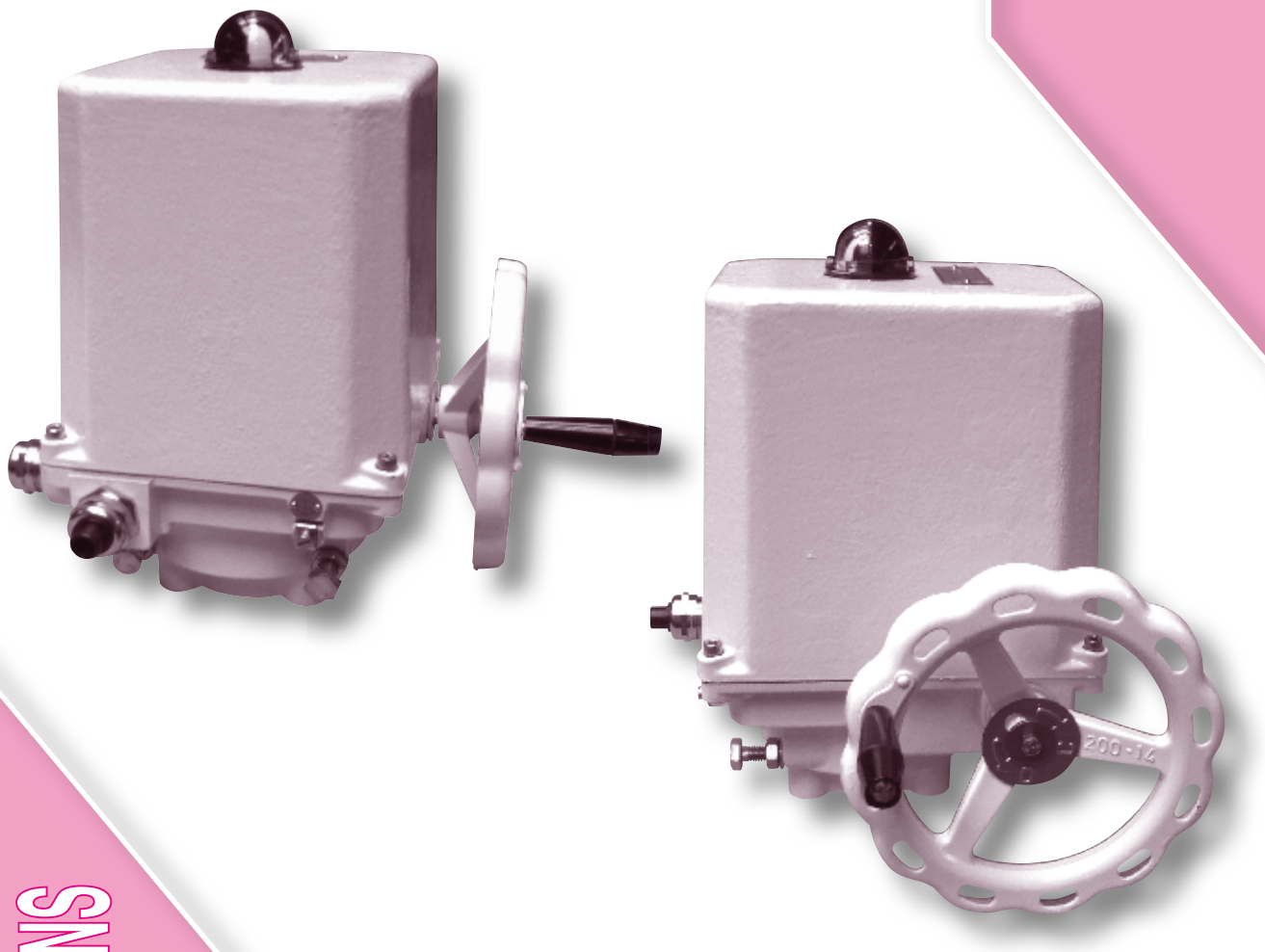
ZPA PEČKY, a.s.



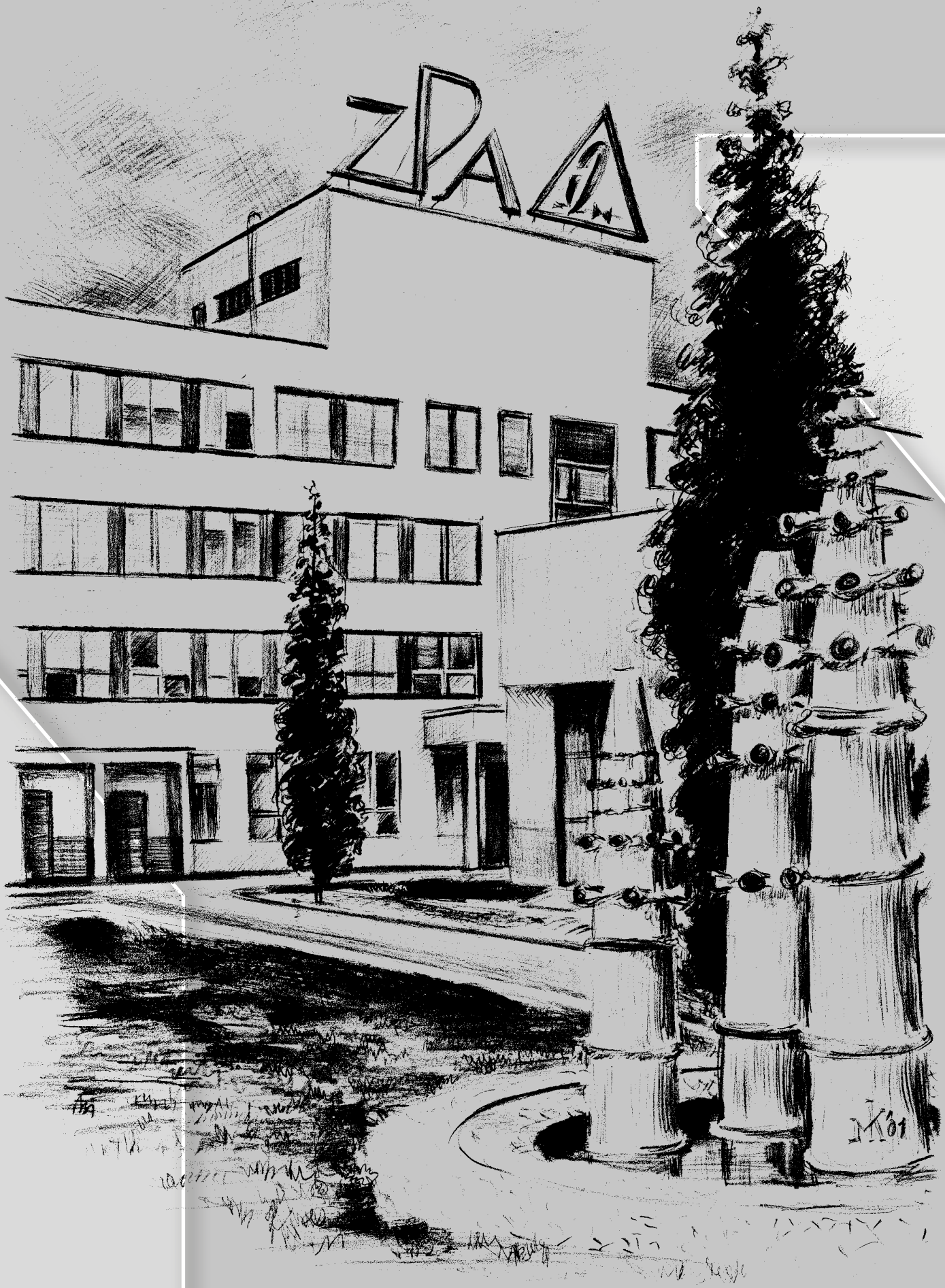
MOUNTING INSTRUCTIONS

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

- outside containment of nuclear power plants with reactors VVER and RBMK

MODACT MOKA

Type numbers 52 325 - 52 329



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

CONTENS

1. USING

Actuators **MODACT MOKA** manufactured in compliance with technical conditions 32-03/07 are intended for controlling shut-off and regulating valves, including valves of protective systems installed in the non-sealed part of nuclear power plants with reactors of type VVER and in attended rooms of nuclear power plants with reactors of type RBMK. The actuators are used to control the valves by turning its control element to the angle of 90°.

Working position of actuators – arbitrary.

Protective enclosure min. IP 65.

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

2. OPERATING CONDITIONS

The actuators in version **MODACT MOKA** must operate reliably with the following parameters of environment:

Temperature	-25 °C to +55 °C (up to 90 °C for 5 h, once in 6 months, 5 cycles for the period of the actuator operation*)
Pressure	from under-pressure 50 Pa to over-pressure 0.1 MPa
Relative humidity	up to 90 % (at 60 °C)

**) The actuator remains operational in this regime even after its termination. In case of the actuators, revision after termination of the mentioned regime is not required.*

Resistance against seismic effects. Resistance against vibrations

The actuators correspond to the I. category of seismic resistance according to NP-031-01 and maintain their operating ability during as well as after the seismic effects of intensity up to MP3.

The actuators are resistant against vibrations and seismic shocks of acceleration 8 g in different directions within the range of excitation frequency 20 to 50 Hz for the period of action 20 s. In addition, operation ability is confirmed by seismic resonance test in the frequency range 5 to 20 Hz.

The actuators are resistant to shocks in the frequency range 5 to 100 Hz under the action of vibrational load in two directions with acceleration up to 1 g and amplitude of oscillations up to 50 μm.

Resistance against action of deactivating solutions

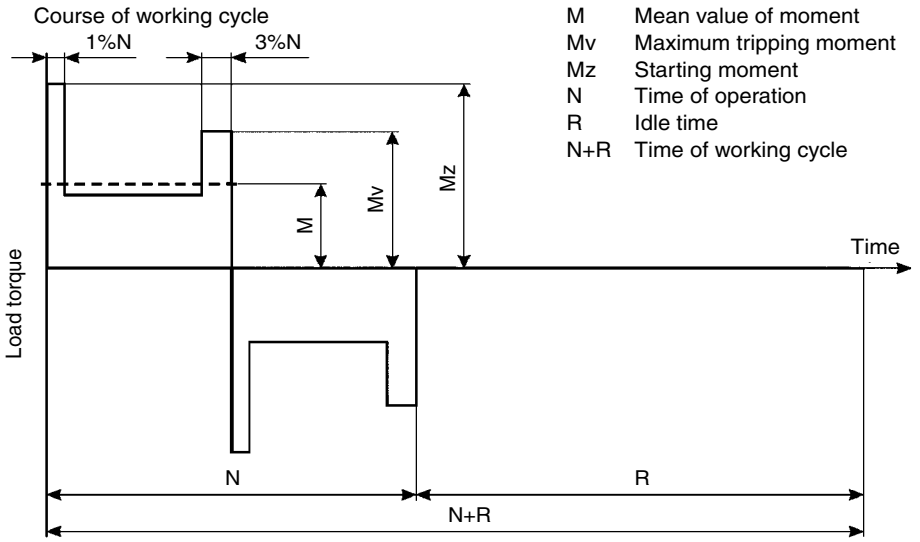
The actuators must be resistant against the action of deactivation solutions. Composition of the solutions is stated in the technical conditions. Composition of deactivation solutions on every single object can be arbitrary in compliance with NP-068-05.

Dipping of the actuators in a vat with the deactivation solution is inacceptable.

3. OPERATING REGIME

Maximum duration of the working cycle (closed – open – closed) is 10 min at surrounding temperature +50 °C and with ratio of time in the state of operation to idle time 1:3 (repeated short-time regime with the period of switching-off PV = 25 %). Mean value of loading moment during the period of switching-on is 60 % of the maximum tripping moment.

The actuators can also operate in a discontinuous regime (e.g. in controlling the regulating valve) with frequency of switching-on up to 1200 h^{-1} with the ratio of time of operation to idle time 1:3. Mean value of loading moment during operation is 40 % of the maximum tripping moment.



4. BASIC TECHNICAL DATA

If the actuator is not equipped by overcurrent protection in a moment of purchase, it is necessary to use external protection.

Service life of actuators. Reliability

Service life of the actuators is min. 40 years.

The actuators belong to the category of restoring products of standardized reliability. During operation, preventative inspections are carried out with period of min. 15,000 hours. The interval between repairs is min. 4 years.

The specified service life in the interval between two repairs is 1500 cycles (open – closed), wherein probability of faultless operation is min. 0.98. Probability of faultless operation with 25 working cycles per 4 years is 0.998. Confidence probability for calculation of the lower confidence limit of faultless operation is 0.95.

Criteria of the actuators failure are as follows:

– discrepancy in output parameters of the actuators with parameters described in these technical conditions;
– failure to meet acceptable deviations of output parameters;
– failure to meet regulating range of output parameters;
– failure to meet insulation resistance;
– leakage of lubricants from the actuators.

Criteria of limit states of the actuators are as follows:

– rupture of integrity of the body parts that prevents normal function;
– changed shape and dimensions of parts (power kinematic circuits and control units;
– as a result of wear or deformation preventing normal function;
– elapsed specified period of service life.

Supply voltage of actuators

Supply voltage - alternating, three-phase 400/230 V or 380/220 V. Frequency of supply voltage 50 Hz. Possible emergency deviations of frequency of mains voltage:

Name of regime	Number of load cycles of device per 30 years
Emergency deviation of frequency in the network:	
51.5 to 52.5 Hz – for up to 5 min one-time, but max. 750 min during operation period;	10 cycles per year
50.5 to 51.5 Hz – for up to 5 min one-time, but max. 750 min during operation period;	10 cycles per year
49 to 47.5 Hz – for up to 5 min one-time, but max. 750 min during operation period;	10 cycles per year
47.5 to 46 Hz – for up to 30 s one-time, but max. 300 min during operation period;	40 cycles per year
Note: *1. With the mentioned emergency deviations of frequency, network voltage must stay at 400/230 V or 380/220 V.* *2. With frequency in the range 51.5 to 52.5 Hz, starting and rated moment can decrease by max. 10 %.*	

The actuators of protective systems must be operational under the following conditions:

– Voltage decreased to 80 % of its rated value with simultaneously decreased frequency by 6 % of its rated value for 15 s;
– Voltage increased to 110 % of its rated value with simultaneously increased frequency by 3 % of its rated value during 15 s. Herewith, the actuator must not stop and possibility of the valve functioning must be secured.

Self-locking

The actuators are self-locking. The self-locking of the actuator is ensured by the mechanical brake.

Manual control

The actuators must be fitted with a substitute manual control. When the electric motor turns, torque is not transferred to the manual control device; in operation with the manual control device, its torque is not transferred to the electric motor. The actuator design ensures safety of the operator during control by means of the manual control device. When the hand wheel is turned in the clock-wise direction, the valve closes.

Force on the manual control device does not exceed 735 N at the maximum moment on the output shaft and does not exceed 295 N at 0.4 of the maximum moment value.

Moments in actuators are set up and works, if actuator is under the pressure.

In case, that manual control will be used, it means actuator will be controlled mechanically, moment settings is not working and valve may be damaged.

Anti-condensation heater

The actuators are fitted with the anti-condensation heater preventing condensation of water vapour. Its resistance in actuators **MOKA 63** is 12 kohm and in actuators of other types 6.8 kohm. The element is connected to the supply source (to one phase) of voltage 230 V or 220 V.

Switches

The actuators are fitted with two end-limit, two position, and two moment micro-switches. The micro-switches must have one opening and one closing contact. Each contact of the micro-switch has its outlet at the terminal board. On agreement with the client, the end-limit and position micro-switches can have a single change-over contact, and the moment switches – a single opening contact.

The end-limit, position, and moment switches must be functional under the following conditions:

In the circuits of alternating voltage up to 250 V of frequency 50 and 60 Hz. Current through the closed contacts up to 500 mA, wherein the loss of voltage on the closed contacts must not exceed 0.25 V.

In the circuits of direct voltage 24 and 48 V with current through the closed contacts 1 to 400 mA, wherein the loss of voltage on the closed contacts must not exceed 0.25 V.

The functional diagram of the position switches and the signalling circuits is shown on the page 20.

Position transmitters

In compliance with requirements of the client, the actuator can be fitted with the passive or active, current or resistance position transmitters.

Passive current position transmitter CPT 1AAE

Rated output signal	4 – 20 mA or 20 – 4 mA
Rated working run	from 0 – 60° to 0 – 120°, regulated
Loading resistance	0 – 500 ohm
Supply voltage	18 – 28 V DC
Dimensions	ø 40 x 25 mm
Waviness of supply voltage	±5 %
Transmitter power input	max. 560 mW
Insulation resistance	20 Mohm at 50 V DC
Electric strength of insulation	50 V DC
Temperature of operating environment	-25 to + 80 °C, for short time up to +110 °C (max. 2 hours)

The limit value of supply voltage (at surrounding temperature -25 to +60 °C) is 30 V. Voltage between the transmitter box and the signalling wire must not exceed 50 V.

The user must provide for connecting the two-wire circuit of the current transmitter to electric earthing of particular regulator, computer, etc. The connection must be realized in a single point at any place of the circuit outside the actuator.

Active current position transmitter DCPT

Rated output signal	4 – 20 mA or 20 – 4 mA
Rated working run	from 60° to 0 – 340°, regulated
Loading resistance	0 – 500 ohm
Non-linearity	max. 1 %
Supply voltage	18 – 28 V DC
Dimensions	ø 40 x 25 mm
Waviness of supply voltage	±5 %
Max. current consumption of transmitter	max. 42 mA
Insulation resistance	20 Mohm at 50 V DC
Electric strength of insulation	50 V DC
Temperature of operating environment	-25 to + 70 °C

Voltage between the transmitter box and the signalling wire must not exceed 50 V. The current loop is supplied from the source DCPZ located inside the actuator.

Resistance position indicator

The resistance position indicator is formed of a double-wire resistor of variable resistance, each part of which having resistance 100 ohm.

Total resistance	1 x 100 ohm with deviation +12 ohm
Maximum loading current	100 mA
Maximum direct voltage	(against frame) 50 V
Working run	0° to 320°
Non-linearity	max. 1 %

Local position indicator

The local position indicator serves for orientational determination of position of the actuator output shaft.

Actuator terminal board

The actuators are fitted with a common terminal board for connecting external electric circuits. The terminal board is located under the actuator cover. All contacts of the micro-switches, circuits of the electric motor, and the earthing terminal are connected to it. The terminal board enables connection of one wire of cross-section 2.5 mm^2 or two wires of cross-section up to 1 mm^2. The actuators are fitted with two cable bushings providing for connection of:

– in actuators **MOKA 63:** one cable of outer diameter 10 – 14 mm for control circuits and one cable of outer diameter 13 - 18 mm for circuits of the electric motor;

– in actuators **MOKA 125, 250:** two cables of outer diameter 13 – 18 mm for control circuits and circuits of the electric motor;

– in actuators **MOKA 500, 1000:** one cable of outer diameter 13 – 18 mm for control circuits and one cable of outer diameter 13 - 20 mm for circuits of the electric motor.

The cross-sections and diameters of cables must be specified in the order.

The actuators are fitted with the earthing terminals including a device against spontaneous releasing. The design prevents the control circuits from being influenced by the power circuits.

The actuators are supplied with blinded bushings.

Insulation resistance

At temperature 20 ±5 °C and humidity 30 to 80 %, the insulation resistance is min. 20 Mohm. Under the most severe working conditions, resistance of the insulation of electric circuits against each other and against the frame is min. 0.3 Mohm.

Electric strength of insulation

Insulation of electric circuits against frame as well as against each other at temperature 20 ± 5 °C and humidity 30 to 80 % must withstand testing alternating voltage of sinus shape of frequency 50 Hz for 1 minute:

Electric circuits of actuator	Testing voltage
of rated voltage max. 250 V	1500 V, 50 Hz
Remote transmitter of rated voltage max. 50 V	500 V, 50 Hz
Electric motor of rated three-phase voltage 400 V (380 V)	1800 V, 50 Hz
	According to GOST 183-74
Circuit of current transmitter CPT 1AAE	50 V DC

Noise

The value of mean level of acoustic pressure *(in no-load operation of actuators)* does not exceed 80 dB.

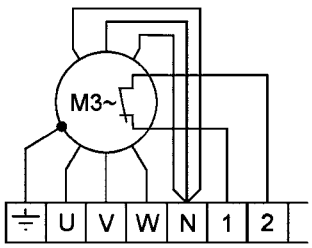
Run-out of output shaft

Motors of type no. 52325, 52 326, 52 328	max. 1.5°
Motors of type no. 52 327, 52 329	max. 2.5 °

Thermal protection of electric motor

Actuators MODACT MOKA 500, type no. 52 328.xx2x and MODACT MOKA 1000, type no. 52 329.xx3x are fitted with the three-phase electric motor (400 V) of power 120 W without a thermal protection. Automatic fuses are built-in in electric motors of other actuators listed in Table 1; they switch off power supply to the electric motor in case of over-heating (after cooling down, the power supply is automatically switched on). Their circuits are not connected to the terminal board of the electric motor. The built-in thermal fuses disconnect the electric motor from power supply in case the temperature of the electric motor winding exceeds +155 °C.

Electric motor FT2B52C is fitted with an automatic fuse the circuit of which is connected to the terminal board of the actuator (see the wiring diagram below). Switched-over load: current 2.5 A at voltage 250 V.



Deviations of basic parameters

Rated values of torques of the output shaft (with acceptable deviations) are given for rated supply voltage with deviation from -15 % to +10 % and for rated frequency of supply voltage in the range ±2 %, wherein the deviations of voltage and frequency must not have opposite signs.

Acceptable deviations of respective parameters:

Tripping moment	±15 % of maximum value
Time of turning by 90°	+10 % to – 15 % of rated value (idle run)
Hysteresis of end-limit and position switches	max. 4°
Setting of working run	±1°
Non-linearity of position transmitter	±2.5 % of rated value of transmitter output signal
Hysteresis of position transmitter does not exceed	2.5 % of rated value of transmitter output signal

5. TECHNICAL DESCRIPTION

The MODACT MOKA actuators consist of the following two parts:

– **Power section** constituted of a one-phase or three-phase asynchronous motor (see Tab. 1), a countershaft gearbox, an epicyclic gear with the output shaft, a manual control mechanism with a handwheel and a floating worm and, in the actuators, Type Nos 52 327 and 52 329, an output gearbox (with adapter) with a 1:2 gear ratio.

– **Control section** which is identical for all MODACT MOKA actuators (Fig. 2), Types MOKA 125 to MOKA 1000 Type No., with the only exception that, it differs in angular displacement of units on the base plate. In the actuator, Type No. 52 325, the unit of position-limit signalling switches is arranged as shown in Fig 1. The control section consists of position-limit switching unit 1, resisence position transmitter 2, torque-limit switching unit 3, terminal block 4 and anti condensation heater 8.

The position-limit switching unit uses 4 microswitches of which 2 are always used for either direction of rotation of the output shaft. The switching point of each microswitch can be adjusted independently within the working travel range of the actuator.

The torque-limit switching unit has independently adjustable microswitches, one for either direction of rotation.The torque-limit switches are not secured against opening at the startig torque.

The potentiometer is fitted with a slipping clutch to permit automatic adjustment along with the output shaft.

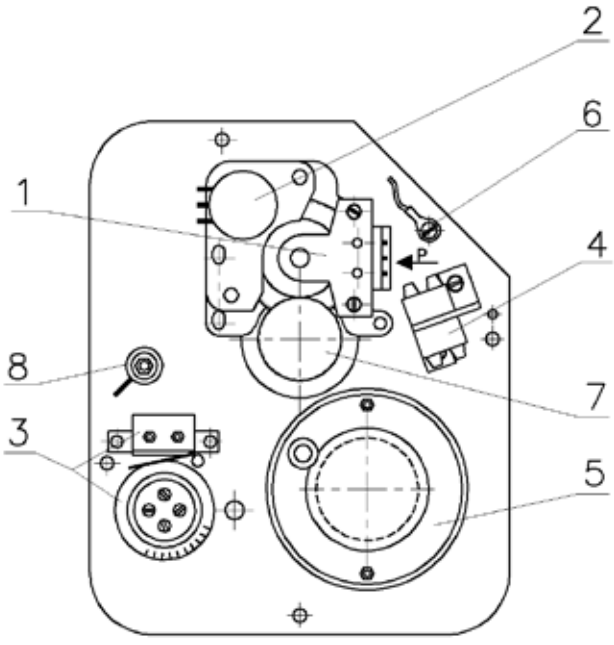


Fig. 1 - ***Control panel (type no. 52 325)***

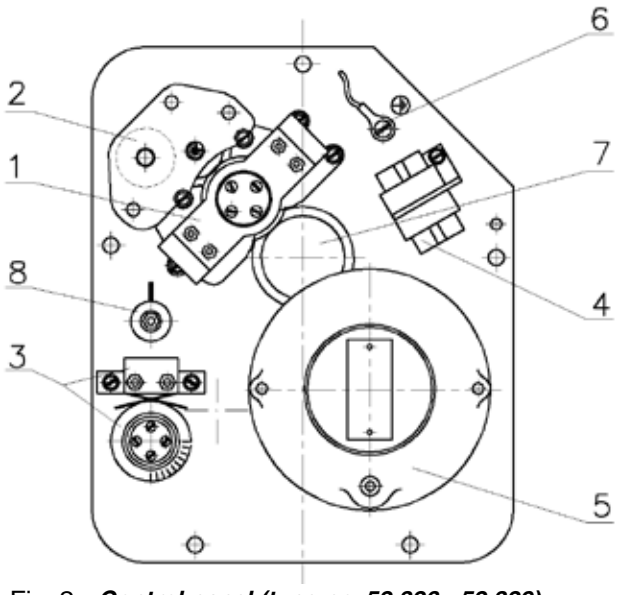
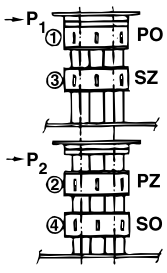
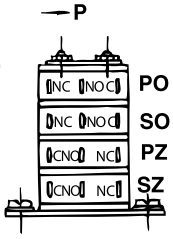


Fig. 2 - ***Control panel (type no. 52 326 - 52 329)***



Legend:

1 – Position-limit switching unit
2 – Position transmitter (potentiometr)
3 – Torque-limit switching unit
4 – Terminal board
5 – Electric motor
6 – Internal protective terminal
7 – Drive gear (or segment)
8 – Anti-condensation heater
9 – Starting capacitor



Note:

The encircled numbers are identical to the numbers of the cam releasing screws of the position-limit switching unit.

The anti-condensation heater 8 (Fig.1, 2) prevents water vapours from condensing under the cover of the control section. The position-limit switching unit and the position transmitter derive their movements from the output shaft of the actuator via a driving gear (or in the actuators, Type Nos 52 326 and 52 327, via driving segment 7, as shown in Fig 1). The torque-limit switching unit is driven by a “floating worm“ of the manual control mechanism where the worm displacement is directly proportional to the torque of the actuator output shaft. This enables the actuator to be switched off immediately the torque on the output shaft to whichthe torque-limit switching unit has been adjusted, is reached.

Note: *The microswitches used are of a single-chamber type, i.e., they can operate as a one-pole cut-out switch a contact maker or a change-ower switch, whereas the torque-limit switches can be used as cut-out switches only (see the respective circuit layout).*

6. ADJUSTMENT OF THE ACTUATOR

Stop screws

Stop screws are used to limit the actuator working travel to 90° in compliance with the CLOSED and OPEN end positions of the valves having no trip dogs of their own. The screw stops are mounted on the outside of the actuator along with the external protective terminal. When viewing the stop screws, the right-hand stop screw is designedfor the CLOSED position, whereas the left-hand stop screw is designed for the OPEN position under the assumption that, when viewing the local position indicator, the output shaft rotates clockwise in the CLOSE direction of rotation. For adjustment of the stop screws, loosen the stop screws, move the actuator with valve into the CLOSED position, and turn the corresponding stop screw till an increased resistance is felt when the screw runs onto the stop face within the actuator. Secure the stop screw in position by retightening its lock nut. Then, rotate the output shaft of the actuator through a 90° angle to bring it into the OPEN position and set the OPEN-position stop screw by the same procedure.

When setting the stop screws in the actuators, Type Nos 52 326 ant 52 327, care should be taken to ensure that, in the CLOSED or OPEN end position, the driving gear segment of the position-limit switching and auxiliary signalling units cannot strike the electric motor. In either end position of the output shaft of the actuator, the local position indicator should tally with the marks on the index plate.

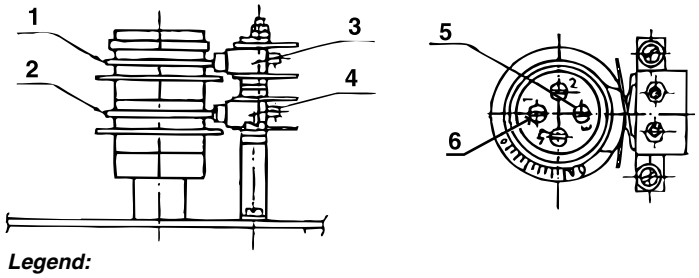
If the valve is required to be tightly closed in the end position and thus the actuator is to be switched off by means of the torque-limit switches, the tripping torque should be transferred to the valve. In this case, set the corresponding stop screw so that the valve is properly sealed when the stops of the output shaft run against the stop screw at which the torque-limit switch operates.

In this case, the respective torque-limit switch is used for switching off the actuator. If stops are required to be used for protection of the acutator and the valve against damage in the case of a failure of the position-limit switch set the stop screws to such a position which ensures dependable operation of the position-limit switch and is still permissible for the valve. In this case, the position-limit switch and the torque-limit switch should be connected in series. Nevertheless, this can only be done when no tight closure of the valve is required.

Torque-limit switches

The torque-limit switches have been adjusted to the specified torque at the factory. If they are required to be readjusted to another torque, release the corresponding cam by means of the cam releasing screws whose numbers are given in the legend of Fig. 3. By the linear division of the respective scale section between the zero and the maximum switching torque as marked on the scale in colour, we obtain a point for the required switching torque with which the arrowhead on the cam should tally. Retighten the cam releasing screw. For manipulation of the releasing screws of the torque-limit switches, the same applies as to the releasing screws of the position-limit switching unit. After the torque-limit switches have been adjusted, check that they operate using a lamp tester.

Caution! *Any manipulation of the releasing screws numbered 2 and 4 is forbidden.*



Legend:

1 – OPEN torque-limit switch cam
2 – CLOSE torque-limit switch cam
3 – OPEN torque-limit switch
4 – CLOSE torque-limit switch
5 – Releasing screw of CLOSE torque-limit switch cam
6 – Releasing screw of OPEN torque-limit switch cam

Fig. 3 - ***Torque-limit switches***

Position-limit switches

Position-limit switches PO, PZ switch off an electric actuator when the output shaft reaches the position for which they are set. Signalling-limit switches SO, SZ signalise the position of electric actuator output shaft.

The setting of position-limit switches is carried out by positioning the output shaft into the position in whichthe set switch should switch off. Then, loosen the micro-switch cam using the releasing screw.

Loosing will be done by turning the releasing screw counter-clockwise. Turn the releasing screw only until the cam is released. By further turning of the releasing screw, you would tighten the cam again. Numbers of relevant releasing screws are on a holder of position unit (Fig. 1) and they correspond to markings on a cam shaft.

When loosened, turn the cam in the opposite direction to the motion of an electric actuator output shaft while setting the position “open” or “closed” until the micro-switch switches over. In this position lock the cam by tightening the releasing screw (clock-wise direction).

A signalling switch must be set so that it switches over sooner than a relevant position-limit switches or torque-limit switches. When adjusting position-limit and signalling switches of electric actuators Type Nos. 52 326 and 52 327, ensure that a gear segment of position and signalling unit drive in the extreme position “open” or “closed” doesn’t hit the actuator case. A position unit of electric actuator Type No. 52 325 is not equipped with the locking of cams using screws (Fig. 2). The cam’s position on the shaft is ensured only by friction which has to be overcome when adjusting the cams. A design Type No. 52 325 has cams locked by friction and central milled nut with contra-nut which must be loosened before adjusting and tightened properly again after adjusting.

Position transmitters

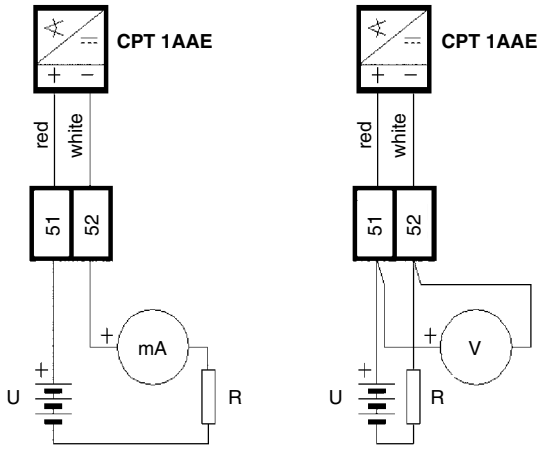
Resistance position transmitter

To adjust resistive position transmitter it is sufficient to set the actuator output shaft to one of the end positions - OPEN or CLOSED. In this way, the potentiometer is automatically preset. The automatic adjustment of the resistance position transmitter is usually provided already when the stop screws or the position-limit switches are adjusted.

Current position transmitter CPT 1AAE – setting

Before starting setting the current transmitter it is necessary to set the end-limit positions *(torque or position switches)* of the actuator and connect them into the tripping circuit of the electric motor. In case of an external source of feeding voltage, verification must be carried out that it does not exceed the maximum value 30 V DC *(limit value when CPT 1AAE is still not damaged)*. Recommended value is 18 – 28 V DC.

Positive pole of the source is connected to the positive pole of the transmitter CPT 1AAE; a milli-ammeter with accuracy ta least 0.5% is connected into the circuit. The current loop must be earthed in one point. The figure does not show the earthing that can be made at any point of the circuit.



1. Move the output shaft to Closed position. During closing, the current signal value should decrease. If it is increasing, unfix the transmitter body and move to decreasing part of output characteristics by turning of cerca 180 degrees. Set 4mA by slight turning. Tighten the shim plates to secure the transmitter against spontaneous turning.
2. Move the output shaft to Open position and set 20 mA using a potentiometer on the transmitter body. The potentiometer has a range of 12 rounds and it has no stops so that it cannot be damaged by furtherturning.
3. Once again verify the current value in the position Closed. If it has changed too much repeat the points 1. and 2. If the required corrections are large this procedure should be repeated several times. After the setting, secure the transmitter against turning and drip the screws with varnish.
4. Use a voltmeter to check the voltage on the CPT 1AAE terminals. Due keep the linearity of the output signal the voltage must not drop below 9 V, not even with off-take 20 mA. If this condition is not met it is necessary to increase the feeding voltage *(within the range of recommend values)* or to decrease total resistance of the current loop R.

Caution!

The transmitter CPT 1AAE must not be connected without checking the supply voltage. The transmitter outlet conductors must neither be connected to the electric actuator frame nor to the earth, not even casually.

Before the supply voltage is checked, it is first necessary to disconnect the transmitter from power supply. Measure the voltage on terminals of the electric actuator to which the transmitter is connected – this can best be done using a digital voltmeter of input resistance at least 1 MΩ. This voltage should fall within the range of 18 – 25 V DC; in no case may it exceed 30 V *(otherwise the transmitter can be damaged).* Then, connect the transmitter so that the positive pole of the power source is connected to the positive pole of the transmitter, i.e. to the pin with red insulator *(r) + (nearer to the transmitter centre).* The terminal with white coating *(wired to the terminal 52)* is connected to the negative pole of the transmitter *(white insulator).* In the latest design variants the red conductor is plus and the black one is minus.

A milli-ammeter, preferentially a digital one with accuracy at least 0.5 %, is temporarily connected in series with the transmitter. The output shaft is moved to the position CLOSE. The signal value must decrease. If this is not the case, the output shaft should be rotated in the CLOSE direction until the signal starts decreasing and the output shaft reaches the CLOSE position.

Then, loosen the screws of the transmitter shim plates so that the whole transmitter can be turned to set the current to 4 mA, and retighten the screws of the shim plates. Thereafter, move the output shaft of the electric actuator to the position OPEN. Using the resistance trimmer on the transmitter face *(nearer to the edge)* set the current to 20 mA. The trimmer has 12 turn and no stops. Hence, it cannot be damaged.

In case the correction of the current 20 mA was considerable repeat adjustment for 4 mA and 20 mA once again. Disconnect the milli-ammeter. The screw secured by a drop of varnish situated nearer to the centre must not be turned. Retighten the countershafts fixing the transmitter shim plates and secure with a drop of varnish against loosening.

After completing the adjusting procedure, check voltage on the transmitter terminals using a voltmeter. The voltage should fall within the range of 9 – 16 V with current 20 mA.

Note:

The transmitter characteristics has two branches: the descending one and the ascending one with respect to the CLOSE position. The characteristics is selected by turning the transmitter body.

Setting of current position transmitter DCPT

1. Set of end-limit positions

Before starting the setting, verification must be carried out that the end-limit positions are within the range 60° – 340° of revolution DCPT. Otherwise, after setting, an error arises (LED 2x).

1.1. Position “4 mA”

Set the drive into the required position and press the push-button **“4”** until LED blinks (about 2 s).

1.2. Position “20 mA”

Set the drive into the required position and press the push-button **“20”** until LED blinks (about 2 s).

2. Setting of sense of rotation

The sense of rotation is specified by viewing from the side of the panel DCPT.

2.1. Rotating anti-clockwise

Press the push-button **“20”,** then the push-button **“4”** and keep them depressed until LED blinks.

2.2. Rotating clockwise

Press the push-button **“4”,** then the push-button **“20”** and keep them depressed until LED blinks.

When the sense of rotation is changed the end-limit positions “4 mA” and “20 mA” remain valid but the working range (track DCPT) between these points is changed to a complement of the original working range. In this way, the permitted working range can be exceeded (LED 2x) – it can be smaller than 60°.

3. Error messages

In case of an error the diode LED blinks an error code:

*	1x	Sensor position out of working range
**	2x	Working range incorrectly set
***	3x	Off the tolerance level of magnetic field
****	4x	Wrong parameters in EEPROM
*****	5x	Wrong parameters in RAM

4. Calibration of currents 4 mA and 20 mA.

On switching-on the power supply, keep the push-buttons **“4”** and **“20”** depressed and release them after a single blink of LED. In this way the option menu 4.1 Calibration of current 4 mA is entered.

4.1. Calibration of current 4 mA

Connect the ammeter to testing terminals. Press the push-button **“20”.** Keep depressed the push-button to evoke the auto-repeat of current decrease. Release the push-button to make record of the present value.

4.2. Calibration of current 20 mA

Connect the ammeter to testing terminals. Press the push-button “4”. Keep depressed the push-button to evoke the auto-repeat of current increase. Release the push-button to make record of the present value.

4.3. Switching-over between option of calibration 4 mA and 20 mA

Entry of option of calibration 4 mA:

Press the push-button **“4”,** then the push-button **“20”** and keep them depressed until LED blinks.

Entry of option of calibration 20 mA:

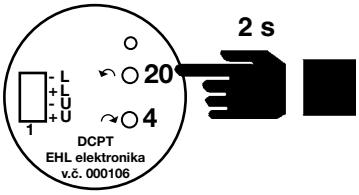
Press the push-button **“20”,** then the push-button **“4”** and keep them depressed until LED blinks.

5. Record of standard parameters

On switching-on the power supply, keep the push-buttons **“4”** and **“20”** depressed and release them after a double blink of LED.

ATTENTION! With this record, the transmitter calibration is also overwritten and, therefore, it must be repeated!!

Parameter setting

Position “4 mA“ Set the actuator to required position (usually Closed) and keep the push-button 4 depressed until LED blinks.	
Position “20 mA“ Set the actuator to a required position (usually Open) and keep the push-button 20 depressed until LED blinks.	

7. ACTUATOR ASSEMBLY AND PUTTING INTO OPERATION

After unpacking the actuator, this should be inspected for possible visible signs of damage that could happen during transportation or storage. If no visible damages are detected, the actuator can be connected to external control and power circuits. Using a short-time switching-on of the actuator in its intermediate position of the working stroke, make sure that the actuator output shaft rotates in a correct direction. This can be verified by pressing the lever of the particular micro-switch (end-limit position or torque switch, depending on the way of controlling the actuator) using an insulation rod with the actuator operating in certain direction. By pressing the lever of the torque switch MZ or end-limit switch PZ with the output shaft rotating in the Close direction, the actuator should stop. With the output shaft rotating in the Open direction, the levers MO and PO should be pressed. If the actuator does not stop by the mentioned pressing but does stop by pressing the levers MO and PO with rotation in the Close direction or MZ and PZ with rotation in the Open direction (i.e. the micro-switch levers switch off the electric motor with rotation in the opposite direction), it is necessary to reverse the sense of rotation of the actuator output shaft by interchanging two (of three) connected phase conductors U, V, W (e.g. the phase conductor connected to the terminal U should be reconnected to the terminal W and the conductor connected to the terminal W to the terminal U). Then, the check of the sense of rotation should be repeated. Finally, the actuator is fitted on the valve and set in compliance with the following procedure.

8. ACTUATOR SETTING

The setting is best accomplished using the manual control. It is recommended to check the switching of the micro-switches on and off using a glow-lamp or another appropriate tester of low voltage up to 24 V.

After setting the actuator, its function should be checked using the control circuit. First, check that the actuator is starting up correctly and that, after switching off particular switch, there is no voltage on the electric motor. In the opposite case, the power supply of the actuator should be disconnected immediately to prevent damaging the actuator. Subsequently, the cause of an incorrect function should be identified.

9. SAFETY REQUIREMENTS

It is prohibited to use the actuators with parameters exceeding the values stated in these instructions.

It is prohibited to dismantle, repair and service the actuator under voltage. Before starting dismantling the actuator, make sure that the actuator is disconnected from power supply and that a table reading “Do not switch on, work in progress“ is placed on the control panel. Before connection, assembly, setting and putting into operation, the actuator must be earthed in a reliable way. During setting, repairing and servicing the actuator, it is necessary to observe the safety regulations applicable to the building where setting, assembly, connection, and putting the actuator into operation is carried out and where it is operated. Assembly and control of the actuators can only be carried out by a specially trained technician acquainted with the technical description and instructions for using the actuators (these instructions) and who has passed training on labour safety.

Important warning

On closing the thermal protection located in the electric motor (except for electric motor of power 120 W), it should be born in mind that, if there is feeding voltage on the electric motor terminals, the actuator is automatically started after the thermal protection has cooled down.

10. SERVICE OF ACTUATORS

Periodicity of preventative inspections and repairs is given in section BASIC TECHNICAL DATA of these instructions. The preventative inspections are carried out with the aim of detecting defects that can be identified visually. The inspection should include checking of conditions of cable connections and cables, and verification of reliability of fastening of the actuator to the valve; the fastening elements should be tightened as necessary (this inspection should be carried out within 6 months at the latest from putting the actuator into operation and then at least once a year). During repairing the actuator, it is necessary to replace damaged and worn-out parts of the actuator.

For the whole period of the actuator operation, there is no need to replace the lubricant. In case the lubricant is to be refilled during repairs and replacement of parts that require lubrication, the lubricant MOLYKOTE 165LT, COUPLING GREASE 0-1 or CIATIM-221 should be used.

11. TRANSPORT AND STORAGE

The actuators can be transported in enclosed vehicles to any distance.

During transportation, the actuators should be transferred in such a way that damage to the actuators and their packing is prevented.

Transport and storage conditions at temperature from -25 °C to +50 °C, unless otherwise stated in the order. Maximum relative humidity during storage is 80 %.

12. GUARANTEE CONDITIONS

The manufacturer guarantees compliance of the manufactured actuators and completing parts with requirements of TP 32-03/07, provided that the user observes the operating, transportation and storage conditions specified in TP.

The guarantee period for the actuators is min. 36 months from the date of issuing the acknowledgement of delivery (or from the date of the border crossing – in case of export deliveries), including 24 months from the date of putting into operation (with observed transportation, storage, assembly, and operating regulations).

Table 1 – Basic technical parameters and characteristics of actuators, type MODACT MOKA for valves, installed in attented areas of nuclear power plants with reactors VVER or RBMK

ACTUATOR									ELECTRIC MOTOR								
Type	Type number basic	Type number complem.	Tripping torque	Shifting time	Gear ratio from output shaft to motor	Gear ratio from output shaft to hand wheel	Max. force on hand wheel[1]	Weight of actuator with electric motor	Type	Nominal power	Voltage	Motor speed	Efficiency	Power factor	Start-up to nominal moment ratio	Start-up to nominal current ratio	Current	Start-up torque
	12 345	678910	[Nm]	[s/90°]			[N]	[kg]		[W]	[V]	[1 / min]	[%]	[cos γ]			[A]	[mNm]
MOKA 63	52 325	xx1xA	16 – 32	10	1850	73	10	7,4	FCJ2B52VA	15	1x230	2750	37,9	0,99	1,0	2,14	0,18	min. 52
		xx2xA	25 – 80	20	3713													
		xx3xA		40	7224													
		xx4xA	25 – 45	80	7224				FCT2B54MA	4		1270	16,3	0,879	1,16	1,235	0,13	min.34
		xx5xA	16 – 32	10	1850				FT2B52C	15	3x400	2680	39,9	0,578	2,43	2,21	0,10	min. 130
		xx6xA	25 – 80	20	3713													
		xx7xA		40	7224													
MOKA 125	52 326	xx1xA	63 – 125	10	1907	65	10	12,7	FCJ4C52N	60	1x230	2770	52,2	0,952	0,67	2,23	0,53	min.140
		xx2xA		20	3623													
		xx3xA		40				12,3	FCT4C54N	20		1350	29,2	0,775	0,7	1,58	0,4	min.100
		xx4xA		80	7332													
		xx5xA		10	1907			12,7	FT4C52NA	90	3x400	2770	62,3	0,63	1,82	2,96	0,34	min. 560
		xx6xA		20	3623													
		xx7xA		40					EAMR56N04A	20		1440	29	0,50	4,0	2,7	0,20	min. 530
		xx8xA		80	7332													
MOKA 125	52 326	xx2xA	125 – 250	20	3890	132	10	21	FCJ4C52N	60	1x230	2770	52,2	0,952	0,67	2,23	0,53	min.140
		xx3xA		40	7394													
		xx4xA		80				20,5	FCT4C54N	20		1350	29,2	0,775	0,7	1,58	0,4	min.100
		xx5xA		160	14963													
		xx6xA		20	3890			21	FT4C52NA	90	3x400	2770	62,3	0,63	1,82	2,96	0,34	min. 560
		xx7xA		40	7394													
		xx8xA		80					EAMR56N04A	20		1440	29	0,50	4,0	2,7	0,20	min. 530
		xx9xA		160	14963													
MOKA 500	52 328	xx2xA	250 – 500	20	1875	72	32	27	1PK 7060-4AB	120	3x400	1350	55	0,75	2,0	2,8	0,42	1700
		xx3xA		40	3506			26										
		xx4xA		80	7640			26,3										
MOKA 1000	52 329	xx3xA	500 – 1000	40	3630	139		45	1PK 7060-4AB	120	3x400	1350	55	0,75	2,0	2,8	0,42	1700
		xx4xA		80	6787			43										
		xx5xA		160	14790			43,3										

Note:

1) In table is mentioned one power from power pairs, acting on handwheel circuit. Electrical connection of actuators – by stuffing gland – terminal block. Rated current is mentioned for voltage 400 V, 50 Hz. For U = 380 V is: rated current $I_n30 = I_n400 \cdot 400/380$. The same proportions is for starting current as well.

Additional type number:

6th position - equipped by position transmitters of output shaft:

6xxxA – resistive transmitter 1x100 ohm;

7xxxA – current transmitter 4-20 mA;

8xxxA – no position transmitter;

9xxxA – current position transmitter 4-20mA with built in power supply.

7th position – reserve: x0xxA – for all types;

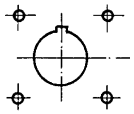
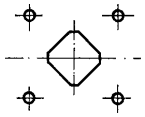
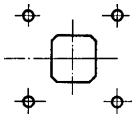
8th position – tripping torque of actuator and adjusting time of output shaft of 90 degrees (according to Table 1).

9th position – connection dimensions (according to Table 2).

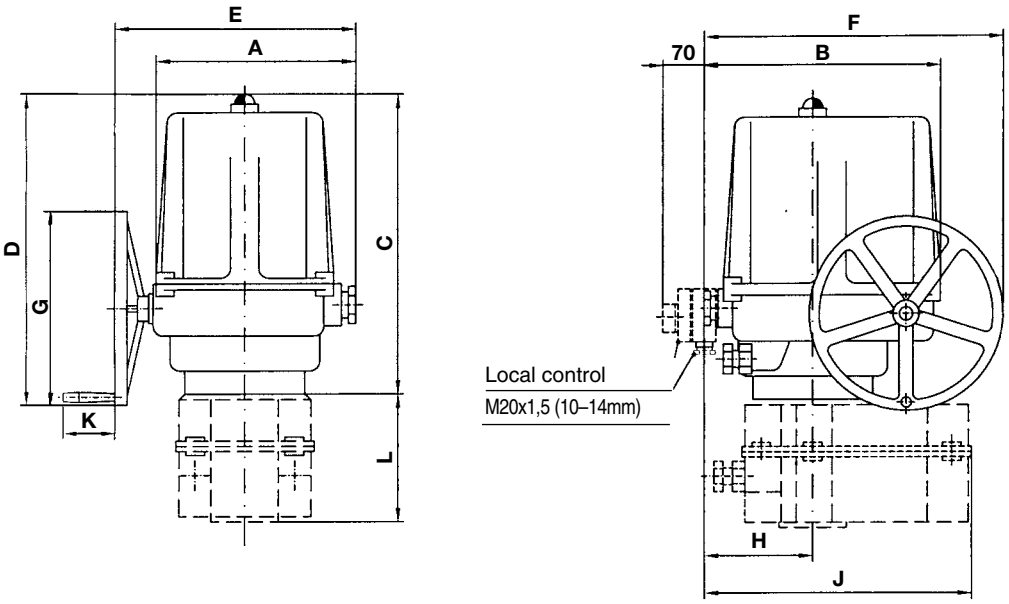
Table 2 – MODACT MOKA – way of mechanical connection

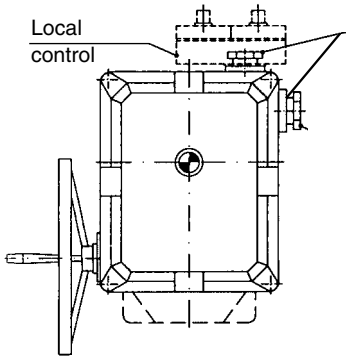
(specification of 9th place of type number)

Type Number	Flange size	Connection or square size with [mm]	Square position	Marking on the 9th place of type number
52325	F05	keyway, , Ø 22	–	xxx0A
		14	basic	xxx1A
	F04	keyway, Ø 18	–	xxx2A
		11	basic	xxx3A
	F05	14	positioned at a 45°	xxx4A
	F04	11		xxx5A
		12	basic	xxx6A
			positioned at a 45°	xxx7A
	F05	16	basic	xxx8A
			positioned at a 45°	xxx9A
52326	F07	keyway, Ø 28	–	xxx0A
		17	basic	xxx1A
	F05	keyway, Ø 22	–	xxx2A
		14	basic	xxx3A
	F07	17	positioned at a 45°	xxx4A
	F05	14		xxx5A
		16	basic	xxx6A
			positioned at a 45°	xxx7A
	F07	19	basic	xxx8A
			positioned at a 45°	xxx9A
52327	F10	keyway, Ø 42	–	xxx0A
		22	basic	xxx1A
	F07	keyway, Ø 28	–	xxx2A
		17	basic	xxx3A
	F10	22	positioned at a 45°	xxx4A
	F07	17		xxx5A
		19	basic	xxx6A
			positioned at a 45°	xxx7A
	F10	24	basic	xxx8A
			positioned at a 45°	xxx9A
		27	basic	xxxAA
			positioned at a 45°	xxxBA
52328	F12	keyway, Ø 50	–	xxx0A
		27	basic	xxx1A
	F10	keyway, Ø 42	–	xxx2A
		22	basic	xxx3A
	F12	27	positioned at a 45°	xxx4A
	F10	22		xxx5A
		24	basic	xxx6A
			positioned at a 45°	xxx7A
		27	basic	xxx8A
			positioned at a 45°	xxx9A
	F12	32	basic	xxxAA
			positioned at a 45°	xxxBA
52329	F12	keyway, Ø 50	–	xxx0A
		27	basic	xxx1A
			positioned at a 45°	xxx4A
		32	basic	xxx5A
			positioned at a 45°	xxx6A

Electric actuator output shaft (when viewing towards the local position indicator). The handwheel tallies with the CLOSED position	**Keyway connection**	**Square**	
	closed	basic position closed	angular position on 45º closed
			

Dimensional sketch of **MODACT MOKA** electric actuators





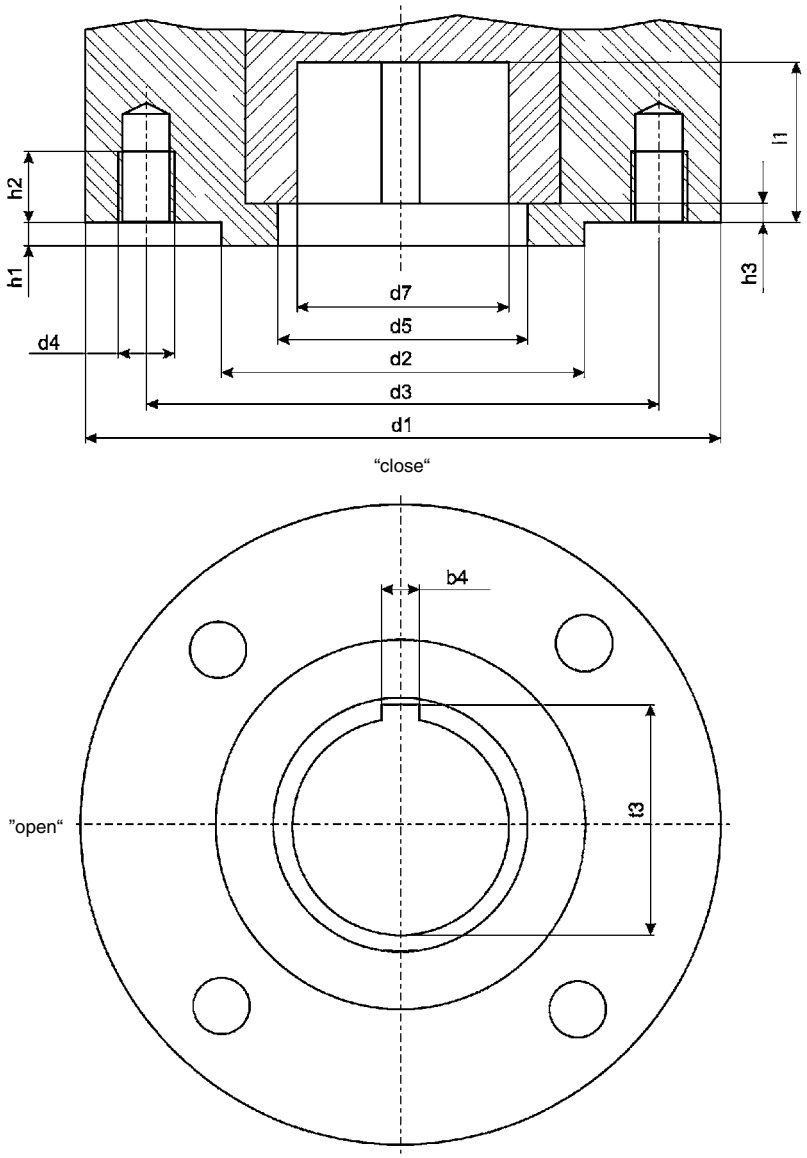
Cable bushings:

MOKA 63	1x	M20x1,5 (10 – 14 mm)
	1x	M25x1,5 (13 – 18 mm)
MOKA 125, 250	2x	M25x1,5 (13 – 18 mm)
MOKA 500, 1000	1x	M25x1,5 (13 – 18 mm)
	1x	M32x1,5 (13 – 20 mm)

Type	A	B	C	D	E	F	G	H	J	K	L
MOKA 63	173	203	247	244	213	245	160	98	-	72	-
MOKA 125	204	237	325	347	252	290	200	111	-	73	-
MOKA 250	204	237	325	347	252	290	200	111	263	73	128
MOKA 500	250	290	386	398	325	362	250	128	-	78	-
MOKA 1000	250	290	386	398	325	362	250	128	323	76	155

Connection dimensions of **MODACT MOKA** actuators

– for valves and control devices with spindles that are provided with a tight-fit keyway
Position of the keyway, according to ISO 5211 and DIN 3337 (The groove is in the CLOSE position whereas the OPEN position is on the left side when viewing the local position indicator).

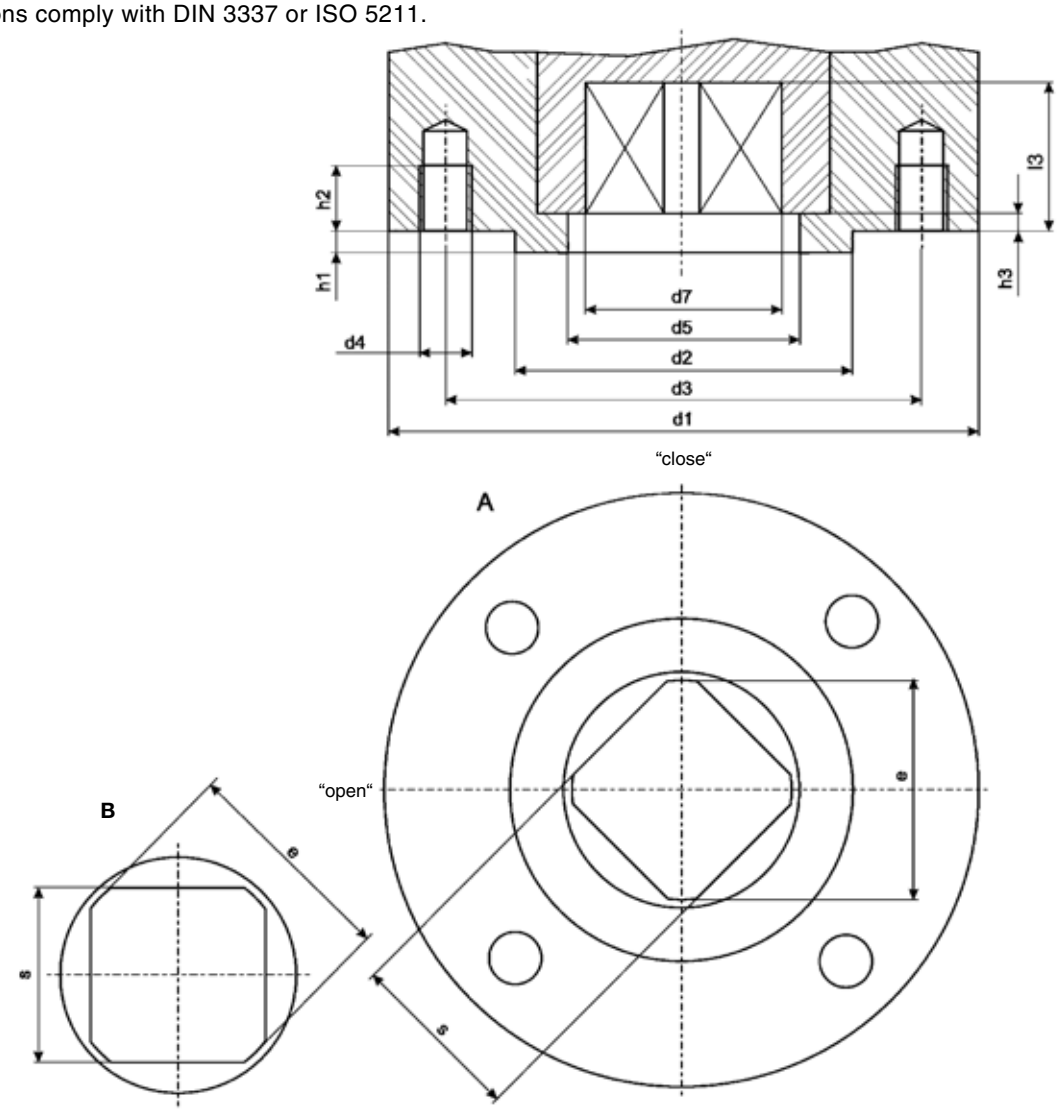


Size, mm

Flange	d_1	d_2 f 8	d_3	d_4	d_7 H 9	h_1 max.	h_2 max.	h_3 max.	l_1 min.	b_4 ls 9	t_3	d_5
F04	65	30	42	M6	18	3	12	3	26	6	20,5	25
F05		35	50		22				30		24,5	28
F07	90	55	70	M8	28		13		35	8	30,9	40
F10	125	70	102	M10	42		16		45	12	45,1	50
F12	150	85	125	M12	50		20		53	14	53,5	70

Connection dimensions of **MODACT MOKA** actuators

– for valves and control devices with spindles that are provided with a square hole
A – Square-end joint in the basic posistion
B – Square-end joint positioned at an angle of 45°
Position of the square hole in the end position of the actuator. The OPEN position is on the left of the CLOSE position, when viewing the local position indicator. The square hole corresponds to DIN 79. The connecting dimensions comply with DIN 3337 or ISO 5211.

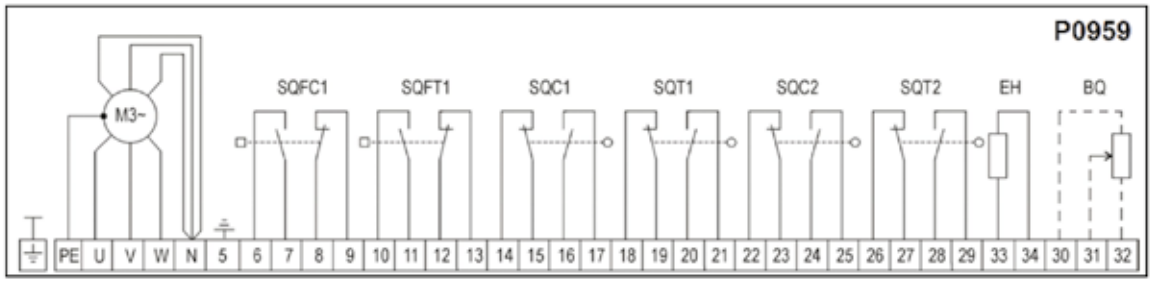


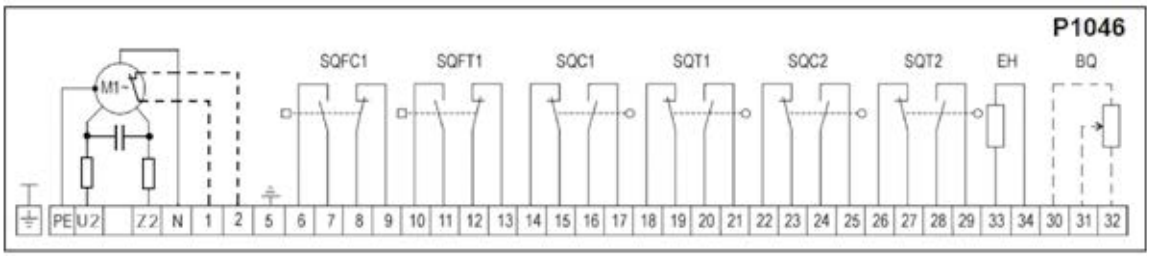
Size, mm

Flange	d_1	d_2 f 8	d_3	d_4	h_1 max.	h_2 min.	h_3 max.	h_4 max.	h_4 min.	s H11	e min.	l_3 min.	d_5
F04	55	30	42	M6	3	12	3	1,5	0,5	11	14,1	15,1	25
										12	16,1	16,1	
F05	65	35	50					3		14	18,1	19,1	28
										16	21,2	22,1	
F07	90	55	70	M8		13				17	22,2	23,1	40
										19	25,2	26,1	
F10	125	70	102	M10		16			1	22	28,2	30,1	50
										24	32,2	33,1	
										27	36,2	37,1	
F12	150	85	125	M12		20							70
										32	42,2	44,1	

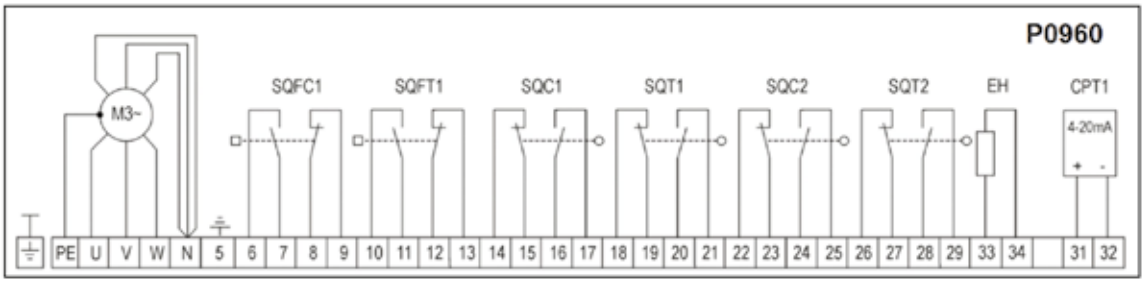
Wiring diagrams of **MODACT MOKA** electric actuators

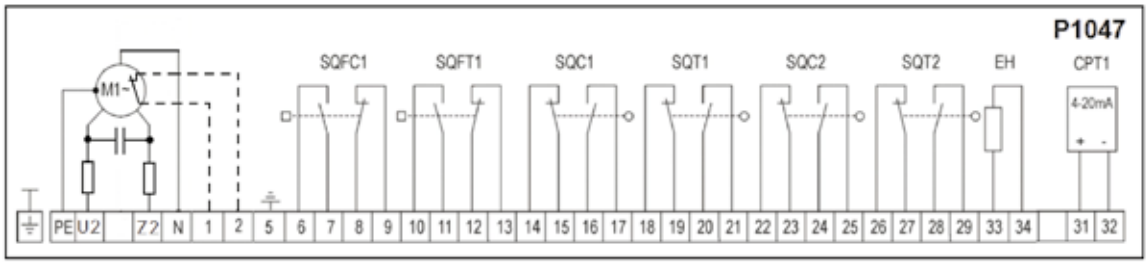
Design with potentiometer or without transmitter



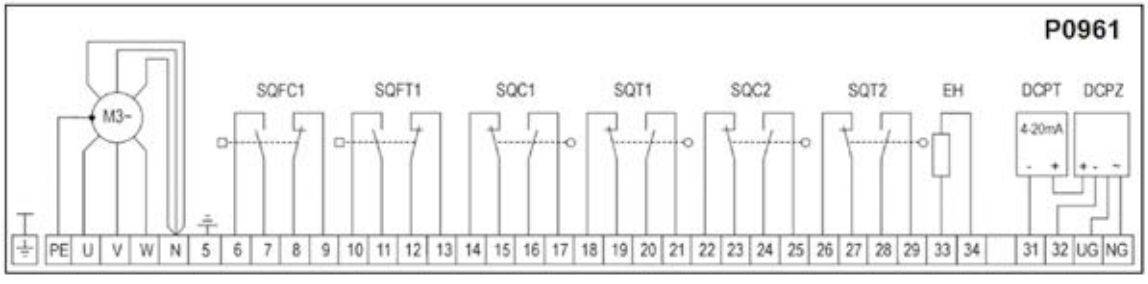


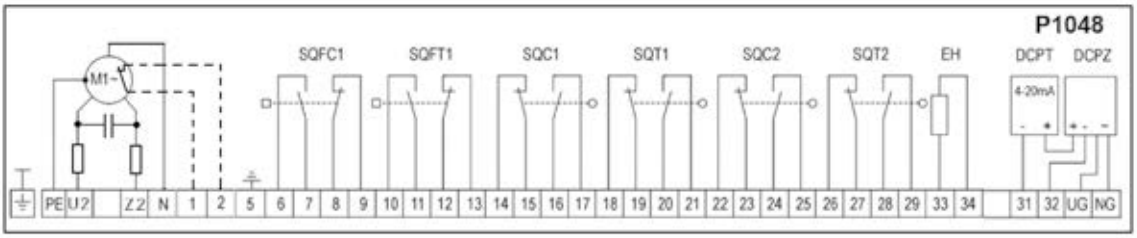
Design with pasive current position transmitter





Design with active current position transmitter (with power source)



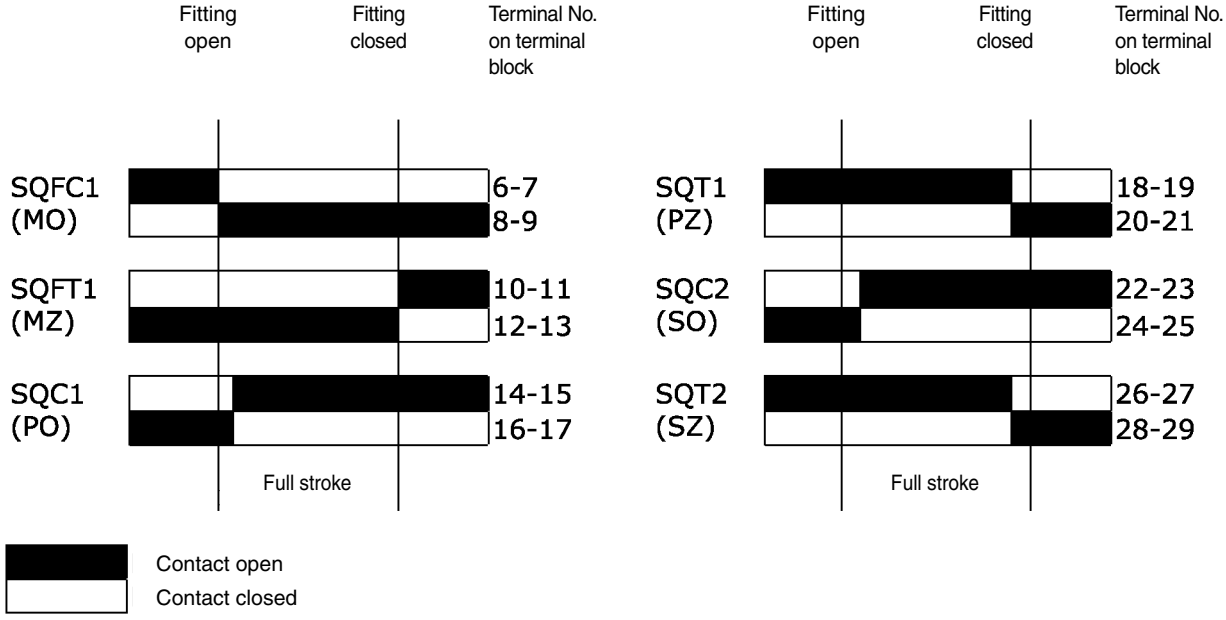


Legend:

SQFC1 *(MO)*	– OPEN torque-limit switch	BQ	– Resistance position transmitter 100 ohm
SQFT1 *(MZ)*	– CLOSE torque-limit switch	CPT1	– Current position transmitter CPT 1AAE
SQC1 *(PO)*	– OPEN position-limit switch	DCPT	– Current position transmitter DCPT *(active)*
SQT1 *(PZ)*	– CLOSE position-limit switch	DCPZ	– Power supply DCPT
SQC2 *(SO)*	– OPEN signalling switch	M3~, *(M1~)*	– Three-phase *(one-phase)* motor
SQT2 *(SZ)*	– CLOSE signalling switch	EH	– Heating resistor

Both ends of all windings of the three-phase electric motor are brought out (they are marked U1, U2, V1, V2, W1, W2). The connection “star” or “delta” can be used for external connection. The electric motor in this actuator has “star” connection, which means that the ends U2, V2, W2 are connected together and to terminal N. This terminal is usually not connected and serves to special purposes when bringing-out of electric zero of the winding is required.

Operation diagram of torque-, position-limit and signalling units



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

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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, MPSP, MPSED, MPSPED
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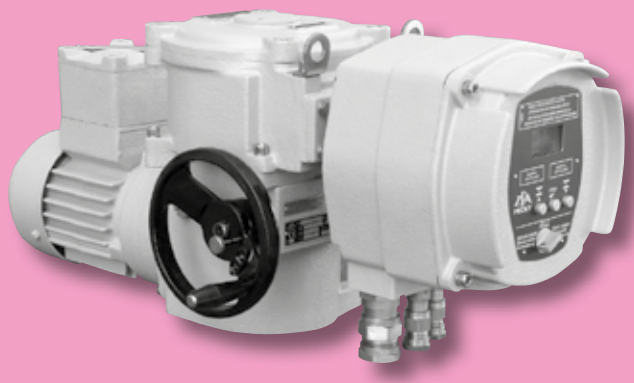
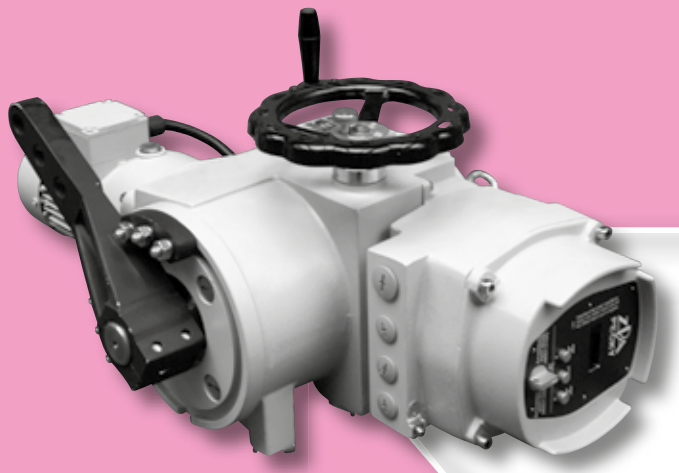
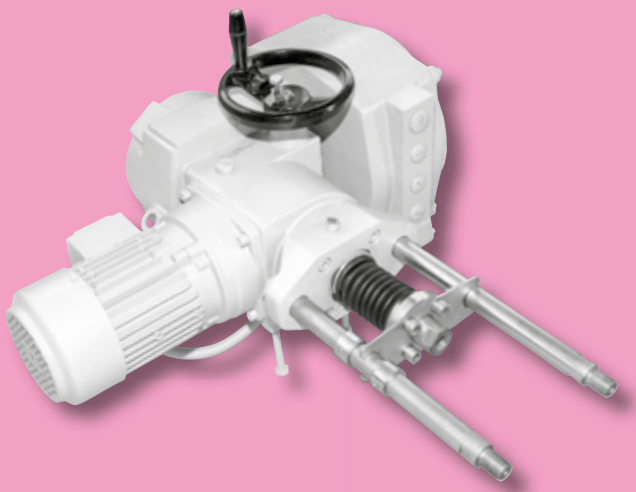
Electric linear thrust actuators with a constant output speed

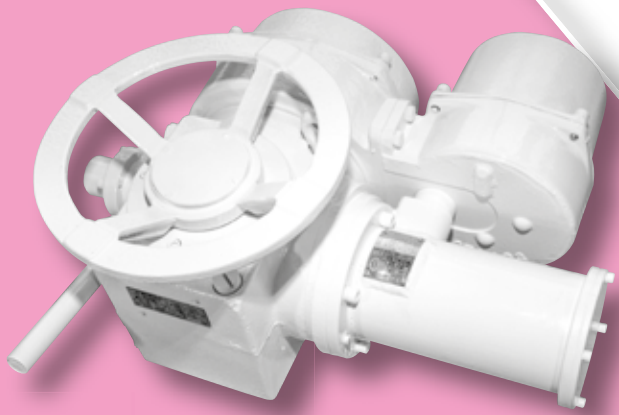
Deliveries of assembled actuator + valve (or MASTERGEAR gearbox) combinations

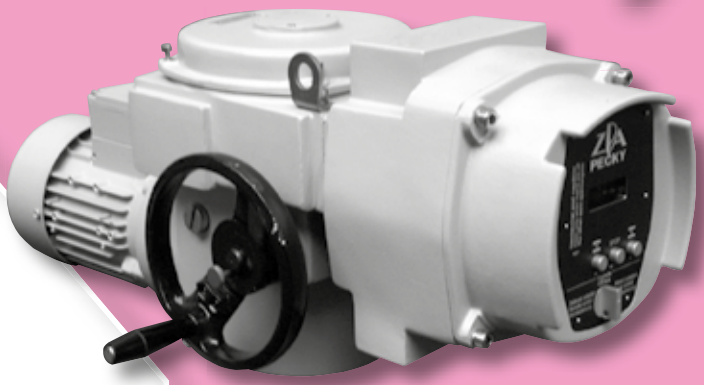
TRADITION • QUALITY • RELIABILITY

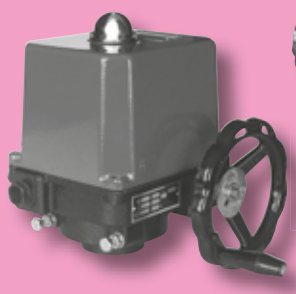


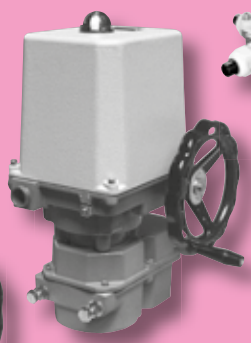












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