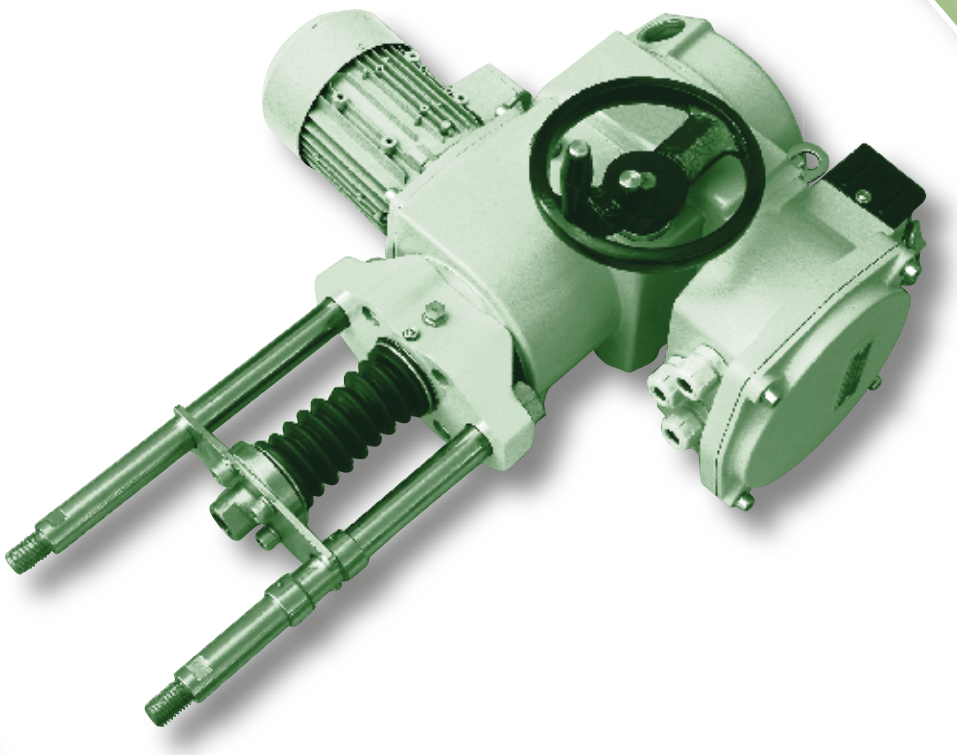
ZPA PEČKY, a.s.



MOUNTING INSTRUCTIONS

Electric Linear (Pull-rod) actuators

MODACT MTN, MTP

Type numbers 52 442, 52 443

CERTIFICATE

TÜV NORD

Management system as per

EN ISO 9001 : 2008

In accordance with TÜV NORD CERT procedures, it is hereby certified that

ZPA Pečky, a.s.
Třída 5. května 166
289 11 Pečky
Czech Republic

with sites acc. to the annex

applies a management system in line with the above standard for the following scope

Development and production of electric actuators, switchboards, production of Roots blowers and sheet metal treatment.

Certificate Registration No. 04 100 950161
Audit Report No. 624 362/400

Valid until 2015-09-24
Initial certification 1995-03-01

Certification Body
at TÜV NORD CERT GmbH

Praha, 2012-09-25

This certification was conducted in accordance with the TÜV NORD CERT auditing and certification procedures and is subject to regular surveillance audits.
The annex (1 page) is the integral part of the certificate.
TÜV NORD CERT GmbH Langemarckstrasse 20 45141 Essen www.tuev-nord-cert.com

TGA-ZM-07-06-00

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APPLICATION

The **MODACT MTN, MTP** actuators are used for remote two-position or three-position control of the valves by a reverse rectilinear motion.

The **MODACT MTN, MTP Control** actuators are fitted with an electronic position controller. In association with the valve exhibiting a suitable control characteristic, they form a position servo-loop. The output pull-rod of these actuators is automatically brought into a position corresponding to the input signal value of the controller.

The actuators can be used even for other devices for which they are in respect of their characteristics and parameters suitable. In some special cases, the contemplated use of the actuators should be consulted with the manufacturer.

OPERATING CONDITIONS, OPERATING POSITION

Operating conditions

The **MODACT MTN, MTP** ***(MODACT MTN, MTP Control)*** actuators should withstand the effect of operating conditions and external influences, Classes AC1, AD5, AD7, AE4, AE6, AF2, AG2, AH2, AK2, AL2, AM-2-2, AN2, AP3, BA4 and BC3 according to ČSN 33 2000-5-51 ed. 3.

When placed on an open area, the actuator is recommended to be fitted with a light shelter to protect it against direct action of atmospheric effects. The shelter should overhang the actuator contour by at least 10 cm at the height of 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. One or two heater elements should be connected, as required.

Installation of the actuators at a location with incombustible and non-conducting dust is possible only if this has no adverse effect on their function. It is advisable to remove dust whenever the layer of dust becomes as thick as about 1 mm.

Notes:

A sheltered location is considered a space where atmospheric precipitations are prevented from falling at an angle of up to 60° from the vertical.

The location of the electric motor should be such that cooling air has free access to the motor and no heated-up blown-out air is drawn in the motor again. For air inlet, the minimum distance from the wall is 40 mm. Therefore, the space in which the motor is located should be sufficiently large, clean and ventilated.

Surrounding temperature

Operating temperature for **MODACT MTN** actuators is from -25 °C to +70 °C or from -40 °C to +60 °C, for **MODACT MTP** actuators from -25 °C to +60 °C.

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

Class:

1) AC1 – Altitude ≤ 2,000 m above sea level
2) AD5 – Spouting water; water can spout in any direction
   AD7 – Shallow dipping; possibility of occasional partial or complete covering *(for the type MTP only)*
3) AE4 – Light dustiness
   AE6 – Heavy dustiness, *(MTP only)*
4) AF2 – Corroding atmosphere and pollutants; the presence of corroding pollutants is significant
5) AG2 – Average mechanical stress; in current industrial plants
6) AH2 – Medium vibrations; in current industrial plants
7) AK2 – Serious risk of growth of vegetation and moulds
8) AL2 – Serious danger of the occurance of animals *(insects, birds, small animals)*
9) AM2-2 – Normal level of 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

Operating position

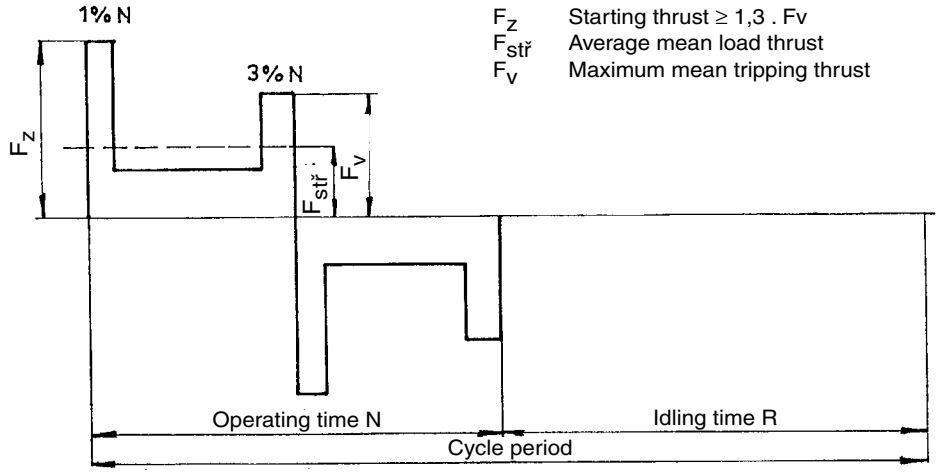
The actuators **MODACT MTN, MTP,** type no. 52 442, 52 443 can be used in any operating position.

OPERATION MODE, SERVICE LIFE OF ACTUATORS

Operation mode

According to ČSN EN 60 034-1, actuators can be operated in S2 load category *(the course of load is shown in the picture).* The operation time at +50 °C shall be 10 minutes, the average mean load thrust value shall be below or equal to 60 per cent of the maximum tripping thrust F_V. According to ČSN EN 60 034-1, the actuators can also be operated in the S4 mode *(interrupted operation with acceleration intervals).* The load factor N/N+R shall be maximum 25 per cent, the longest operation cycle N + R is 10 minutes. The maximum number of switching actions in automatic control mode is 1200 actions per hour. The average mean load thrust at load factor of 25 per cent and 50 °C shall not exceed 40 per cent of the maximum tripping thrust F_V.

The maximum average mean of the load thrust equals the rated thrust of the actuator.



F_Z Starting thrust ≥ 1,3 . Fv
$F_{stř}$ Average mean load thrust
F_V Maximum mean tripping thrust

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

TECHNICAL DATA

Supply voltage

The rated supply voltage of the actuators is 3 x 230 / 400 V, 50 Hz *(3 x 220 / 380 V, 50 Hz)* with permissible line voltage fluctuations between +10 % and -15 % and frequency shift within ±2 %. Over these ranges, the rated values of all parameters are retained except for the readjusting speed of the output part and the starting thrust; the latter is directly proportional to the square of line voltage variation. Actuators employing another voltage and/or frequency are available upon special request. The basic technical parameters should be determined individually for each supply voltage and frequency.

Protective enclosure

Protection of the actuators

MODACT MTN *(MODACT MTN Control)* – IP 55
MODACT MTP *(MODACT MTP Control)* – IP 67

Noise

Acoustic pressure level A	max. 85 dB *(A)*
Acoustic power level A	max. 95 dB *(A)*

Tripping thrust

At the factory, the tripping thrust has been adjusted within the min./max. range giving in Table 1, according to the customer's requirements. If no tripping thrust adjustment is required the actuator is adjusted to its maximum tripping thrust.

Starting thrust

The starting thrust of the actuator is a calculated value determined by the starting torque of the electric motor and the total gear ratio and efficiency of the actuator. After run reversation, the actuator can produce a starting thrust for the duration of 1 to 2 revolutions of the output shaft when torque-limit switching is locked. This can take place in either end position or in any intermediate position.

Self-locking

The actuator is self-locking provided that the load only acts in the direction against motion of the actuator output shaft. Self-locking is ensured by a roller arrest immobilizing the electric motor rotor even in the case of manual control.

In order to observe safety regulations, the actuators cannot be used for driving transportation lifting devices with possible transport of persons or for installations where persons can stand under the lifted load.

Working stroke

The ranges of working stroke are given in Table No. 1.

Manual control

Manual control is performed by a hand wheel directly *(without a clutch)* and it is also possible when the electric motor is running. By rotating the hand wheel in the clock-wise direction the actuator output pull rod is thrown out *(closes).*

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.

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 except the region in which they are locked *(see Starting thrust).*

The tripping torque can be adjusted within the range shown in Table No. 1. The torque-limit switches are locked if the load torque is lost after they have been brought into the OFF-position. This feature secures the actuator against the so-called "pumping".

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 MTN, MTP** electric actuators can be supplied without position transmitter can be fitted with position transmitter:

a) Resistance transmitter 2 x 100 Ω.

Technical parameters:

Position scanning	resistance
Turning angle	0° – 160°
Non-linearity	≤ 1 %
Transition resistance	max. 1.4 Ω
Permitted voltage	50 V DC
Maximum current	100 mA

b) Type CPT 1A 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 1A is set by a potentiometer on the transmitter body and its starting value by corresponding partial turning of the transmitter.

Technical parameters of CPT 1A:

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		-25 °C to +60 °C
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 MTN, MTP Control** with the regulator ZP2.RE5, 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 1A 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.

Anti-condensation heater

The actuators are fitted with an anti-condensation heater preventing condensation of water vapour. 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”.

The former change-over switch can be built-in as two-pole or four-pole. The change-over switches are installed in a terminal-board box and the control elements on the lid of this terminal-board box.

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.

Dynamic brake

The brake is an optional accessory to the actuators **MTN, MTP Control.** After opening the contactor, it induces dynamic braking moment in the electric motor lasting for several tenths of second. It reduces dramatically the run-down time and regulation is thus more precise. When the actuator is in a standstill no braking moment is exerted.

The actuators without regulator are fitted with autonomous brake **BAM-002.** For its function, it requires auxiliary contacts of the contactors and auxiliary contact of the over-current relay. It is dimensioned for electric motors 3 x 230 / 400 V, output up to 550 W.

The actuators with regulator ZP2RE5 are fitted with simpler controlled brakes **BR2.** They are interconnected with the regulator that provides impulse for action.

According to the electric motor output, corresponding variant is chosen:

BR2 550 of output up to 550 W,

BR 2.2 of output up to 2.2 kW.

If outputs higher than 2.2 kW are to be braked, electric motors of special version with an electromagnetic brake should be used.

Switching of electric motor, contactor unit

The actuators in variants Control are fitted with built-in reversing contactor combinations. These are assembled of two contactors and an over-current relay. The combination also includes mechanical blocking that prevents both contactors from being closed at the same time. This could, for instance, happen in case of wrong connection of jumpers on the terminal board. The blocking is not dimensioned for long-term action. The over-current relays protects the electric motor against over-loading and is dimensioned with respect to its output. According to the actuator version, the contactors are controlled by the regulator, change-over switch of local control or external input. Control voltage is 230 V / 50 Hz as a standard; it is supplied via contacts of position and/or moment micro-switches. Thus, these micro-switches need not be led out of the actuator.

The contactors used have a long mechanical service life and great reserve in switching ability; consequently, the electric service life is also sufficient for particular use. The thermal relay is chosen so that it would reliably protect the electric motor against overload. Set-up and outfit of the actuators provide for simple connection to power-supply and control circuits.

The power-supply circuits can be common for the whole group of actuators, which will save the cabling.

ELECTRIC PARAMETERS

External electric connection

a) Terminal board

The electric actuator is equipped with a terminal board for connection to external circuits. This terminal board uses screw terminals allowing conductors with a maximum cross-section 4 mm^2 to be connected. Access to the terminal board is obtained after removal of the terminal box cover. All control circuits of the electric actuator are brought out to the terminal board. The terminal box is fitted with cable bushings for connecting the electric actuator. The electric motor is fitted with an independent box with a terminal board and a bushing.

b) Connector

According to the customer's requirements the **MODACT MTN, MTP** actuators can be fitted with the connector to provide for connection of control circuits. This connector uses screw terminals allowing conductors with a maximum cross-section 4 mm^2 to be connected. ZPA Pečky, a.s. also supplies a counterpart for the cable. In order to connect the cable to this counterpart it is necessary to use special crimping pliers.

Actuator internal wiring

The internal wiring diagrams of the **MODACT MTN, MTP** 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 terminal box. 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. Isolation resistance of the electric motor is min. 1.9 MΩ. See Technical specifications for more details.

Electric strength of electric circuits isolation

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

Deviations of basic parameters

Tripping thrust	±12 % of the maximum value of the range
Adjusting speed	-10 % of the maximum value of the range
	+15 % of the rated value *(in no-load operation)*
Setting of signalling switches	±2.5 % of the maximum value of the range
	(for the ranges, refer to the Mounting instructions).
Hysteresis of signalling switches	max. 4 % of the maximum value of the range
Setting of position-limit switches	±0.2 mm of the output pull-rod displacement
	(without the influence of running-down)
Hysteresis of position-limit switches	max. 1.2 mm of the output pull-rod displacement
Clearance of output part	max. 1 mm

Protection

The actuators are fitted with one internal and one external protection terminal for ensuring protection against electric shock injury according to ČSN 33 2000-4-41. One protection terminal is also installed on the electric motor. The protection terminals are marked according to ČSN EN 60 417-1 and 2 (013760).

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

DESCRIPTION

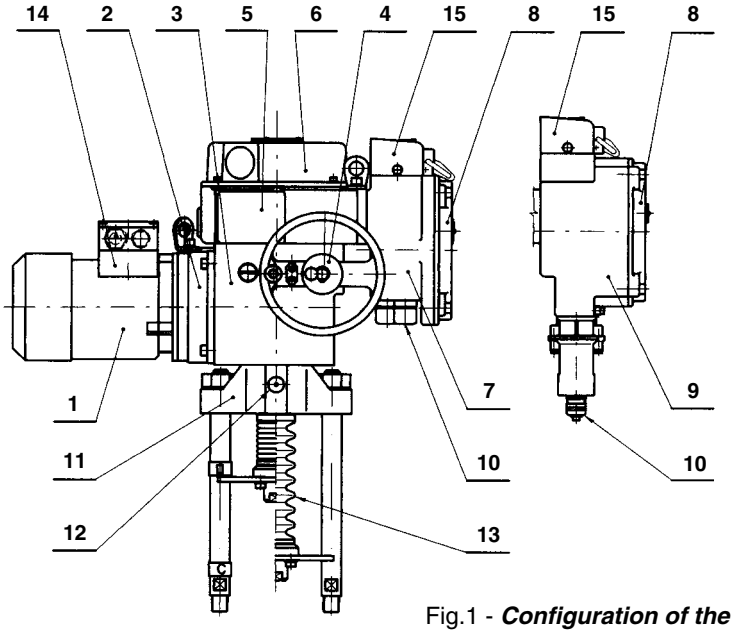
In respect of their basic connecting dimensions, the actuators have been engineered for direct mounting to the valve. The connection of the actuator to the valve is provided by means of columns according to ČSN 18 6314, art. 1.3, or by means of columns and a flange *(in non-standard design **MTN, MTP 40** only).*

For transmission of the output pull-rod motion of the actuator to the valve, the actuator is provided with a coupling, according to ČSN 18 6314, Type A, art. 1.3 *(with female thread),* or Type B, art. 1.3 *(with male thread)* - see dimensional sketches and Tab. 2.

Actuator configuration *(Fig.1)*

The three-phase asynchronous motor 1 drives via countershaft gearing 2 the sun gear of a differential gear unit enclosed in the supporting actuator box *(power gear transmission)* 3. In the mechanical power control mode, the crown gear of the planet differential unit is held in a steady position by a self-locking worm gear drive. The handwheel 4, which is connected with the worm, allows manual control to be accomplished even during motor operation.

The output hollow shaft is fixably coupled to the planet-gear carrier. The output shaft of the actuator is extended to the rectilinear mechanism 11 which converts the rotary shaft motion to the rectlilinear motion of a pull-rod. The output shaft goes into the control box 5 in which all control devices of the actuator have been concentrated, including position--limit, signalling and torque-limit switches, a position transmitter and the anti-condensation heater. The operation of the position-limit and signalling switches is derived from output shaft rotation via mechanisms.



Legend:
1 – Three–phase asynchronous motor
2 – Countershaft gear box
3 – Power transmission gear
4 – Handwheel
5 – Control box
6 – Control box cover
7 – Terminal box – design with terminal box
8 – Terminal box cover
9 – Terminal box – design with connector
10 – Cable bushings for control
11 – Rectilinear mechanism
12 – Grease cup
13 – Dust seal
14 – Terminal board of electric motor
15 – Local controller

Fig.1 - ***Configuration of the actuator***

The operation of the torque-limit switches is derived from the axial displacement of a “floating worm” of the manual control unit which is sensed and transferred to the control box by means of a lever. All controls are accessible after removal of cover 6 of the control box. Access to the terminal box 7 *(9)* is obtained after removal of cover 8. Cable inlets are secured by cable bushings 10.

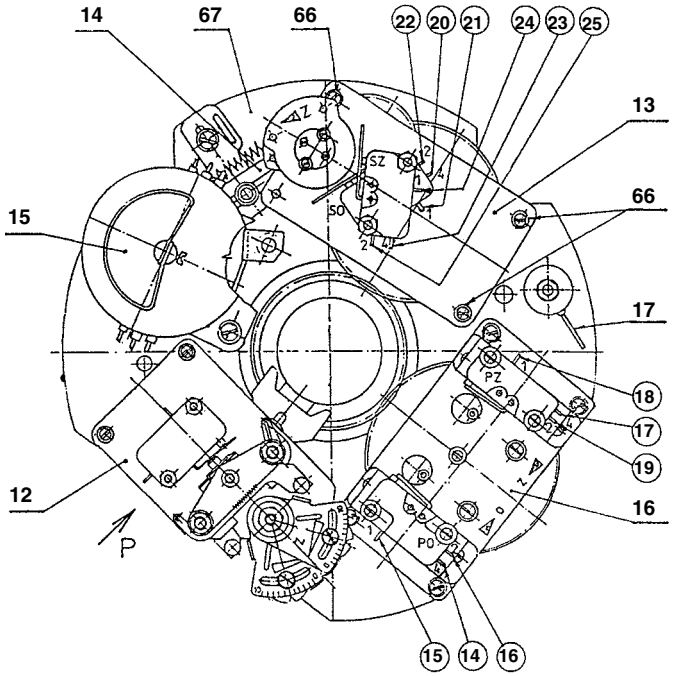
The electric motor has its own terminal board 14 with a cable leadthrough. The position of the output shaft can be read on a position indicator mounted on the pull-rod. In addition, it can be read on a local position indicator enclosed in the control box cover. The individual operating functions of the actuator, e.g., torque-limit switching,position-limit switching, auxiliary signalling, remote position indication *(potentiometer position transmitter),* are provided by mechanical groups *(units),* which are accommodated on the control board enclosed in the control box *(Figs 2 and 2a).*

Control units *(Figs 2, 2a)*

a) Torque-limit switching unit *(12)*
b) Signalling unit *(13)*
c) Adjusting mechanism of potentiometer or gear wheel of current transmitter *(14)*
d) Potentiometer position transmitter with mechanical position indicator or current transmitter of 4 to 20 mA without position transmitter *(15)*
e) Position-limit switching unit *(16)*
f) Anti-condensation heater *(17)*

Caution!

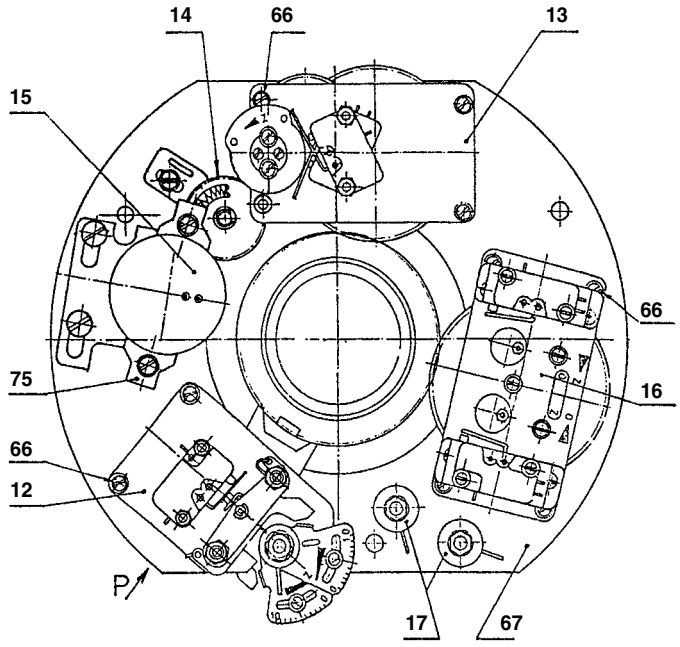
The microswitches used in the individual units do not allow two voltages of different values or phases to be applied to contacts of the same microswitch. Thus, they can be used as a switch, cut-out or change-over switch for a singlecircuit only.



Legend:
12 – Torque–limit switching unit
13 – Signalling unit
14 – Transmitter adjusting mechanism
15 – Potentiometer position transmitter with mechanical position indicator
16 – Position–limit switching unit
17 – Anti–condensation heater
66 – Fixing screws
67 – Basic control board

The encircled numbers correspond to the numbers of terminals on the terminal board of the actuator.
The microswitches can be used as one-circuit devices only.

Fig.2 - ***Base plate - desing with potentiometer***



Legend:
14 – Drive wheel
15 – Current position transmitter
75 – Shim plates

Other items are identical to those used on the control board with potentiometer shown in Fig.2. The same applies to the numbers of microswitch terminals. In the actuator, Type No. 52 442, the transmitter support is positioned at an angle of 180 °C with respect to the illustrated position.

Fig.2a - ***Base plate - design with current transmitter***

For control of the actuator at the site of installation, deblocking device consisting of deblocking switch and local control switch can be fitted, if required.

Block of local control consists of two change-over switches. One is used to switch between remote and local control, the second is used to open or close the valve when the first switch is set to local control. Both change-over switches are part of the terminal box. Change-over switch local / remote control can be locked with a padlock against unauthorized manipulation (padlock is included in the delivery).

Description and functions of control units

a) The torque-limit switching unit *(Fig. 3)*

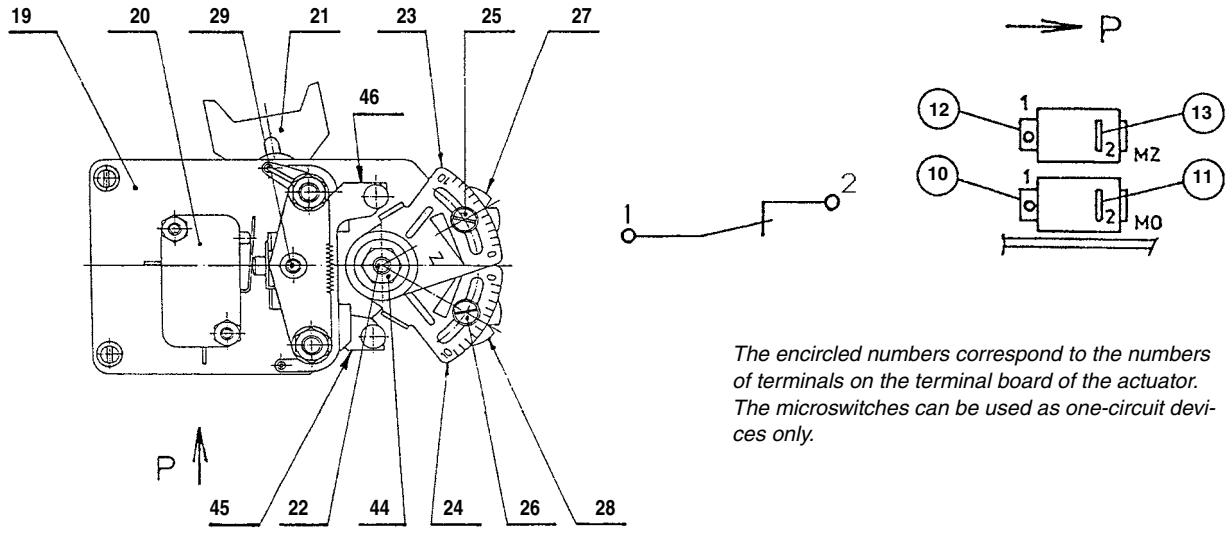
- forms an independent assembly group consisting of the base plate 19 which carries microswitches 20, while at the same time providing for bearings of the torque control shaft 22 and the locking shaft 29.

The torque control shaft transmits movements of the floating worm from the power transmission gear to the CLOSE torque-limit microswitch *(MZ)* or the OPEN torque-limit microswitch *(MO)* by means of segments 23 or 24 and levers 45 or 46. The amount of limit-switching torque and thus indirectly even the axial force on the actuator pull-rod can be adjusted by the segments being turned with respect to the tripping levers. For readjusting the amount of the tripping torque outside the factory, the segments 23 are provided with a scale on which the points of adjusting the maximum and minimum torques have been marked red individually for each actuator, the adjusted torque being indicated by slots in the segments 27 and 28. However, the numbers on the scale provide no direct indication of the tripping torque adjustment, but the scale divisions serve only for a more accurate division of the band between the points of maximum and minimum tripping torques and thus for more accurate adjustment of the torque outside the factory in a location where no test stand is available. The segment 23 is designed for the CLOSE direction, whereas the segment 24 is designed for the OPEN direction.

The torque control unit is also fitted with a locking mechanism. On operation of the torque-limiting switch, thismechanism locks this switch and thereby precludes the switch from being reclosed unprompted and thus prevents the actuator from pulsing. Moreover, the locking mechanism prevents the torque-limit switch from opening after reversal of the actuator.

The locking mechanism acts in either direction of the output shaft motion of the actuator in the end positions as well as in the intermediate position for the duration of 1 to 2 revolutions of the output shaft after reversal thereof.

With the output shaft of the actuator loaded at a reversed torque, the torque control shaft 22 and thus the segments 23 and 24 turn by a slight amount. From the segments, this displacement is transmitted to the tripping lever 45 or 46. When the torque on the output shaft of the actuator reaches the value to which the torque-limit switching unit has been adjusted, the tripping lever depresses the button of the corresponding microswitch so that the electric motor is disconnected from the mains, thus stopping the actuator.



The encircled numbers correspond to the numbers of terminals on the terminal board of the actuator. The microswitches can be used as one-circuit devices only.

Legend:

19 – Base plate
20 – CLOSE and OPEN torque–limit switches (MZ, MO)
21 – Shifter
22 – Torque control shaft
23 – Upper CLOSE segment
24 – Upper OPEN segment
25 – CLOSE lock screw
26 – OPEN lock screw
27 – Lower CLOSE segment with slot
28 – Lower OPEN segment with slot
29 – Locking shaft
44 – Lock nut
45 – OPEN tripping lever
46 – CLOSE tripping lever

Fig.3 - ***Torque-limit switching unit***

Adjusting procedure of the torque-limit switching unit

To adjust a different tripping torque from that adjusted at the factory, the procedure is the following: Loosen the lock nut 44 *(see Fig. 3)* and then the lock screw 25 *(for the CLOSE direction)* or 26 *(for the OPEN direction).* Place a screwdriver in the slot of the upper segment 23 or 24 and turn the segment till the slot in the segment 27 or 28 tallies with the respective scale graduation line. This scale division line can be determined so that the difference *(in Nm)* between the maximum and the minimum adjustable torques is divided by the number of divisions between the marks of the minimum and maximum torques. In this way, the amount of tripping torque *(in Nm)* per scale division is obtained, making it possible to determine by interpolation the scale division with which the slot in the segment 27 or 28 should tally. The colour division line which is the nearest to number 10 marks the point of adjustment of the maximum tripping torque, whereas the other division line shows the point of adjustment of the minimum tripping torque. The torque control unit should be never adjusted so that the slot in the lower segment is outside the zone marked by the colour scale division lines. After adjustment of the tripping torque, retighten the lock screw 25 or 26 and the lock nut 44.

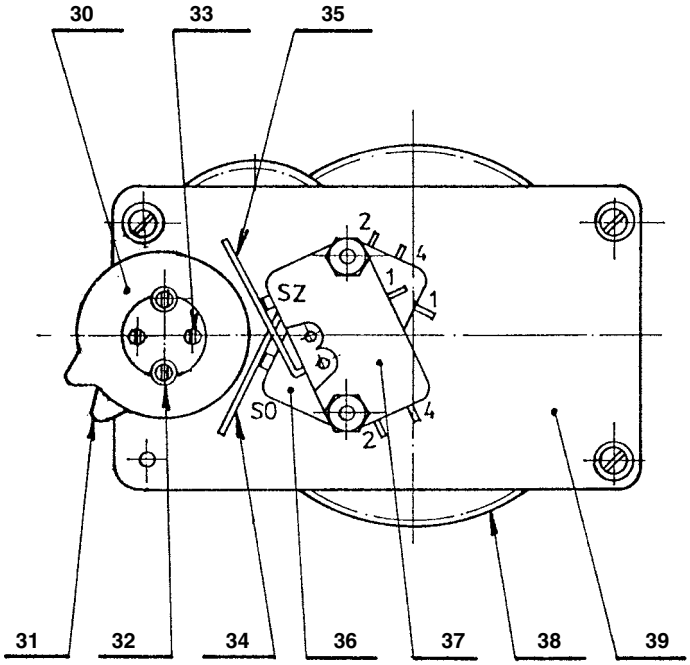
b) Signalling unit *(Fig. 4)*

This unit transmits an electrical signal to indicate the position of the output shaft of the actuator, drive of the unit being provided via gear wheel 38 by the output shaft through a multistage gearbox to the cams 30 and 31 which control the OPEN signalling microswitch 36 *(SO)* and the CLOSE signalling microswitch 37 *(SZ).* The instant of operation of the signalling switches can be selected at any point of the working stroke of the actuator except the narrow band about the end positions. *(The signalling switch should close before the position-limit switch while the output shaft is still moving).* The upper cam 37 operates in the CLOSE direction, whilst the lower cam 36 operates in the OPEN direction.

Designed as an independent assembly unit, the signalling unit has been assembled on the support 39 under which there are gears arranged as shown in the kinematic diagram of the Fig. 5. This gearing has been assembled so that the adjusting wheel K3 can be moved to different levels designated I, II and III after loosening of the lock screw 47. In this way, the range of adjustment of the signalling switches and the position transmitter can be changed, depending on the working stroke of the actuator. Fig.6 is a table showing the ranges of adjustment for the individual positions of the adjusting wheel K3.

Adjustment of the signalling unit

If the ranges of adjustment of the signalling switches and the transmitter are required to be changed the position of adjusting wheel K3 should be changed. For this purpose, the signalling unit should be partially withdrawn from the control box *(which is possible due to a sufficient length of lead-in wires of the microswitches).* This can be done after removal of the 3 screws 66 *(Figs 2 and 2a)* used for mounting the unit onto the base plate. After the signalling unit has been adjusted to the required range it should be brought back into its original position. Before retightening the screws 66, the correct meshing of gears K1 and K2 should be checked *(see Fig. 5).* Put on at the lower end of the camshaft 48 *(Fig. 5)* is the pinion 49 *(Fig. 5)* which is connected to the shaft 46 by an adjustable friction clutch. On this pinion, the motion required for driving the potentiometer position



Legend:
30 – CLOSE direction cams
31 – OPEN direction cams
32 – Screws of CLOSE direction cams
33 – Screws of OPEN direction cams
34 – OPEN direction lever
35 – CLOSE direction lever
36 – OPEN direction microswitch (lower)
37 – CLOSE direction microswitch (upper)
38 – Drive gear
39 – Supporting plate of signalling unit

The encircled numbers correspond to the numbers of terminals on the terminal board of the actuator.
The microswitches can be used as one–circuit devices only.

Diagram of microswitches

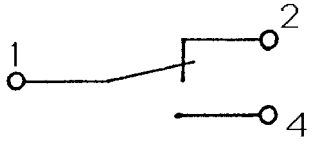


Fig. 4 - ***Signalling unit***

transmitter is sensed. The arrangement of cams and microswitches of the signalling unit is shown in Fig. 4. Shoulders of the cams 30 or 31 deflect the levers 34 and 35, which in turn control the microswitches 36 *(SO)* and 37 *(SZ)*. When adjusting the signalling and position-limit switches and the position transmitter, the output shaft of the actuator should be moved to the position in which changing-over of the microswitches should take place or the required position of the position transmitter cursor should be reached. When adjusting the signalling switches, the following procedure should be used: First, loosen the screws 32 *(for the CLOSE signalling switch SZ)* or 33 *(for the OPEN signalling switch SO),* as shown in Fig. 4. Then, turn the cam 30 or 31 in the direction of the arrowhead till the microswitch closes. In this position, hold the cams and retighten the lock screws.

Caution!

After any manipulation of the lock screws in the control section of the actuator, these screws should be secured against loosening due to vibrations by a drop of quick-drying varnish. If the screws have been secured previously in this way then, during adjustment, varnish residue should be removed and the surface under them should be properly degreased.

c) Adjusting mechanism of the transmitter *(Fig. 8)*

This mechanism consists of 2 geared rocker arms 51 and 55 on which spring 52 is hung. A rail with pins 53 provides for mutual sliding movements of the two rocker arms. This group turns on pivot 54. The whole mechanism is mounted onto the basic control plate 67 *(Fig. 2 and 2a)*. The geared rocker arms are in mesh with pinion 43 of the transmitter *(Fig. 10)* and pinion 49 *(Fig. 5)*. Then, the position of pivot 54 determines

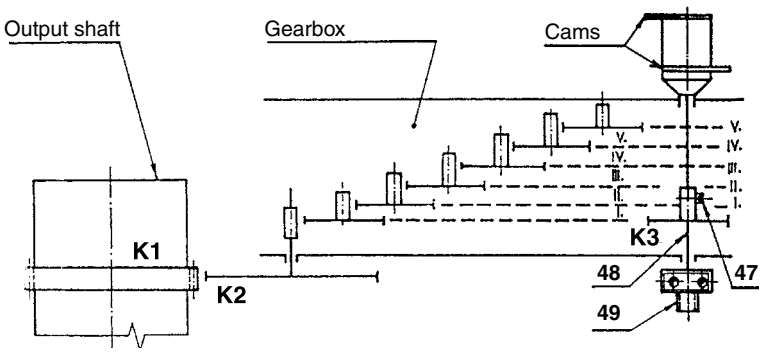


Table for setting the working stroke of the gearbox of the signalling unit (resistive position transmitter)

Gear change step	Actuator Type No. - Adjustment range of working stroke	
	52 442	52 443
I.	10 - 12,5 mm	-
II.	12,5 - 52,5 mm	20 - 66 mm
III.	52,5 - 100 mm	66 - 120 mm

Legend:

K 1 – Gear
K 2 – Drive gear
K 3 – Adjusting gear
47 – Lock screw of adjusting gear
48 – Camshaft
49 – Pinion with friction clutch

Fig.5 - ***Kinematic diagram of gears (version with resistive position transmitter)***

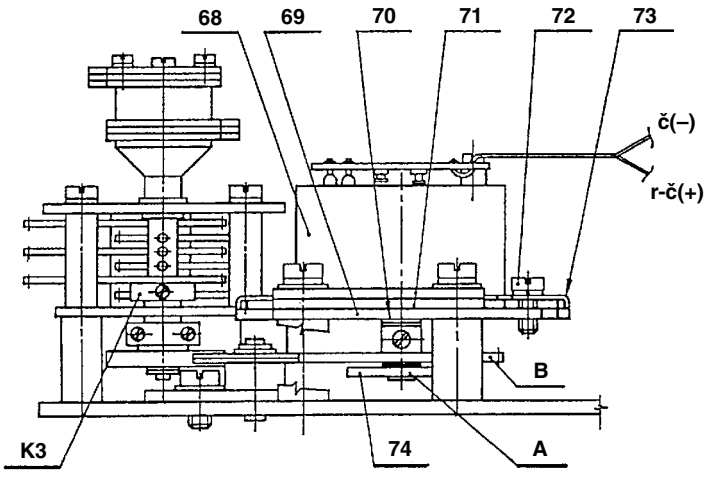


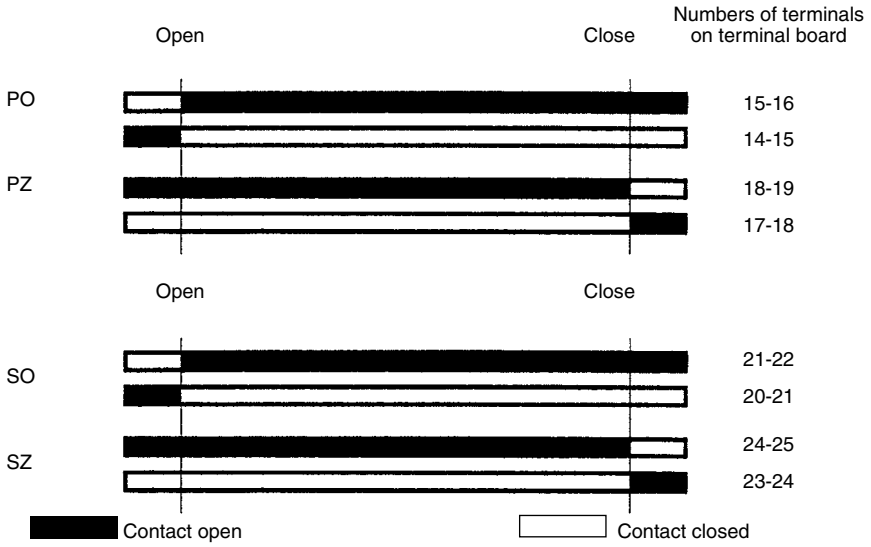
Table for setting the working stroke of current position transmitter CPT 1A

Gear-change step	Gear on transmitter	Type No.	
		52 442	52 443
I.	B	10 - 16,5	–
II.	A	10,5 - 21	20 - 26,4
	B	17 - 34,5	24 - 48
III.	A	33,5 - 67	44,4 - 88,8
	B	58 - 100	81 - 120

Fig.6 - ***Gears on the position transmitter (version with current position transmitter)***

Note:

For the individual gear-change steps, the position of the adjusting gear for the actuators, Type No. 52 442, is shown at left and for the actuator, Type No. 52 443, at right.



Operating diagram of position-limit switching and signalling switches

the gear ratio of the adjusting mechanism, i.e., the angle of positioning the transmitter and the local position indicator is always 160° for different values of working stroke of the actuator and thus for different amounts of displacement of the camshaft in the signalling unit. This ensure that, at any working stroke, the rated value of the transmitter signal, i.e., 100 Ω, is always available.

d) Resistive position transmitter, including position indicator *(Fig. 9)*

The heart of this unit is a resistive position transmitter 42 whose rated value of the resistive signal is 100 Ω. The transmitter has a shaft which has been brought out on both sides. Put on the shaft at the lower end, the pinion 43 has been arranged to slip on the shaft in either end position of the transmitter, a feature that is extremely suitable for adjusting the unit.
At the upper end of the transmitter shaft, the position indicator 40 is mounted so that it can be adjusted with respect to the inspection hole in the control box cover.

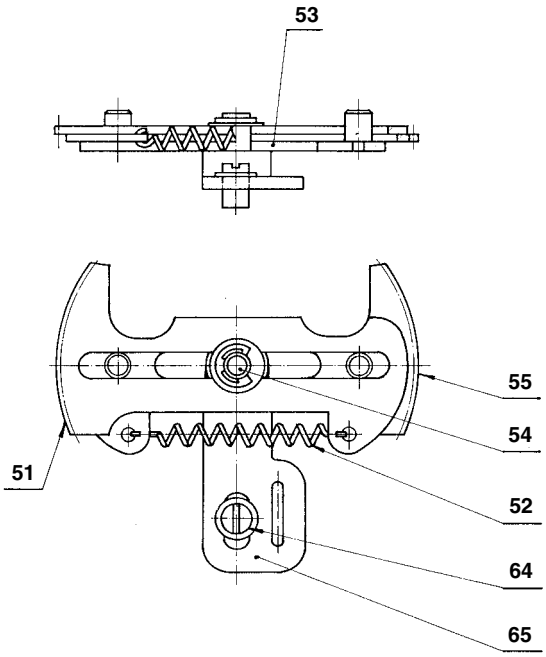
Adjustment of the resistive position transmitter and position indicator

For position adjustment of the transmitter, the procedure is the following: In the CLOSE position of the output shaft, press down the geared rocker 51 *(Fig. 8)* to move it towards the transmitter out of engagement with the pinion 49 *(Fig. 5)*. Then, turn the rocker clockwise up to the stop formed by a column under the signalling unit. Finally, bring the rocker into engagement with the pinion 49, whereupon the transmitter pointer should indicate 0°. If this is not the case, withdraw the rocker 51 from the stop and depress the rocker 55 to release the position transmitter pinion. Set the transmitter pointer near the transmitter scale division line 0° so that, after bringing the rocker 55 into engagement with the position transmitter pinion, their teeth fit into one another correctly. This can be checked by carefully turning the transmitter shaft. Then, throw the rocker 51 out of engagement and move it up to the stop, exerting an increased force. *(After the transmitter pointer has been set to 0° the pinion starts slipping)*. Bring the rocker 51 again into engagement with the pinion 49 *(Fig. 5)*. In this position, the oval holes in the geared rockers are parallel with the oval hole in the basic control plate 67 *(Figs 2 and 2a)*. Thus, the transmitter has been adjusted for the CLOSE position.

Then, loosen the screw 64 *(Fig. 8)*, move the adjusting lever 65 towards the transmitter up to the stop and retighten the screw 64.

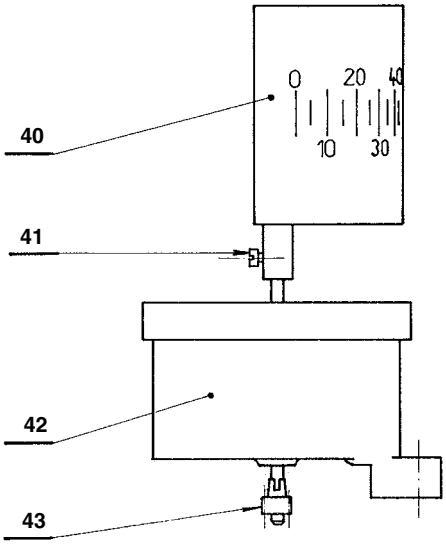
Bring the actuator into the OPEN position, the transmitter pointer being set to a position between 0° and 160°. Loosen the screw 64 and turn the adjusting lever 65 anticlockwise till the transmitter pointer tallies with the scale line 160°.

Then, retighten the screw 64 and secure it against loosening by a drop of quick-drying varnish. In this way, the transmitter has been adjusted for the OPEN position. The position indicator is mounted on the shaft of potentiometer 42 by screw 41 *(Fig. 9)*. Loosen this screw and, in the OPEN position, turn the indicator so that the division line 100 on its scale tallies with the red point on the sight glass in the control box cover. Finally, retighten the screw 41 and secure it by a drop of quick-drying varnish.



Legend:
51 – Geared rocker arm
51 – Spring
53 – Rail with pins
54 – Adjusting pin
55 – Geared rocker arm
64 – Screw
65 – Adjusting lever

Fig. 8 - ***Adjusting mechanism of the resistive transmitter***



Legend:
40 – Position indicator
41 – Screw of position indicator
42 – Resistive transmitter
43 – Pinion of resistive transmitter

Fig. 9 - ***Resistive transmitterr***

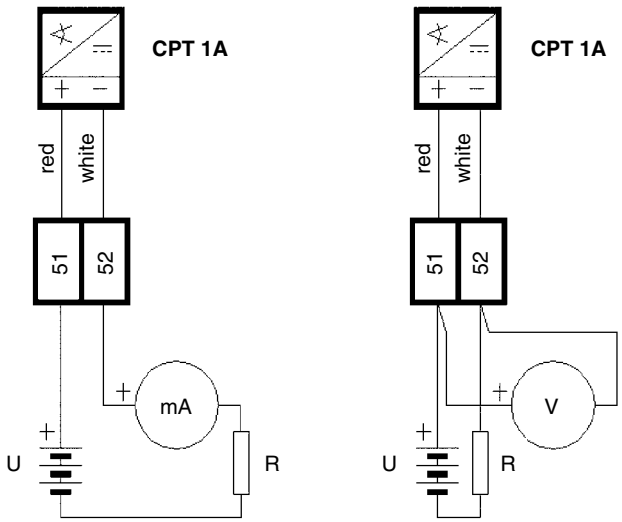
e) Current position transmitters

Current position transmitter CPT 1A – setting

Before starting setting the current transmitter it is necessary to set the end-limit positions *(torque or position switches)* of the actuator and connect them into the tripping circuit of the electric motor. In case of an external source of feeding voltage, verification must be carried out that it does not exceed the maximum value 30 V DC *(limit value when CPT 1A 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 1A; 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 1A 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 1A 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 first 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 can best be done using a digital voltmeter of input resistance at least 1 MΩ. This voltage should fall within the range of 18 – 25 V DC; in no case may it exceed 30 V *(otherwise the transmitter can be damaged).* Then, connect the transmitter so that the positive pole of the power source is connected to the positive pole of the transmitter, i.e. to the pin with red insulator *(r) + (nearer to the transmitter centre).* The terminal with white coating *(wired to the terminal 52)* is connected to the negative pole of the transmitter *(white insulator).* In the latest design variants the red conductor is plus and the black one is minus.

A milli-ammeter, preferentially a digital one with accuracy at least 0.5 %, is temporarily connected in series with the transmitter. The output shaft is moved to the position CLOSE. The signal value 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 fixing the transmitter shim plates and secure with a drop of varnish against loosening.

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

Note:

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

Current position transmitter DCPT – setting

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:

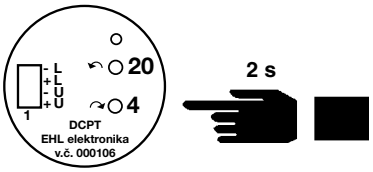
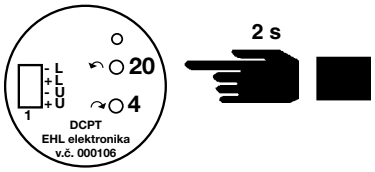
Press the push-button **"20",** then the push-button **"4"** and keep them depressed until LED blinks.

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.

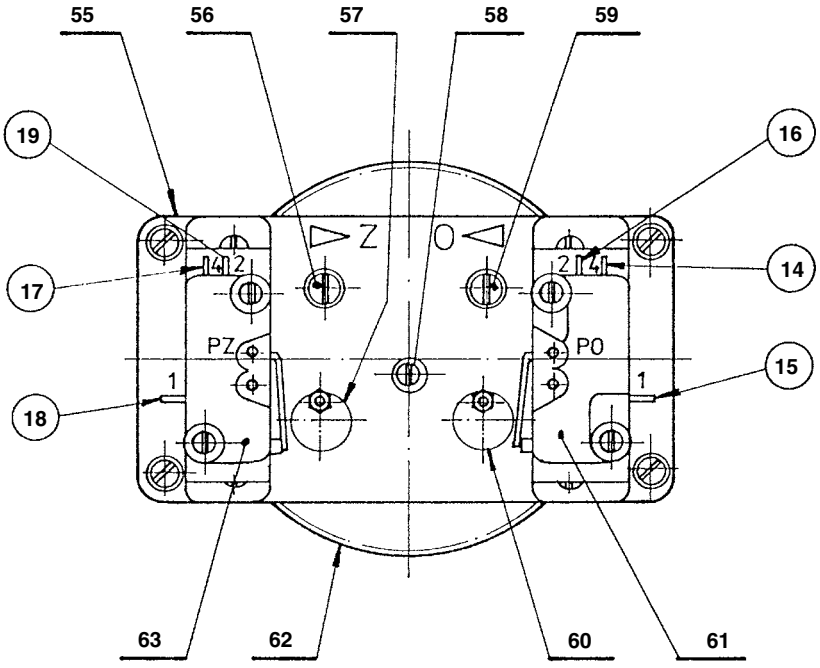
ATTENTION! With this record, the transmitter calibration is also overwritten and, therefore, it must be repeated!!

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.	

f) Position-limit switching unit *(Fig. 10)*

This unit causes the CLOSE or OPEN position-limit switch *(PZ or PO)* to open when the preadjusted RPM of the output shaft are reached, the rotary motion of the unit being derived from that of the output shaft by means of the drive wheel 62. This wheel is rotated step by step by gear wheels driving cam 57 *(60).* Turning of the cam up to the lever of the CLOSE or OPEN position-limit switch *(PZ or PO)* causes the switches to change over.



Legend:

55 – Decadic transmission gearing
56 – CLOSE adjusting screw
57 – CLOSE tripping cam
58 – Tripping rod
59 – OPEN adjusting screw
60 – OPEN tripping cam
61 – OPEN position–limit microswitch (PO)
62 – Drive gear
63 – CLOSE position–limit microswitch (PZ)

(the encircled numbers correspond to the numbers of terminals on the terminal board of the actuator.)

Diagram of microswitches

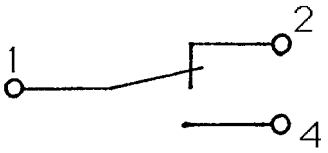


Fig.10 - ***Position-limit switching unit***

Handling and setting

The unit can be adjusted within the range of 10 to 100 mm *(Type No. 52 442)* and 20 to 120 mm *(Type No. 52 443)* of the working stroke of the actuator.

The adjusting procedure is the following:

a) After attachment of the actuator to a valve, bring the actuator with the valve into the CLOSE position.
b) In this position, depress the tripping rod 58 in the vertical direction and then rotate it through an angle of 90° to the left or right.
c) Turn the adjusting screw 56 in the direction of arrowhead designated “Z” *(CLOSE)* till the cam 57 depresses the spring of microswitch 63 *(CLOSE position-limit switch PZ).*

d) Rotate the tripping rod 58 at an angle of 90°. As a result, the rod should shift out again. If this is not the case, turn the screw 56 or 59 by a small amount.

e) Readjust the valve to the OPEN position by the required number of revolutions, making use of the actuator.

f) Depress the tripping rod 58 again in the vertical direction and position it at an angle of 90° on either side.

g) Turn the regulating screw 59 in the direction of arrowhead designated "O" *(OPEN)* till the cam 60 depresses the spring of microswitch 61 *(OPEN position-limit switch PO).*

h) Rotate the tripping rod 58 at an angle of 90°. As a result, the rod should shift out again. If this is not the case, turn the screw 59 or 56 by a small amount.

Note:

Turning the regulating screw 56 or 59 should be stopped at the instant of change-over.

If the cams are in the position shown in Fig.10 before they are adjusted, or the cam has already pressed down the button of the microswitch, the following procedure is used to advantage:

With the tripping rod 58 depressed and positioned, turn the adjusting screw 56 or 59 against the direction of the arrowheads till the cam withdraws at its peak from the microswitch lever towards the respective adjusting screw and the microswitch changes over, which can be checked by a suitable indicating tester. Then, move the cam by turning the adjusting screw 56 or 59 backwards in the direction of the arrowhead to make the cam peak run back on the microswitch level till the microswitch changes over again *(with its button depressed).* Thus, the adjusting procedure of the microswitch has been completed. Finally, shift out the tripping rod 58, as described above.

Manual control

The output pull-rod of the actuator can be also adjusted by the hand, employing the handwheel. By rotating the handwheel clockwise, the valve *(when left-hand threaded)* is closed.

PACKING AND STORING

For inland freight, the actuators are unpacked. However, they should be transported by covered conveyances or in transport containers.

For delivery abroad, the actuators should be packed, the type and design of package being adapted to the transport conditions and the distance of the place of destination.

Upon receipt of the actuator from the factory, it is essential to check that no damage was caused during transport and to compare the data on the actuator rating plates with those contained in the order and accompanying documentation. Any discrepancy, defect or damage should be immediately reported to the supplier.

When the unpacked actuator is not immediately installed it should be stored at a dust-free location with a temperature within the range of - 25 °C to + 50 °C and relative humidity up to 80% where there are neither aggressive gases nor vapours and which is secured against the harmful effects of climatic conditions.

If the actuator is to be stored for a longer period than 3 years then, prior to commissioning, oil refilling should be made. Any manipulation of the equipment at a temperature below - 25 °C is forbidden. Storing the actuator out of doors or at a location that is not protected against the effects of rain, snow or ice accretion should be avoided. Before putting the actuator into operation, excessive slush should be removed. When unpacked actuators are to be stored longer than 3 months it is advisable to place a bag with silica gel or another suitable dessicant in the terminal box.

CHECKING OF THE INSTRUMENT FUNCTION AND ITS LOCATION

Prior to installation, be sure that the actuator was not damaged during storing. A functional check of the electric-motor can be made so that it is connected to the AC mains via a circuit breaker and started for short-time operation. In this case, it is sufficient to check that the electric motor starts and turns the output shaft.

The actuator should be installed so that easy access to the handwheel, the terminal box and the control box is provided. It is also imperative to check that the installation complies with the Clause "Operating Conditions". If another method of installation is required due to local conditions, please consult the manufacturer.

ATTACHMENT TO A VALVE

Place the actuator on the valve so that its output pull-rod can be connected to the output pull-rod of the valve. Attach the actuator to the valve and check the attachment by rotating the handwheel. Remove the terminal box cover and wire the actuator, according to the internal and external circuit layouts.

ADJUSTMENT OF THE ACTUATOR WITH A VALVE

After placing the actuator on the valve and checking its attachment, the following adjusting procedure should be used:

1) Bring the actuator into an intermediate position by the hand.
2) Connect the actuator to the AC mains and check the correct sense of output pull-rod movement. When viewing into the control box, the output shaft should rotate clockwise while the pull-rod is moving in the CLOSE direction and shifting out.
3) Move the actuator electrically near the CLOSE position and complete the adjusting operation by setting the actuator precisely to the CLOSE position, employing the handwheel. In this position, set the position-limit switching unit *(CLOSE position-limit microswitch PZ)* and the potentiometer position transmitter, according to Points 3e and 3d, respectively.
4) Bring the pull-rod of the actuator to the position in which the CLOSE signalling switch *(SZ)* should change over. Adjustment of the CLOSE signalling switch *(SZ)* should be made, according to Point 3b.
5) Move the output pull-rod of the actuator by the required amount of working stroke and set the OPEN position-limit switch *(PO)* and the potentiometer position transmitter, according to Point 3e and 3d, respectively. The position adjustment of the position-limit and signalling switches as well as the position transmitter should be checked repeatedly.
6) Bring the output pull-rod into the position in which the OPEN signalling switch *(SO)* should change over. Adjust the OPEN signalling switch *(SO)*, according to Point 3b.

Caution!

The control box cover should be removed so that it is displaced in the direction of extended axis of the actuator output shaft, taking care to avoid any damage to the position indicator. When mounting the valve on a pipeline, the valve should be brought into the midway position by means of the handwheel. By starting the actuator for a short time, check that it rotates in the correct direction. If this is not the case, the two phase conductors should be mutually interchanged on the terminal board.

OPERATION AND MAINTENANCE

Depending on the operating conditions, the operation of rectilinear actuators usually involves only the transmission of pulses, as required for the individual functions. In the event of a power supply failure, readjust the controlled device by the handwheel. If the actuator has been connected in the circuit of automatic equipment *(which does not imply the control mode)*, it is advisable that manual remote control units are connected in the circuit so that the actuator can be controlled even if a failure of the automatic equipment occurs. It is the operator's duty to ensure that the actuator is given the specified maintenance attention and is protected against the harmful effects of ambient and climatic conditions not included in the Clause "Operating conditions".

The actuators are lubricated with plastic consistent lubricants. The types of lubricant and amounts are listed in the table.

For lubrication of drive units use plastic consistent lubricants.

Lubricants in the drive units supplied are designed to last the entire useful life of the unit.

During the time when the drive units are in use, it is not necessary to change or monitor the amount of the lubricant.

The actuators with plastic lubricant are labelled *"Filled: solid grease"* on the power box at the side of the hand-wheel.

Type number of drive unit	**Amount of lubricant *(kg)***	**Type of lubricant for specific climatic conditions and temperature**	
		T1 ***(-25 – +70 °C)***	**U1** ***(-40 – +55 °C)***
52 442	0,30	CIATIM – 201 GOST 6267-74 CIATIM – 221 GOST 9433-80	
52 443	0,50		

Note: *The Ciatim 221 lubricant is designed for the friction points of rubber bushings against metal surfaces, roller brake, the hub of an outer cogged wheel of a planetary-gear differential of actuators 52 442 (for locations of friction between the shaft and other surfaces).*

Moreover, the rectilinear mechanism 11 *(Fig. 1)* should be greased yearly. For this purpose, force about 50 g of grease MOGUL LV 2-EP into grease box 12 of the rectilinear mechanism *(Fig. 1).* The threads of the nut and the spindle are also greased with MOGUL LV 2-EP so that the upper tightening strip or ring of dust seal 13 *(Fig. 1)* is released. After removal of the dust seal, the threads should be greased through the gap that has been thereby disclosed. This procedure should be made with the pull-rod in the CLOSED position.

FAILURES AND THEIR REMOVAL

Actuator in the end position does not start, with motor droning. In this case, check that no phase of the actuatorpower-supply has been discontinued.

Self-stopping after starting of the actuator from the end position of the output shaft. In this case ensure that the slot of the change-over gear *(Fig. 2)* stops in the end position of the actuator output shaft *(after operation of the torque-limit switch)* before running onto the shifting device 21 *(Fig. 3).* This can be achieved by turning the output shaft round a suitable amount while the actuator is connected to the valve, or by turning the change-over gear round a suitable amount with respect to the output shaft. For this purpose, the change-over gear is provided with two slots for a connecting spline.

Table 1 – MODACT MTN, MTP (Control) electric actuators

– basic technical parameters, design

Basic electrical equipment:
- 2 thrust-limit switches *(OPEN - MO, CLOSE - MZ)*
- 2 position-limit switches *(OPEN - PO, CLOSE - PZ)*
- 2 signalling switches *(OPEN - SO, CLOSE - SZ)*
- 1 potentiometer of 2 x 100 Ω or current position transmitter
- 1 anti-condensation heater
- 1 three-phase asynchronous motor

Basic technical parameters: *(8^{th} place of t. no.):*

Type	MTN Control, MTP Control	Adjustment range of tripping thrust [kN]	Starting thrust [kN]	Adjusting speed [mm/min]	Working stroke [mm]	Electric motor: Type	Power [W]	Revolutions per minute [1/min]	I_n (400 V) [A]	$\frac{I_z}{I_n}$	Weight [kg]	Type Number: basic 1 2 3 4 5	Type Number: additional 6 7 8 9 10
MTN 15 MTP 15	C	11,5 – 15	17	50	10 – 100	1xx7070-6AA	180	835	0,62	2,3	33	5 2 4 4 2	x x 0 x x
	C			80		1xx7070-6AA	180	835	0,62	2,3			x x 1 x x
	C			125		1xx 7070-4AB	250	1350	0,76	3,0			x x 3 x x
	C			36		1xx7073-8AB	120	645	0,51	2,2			x x 2 x x
	C			27		1xx7073-8AB	120	645	0,51	2,2			x x A x x
MTN 25 MTP 25	C	15 – 25	32,5	50		1xx7070-6AA	180	835	0,62	2,3			x x 4 x x
	C			80		1xx7070-6AA	180	835	0,62	2,3			x x 5 x x
	C			125		1xx7070-4AB	250	1350	0,76	3,0			x x 6 x x
	C			36		1xx7073-8AB	120	645	0,51	2,2			x x 7 x x
	C			27		1xx7073-8AB	120	645	0,51	2,2			x x 8 x x
MTN 40 MTP 40[1)]	C	25 – 40	52	80	20 – 120	1xx7083-6AA	550	910	1,6	3,4	60	5 2 4 4 3	x x 1 x x
	C			125		1xx7080-4AA	550	1395	1,45	3,9			x x 2 x x
MTN 63	C	40 – 63	82	80		1xx7090-6AA	750	915	2,1	3,7			x x 4 x x
MTP 63	C			125		1xx7090-4AA	1100	1415	2,55	4,6	63		x x 5 x x

Electrical connection *(6^{th} place of t. no.)*

with block of terminals	6 x x x x
with connector	7 x x x x

Connecting dimensions *(7^{th} place of t. no.)*

Type No. 52 442 *(Table No. 2, Figs. 1, 2, 3)*	
Type No. 52 443 *(Figs. 4, 5, 6)*	x 1 x x x
Type No. 52 443 *(Fig. 7)*	x 2 x x x

Position transmitter, block of local control - MODACT MTN, MTP actuators *(9^{th} place of t. no.)*	current transmitter without power supply *(CPT 1A)*	current transmitter with power supply *(DCPT)*
current transmitter 4 – 20 mA	x x x 0 x	x x x R x
current transmitter 4 – 20 mA with BMO	x x x 1 x	x x x S x
resistance transmitter 2 x 100 Ω		x x x 2 x
resistance transmitter 2 x 100 Ω with BMO		x x x 3 x
without transmitter, with BMO		x x x P x
without transmitter, without BMO		x x x Z x

Additional electric outfit - MODACT MTN, MTP Control actuators with built-in contactor combination *(9^{th} place of t. no.)*		potentiometer 2 x 100 Ω	current transmitter without power supply *(CPT 1A)*	current transmitter with power supply *(DCPT)*
without BMO	without brake and position regulator	x x x 4 x	x x x A x	x x x K x
	with brake, without position regulator	x x x 5 x	x x x B x	x x x L x
	with brake and position regulator			x x x C x
with BMO	without brake and position regulator	x x x 7 x	x x x D x	x x x M x
	with brake, without position regulator	x x x 8 x	x x x E x	x x x N x
	with brake and position regulator			x x x F x

Protective enclosure *(10^{th} place of t. no.)* IP 55 – N; IP 67 – P

Notes:

[1)] Design with clutch internal threads and a flange (non-standard) is available only in the design variants, Type No. 52 443.x21xxN and 52 443.x22xxN (Type MTN 40) and Type No. 52 443.x21xxP and 52 443.x22xxP (Type MTP 40).

[2)] The design variant with BR2 brake is available only in case of actuators without regulator (with contactors) with up to 550 W of electric motor power, inclusive. The design variant with BR2 brake is available in case with ZP2.RE5 regulator.

[3)] If a design variant with flashing indication is required this should be specified in words: Design with flashing indication.

[4)] Design without thrust locking after reversation have at end position capital letter M (for example 52 442.6211NM).

[5)] The MODACT MTN, MTP Control actuators with ZP2.RE5 regulator - the digit "5" is put on the 11th place.

[6)] Type of electric motors: For actuators MODACT MTN, MTN Control and MODACT MTP, MTP Control the symbols xx are replaced with letters LA and PP, respectively.

Table 2 – Connecting dimensions

– specification of the 7th place of Type No. 52 442.xxxxx

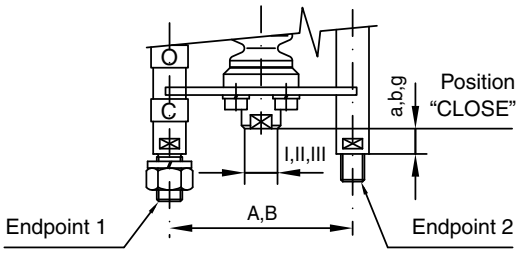
Design spacing of columns A *(160 mm)*	**Character on 7th place**
Aa1I	0
Aa1II	1
Aa1III	2
Aa2I	3
Aa2II	4
Aa2III	5
Ab1I	6
Ab1II	7
Ab1III	8
Ab2I	9
Ab2II	A
Ab2III	B

Design spacing of columns B *(150 mm)*	**Character on 7th place**
Ba1I	C
Ba1II	D
Ba1III	E
Ba2I	F
Ba2II	G
Ba2III	H
Bb1I	I
Bb1II	J
Bb1III	K
Bb2I	L
Bb2II	M
Bb2III	P
Bg2I	R

Deliveries in design III with coupling M 10 x 1 upon special request only.

Spacing of columns
Thread of coupling
Ending of columns
Position “Closed”

Spacing of columns	A	160 mm		
	B	150 mm		
Position “Closed”	a	30 mm	Long columns c	see table
	b	74 mm	Long columns d	“Design variants”
	g	130 mm	Long columns h	- Fig. 1 and 2
Thread of coupling	I	M20 x 1,5		
	II	M16 x 1,5		
	III	M10 x 1		



Dimensional sketch of
MODACT MTN, MTP 15
MODACT MTN, MTP 25
electric actuators, Type No. 52 442.xxxxx

– with block of terminals

Design 1	
A	160
B	150
a	30
b	74
g	130
c (a)	323
d (b)	367
h (g)	423
e (a)	620
f (b)	664
ch (g)	720

Design 2	
A	160
B	150
a	30
b	74
g	130
c (a)	308
d (b)	352
h (g)	408
e (a)	605
f (b)	649
ch (g)	705

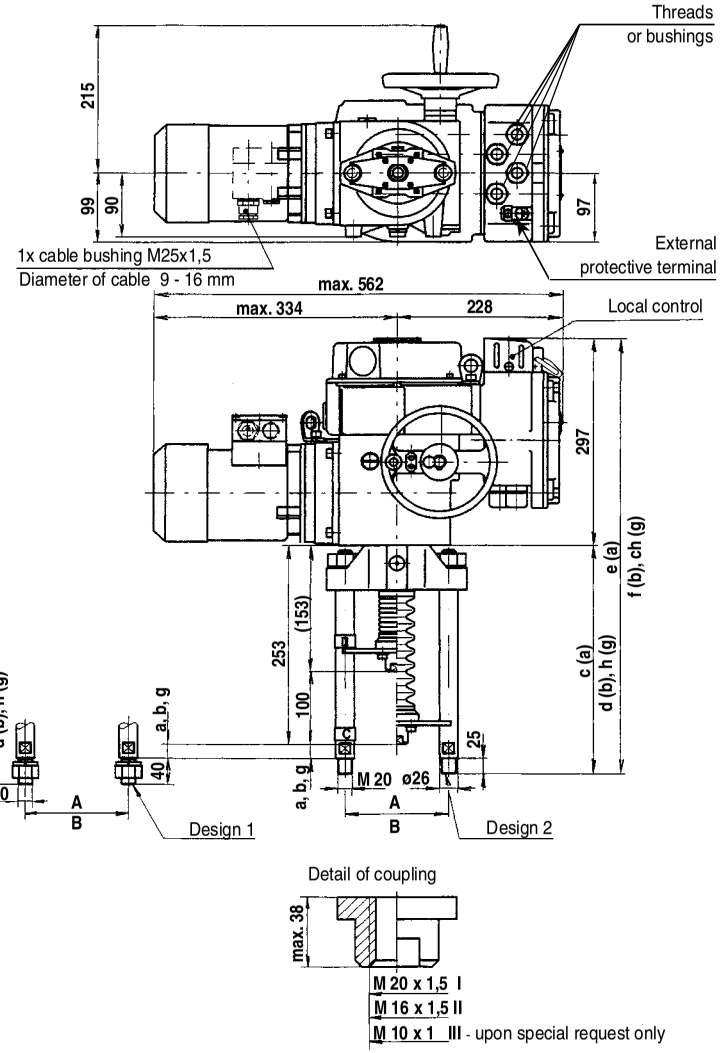


Fig. 11

Dimensional sketch of
MODACT MTN, MTP 15
MODACT MTN, MTP 25
electric actuators, Type No. 52 442.xxxxx

– with connector

Design 1	
A	160
B	150
a	30
b	74
g	130
c (a)	323
d (b)	367
h (g)	423
e (a)	648
f (b)	692
ch (g)	748

Design 2	
A	160
B	150
a	30
b	74
g	130
c (a)	308
d (b)	352
h (g)	408
e (a)	633
f (b)	677
ch (g)	733

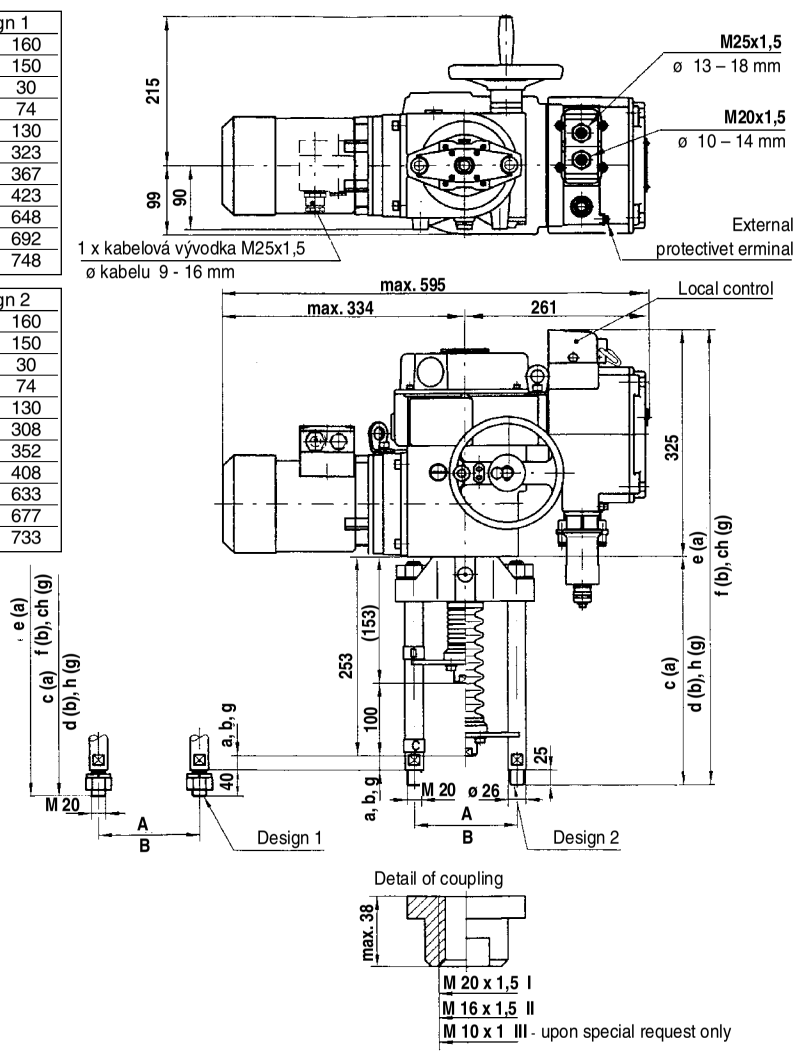


Fig. 12

Note: *For actuators MODACT MTN, the switchboard box has threads for bushings: 3 x thread M20 x 1.5; 1 x thread M25 x 1.5 (the bushings are included in the delivery - wrapped-together part).*
For actuators MODACT MTP, the switchboard box has bushings: 1 x M25 x 1.5, range of Ø 13 – 18 mm; 2 x M20 x 15 range of Ø 10 – 14 mm; 1 x M20 x 1.5 range of Ø 6 – 12 mm.
The electric motor (except for the actuator version with the motor interconnected with the switchboard box) is always delivered with cable bushing. Connector Harting is always fitted with cable bushings.

Dimensional sketch of
MODACT MTN, MTP 40
MODACT MTN, MTP 63
electric actuators, Type No. 52 443.x1xxx

– with block of terminals

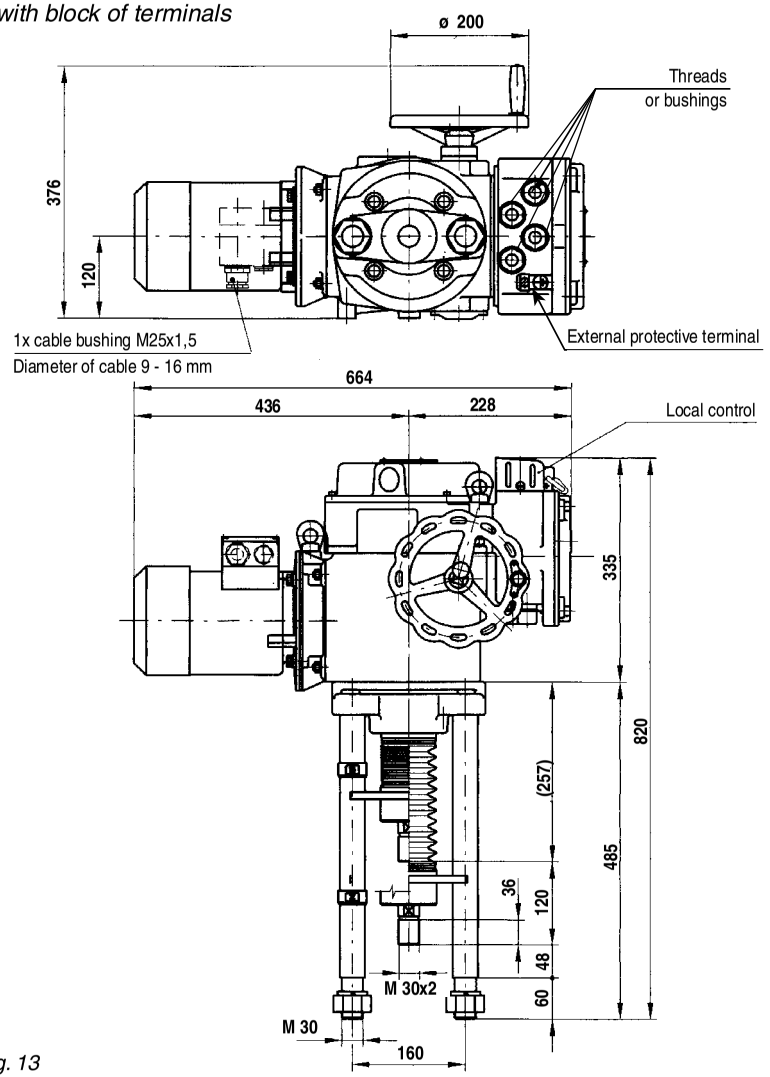


Fig. 13

Dimensional sketch of
MODACT MTN, MTP 40
MODACT MTN, MTP 63
electric actuators, Type No. 52 443.x1xxx

– with connector

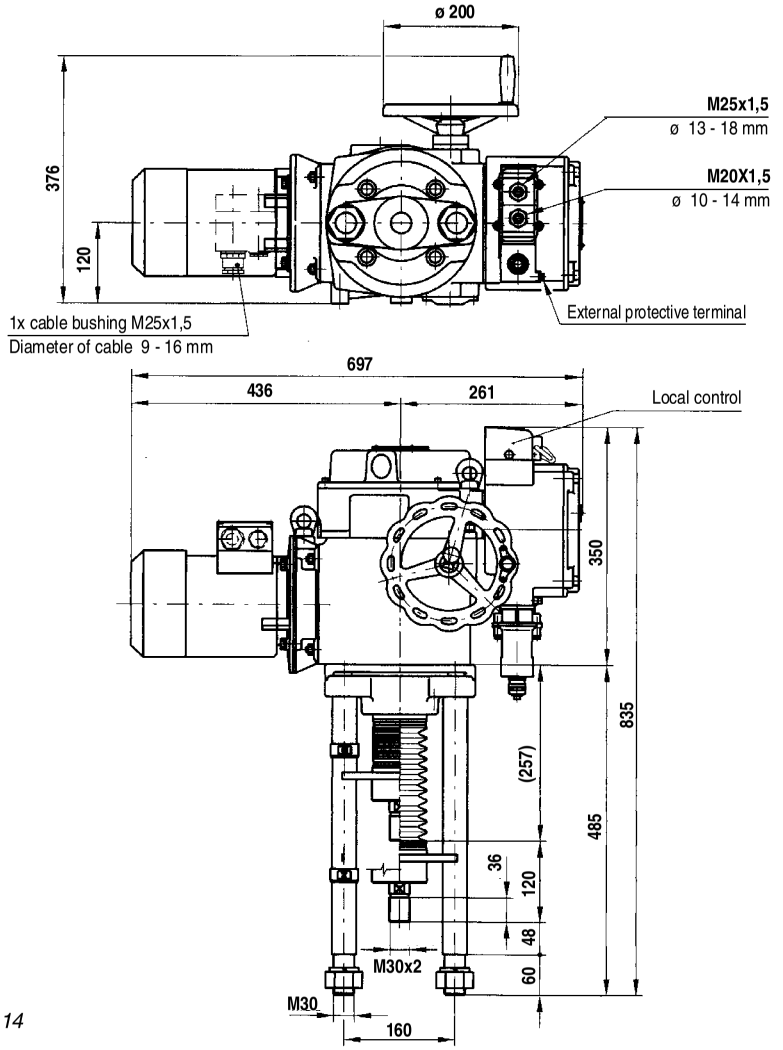


Fig. 14

Dimensional sketch of linear transmission unit for **MODACT MTN, MTP 40** electric actuators,
Type No. 52 443.x2xxx
– design with flange – non standard
(other dimensions and designs of actuators are according to fig. 13 and 14)

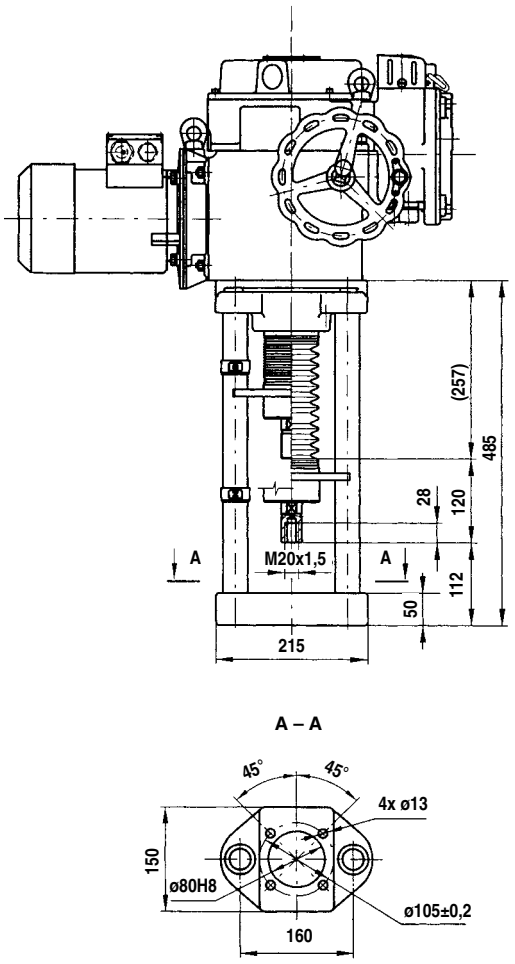


Fig. 15

Wiring diagrams of **MODACT MTN, MTP** electric actuators

Legend:

SQ1 *(MO)*	– OPEN torque-limit switch	CPT 1A	– Analog adjustable current position transmitter
SQ2 *(MZ)*	– CLOSE torque-limit switch	DCPT	– Digitally adjustable current position transmitter
SQ3 *(PO)*	– OPEN position-limit switch	DCPZ	– Power source of DCPT transmitter
SQ5 *(PZ)*	– CLOSE position-limit switch	ZP2.RE5	– Elektronic position regulator
SQ4 *(SO)*	– OPEN signalling switch	BAM-002	– Elektronic brake
SQ6 *(SZ)*	– CLOSE signalling switch	BR2	– Elektronic brake
SA1	– LOCAL-REMOTE control switch	EH	– Anti-condensation heaters
SA2	– OPEN-CLOSE control switch	M3~	– Three-phase motor
KO	– OPEN-direction contactor	B	– Blinker
KZ	– CLOSE-direction contactor	F	– Thermal relay
BQ1, BQ2	– Resistance position transmitter	FT	– Supply mains filter
BMO	– Block of local control	SSR	– Contact-less switches

Positions of the switches: L – Local; R – Remote; O – Open; C – Close

Optional accessories:

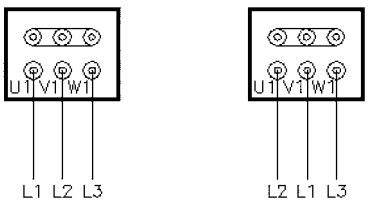
Block of local control BMO
Position transmitter – resistance V1, V2
– current, passive CPT1
– current, active DCPT + DCPZ
– without transmitter
Signalling switches SO, SZ
Blinker B

Motors used:

In case of **MTN, MTP** actuators are used three-phase electric motors in design variant with terminal board.

In case of actuators with connecting terminal board, the motors are also connected to this terminal board; in case of actuators with connecting connector, the electric motors are also connected via this connector.

3-phase motor

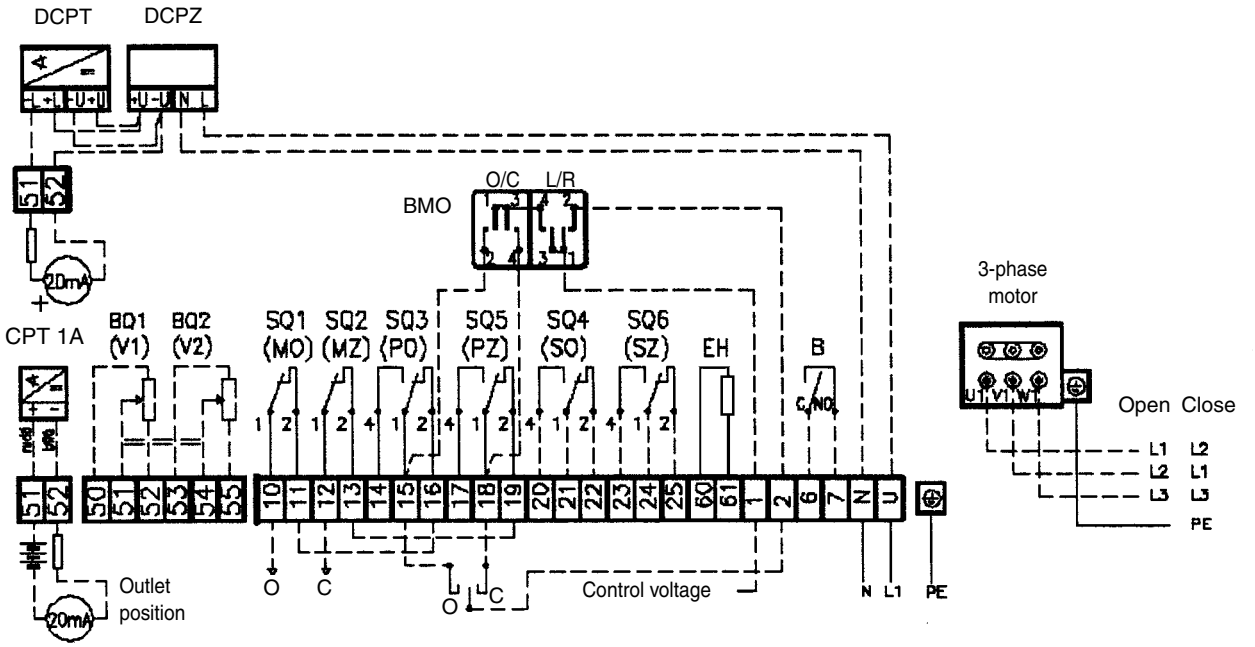


Open Close

Wiring diagram of **MODACT MTN, MTP** electric actuators

– terminal board

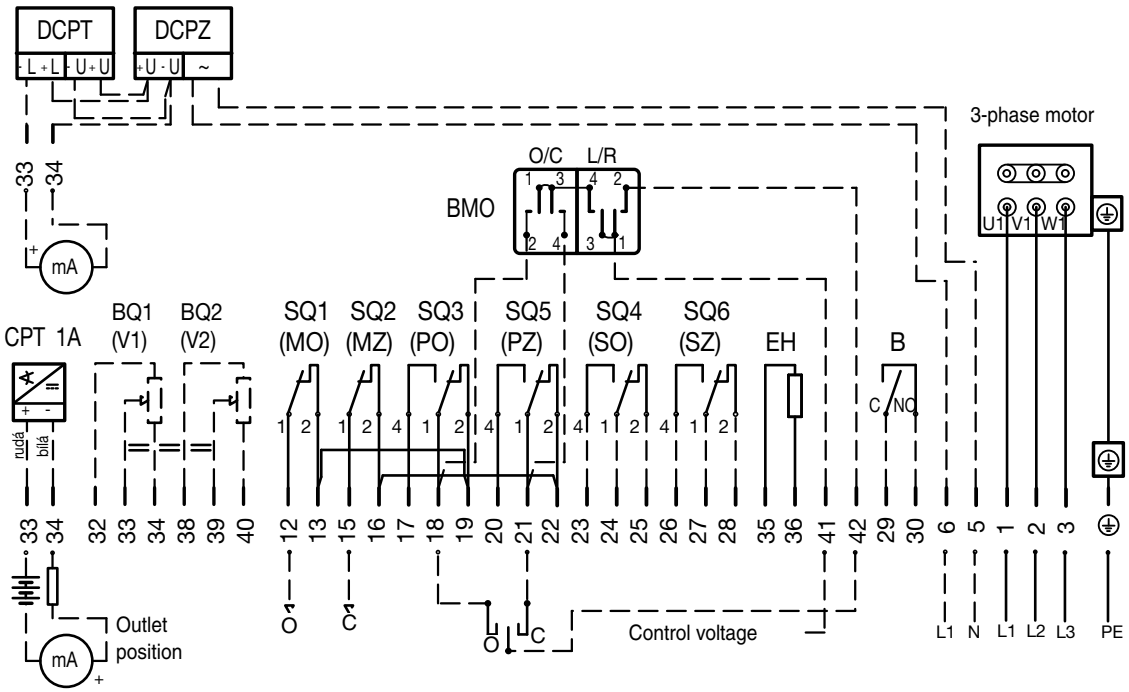
P0938-E



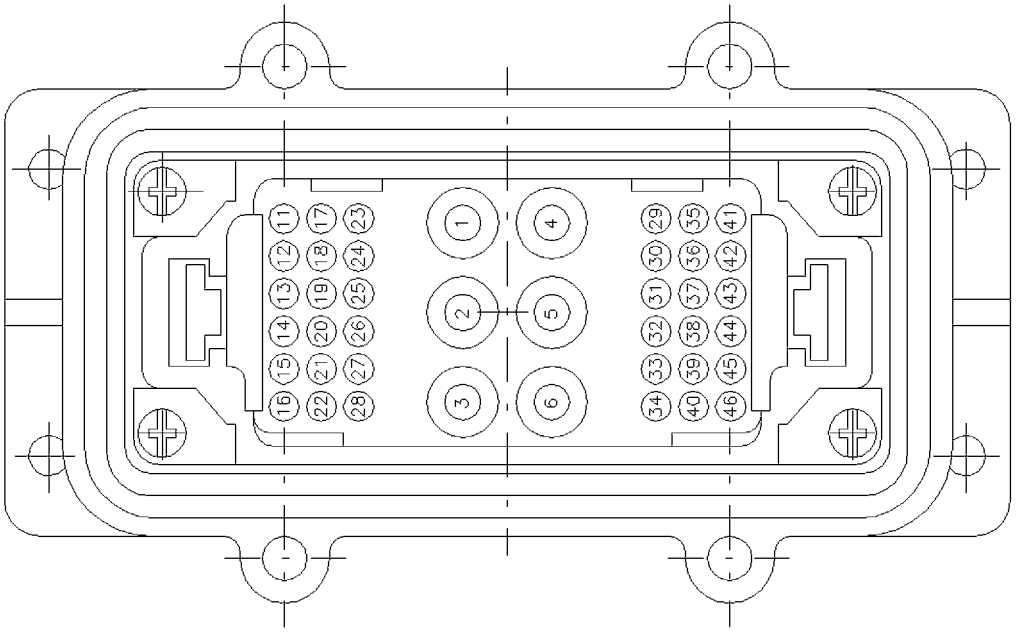
Wiring diagram of **MODACT MTN, MTP** electric actuators

– connector

P0940-E



Connector


1
2
3
4
5
6
11 12 13 14 15 16
17 18 19 20 21 22
23 24 25 26 27 28
29 30 31 32 33 34
35 36 37 38 39 40
41 42 43 44 45 46

List of spare parts of **MODACT MTN, MTP** actuators

(for 5 years of operation)

	Designation	Drawing or ČSN Standard No.		Application
52442	Sealing ring 125x3	PN 02 9281.2	1	Packing between power gear box and flange with gears
	Sealing ring 130x3	PN 02 9281.2	1	Packing between control box and power gear box
	Sealing ring 43x35	PN 02 9280.2	1	Sealing of output shaft in the control box
	Sealing ring 170x3	PN 02 9280.2	1	Sealing of control box cover
	Rotary shaft seal 40x52x7	ČSN 02 9401.0	1	Sealing of output shaft in the control box
	Rotary shaft seal 40x52x7	ČSN 02 9401.0	2	Sealing of output shaft in the power gear box
	Rotary shaft seal 16x28x7	ČSN 02 9401.2	1	Sealing of handwheel shaft
	Potentiometer 2 x 100 Ω 99556-3	214628650	1	Mounting on the control board
52 443	Sealing ring 160x3	PN 02 9281.2	1	Packing between power gear box and flange with gears
	Rotary shaf seal 20x32x7	ČSN 02 9401.0	1	Sealing of handwheel shaft
	Sealing ring 95x85	PN 02 9280.2	1	Packing of the rubber-copper sealing ring in the power box
	Sealing ring 50x2	PN 02 9281.0	1	Sealing of torque-limit switching spring cover
	Rotary shaft seal 60x75x8	ČSN 02 9401.0	2	Sealing of output shaft in the power gear box
	Sealing ring 190x3	PN 02 9280.2	1	Packing between control box and power gear box
	Rotary shaft seal 55x70x8	ČSN 02 9401.2	1	Sealing of output shaft in the control box
	Sealing ring 60x50	PN 02 9280.2	1	Sealing of output shaft in the control box cover
	Sealing ring 190x3	PN 02 9281.0		Sealing of control box cover
	Potentiometer 2 x 100 Ω 99556-3	2340510232	1	Mounting on the control board
52 442	Packing 16x22	224580840	2	Packing of threaded plug *(for oil filling)*
52 443	Sealing ring 125x5	ČSN 02 9281.2	1	Packing between control box and terminal box
	Packing	52 442 - 224591870 52 443 - 224642240	1 1	Packing between electric motor and flange with gears
	Microswitch CHERRY D - 433 - B8LD		1 1	CLOSE signalling switch *(SZ)* OPEN signalling switch *(SO)*
	Microswitch CHERRY D - 433 - B8LD		1 1	CLOSE position-limit switch *(PZ)* OPEN position-limit switch *(PO)*
	Microswitch SAIA XGK 12-88-J21	ČSN 02 9281.2 4 - 56480	1 1	CLOSE torque-limit switch *(MZ)* OPEN torque-limit switch *(MO)*
	Sealing ring 180x3	ČSN 02 9281.2	1	Packing of terminal box cover
	Sealing ring 32x2	ČSN 02 9281.2	1	Packing of inspection hole of local position indicator
	Inspection hole	4 - 62847	1	Local position indicator cover
	Sealing ring 10x6	ČSN 02 9280.2	2	Packing of torque-limit switching shaft
	Current transmitter CPT 1A	2340510393	1	Mounting on the control board
	Current transmitter DCPT	214652060	1	Mounting on the control board
	Feeding source for DCPT	214651921	1	Mounting in the terminal box

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 rotary (90°) actuators (up to 30 Nm)

MODACT MOK, MOKED, MOKP Ex, MOKPED 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

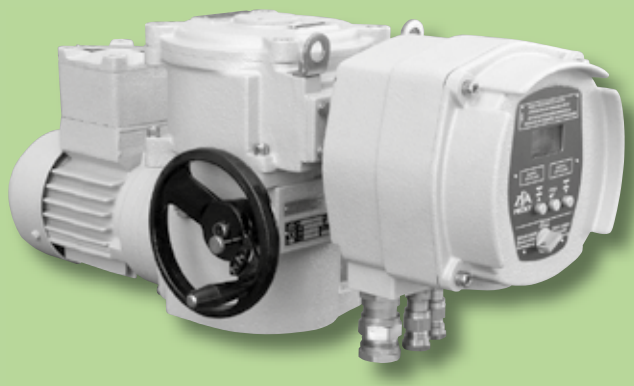
MODACT MPR Variant
Electric rotary (160°) lever actuators with a variable output speed

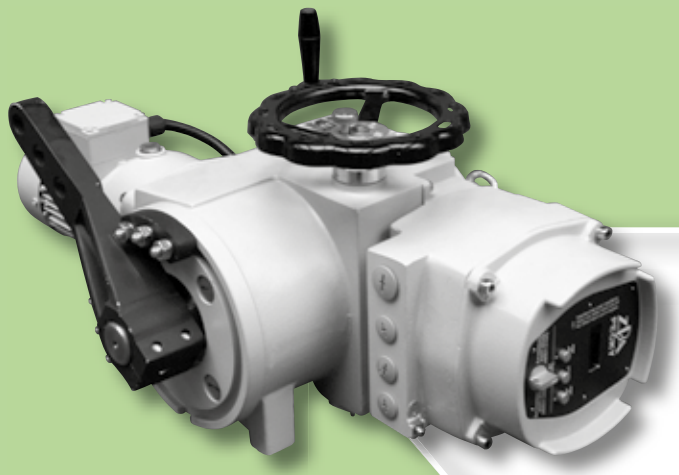
MODACT MPS Konstant, MPSED
Electric rotary (160°) lever actuators with a constant output speed

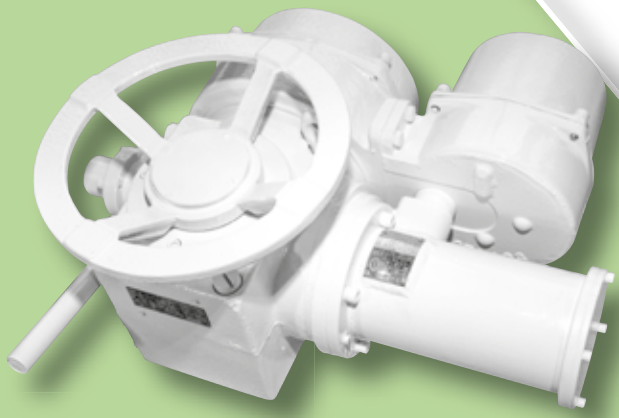
MODACT MTN, MTP, MTNED, MTPED
Electric linear thrust actuators with a constant output speed

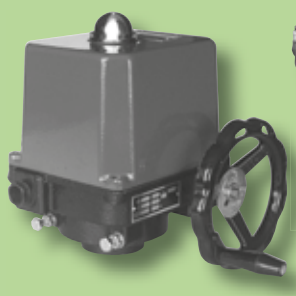
Deliveries of assembled actuator + valve (or MASTERGEAR gearbox) combinations

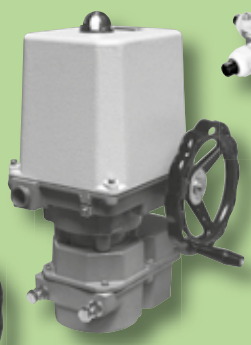
TRADITION • QUALITY • RELIABILITY











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