

CONTROL LOADING SOLUTIONS



Rev C, October 2016

A FULL RANGE OF CONTROL LOADING
SOLUTIONS FOR FIXED AND ROTARY WING

WHAT MOVES YOUR WORLD

MOOG



TAKE YOUR CONTROL LOADING SYSTEMS TO NEW HEIGHTS

With a few decades of experience and thousands of control loading channels in the field, Moog is the world leader in control loading systems for both military and commercial simulator programs for fixed and rotary wing aircraft.

Our unique model-follower force-loop technology forms the basis for all our control loading systems. Combined with highly responsive electric actuators and sophisticated software models, Moog control loading systems deliver an unsurpassed level of performance, fidelity and reliability.

ADVANTAGES

- Highest level of design flexibility and unique expertise, with proven reliability in critical loading applications around the world for flight simulation and other applications
- Turnkey control loading solutions are fully tailored to customer requirements. A typical set-up could include base frame, interconnecting linkages, replica controls and integration of control loading hardware and software
- Optimal solution for all control loading requirements, from basic flight training to high fidelity full flight simulation to the highest level of certification from the US Federal Aviation Administration (FAA), Joint Aviation Authority (JAA) or military equivalent
- All actuators are based on brushless permanent magnet servomotors and digital control electronics for smooth and dependable performance
- Provides a wide range of services including mechanical linkage design and manufacturing, software development, aircraft control response measurement, tuning and acceptance, installation support and training

ELECTRIC ROTARY CONTROL LOADERS HIGH DYNAMIC

These actuators are based on high torque servomotors in a direct-drive setup, capable of generating an output torque of up to 200 Nm (1,770 lb in) continuously. They are designed for primary controls with high fidelity requirements in applications related to high fidelity control force simulation. High dynamic is provided through high torque and velocity.



| Model * | CL-R-E/HD/50Nm | CL-R-E/HD/100Nm | CL-R-E/HD/150Nm | CL-R-E/HD/200Nm |
|---|---|---|---|---|
| Continuous Output Torque | 45 Nm (73.8 ft-lb) | 100 Nm (885 lb in) | 150 Nm (1,325 lb in) | 200 Nm (1,770 lb in) |
| Output Torque < 30 sec | 55 Nm (88.5 ft-lb) | 120 Nm (1,050 lb in) | 175 Nm (1,550 lb in) | 250 Nm (2,210 lb in) |
| Output Torque Peak < 1 sec | 80 Nm (177 ft-lb) | 240 Nm (2,125 lb in) | 300 Nm (2,650 lb in) | 350 Nm (3,100 lb in) |
| Output Stroke | Multi-turn | +/- 45° | +/- 45° | +/- 45° |
| Output Mechanical Interface | Flange with 6 holes for sprocket or lever | M8 rod-end | M8 rod-end | M8 rod-end |
| Maximum Velocity (1 x 208-230 VAC) | 2,500 °/s | 600 °/s | 590 °/s | 500 °/s |
| Maximum Velocity (3 x 400 VAC) | - | - | - | 600 °/s |
| Weight | 20 kg (44.1 lb) | 28 kg (61.7 lb) | 37 kg (81.6 lb) | 42 kg (92.6 lb) |
| Dimensions of Motor (LxWxH) | 263 x 232 x 241 mm (10.4 x 9.1 x 9.5 in) | 341 x 332 x 223 mm (13.4 x 13.1 x 8.8 in) | 341 x 332 x 248 mm (13.4 x 13.1 x 9.8 in) | 341 x 332 x 273 mm (13.4 x 13.1 x 10.7 in) |
| Max. Power Consumption | 1,000 Watt | 1,000 Watt | 1,150 Watt | 1,500 Watt |
| Average Power Consumption | 100 Watt | 250 Watt | 300 Watt | 350 Watt |
| CE Approved | Yes | Yes | Yes | Yes |
| Operating Temperature | 0 - 45 °C (273 - 318 K) | 0 - 45 °C (273 - 318 K) | 0 - 45 °C (273 - 318 K) | 0 - 45 °C (273 - 318 K) |
| Storage Temperature | -25 - 70 °C (248 - 343 K) | -25 - 70 °C (248 - 343 K) | -25 - 70 °C (248 - 343 K) | -25 - 70 °C (248 - 343 K) |
| Humidity | <85% (operating); <95% (storage) non-condensing |

ELECTRIC ROTARY CONTROL LOADERS MEDIUM DYNAMIC

These actuators comprise compact servomotor gearbox combinations capable of generating an output torque of up to 100 Nm (885 lb in) continuously. They are mainly used for secondary controls and medium fidelity primary controls in applications related to control force simulation. Medium dynamic is provided through medium torque and velocity.



| Model | CL-R-E/MD/40Nm | CL-R-E/MD/100Nm |
|--------------------------------------|---|---|
| Continuous Output Torque | 40 Nm (354 lb in) | 100 Nm (885 lb in) |
| Output Torque < 30 sec | 50 Nm (443 lb in) | 120 Nm (1,062 lb in) |
| Output Torque Peak < 1 sec | 80 Nm (708 lb in) | 200 Nm (1,770 lb in) |
| Output Stroke | +/- 45° | +/- 45° |
| Maximum Velocity | 300 °/s | 300 °/s |
| Weight | 7 kg (15.4 lb) | 11 kg (24.3 lb) |
| Maximum Power Consumption | 500 Watt | 1,150 Watt |
| Average Power Consumption | 125 Watt | 250 Watt |
| Output Mechanical Interface | M6 rod-end | M8 rod-end |
| CE Approved | Yes | Yes |
| Dimension of Motor (LxWxH) | 334 x 94 x 135 mm (13.1 x 3.7 x 5.3 in) | 364 x 136 x 181 mm (14.3 x 5.3 x 7.1 in) |
| Operating Temperature | 0 - 45 °C (273 - 318 K) | 0 - 45 °C (273 - 318 K) |
| Storage Temperature | -25 - 70 °C (248 - 343 K) | -25 - 70 °C (248 - 343 K) |
| Humidity | <85% (operating); <95% (storage) non-condensing | <85% (operating); <95% (storage) non-condensing |

*See page 4 for the explanation of the ordering code

ELECTRIC LINEAR CONTROL LOADER

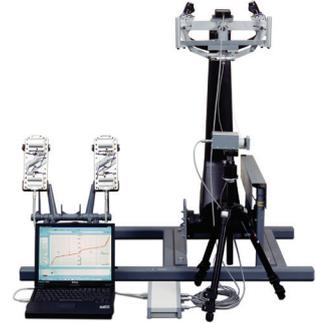
These actuators are compact with servo-ball screw combinations capable of generating an output force of up to 2,400 N (539 lbf) continuously. Their primary use is for heavily loaded primary control force simulation. They are compact and provide high performance.



| | |
|---|--|
| Model | CL-L-E/2.2kN |
| Stroke Length | 127 mm (5.0 in) |
| Lubrication | Oil Lubrication-Lifetime Lubrication |
| Finish | Paint Flat Black |
| Position Feedback | Encoder (Absolute) |
| Static Design Load | 4 kN (899 lbf) |
| Weight | 13 kg (28.7 lb) |
| CE Approved | Yes |
| Actuator Continuous Force Capability | 2.2 kN (495 lbf) |
| Actuator Peak Velocity Set by Controller | 609 mm/s (24.0 in/s) |
| Actuator Screw Lead | 20 mm/rev (0.79 in/rev) |
| Total Actuator Inertia | 0,006 in-lb-s ² (Rotor, Screw, Interface of Bearings, Nute, Keyways) |
| Actuator Design Life | Dynamic Load Rating of Screw 19.5 kN (4,383 lbf) |
| L₁₀ Life | 10.8 million m (426 million in) of Travel at 1.1 N (250 lbf) Cubic Mean Load |

CONTROL FORCE MEASUREMENT SYSTEM (CFM)

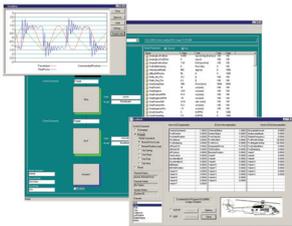
The CFM facilitates accurate force-position measurements of aircraft flight controls for the development of type-specific software models and verification/validation of the flight control responses in simulators.



Key Features

- High precision force/position measurement
- Extensive data analysis
- Position or angle measurements by rate-gyro. In combination with the stringpot, cross coupling measurement is possible
- Pedal plates, with sensors for measuring of heel and toe forces

CONTROL LOADING SOFTWARE



All Moog control loading systems are delivered with a basic model, allowing the operator to use the system with limited parameters (spring, damping and friction).

The Moog generic model represents a typical flight control system and is suitable for medium fidelity training devices. This software is available for fixed wing or rotary wing aircraft simulation.

The Moog aircraft-specific model exactly replicates the controls of the simulated aircraft. This software model is used by customers to obtain the highest level of certification from the FAA, JAA or military equivalent.

Moog Explorer, supplied with each system, is a Graphical User Interface to monitor, control and diagnose all individual components of the control loading system.

ORDERING INFORMATION

| | | | | |
|---------------------|---------------------------|--------------|---|---|
| Control Loader (CL) | Rotary or Linear (R or L) | Electric (E) | High Dynamic or Medium Dynamic (HD or MD) | Torque or Force (values as indicated in this brochure) ## Nm/kN |
|---------------------|---------------------------|--------------|---|---|

EXAMPLE

CL-R-E/HD/200Nm

TAKE A CLOSER LOOK

Control Loading Solutions from Moog are available around the world.
For more information, visit our web site or contact one of the locations below.

Australia
+61 3 9561 6044
Service + 61 3 8545 2140
info.australia@moog.com
service.australia@moog.com

Brazil
+55 11 3572 0400
info.brazil@moog.com
service.brazil@moog.com

Canada
+1 716 652 2000
info.canada@moog.com

China
+86 21 2893 1600
Service +86 21 2893 1626
info.china@moog.com
service.china@moog.com

France
+33 1 4560 7000
Service +33 1 4560 7015
info.france@moog.com
service.france@moog.com

Germany
+49 7031 622 0
Service +49 7031 622 197
info.germany@moog.com
service.germany@moog.com

Hong Kong
+852 2 635 3200
info.hongkong@moog.com

India
+91 80 4057 6666
Service +91 80 4057 6604
info.india@moog.com
service.india@moog.com

Ireland
+353 21 451 9000
info.ireland@moog.com

Italy
+39 0332 421 111
Service 800 815 692
info.italy@moog.com
service.italy@moog.com

Japan
+81 46 355 3767
info.japan@moog.com
service.japan@moog.com

Korea
+82 31 764 6711
info.korea@moog.com
service.korea@moog.com

Luxembourg
+352 40 46 401
info.luxembourg@moog.com

The Netherlands
+31 252 462 000
info.thenetherlands@moog.com
service.netherlands@moog.com

Russia
+7 8 31 713 1811
Service +7 8 31 764 5540
info.russia@moog.com
service.russia@moog.com

Singapore
+65 677 36238
Service +65 651 37889
info.singapore@moog.com
service.singapore@moog.com

South Africa
+27 12 653 6768
info.southafrica@moog.com

Spain
+34 902 133 240
info.spain@moog.com

Sweden
+46 31 680 060
info.sweden@moog.com

Turkey
+90 216 663 6020
info.turkey@moog.com

United Kingdom
+44 (0) 1684 858000
Service +44 (0) 1684 278369
info.uk@moog.com
service.uk@moog.com

USA
+1 716 652 2000
info.usa@moog.com
service.usa@moog.com

www.moog.com/industrial

Moog is registered trademark of Moog Inc.
All trademarks as indicated herein are the property of Moog Inc. and its subsidiaries.
©2016 Moog Inc. All rights reserved. All changes reserved.

Control Loading Solutions
Mobium /PDF/Rev.C, October 2016, id CDL48358-en