



Electric Rotary (90°)
Part-turn Actuators

KP MINI
KP MINI CONTROL

Type number 52 997

KP MINI EEx
KP MINI CONTROL EEx

Type number 52 998



www.zpa-pecky.cz


ZPA Pečky, a.s. is certified company in accordance with ISO 90001 as amended.


1. APPLICATION


The **KP MINI and KP MINI EEx** rotary (90°) electric actuators with constant speed of the output shaft motion (*hereinafter electric actuators only*) have been specially designed for actuating fittings (*ball and flapper valves*), louvers, air flaps and other devices for which they are in respect of their characteristics suitable. They can be used in remote and automatic control circuits.

When equipped with an electronic position regulator with position feedback, these actuators can act as a final power control element of continuous-action control circuits used for regulation of physical variables.

Electric actuators **KP MINI EEx** in the non-explosive version Ex d IIC T6 are intended for control and operation in the environment with a risk of explosion of an explosive gaseous atmosphere in zones 1 and 2 according to **ČSN EN 60079-10 (332320)**; they are designed in compliance with the standards **ČSN EN 60079-0:2014** and **ČSN EN 60079-1:2015** for an explosive gaseous atmosphere in compliance with the standard **ČSN EN 60079-31:2014** for environments with flammable dust.

This is about non-explosive electrical devices of Group II, category 2 in environment potentially explosive by gases, vapours and mist - "G". The actuators are marked by sign of protection against explosion and symbols and categories of devices  II 2GD.

Complete actuator is designed as fixed closure „d“ with marking according to certification as follows:
 II 2G Ex db IIC T6 Gb -25 ≤ Ta ≤ 55 °C.

Actuator label marking for explosional atmosphere formed by a cloud of flammable coal dust in the air (zone 22):
 II 3D Ex tc IIIC T55°C Dc.

Electric actuator must not be exposed to heavy charging, e.g. intensive air-dust mixture streaming to prevent of creep electrostatic discharges.

Producer does not guarantee for damages caused by different use. Risk is carried by the user. Following these operation instruction belongs between correct condition of use.

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 substance in a dust or fibre form with air during atmospheric conditions, in which combustion after ignition extends into an unused 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 – is an area where, during usual operation, the probability of occurrence of an explosive atmosphere of a mixture of flammable substances in the form of gas, vapour or for with air is occasional.

Zone 22 – is defined as a environment, in which is creation of explosive atmosphere formed by a cloud of flammable coal dust in the air not probable. If explosional atmosphere will rise up, it will be only rarely and only during short time period. (*attachement no. 1 NV no. 406/2004 Sb.*)

Standards

The following basic standards apply to **KP MINI EEx** explosion-proof actuators:

- ČSN EN 60079-14 Regulations for electrical devices in areas with a danger of explosion of flammable gases and vapours.
- ČSN IEC 60721 Types of environment for electrical devices.
- ČSN EN 60079-0 Electrical devices for explosive gaseous atmosphere. General requirements.
- ČSN EN 60079-1 Electrical devices for explosive gaseous atmosphere. Explosion-proof closure “d”.
- ČSN EN 60079-10 Electrical 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 60079-31 Explosive atmospheres. Devices protected against ignition of dust by a closure „t“.

Designation of explosion-proof properties

It consists of the following symbols:

- Ex** Electric device complies with the standard ČSN EN 60 079-0 and related standards for various types of protection against explosion.
- db** Designation of the type of protection against explosion, explosion-proof closure according to ČSN EN 60 079-1.
- tc** Protection by a closure „t“, according to standard ČSN EN 60079-31 ed. 2:20014.
- IIC** Designation of the group of explosion-proof electric device according to ČSN EN 60 079-0.
- IIIC** Mark a group containing conductive dusts for explosive atmosphere with coal dust, according to ČSN EN 60079-0 ed 4:1013/Opr. 2:2014/A11:2014.
- T6** Designation of temperature class of explosion-proof electric device of the Group II according to ČSN EN 60 079-0.
- T55°C** Maximum surface temperature.
- 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.
- Dc** Marking cover "increased" level protection is not source of initiation in normal operation and can have some additional protection for security, that device will remain passive as a source of initiation, at regularly expected events according to ČSN EN 60079-10-2:2010/Opr. 1:2011/Z1:2015.
- IP 67** Marking cover level protection, according to standard ČSN EN 60079-0 and ČSN EN 60529.

2. OPERATING CONDITIONS

The **KP MINI (KP MINI Control, KP MINI EEx)** electric actuators should withstand the effects of operating conditions and external influences, Classes AC1, AD7, AE6, AF2, AG2, AH2, AK2, AL2, AM-2-2, AN2, AP3, BA4, BC3 and BE3N2 according to ČSN 33 2000-5-51 ed. 3.

Surrounding temperature

Operating temperature for **KP MINI** actuators is from -25 °C to +70 °C and for **KP MINI EEx** actuators is from -25 °C to +55 °C.

Relative humidity from 10 to 100 %.

Classes of external influences – as extracted from ČSN Standard 33 2000-5-51 ed. 3.

Class:

- 1) AC1 – elevation above sea level ≤ 2000 m
- 2) AD7 – water occurrence - shallow dipping - short-time
- 3) AE6 – strong dustiness.
- 4) AF2 – occurrence of corrosive or polluting substances in the 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) AK1 – occurrence of plant species or moulds without danger
- 8) AL2 – serious danger of the occurrence of animals (*insects, birds, small animals*)
- 9) AM2-2 – harmful effects of escaping stray currents
- 10) AN2 – medium sun radiation. Intensity from 500 to 700 W/m²
- 11) AP3 – medium seismic effects. Acceleration from 300 to 600 Gal
- 12) BA4 – staff capability. Instructed persons.
- 13) BC3 – frequent contact of persons with earth potential. Persons often touch foreign conductive parts or stand on conductive 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 corresponding to category of corrosion aggressiveness C4, C5-I and C5-M.

In following table is provided an overview of environment for each category 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.

Supply voltage

Rated AC voltage	230 V
The permissible supply voltage fluctuations are from	-15 % to +10 % of the rated value
Nominal supply voltage frequency	50 Hz or 60 Hz
The permissible frequency variation is	±2 % of the nominal value

Protective enclosure

The type of protective enclosure of the actuator is IP 67, according to ČSN EN 60529 (33 0330).

Self-locking

Self-locking facility of the actuators is secured up to the rated torque due to the characteristics of the electric motor used.

Protection

The actuators are fitted with an external and an internal protective terminal. The protective terminals are provided with marks, according to ČSN IEC 417.

Operating position

The actuator can be in any operating position.

3. DESCRIPTION AND FUNCTION

The **KP MINI (KP MINI Control)** electric actuators consist of the following basic units:

- a) **reversible synchronous motor with a permanently connected starting capacitor**
 - b) **power gearing with output shaft and universal clamp**
 - c) **electric outfit**
- a) The power gearing consists of a pinion attached to the output shaft of the electric motor, spur gearings and a geared segment coupled with the output shaft of the electric actuator. Supported on bearings, the output shaft is fitted on its outside with a universal clamp providing for connection to the driven shaft (*diameter of 12 to 22 mm or square s = 9 to 17 mm*). For control of the position-limit and signalling switches, adjustable cams

are fitted at the other end of the output shaft, which is extended in length into the actuator control part. Position of the cams is secured by retightening the upper and lock nuts. The electric actuators are also fitted with manual control.

- b) Electric outfit consists of four microswitches of which two are used for tripping the actuator when the end positions of the output shaft have been reached and two can be used for the position signalling of the output shaft, the actuator is also fitted with a position transmitter. When viewing from the top (*from the side of manual control*) the sequence of micro-switches is as follows: PO, SO, PZ, SZ.

In addition, the actuator is fitted with a position transmitter (*potentiometer or current transmitter*).

Outlets of the micro-switches, position transmitter, and electric motor are connected to a terminal board which serves for electric connection of the actuator to external circuits by means of a cable with conductors of maximum cross-section 1.5 mm²).

For sealing of inlet cables, the actuator is fitted with two cable bushings. Cable bushings PG 11 (*for cables \varnothing 5 - 10 mm*) are used for the actuators of type 52 997. Cable bushings CMP 20 - A2F (*for cables \varnothing 11 - 14 mm*) are used for the actuators of the version EEx, type 52 998. Protection against shock voltage is provided for by internal and external protective terminals.

A heating element is installed for establishing a micro-climate in the space of the control section.

Note: *If the actuator works in the environment of temperature exceeding 35 °C the heating element will not be switched on. In other cases the heating element should be used.*

The actuators KP MINI Type No. 52 998 are fitted with a reversible opening thermostat SM 4070; its role is to protect the motor in case of an abnormal operation. Using of this thermostat (*it opens at temperature 70 °C*) prevents increased surface temperature of the actuator.

A resistor of rating 10 W and resistance 18 k Ω is used as an anti-condensation heater.

Position transmitters

- a) **Resistance position transmitter** is a potentiometer of nominal value 100 Ω . It is transferred to a transmitter by fitting a friction clutch for easy setting.
- b) **Resistance transmitter with converter RNI-RT.** The converter RNI-RT is a supplement to the resistance transmitter. It transfers the signal from the resistance transmitter to the current output. The output signal is linear and proportional to the input signal. The converter is fed from the current loop; it requires no additional power source.

Technical parameters:

Feeding voltage	11 – 35 V DC, recommended 24 V DC
Measuring range	0 – 100 Ω
Output signal	4 – 20 mA
Measurement error	< 0.8 %

- c) **Transmitter DCPT2** is an electronic contact-less current transmitter of position. For its function, it uses magneto-resistant sensors. It is characterized by long service life and simple setting of working range by means of two push-buttons. It features a possibility of auto-diagnostics and error messages by a blinking code of the LED diode. The transmitter is fed from the source DCPZ.

Technical parameters:

Scanning of position	contact-less magneto-resistant
Working stroke	adjustable 60° – 360°
Non-linearity	max. \pm 1%
Loading resistance	0 – 500 Ω
Output signal	4 – 20 mA
Power supply	15 – 28 V DC, < 42 mA
Working temperature	-25 °C to +70 °C
Dimensions	\varnothing 40 x 45 mm

4. TECHNICAL PARAMETERS

Basic technical parameters - table of design variants

Type	Rated torque [Nm]	Working stroke [°]	Adjusting time (90°) [s]			Electric motor Type	Type number	
			DC	50 Hz	60 Hz		basic	supplementary
KP MINI + KP MINI EEx	30	90		30		SMR 300/1200 or RSM 63/10FDG	52 997	x x 1 x
				60	48		52 998	x x 2 x
Supply voltage, frequency								
AC 50 Hz			230 V			52 997 + 52 998	1 x x x	
Position transmitter - electronic position transmitter ZP 2.RE								
with position transmitter 1x100 Ω			without regulator			52 997 + 52 998	x x x 4	
			with regulator				x x x 5	
without position transmitter			without regulator				x x x 6	
			with regulator				x x x 7	
with position transmitter 2x100 Ω			without regulator				x x x B	
with position transmitter 4 – 20 mA with source			with regulator				x x x C	
union flange size			flange F03				x 1 x x	
			flange F04				x 2 x x	
			flange F05			x 3 x x		
			flange F07			x 4 x x		

Additional technical parameters

Duty:	S2 - 10 min.
	S4 - 30 % - 1,200 cycles/hour
Weight:	4 kg
Rated resistance of position transmitter:	1 x 100 Ω or 2 x 100 Ω (or with another rated value)
Linearity of position transmitter:	± 2 % of the resistance rated value
Hysteresis of position transmitter:	< 2 % of the resistance rated value
Output shaft play:	1.5°
Insulation resistance:	at least 20 MΩ under dry condition; at least 2 MΩ after a damp test
Actuator life:	at least 1x10 ⁶ operations with a running time of 0.75 s at the rated torque
Climatic resistance:	standard design
Design in respect of explosion-proofness:	standard design - Type No. 52 997
	explosion-proof design EExd II CT 6 - Type No. 52 998
Protective enclosure:	IP 67

Technical parameters of the electric motors used

Type of electric motor	Power [W]	Supply voltage [V]	Frequency [Hz]	Current [A]
SMR 300 - 1200	3,8	230	50	0,068
RSM 63/10FDG	4,2			0,045

Basic electric outfit:

- 2 position-limit switches (OPEN and CLOSE)
- 2 signalling switches (OPEN and CLOSE)
- 1 synchronous motor
- 2 cable bushings
- 1 terminal board
- 1 anti-condensation heater
- 1 handwheel

Additional electric outfit (according to the customer's requirements):

- 1 electronic position regulator
- 1 position transmitter

5. POSITION REGULATOR

The built-in position regulator allows automatic positioning of the actuator output shaft to be performed, depending on the analog input signal. At the regulator input, the input control signal is compared with the feedback signal of the position transmitter. The resulting regulating deviation, if any, is used for actuator run control; the actuator output shaft is then brought into the position corresponding to the input control signal value.

This regulator utilizes the high performance of the RISC processors MICROCHIP for performing all its functions, while at the same time enabling continuous system self-diagnosis to be effected and error messages to be displayed whenever a failure occurs. Due to this facility, the user need not make complicated adjustment as in the case of a current analog regulator. For this purpose, it is sufficient to start the initializing program to make the regulator perform all necessary functions.

Regulator software

- 1) The regulator can be programmed to perform the required functions in the following two ways:
 - By a PC via the RS 232 interface.
 - By means of the functional keys and LEDs on the regulator.

The following parameters can be programmed:

- P1** - Control signal
- P2** - Regulator response to the TEST signal and the error state
- P3** - Mirroring
- P4** - Regulator insensitivity
- P5** - Type of regulation

Moreover, the computer can be used for setting:

- active level of TEST signal
 - active level of TP signal
- 2) All operating states of the regulator can be monitored by PC via the RS 232 interface. In this case, the regulator issues error messages by means of LEDs or PC.
 - Presence of the TEST signal
 - Control signal missing
 - Limit switches (*faulty connection*)
 - Failure of position sensor
 - Failure of thermal protection

Technical parameters of the regulator

Supply voltages	A. 230 V	+10% -15%; 50 – 60 Hz
	B. 120 V	+10% -15%; 50 – 60 Hz
	C. 24 V	+10% -15%; 50 – 60 Hz
Input signals	analog	control signal 0 to 20 mA, 4 to 20 mA, 0 to 10 V
	two-valued	TEST contact from superior system (<i>simulation of faulty condition</i>) State of OPEN and CLOSE torque-limit switches of electric actuator*)
Output signals	two-valued	2x contact of relay 8 A/230 V, protected by fuse F 1.6 A signalization of failure - KOK contact (24 V, 2 W)
	5x LED 4 – 20 mA	feeding, failure, set parameters, opens, closes Maximum load impedance 350 Ω (<i>with rated feeding voltage</i>). Maximum load impedance 100 Ω (<i>with feeding voltage reduced by 15 %</i>)
Position transmitter	potentiometer 100 – 10,000 Ω **) DCPT current transmitter **)	
Error report	TEST mode failure of feedback transmitter end-limit switches reversed*) control signal missing actuator switched off in intermediate position by end-limit switch*)	

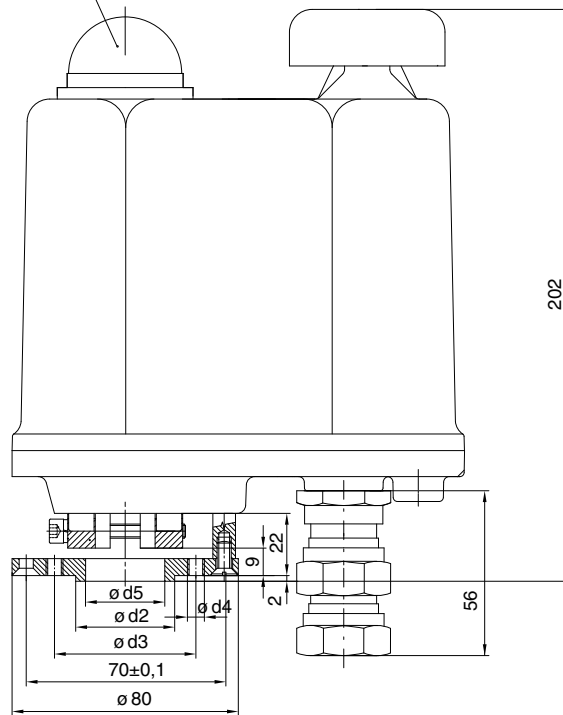
Response to failure	failure of feedback transmitter control signal missing TEST mode	actuator into position Test, error message actuator into position Test, error message actuator into position Test, error message
Adjusting devices	2x functional key for setting parameters without PC communication connector for connecting PC	
Regulator linearity	0.5 %	
Regulator insensitivity	1 – 10 % (<i>adjustable</i>)	
Operating temperature range	-25 °C to +75 °C	
Dimensions	75 x 75 x 25 mm	

**) The end-limit switch is the position-limit switch of the electric actuator connected so that the actuator motion is stopped in the given direction. During the auto-calibration, the regulator ZP2 measures the feedback signal at which the end-limit switches make the electric actuator to switch off (for both directions of motion) and stores it in memory as parameter. During regulation, the state of end-limit switches is continuously monitored. If the electric actuator is switched off by the end-limit switch in a position different from that corresponding to the position found during the auto-calibration, the regulator shall evaluate this state as an error.*

****) Type of position transmitter (resistance / current) is set automatically during the auto-calibration.*

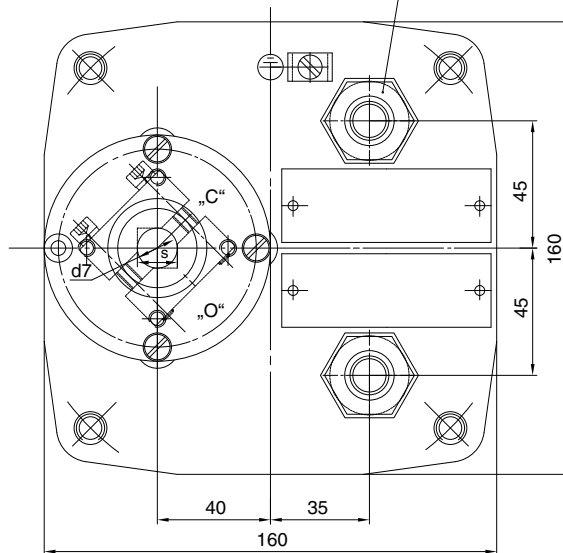
Dimensional sketch of the **KP MINI** electric actuators, Type No. 52 997, 52 998 design with flange F03, F04, F05 (actuator in OPEN position)

only Type No. 52 997



2x cable bushing P11 (52997)

2x cable bushing M20x1,5 (52998)

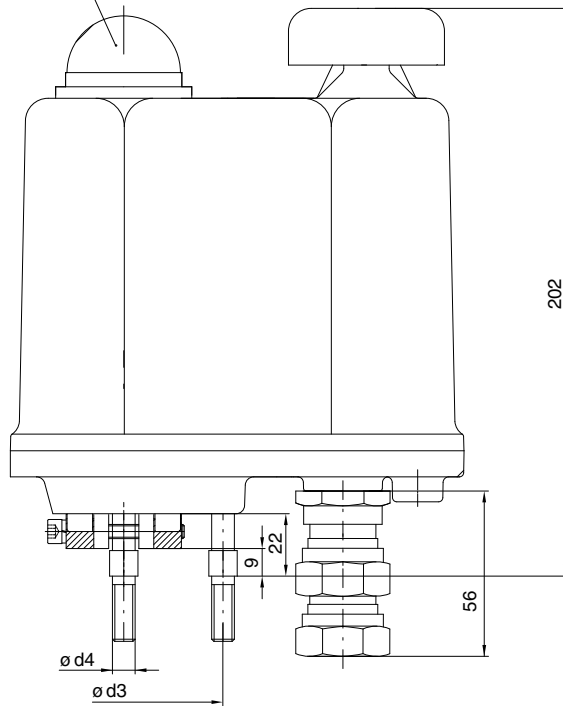


Connecting dimensions for actuator connection to a valve
(any other connection should be consulted with the manufacturer beforehand).

Flange	Dimension					
	d2	d3	d4	d5	s	d7
FO3	25	36	M5	20	9-14	12-20
FO4	30	42	M5	25	9-17	12-22
FO5	35	50	M6	28	9-17	12-22

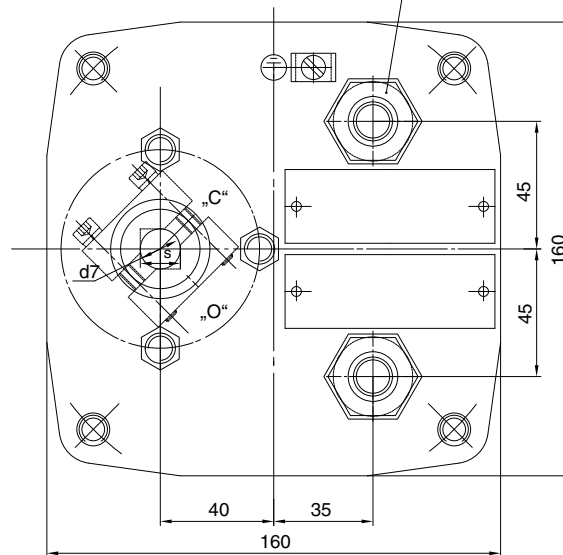
Dimensional sketch of the electric actuators, Type No. 52 997, 52 998
design with flange F07 (actuator in OPEN position)

only Type No. 52 997



2x cable bushing P11 (52997)

2x cable bushing M20x1,5 (52998)



Connecting dimensions for actuator connection to a valve
(any other connection should be consulted with the manufacturer beforehand).

Flange	Dimension					
	d2	d3	d4	d5	s	d7
FO7	-	70	M8	-	9-17	12-22

Internal wiring diagrams of the electric actuators

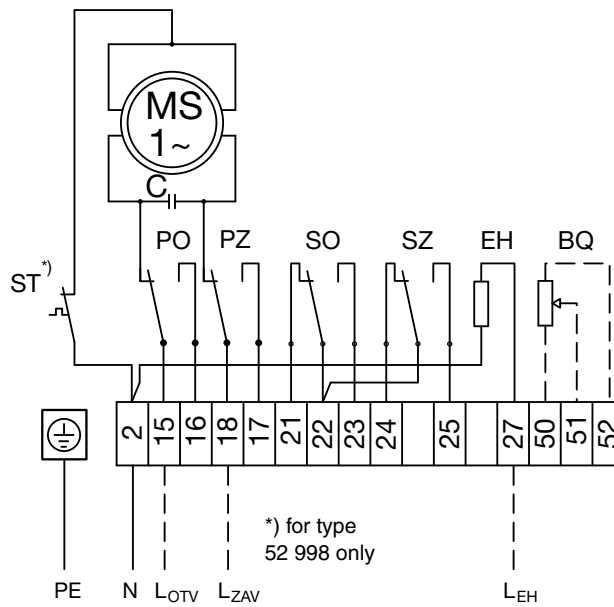
Legend:

PO open position-limit switch
 PZ close position-limit switch
 SO open signalling switch
 SZ close signalling switch
 EH anti-condensation heater
 BQ position transmitter

MS1~ single-phase motor
 C motor capacitor
 M~ direct current electric motor
 ST thermostat (*only Type No. 52 998*)
 DO, DZ diodes for connecting respective position-limit switches
 (*according to sense of rotation of the motor*)
 ZP2.RE three-position motor regulator

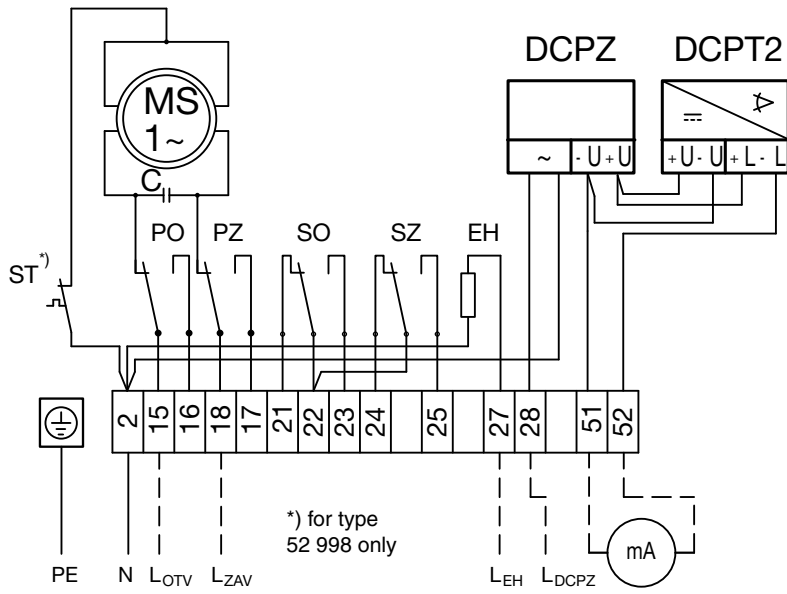
Internal wiring diagram of electric actuators **KP MINI**

P0853



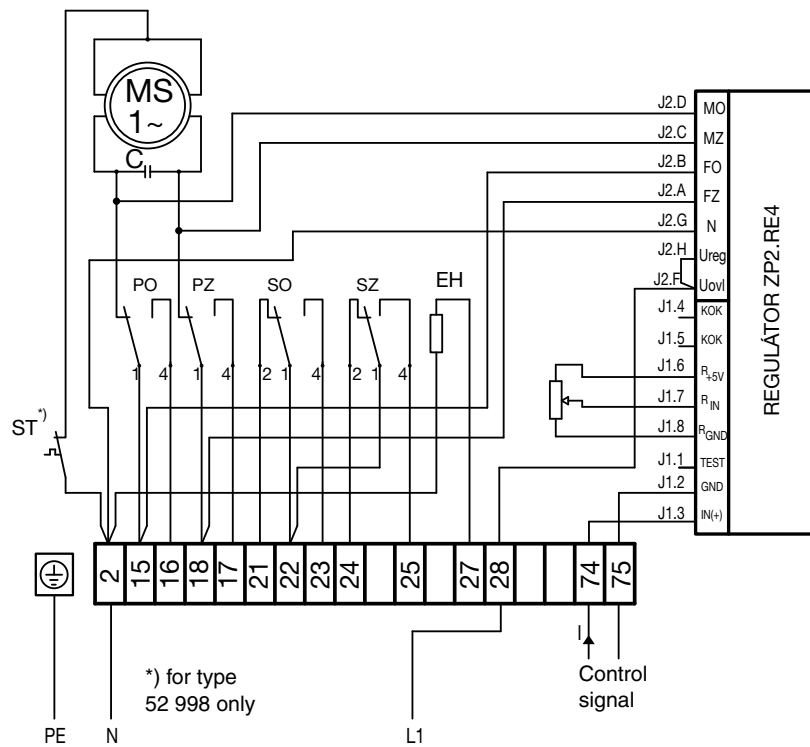
Internal wiring diagram of electric actuators **KP MINI**
with current transmitter of position **DCPT2**

P0853-E



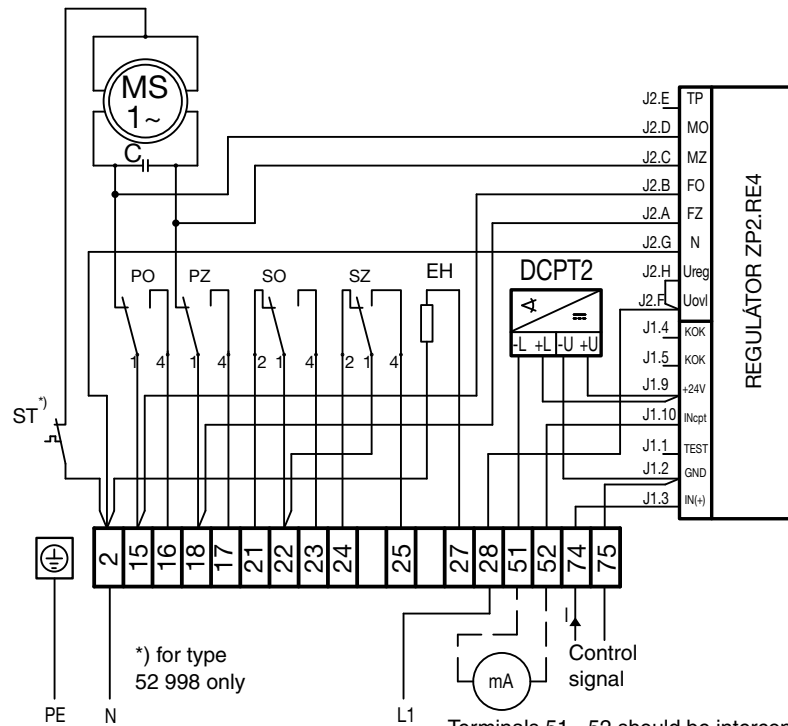
Internal wiring diagram of electric actuators **KP MINI**
with position regulator and resistance transmitter

P0850



Internal wiring diagram of electric actuators **KP MINI**
with position regulator and current transmitter DCPT2

P0850-E



Terminals 51 - 52 should be interconnected with mA or a jumper wire



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 rotary (90°) actuators (up to 30 Nm)

MODACT MOK, MOKED, MOKP Ex

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

MODACT MOKA

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

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

Electric rotary multi-turn actuators

MODACT MO EEX, MOED EEX

Explosion proof electric multi-turn actuators

MODACT MOA

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

MODACT MOA OC

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

MODACT MPR VARIANT

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

MODACT MPS KONSTANT, MPSED

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

MODACT MTN, MTP, MTNED, MTPED

Electric linear thrust actuators with a constant output speed

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



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