ZPA PEČKY, a.s.

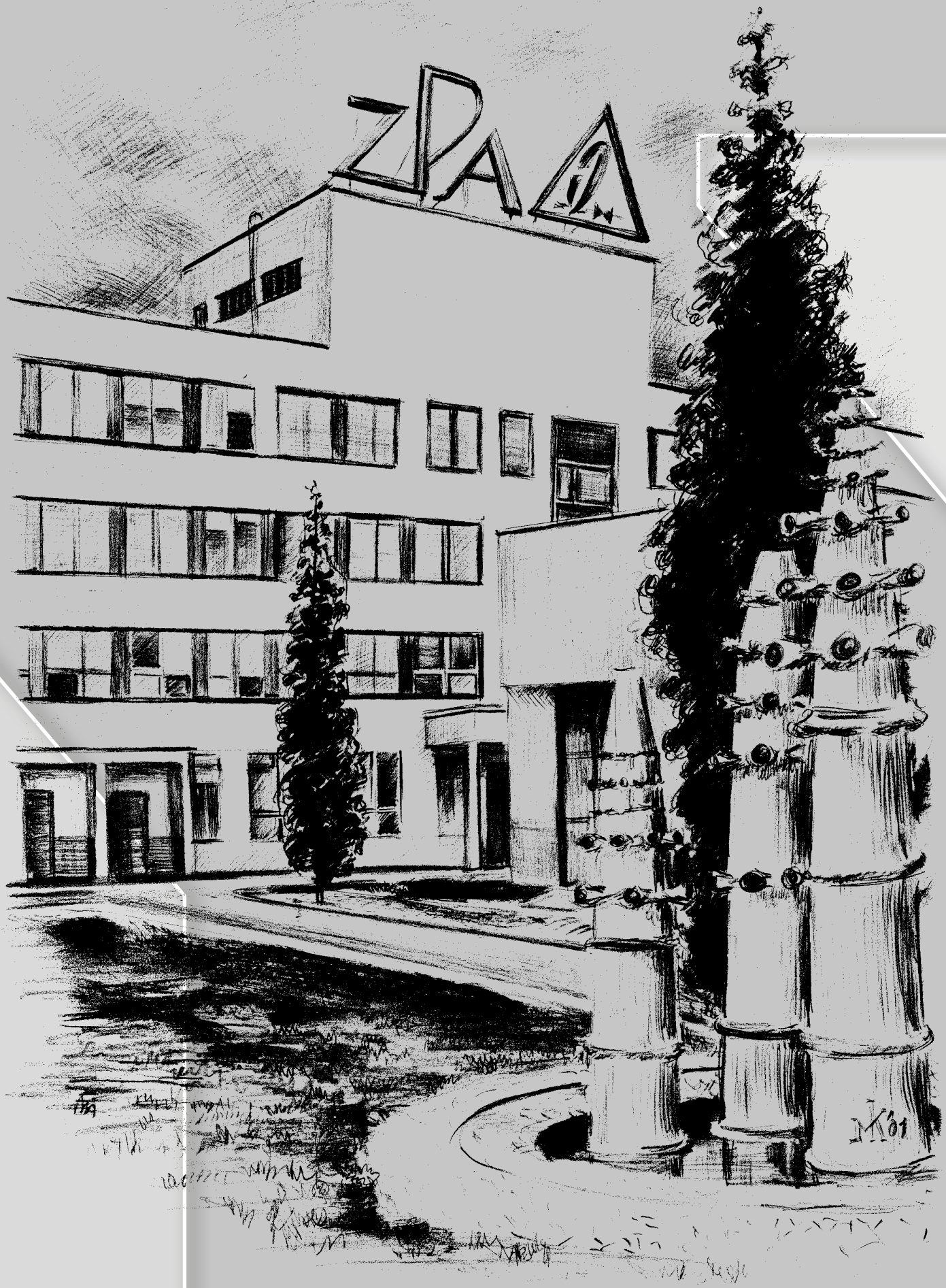
INSTRUCTION FOR ASSEMBLY AND OPERATION

Electric actuators, rotating, single speed,

in non-explosive version, with constant velocity of changing-over the output part - coverage IP67

MODACT MOKP Ex
MODACT MOKP Ex CONTROL

Type numbers 52 320 - 52 322



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

CONTENS

The instructions for assembly and operation lay down basic principles of fitting, connection, adjustment, operation, maintenance and repairs of electric explosion-proof actuators. The principle assumption is that assembly, operation, maintenance, and revisions are carried out by skilled experts authorized for operation of and works on explosion-proof electric installations, and professional supervision is performed by a person professionally qualified and demonstrably instructed.

1. APPLICATION

MODACT MOKP Ex electric actuators in non-explosive version are intended for control and operation in an environment with danger of explosion of explosive gaseous atmosphere in zone 1 and zone 2 according to ČSN EN 60079-10-1, and for areas with flammable dust in zone 21 and zone 22 according to ČSN EN 60079-10-2. The actuators are designed in compliance with the standards ČSN EN 60079-0:2013 a ČSN EN 60079-1:2015 for explosive gaseous atmosphere and with the standard ČSN EN 60079-31:2014 for areas with flammable dust.

The actuators are used for control of fittings by reverse rotation movement in remote control and automatic control circuits. They can be used for other appropriate units as well. Special applications should be discussed with the manufacturer.

Actuators **MODACT MOKP Ex Control** are fitted with an electronic position controller and, in case of the three-phase version, also with a built-in reversing contactor and a protecting thermal relay. They serve as power terminal elements of control circuits in regulating physical variables.

Whole actuator is designed as hard closure "d" with marked with certification as follows:

II 2GD	**Ex db IIC T6 Gb**	**-25 ≤ Ta ≤ 55 °C**
	Ex db IIB T6 Gb	**-50 ≤ Ta ≤ 55 °C**
	Ex tb IIIC T80°C Db	**-50 ≤ Ta ≤ 55 °C**

Electric actuator must not be exposed strong charging e.g. intensive flow dust-air mixture to prevent generating of electrostatic discharges.

Nomenclature

Environment with explosion danger – Environment in which an explosive atmosphere can be created.

Explosive gaseous atmosphere – A mixture of flammable substances *(in the form of gases, vapours or mist)* with air under atmospheric conditions in which, after initialization, burning spreads out to non-consumed mixture.

Explosive dust atmosphere – mixture of flammable substances in the form of gas, vapour, mist and dust with air, under atmospheric conditions, in which, after ignition, combustion spreads to the entire unburned mixture.

Maximum surface temperature – The highest temperature created during operation under the most unfavourable conditions *(however within approved limits)* on any surface part of the electric device, which could induce ignition of surrounding atmosphere.

Closure – All walls, doors, covers, cable bushings, shafts, rods, pull-rods, etc. which contribute to the type of protection against explosion and/or to the level of protection *(IP)* of the electric device.

Explosion-proof closure *„d“*	– Type of protection in which the parts capable of causing ignition of an explosive atmosphere are installed inside the closure; in case of internal explosion this closure should withstand pressure of the explosion and prevent spreading of the explosion into the surrounding atmosphere.
Zone 1	– A space where probability of occurrence of an explosive atmosphere of a mixture of flammable substances in the form of gas, vapour or mist with the air is occasional under normal operation.
Zone 2	– A space where occurrence of an explosive gaseous atmosphere formed of a mixture of flammable substances in the form of gas, vapour or mist with the air is improbable under normal operation; however, if this atmosphere is formed it will only persist for a short period of time.
Zone 21	– An area in which the explosive atmosphere is created by a cloud of whirled flammable dust in air formed in normal operation is occasional.
Zone 22	– An area in which an explosive mixture is not likely to occur in normal operation and if it occurs it will exist only for a short time.

Standards

The following basic standards are related to the explosion-proof actuators:

ČSN EN 60 079-14	Regulations for electric devices in areas with a risk of explosion of flammable gases and vapours.
ČSN IEC 60 721	Types of environment for electric devices.
ČSN EN 60 079-0	Electric devices for explosive gaseous atmosphere. General requirements.
ČSN EN 60 079-1	Electric devices for explosive gaseous atmosphere. Explosion-proof closure “d”.
ČSN EN 60 079-10	Electric devices for explosive gaseous atmosphere. Specification of dangerous areas.
ČSN 33 0371	Non-explosive mixtures. Classification and testing methods.
ČSN 34 3205	Operation of electric rotating machines and work with them.
ČSN EN 1127-1	Explosive environments – prevention of and protection against explosion.
ČSN EN 60079-31	Explosive atmospheres. Equipment dust ignition protection by enclosure “t”

Marking of explosion-proof properties

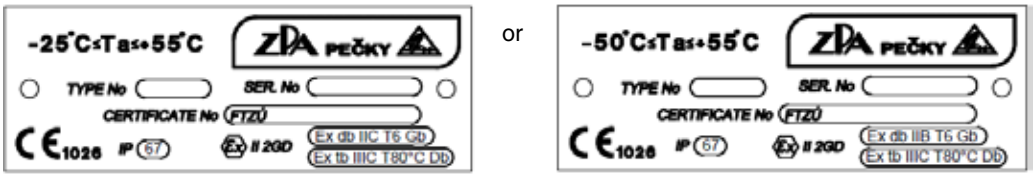
It includes the following marks:

Ex	The electric device corresponds to the standard ČSN EN 60079-0 and associated standards for various types of protection against explosion.
db	Marking of type and level of protection against explosion, explosion-proof closure, according to the standard ČSN EN 60 79-1
tb	protection by enclosure “t” according to ČSN EN 60079-31.
IIC, IIB	Designation of the group of explosion-proof electric device for explosive gaseous atmosphere, according to ČSN EN 60 079-0.
IIIC	Designation of the group of explosion-proof electric device for areas with flammable dust, according to ČSN EN 60 079-0.
T6	Designation of temperature class of explosion-proof electric device of the Group II, according to ČSN EN 60 079-0.
T 80 °C	Maximum surface temperature T of an explosion-proof electric device of group III, according to ČSN EN 60079-0.
Gb	Designation of an explosion-proof electric device for explosive gas atmospheres with a “high” level of protection and is not a source of ignition in normal operation or during expected malfunctions, according to ČSN EN 60079-0.
Db	Designation of an explosion-proof electric device for areas with flammable dust with a “high” level of protection and is not a source of ignition in normal operation or during expected malfunctions, according to ČSN EN 60079-0.
IP 67	Designation of protective enclosure, according to ČSN EN 60079-0 and ČSN EN 60529.

Data on actuators

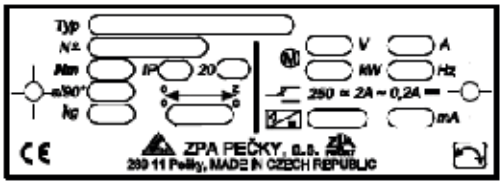
The actuators are fitted withthe following plates:

1) Plate with data of non-explosive closures



2) Rating and instrument plate contains:

– manufacture's name and address
– type designation of product *(type number)*
– serial number
– year of production
– rated value of tripping torgue Nm
– rated speed of shifting s/90°
– rated working stroke 90°
– designation of protective enclosure of actuator IP
– weight of actuator kg
– mark of conformity CE
– electrical data of power circuits *(voltage and frequency, current and output of electric motor);*
– electrical data of control circuit of micro-switches *(voltage, current);*
– position transmitter *(resistance, voltage and/or current)*



3) Warning plate

4) Plates on covers with marking of used protection against explosion

or

2. OPERATING CONDITIONS, OPERATING POSITION

Operating conditions

The **MODACT MOKP Ex** actuators should withstand the effect of operating conditions and external influences, Classes AC1, AD7, AE6, AF2, AG2, AH2, AK2, AL2, AM-2-2, AN2, AP3, BA4, BC3 a BE3 according to ČSN 33 2000-5-51 ed. 3.

Surrounding temperature

Operating temperature for the **MODACT MOKP Ex** is from -25 °C to +55 °C or from -50 °C to +55 °C.

Classes of external influences

Basic characteristics – as extracted from ČSN 33 2000-5-51 ed. 3.

1) AC1 – elevation above sea level ≤ 2000 m
2) AD7 – water occurrence – shallow dipping
3) AE6 – occurrence of foreign solid bodies – strong dustiness. Thick dust layers.
4) AF2 – occurrence of corrosive or polluting substances from atmosphere. Presence of corrosive polluting substances is significant
5) AG2 – medium mechanical stress by impacts – common industrial processes
6) AH2 – medium mechanical stress by vibrations – common industrial processes
7) AK2 – serious risk of growth of vegetation and moulds
8) AL2 – serious danger of the occurance of animals *(insects, birds, small animals)*
9) AM-2-2 – normal level of the signal voltage. No additional requirements
10) AN2 – medium solar radiation with intensities > 500 W/m^2 and ≤ 700 W/m^2

11) AP3 – medium seismic effects; acceleration > 300 Gal ≤ 600 Gal

12) BA4 – personal abilities. Instructed people.

13) BC3 – frequent contact with the earth potential. Persons coming frequently into contat with “live” parts or standing on a conducting base.

14) BE3 – danger of explosion, production and storage of explosive substances

Corrosion protection

Actuators are standardly delivered with surface treatment corresponding to category of corrosion aggressiveness C1, C2 and C3 according to ČSN EN ISO 12944-2.

On customer's request is possible to do surface treatment correcponding to category of corrosion aggressiveness C4, C5-I and C5-M.

In following table is provided and overview of environment for each categories of corrosion aggressiveness according to ČSN EN ISO 12944-2.

Corrosion aggressiveness level	Example of typical environment	
	Outdoor	Indoor
C1 (very low)		Heated buildings with clean atmosphere e.g. offices, shops, schools, hotels.
C2 (low)	Atmosphere with low level of pollution. Mostly outdoor areas.	Unheated buildings, in which may occur condensation, e.g. stocks, sports halls.
C3 (middle)	Urban industrial atmospheres, mild pollution of sulfur dioxide. Seaside areas with middle salinity.	Production areas with high humidity and low air pollution, e.g. food industry, processing factories, breweries.
C4 (high)	Industrial areas and seaside areas with middle salinity.	Chemical plants, swimming pools, seaside shipyard.
C5-I (very high – industrial)	Industrial areas with high humidity and aggressive atmosphere.	Buildings or areas with predominantly continuous condensation and high air pollution.
C5-M (very high – seaside)	Seaside areas with high salinity.	Buildings or areas with predominantly continuous condensation and high air pollution.

MODACT MOKP Ex electric actuators in version for surrounding temperature from -50 °C do +55 °C must be resistant against effect of process conditions characterized by surrounding temperature ranging between -50 °C and +55 °C.

This version of actuators is fitted with three-phase motors and outfit without a transmitter or with the current transmitter CPT1 AF.

The above mentioned actuators will be marked with letter F at the last place of the complementary type number, i.e. 52 32x.xxxxF.

In all markings of non-explosiveness of the actuators type no. 52 32x.xxxxF, the marking of sub-group of the group II of a non-explosive electric device according to the standard ČSN EN 60079-0 will be changed from IIC to IIB, i.e. to Ex db IIB T6 Gb.

When placed on a free area, the actuator should be fitted with a light roofing against direct action of atmospheric effects. The roof should overlap the contour of the actuator by at least 10 cm at the height 20 – 30 cm.

If the actuator is used at a location with an ambient temperature under -10 °C and/or relative humidity above 80 %, at a sheltered location, or in the tropical atmosphere, the anti-condensation heater which has been built in all actuators, should be always used.

The anti-condensation heater is a resistor of rating 10 W and resistance 6.8 kΩ. The feeding circuit of the anti-condensation heater includes the thermal switch type 228 – 2563 *(series 2455R)* that opens at temperature 25 °C ±3 °C and closes again when temperature drops to 15 °C ±4 °C.

Note:

A space is considered sheltered if it prevents falling of atmospheric precipitations under angles up to 60° from the vertical.

Working position

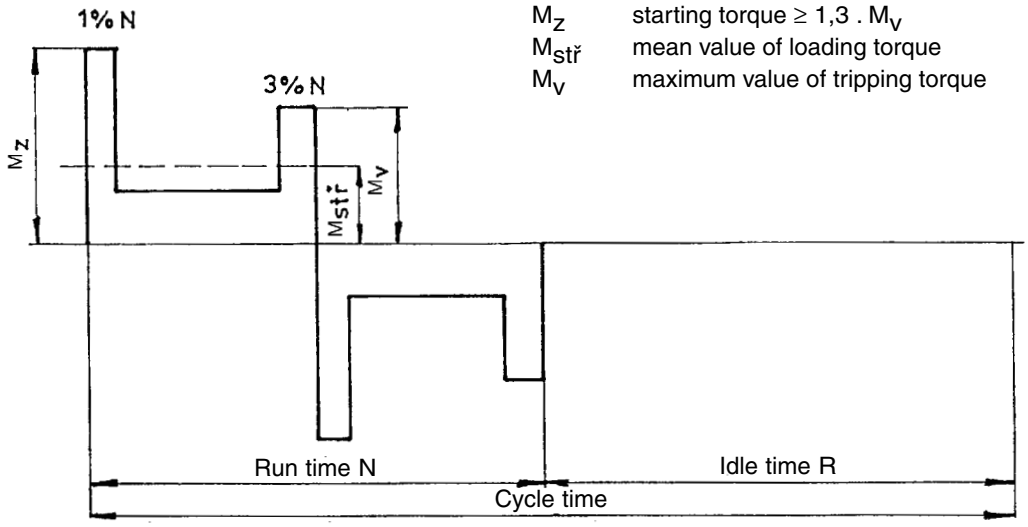
The electric actuators **MODACT MOKP Ex** ***(MODACT MOKP Ex Control)*** can operate in any working position.

3. OPERATION MODE, SERVICE LIFE OF ACTUATORS

Operation mode

The actuators can be operated with the type of loading S2 according to ČSN EN 60 034-1. The run period at temperature +50 °C is 10 minutes; the mean value of loading torque should not exceed 60 % of the value of maximum tripping torque M_V. The actuators can also work in the regime S4 *(interrupted run with start-up)* according to ČSN EN 60 034-1. Load factor N/N+R is max. 25 %; the longest working cycle *(N+R)* is 10 minutes *(course of working cycle is shown in the figure).* The highest number of closing operations in automatic regulation is 1200 cycles per hour. Mean value of loading torque with load factor 25 % and surrounding temperature +50 °C is not higher than 40 % of maximum tripping torque M_V.

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



M_Z starting torque ≥ 1,3 . M_V
$M_{stř}$ mean value of loading torque
M_V maximum value of tripping torque

Course of working cycle

Service life of actuators

The actuator intended for shut-off valves must be able to perform at least 10,000 operating cycles *(C - O - C).*

The actuator intended for regulating purposes must be able to perform at least 1 million cycles with operation time *(during which the output shaft is moving)* at least 250 hours. Service life in operating hours *(h)* depends on load and number of switching. Not always, high frequency of switching influences positively accuracy of regulation. For attaining the longest possible faultless period and service life, frequency of switching is recommended to be set to the lowest number of switching necessary for the given process. Orientation data of service life derived from the set regulation parameters are shown in the following table.

Service life of actuators for 1 million starts

Service life [h]	830	1 000	2 000	4 000
Number of starts [1/h]	Max. number of starts 1200	1 000	500	250

4. TECHNICAL DATA

Supply voltage

Rated value of alternating electric voltage is — 1 x 230 V or 3 x 230/400 V *(according to version)*

– permitted deviation of feeding voltage is — -10 % to + 6 % of rated value
– rated frequency of feeding voltage is — 50 Hz
– permitted deviation of frequency of feeding voltage is — ±2 % of rated value.

In this range of feeding voltage, rated values of all parameters are maintained, except for starting torque that changes with the second power of deviation of feeding voltage from its rated value. The change is directly proportional to the change in feeding voltage. Larger deviations of feeding voltage and frequency are not permitted.

Protective enclosure

Protective enclosure of actuators **MODACT MOKP Ex** IP 67 according to ČSN EN 60 529 *(33 0330).*

Noise

Level of acoustic pressure A	max. 85 dB *(A)*
Level of acoustic output A	max. 95 dB *(A)*

Tripping torque

At the factory, the tripping torque has been adjusted as shown in Table 1, according to the customer's requirements. If no tripping torque adjustment has been specified by the customer the maximum tripping torque is adjusted.

Self-locking

Actuator self-locking capacity is provided by mechanical electric motor brake, at actuator type no. 52 320 by mechanic gearbox brake.

Sense of rotation

When looking at the output shaft in the direction towards the control box, the CLOSE direction of rotation is identical with the clockwise sense.

Working stroke

The working stroke of **MODACT MOKP Ex** actuators is 90°.

Manual control

Manual control is performed directly by a handwheel *(without clutch).* It can be used even when the electric motor is running *(the resulting motion of the output shaft is determined by the function of the differential gear).* When the handwheel is rotated clockwise the output shaft of the actuator also rotates clockwise *(when looking at the shaft towards the control box).* On condition that the valve nut is provided with left-hand thread, the actuator closesthe valve.

Torque-limit switches in the actuator are set and work when the actuator is under voltage.

When using the manual control, ie. actuator is controlled mechanically, the torque-limit switches doesn´t work and the valve can be damaged.

5. ACTUATOR OUTFIT

Torque-limit switches

The actuator is fitted with two torque-limit switches *(MO – OPEN, MZ – CLOSE)* each of which acts only in one direction of motion of the actuator output shaft. The torque-limit switches can be set to operate at any point of the working stroke.

The tripping torque can be adjusted within the range shown in Table 1.

Position-limit switches

The PO – OPEN and PZ – CLOSE position-limit switches limit the actuator working stroke, each being adjusted to operate in either end position.

Position signalling

For signalling position of the actuator output shaft, two signalling switches, i.e. the SO – OPEN signalling switch and the SZ – CLOSE signalling switch, are used. Each of these switches acts only in one direction of output shaft rotation. The operating point of the microswitches can be set within the whole working stroke range except the narrow band before the operating point of the microswitch used to switch off the electric motor.

Position transmitters

The **MODACT MOKP Ex** electric actuators can be supplied without position transmitter or can be fitted with position transmitter:

a) Resistance transmitter 1 x 100 Ω.

Technical parameters:

Position scanning	resistance
Turning angle	0° – 320°
Non-linearity	≤ 1 %
Transition resistance	max. 1.4 Ω
Permitted voltage	50 V DC
Maximum current	100 mA

b) Type CPT 1Az passive current transmitter. Power supply to the current loop is not a part of the actuator. Recommended feeding voltage is 18 – 28 V DC, at maximum loading resistance of the loop 500 Ω. The current loop should be earthed in one point. Feeding voltage need not be stabilized; however, it must not exceed 30 V or else the transmitter could be damaged.

Range of CPT 1Az is set by a resistance transmitter on the transmitter body and its starting value by corresponding partial turning of the transmitter.

Technical parameters of CPT 1Az:

Scanning of position		capacity
Working stroke		adjustable 0° – 40° to 0° – 120°
Non-linearity		≤ 1 %
Non-linearity, including gears		≤ 2.5 % *(for a maximum stroke of 120°)*
Hysteresis, including gears		≤ 5 % *(for a maximum stroke of 120°)*
(*The non-linearity and hysteresis are related to a signal value of 20 mA*).		
Loading resistance		0 – 500 Ω
Output signal		4 – 20 mA or 20 – 4 mA
Supply voltage	for R_{load} = 0 – 100 Ω	10 to 20 V DC
	for R_{load} = 400 – 500 Ω	18 to 28 V DC
Maximum supply voltage ripple		5 %
Maximum transmitter power demand		560 mW
Insulation resistance		20 MΩ at 50 V DC
Insulation strength		50 V DC
Operational environment temperature – extended range		-25 °C to +70 °C *(additional on demand)*
Dimensions		ø 40 x 25 mm

c) Type DCPT active current transmitter. Power supply to the current loop is not a part of the actuator. Maximum loading resistance of the loop is 500 Ω. For variants **MODACT MOKP Ex** with the regulator ZP2.RE4, it is used as a position sensor.

DCPT can be easily set by two push-buttons with LED diode on the transmitter body.

Technical parameters of DCPT:

Scanning of position	contact-less magneto-resistant
Working stroke	adjustable 60° – 340°
Non-linearity	max. ±1 %
Loading resistance	0 – 500 Ω
Output signal	4 – 20 mA or 20 – 4 mA
Power supply	15 – 28 V DC, < 42 mA
Working temperature	-25 °C to +70 °C
Dimensions	ø 40 x 25 mm

For the transmitters CPT 1Az as well as DCPT, a two-wire connection is used, i.e., the transmitter, the power supply and the load are connected in series. The user should secure that the two-wire circuit of the current transmitter is connected to the electric earth of the associated regulator, computer, etc. This connection should only be made at a single point in any section of the circuit, outside the actuator.

Position indicator

The actuator is fitted with a local position indicator.

Heating element

Actuators are equipped with a heating element to prevent water vapour condensation. It is connected to the AC mains of voltage 230 V.

Local control

Local control serves for controlling the actuator from the site of its installation. It includes two change-over switches: one with positions *"Remote control - Off - Local control",* the other *"Open - Stop - Close"*.

Position regulator

The position regulator built-in in the actuator enables to control position of the output shaft of the actuator and thus also the valve by the input analog signal.

The control unit is microprocessor-based programmed for regulating the actuator, ascertaining and repairing error conditions, and for simple setting of regulation parameters.

The regulator design enables to switch off the regulator feeding. If the regulator is not under voltage it does not regulate but, after its feeding is switched on, the regulator function is automatically restored; the parameters and diagnostic data stored in the regulator memory are retained. The regulator circuits compare the input signal with the feedback signal from the position transmitter of the actuator output shaft. If there is a difference between the input and feedback signals the regulator closes one of the built-in contactors in the actuator so that the actuator shaft is reset to the position corresponding to magnitude of the input signal. When the feedback signal is equal to the input signal the actuator stops.

The control parameters are set by functional push-buttons on the regulator or by PC connected to the regulator via a serial interface for the period of setting the parameters or during the communication module.

6. ELECTRIC PARAMETERS

External electric connection

The actuators have terminal boards for external connection. The terminal board has terminals for connection of one 1.5 mm^2 conductor or two conductors with the same cross-section 0.5 mm^2 each.

Connecting of actuators with connector – on special request.

Actuator internal wiring

The internal wiring diagrams of the **MODACT MOKP Ex** actuators with terminal designation are shown in this Mounting and operating instructions.

Each actuator is provided with its internal wiring diagram on the inner side of the actuator cover. The terminals are marked on a self-adhesive label attached to a carrying strip under the terminal block.

Current rating and maximum voltage of microswitches

Maximum voltage of mikroswitches is 250 V AC as well as DC, at these maximum levels of currents.

MO, MZ	250 V AC / 2 A; 250 V DC / 0,2 A
SO, SZ	250 V AC / 2 A; 250 V DC / 0,2 A
PO, PZ	250 V AC / 2 A; 250 V DC / 0,2 A

The microswitches can only be used as single-circuit devices. Two voltages of different values and phases cannot be connected to the terminals of the same microswitch.

Isolation resistance

Isolation resistance of electric control circuits against the frame and against each other is min. 20 MΩ. After a dump test, isolation resistance of control circuits is min. 2 MΩ. See Technical specifications for more details.

Electric strength of electric circuits isolation

Circuit of resistance transmitter		500 V, 50 Hz
Circuit of current transmitter		50 V DC
Circuits of microswitches and anti-condensation heater		1 500 V, 50 Hz
Electric motor	Un = 1 x 230 V	1 500 V, 50 Hz
	Un = 3 x 230/400 V	1 800 V, 50 Hz

Deviations of basic parameters

Tripping torque	±15 % of the maximum tripping torque
Operating time of the output shaft	+10 % -15 % of the rated value
Hysteresis of position limit and signalling switches	≤4°
Adjustment of position limit and signalling switches *(working travel)*	±1°
Clearance of the output part	max. 1.5°

Protection

The actuators have external and internal protection terminal against electric shock voltage.

The terminals are identified in compliance with ČSN IEC 417 *(34 5550).*

If isn´t the actuator equipped with overcurrent protection when purchased is needed to ensure that the protection is secured externally.

7. TECHNICAL DESCRIPTION

The entire servo drive consists of solid lock “d” marked Ex db IICT6 Gb or Ex db IIB T6 Gb. If the servo drive is with local control system, the local control makes another solid lock “d”. Both solid locks are in such case separated by a bushing.

The electric actuators MODACT MOKP Ex consist of two parts:

– **Power part** – is composed of a single- or three-phase asynchronous electric motor *(see table no. 1)*, countershaft gear box, planet gear box with output shaft, device for manual control with a hand wheel and floating screw.

– **Control part** – is identical for the electric actuators MODACT MOKP 250 and 600 Ex. For these types, it differs only in partial turning of units on the main plate. For the electric actuators type no. 52320 the unit of position and signalling switches is arranged according to Fig. 1. The control part is composed of the position unit 1, transmitter of position 2, moment unit 3, terminal board 4 and heating element 5. The position unit is fitted with four micro-switches, always two for each direction of the output shaft rotation. The point of switching-over of each micro-switch can be separately adjusted within the working stroke of the electric actuator. The moment unit has independently adjustable micro-switches – one for each direction of rotation. The moment switches are not blocked against disconnecting at the engagement moment. The position transmitter is fitted with a slipping clutch enabling its automatic adjustment with the output shaft. The heating element 8 *(Fig. 1)* prevents condensation of water vapour under the control part cover. The position unit and the position transmitter derive their motion from the output shaft of the electric actuator via a drive wheel or a drive segment – 7. The moment unit is driven by a *“floating screw”* of manual control wherein the screw displacement is directly proportional to twisting moment on the output shaft of the electric actuator. In this way the electric motor can be switched off when a value of twisting moment is reached to which the moment unit is adjusted.

Warning:

The micro-switches used are of a single-chamber type, i.e. they can operate as a single-position cut-out switch, contact maker or change-over switch, the moment switches as cut-out switch only – see particular wiring scheme.

If isn´t the actuator equipped with overcurrent protection when purchased is needed to ensure that the protection is secured externally.

8. ADJUSTMENT OF ELECTRIC ACTUATOR

a) Stop screws

The stop screws are used to limit the working stroke of the electric actuator to a required value in compliance with and positions *"Closed"* or *"Opened"* of the piping fittings which do not have their own stops. The stop screws are located on the external side of the electric motor where the external protective terminal is also fitted. When viewing the stop screws, the right stop screw is intended for the position *"Closed"* and the left one for the position *"Opened".* Herewith, it is assumed that, when viewed in the direction to the local position indicator, the output shaft moves in the clockwise sense if it rotates in the direction to *"Closed".* Adjustment of the stop screws is carried out in such a way that the stop screws are first released, the electric actuator with the piping fitting is moved to the position *"Closed"* and the particular stop screw is rotated until there is a perceptible increased resistance as the screw strikes against the contact plate of the output shaft of the electric actuator. The stop screw is secured by proper tightening of its safety nut. Then, the output shaft of the electric actuator is turned to the position *"Opened"* and the stop screw is adjusted for the position *"Opened"* in a similar way.

When adjusting the stop screws of the type no. 52 321 care should be taken that the geared segment of drive of the position and signalling unit in the limit position *"Closed"* or *"Opened"* does not strike against the electric motor jacket.

If a tight closure is required in the end position of the piping fitting and, hence, cutting-out of the electric actuator by means of the moment switches the cutting-out moment should be transferred to the piping fitting. In such case the particular stop screw is set so that the piping fitting is properly tight when the trips of the output shaft strike against the stop screw with cutting-out of the moment switch.

The particular moment switch is used for cutting-out the electric actuator. If the stops are to be used for securing the electric actuator and the piping fitting against damage in case of the position switch failure the stop screws should be set to such a position when reliable cutting out of the position switch takes place and which is still acceptable for the piping fitting. Herein, the position and moment switches are connected in series. This can only be realized in the case when a tightly closed piping fitting is not required.

Circlips for shafts in according DIN 6799 are used for not allowing of stop screws removal. Circlips for shafts are removable only inside flameproof enclosure and in any case is forbidden removing circlips for shafts.

b) Position switches

Position end switches PO, PZ are used for cutting out the electric actuator when it reaches the position of the output shaft of the electric actuator for which it is set.

The signalling switches SO, SZ are used for signalling the position of the output shaft of the electric actuator.

The position switches are adjusted in such a way that the output shaft is first set to the position where the switch being adjusted should cut out. Then, the micro-switch cam is released by a particular releasing screw. Releasing is carried out by turning the releasing screw counterclockwise. The releasing screw should only be turned to the extent sufficient for releasing the cam. Further turning of the releasing screw would result in retightening the cam.

The signalling switch should be set so that it switches over earlier than the particular position end or moment switch. When adjusting the position and signalling switches of the electric actuator type no. 52 321, care should be taken that the geared segment of drive of the position and signalling unit in the limit position *"Closed"* or *"Opened"* does not strike against the electric motor jacket. For the electric actuator type no. 52 320 the cams are secures by friction and by a central grooved nut with a safety nut which should be released during adjusting. After adjusting they should be properly retightened.

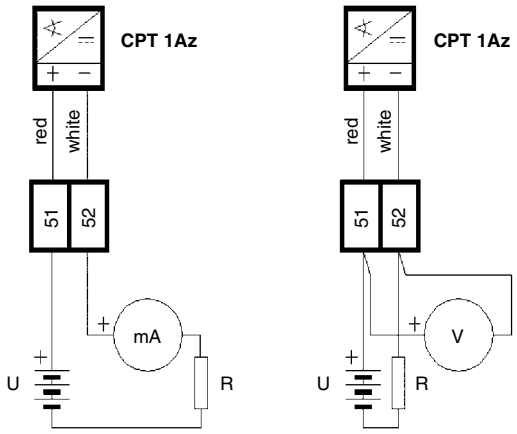
c) Position transmitters

Resistance transmitter

For setting the resistance transmitter of position it is sufficient to reset the output shaft of the electric actuator to either of the end positions *"Opened"* or *"Closed".* In this way the transmitter of position is automatically set. This is usually done in setting the stop screws or the position end switches.

Setting of current position transmitter CPT 1Az

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 1Az 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 1Az; a milli-ammeter of precision at least 0.5 % 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. Shift the output shaft into the position Closed. During closing, the current signal value should decrease. If it increases release the transmitter body and, by turning of about 180°, shift to the descending part of the outputcharacteristics. Set 4 mA by fine turning. Tighten the shim plates to secure the transmitter against spontaneousturning.
2. Shift the output shaft to the position Open and set 20 mA using a potentiometer on the transmitter body. The potentiometer has a range of 12 revolutions 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, securethe transmitter against turning and drip the screws with varnish.
4. Use a voltmeter to check the voltage on the CPT 1Az terminals. In order to keep 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 1Az 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 accidentally.

Before the supply voltage is checked, it is fi rst necessary to disconnect the transmitter from the supply mains. Measure the voltage on terminals of the electric actuator to which the transmitter is connected – this canbest 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 should 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 fi xing 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:

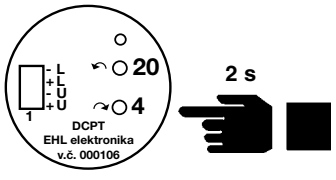
Press the push-button **"20",** then the push-button **"4"** and keep them depressed until LED blinks.

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.	

d) Moment switches

The moment switches are factory-set to a prescribed moment. If the moment switches are to be readjusted to another moment a particular cam is released by a releasing screw *(numbers of releasing screws are given in the legend on Fig. 3)*. By linear division of the section of a particular scale between zero and maximum cutting-out moment, which is depicted on the scale by a special mark – colour, a point is received for the required cutting-out moment against which the cam arrow is set. The releasing screw is then retightened. In manipulating the releasing screws of the moment switches the same applies as for the releasing screws of the position unit. After setting the moment switches their proper cutting out function is verified by a neon tester.

Warning:

The releasing screws marked 2 and 4 must not be manipulated.

Tripping torque cannot be set to a higher value than those that corresponding to the type No. in tables 1 and 1A.

9. REGULATOR ZP2.RE4

a) Description

The basic part of the regulator ZP2.RE4 is a microcomputer with control program in its internal memory. The regulator has its own supply source with mains transformer and stabilizer. Supply voltage is also connected to contacts of the output relays FO, FZ which are employed by the regulator in controlling the contactor combination. Electronics of the regulator is protected by a fuse 160 mA, phase for controlling the contactors by a fuse 1.6 A.

The power input circuits of the regulator receive the signals MO and MZ from the limit switches and the signal TP from the tripping contact of the thermal protection.

The control and feedback signals are lead to the A/D converters of the regulator. The regulator compares the value of the control signal with the value of the feedback signal from the position transmitter. If a regulation deviation is found the regulator activates one of the output signals FO, or FZ, until the output shaft of the actuator is shifted to a position corresponding to the magnitude of the control signal.

The regulator sets the position but it does not influence the shifting speed. This is given by the type and version of the actuator.

Parameters of the regulator are set by the push-buttons SW1 and SW2; the response is monitored on the pilot lights D3 and D4 *(see Fig.1).* During the operation, the pilot lights indicate the course of regulation and depict the type of possible error.

Setting of parameters and monitoring of the actuator run can also be accomplished by the computer with service program connected to the communication connector of the regulator. The computer can also continuously monitor the magnitude of the control signal and the current position of the actuator, and read diagnostic data *(total operation time and number of closing of the output relays)* which are stored by the regulator in its memory during the operation. Two plates are fitted on the regulator. One indicates the date of production and serial number of the regulator and the other the software version. In case of an inquiry or a comment on the regulator function, it is appropriate to state the version of the software programmed in the given regulator:

ZP2.RE4 006/0708	The plate with the indicated type and version of the regulator: “Sixth piece in the seventh month of 2008”.
EHL SERVO V 4.27 (c) 2005	The plate indicating the software version: “Version 4.27 from 2005”.

b) Technical parameters

Supply voltage:	230 V + 10 % -15 %, 50 – 60 Hz *(different voltage on demand)*
Protected:	160 mA regulator electronics
	1.6 A output control phase
Regulator linearity:	0.5 %
Regulator insensitivity:	1 – 10 % *(adjustable)*
Input signals, two-parameter:	
TEST	Connection to /disconnection from OV of direct supply voltage
MO, MZ	State of limit switches of actuator *(N / 230V)*
TP	State of thermal relay *(N / 230V)*
U	Inlet of control phase from BMO *(-/ 230V)*
Input signals, analog:	
Control signal:	0/4 – 20 mA *(input impedance 250 Ω),* 0 – 10 V *(input impedance 20 kΩ);* by shielded cable
Feedback signal:	Current transmitter 4 – 20 mA

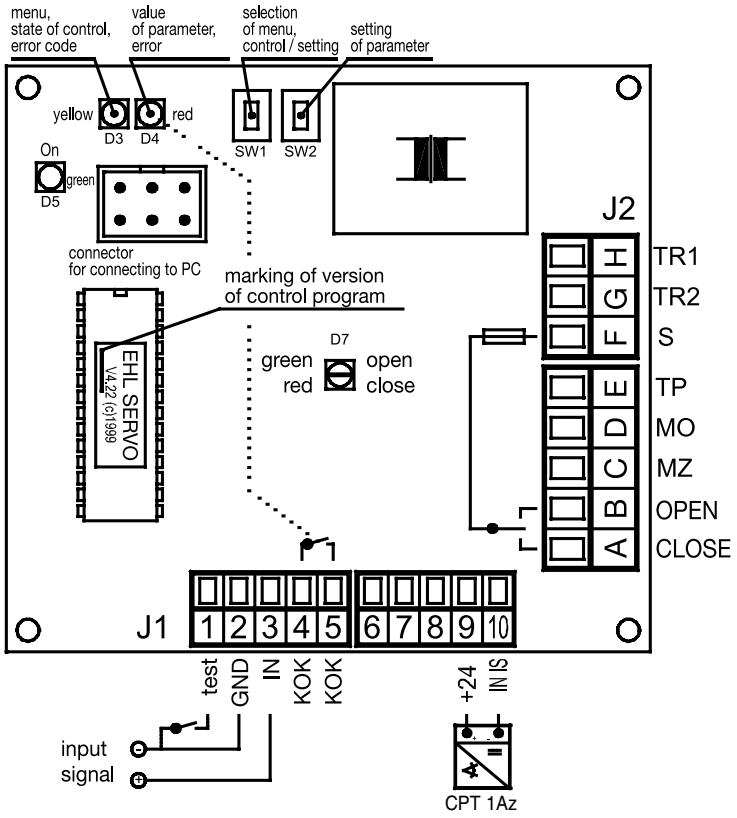


Fig. 1 - ***Regulator ZP2.RE4 - layout of indicator LEDs, push-buttons, terminals and connectors***

J1 - signal terminal board

1	test	input of logic control signal test
2	GND	control signal – negative pole
3	IN	control signal – positive pole
4	KOK	switching contact of error report
5	KOK	switching contact of error report
6		
7		
8		
9	+24 V	feeding of current position transmitter
10	IN IS	signal from current position transmitter

J2 - power terminal board

A	OPEN	power output "Open"
B	CLOSE	power output "Close"
C	MZ	limit switch "Closed"
D	MO	limit switch "Open"
E	TP	thermal fuse
F	S	feeding of power outputs 1) one-phase electric motors L1 2) three-phase electric motors N
G	TR1	feeding of regulator
H	TR2	

Notes:

The signals MO, MZ, TP and "Test" are input, neither the signal TP nor the signal "Test" need to be connected. Set the active level (the level of which the regulator evaluates the error status) of signals (TP) and the "test" differently than as set by the manufacturer of the regulator or by ZPA Pečky a.s. can be done just by computer.

Output signals, two-parameter:

FO, FZ	Control phase via contacts of relay 5 A / 230 V; protected by fuse 1.6 A
Relay contact OK	Error message; contact 24 V / 2 W
Brake	control signal 2 mA *(for brake module ZP3-BR)*
Actuator position	I^2C bus bar *(signal for additional module)*

Output signal, analog:

CPT	Current loop of feedback signal *(maximum loading resistance 100 Ω)*

Signalization:

D3 (yellow)	displayed menu / failure message
D4 (red)	displayed selection / failure message
D5 (green)	feeding
D7 (green/red)	drive opens / closes

Setting elements:

push-button SW1	parameter choice
push-button SW2	parameter value selection
Communication	connector for connecting the computer with service program ZP2RE4

Range of working temperatures: -25 °C – +75 °C

Dimensions: 75 x 75 x 25 mm

Connection of regulator

Mains connection

The actuators MODACT Control with the position regulator ZP2.RE4 are connected and tested in the factory with the position feedback so that their behaviour is stable. In case the actuator is in a position corresponding to the control signal and is diverted from this position by an external intervention *(for instance by the hand wheel)* it is automatically returned to this position by action of the regulator.

If the actuator is connected to a reverse sequence of phases than that in which it has been set and tested, it will start behaving unstably. The output shaft is shifted to one of the limit positions and, on reaching it, the actuator is switched off as, in this case, the limit micro-switch acts on the contactor for motion in the opposite direction. The valve is thus loaded with maximum torque that the electric motor is able to exert. The loading lasts until the thermal relay disconnects the motor. The acting torque is higher than the set rated torque and the valve and/or the actuator can be damaged.

After connecting the actuator to the supply voltage, make sure that the regulator reacts correctly to the changed control signal and that the drive is switched off by particular limit micro-switches.

In case the actuator is not stable, it should be immediately stopped. The best way of doing it is changing over the block of local control BMO “Local” / “0” / “Remote” to the position “0”. If the actuator is not fitted with BMO the motor can be stopped by pressing the red push-button O/I on the thermal protection. For some types of protection, the motor stops only for the period when the push-button is depressed. After releasing, it starts running again.

ATTENTION!

Even after this stopping, the actuator circuits are under voltage. Before any further work on the actuator, the supply voltage must be switched off!!

The change in sequence of phases causing unstable behaviour can also occur during repairs and/or modifications in the distribution of the three-phase mains supply!

Low-voltage connection

Galvanic interconnection of the circuits of the current position ttransmitter CPT 1Az, the circuits of the control signal, and the circuits of the terminal TEST is realized in the regulator. Connection of these circuits with the electric earth can only be realized in one of them. The remaining circuits must not be connected to the earth.

In external circuits, galvanic isolation of the active feedback signal from the circuits of the control signal and the signal TEST must be established. In case this condition cannot be met, it must be brought out as passive signal via the additional module *(on special order).*

The control signal should be lead in by a shielded conductor. Shielding of the cable of the control signal must be earthed out of the actuator – on the side of the superior system. On the actuator side, on contrary, its earthing must be prevented.

Setting of regulator ZP2RE4

Adjustable parameters

After fitting to the valve and mechanical adjustment, the correct function of the actuator is provided for by setting the regulator parameters and starting the auto-calibration. The regulator parameters can be set by the push-buttons and/or by the computer.
The push-buttons can be used for setting:

Control signal **(P1)**
Response to the signal TEST and lost control signal **(P2)**
Mirroring **(P3)**
Insensitivity of regulator **(P4)**
Type of regulation **(P5)**

In addition, the computer can be used for setting:
Active level of signal TEST
Active level of signal TP

In the push-button setting, the changed parameters are stored in the regulator memory in the regime Auto-calibration. In setting by the computer, the parameters can also be stored without auto-calibration.

The auto-calibration is an automatic process during which the regulator detects additional necessary data:

Check of the position transmitter and the sense of rotation of the output shaft.

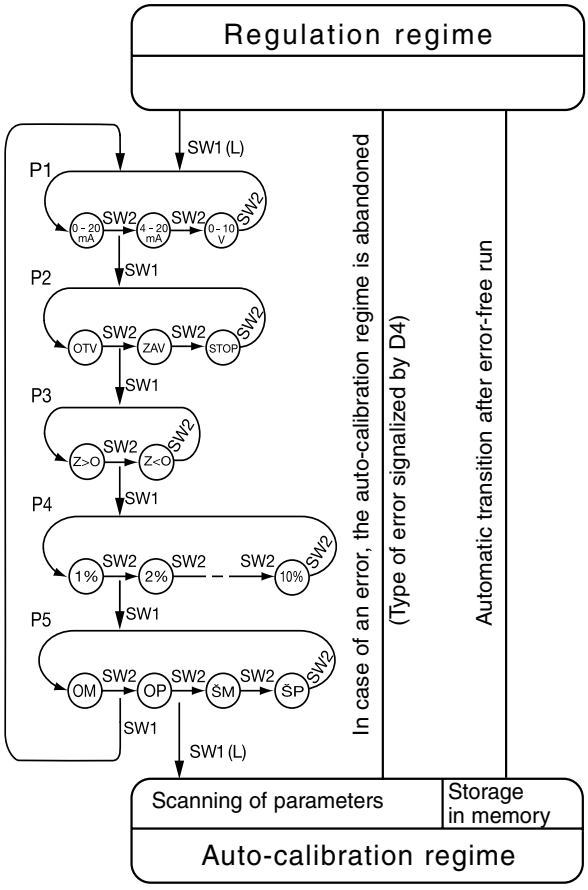


Fig. 2 - ***Regime of setting ZP2.RE4***

Shifting of the shaft to the limit positions Opened and Closed and recording of particular value from the position transmitter.

Measurement of the shaft inertia for both directions of rotation.

In case of an error-free run, it will store the set parameters and found-out data in the memory. The auto-calibration is the most precise when the piping with the valve is filled with the working medium. Before starting the auto-calibration, the limit switches *(position- and/or torque-limit)* of the actuator must be connected and set, and the position transmitter adjusted. If the torque-limit switches are used as the limit switches it is necessary to verify that the actuator is able to exert required tripping torque.

The auto-calibration should be started in each case of changed conditions, which can influence error-free function of the regulator.

For instance, if adjustment of the actuator limit switches is changed or in case of a change in mechanical properties of the valve *(tightened packing, replaced valve, etc.).*

Function of push-buttons SW1 and SW2

The regulator parameters are set by means of the push-buttons SW1 and SW2.

Long pressing of the push-button **SW1 (L)** results in gradual change of the regimes Regulation, Setting and Auto-calibration.

Long pressing of the push-button **SW2 (L)** is only used in common function with SW1 (L) in setting the backup parameters.

In the regime Setting, short pressing of the push-button **SW1** results is changing over between respective parameters; short pressing of the push-button SW2 is used for choosing required value of the current parameter.

The procedure of setting the parameters is shown in the Graph.

The pilot lights **D3** and **D4** indicate the regulator response. In the regime Setting, blinking of **D3** signalizes the number of current parameter and **D4** its chosen value.

Table shows in detail meaning of the signalization pilot lights and survey of values of respective parameters.

Values of parameters P1 – P5

Parametr	D3 (yellow)	D4 (red)	Value of parameter	Note
P1 Control signal	**1x**	**1x**	**0 – 20 mA**	
		2x	**4 – 20 mA**	
		3x	**0 – 10 V**	
P2 Response to signal TEST and lost control signal	**2x**	**1x**	**opens**	
		2x	**closes**	
		3x	**drive stop**	
P3 Mirroring	**3x**	**1x**	**yes**	**lower signal opens higher signal opens**
		2x	**no**	
P4 Regulator insensitivity	**4x**	**1x**	**1 %**	
		2x	**2 %**	
		...	**...**	
		10x	**10 %**	
P5 Regulation method	**5x**	**1x**	**narrow, to torque**	**see Notes under the table FS - feedback signal CS - control signal**
		2x	**narrow, to position**	
		3x	**wide, to torque**	
		4x	**wide, to position**	

Note to parameter **P5:**

"Narrow" – the actuator moves and/or steps exactly to the position determined by CS; parameter P4 is inactive.

"Wide" – the actuator moves and/or steps to the zone of insensitivity *(see parameter P4)* of the position determined by CS.

"To torque" – in the vicinity of the limit values *(for the control signal 4 – 20 mA these values are smaller than 4.2 mA a higher than 19.8 mA)* the actuator does not stop when the control and feedback signalsare identical but goes on moving until the particular limit switch is activated. If the torque-limitswitch is connected as the limit switch the valve is thus tightly closed.

"To position" – the actuator is always, even in the vicinity of the limit position, stopped in the position where FS = CS *("narrow")* or FS = CS – zone of insensitivity *("wide")*

Recommended setting is "narrow, to position".

Auto-calibration

The auto-calibration is started by shifting the position in the direction Open. To prevent an error, the actuator should be set in advance to an intermediate position sufficiently distant from the limit positions. If the auto-calibration is completed without errors the parameters are stored in the regulator memory and the regulator changes automatically to the regime Regulation. In case that an error occurs the parameters are not stored and the actuator should be reset. After repairing the error and switching-on the feeding, the parameters should be reset and the auto-calibration repeated.

Operation and error messages in the regime Auto-calibration

Parameter	D3 (yellow)	D4 (red)	Parameter value	Note
P6 Auto-calibration	**6x**	**no**	A. error-free run	
	6x	**3x**	A. start on the limit switch or failure of **limit switch**	
		4x	incorrectly connected **limit switch**	The name "limit switch" indicates the torque- or position-limit witch, which is connected in the control circuit.
		5x	incorrectly connected or defective current position sensor CPT	
		8x	wrong direction of rotation, opposite connection of the R position sensor	

Regime of regulation

During the operation, the actuator reacts to the changed control signal. During the regulation intervention, the pilot light D3 is lit on; during the delay, neither D3 nor D4 is lit on. In case of an error, D4 is lit on and the pilot light D3 blinks the code of error *(see table 1.5.1)*. After repairing the error, the regulator returns to the regime Regulation.

Operation and error messages

Message	D3 (yellow)	D4 (red)	State or type of defect	Response to error
Operation	lit on	no	regulation intervention in progress	Normal operation state
	no	no	regulation deviation in the insensitivity zone	
Error	1x	lit on	Regime TEST	According to setting **P2.**
	2x		Voltage control signal missing	According to setting **P2.**
	4x		The actuator switched off by the limit switches in an intermediate position (obstacle in the valve)	Actuator without response. Regulation only if the opposite direction is required.
	5x		Error of position transmitter	Actuator without response.
	6x		Action of TP	Actuator without response.
	7x		Error in current control signal (control current < 3.5 mA)	According to setting **P2.**

Relay KOK

An error output from the regulator is, in addition to optical signalization, also the relay KOK contact. If any of the specified errors occurs the lighting on of the pilot light D4 is accompanied by closing the contact *(connectors J1-4 and J1-5)* of the error relay KOK.

Auxiliary functions

Function Test

By connecting terminal connector (J1-1) to the terminal (J1-2) GND, the actuator will shift into a predefined state given by setting of the parameter P2. If the function TEST is not used terminal J1-1 is not connected. The regulator will shift into the state given by the parameter P2 also in case of the lost control signal.

Reset

It is applied in case of a suspicion of a software error and for releasing the regulator in an erroneous course of the Auto-calibration. The function Reset consists in short-time switching off of the regulator feeding *(ca 20 s, to allow for discharging the filtration capacitors in the supply source)* and restarting.

Setting back-up parameters

If the regulator comes into a state to be cancelled *(for instance, after a larger number of parameters has been changed)* the system can be returned to the basic factory setting:

Control signal ***(P1)***	4 – 20 mA
Response to signal **TEST** ***(P2)***	stop
Mirroring ***(P3)***	no
Insensitivity ***(P4)***	2 %
Type of regulation ***(P5)***	narrow, to position
Level of signal **TEST**	active Low
Level of signal **TP**	active High

The last two characteristics may be altered by means of a computer only.

The standby characteristics setting mode is apparent on Fig. 3.

Switch off the controller power input.

Press **SW 1*(L)*** and **SW2*(L)*** at the same time.

Switch on the controller power input and hold the keys pressed for approx. 2 seconds until the *(yellow)* signal light flashes.

Release the keys; the controller changes into Setting mode.

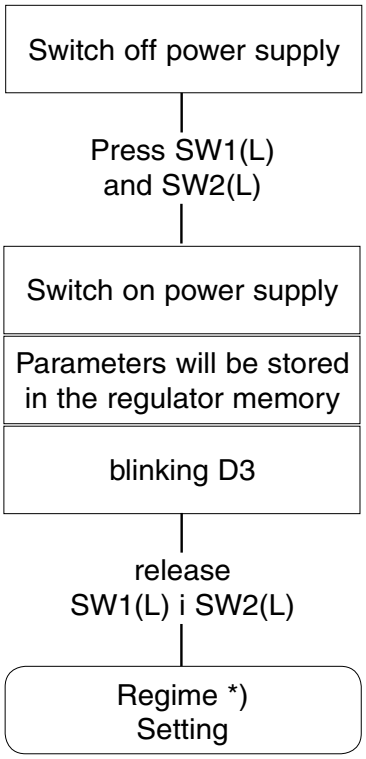


Fig. 3 – ***Graphic representation of setting backup parameters***

10. ASSEMBLING AND PUTTING THE ELECTRIC ACTUATOR INTO OPERATION

After receiving the actuators from the manufacturer, the customer should check whether they have not been damaged during transportation. Check should be made whether data on the plates of the actuator agree with the order and with the accompanying documentation. Possible discrepancies, defects and damages should be immediately reported to the supplier. In this case, the actuator cannot be put into operation. If the unpacked actuator is not mounted immediately, it should be stored in a dust-free room with temperature ranging between -25 °C and +50 °C and relative humidity up to 80 %; the room should be free of caustic gases and vapours and protected against harmful climatic effects. Any manipulation at temperatures below -25 °C is prohibited. The actuators must not be stored in the open area or in rooms not protected against rain, snow and frost. Surplus conserving grease should be removed just before putting the actuator into operation. When unpacked actuators are to be stored for a period longer than 3 months, it is recommended to insert a sachet with silicagel or another suitable desiccant under the actuator cover.

The user can only put into operation the electric devices in satisfactory conditions documented by a report on initial revision. Before fitting, the actuator should be carefully inspected, particularly in case it has been stored for a longer time; the following check should be made:

– conditions of parts and connections forming explosion-proof closure,
– insulation resistance of motor winding,
– absence of any damage to the actuator during storage.

It should again be verified whether placement corresponds to provisions of the paragraph “Working conditions”. If different way of assembly is necessary due to local conditions, an agreement with the manufacturer is required.

The protective conductor must be connected to the protection terminal marked according to ČSN IEC 417. The actuator is fitted with protection terminals on the frame and inside the actuator on the control panel at the terminal board.

Connection

The actuator is connected according to the wiring diagram located inside the cover in such a way that the mains supply wires have permanent good contact with the connecting terminals. The mains voltage should correspond to the voltage specified on the rating plate of the actuator. The Internal space of the cover must be clean and dry. There must not be any freely protruding wires on the connected cables.

Protection

Electric motors of the actuators are fitted with a built-in automatically restoring thermal protection according to ČSN EN 600034-11. For the actuators type no. 52320 with single-phase electric motors ES 7150-2AL, ES 7130-4AL and FCJ2B52D, it is connected in series with the electric motor winding; hence, it controls the motor directly and is not

connected to the terminal board of the actuator. For other electric motors, the thermal cut-out is connected by two separate outlet wires to the terminal board of the electric motor and the motor is controlled by means of another device *(contactor, relay, etc.).* The actuator must be protected by a current circuit breaker with characteristics C set to rated current In according to table no.1.

Insulation resistance

Before putting into operation or starting an actuator that has not been used for a longer period of time, it is necessary to check whether insulation conditions have not been deteriorated and whether this cannot cause any risk of damaging to the winding or an electric shock. Insulation conditions should also be checked during inspections in compliance with provisions of ČSN 34 3205 and standards valid for explosion-proof electric devices. Insulation resistance of electric control circuits against frame as well as against each other is min. 20 MΩ. Insulation resistance of the electric motor is min 1.9 MΩ. Insulation resistance of the transmitter CPT 1A is min. 20 MΩ with 50 V DC.

The actuators of lower insulation resistance must not be put into operation. The reason can be in a damaged winding or excess humidity. Moist motors, the insulation resistance of which is lower than the specified value, must be carefully dried before being put into operation. The purpose of drying the winding is to get rid of moisture from the insulation and thus increase insulation resistance to the prescribed value. Drying can be carried out in various ways. Directives for drying are laid down in the standard ČSN 35 0010 or local recommended methods can be used.

Supply line and wiring

Cable entries into actuators flameproof enclosure are equipped with the followings threaded holes:

a) Actuator - has 2 or 3 threaded entries M20x1,5 or M25x1,5 *(see dimensional drawing of actuator)*
b) Local control - has 2 threaded entries M20x1,5.

Threaded holes for cable entries are marked M20x1,5 or M25x1,5 in accordance with article 13 of ČSN EN 60079-1.
These entries are sealed by plugs M20x1,5 or M25x1,5.
The customer is obliged to establish electrical connection for direct entry to the flameproof enclosure, that corresponds to the requirements of ČSN EN 60079-14 and the protective enclosure is at least IP67.

At the customer's request, the manufacturer can supply motors with cable bushing system that meets the requirements of ČSN EN 60079-14 Article 10.4.2.d for direct entry into flameproof enclosure of group IIC. For entry into actuators flameproof enclosure are used Peppers glands (type CR-U) or HAWKE glands (type ICG 623) according to following table.

Cable diameter	Gland	Threaded entry
CR-U/25	M25x1,5	11.7 – 20.0 mm
ICG 623/B	M25x1,5	13.0 – 20.2 mm
CR-U/20	M20x1,5	9.5 – 14.0 mm
ICG 623/A	M20x1,5	11.0 – 14.3 mm

In case of using bushings ICG customer is obligated to follow the following instructions of sealing individual cable cores when connecting the actuator.

CR-U* Compound-Filled Cable Gland
- ASSEMBLY INSTRUCTIONS FOR SAFE USE

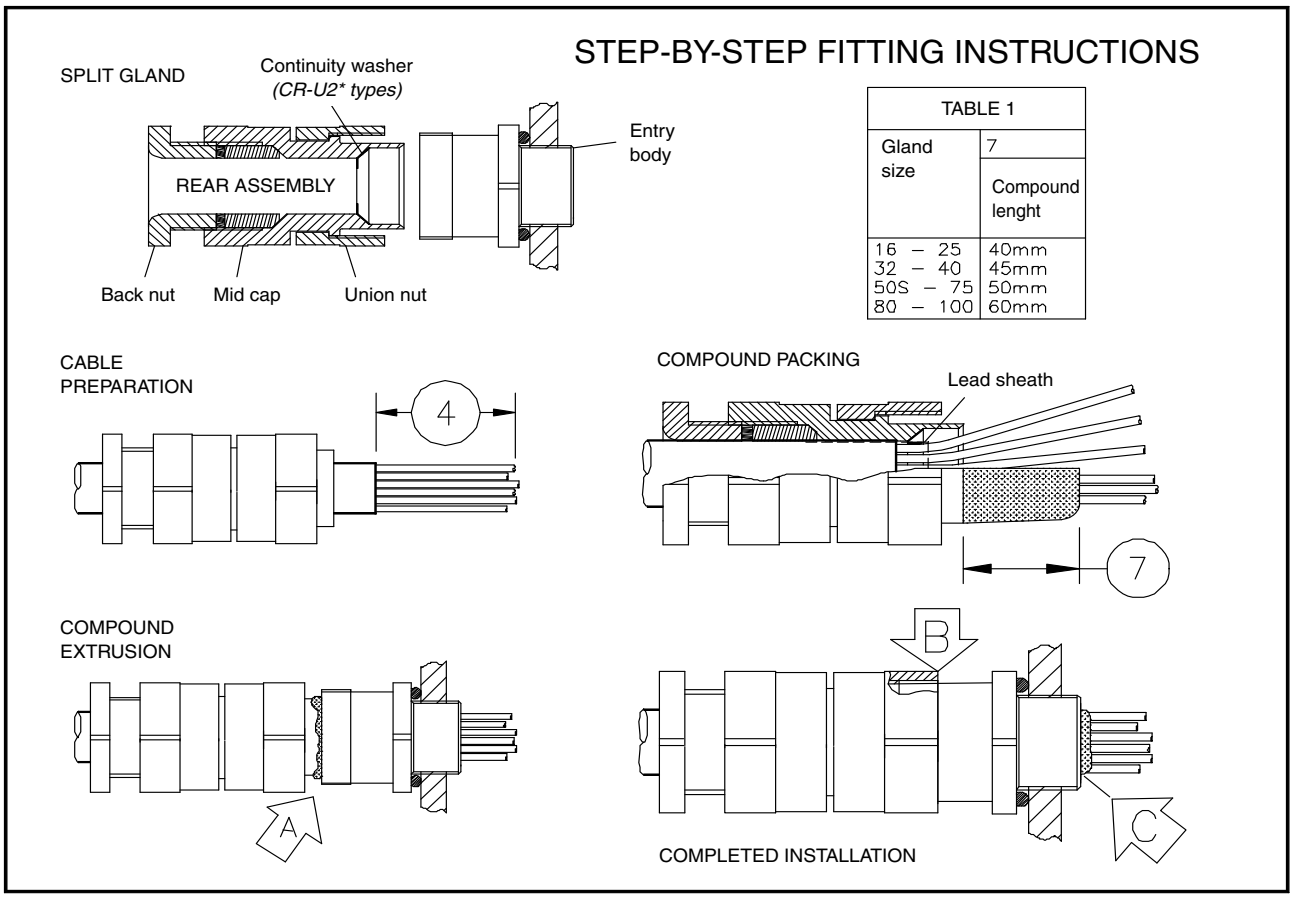
Where cable gland CR-U* is used customer is obliged to follow the following instructions with sealing individual cable cores when connecting the actuator.

Brief Description

The Peppers CR-U* type Compound-filled cable gland is for outdoor use in the appropriate Hazardous Areas with unarmoured cable of any construction, with or without braids or screens, where the braids or screens pass trough the compound. A variant giving electrical continuity to a lead sheath is available. It gives environmental protection to IP 66, IP 68 and Deluge.

Warning:

PLEASE STUDY CAREFULLY THESE INSTRUCTIONS BEFORE INSTALLATION. These glands should not be used in any application other than those mentioned here or in Peppers Data Sheets, unless Peppers states in writing that the product is suitable for such application. Peppers can take no responsibility for any damage, injury or other consequential loss caused where the glands are not installed or used according to these instructions. This leaflet is not intended to advise on the selection of cable glands. Further guidance can be found in the standards listed below.



STEP-BY-STEP FITTING INSTRUCTIONS

1. Split gland as shown.
2. Fit Entry Body. Hand-tighten, then using wrench tighten a further 1/2 turn. DO NOT EXCEED MAX TORQUE FOR ENCLOSURE.
3. Slide Rear Assembly *(Back Nut, Mid Cap and Union Nut)* onto cable as shown.
4. CABLE PREPARATION

   Strip jacket so that cores are fully exposed in the compound chamber, length to suit installation. Lead sheath must be cut to push through the continuity washer. Remove protective foils, and any cords/fillers from around and between the cores. Take care not to cut the insulating sleeves of the cores. Pigtail and sleeve any screens to be passed through compound.

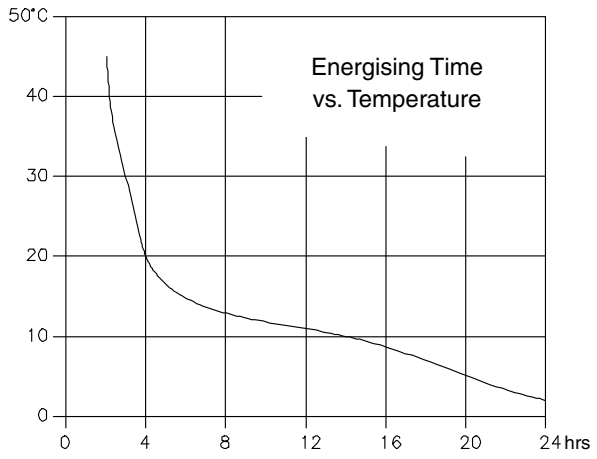
HEALTH AND SAFETY WARNING The resin used in the compound can cause eye and skin irritation. For your personal protection, wear the gloves supplied while mixing and applying. The uncured compound should not be allowed to come into contact with foodstuffs.

A COMPREHENSIVE SAFETY DATA SHEET PROVIDED BY THE COMPOUNDMANUFACTURER IS AVAILABLE ON REQUEST.

5. Check compound has not passed its "Use By" date. Installation at temperatures below 10 °C should be avoided if possible.
6. Trim any hardenes pieces from ends of stick. Mix the compound by rolling, folding and breaking. Ease mixing by cutting large sticks in half. Fully mixed compound has a uniform yellow colour with no streaks.
7. Support the cable and Rear Assembly, holding them roughly concentric. Any lead sheath should be pushed through the continuity washer - ensure that contact has been made. Splay out the cores. Starting at the middle, pack small amounts of rolled-out compound between the cores. Restraighten each core and work outwards untill all gaps are filled. Bundle the cores with cord or tape so they are not disturbed. Pack around the outside of the outer cores to completely fill the Rear Assembly cup. Build up compound around the outside of the cores, with a slight taper & to approximate compound lenght shown in diagram & Table 1 column 7.
8. Pass cores through & push compound into Entry Body until Rear Assembly engages. Remove squeezed out compound at arrow A. Screw Union Nut 7 full turns onto Entry Body *(arrow B).* Ensure that compound emerges at entry thread *(arrow C).*
9. Clean off excess compound from Entry Body to allow withdrawal when cured *(arrow C).* Cores may be disturbed after 1 hour. Leave to cure for 4 hours when working at 21 °C.
10. To release and pull back joint for inspection, unscrew Union Nut. Ensure that the compound is uniform and full form to fit into the entry body.
11. Hand-tighten Union Nut to remake joint. Then refer to table below table and tighten Union Nut using wrench to the given amount.
12. Hold Mid Cap with wrench and tighten Back Nut onto cable. Ensure seal makes full contact with cable sheath, then tighten 1 extra turn.
13. The equipment should not be energised until the compound has been left to cure for at least 4 hours when working at 21 °C. See chart ´ Energising Time vs. Temperature´ for further guidance.

Wrench tightening information *(Instruction 11),* cable sizes *(mm)* & permitted cores

Gland size	Tighten Union Nut using wrench up to	Max Diameter over Cores	Max No of Cores	Outher sheath	
				Min.	Max.
16	½ -turn	8,4	7	3,4	8,4
20S	½ -turn	10,4	8	4,8	11,7
20	½ -turn	12,5	14	9,5	14,0
25	½ -turn	17,8	25	11,7	20,0
32	¼ -turn	23,5	50	18,1	26,3
40	¼ -turn	28,8	80	22,6	32,2
50S	½ -turn	34,2	100	28,2	38,2
50	½ -turn	39,4	100	33,1	44,1
63S	½ -turn	44,8	120	39,3	50,1
63	½ -turn	50,0	120	46,7	56,0
75S	½ -turn	55,4	140	52,3	62,0
75	½ -turn	60,8	140	58,0	68,0
80	½ -turn	64,4	160	61,9	72,0
85	¾ -turn	69,8	180	69,1	78,0
90	¾ -turn	75,1	200	74,1	84,0
100	¾ -turn	80,5	220	81,8	90,0



Installation Guidance

Point Advice

1. BS EN 60079-10:2003 Classification of Hazardous areas
   BS EN 60079-14:1997 Electrical Installations in hazardous areas *(other than mines)*
   BS 6121, Part 5 Selection, Installation and Maintenance of Cable Glands
   IEC 60079-31:2008 Ignitable dust - Protection by enclosure
2. Installation should only be carried out by a competent electrician, skilled in cable gland installation.
3. NO INSTALLATION SHOULD BE CARRIED OUT UNDER LIVE CONDITIONS.
4. To maintain Ingress Protection ratings above IP64, use IP washers or O-rings for parallel threads. For taper threads use thread sealand. Also see page 1 diagram and Hole Data above.
5. To ensure the stated IP rating is maintained, at the point of interface the surface of the enclosure should be flat, free from debris and rigid with the hole drilled straight and to an appropriate diameter.

6. Where an earth contact is required the surface of the enclosure should be sufficiently flat and rigid. With painted enclosures a serrated star washer should be fitted to break through the paint and make a satisfactory earth contact.
7. Once installed do not dismantle except for routine inspection. A detailed inspection should be conducted as per IEC/EN 60079-17. After inspection the gland should be re-assembled as detailed in points 11 and 12, ensuring the Mid Cap is fully tightened.
8. Parts are not interchangeable with any other design. If manufacturers parts are mixed, certification will be invalidated. The gland is not serviceable and spare parts are not supplied.

Limitations on Usage. Be sure your installation complies with the following:

Feature	**Comment**
Enclosure entry thread	The female thread in the entry enclosure must comply with clause 5.3 of IEC/EN 60079-1. Do not damage threads on assembly . Check that the number of fully engaged threads is at least 5.

Interpretation of Markings. Markings on the outside of this gland carry the following meanings:

Cable Gland Type and Size	
CR	Product range
U	Gland over the counter for unarmoured cable Seal type: epoxy resin-based sealant *(temperature -60 °C to +85 °C)*
2	Continuity washer option for lead sheathed cable
B	Main component material, B=brass, S=stainless steel
20S	Gland size
PG16	Entry thread type and size Year code: XX
ATEX marking *(directive 94/9/ES)*	
Ex	European explosive atmosphere symbol
I M2	Mining equipment, category 2
II 2	Non-mining equipment, suitable for use in category 2, zone 1, 2, 21, 22
G	Type of explosive atmosphere - gas
D	Type of explosive atmosphere - dust

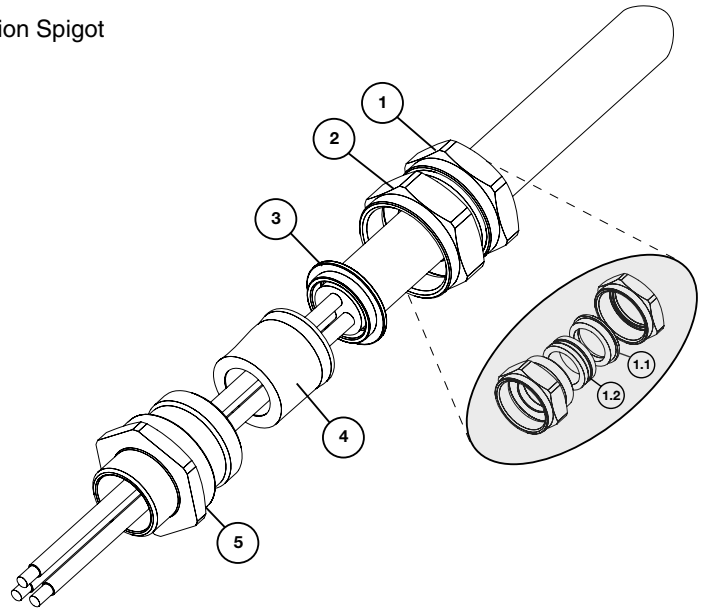
CENELEC certification marks	
E	Conformity with European standard
Ex	Symbol of protection against explosion
d	Type of protection: d=flameproof
I & IIC	Code for group of gases suitable for group I *(for example Methane)* and group IIC *(for example hydrogen)* flammable gases/ air mixtures and also groups IIA and IIB
03	Year of certifications
ATEX	Certified conformity with standard ATEX 94/9/ES
1479	Serial number of certification
X	These glands must not be used with enclosures where the temperature at the point of mounting exceeds -60 °C to +85 °C

Instruction for Use no. N740052 – issue no.1
Non-explosive cable bushings, type ICG 623

Assembly Instructions for cable gland: ICG 623 Exd IIC/Exe II
Certificate BASEEFA No. BAS 01 ATEX 2079X *(Ex)* II 2 GD IP66 CE 623 EExd I/EExe I
Certificate BASEEFxA No. BAS 02 ATEX 0177X *(Ex)* IM 2 IP66 CE
Operating temperature range -60 °C +80 °C

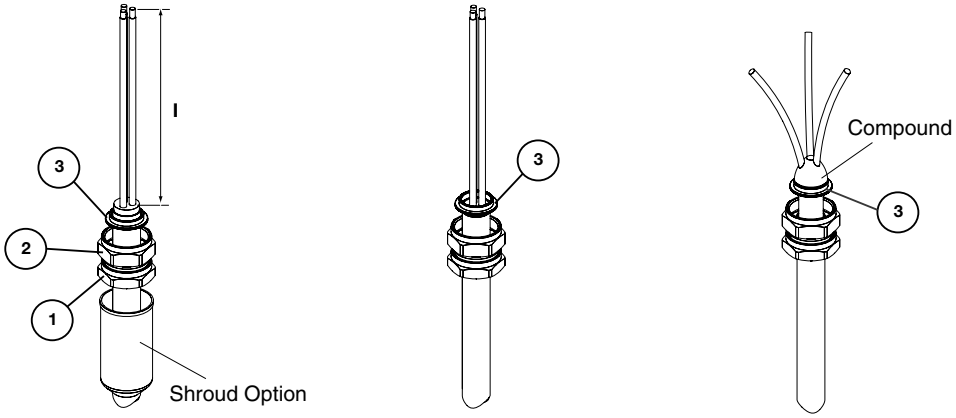
Assembly Instructions AI 305 / Issue L - 08/06
HAWKE International

1. Backnut
   1.1 Rear Compression Spigot
   1.2 Rear Seal
2. Middle Nut
3. Pot Cap
4. Rubber Pot
5. Entry



Detail for specification.
The parts 1 and 2 should not be dismounted.

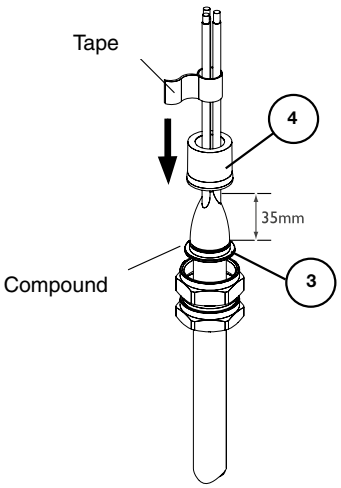
Cable Preparation ***Gland Preparation***



A
Strip Cable to suit equipment as shown above,
removing all cable fillers.
Length l to suit equipment.
If required, fit shroud.
See Notes re. Drain Wires.

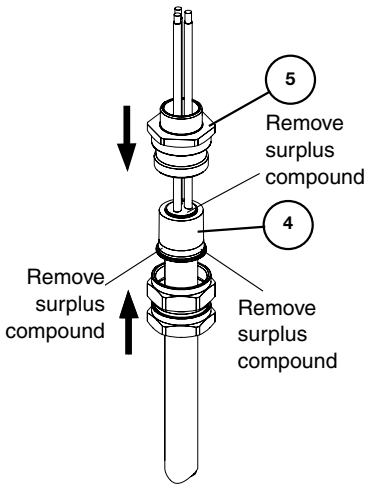
B
Position rear of pot cap *(3)* level with prepared face
of cable insulation, ensuring that the cap remains
concentric to cable at all times.

C
Spread the cable cores out for the compound packing.
Pack the compound between the cores as shown.
See notes overleaf and Fig. 7 for compound preparation.



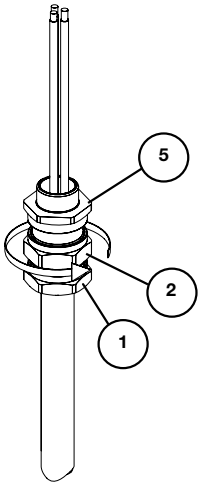
D

With all gaps and voids filled, bring the conductors back together and pack more compound around the outside of the conductors. Tape the conductors together to prevent disturbance of the compound seal. Pass the rubber pot *(4)* over pot cap *(3)* and remove any surplus compound from the top of rubber pot *(4)* and joint faces as indicated.



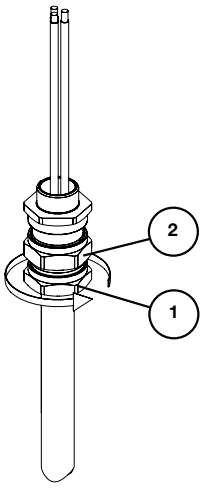
E

Replace the entry *(5)* over the rubber pot *(4)* ensuring that compound does not cover end of rubber pot *(4).*



F

Locate and hand tighten the sub-assembly *(1)* and *(2)* to the entry *(5).*

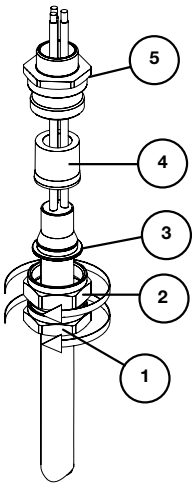


G

To further locate and support the compound and rubber pot assembly, while holding the middle nut *(2)* with a spanner/wrench, tighten the backnut *(1)* until the seal grips the cable to prevent movement of the cable gland.

Important note:

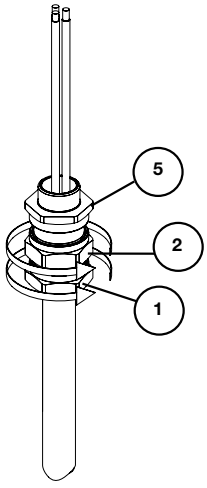
The conductors must not be moved for a minimum of four hours.



H

Allow the compound to cure. *(See Fig. 7 for Curing Times).*

Untighten firstly the backnut *(1)* from *(2)* and secondly the middle nut *(2)* from the entry *(5).* The rubber pot *(4)* may be removed for inspection to ensure that the packing is satisfactory. Add further compound if necessary.



I

Re-assemble rubber pot *(4)* and the entry *(5).* Hand tighten the sub-assembly *(1)* and *(2)* to the entry *(5)* and add half a turn to *(2)* with a spanner/wrench. Tighten the backnut *(1)* to form a seal around the cable, then tighten a further half to full turn using a spanner/wrench. Ensure that the middle nut *(2)* does not rotate when tightening the backnut *(1).* Locate the shroud over the cable gland if applicable.

EPOXY COMPOUND PREPARATION

When handling this material, the gloves supplied must be worn. The epoxy compound is supplied in the form of a two part package. These should be mixed into the ratio of I: I until both colours have blended into one, without any streaks. Rolling and folding is the most satisfactory method of obtaining an even blend. Once mixed, the compound must be used within 30 minutes. After this time it will begin to stiffen. The compound should be kept at an ambient temperature of no less than 20 °C prior to using.At lower temperatures it becomes difficult to mix. Should any compound come into contact with the skin it should be cleaned off with skin cleaner and not allowed to dry on the skin. Only compound for immediate terminations should be mixed.

The mixing and installation of the compound at an ambient temperature below 4 °C is not recommended due to extended curing period.

The following instructions are the various BASEEFA approved methods of passing drain wires etc. through the compound barrier and should be followed if permitted by cable installation specifications.

Drain wire preparation

1.0. Insulating drain wires with heat shrink or cold shrinktubing

1.1. Fold back the armour I braid and bend it to right angles from the inner sheath.

1.2. Remove foils and tape level with the outer sheath. exposing the drain wires and insulated conductors. Cut back a further 10 mm of inner sheath.

1.3. Pass 100 mm length of heat shrink or cold shrink tubing over the drain wire until it comes into contact with the foils, then shrink the tubing evenly down onto the drain wire so that no air pockets occur.

1.4. To insulate the joint between the foils and the tubing a suitable piece of 10 mm long shrink tubing or neoprene stretch tubing or a 10 mm wide lap of PVC tape may be used.

1.5. After completing 1.1 to 1.4 on each drain wire, lay the armour I braid parallel to the cable, if applicable, then carry out instruction B.

2.0. Insulating drain wires i screens with separate insulated crimped conductors or soldered connection

2.1. Fold back the armour I braid and bend to right angles from the inner sheath.

2.2. Remove a further I 5mm of inner sheath *(See Fig. I).*

2.3. Unravel one or two groups of wires from the screen wires, then remove the remainder of the screen wires *(See Fig. 2).*

2.4. Twist the group of screen wires into a pigtail and cut to 15 mm long.

2.5. Crimp an insulated conductor to the pigtail wih a suitable insulated butt ferrule *(or soldered connection),* leaving enough length of the insulated conductor to enable the remote end to be connected to the earth terminal in the equipment. *(See Fig. 3).*

Note: *There shall be a minimum of I Omm of compound on both ends of the crimped I soldered joint.*

2.6. To insulate the joint between the screen wires and the insulated conductor, place one lap of PVC insulating tape over the exposed metallic joint.

2.7. After completing 2.1 to 2.6 on each drain wire. lay the armour I braid parallel to the cable. Then carry out instruction B.

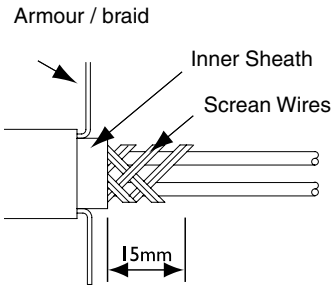


Fig. 1

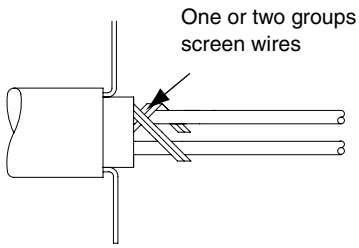


Fig. 2

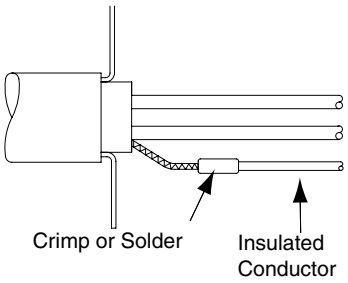


Fig. 3

3.0. Insulating drainwireswith insulating varnish or paint

3.1. Fold back the armour I braid and bend it at right angles from the inner sheath.

3.2. Remove the foil and tape level with the inner sheath exposing the drain wires and conductor pairs.

3.3. Cut back a further 10 mm of inner sheath *(See Fig. 4).*

3.4. Spray or paint the drain wires with insulating varnish or paint, then leave to dry *(See Fig. 5)*

3.5. To insulate the foil ends a suitable piece of 10 mm long shrink tubing or neoprene stretch tubing or a 10 mm wide lap of PVC tape may be used *(See Fig. 6).*

3.6. After completing 3.1 to 3.5 on each drain wire, lay the armour I braid parallel to the cable. Then carry out instruction B.

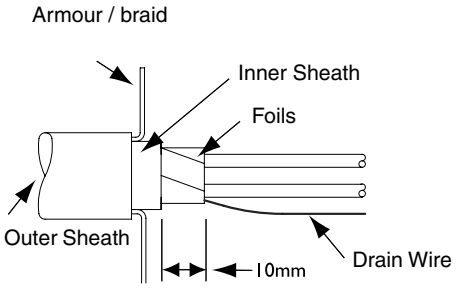


Fig. 4

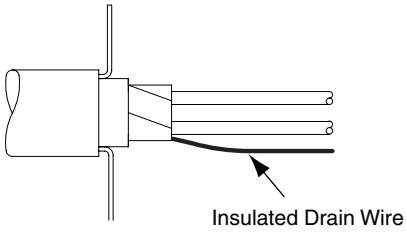


Fig. 5

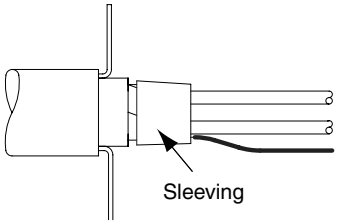


Fig. 6

Epoxy Compound Cure Time Vs. Temperature

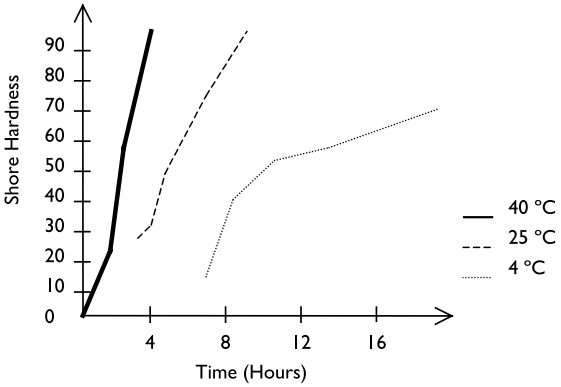


Fig. 7

- The compound may be adversely affected by some solvent vapours.If such vapours are likely to be present in the vicinity of the cable gland in service, suitable precautions may be necessary. *(Contact Hawke's Technical Dept).*

- The compound cures at a Shore D hardness of 85, when it can be handled. The compound when fully cured is suitable for use at a temperature range of -60 °C to +80 °C.

CABLE GLAND SELECTION TABLE

Size Ref.	Entry Thread Size		Cable Acceptance Details							Max. Length	Hexagon Dimensions	
			Inner Sheath/Cores			Outer Sheath						
						Standard Seal		Alternative Seal (5)				
	Metric	NPT	Max. Over Cores	Max. Inner Sheath	Max. No. of Cores	Min.	Max.	Min.	Max.		Across Flats	Across Corners
Os	M20	½"	8.0	8.0	6	3.0	8.0	-	-	66	24.0	27.7
O	M20	½"	8.9	10.0	6	7.5	11.9	-	-	66	24.0	27.7
A	M20	½" – ¾"	11.0	12.5	10	11.0	14.3	8.5	13.4	63	30.0	34.6
B	M25	¾" – 1"	16.2	18.4	21	13.0	20.2	9.5	15.4	68	36.0	41.6
C	M32	1" – 1¼"	21.9	24.7	42	19.0	26.5	15.5	21.2	70	46.0	53.1
C2	M40	1¼" – 1½"	26.3	29.7	60	25.0	32.5	22.0	28.0	72	55.0	63.5
D	M50	1½" – 2"	37.1	41.7	80	31.5	44.4	27.5	34.8	87	65.0	75.1
E	M63	2" – 2½"	48.8	53.5	100	42.5	56.3	39.0	46.5	90	80.0	92.4
F	M75	2½" – 3"	59.0	65,3/66,2	120	54.5	68.2	48.5	58.3	92	95.0	109.6

Limiting conditions:

1. Cable bushings OS and O can only be used for braided cables and firm instruments; the cable should be properly fixed to prevent its possible pulling out or twisting.
2. Operating temperature of the cable bushing is -60 °C to +80 °C.
3. The space between the equipment and the cable bushing should be sealed in order to preserve particular degree of protection against penetration of dust, solid particles, and water.

Accessories:

Before assembling or dismounting the cable bushing, become familiar with accessories of the cable bushing which include, for instance:

– coat providing additional protection against corrosion;
– safety nut securing position of the cable bushing;
– sealing washer under the additional protection of the cover of the cable bushing front part against penetration;
– knurled washer damping vibrations that could loosen the safety nut or the cable bushing assembly

The inlet to the actuator and connection to its switching, protection and securing instruments can only be installed by technicians with particular qualification who must follow pertaining standards and wiring diagrams as provided in these Instructions for Use. After connecting the inlet cables, all screws of the connecting terminals should be checked for tightness so that they do not get warm during operation due to increased transition resistance. The connecting terminals must not be under tension or bending stress from the connected conductors. In case of connection with aluminium conductors the following measures are recommended. One-step before connecting the conductor, the oxidized layer should be removed from the conductor and new oxidation should be prevented by smearing the connection with a neutral vaseline.

After the connection, make sure, by short starting of the actuator in the intermediate position of the working stroke, that the output shaft of the actuator rotates in a proper direction. If this is not the case, reconnect any two conductors on the terminals U, V, W of the motor *(actuator)* terminal board. Then, repeat the functional check. After verifying correct electric connection, the actuator is fitted to the valve and adjusted according to the paragraph Actuator Setting. The adjustment is best carried out using the manual control regime.

Important warning!

1) During adjusting, repair, and maintenance, secure the actuator in the prescribed way in order to rule out its connection to the power supply and thus to prevent possibility of an injury due to electric shock or the actuator rotation.

After adjusting the actuator, check its function using the control circuit. In particular, make a check that the actuator is correctly starting and that there is no voltage on the electric motor after particular relays has been switched off. If this is not the case, switch the actuator power supply immediately so that damage to the electric motor is prevented, and seek for the failure.

11. OPERATION AND MAINTENANCE OF ELECTRIC ACTUATORS

Operation of the electric actuators results from the operating conditions and, as a rule, it is limited to giving impulses to respective functional tasks. The electric actuator can be controlled electronically in remote way as well as manually on site of their installation. Manual control is possible by means of a hand wheel of the electric actuator, it does not require any change-over switch and can be used without any danger to the staff even in case that the electric motor is running.

The operator should take care that a prescribed maintenance is carried out, the electric actuator is protected against dangerous effects of the environment and weather conditions which are not listed in the chapter “Working Conditions”. Moreover, care should be taken to prevent abnormal heating-up of the surface of the solid closure of the electric actuator. It is also necessary to monitor that the rated values are not exceeded and that abnormal vibrations of the electric actuator do not occur.

Maintenance

The maintenance of electric actuators lies in possible replacement of defective parts. Grease filling is stable for the electric actuator service life, i.e. 6 years. If the electric actuator is capable of operating even after 6 years the old grease should be taken out from the power part and new grease filled in.

After 6 months at most from putting the electric actuator into operation and then at least once a year, the connecting screws between the piping fitting and the electric actuator should be retightened. The screws are tightened in a crosswise manner.

Cleaning - general inspection

The electric actuators ex should be kept clean and care should be taken to prevent their clogging by impurities and dust. Cleaning should be carried out regularly and as often as required by operating conditions. Surface temperature of the actuator 80 °C (T6) should be determined without a dust layer. From time to time, it should be verified whether all connecting as well as earthing clamps are duly tightened to prevent their heating up during operation. General inspection of the electric actuator is recommended to be carried out once a year unless otherwise stated in revision regulations of electric devices.

Checking the parts of non-explosive closure

The parts of the electric actuator forming the solid closure are inspected for possible ruptures or other damages (attacked by corrosion, abrades etc.). With the electric actuator disconnected, sealing rings of cable outlets should be inspected. Material of the sealing rings undergoes ageing and its hardness increases. Therefore, after 3 years they should be replaced during the reassembly. Defective parts of the closure must not be used again during assembly of the electric actuator.

In all relevant repairs of the non-explosive closure which effect its safety it is recommended to have the electric actuator ex repaired at the manufacturer who can, on the basis of approved documentation and prescribed tests, put the closure into a state corresponding to ČSN EN 60079-1.

Table No. 1 – MODACT MOKP Ex electric actuators

– basic technical parameters

Type	Type number		Adjusting time s/90 °	Tripping torgue range Nm	Electric motor						Weight kg
	Basic	Complem.			Power W	Type	Rpm $1.min^{-1}$	Voltage V	Current A	Capacity µF	
	1 2 3 4 5	6 7 8 9									
MOKP 100 Ex	5 2 3 2 0	x x 1 x	10	25 – 100	74	ES 7150-2AL	2750	1 x 230	0.67	7	9.7
		x x 2 x	20		74	ES 7150-2AL	2750	1 x 230	0.67	7	
		x x 3 x	40	25 – 85	15	FCJ2B52VA	2780	1 x 230	0.37	3.5	
		x x 4 x	80	25 – 100	17	ES 7130-4AY	1300	1 x 230	0.27	3.5	
		x x 5 x	10	16 – 32	15	FT2B52C	2680	3 x 400	0.10	-	
		x x 6 x	20	25 – 90	15	FT2B52C	2680	3 x 400	0.10	-	
		x x 7 x	40	25 – 100	15	FT2B52C	2680	3 x 400	0.10	-	
MOKP 250 Ex	5 2 3 2 1	x x 1 x	10	63 – 125	90	EAMRB56N02	2780	1 x 230	0.9	8	18.5
		x x 2 x	20	100 – 250	90	EAMRB56N02	2780	1 x 230	0.9	8	
		x x 3 x	40		40	EAMRB56N04A	1380	1 x 230	0.55	5	
		x x 4 x	80		40	EAMRB56N04A	1380	1 x 230	0.55	5	
		x x 5 x	10	63 – 200	90	EAMR56N02L	2790	3 x 400	0.25	-	
		x x 6 x	20	100 – 250	90	EAMR56N02L	2790	3 x 400	0.25	-	
		x x 7 x	40		60	EAMR56N02A	2790	3 x 400	0.20	-	
		x x 8 x	80		20	EAMR56N04A	1440	3 x 400	0.20	-	
MOKP 600 Ex	5 2 3 2 2	x x 1 x	10	250 – 510	180	EAMR63N04	1370	3 x 400	0.6	-	31
		x x 2 x	20	250 – 600	120	EAMR63N04L	1390	3 x 400	0.45	-	
		x x 3 x	40		60	EAMR63L02A	2790	3 x 400	0.20	-	
		x x 4 x	80		20	EAMR63L04A	1440	3 x 400	0.20	-	
		x x 5 x	160		20	EAMR63L04A	1440	3 x 400	0.20	-	
		x x 6 x	20	250 – 450	180	EAMRB63N04	1320	1 x 230	1.35	10	
		x x 7 x	40	250 – 550	90	EAMRB63L02	2780	1 x 230	0.90	8	
		x x 8 x	80	250 – 600	40	EAMRB63L04A	1380	1 x 230	0.55	5	
		x x 9 x	160		40	EAMRB63L04A	1380	1 x 230	0.55	5	

The type number indikates

Place 6:

Stroke 90°	Stroke 60°	Stroke 120°	Stroke 160°	Using transmitter
6	-	-	-	with resistance transmitter 1 x 100 Ω
7	B	F	J	with CPT 1Az 4 – 20 mA without built-in feeding source
8	C	G	K	without transmitter
9	D	H	L	with DCPT 4 – 20 mA with built-in feeding souce

Place 7:
- 0 version without built-in regulator of position and without BMO *(block of local control)*
- 1 version with built-in regulator of position and without BMO *(Note 1)*
- 2 version without built-in regulator of position and with BMO
- 3 version with built-in regulator of position and with BMO *(Note 1)*
- 4 version with power relays, without regulator of position and without BMO *(Note 2)*
- 5 version with power relays, with regulator of position and without BMO *(Note 2)*
- 6 version with power relays, without regulator of position and with BMO *(Note 2)*
- 7 version with power relays, with regulator of position and with BMO *(Note 2)*

Place 8: adjusting time, tripping torgue *(digit according to Table 1)*

Place 9: way of connecting *(digit or letter according to Table 2)*

The actuators for surrounding temperature -50 °C to +55 °C will be marked with letter F at the last place of the complementary type number: namely 52 32x.xxxxF.

In all markings of explosion-proofness of actuators type no. 52 32x.xxxxF, the marking of sub-groups of group II of an explosion-proof electric device according to standard ČSN EN 60079-0 will be changed from IIC to IIB, namely Ex db IIB T6 Gb.

Notes:

1) This version is delivered with single-phase electric motor only

2) This version is delivered with three-phase electric motor only

3) Electric actuators type no. 52 320 are not delivered in version with built-in contactors for three-phase type

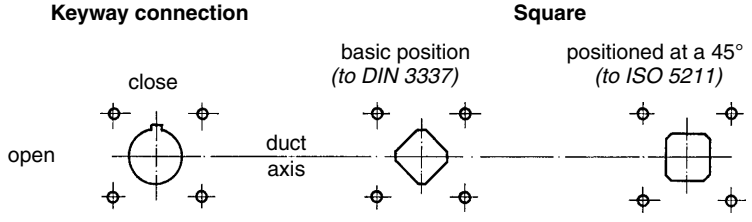
4) The version 52 32x.xxxxF is only available with three-phase electric motors and without transmitter or with current transmitter CPT 1AF.

Table 2 – Way of connecting MODACT MOKP Ex electric actuators

– specifying of the 9th place in type number

Flange size	Connection	Square size s [mm]	Square position	Marking of the 9th position in the type number	Structural design of output
Type number **52 320**					
F05	keyway	Ø 22		0	collar
F05	square	14	basic	1	exchangeable inserts
F04	keyway	Ø 18		2	
F04	square	11	basic	3	
F05		14	positioned at a 45°	4	
F04		11	positioned at a 45°	5	
F04		12	basic	6	
F04		12	positioned at a 45°	7	
F05		16	basic	8	
F05		16	positioned at a 45°	9	
Type number **52 321**					
F10	square	22	basic	1	exchangeable inserts
F07	keyway	Ø 28		2	
F07	square	17	basic	3	
F10		22	positioned at a 45°	4	
F07		17	positioned at a 45°	5	
F07		19	basic	6	
F07		19	positioned at a 45°	7	
F10		24	basic	8	
F10		24	positioned at a 45°	9	
F10		27	basic	A	
F10		27	positioned at a 45°	B	
Type number **52 322**					
F12	keyway	Ø 50		0	collar
F12	square	27	basic	1	exchangeable inserts
F10	keyway	Ø 42		2	
F10	square	22	basic	3	
F12		27	positioned at a 45°	4	
F10		22	positioned at a 45°	5	
F10		24	basic	6	
F10		24	positioned at a 45°	7	
F10		27	basic	8	
F10		27	positioned at a 45°	9	
F12		32	basic	A	
F12		32	positioned at a 45°	B	

Actuator output shaft position
(when viewing towards the local position indicator).
The handwheel tallies with the CLOSED position



Another connection of electric actuators on demand.
Another connection of electric actuators on demand.

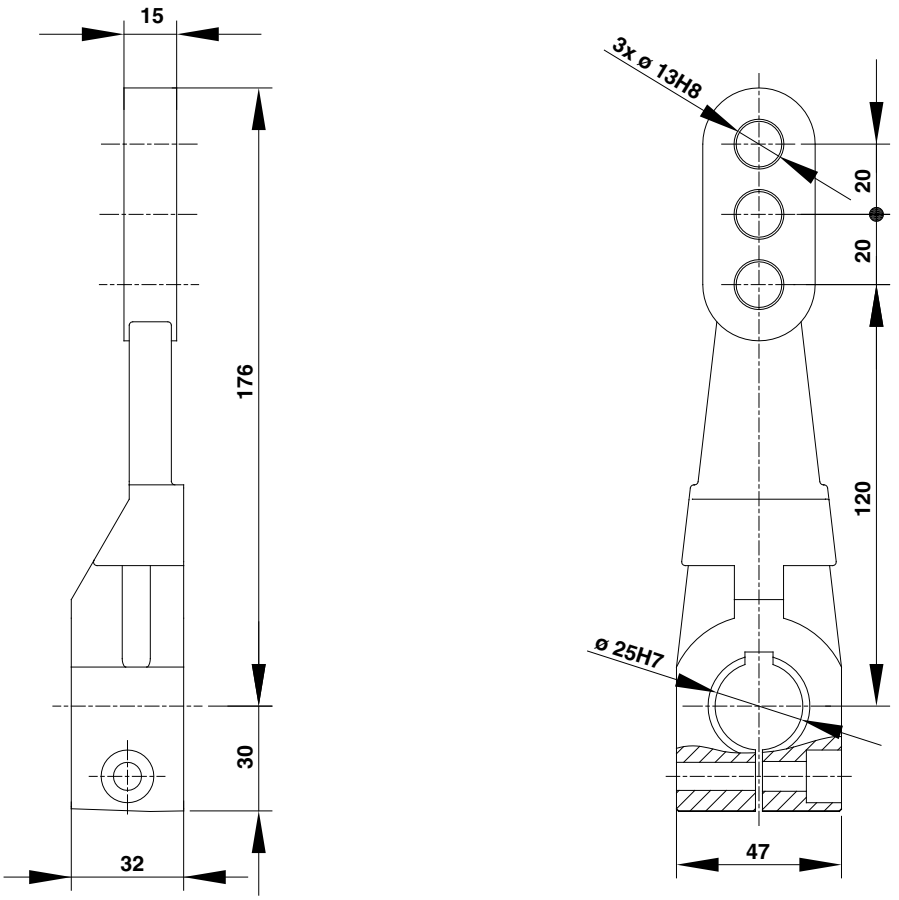
Addition to table 2 – MODACT MOKP Ex electric actuators with lever adapter

– mechanical connection (designation of the 9th place of the type number)

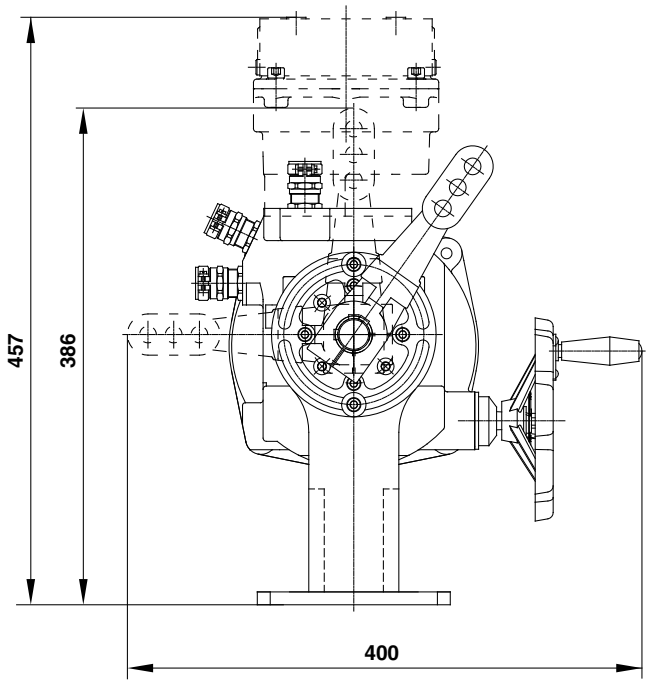
Flange size	Connection	Square size s [mm]	Square position	Marking of the 9th position in the type number	Structural design of output
Type number 52 320					
F05	keyway	Ø 22		0	collar
F05	square	14	basic	1	exchangeable inserts
F04	keyway	Ø 18		2	
F04	square	11	basic	3	
F05		14	positioned at a 45°	4	
F04		11	positioned at a 45°	5	
F04		12	basic	6	
F04		12	ppositioned at a 45°	7	
F05		16	basic	8	
F05		16	positioned at a 45°	9	
Actuator with lever adapter				W	lever
Type number 52 321					
F07	keyway	Ø 28		0	not available
F07	square	17	basic	1	exchangeable inserts
F05	keyway	Ø 22		2	
F05	square	14	basic	3	
F07		17	positioned at a 45°	4	
F05		14	positioned at a 45°	5	
F05		16	basic	6	
F05		16	positioned at a 45°	7	
F07		19	basic	8	
F07		19	positioned at a 45°	9	
Actuator with lever adapter				W	lever

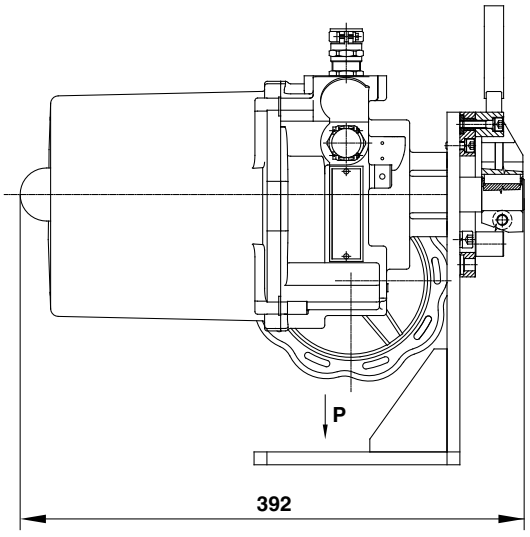
Dimensional sketch of **MODACT MOKP Ex electric actuator with lever adapter**

Lever



Lever adapter with **Type No. 52 320** actuator

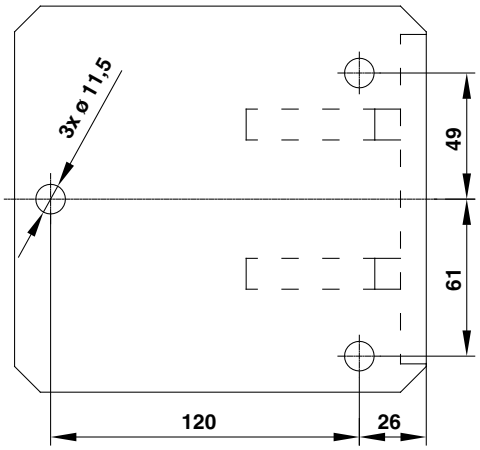




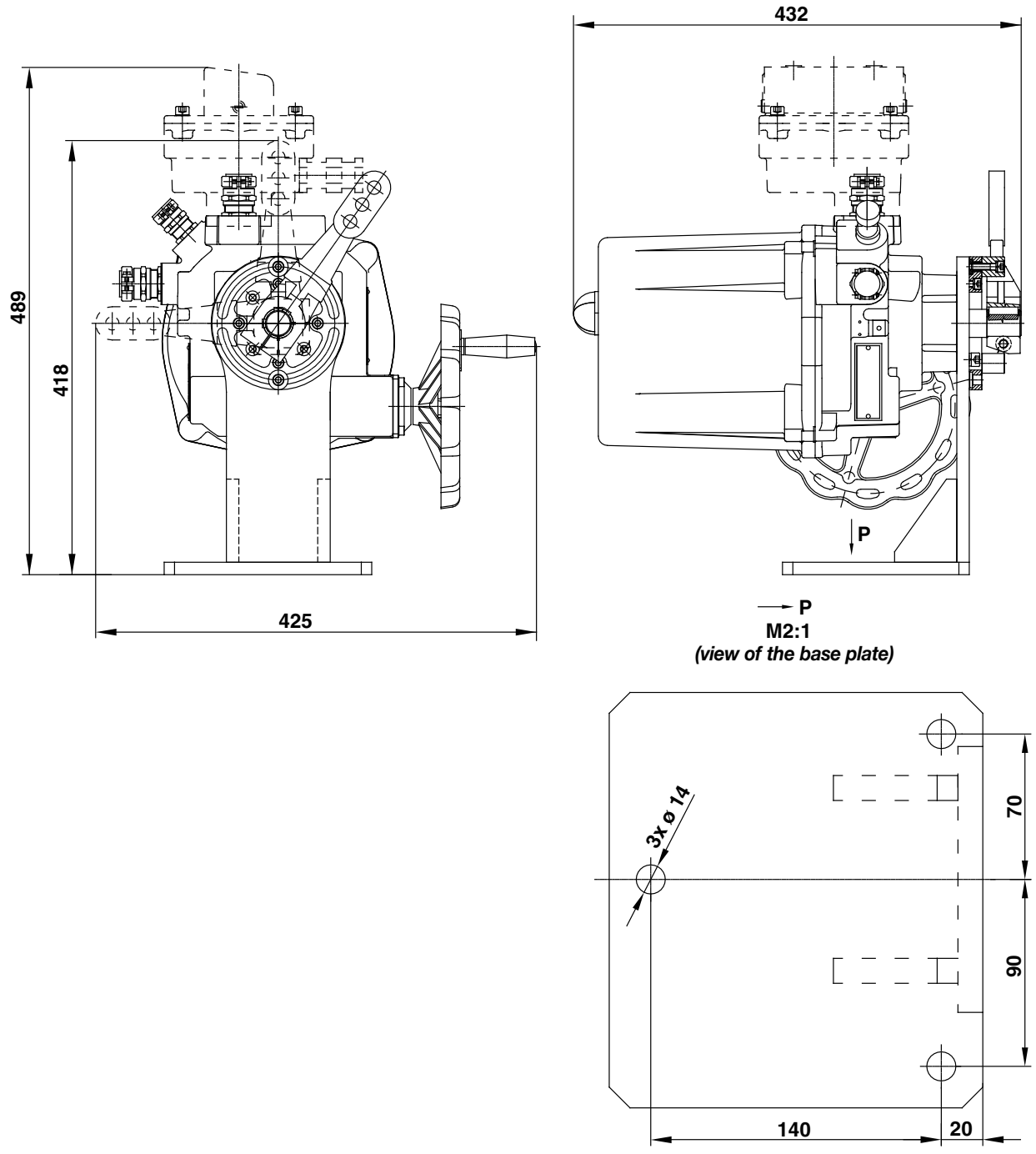
P

M2:1

(view of the base plate)

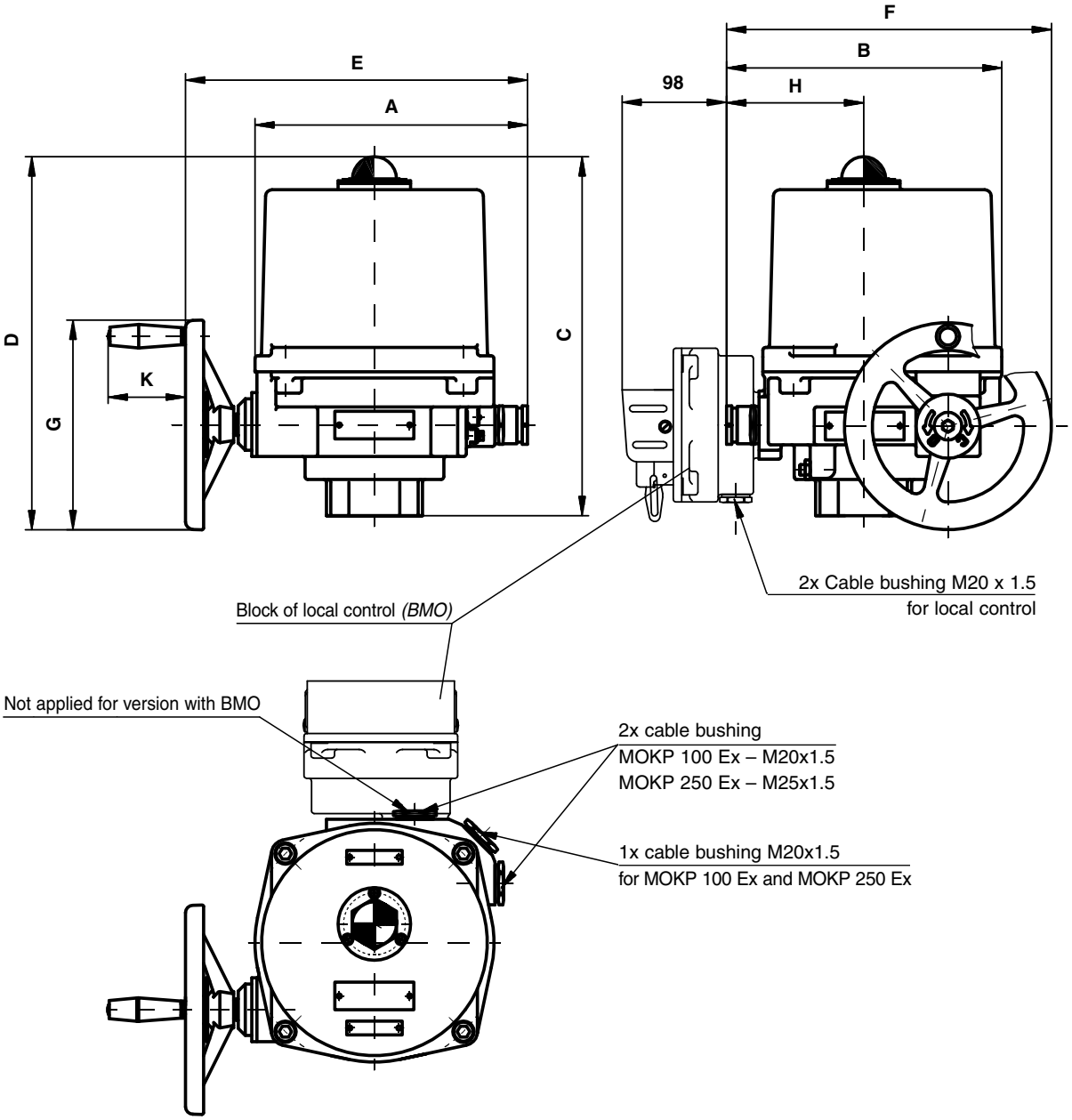


Lever adapter with **Type No. 52 321** actuator



Note: *Other dimensions are listed in the dimension table.*

Dimensional sketch of **MODACT MOKP 100 Ex and 250 Ex** electric actuators



Type	A	B	C	D	E	F	G	H	K
MOKP 100 Ex	253	276	297	308	311	316	160	170	72
MOKP 250 Ex	306	312	368	385	376	363	200	183	72

Dimensional sketch of **MODACT MOKP 600 Ex** electric actuators

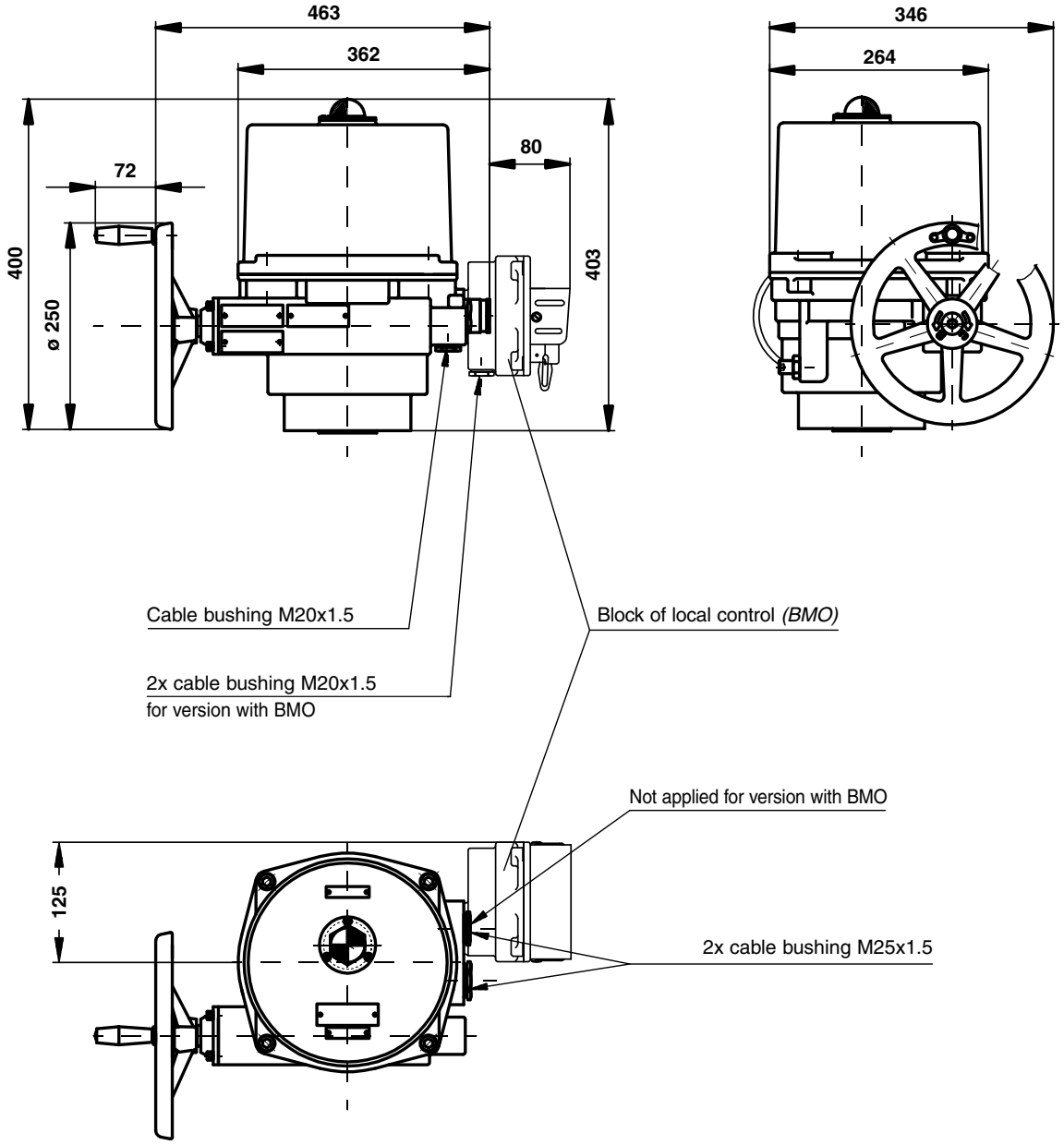
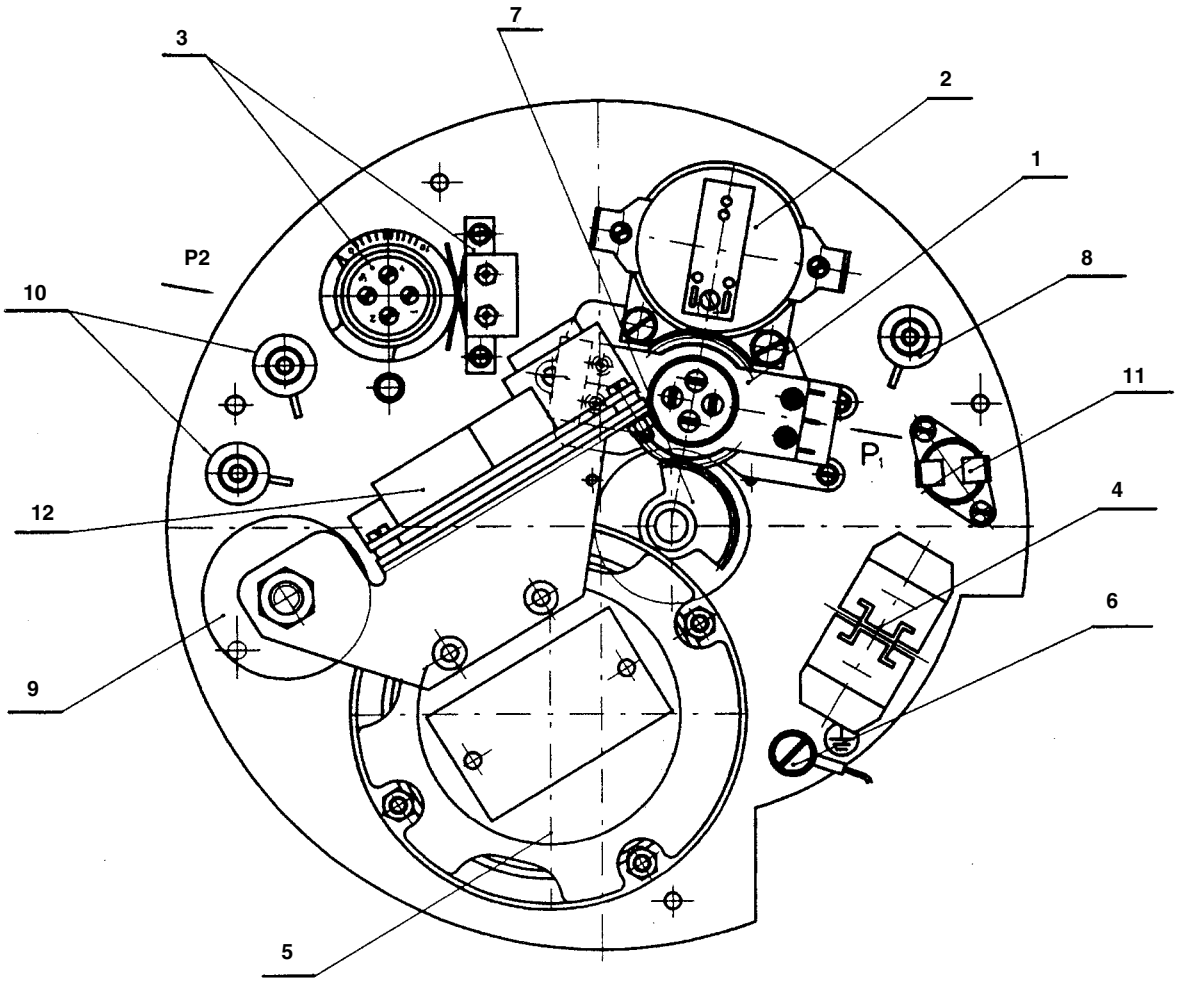
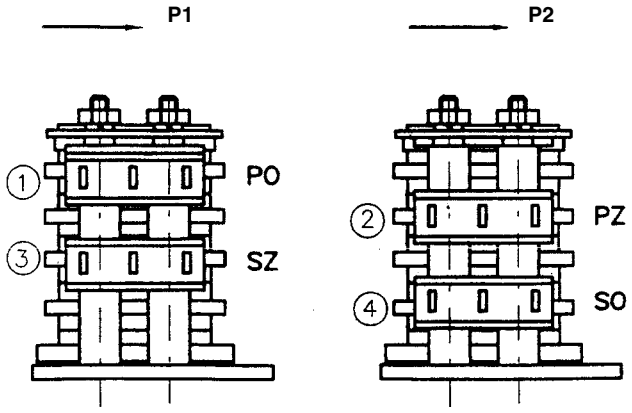


Fig. 1: Control plate *(Type No. 52 321)*





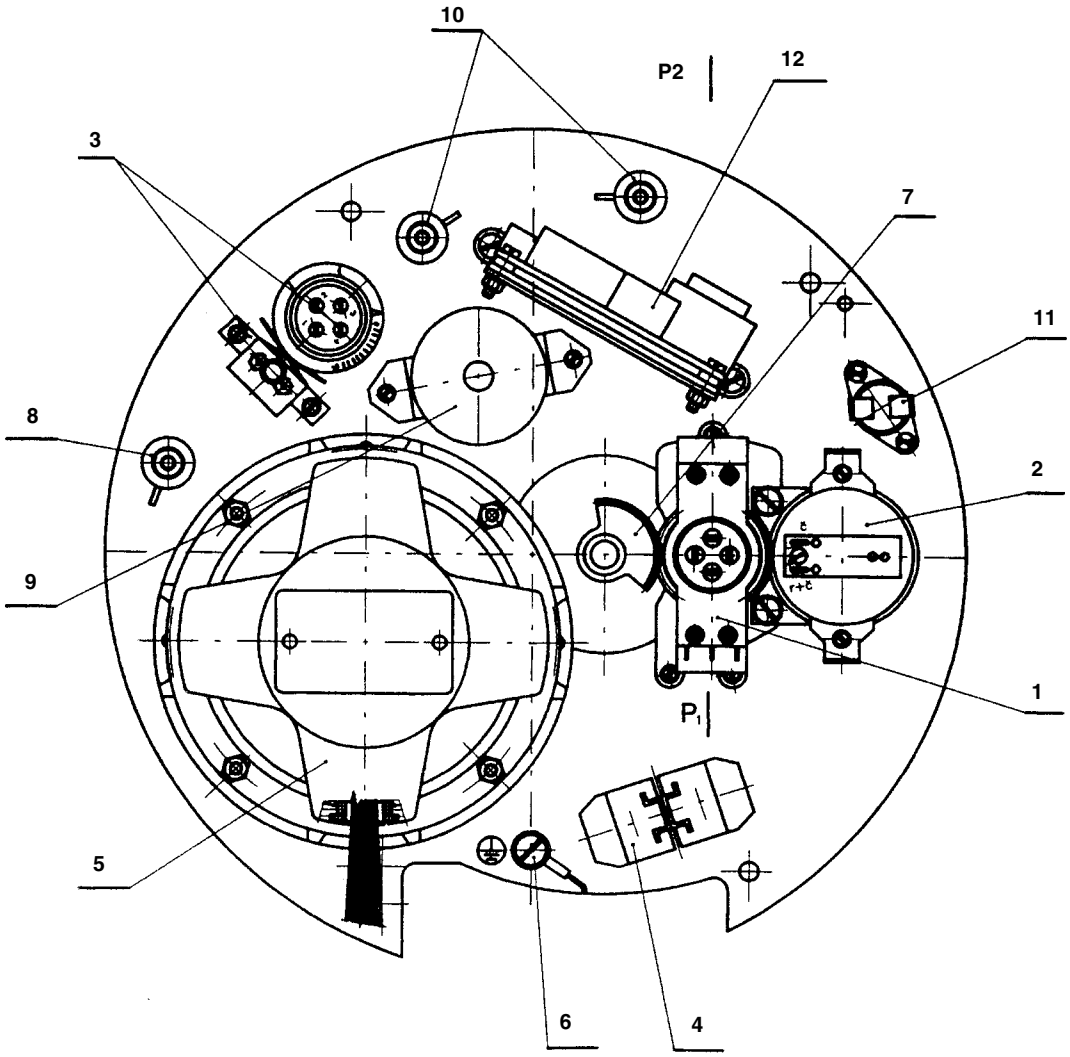
Legend:

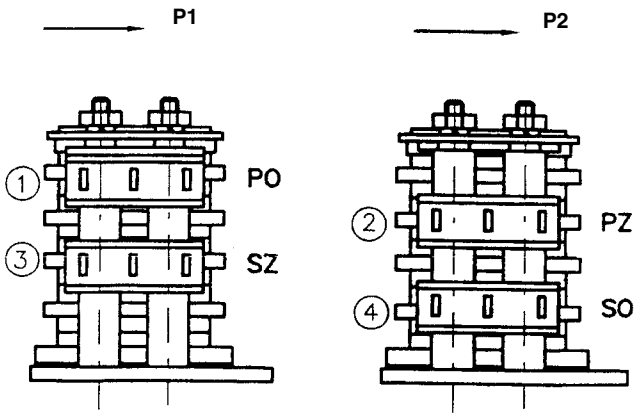
1 – position unit
2 – position transmitter
3 – moment unit
4 – terminal board
5 – electric motor
6 – internal protective connector
7 – drive wheel (or segment)
8 – heating element
9 – starting capacitor
10 – protective resistance
11 – thermal switch
12 – regulator

Note:

The numbers in circles are identical with the numbers of releasing screws of cams of the position unit.

Fig. 1a: Control plate *(Type No. 52 322)*





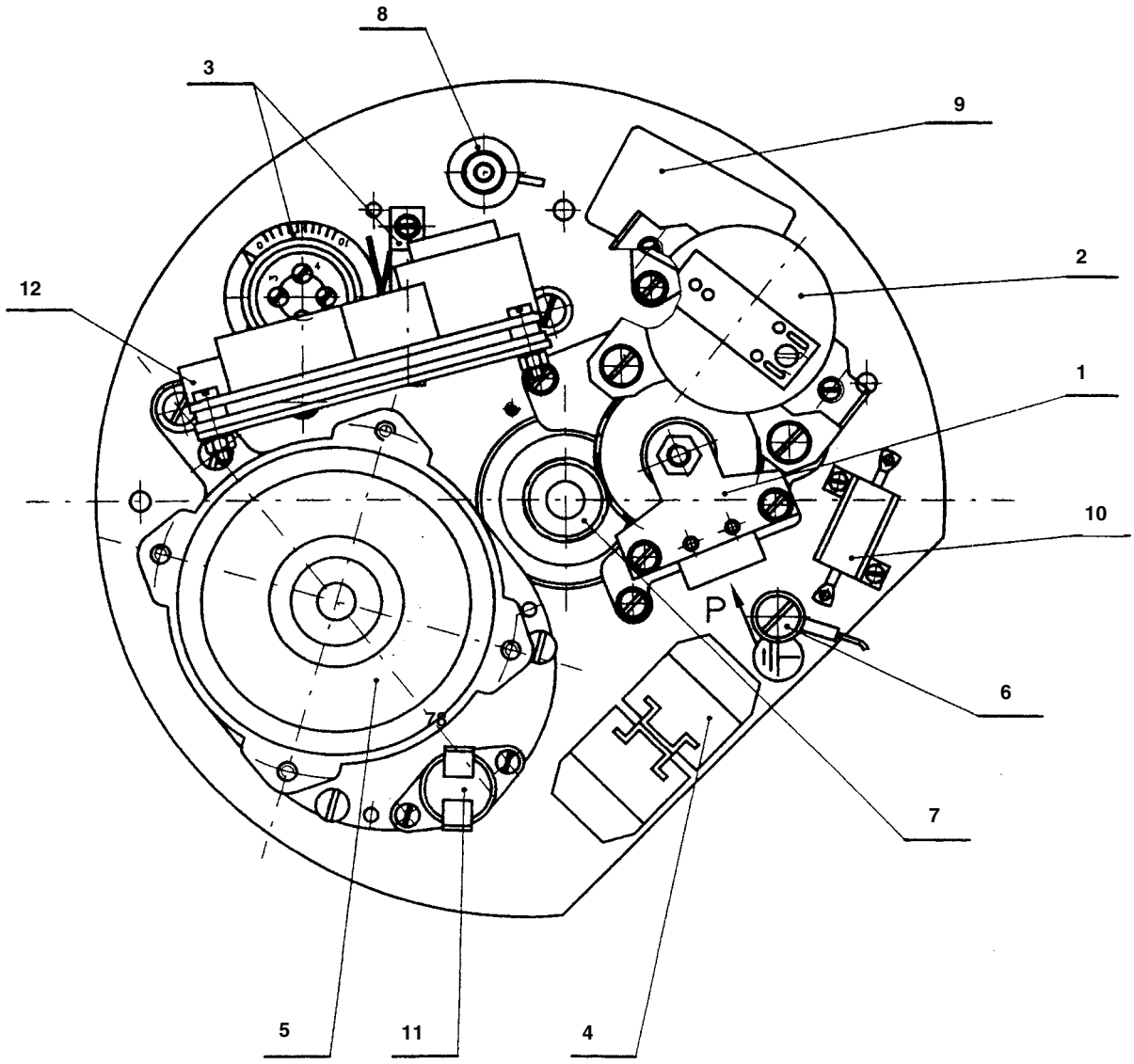
Legend:

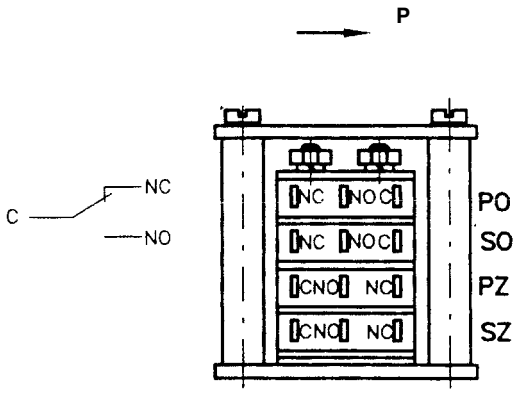
1 – position unit
2 – position transmitter
3 – moment unit
4 – terminal board
5 – electric motor
6 – internal protective connector
7 – drive wheel (or segment)
8 – heating element
9 – starting capacitor
10 – protective resistance
11 – thermal switch
12 – regulator

Note:

The numbers in circles are identical with the numbers of releasing screws of cams of the position unit.

Fig.2: Control plate *(Type No. 52 320)*

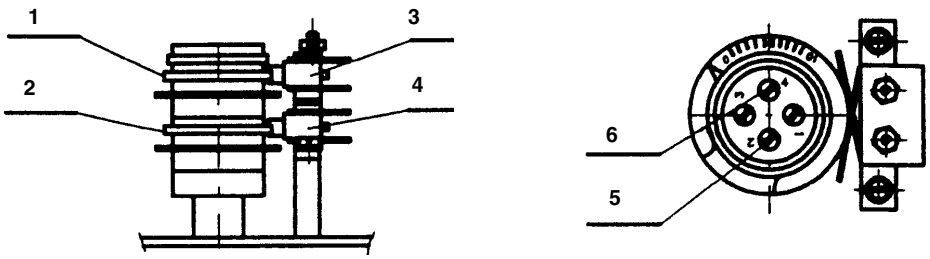




Legend:

1 – position unit
2 – position transmitter
3 – moment unit
4 – terminal board
5 – electric motor
6 – internal protective connector
7 – drive wheel (or segment)
8 – heating element
9 – starting capacitor
10 – protective resistance
11 – thermal switch
12 – regulator

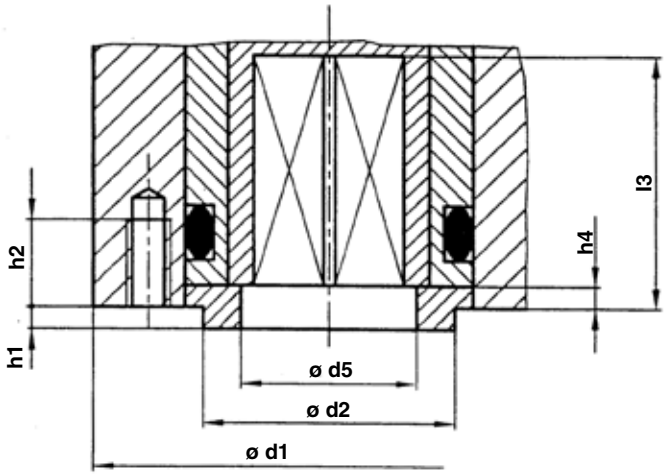
Fig 3: Moment switches



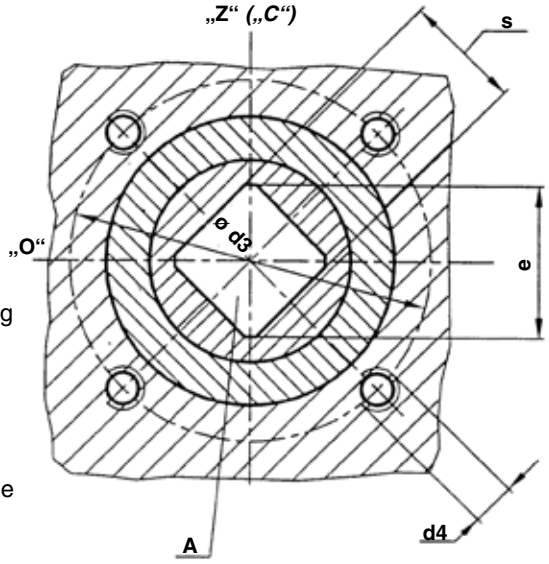
***Legend**:*

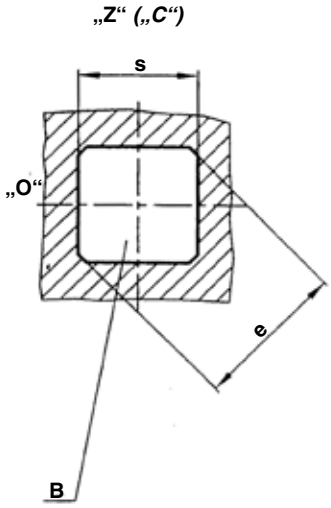
1 – cam of switch MO
2 – cam of switch MZ
3 – moment switch MO
4 – moment switch MZ
5 – releasing screw of cam switch MZ
6 – releasing screw of cam switch MO

Connecting dimensions of **MODACT MOKP Ex** electric actuators
– connecting with square



The position of the square hole in end position of electric actuator.
The position "Opened" is to the left of the position "Closed" when viewing in the direction to the local indicator of position.
The square hole is according to DIN 79:2013-02.
Connecting dimensions are according to DIN 3337 or ISO 5211.
The position "Z" *("C")* of the square hole for spindle is identical with the position "Z" *("C")* on the local indicator of position.

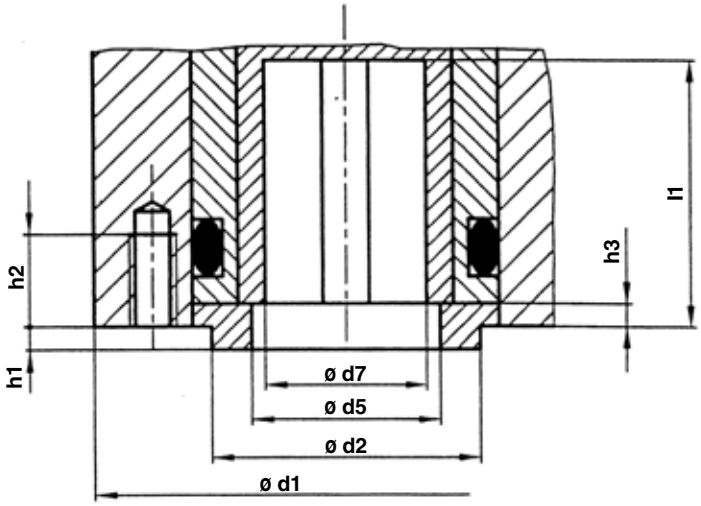




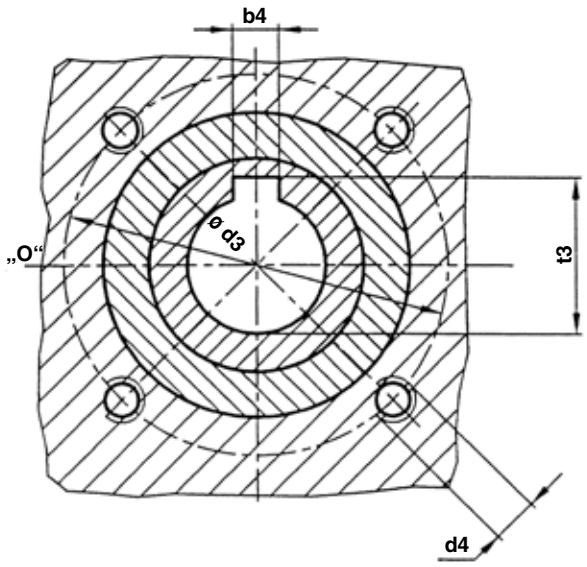
A – connection by square in basic position
B – connection by square turned by 45 °

Flange	ø d1	ø d2 f8	ø d3	d4	h4		h2 min.	h1 max.	l 3 min.	s H 11	e min.	ø d5
					min.	max.						
F04	65	30	42	M6	1,5	0,5	12	3	15.1	11	14.1	25
									16.1	12	16.1	
F05	65	35	50	M6	3	0,5	12	3	19.1	14	18.1	28
									22.1	16	21.2	
F07	90	55	70	M8	3	0,5	13	3	23.1	17	22.2	40
									26.1	19	25.2	
F10	125	70	102	M10	3	1	16	3	30.1	22	28.2	50
									33.1	24	32.2	
									37.1	27	36.2	
F12	150	85	125	M12	3	1	20	3	37.1	27	36.2	70
									44.1	32	42.2	

Connecting dimensions of **MODACT MOKP Ex** electric actuators
– connecting with keyway



„Z“ *(„C“)*



The position of groove for keyway according to ISO 5211 and DIN 3337 is in the position “Closed”. The position “Opened” is to the left of the position “Closed” when viewing in the direction to the local indicator of position.

The position “Z” *(“C”)* of the groove for keyway is identical with the position “Z” *(“C”)* on the local indicator of position.

Flange	ø d1	ø d2 f8	ø d3	d4	d7 H9	h3 max.	h2 min.	h1 max.	l1 min.	b4 Js 9	t3 +0.4 +0.2	ø d5
F04	65	30	42	M6	18	3	12	3	26	6	20.5	25
F05	65	35	50	M6	22	3	12	3	30	6	24.5	28
F07	90	55	70	M8	28	3	13	3	35	8	30.9	40
F10	125	70	102	M10	42	3	16	3	45	12	45.1	50
F12	150	85	125	M12	50	3	20	3	55	14	53.5	70

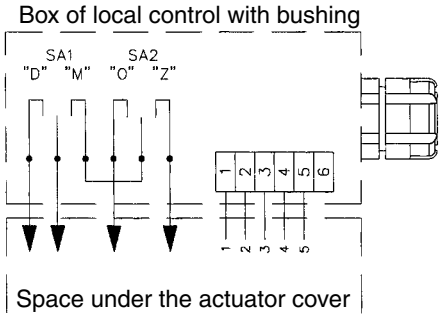
Wiring diagrams of **MODACT MOKP Ex** electric actuators

Legend:

SQ1 *(MO)* – moment switch for direction “opens”
SQ2 *(MZ)* – moment switch for direction “closes”
SQ3 *(PO)* – position switch for direction “opens”
SQ4 *(PZ)* – position switch for direction “closes”
SQ5 *(SO)* – signalling switch for direction “opens”
SQ6 *(SZ)* – signalling switch for direction “closes”
EH, ST – heating element with thermal switch
BQ1, BQ2 – double resistance transmitter of position 1 x 100 Ω
CPT1 – current position transmitter CPT 1Az
DCPT – current position transmitter DCPT
DCPZ – feeding source for DCPT
M1 ~, TH – electric motor, single-phase, with thermal protection
C – motor capacitor
M3~, TH – electric motor, three-phase, with thermal protection
SA1 – change-over switch “local” – “remote”
SA2 – change-over switch “opens” – “closes”
ZP2 – electronic position regulator
KO – power relay for direction “opens”
KZ – power relay for direction “closes”
F – thermal relay
BMO – block of local control
R1, R2 – 2x resistance protection 10 Ω for single–phase motors

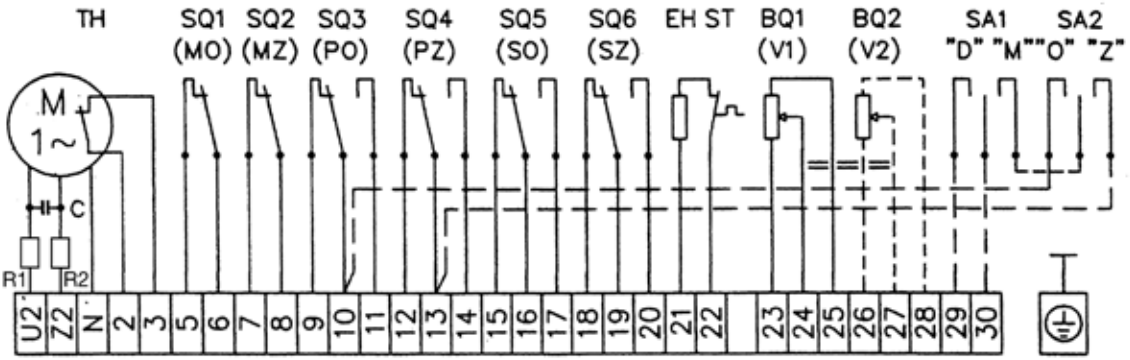
Wiring diagram:

Number of diagram	Elektric motor	Feed-back transmitter	Others
P0816	single-phase	1 x 100 Ω	
P0817	single-phase	CPT 1Az or without transmitter	
P0818 E	single-phase	DCPT + source	
P0819	three-phase	1 x 100 Ω	
P0820	three-phase	CPT 1Az or without transmitter	
P0821 E	three-phase	DCPT + source	
P0822 E	single-phase	DCPT	regulator ZP2
P0823 E	three-phase	DCPT	regulator ZP2, thermal relay, reversing power relay

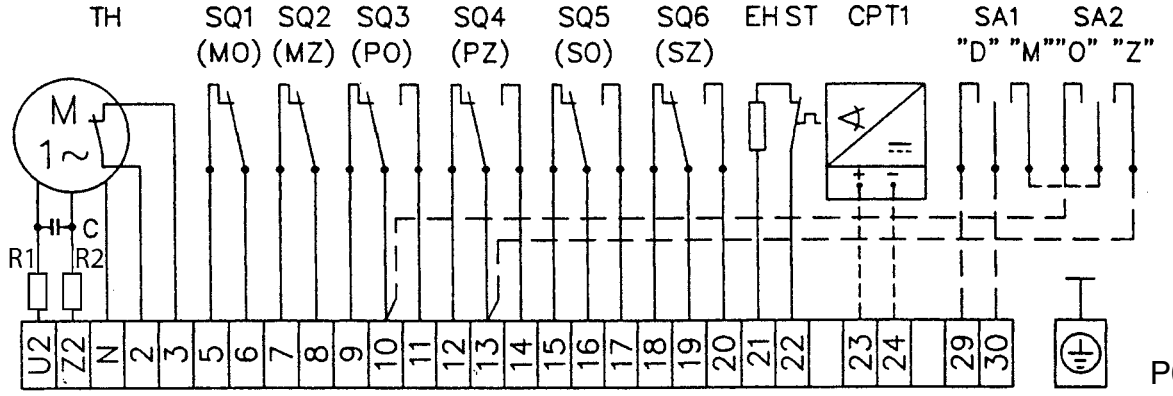


The actuators can be fitted with the block of local control *(dashed lined in the diagrams).* The actuator **MOKP Ex** has two cable bushings. **If the actuator is in the version with the block of local control,** one bushing is on the actuator body, the other on the body of local control. In order that the actuator can meet requirements for the version Ex, the conductors between the actuator and the local control are imbedded into an insulation material. In addition to conductors for connection of the local control, the insulation material also imbeds additional five conductors which are at disposal to the customer. In the actuator these conductors are designated with the numbers 1 - 5 and their ends are insulated. In the block of local control they are connected to the row terminal board on the terminals 1 - 5, *(the terminal no. 6 is free).*

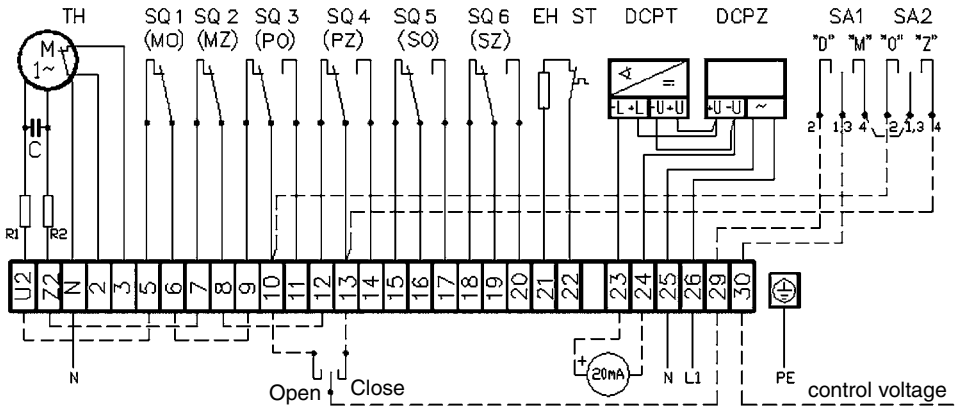
Wiring diagrams of **MODACT MOKP Ex** electric actuators,
Type No. 52 320 - 52 322



P0816



P0817

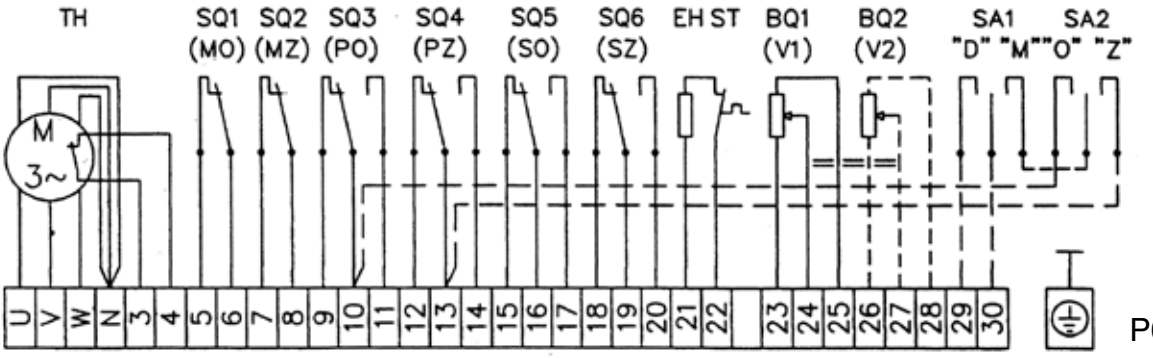


P0818–E

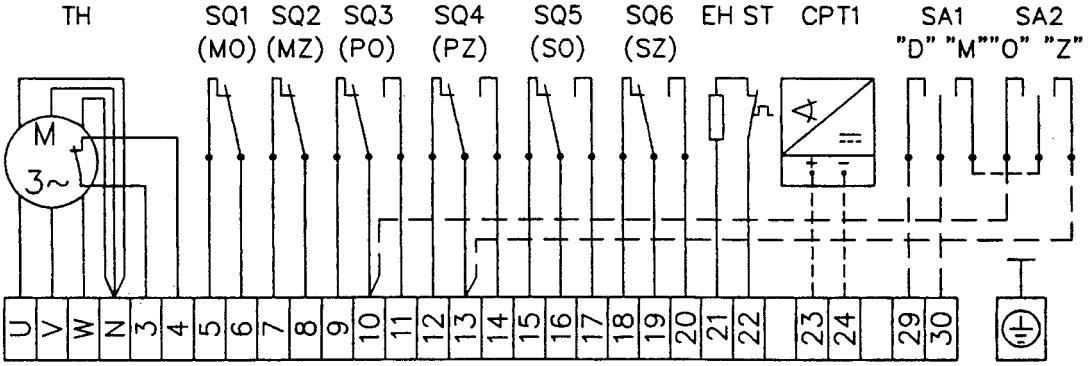
Note:

The position and signalling switches can work as a single-circuit type. State of contacts in the scheme is valid for the intermediate position.

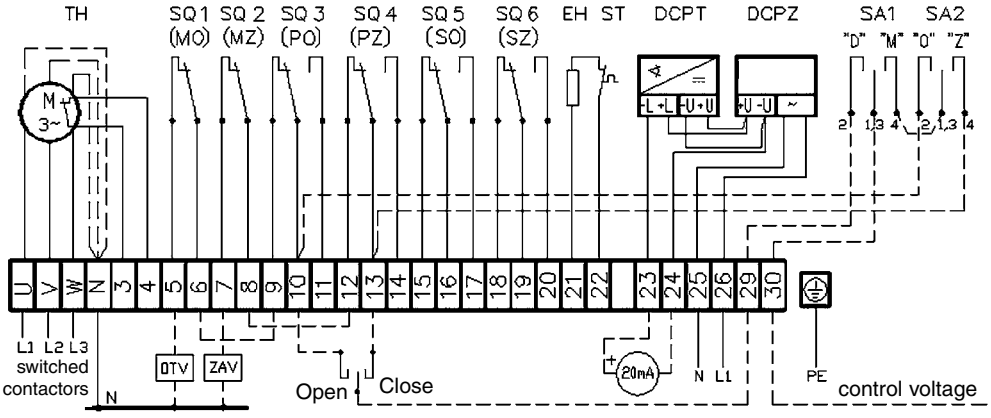
In the version with the current transmitter the user shall ensure connection of the double-wire circuit of the current transmitter to electric earth of the linked-up regulator, computer, etc. The connection should only be realized at one point in any part of the circuit outside of the electric actuator. The voltage between the electronics and the transmitter case must not exceed 50 V DC.



P0819



P0820



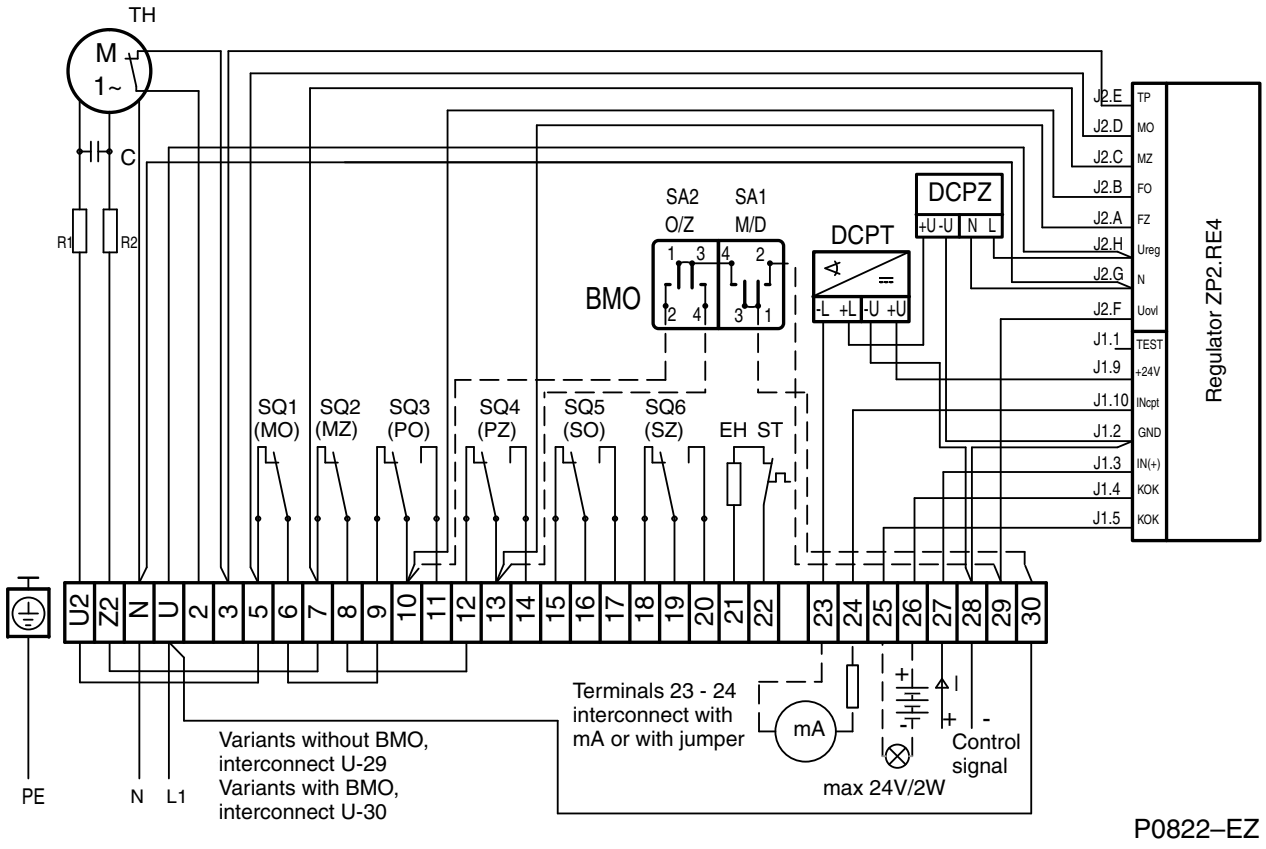
P0821–E

Note:

The position and signalling switches can work as a single-circuit type. State of contacts in the scheme is valid for the intermediate position.

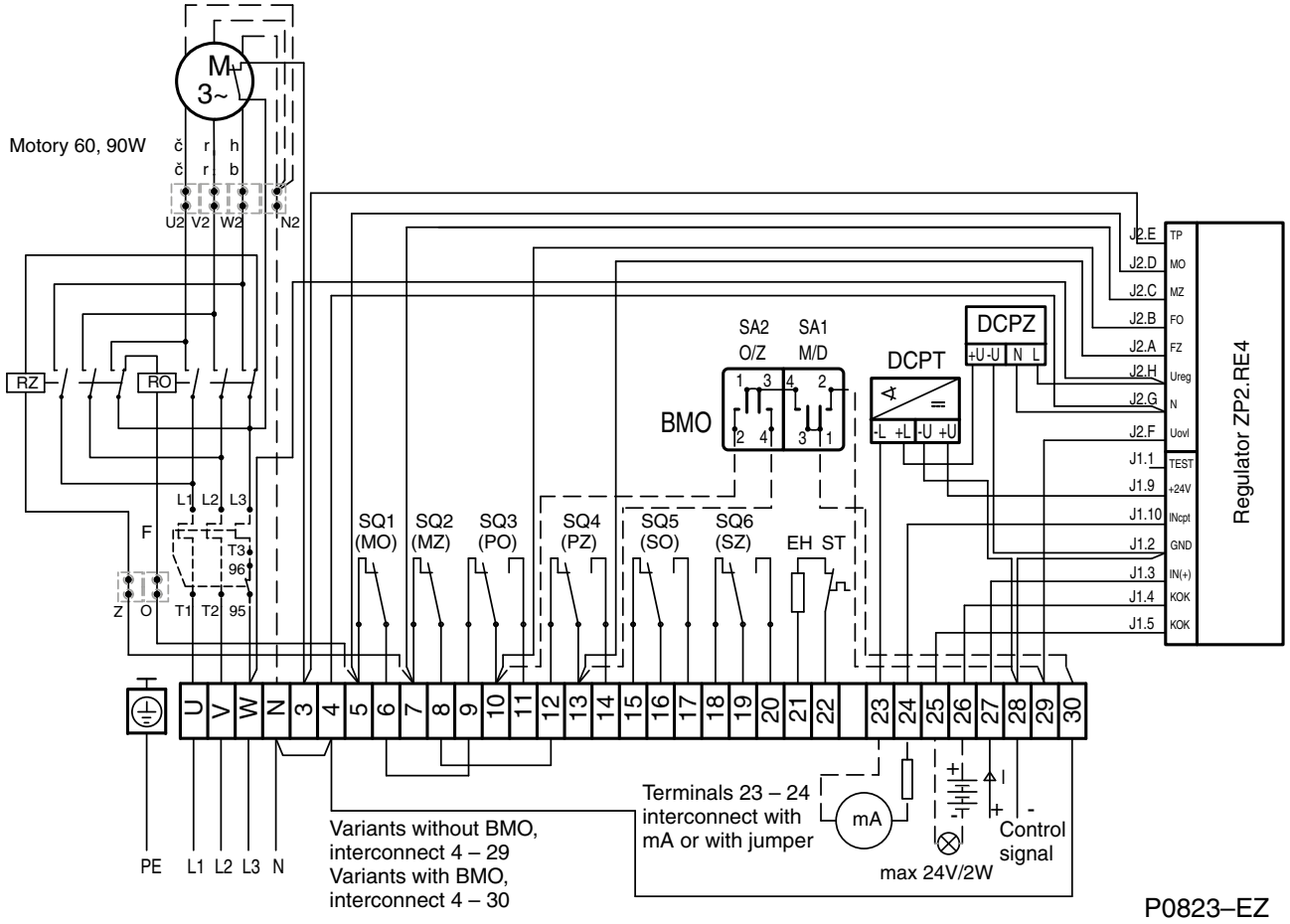
In the version with the current transmitter the user shall ensure connection of the double-wire circuit of the current transmitter to electric earth of the linked-up regulator, computer, etc. The connection should only be realized at one point in any part of the circuit outside of the electric actuator. The voltage between the electronics and the transmitter case must not exceed 50 V DC.

Wiring diagram of **MODACT MOKP Ex** Control electric actuators,
Type No. 52 320 - 52 322



P0822–EZ

Wiring diagram of **MODACT MOKP Ex** Control electric actuators,
Type No. 52 320 - 52 322



52 320 – relay Finder 56.34
52 321 a 52 322 – relay Schrack RM735730 + thermal relay Lovato

Note:

Analog input signal and analog feedback signal (if brought out of the actuator) must be conducted by shielded cables. The shielding must be connected to the signal source frame.

Spare parts for **MOKP Ex**

Name:	**Actuator type no.:**	**Using, note:**
“O” – ring 180x3	52 320	Between cover and box of power part
“O” – ring 210x3	52 321	Between cover and box of power part
“O” – ring 250x3	52 322	Between cover and box of power part
Micro-switch CHERRY DB1G-A1LC	52320 – 25322	MO,MZ; PO,PZ; SO,SZ

ZPA PEČKY, a.s.

Development, production and services of electric actuators and switchboards.
Top-quality sheet-metal processing (TRUMPF equipment), powder paint shop.

SURVEY OF PRODUCED ACTUATORS

KP MINI, KP MIDI
Electric single turn rotary actuators (up to 30 Nm)

MODACT MOK, MOKED, MOKP Ex, MOKPED Ex
Electric rotary single turn actuators for ball valves and flaps

MODACT MOKA
Electric rotary single turn actuators for nuclear power stations
application outside containmen

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

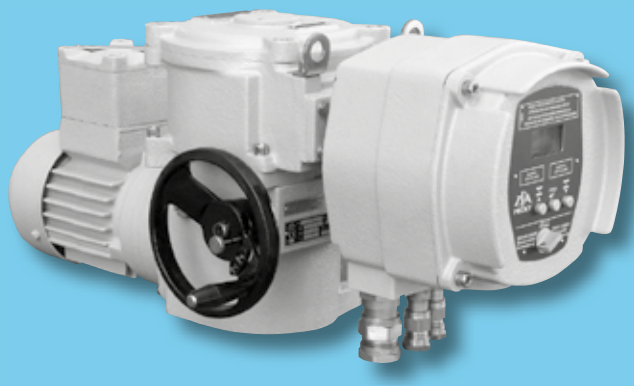
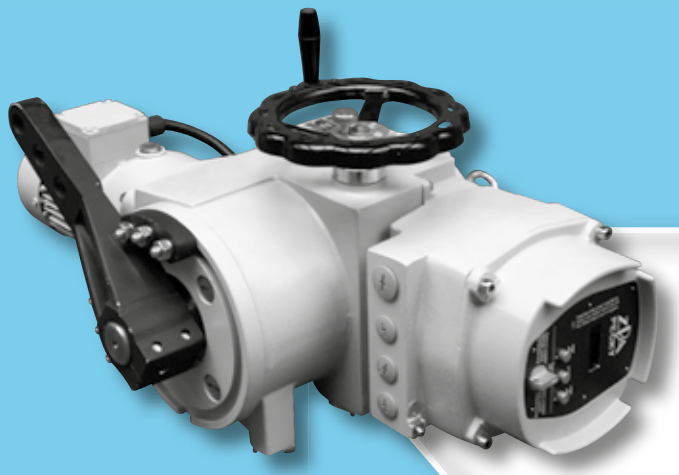
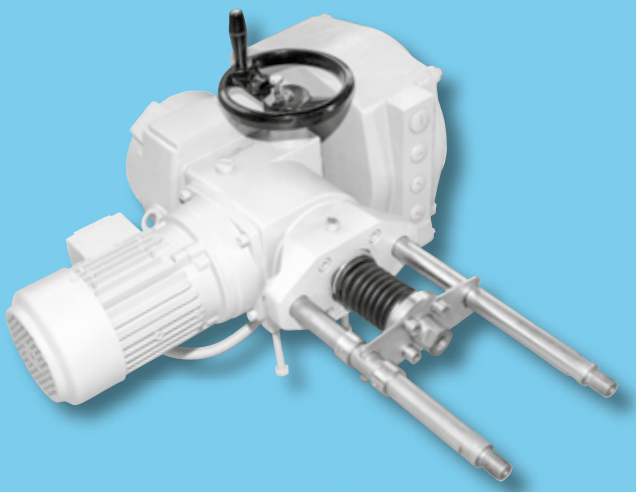
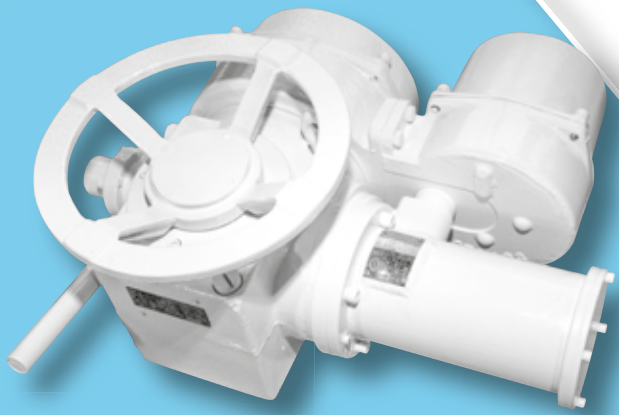
MODACT MPR Variant
Electric rotary (160°) lever actuators with a variable output speed

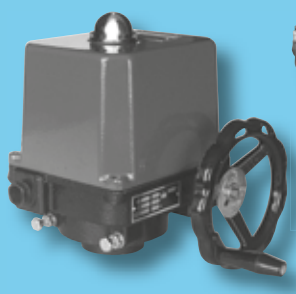
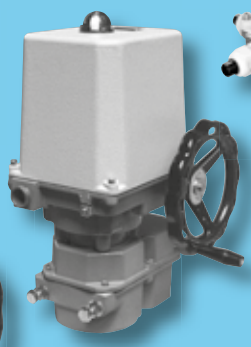
MODACT MPS, MPSP, MPSED, MPSPED
Electric rotary single turn lever actuators with a constant output speed

MODACT MTN, MTP, MTNED, MTPED
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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