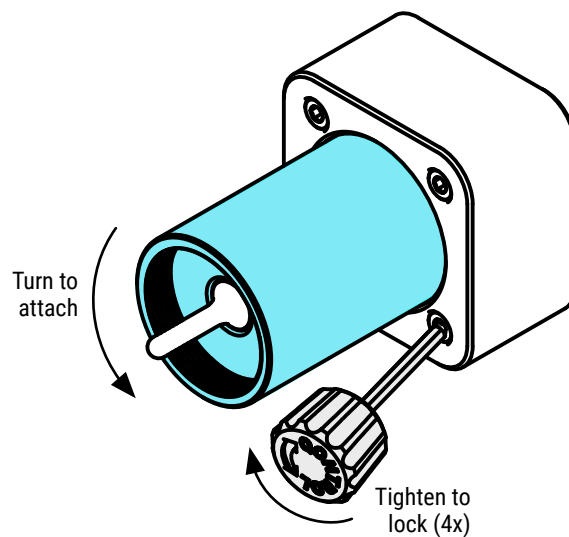
### Attaching the actuator to a stage

Follow these steps to attach the ACTL2 to a suitable stage mount:

1. Ensure the collar spins freely in its housing.
2. Align the ACTL2 with the target port of the stage.



3. Holding the actuator body in alignment, rotate the collar clockwise.
  - Stop when tight.
4. Tighten the four collar fixing screws.
  - Use a Qontrol ACTM25 tool, or a small generic 2.0 mm hex key.
  - Choose the most convenient angle for your application.
5. With the *power off*, insert the CABM6 connector into a compatible backplane or interposer.



The diagram above shows how to turn the collar and collar fixing screws to attach and mount the ACTL2. Reverse the above instructions to detach the ACTL2.

## Software setup

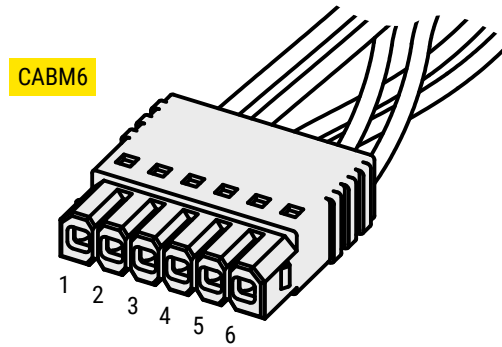
This section assumes a Qontrol M2 motor controller, and the ACTL2 is connected to channel `ch`, and that you have already obtained the Qontrol Python API<sup>2</sup>.

```
q = qontrol.MXMotor(serial_port_name = serial_port_name)
q.mode[ch] = 21
q.xmin[ch] = -100
q.xmax[ch] = 6200
```

<sup>2</sup>Available from Github ([github.com/takeqontrol/api](https://github.com/takeqontrol/api)) or PyPI (`pip install qontrol`).



## Wiring and Pin Map



The stepper motor windings and the detector switch contacts are presented on a CABM6 connector compatible with the BP3M motor backplane. These can be easily disconnected with the help of a small slotted screwdriver. The CABM6 connector is keyed, but the interlock (pin 1,6) and winding (pin 2,3,4,5) connections are symmetric.

CABM6 Pin	Function
1	Detector switch first terminal
2	Winding A first terminal
3	Winding A second terminal
4	Winding B first terminal
5	Winding B second terminal
6	Detector switch second terminal



## Notes and disclaimer

If you find an error in this document, or have suggestions for how we could make it better, please do get in touch with us at [support@qontrol.co.uk](mailto:support@qontrol.co.uk) with your ideas and feedback.

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## Revision history

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1.1 (this version)	2021-03-18
1.0	2021-03-12

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