

**Electric multi-revolution actuator  
for nuclear power plants  
outside containment**

**MODACT MOA**

**Type number 52 029**



ZPA Pečky, a.s. is certified company in accordance with ISO 9001 as amended.

## APPLICATION

Electric rotary multi-revolution actuators **MODACT MOA** are designed for remote control of special valves installed in attended areas of nuclear power plants with reactors VVER or RBMK, except for valves of the safety system. The actuators are suitable for controlling sliding valves and valves with nuts. The electric actuators comply with the document Interatomenergo „OTT-87“ Valves for installations and piping of nuclear power plants - general technical requirements.

The actuators fitted with the current position transmitter of unified signal 4 – 20 mA can also work in the circuits of automatic regulation with regime S4.

### Protective enclosure

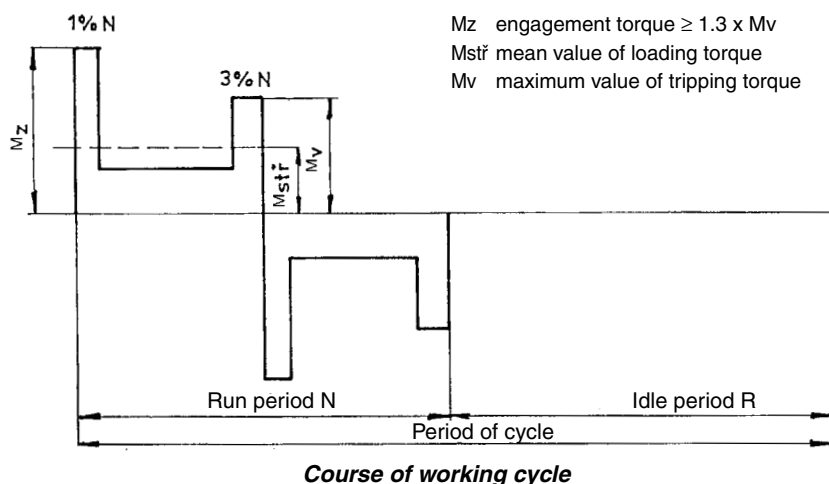
Type of protective enclosure of the actuator is IP 67 according to ČSN EN 60529.

## WORKING REGIME - FREQUENCY OF SWITCHING

The actuators can work during short-time loading with the type of loading S2 according to ČSN EN 60 034-1, wherein the course of loading is shown in the figure. The longest working cycle (close-open-close) is 10 minutes with the ratio of run to idle time 1:3 (load factor 25 %). Average loading of the actuator during the running time is 33 % of the value of maximum tripping torque and it is called rated torque.

The actuators can also work in the regime of interrupted run with start-up S4 according to ČSN EN 60 034-1 (e.g. during gradual opening of the valve etc.). The highest number of closing in automatic regulation is 1200 cycles per hour with load factor 25 % (ratio of run to idle time 1:3). Mean value of loading torque is 33 % at most of the maximum tripping torque. The longest working cycle (N+R) is 10 minutes, load factor (N/N+R) is max. 25 %.

The highest mean value of loading torque is equal to rated torque of the actuator.



## OPERATING CONDITIONS

The actuators must operate reliably with the following parameters of surrounding environment:

### Nominal operation regime:

temperature	-25 °C to +55 °C
pressure	atmospheric
relative humidity	up to 90 %
under-pressure	0.196 kPa (20 mm of water column or 0.09984 MPa of absolute pressure)

### Resistance against seismic shocks

The actuators must be resistant against shocks of acceleration 8 g in any direction, in the range of actuating frequencies 20 to 50 Hz for the period of up to 20 s. Moreover, seismic resonance tests must be carried out in the frequency range of 5 to 20 Hz.

## Reliability

The actuators belong to the group of repaired instruments. They must work reliably for the period of at least 4 years (30 000 hour of continuous operation of the reactor). After the 4 year operation, is necessary to replace lubricants, make inspection and, if necessary, repair of the actuator. During 4 years, guaranteed number of working cycles (open - close - open) for shut-off valves under operating conditions according to point 2.4 of the Technical conditions is 3 000, with the probability of fault-less operation 0.98. The reliability coefficient for calculation of the lower confidence limit of fault-less operation is 0.95.

For the actuators designed for regulating valves, the probability of fault-less operation lasting 8000 hours is 0.98.

## Position transmitters

### Resistance potentiometer

- total resistance 100 ohm with deviation +12 ohm. The highest load 100 mA, the highest direct voltage (against frame) 50 V.

### Current transmitter CPT 1AAE

- rated output signal 4 – 20 mA or 20 – 4 mA
- rated working stroke 0° – 60° to 0° – 120° (smoothly adjustable)
- non-linearity including gearings ± 2,5 % (for max. stroke 120°)
- hysteresis including gearings ≤ 5 % (for max. stroke 120°)  
*(non-linearity and hysteresis relate to the signal value 20 mA)*
- loading resistance Rz 0 ohm to 500 ohm
- feeding voltage for Rz 0 – 100 ohm 10 – 20 V DC  
Rz 400 – 500 ohm 18 – 28 V DC
- maximum waviness of feeding voltage 5 %
- maximum input of transmitter 560 mW
- insulation resistance 20 M ohm at 50 V DC
- electric resistance of insulation 50 V DC
- temperature of working environment -25 °C to +80 °C
- short-time +110 °C / 2 hours

## Manual control

The actuators are fitted with manual control realized by the hand wheel directly (without a clutch) and it is possible even when the electric motor is running. By rotating the hand wheel in the clockwise direction the output shaft of the actuators also rotates in the clockwise direction (viewing the shaft in the control box). Assuming the left thread of the valve nut, the actuator closes the valve.

**Table 1 – Basic technical parameters and characteristics of actuator, type MODACT MOA for shut-off vales installed in attended areas of nuclear power plants with reactors VVER or RBMK**

Size of connecting flange	ACTUATOR										
	Type designation	Type number		Range of setting torque tripping	Range of setting output revolutions (of stroke)	Speed of output shaft resetting	Gear ratio output shaft / electric motor	Gear ratio output shaft / hand wheel	Max. force on had wheel	Min. guaranteed M <sub>close</sub> at U=80% U <sub>nom</sub>	Weight of actuator incl. electric motor
		Basic	Complementary	[Nm]	[rev.]	[min <sup>-1</sup> ]			[N] 1)	[Nm] 3)	[kg]
F10 (F07)	MOA 30-9	52 029. x x 1 x		10÷30	1.5÷38	9	1:155	1:93	4	30	17
	MOA 30-15	52 029. x x 2 x				15	1:91				
	MOA 30-25	52 029. x x 3 x				25	1:54				
	MOA 30-40	52 029. x x 4 x				40	1:34				

1) The table shows one force from pair of forces acting at diameter of the hand wheel.

2) The cables are connected through a gland bushing.

3) The value recommended by the manufacturer to be set as maximum is 1.3x higher for engagement torque than the closing value at voltage reduced by 20 %.

ELECTRIC MOTOR										
Type designation	Output	Speed of electric motor	Rated current	Engagement current	Efficiency	Power factor	Ratio of engagement / rated torque	Ratio of engagement / rated current	Engagement torque	Weight of electric motor
	[kW]	[min <sup>-1</sup> ]	[A]	[A]	[%]	[cos φ]			[Nm]	[kg]
EAMXR63L04A	0.02	1440	0.20	0.54	29	0.50	4.0	2.7	0.53	2.15
EAMXR63L04	0.09	1385	0.44	1.40	56	0.59	3.2	3.2	1.98	3.5
EAMXR63N04L	0.12	1390	0.45	1.26	58	0.67	1.8	2.8	1.48	3.3
EAMXR63N04	0.18	1370	0.66	2.24	62	0.70	2.0	3.4	2.50	3.9

**Meaning of complementary numbers in the actuator type number:**

- the first complementary number means the way

of mechanical connection:  
 1xxx – connection F07, shape C  
 2xxx – connection F07, shape D  
 3xxx – connection F07, shape E  
 4xxx – connection F10, shape C  
 5xxx – connection F10, shape D  
 6xxx – connection F10, shape E

- the second complementary number means the required time

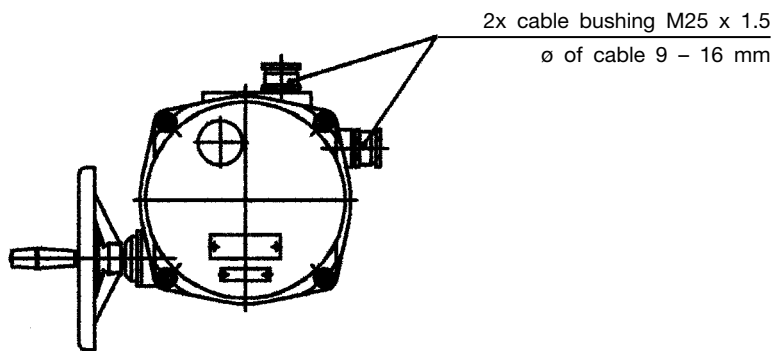
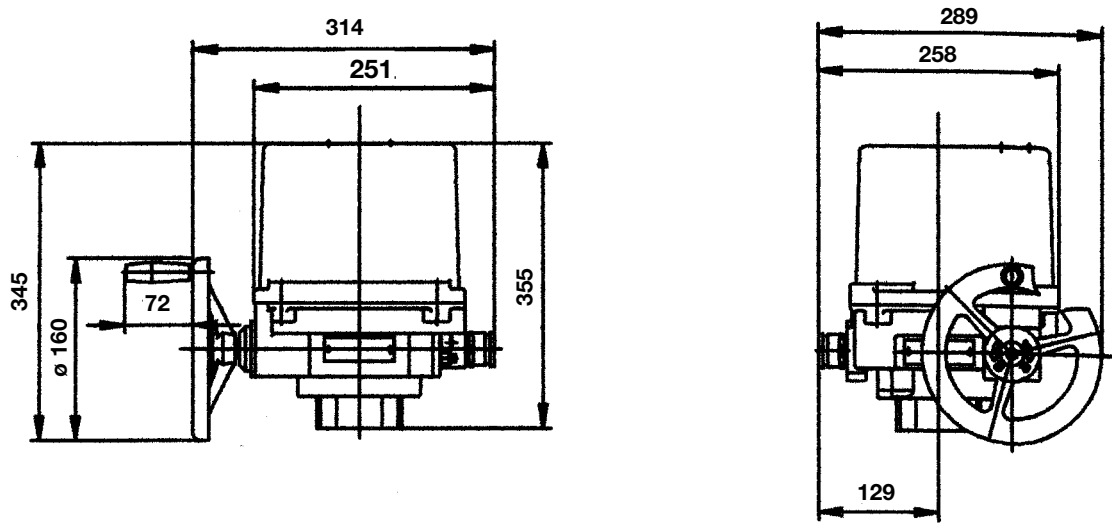
of torque blocking:  
 x0xx – time of blocking between 1.5 and 3 revolutions of output shaft after reversing  
 x1xx – time of blocking between 0.75 and 1.5 revolutions of output shaft after reversing  
 x2xx – time of blocking between 0.4 and 0.75 revolutions of output shaft after reversing

- the third complementary number means resetting speed – see the table.

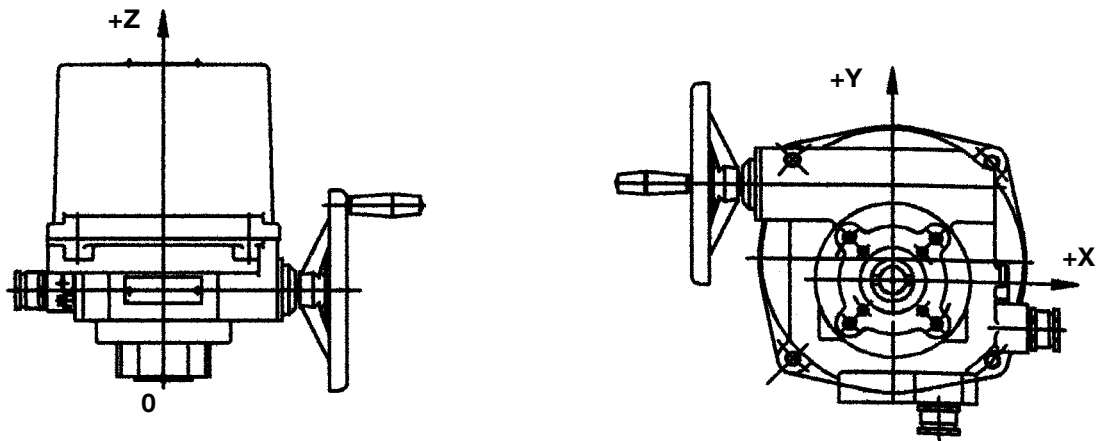
- the fourth complementary number means possible use

of position transmitter:  
 xxx0 – without position transmitter  
 xxx1 – resistance transmitter 1 x 100 ohm  
 xxx2 – current transmitter CPT 1AAE  
 xxx3 – current transmitter CPT 1AAE with feeding source

Dimensional sketch of actuator **MODACT MOA**, Type No. 52 029

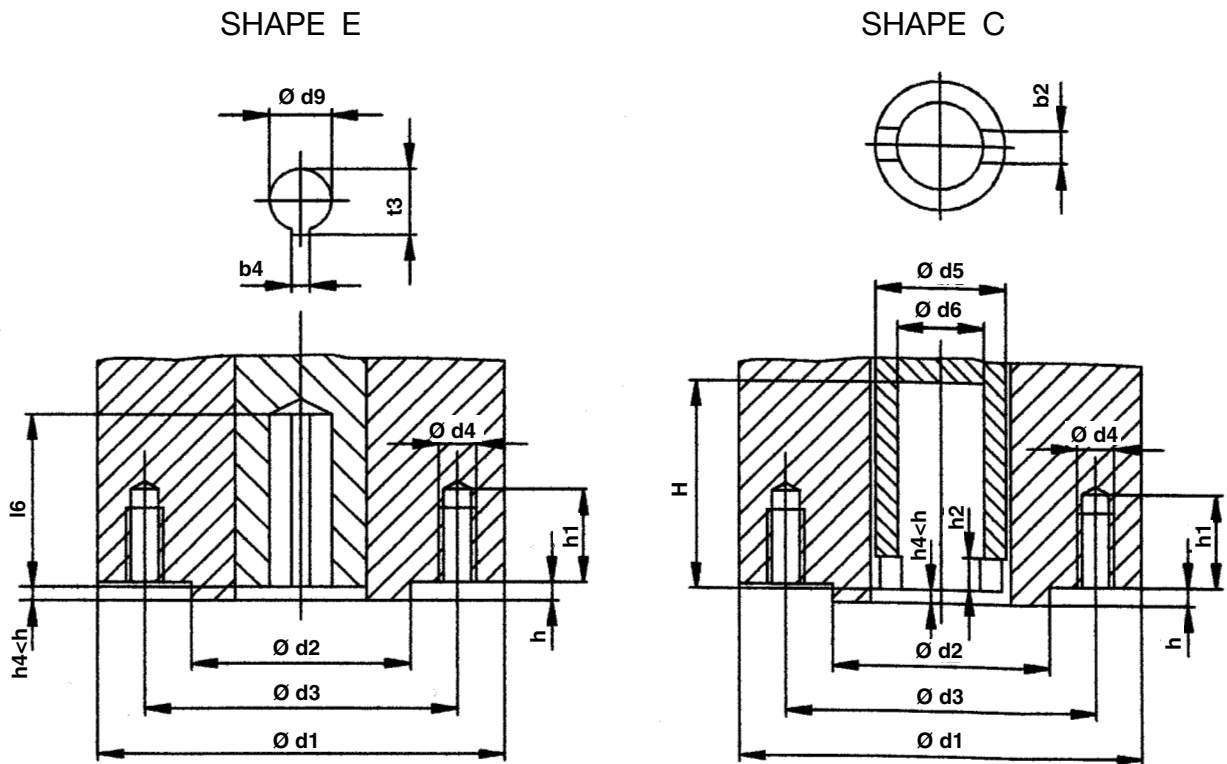


Centre of mass of actuator **MODACT MOA**, Type No. 52 029



Type number	Coordinates of centre of mass			Actuator weight (kg)
	x (mm)	y (mm)	z (mm)	
52 029	-7.5	+22	+148	17

Mechanical connecting dimensions of actuator **MODACT MOA**, Type No. 52 029

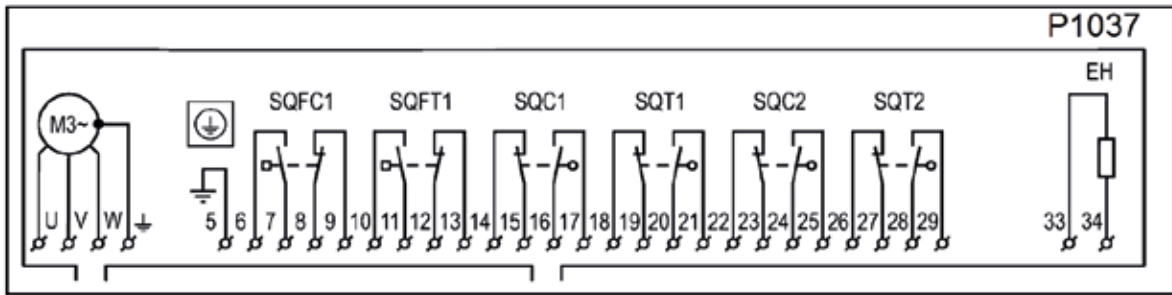


Flange size	Common data for both shapes							Data for shape C					Data for shape E				
	Ø d1	Ø d2f8	Ø d3	Ø d4	Number of threaded holes	h1	h	Ø d5	h2	H	b2H11	Ø d6	Ø d9H8	l6 min	t3	b4Js9	
F 07	125	55	70	M8	4	16	3	40	10	125	14	28	16	40	18.1	5	
F 10	125	70	102	M10	4	20	3	40	10	125	14	28	20	55	22.5	6	

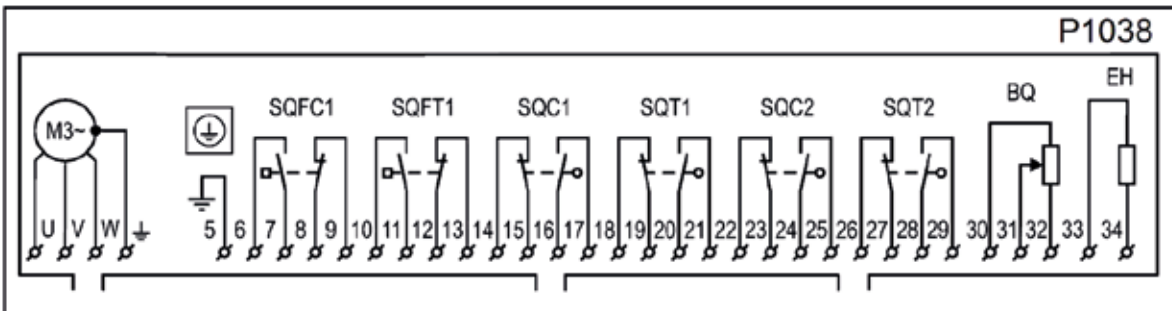


Diagrams of internal electric wiring of actuators **MODACT MOA**, Type No. 52 029

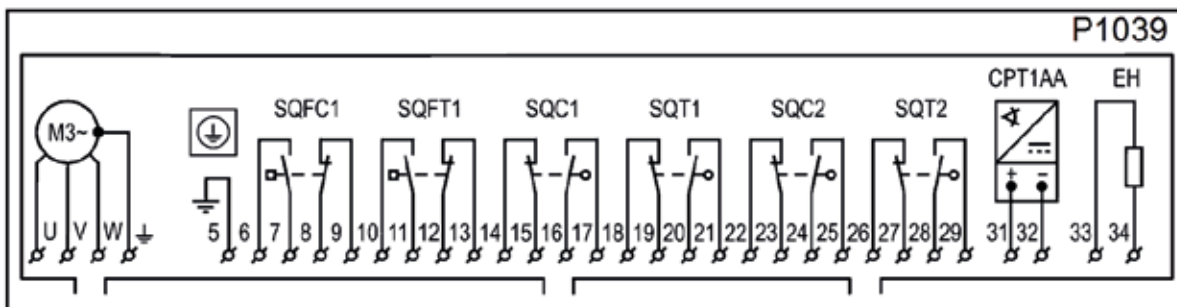
Position transmitter – no



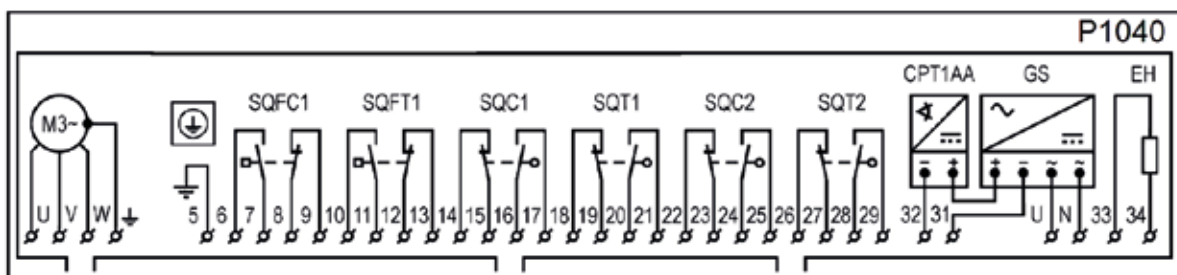
Position transmitter – resistance 100 ohm



Position transmitter – current 4 – 20 mA or without transmitter



Position transmitter – current 4 – 20 mA with feeding source



**LEGEND:**

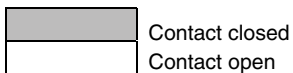
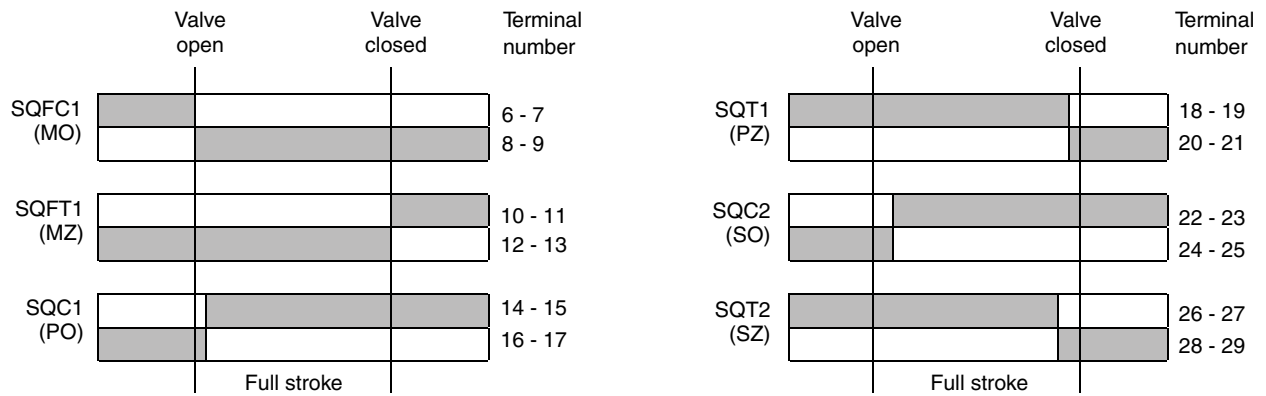
- |  |                                       |
|--|---------------------------------------|
| SQFC1 (MO) – torque-limit switch „open“        | BQ) – resistance transmitter 100 ohm  |
| SQFT1 (MZ) – torque-limit switch „close“       | CPT1AA – current transmitter CPT 1AAE |
| SQC1 (PO) – position-limit switch „open“       | GS – feeding source for CPT1AAE       |
| SQT1 (PZ) – position-limit switch „close“      | M3 – three-phase motor                |
| SQC2 (SO) – position signalling switch „open“  | EH – heating resistance               |
| SQT2 (SZ) – position signalling switch „close“ |                                       |

The micro-switches can be used as single-circuit only. Two voltages of different magnitudes or phases must not be connected to contacts of the same micro-switch. The contacts of micro-switches are drawn in the intermediate position.

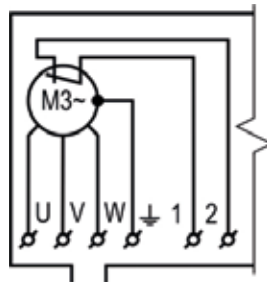
In the version with current transmitter, the user should ensure connection of two-wire circuit of the current transmitter to electric earth of the linked-up regulator, computer, etc. Connection must be realized just in one point in any part of the circuit outside the electric actuator.



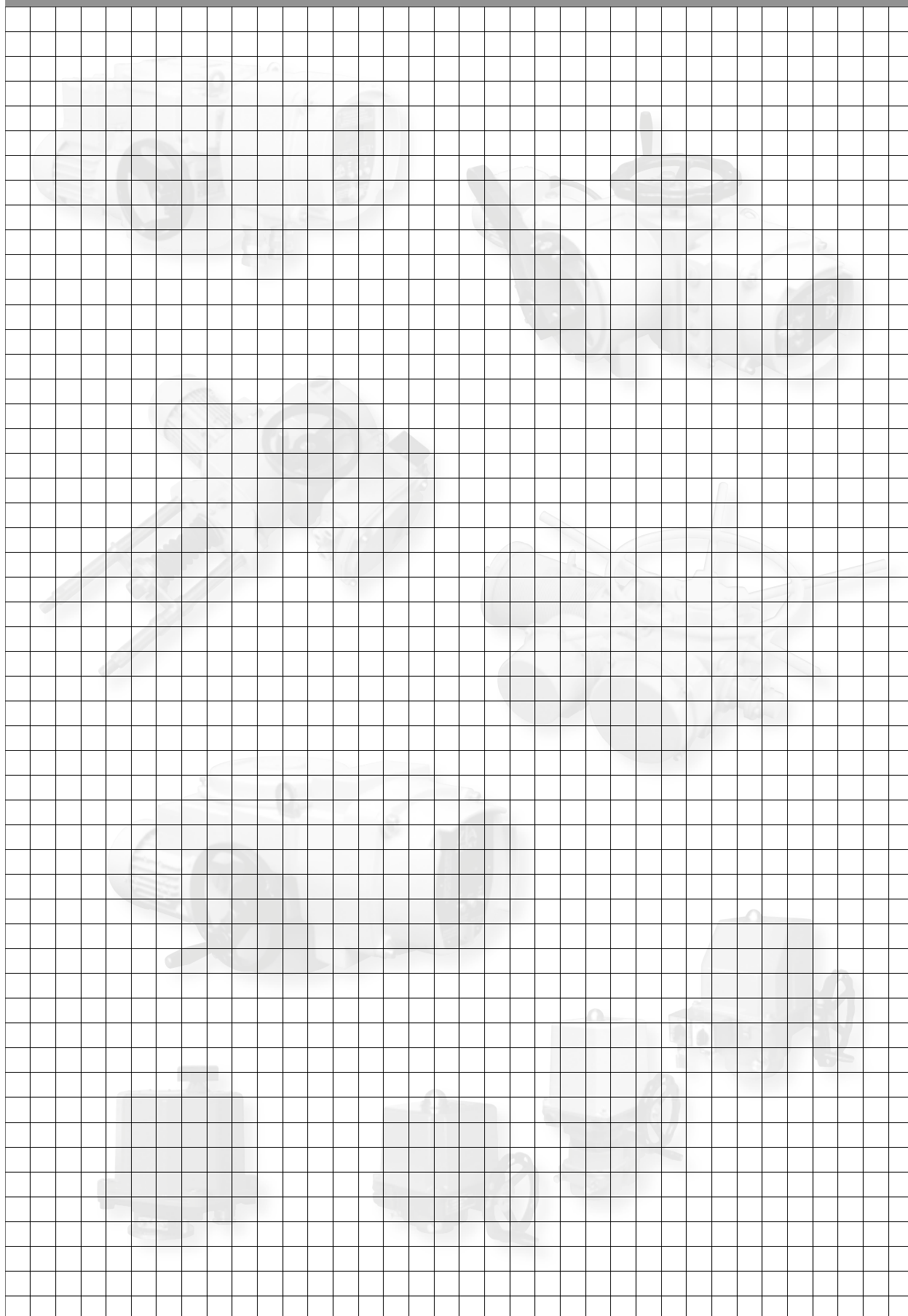
## Operation diagram of torque, position and signalling switches



Electromotors can have built-in thermocontacts, which are brought on terminals 1 and 2. This built-in thermal protection together with driving system will disconnect electromotor from power supply, if winding temperature of electromotor exceeds the temperature +155 °C.



**Thermocontacts diagram**





Development, production and services of electric actuators and switchboards.  
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## SURVEY OF PRODUCED ACTUATORS

### **KP MINI, KP MIDI**

Electric rotary (90°) actuators (up to 30 Nm)

### **MODACT MOK, MOKED, MOKP Ex**

Electric rotary (90°) actuators for ball valves and flaps

### **MODACT MOKA**

Electric rotary (90°) actuators for nuclear power stations application outside containment

### **MODACT MON, MOP, MONJ, MONED, MOPED, MONEDJ**

Electric rotary multi-turn actuators

### **MODACT MO EEX, MOED EEX**

Explosion proof electric multi-turn actuators

### **MODACT MOA**

Electric multi-turn actuators for nuclear power stations application outside containment

### **MODACT MOA OC**

Electric multi-turn actuators for nuclear power stations application inside containment

### **MODACT MPR VARIANT**

Electric rotary (160°) lever actuators with a variable output speed

### **MODACT MPS KONSTANT, MPSED**

Electric rotary (160°) lever actuators with a constant output speed

### **MODACT MTN, MTP, MTNED, MTPED**

Electric linear thrust actuators with a constant output speed

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Deliveries of assembled actuator + valve (or MASTERGEAR gearbox) combinations

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