

rotork[®]

Controls

CMA Range



Linear, Rotary and Quarter-Turn
Control Valve Actuators

Keeping the World Flowing

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rotork® Controls

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Rotork is the global market leader in valve automation and flow control. Our products and services help organisations around the world improve efficiency, assure safety and protect the environment.

We strive always for technical excellence, innovation and the highest quality standards in everything we do. As a result, our people and products remain at the forefront of flow control technology.

Uncompromising reliability is a feature of our entire product range, from our flagship electric actuator range through to our pneumatic, hydraulic and electro-hydraulic actuators, as well as instruments, gearboxes and valve accessories.

Rotork is committed to providing first class support to each client throughout the whole life of their plant, from initial site surveys to installation, maintenance, audits and repair. From our network of national and international offices, our engineers work around the clock to maintain our position of trust.

Rotork. Keeping the world flowing.

Product Overview

This brochure provides a comprehensive overview of the applications and associated functions available with the Rotork CMA actuators – comprising CML linear, CMQ quarter-turn and CMR rotary actuators.

Building on Rotork's historical success with innovative technology, the CMA offers a highly accurate and responsive method of automating damper drives, control valves and metering pumps without the complexity of spring diaphragm actuators.

With an increased focus on production costs and efficiency, accurate control is paramount.



CMA Actuator Range

CMA Linear, Quarter-turn and Rotary Actuators

The Rotork CMA delivers a range of sizes suitable for almost all linear, quarter-turn and rotary control valve and other applications requiring exact position control and continuous modulation.

Configuration

The Rotork CMA range provides for simple safe and easy set up via an internal electronic 6-segment LCD display and pushbutton configuration.



CMR
Rotary
Actuator

CML
Linear
Actuator

CMQ
Quarter-turn
Actuator



Features

- Powered by single-phase or 24 V direct current supplies
- Linear, quarter-turn and rotary drive action
- Optional Local Controls including positional display
- Optional Reserve Power Pack (RPP) including local controls and positional display
- Permanently lubricated and maintenance free drive train
- Optional configurable ESD input for end of travel or stayput emergency shutdown function
- Accurate and repeatable position control
- 4 to 20 mA loop powered, feedback signal
- All CMA units have the ability to adjust their speed 50-100% of operation
- Seating torque/thrust capability (60 -150% of rated) for required tight seating of the valve in the CLOSE position
- Wide standard ambient temperature range:
EP Product: -4 to +149 °F (-20 to 65 °C)
WT Product: -22 to +158 °F (-30 to 70 °C)
RPP Product: -4 to +140 °F (-20 to 60 °C)
- Manual override standard
- Electronic thrust/torque limiting
- Two standard adjustable position relay outputs
- Digital communication options including Pakscan™, HART®, Foundation Fieldbus®, Profibus®, DeviceNet® and Modbus® are available
- For discreet hardwired control, the optional RIRO (Remote In, Remote Out) can be fitted. The option allows the user to hardwire a discreet digital control (24 VDC nominal or 120 VAC nominal) for open and close operation. The option also allows up to four extra relay contacts to be available.



Modbus®



HART
COMMUNICATION PROTOCOL



DeviceNet®
CONFORMANCE TESTED

RIRO

Advanced Design Features

CMA Advanced Design Features

- Constantly changing process demands are no problem to the continuous modulating capability of the CMA.
- The CMA encompasses advanced design in a compact, robust and reliable package.
- The CMA provides consistent and precise performance regardless of changing process conditions.
- The brushless DC motor technology provides high dynamic performance with a maintenance free, high endurance drive train.
- Thrust or torque is instantly delivered to the valve to provide smooth operation without any stick/slip effect to disrupt the process variable. The sturdy mechanical drive train eliminates the unwanted movements associated with spring diaphragm actuators.
- The CML and CMQ standard build includes an anti-backdrive mechanism capable of resisting any backdrive from the load, up to 125% of the rated thrust or torque of the actuator.
- Compact and flexible, the CMA range can be mounted on any type or make of valve including all the leading control valve makers' products.
- Other applications such as pump stroke control are perfect for the CMA with its high accuracy, especially for applications requiring hazardous area certifications.

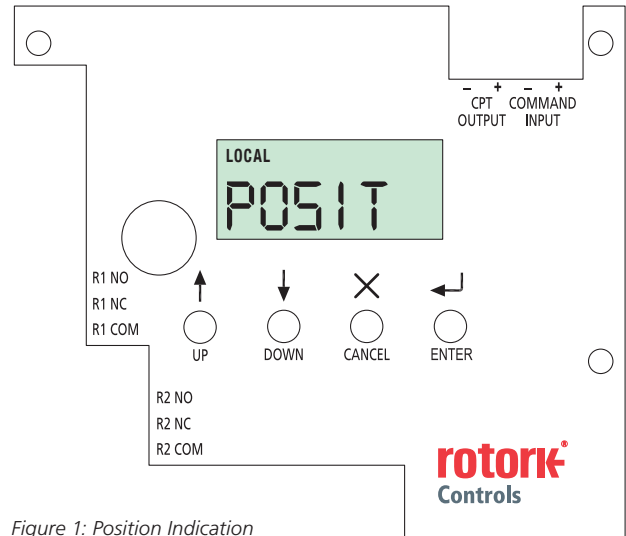


Figure 1: Position Indication

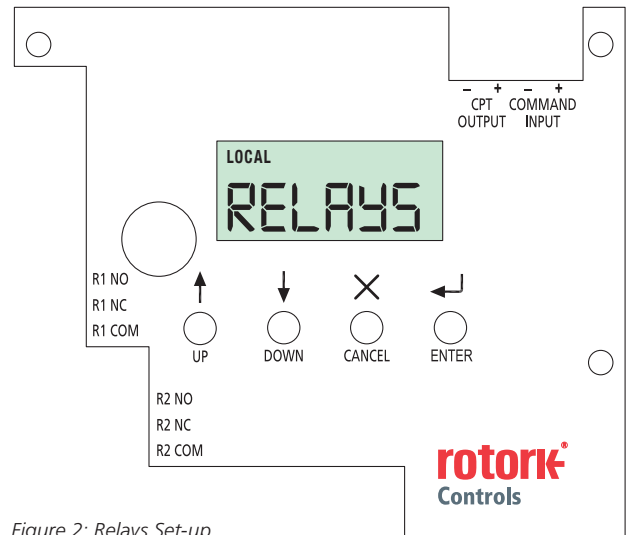


Figure 2: Relays Set-up

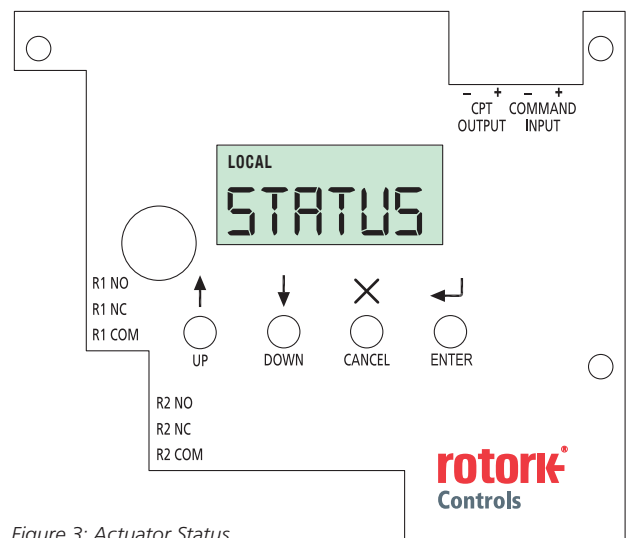
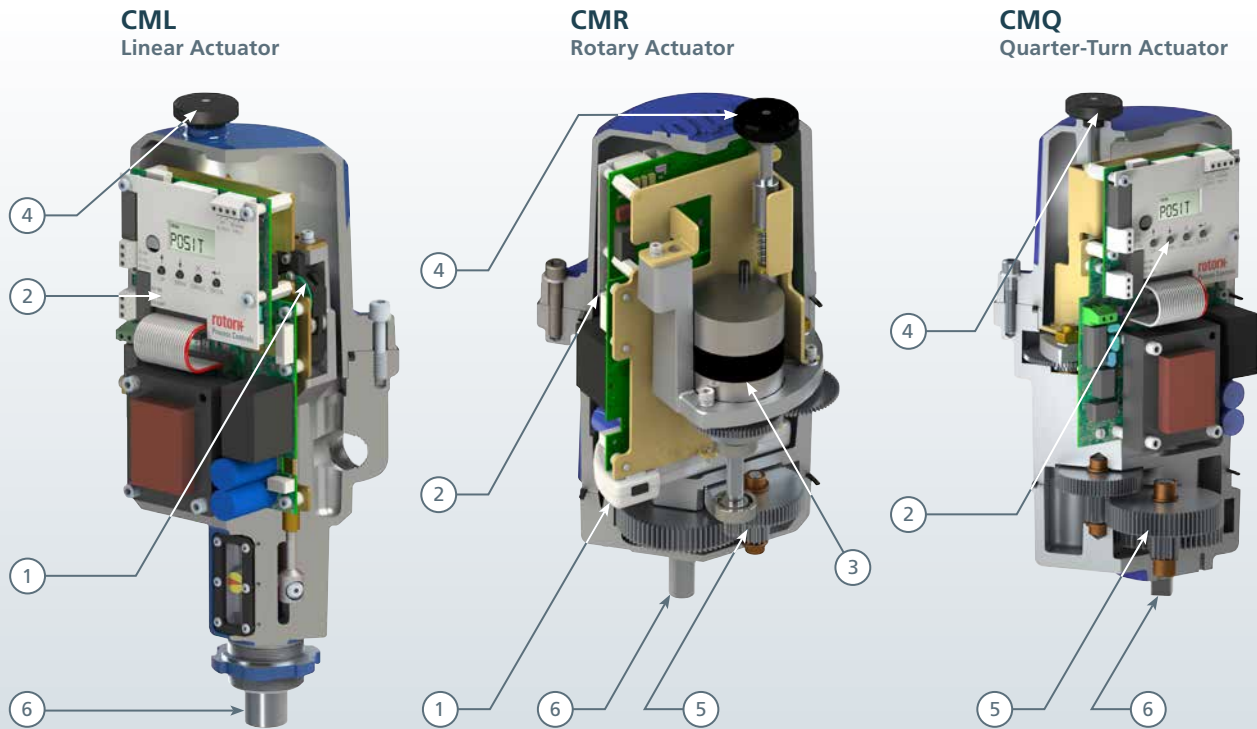


Figure 3: Actuator Status

Advanced Engineering

CMA Range Standard Unit



1 Encoder Technology

The CMA utilises absolute encoder technology where a unique digital code corresponds to the angular position (CMQ), stroke length (CML) or rotary (CMR) position of the actuator.

To achieve high resolution, the position sensor location eliminates any backlash effect in the gearing. The sensor is 12-bit for quarter-turn and linear actuators and 10-bit for rotary actuators, fitted at the output gear stages, removing any internal backlash effect that may exist in the drive train.

2 User Interface

Two programmable relays energize upon reaching a desired position or any other available condition among the programmable options.

Field selectable adjustments for:

- Deadband
- Zero and span
- Command signal type
- Standard or reverse acting
- Manual-auto operation
- Fail to position on loss of signal capability

3 DC Brushless Motor

The CMA uses a high efficiency, continuous rated, brushless DC motor allowing for maintenance-free operation with continuous modulation duty.

4 Hand Drive

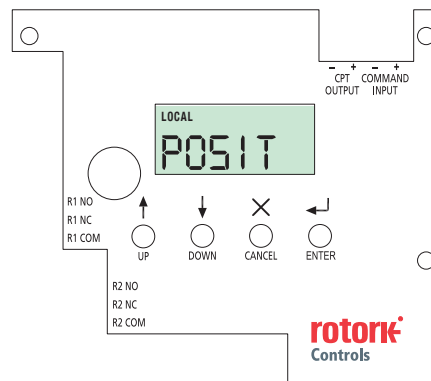
A hand drive mechanism is provided as standard for all CMA actuators to allow manual operation of the valve. Pressing down on the hand-knob shaft engages a gear in the upper section of the drive train and releasing the knob causes the spring to disengage the gear.

5 Geartrain

The simple yet durable high efficiency spur gear drive is lubricated for life with proven high reliability.

6 Output Drive

The CMQ base conforms to MSS SP-101 or ISO 5211. CML and CMR may be adapted to suit individual valves.



Advanced Engineering

CMA Range with Options

CML
Linear Actuator



CMR
Rotary Actuator



CMQ
Quarter-Turn Actuator

CML
Linear Actuator



CMQ
Quarter-Turn Actuator



Optional Local Controls and Display

The CMA range of linear, quarter-turn and rotary actuators, simplifies initial engineering and procurement requirements. The display provides local control to CMA range actuators through selector switches and an LED backlit display for clear valve position indication.

The CMA range local controls option consists of the following features:

- **Linear, quarter-turn and rotary control** with continuous indication of valve position in 0.1% increments
- **Large, easy-to-read screen** with icons for fast diagnostic feedback
- **Vivid display** showing actuator position, critical and non-critical fault symbols
- **Valve position** as a percentage of set valve travel (e.g. 100% = Open)
- **Control selection knobs** provide Local, Stop or Remote operation mode selection and Open or Close input commands for position adjustment in local control mode
- **Tamper resistance** capability for the mode selection knob allows each mode to be locked in place preventing unauthorized changes to actuator operation

Note: Actuators not displayed in proportion to each other.

Optional Local Controls and Display Plus Reserve Power Pack (RPP)

This option includes all the benefits of the local controls option with the addition of power and signal-loss action functionality:

- **Linear and quarter-turn** control with continuous indication of valve position and fail-to-position functionality
- **Reserve Power Pack (RPP)** provides the actuator with enough stored energy to perform a predetermined action on mains power failure
- **Position indication** during power loss action on the LCD display
- **Vivid display** showing actuator position, critical and non-critical fault symbols plus additional RPP status
- **Short, 2 minute charge time** for the reserve power pack, once mains power is reinstated, allows actuation control to continue quickly and efficiently – the LCD display will flash and operation is inhibited during charging
- **Super capacitors** do not suffer from the 'memory' effect caused by repeat partial charge/discharge cycles
- **Power loss action** is easily configured via the standard CMA Human-Machine Interface (HMI)

Control & Monitoring

Bus Network Compatibility

In addition to Rotork's own *Pakscan*[™] network system, Rotork actuators are compatible with most industry standard fieldbus systems via network cards that are fitted in the main electronics enclosure.



The Rotork *Pakscan* system is a world leader in flow control automation. First launched in 1986, *Pakscan* has been at the forefront of network technology since its inception, helping to control over 100,000 actuators worldwide.

Pakscan network systems offer the customer unrivalled control, reliability and support. This is backed-up by a worldwide service and support network to help keep your plant running 24 hours a day, 7 days a week.

The *Pakscan* system provides the vital link between valve actuators and supervisory control. It is an intelligent, reliable, high integrity, fast and easy to install network between field equipment and the control room, designed specifically for use with Rotork products.

- Defined transaction times based on cable parameters and length
- Automatic cable monitoring and fault isolation
- Field cable fault tolerant
- Fully pre-programmed master station
- Master station with HMI Screen, keypad and built-in web server for full system diagnostics
- Hot standby master station capability
- Easily expanded
- Simple Modbus RTU (RS232/RS485) / TCP (Ethernet) host communications
- Field and host communication diagnostics and data logging
- Commission without the need for a host DCS or PLC
- Proven track record
- Over 100,000 installed nodes
- Multiple host connections supported
- Network with the capacity for up to 240 actuators on a single 20 km 2-wire loop

See publication *PUB059-030* for further details.



The HART[®] signal consists of two parts, the analogue 4 to 20 mA current loop and a superimposed digital variable frequency signal. Traditionally the 4 to 20 mA loop is used for control and the superimposed digital signal for feedback, diagnostics and configuration. Configuration and feedback using the HART digital signal can be achieved using the host connected to the actuator to select the parameters required.

See *PUB060-006* for further details



The Rotork Foundation Fieldbus[®] module connects directly onto the standard Foundation H1 bus system. The ability to report extensive actuator feedback within a single input block as well as system diagnostic information makes Rotork the first choice for use with a Foundation Fieldbus system.

See *PUB060-003* for further details.



Rotork's DeviceNet[®] module Electronic Data Sheet description file is used to set up the actuator parameters to allow the systems performance to be optimised. The Rotork module has been certified by the Open DeviceNet Vendor Association.

See *PUB060-004* for further details.



Profibus[®] is a leading international network protocol for Rotork's Profibus DP module uses DP-V0 cyclic comms and extended actuator diagnostics and configuration is included in the DP-V1 acyclic data. EDD and DTM files allow the Rotork device to be incorporated into asset management systems, whilst the GSD file guarantees device interoperability.

See *PUB060-002* for further details.

Modbus[®]

Rotork's Modbus[®] module allows actuators to be connected to a 2-wire RS485 network for direct communication to a PLC or DCS using Modbus RTU protocol.

See *PUB060-005* for further details.

RIRO

For discrete hardwired control, the optional RIRO (Remote In Remote Out) can be fitted. The option allows the user to hardwire a discrete digital control (24 VDC nominal or 120 VAC nominal) for open and close operation. The option also allows up to four extra relay contacts to be available for various functions.

See *PUB094-004* for further details.

Performance Summaries

Mechanical Performance

The values shown in the performance charts relate to the maximum available speeds or fastest operating times. These speeds can be slowed down to 50% of the maximum value in 1% increments.

The rated force (thrust or torque) for each size of actuator is detailed below. Operating time tolerance +/-10%.

The CML and CMQ can resist backdriving forces from the valve up to 125% of rated load without movement. All CMA actuators are factory calibrated. CMA resolution is 0.20%.

CML: Linear Actuator

Model	Min Modulating Thrust (lbf)	Min Modulating Thrust (N)	Max Modulating Thrust (lbf)	Max Modulating Thrust (N)	Max Seating Thrust (lbf)*	Max Seating Thrust (N)*	Max Speed (inches/sec)	Max Speed (mm/sec)	Stroke (inches)	Stroke (mm)
CML-100	60	266.9	100	444.8	150.00*	667.2*	0.25	6.35	1.5	38.1
CML-250	150	667.2	250	1112.1	375.00*	1668.1*	0.13	3.18	1.5	38.1
CML-750	450	2001.7	750	3336.2	1125.00*	5004.2*	0.13	3.18	2.0	50.8

CMQ: Quarter-Turn Actuator

Model	Min Modulating Torque (lbf.in)	Min Modulating Torque (Nm)	Max Modulating Torque (lbf.in)	Max Modulating Torque (Nm)	Max Seating Torque (lbf.in)*	Max Seating Torque (Nm)*	CMQ High Speed Fastest Time for 1/4 Turn (secs)	CMQ Self Locking Fastest Time for 1/4 Turn (secs)
CMQ-250	150	16.9	250	28.2	375*	42.4*	5	10
CMQ-500	300	33.9	500	56.5	750*	84.7*	7.5	15
CMQ-1000	600	67.8	1000	113.0	1100*	124.3*	11	22

Note: The CMQ low speed units are normally self-locking up to 125% of rated load. The CMQ high speed unit is not self-locking.

* **Seating Torque and Thrust** – Some applications require tight seating at the valve in the close position. The CMA has a selective seating capability. The seating torque/thrust values shown for CML and CMQ are the forces available to close a valve tightly at it's end of travel. The seating torque/thrust option can be selected and configured during setup (at "close action" selection, choose "torque" or "thrust" as applicable).

CMR: Rotary Actuator

Model	Min Torque (lbf.in)	Min Torque (Nm)	Max Torque (lbf.in)	Max Torque (Nm)	Max Speed (RPM)	Total turns available
CMR-50	20	2.3	50	5.6	11	90° to 320 turns in 2° increments
CMR-100	40	4.5	100	11.3	10	90° to 320 turns in 2° increments
CMR-200	80	9.0	200	22.6	5	90° to 320 turns in 2° increments
CMR-89	35.6	4.0	89	10.1	24	90° to 320 turns in 2° increments
CMR-125	50	5.6	125	14.1	18	90° to 320 turns in 2° increments
CMR-250	100	11.3	250	28.2	10	90° to 320 turns in 2° increments
CMR-250/GB3	160	18.1	400	45.2	5.8	90° to 200 turns in 3.2° increments

Positioning Control Performance

The following control positioning performance is based on a 4 to 20 mA control system with CMA operating over its maximum stroke, rated speed and constant force with minimum deadband set and with a linear demand/valve characteristic. Resolution is defined as: minimum change in input signal required for guaranteed response.

4 to 20 mA Control - Positioning: % demand signal range

		Equal to or better than:
Resolution	Linear and Quarter-turn	0.2%
	Rotary	2°
Linearity		1%

Position Feedback Performance

The following position feedback performance is based on CMA operating at maximum stroke with a linear characteristic set. Feedback calibration is automatic to the set limit positions. Resolution is defined as: minimum change in position/thrust required for feedback signal change.

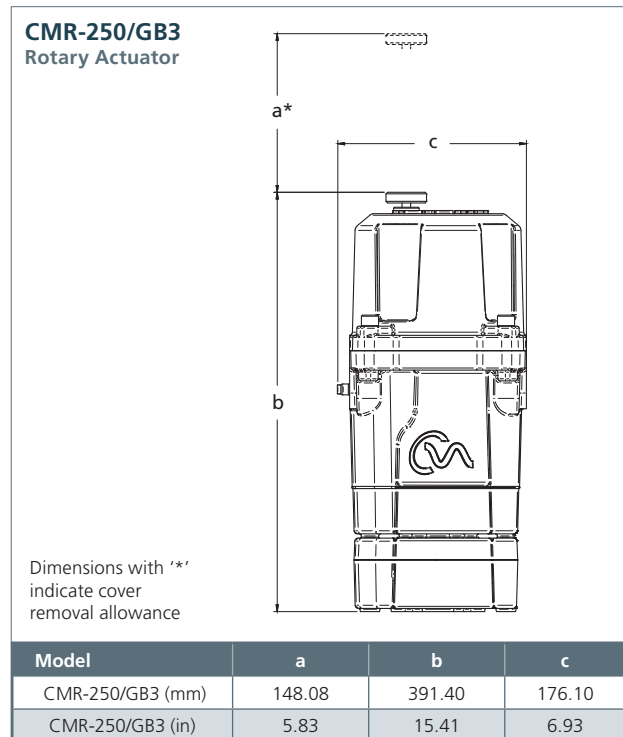
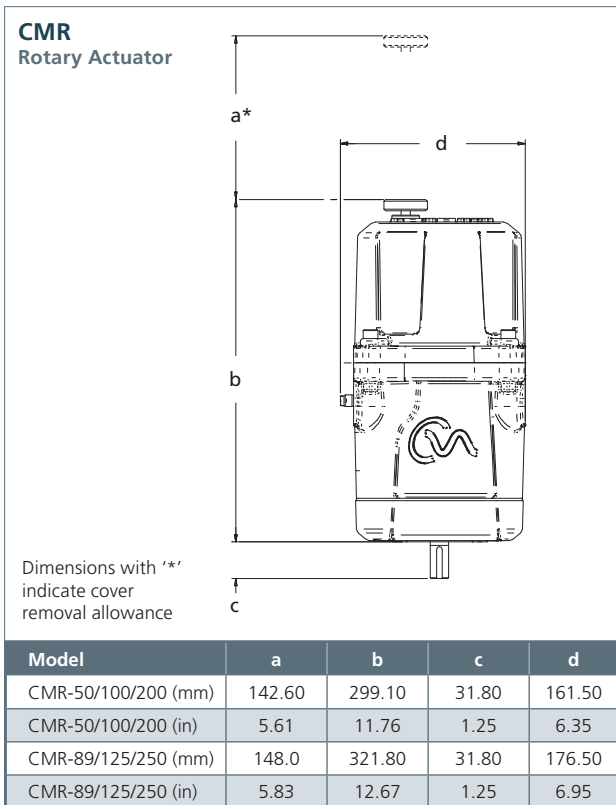
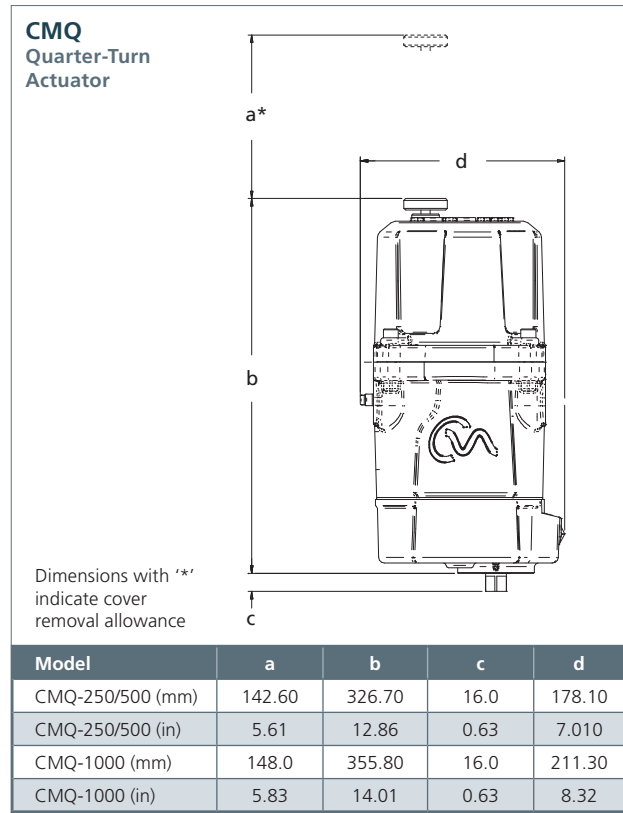
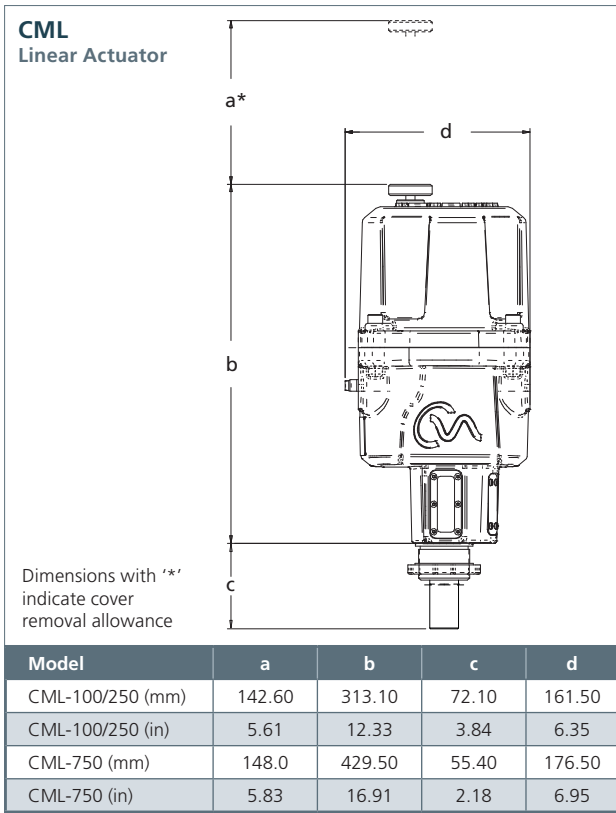
4 to 20 mA Feedback - % feedback signal range

		Equal to or better than:
Resolution	Linear and Quarter-turn	0.2%
	Rotary	2°
Linearity		1%

Ultimate performance will be determined by the process, valve and control system.

General Dimensions

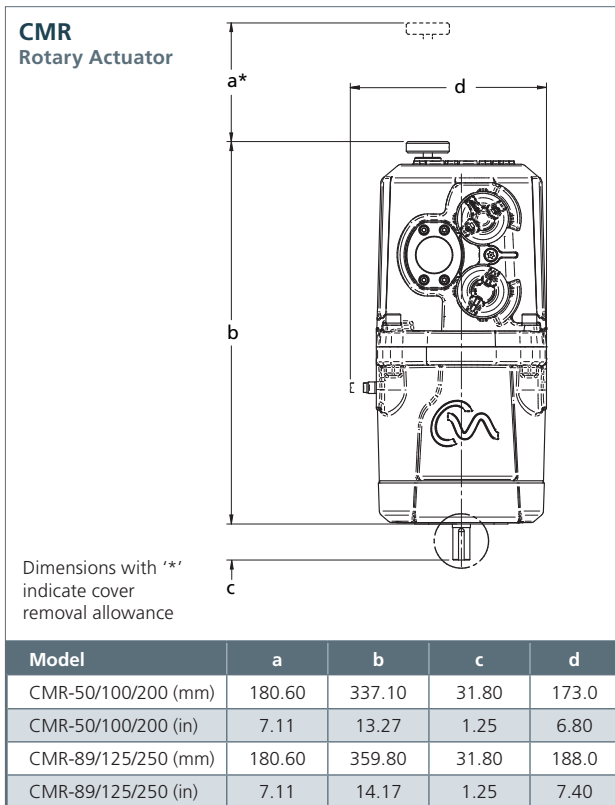
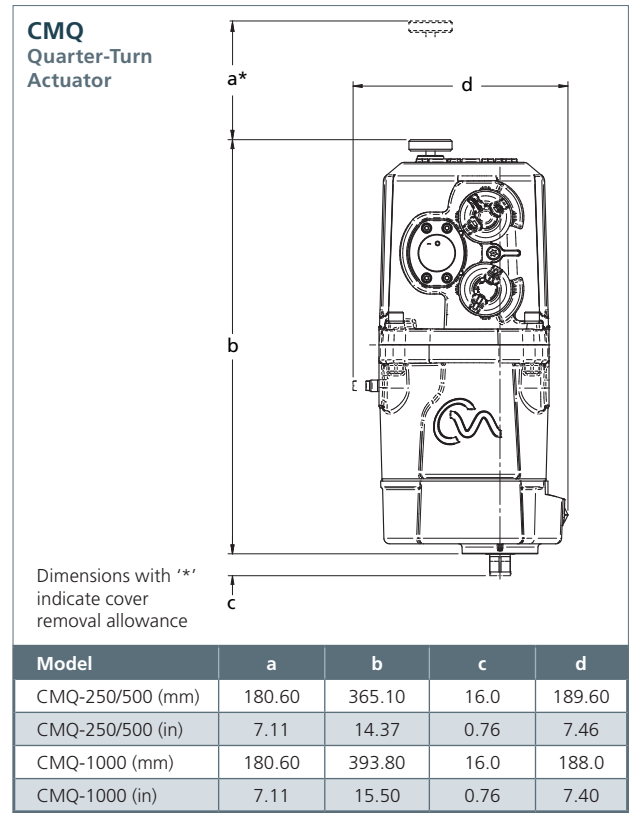
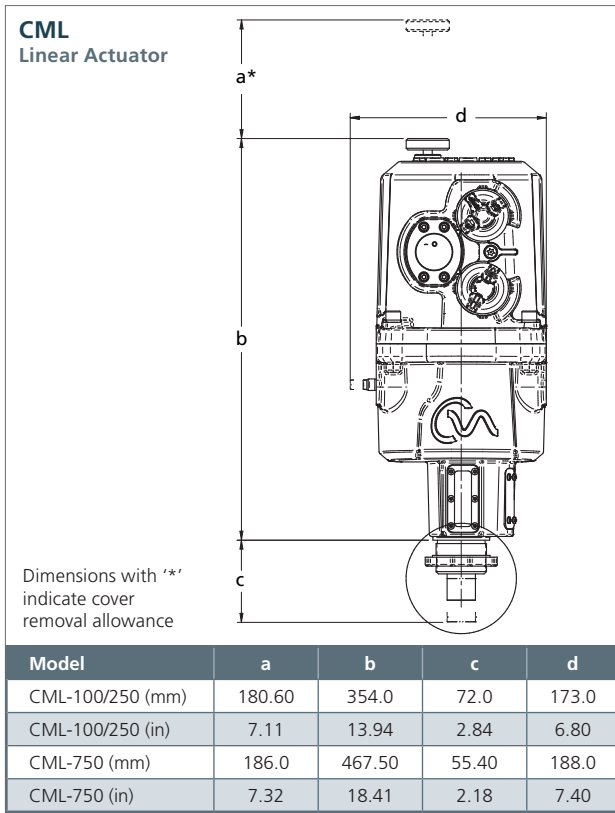
CMA - General Dimensions



Note: Drawings are for reference only. Please contact Rotork for details.

General Dimensions

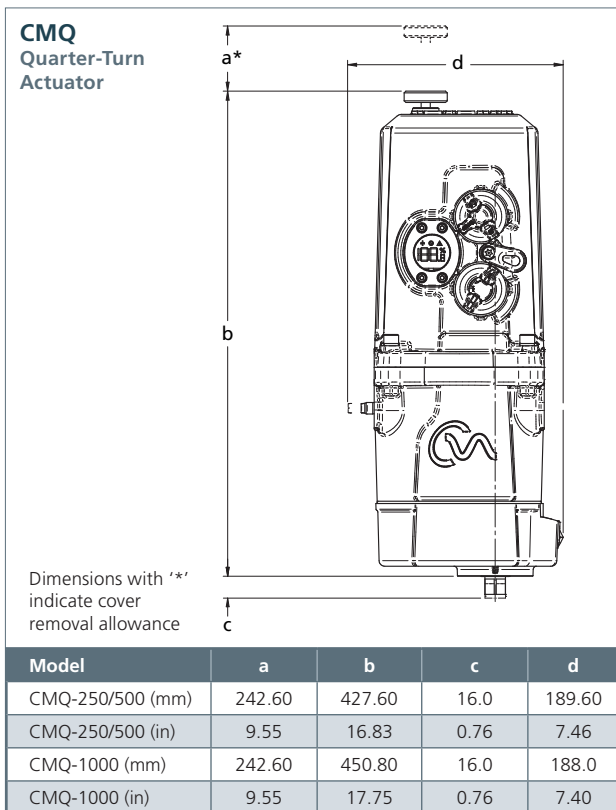
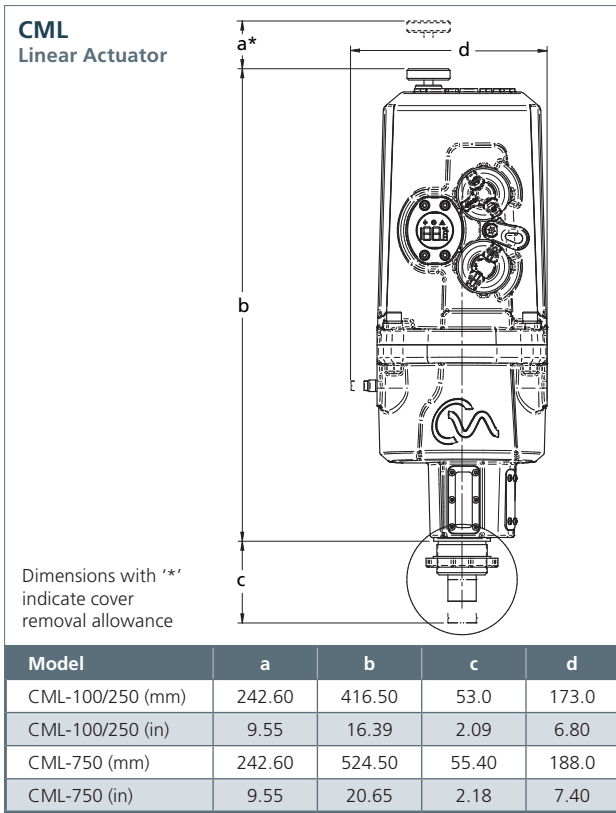
CMA Local Controls - General Dimensions



Note: Drawings are for reference only. Please contact Rotork for details.

General Dimensions

CMA Local Controls & Reserve Power Pack - General Dimensions



Note: Drawings are for reference only. Please contact Rotork for details.

Design Specifications

Vibration, Shock and Noise

CMA actuators are suitable for applications where vibration and shock severity does not exceed the following:

Type	Level
Plant induced vibration	1 g RMS total for all vibration within the frequency range of 10 to 1000Hz.
Shock	5 g peak acceleration.
Seismic	2 g acceleration over a frequency range of 1 to 50 Hz if it is to operate during and after the event.
	5 g over a frequency range of 1 to 50 Hz if it is only required to maintain structural integrity.
Emitted noise	Independent tests have shown that at 1 m generated noise does not exceed 61 db (A).

Levels quoted are those present at the actuator mounting interface. It should be noted that the effects of vibration are cumulative and therefore an actuator subjected to significant levels may have reduced life.

Operating Temperature

CMA actuators are suitable for operation within the ambient temperature ranges shown below. Refer to section 5 for hazardous area certification operating temperature restrictions. For temperatures outside this range please contact Rotork. Prior to installation actuators should be stored in a dry location with a temperature range not exceeding -50 to +70 °C (-58 to 158 °F).

Actuator Type	Standard Temperature*	Low Temperature Option*
CML / CMQ / CMR	-30 to +70 °C (-22 to +158 °F)	-40 to +60 °C (-40 to +140 °F)

*Hazardous Area certification determines permissible operating temperature range. Refer to section 5.

Paint Finish

The standard paint finish is RAL5010 (blue) polyester powder coated to Rotork specification RS237. Optional paint colours and finishes are available, please contact Rotork for more information.

Unpainted units available for OEM customers.

Approvals

Non-Hazardous and Hazardous Certified Enclosures

All CMA actuator hazardous and non-hazardous area enclosures are watertight to IP66, IP67 and NEMA 4.

CMA actuators are available with the following enclosure types for which the ambient working temperature ranges are stated.

The limits of frequency of operation are a function of the load on the actuator and the ambient temperature.

Under the heaviest load at the highest temperature the capability would be not less than 2,000 starts in one hour, in favorable load conditions the number of starts per hour would be infinite.

Where option temperatures are indicated, changes to some actuator components are required and therefore the temperature requirement must be specified. Hazardous area approvals for other country standards are available; please contact Rotork.

CMA range actuators are built in accordance with the following standards:

Non-Hazardous Area Enclosures

WT: Standard Watertight

Standard	Rating	Standard Temperature	Low Temperature Option
BS EN 60529 (1992)	IP67	-30 to +70 °C (-22 to +158 °F)	-40 to +60 °C (-40 to +140 °F)
NEMA (US)	4 & 6	-30 to +70 °C (-22 to +158 °F)	-40 to +60 °C (-40 to +140 °F)
CSA (Canadian)	4 & 6	-30 to +70 °C (-22 to +158 °F)	-40 to +60 °C (-40 to +140 °F)

Hazardous Area Enclosures

European ATEX Directive

Directive/Standard	Rating	Standard Temperature	Low Temperature Option
Directive = 94/9/EC	II 2GD	-20 to +65 °C (-4 to +150 °F)	
Standard = EN 60079-0 EN 60079-1	Ex d IIB T4 Gb Ex tb IIIC T85°C Db	Units fitted with UPS or HMI option -20 to +60 °C (-4 to 140 °F)	-40 to +60 °C (-40 to +140 °F)

International Hazardous Area IECEx

Directive/Standard	Rating	Standard Temperature	Low Temperature Option
No Directive	II 2GD	-20 to +65 °C (-4 to +150 °F)	
Standard = IEC 60079-0 IEC 60079-1	Ex d IIB T4 Gb Ex tb IIIC T85°C Db	Units fitted with UPS or HMI option -20 to +60 °C (-4 to 140 °F)	-40 to +60 °C (-40 to +140 °F)

USA Hazardous Area – Factory Mutual Certified Explosionproof to NEC Article 500

Class	Division	Group	Standard Temperature	Low Temperature Option
I	1	C, D	-20 to +65 °C (-4 to +150 °F)	-40 to +60 °C (-40 to +140 °F)
II	1	E, F, G		

Enclosures Types 4/IP67

Canadian Hazardous Area – Canadian Standards Association (CSA EP) to NEC Article 500

Class	Division	Group	Standard Temperature	Low Temperature Option
I	1	C, D	-20 to +65 °C (-4 to +150 °F)	-40 to +60 °C (-40 to +140 °F)
II	1	E, F, G		

Approvals

Regulatory Standards

Compliance with the following European Economic Community Directives permits the CMA range of actuators to be CE marked under the provision of the Machinery Directive.

Directive	Applicable to	Reference
Electromagnetic compatibility (EMC)	Immunity to / emissions of electromagnetic energy	2004/108/EC by application of BS EN 61326-1:2006
Low Voltage (LV)	Electrical Safety	2006/95/EC by application of BS EN 601010-1:2010
Machinery*	Product Safety	Actuators follow the provision of the Machinery Directive (2006/42/EC) by the application of BS EN ISO12100-1:2003+A1:2009. The CMA must not be put into service until the equipment into which it is being incorporated has been declared to be in conformity with the provisions of the European Community Machinery Directive 98/37/EC and 98/79/EC*
Waste Electrical Equipment	Exempt under the scope	

*Actuators are not classified as machines within the scope of the machinery directive. Contact Rotork for a copy of our Declaration of Conformity and Incorporation.



Keeping the World Flowing

A dark blue world map is centered in the background of the lower half of the page. A white grid of latitude and longitude lines is overlaid on the map, creating a perspective effect.

www.rotork.com

A full listing of our worldwide sales and service network is available on our website.

Rotork plc
Brassmill Lane, Bath, UK
tel +44 (0)1225 733200
fax +44 (0)1225 333467
email mail@rotork.com

USA
Rotork Controls Inc.
tel +1 (585) 247 2304
fax +1 (585) 247 2308
email info@rotork.com

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