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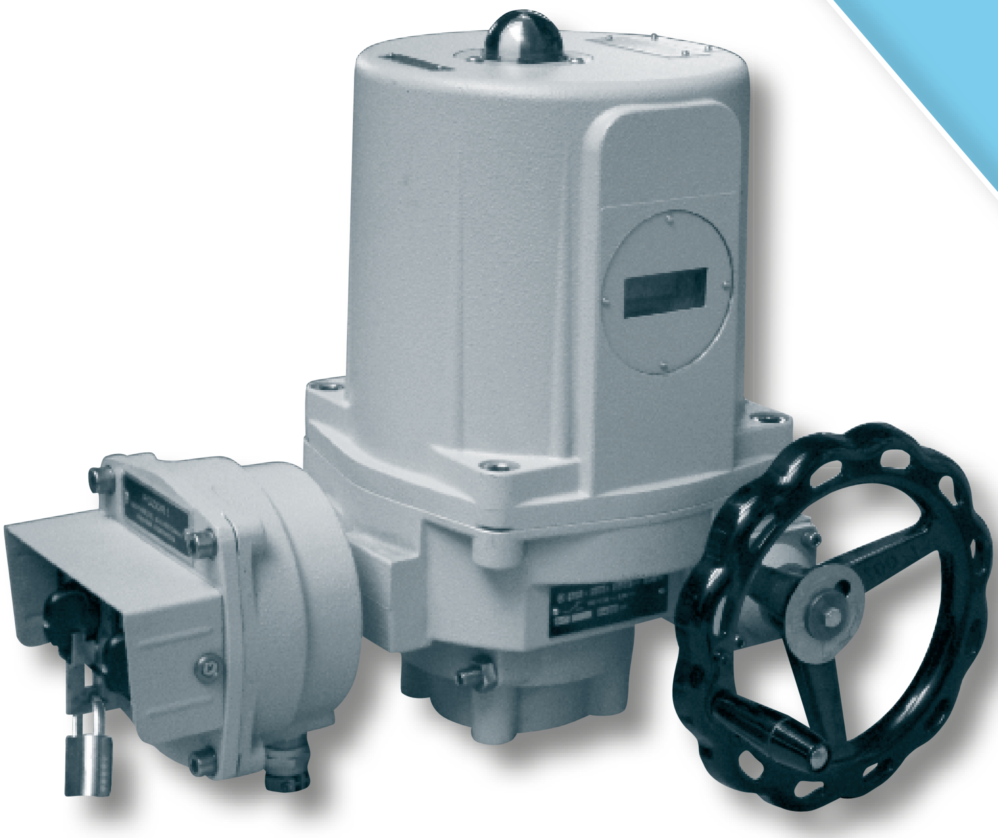

INSTALLATION AND OPERATING INSTRUCTIONS

**Electric single-turn rotary actuators**
**in non-explosive version, with constant velocity of changing-over the output part – IP 67 protection**

# MODACT MOKPED 100 Ex
# MODACT MOKPED 250 Ex
# MODACT MOKPED 600 Ex

**Type numbers 52 320 - 52 322**

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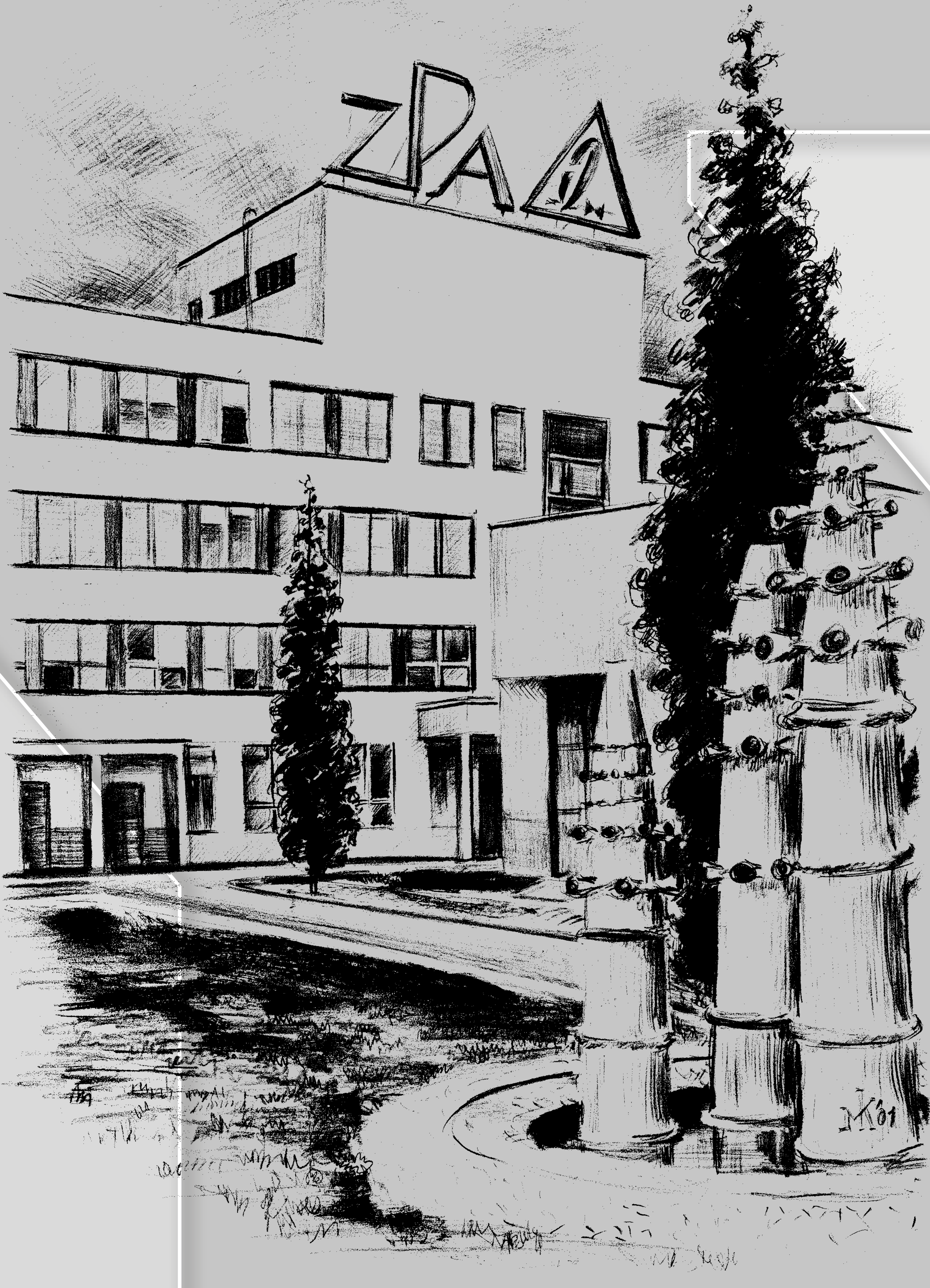


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# CONTENS



The Installation and Operating Instructions specify basic principles for mounting, connection, adjustment, operation, maintenance, and repairs of electric explosion-proof actuators. The fundamental prerequisite is that assembly, operation, maintenance, and revisions are performed by skilled technicians qualified for operation and works on explosion-proof electric devices and the works are supervised by a professionally qualified expert instructed in a demonstrable way.

# 1. APPLICATION

The actuators are designed for shifting valves with reversing rotary motion in circuits of remote control and automatic control. They can also be used for other devices for which they are suitable with their characteristics and parameters. Special cases are to be discussed with the manufacturer.

**MODACT MOKPED Ex** electric actuators in non-explosive version are intended for control and operation in an environment with danger of explosion of explosive gaseous atmosphere in zone 1 and zone 2 and for areas with flammable dust in zone 21 and zone 22 according to ČSN EN 60079-10 *(332320)*. The actuators are designed in compliance with the standards ČSN EN 60079-0:2013 and ČSN EN 60079-1:2008 for explosive gaseous atmosphere and with the standard ČSN EN 60079-31:2014 for areas with flammable dust.

These are non-explosive electric appliances of the group II, category 2, in areas where occurrence of explosive atmosphere created by gases, vapours or mist – *"G"* is probable. The actuators can also be used in areas with flammable dust according to ČSN EN 50281-1-3. The actuators are labelled with a sign of protection against explosion and symbols of the group and category of appliance Ex **II 2GD.**

The entire electric actuator is designed as explosion-proof enclosure "d" with marking according to the performed certification as follows:

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

The electric actuator must not be subjected to heavy charging, eg. an intense flow of a dust-air mixtures in order to prevent the occurrence of creeping electrostatic discharges.

## Nomenclature

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

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

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

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

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

**Explosion-proof closure „*d*“** – Type of protection in which the parts capable of causing ignition of an explosive atmosphere are installed inside the closure; in case of internal explosion this closure should withstand pressure of the explosion and prevent spreading of the explosion into the surrounding atmosphere.

**Zone 1** – A space where probability of occurrence of an explosive atmosphere of a mixture of flammable substances in the form of gas, vapour or mist with the air is occasional under normal operation.

**Zone 2** – A space where occurrence of an explosive gaseous atmosphere formed of a mixture of flammable substances in the form of gas, vapour or mist with the air is improbable under normal operation; however, if this atmosphere is formed it will only persist for a short period of time.

**Zone 21** – An area in which the explosive atmosphere is created by a cloud of whirled flammable dust in air formed in normal operation is occasional.

**Zone 22** – An area in which an explosive mixture is not likely to occur in normal operation and if it occurs it will exist only for a short time.

## Applied Standards

The following basic standards apply to explosion-proof actuators:

| | |
|---|---|
| ČSN EN 60079-14 | Regulations for electrical devices in areas with a danger of explosion of flammable gasesand 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 1127-1 | Explosive atmospheres – Explosion prevention and protection. |
| ČSN EN 60079-31 | Explosion properties. Equipment protected against dust ignition with *“t“* closure. |

## Designation of explosion-proof properties

It consists of the following symbols:

| | |
|---|---|
| Ex | Electric device complies with the standard ČSN EN 60079-0 and related standards for various types of protection against explosion. |
| d | Designation of the type of protection against explosion, explosion-proof closure according to ČSN EN 60079-1. |
| tb | Protection by enclosure *“t“* – according to ČSN EN 60079-31. |
| IIC, IIB | Designation of the group of explosion-proof electric device according to ČSN EN 60079-0. |
| IIIC | Designation of explosion-proof electric equipment for explosive atmospheres with combustible dust, according to standard ČSN EN 60079-0. |
| T6 | Designation of temperature class of explosion-proof electric device of the Group II according to ČSN EN 60079-0. |
| T80°C | Designation of explosion-proof electric equipment for explosive atmospheres with combustible dust, according to standard ČSN EN 60079-0. |
| Gb | Designation of explosion-proof equipment for explosive gaseous atmospheres, having a *“high“* level of protection, and not a source of ignition in normal operation or during expected malfunctions; according to ČSN EN 60079-0. |
| Db | Designation of explosion-proof equipment for explosive dust atmospheres, having a *“high“* level of protection, and not a source of ignition in normal operation or during expected malfunctions; according to ČSN EN 60079-0. |
| IP 67 | Identification of the degree of protection; according to ČSN EN 60079-0 and ČSN EN 60529. |

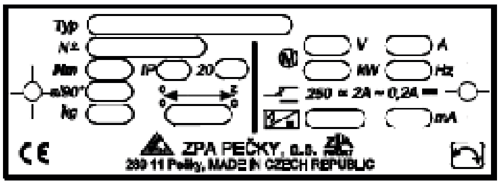
## Data on actuators

The actuators are fitted with the following plates:

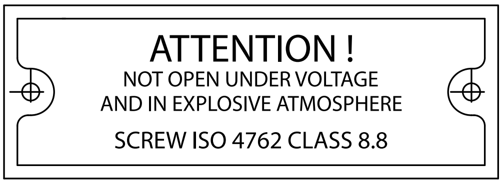

or

2) Rating and instrument plate contains:

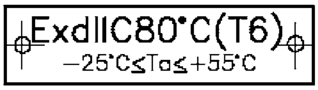
– manufacture's name and address
– type designation of product *(type number)*
– serial number
– year of production
– rated value of tripping torgue Nm
– rated speed of shifting s/90°
– rated working stroke °
– designation of protective enclosure of actuator IP
– weight of actuator kg
– mark of conformity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




3) Warning plate

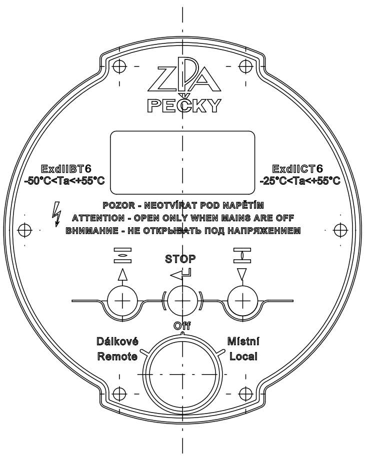



4) Plates on covers with marking of used protection against explosion




or


or front label No. 23354393 for design with local control switches and display.




## 2. OPERATING CONDITIONS, OPERATING POSITION

### Operating conditions

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

### Temperature and humidity

The operating temperature for actuators **MODACT MOKPED Ex** is -25 °C to +55 °C or -50 °C to +55 °C, relative humidity from 10% to 100% with condensation.

## Classes of external effects – excerpt from ČSN 33 2000-5-51 ed. 3.

**Class:**

1) AC1 – elevation above sea level ≤ 2000 m
2) AD7 – water occurrence – shallow dipping
3) AE6 – strong dustiness
4) AF2 – occurrence of corrosive or polluting substances from atmosphere. Presence of corrosive substances is significant.
5) AG2 – medium mechanical stress by impacts – common industrial processes.
6) AH2 – medium mechanical stress by vibrations – common industrial processes.
7) AK2 – serious risk of growth of vegetation and moulds.
8) AL2 – serious danger of the occurrence of animals *(insects, birds, small animals).*
9) AM-2-2 – normal level of the signal voltage. No additional requirements.
10) AN2 – medium solar radiation with intensities > 500 W / m² and ≤ 700 W / m².
11) AP3 – medium seismic effects; acceleration > 300 Gal ≤ 600 Gal.
12) BA4 – personal abilities. Instructed people.
13) BC3 – frequent contact with the earth potential. Persons coming frequently into contat with *"live"* parts or standing on a conducting base.
14) BE3 – danger of explosion, production and storage of explosive substances.

## Corrosion protection

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

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

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

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

**MOKPED Ex** electric actuators designed for an ambient temperature of -50 ° C to +55 ° C must be resistant to operating conditions characterized by an ambient temperature range from -50 ° C to +55 ° C.

The actuators are designed with three-phase motors.

The aforementioned actuators will be designated with the letter F at the last place of the supplementary type number: thus 5232x.xxxxEDF.

In all denominations of explosion-proof design of electric actuators Type No. 5232x.xxxxEDF the designation of subgroup II of explosion-proof electric device according to ČSN EN 60079-0 changes from IIC to IIB, i.e. to Ex d IIB T6 Gb.

When located in open areas, we recommend you to provide a light shelter to prevent direct impact of atmospheric conditions. The shelter should overreach the actuator's ground plan by at least 10 cm at the level of 20 to 30 cm.

When actuators are located in a working environment with temperatures below -10°C, with relative humidity exceeding 80%, below a shelter, or in cold areas, it is always necessary to use the thermal element that is mounted to all actuators.

The heating elements used are resistors TRA 25 5K1/J with a power output of 25W and resistance of 5 kOhm *(located in the Control area of the actuator)* and TRA 15 10K/J with a power of 15 W and a resistance 10 kOhm (located in the area of local control). They are switched by a switch for the heating resistor located on the source circuit board. Computer program can be used to set the switching temperature in the range of -40 to +70 °C. Permanent heating can be reliably ensured the temperature setting +70 °C. Maximum heating flow of the switch is 0.4 A / 230 V.

The present temperature range limit values for the use of the actuators *(-40 ° C and +70 ° C),* which can be changed according to customer needs. Exceeding these limits close the fault contact READY and an error signal occurs.

***Note:*** *Sheltered areas are considered those where the fall of atmospheric precipitations under an angle up to 60° is prevented.*

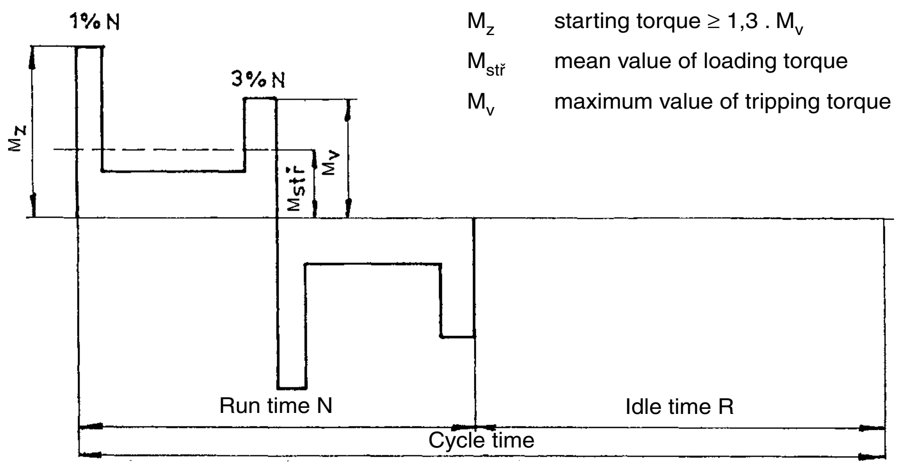
## Operating position

The actuators **MODACT MOKPED Ex** can operate in any operating position.

# 3. OPERATION MODE, SERVICE LIFE OF ACTUATORS

## Operation mode

The actuators can operate at rated load torque, which is 50% of the maximum tripping torque, with S2 type load. The operation time is in this kind of load is 10 minutes at ambient environment temperature up to +55 ° C. The actuators can operate at rated load torque and intermittent operation with start-up with the S4 type of load according to ČSN EN 60034-1 *(35 0000).* The load factor is 25%, and switching frequency up to 1200 times per hour. The maximum duty cycle is determined by the run time at a full stroke of the actuator. Maximum medium level of load torque equals to rated torque of actuator. The highest mean value of loading torque is equal to rated torque of the actuator.




$M_z$ starting torque ≥ 1,3 . $M_v$

$M_{stř}$ mean value of loading torque

$M_v$ maximum value of tripping torque

***Course of working cycle***

## Service life of actuators

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

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

Service life of actuators for 1 million starts

| | | | | |
|---|---|---|---|---|
| Service life [h] | 830 | 1000 | 2000 | 4000 |
| Number of starts [1/h] | Max. number of starts 1200 | 1000 | 500 | 250 |

# 4. TECHNICAL DATA

Basic technical parameters are given in Table 1.

## Power supply

| | |
|---|---|
| – nominal value of the AC voltage is | 1 x 230 V or 3 x 400 V *(according to version)* |
| – permitted power supply voltage tolerance is | -10 % to +6 % of the nominal value |
| – rated frequency of supply voltage is | 50 Hz |
| – permitted power supply voltage frequency tolerance is | 2% of the nominal value |

Within this supply voltage range, all parameters are kept up except the starting torque which varies with the square of the supply voltage deviation from the rated value. This dependence is directly proportional to the supply voltage variation; no larger supply voltage and frequency fluctuations are permitted.

## Protective enclosure

Protective enclosure of the **MODACT MOKPED Ex** actuators is IP 67 according to ČSN EN 60529 *(33 0330).*

## Noise

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

## Tripping torque

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

## Self-locking

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

## Sense of rotation

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

## Working stroke

The working stroke of **MODACT MOKPED Ex** actuator is 90° *(after agreement with the manufacturer actuators can be supplied with working stroke 60 °, 120 ° or 160 °).*

## Manual control

The actuators are controlled by a hand wheel directly *(without a clutch)* and control is possible even during operation of the electric motor. When rotating the hand wheel in clockwise direction, the actuator's output shaft also rotates in clockwise direction *(looking at the local position indicator).* Handwheel direction of rotation is also indicated on the label of the handwheel.

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

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

# 5. ACTUATOR OUTFIT

## Position indicator

The actuator can be fitted with a display as an option for **DMS2 ED** electronic system. Actuator with **DMS2** electronic system is equipped with two-line display.

## Heating element

Actuators are equipped with a heating element to prevent water vapour condensation. As a heating element they apply resistors TRA 25 10 K/J with an output of 25 W and resistance of 10 kΩ. They are switched by a switch for the heating resistor located on the source circuit board. It is possible to use a computer to set the switching temperature in the range of -40 to +70 °C. Permanent heating can reliably be ensured by the temperature setting +70 °C. Maximum heating current of the switch is 0.4 A/230 V.

The preset temperature range limit values of the actuators *(-40 °C and +70 °C)* can be changed according to customer needs. Exceeding these limits close the fault contact READY and an error signal occurs.

### Local control

Local control serves for controlling the actuator from the site of its installation. For DMS2 ED electronic system includes two change-over switches: one with positions *"Remote control – Off - Local control"*, the other *"Open – Stop – Close"*.

The first 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.

If the actuator is equipped with DMS electronic system local control consists of 3 buttons – *"Open", "Stop", "Close"* and rotary switch *"Local, Remote, Off"*.

## 6. ELECTRIC PARAMETERS

### Terminal board of the actuator

Electrical equipment consists of electronics power supply circuit and motor control circuit. Connection of the distribution network is performed by means of the terminal board located on the control module. The terminal block is designed that the total connection does not need any other terminals.

This terminal board uses screw terminals allowing to connect conductors with a maximum cross-section of 2,5 $mm^2$.

### Actuator internal wiring

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

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

### Isolation resistance

Isolation resistance of electric control circuits against the frame and against each other is min. 20 MΩ. Isolation resistance of the electric motor is min. 1,9 MΩ. After a dump test, isolation resistance of control circuits is min. 2 MΩ.

### Electric strength of electric circuits isolation

**MOKPED Ex** actuator with electronic system are tested:

| | |
|---|---|
| circuits of anti-condensation heater | 1500 V 50 Hz |
| circuits of electric motor | 1000 V +2.Ujm 50 Hz, at least 1500 V |
| circuits of outgoing and control signal circuits | 50 V DC |

### Deviations of basic parameters

| | |
|---|---|
| Tripping torque | ±15 % of max. value of range |
| Adjusting time | +10 % till -15 % of rated value *(idle run)* |

### Protection

The actuators are fitted with one internal and one external protective terminals ensuring protection against electric shock according to ČSN 33 2000-4-41. One protective terminal is also fitted to the electric motor. The protective terminals are labelled with a mark according to ČSN EN 60417-1a2 *(013760).*

## 7. DESCRIPTION

The entire actuator is designed as explosion-proof closure *"d"* marked **Ex d IICT6 Gb or Ex d IIB T6 Gb** for explosive gaseous atmosphere and **Ex tb IIIC T80°C Db IP67** for areas with flammable dust.

If the actuator is equipped with local control unit, the local control unit makes another explosion-proof closure *"d"*. Both explosion-proof closures are in such case separated by a bushing.

The motors consist of two parts:

a) **Power part** – is used to draw the necessary torque to the valve and is composed of a single- or three-phase asynchronous electric motor, countershaft gear box, planet gear box with output shaft, device for manual control with a hand wheel and floating screw.
b) **Control *(electronic)* part** onsisting of **DMS2** or **DMS2 ED** electronic system is used to control the actuator. The individual modules of both electronic systems and their functions are described in Chapter **ELECTRONIC OUTFIT.**

Operation of the position-limit is derived from rotation of the output shaft via special mechanisms. Operation of the torque-limit switches is derived from axial displacement of the *"floating worm"* of the manual control unit which is scanned and transferred to the control box.

The tripping torque can be adjusted within the range specified in the table 1. Torque switches may be blocked when actuator needs to produce a starting torque.

Showing position of the output shaft of the actuator can be either on site using mechanical indicators or display that can be installed in the actuator or remotely via an analog output signal and the corresponding indicator. Indicator is not included in the delivery.

# 8. ADJUSTMENT OF ELECTRIC ACTUATOR

## Stop screws

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

If a tight closure is required in the end position of the piping fitting and, hence, cutting-out of the electric actuator by means of the moment switches the cutting-out moment should be transferred to the piping fitting. In such case the particular stop screw is set so that the piping fitting is properly tight when the trips of the output shaft strike against the stop screw with cutting-out of the moment switch. Herein, the position and moment switches are connected in series. This can only be realized in the case when a tightly closed piping fitting is not required.

Clamp rings according to DIN 6799 are use to avoid removing of stop screws. These rings are removable only from the inside of explosion-proof closure and may in no case be removed.

# ELECTRONIC OUTFIT

The actuator is controlled with the electronic system **DMS2** or **DMS2 ED.** Both systems scan position of the output shaft and torque of the electric actuator by contact-free magnetic sensors. Long service life is guaranteed for the contact-free sensors that do not get mechanically worn.

The sensor of the output shaft position is absolute and does not require any backup power supply in case supply voltage is disconnected during operation of the electric actuator. Both systems can be set and monitored by a computer with controlling program *(set parameter can be backed up on a computer)* or manually without a computer *(for the electronics **DMS2,** parameters can be manually set and it can be checked without computer only if the system is equipped with a display and local control).* They contain diagnostic functions – error messages on the display, memory of recent failures and number of occurrences of respective failures.

The more simple system **DMS2 ED** substitutes the electro-mechanical board and/or provides for controlling the electric actuator by input analog signal as in the version Control.

The system **DMS2** enables the electric actuator to be used for two-position and three-position regulation or to be connected to the industrial bus bar Profibus.

# DMS2 ED SYSTEM

**Basic outfit of the DMS2 ED electronics:**

| | |
|---|---|
| Position control unit | – main part of the system DMS2 ED – includes microcomputer, position sensor, 3 signal lamps LED, 4 push-buttons for simple setting and checking the actuator, connectors for connecting the torque sensor, source board, and interface RS 232 *(connection of computer for setting and diagnostics).* |
| Source unit | – electronic power supply, user's terminal board *(connection of power supply and control signals),* 2 torque relays, 2 position relays, 2 signalling relays, 1 relay for signalling errors *(READY),* switch of resistance anti- condensation heater and its thermostatic control, connectors for connecting the control unit and analog CPT module. |
| Torque sensor | – provides contactless torque sensing |

**Optional outfit of the DMS2 ED electronics:**

| | |
|---|---|
| Analog module | – output of feed-back signal 4 – 20 mA, in version CONTROL input of control signal 0/4 – 20 mA |
| LCD display | – communication, position indicator |
| Local control | |
| Reversing relays | – for three-phase motors |

**Technical parameters of the DMS2 ED electronics:**

| | |
|---|---|
| Scanning of position | contact-less, magnetic |
| Scanning of torque | contact-less, magnetic |
| Working stroke see | 90° |
| Torque blocking | 0 – 20 s at reversing in limit positions |
| Input signal | 0*(4)* – 20 mA, 20 – 0*(4)* mA with switched on regulator function |
| | Local/Remote control, Local open/close |
| Output signal | 7 x relay 250 V AC, 3 A *(MO, MZ, PO, PZ, SO, SZ, READY)*<br>Position signal 4 – 20 mA, max. 500 Ω, active/passive, galvanic-isolated, 2x12 character LED display |
| Power supply of electronic | 230 V AC, 50 Hz, 4 W, over-voltage category II |

**Design of DMS2 ED electronics:**

| | |
|---|---|
| **Replacement of electromechanical board** | – the provided relay contacts substitute position, torque and signalling micro-switches; current feed-back signal 4 – 20 mA can also be brought out; the actuator is controlled by the superior control system with signals *“open“* and *“close“.* |
| **CONTROL** | **–** the electronics covers also function of the regulator; the output shaft position is controlled by analog input signal. |

## Function and setting of output relays

The output relays replace end-limit micro-switches; to some extent, function of the output relays differs according to chosen mode of electronics or it can be selected, preferably by the setting program.

**Setting program** – allows to select multiple authorization levels *(user, service, manufacturing*) and thereby change various parameters of the electronic equipment.

**Setting program** – is same for communication with the electronics DMS2ED and DMS2. **The users' version can be freely downloaded.** The next level of approval is given by the HW key, which must be connected to the computer.

Program is modified to leading the user by excluding the impossible variants.

*__Note:__ In the window “Parameters” of the setting program, column “Access”, the word “NO” designates parameters that cannot be changed by the user (change of these parameters is blocked).*

For actuator with **DMS2 ED** electronic system in ***“Replacement of electro-mechanical board“*** design have two contacts function of **torque** switches, two contacts function of **position** switches and two contacts can be used according to the customer requirements according to the list below *(typically a function of signalling switches).*

In version **CONTROL** have two contacts function of **motor** relay *(they control the actuator in “open“ and “close“ position by comparison result of the output shaft of the actuator and input signal),* two contacts have function of **torque** switches or torque + **position** switches according to setting, two contacts are available to the customer.

| Parametr | Změna | Chyba | Přístup | |
|---|---|---|---|---|
| Setrvačnost [0.1%] | | | NE | 5 |
| Setr Doběh [0.1s] | | | NE | 6 |
| Necitlivost [%] | | | | 1 |

Parametr – Parameter
Změna – Change
Chyba – Error
Přístup – Access
Setrvačnost *(0,1 %)* – Inertia [0.1 %]
Setr. Doběh *(0,1 s)* – Inertial run-out [0.1 s]
Necitlivost *(%)* – Insensitivity [%]
NE – NO

## *Relay MO, MZ, SO, SZ*

| Relay | DMS2 ED | DMS2 ED Control |
|---|---|---|
| **MO** | ***torque open***<br>*(also changes-over to errors)* | ***motor open*** |
| **MZ** | ***torque closed***<br>*(also changes-over to errors)* | ***motor closed*** |
| **PO** | ***position open*** | ***torque open*** *(also changes-over to errors )*<br>*+ optional tripping in position open (parameter Tripping)* |
| **PZ** | ***position closed*** | ***torque closed*** *(also changes-over to errors )*<br>*+ optional tripping in position closed (parameter Tripping)* |

In the version Control, the function of relay **MO/MZ** is same as that of motor relays.

Their operation is controlled by: – **regulation loop** *(deviation of required and actual position)*
– **active errors**

Any induced active error will change over both relays to a standstill position *(coils not energized).* In case of errors, the relays with a function of torque relays *(in both versions DMS2 ED and DMS2 ED Control)* are also controlled.

**List of functions that can be selected for signalling contacts SO, SZ:**

| | | | |
|---|---|---|---|
| off | torque and position O | position | torque O or Z |
| position O | torque and position Z | position negated | |
| position Z | opening | control – local | |
| torque O | closing | control – remote | |
| torque Z | movement | control – off | |

**Ready contact relays for errors signalling and non-standard states according to the following list:**

| | | |
|---|---|---|
| off | warnings + errors | torque O or Z |
| warning | errors + not remote | |
| errors | errors + warnings + not remote | |

***Note:***

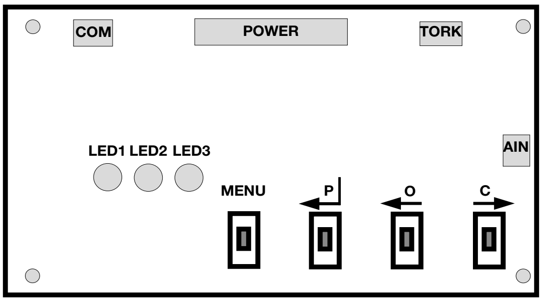
**Error** – a condition that affects the electronics, actuator reacts according to "*Response to failure and SAFE signal" (SAFE – external signal, which can impose error condition to the actuator. May use, for instance, when the actuator must be set as an error because the error occurred in another device).*

**Warning** – condition, which is only indicated, will not affect the electronics.

Can be set what condition will be evaluated as a **Warning** and what as an **Error.**

## Procedure of setting parameters by means of push-buttons

For simple programming of required operating parameters, the control unit is fitted with four push-buttons: **MENU, P, O, C** and three signal lamps.




**Colours of diodes:**
LED1 – yellow *(menu number)*
LED2 – red *(parameter value)*
LED3 – green

***Push-buttons and signal lamps LED on control unit DMS2.ED.S and DMS2.ED.S90***

| Yellow | Red | Green | State |
|---|---|---|---|
| - | - | - | System without feeding |
| - | - | lit on | Everything OK – working regime *(remote, local or switched off control)* |
| - | blinking | lit on | Error or warning – working regime *(remote, local or switched off control)* |
| lit on | - | lit on | Enter or exit of Setting of parameters by means of push-buttons or Setting of parameters by means of PC |
| blinking | - | lit on | Setting of parameters by means of push-buttons |
| blinking | blinking | lit on | |
| blinking | lit on | lit on | |

## Zápis poloha zavřeno, otevřeno a autokalibrace

– The actuator is set to position Closed and position Closed is stored by long pressing of push-button **C** – *until the LED1 turns on (without entering the Menu).*

– The actuator is set to position Open and position Open is stored by long pressing of push-button **O** – *until the LED1 turns on.*

– The calibration routine is started by means of push-button **P** *(in remote control)* that, in the three-position regulation, will measure actual inertial masses of the system and store them into the memory of the control unit.
**This function is designed for 3P regulation only** and serves to measure the inertial mass.

– In case the actuator stroke is to be increased and the switching off is set to ***"from position",*** the actuator will switch off during shifting in position 0 or 100 %. To further change the position, press **C** or **O**, and, while keeping it depressed, the actuator can be further shifted.

## Overview of MENU

BROWSING THROUGH MENU

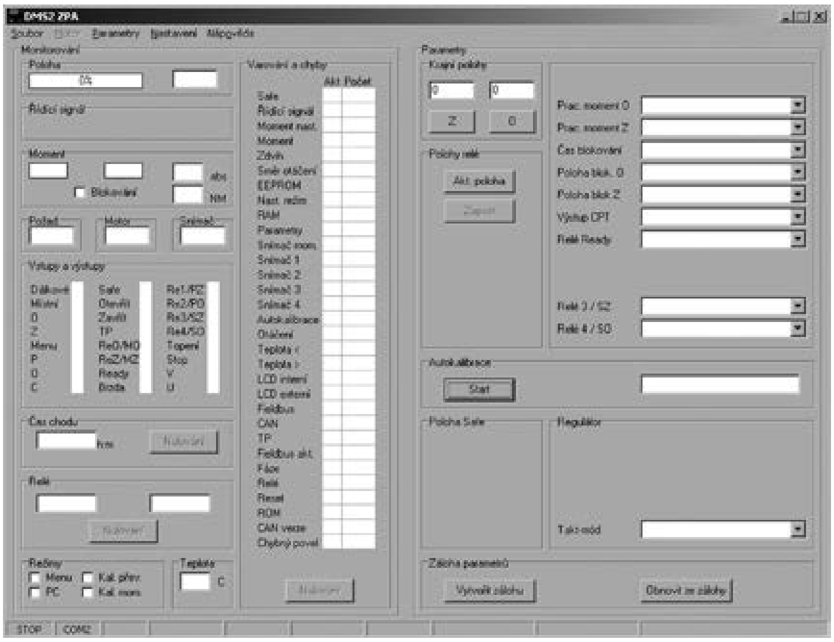
– The setting mode is entered by pressing and keeping depressed push-button **MENU** for at least 2 s; LED1 is then lit on.

– Shortly press **MENU** to select the basic MENU – menu M1 to M8 *(LED1 signalizes the menu number);* by short pressing of **P, O, C** they are entered *(LED2 signalizes particular parameter).*

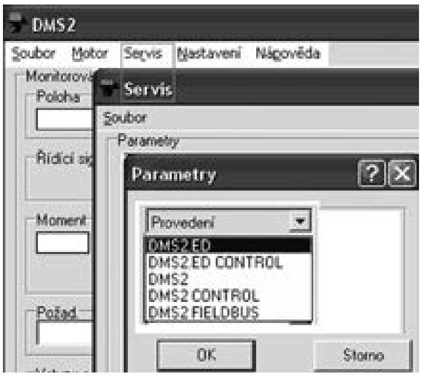
– Shortly press **P** to select required value of the parameter. In case the parameter can be set to several values, they are changed by short pressing of P *(number of blinking of LED2 indicates its value).* Keep pressing of P to record the chosen parameter; the record is confirmed by lighting on of LED2.

– Shortly press **MENU** to gradually set the required menu and parameters.

– After setting all required parameters, exit the setting menu by pressing and keeping depressed push-button **MENU** for at least 2 s. The setting menu will also be left in case that no push-button is pressed within 1 minute.



Main window of setting program




Selection of electronics

**MENU 1 – Setting of tripping torques**

– After entering the menu by means of push-button **C** or **O**, select required torque.

– Shortly press **P** to select the set value of the parameter 50 – 100 % *(5 – 10 blinking of LED2)* and keep pressing push-button **P** to store the parameter to memory.

**MENU 2 – Setting function of signalling relays**

– Basic setting of the signalling relays is SZ 1 % and SO 99 % of stroke.

– In case different setting is required, it can be changed after shifting the actuator to required position by means of push-button **C** or **O**.

– Using push-button **P**, perform basic setting SZ 1 % and SO 99 % of stroke.

**MENU 3 – Setting of blocking of torque in end-limit positions**

– Shortly press **P** to select the set value of blocking time 0 – 20 s *(0 – 20 blinking of LED2)* and keep pressing push--button **P** to store the parameter to memory.

– Keep pressing push-button **C** to store actual position for blocking torque on the side Closed to memory.

– Keep pressing push-button **O** to store actual position for blocking torque on the side Open to memory.

**MENU 4 – Setting transducer characteristics**

– Shortly press **P** to select the value 4 – 20 mA – 1x blinking of LED2 or 20 – 4 mA – 2x blinking of LED2, and keep pressing push-button **P** to store the parameter to memory.

## Other menus only serve for board setting in version Control

**MENU 5 – Setting control signal in 3P regulation**

– Shortly press **P** to select value 4 – 20 mA - 1x blinking of LED2,
or 20 – 4 mA - 2x blinking of LED2,
or 0 – 20 mA - 3x blinking of LED2,
or 20 – 0 mA - 4x blinking of LED2

and keep pressing push-button **P** to store the parameter to memory.

**MENU 6 – Setting insensitivity in three-position regulation**

– Shortly press **P** to select value 1 – 10 % *(1 – 10x blinking of LED2)* and keep pressing push-button P to store the parameter to memory.

**MENU 7 – Response in case of losing control signal in three-position regulation**

– Shortly press **P** to select value OPEN - 1x blinking of LED2,
or CLOSSE - 2x blinking of LED2,
or STOP - 3x blinking of LED2

and keep pressing push-button **P** to store the parameter to memory.

**MENU 8 – Way of switching off in end-limit positions in 3P regulation**

| | |
|---|---|
| – Shortly press **P** to select value TORQUE | - 1x blinking of LED2, |
| or TORQUE+PO | - 2x blinking of LED2, |
| or TORQUE+PZ | - 3x blinking of LED2, |
| or TORQUE+PO+PZ | - 4x blinking of LED2 |

and keep pressing push-button **P** to store the parameter to memory.

# PROCEDURE OF SETTING PARAMETERS BY PROGRAM DMS2

– Before starting the actuator, it is necessary to set some parameters of the system by means of program DMS2 on PC.
– For safety reasons, the system is delivered in the state of induced error of Calibration when the functions are limited in order to reduce the risk of damaging the actuator by wrong wiring. In controlling the actuator from program DMS2, its run is stopped when any torque is induced.

## Working torque

– Check and, if necessary, set the value of working torque 50 – 100 % in program DMS2.

## End-limit positions – working stroke

Position Z
– Shift to position Closed either manually or by means of menu Motor in program DMS2.
– The actuator can only be controlled by means of the program if no torque is induced. The torque should be left manually.
– Press push-button **Z** to confirm consent with the record.

Position O
– Shift to position Open either manually or by means of menu Motor in program DMS2.
– The actuator can only be controlled by means of the program if no torque is induced. The torque should be left manually.
– Press push-button **O** to confirm consent with the record.

## Autocalibration *(CONTROL only)*

– The autocalibration can only be started by means of the program if no torque is induced. The torque should be left manually.
– The autocalibration is started by push-button Start in program DMS2.
– Wait until the autocalibration is completed; information on its course is signalized next to push-button **Start.**

## Other parameters

Check and, if necessary, change other parameters:

| | |
|---|---|
| Control signal | 4 – 20 mA, 20 – 4 mA, 0 – 20 mA, 20 – 0 mA |
| Insensitivity | 1 – 10 % |
| Function in case of error | open, close, stop, to position |
| Time of torque blocking in end-limit positions | 0 – 20 s *(default 5s from producer)* |
| Position of torque blocking in end-limit positions | 1 – 10 % |
| Output of position signal | 4 – 20 mA, 20 – 4 mA |
| Function READY | combined error |

***Note:*** *Signal READY is brought out as contact of the relay on the terminal board. If the state ERROR or WARNING is not detected (setting can be made of what is to be evaluated as error or warning), the contact is closed; in case of error, warning, or if feeding of electronics is interrupted, the contact is opened. The state of the relay READY is indicated by the LED diode on the source board.*

# AUTODIAGNOSTICS

DMS2 ED performs continuously its diagnostics and, if a problem is detected, it reports warning or error. The warning or error is signalized by LED of the display and, possibly, by relay Ready. The warning has no effect on operation of the system, the error stops the actuator.

Assigning or switching off of warnings and errors is set in window *“Warning and error”* of the setting program *(it is opened by clicking one of parameters Warning 1 – 4 or Error 1 – 4 in window “Parameters”).*

## List of warnings and errors

| No. | Name | Warning[1] | Error[1] | Description |
|---|---|---|---|---|
| 1 | SAFE * | X | | Input SAFE activated *(external error, irrelevant in DMS2 ED)* |
| 2 | Control signal | X | | Value of control signal ≤ 3 mA *(it applies to ranges 4 – 20 / 20 – 4 mA)* |
| 4 | Torque | X | | Induced torque beyond end-limit positions or disconnected torque sensor |
| 6 | Heat protection | X | | Input heat protection activated |
| 7 | Sense of rotation | X | | Reverse sense of rotation *(for CONTROL only)* |
| 8 | EEPROM | X | | Wrong control sum of parameters in EEPROM |
| 9 | RAM | X | | Wrong control sum of parameters in RAM |
| 10 | Parameters | X | | Wrong parameters in EEPROM |
| 11 | Setting modes | X | | Setting mode from push-buttons or PC |
| 12 | Torque sensor | X | | Disconnected or defective torque sensor |
| 13 | Sensor 1 | X | | Error of sensor of position 1 *(lowest stage)* |
| 14 | Sensor 2 | X | | Error of sensor of position 2 |
| 15 | Sensor 3 | | X | Error of sensor of position 3 |
| 16 | Sensor 4 | | X | Error of sensor of position 4 *(highest stage)* |
| 17 | Calibration | X | | Autocalibration not carried out |
| 18 | Torque setting | | X | Wrong setting of torques *(parameters Torque O/Z/50/100%)* |
| 19 | Stroke | | X | Wrong setting of stroke *(parameters Position O/Z)* |
| 20 | Rotation error | | X | The actuator does not rotate |
| 21 | High temperature | X | | Permitted max. temperature exceeded *(parameter Temperature max.)* |
| 22 | Low temperature | X | | Permitted max. temperature exceeded *(parameter Temperature min.)* |
| 23 | LCD internal * | X | | Display of LCD internal does not communicate or not added in parameter CAN of configuration |
| 24 | LCD external * | X | | Display of LCD external does not communicate or not added in parameter CAN of configuration |
| 25 | Fieldbus * | X | | Module of industrial bus does not communicate or not added in parameter CAN of configuration |
| 26 | CAN * | X | | Error of bus CAN *(short circuit, interruption, only sensor communicates)* |
| 27 | Fieldbus activity* | X | | Connection to industrial bus not active |
| 28 | Phase * | | X | Inverse order of phases or some phase missing |
| 29 | Relay of service life | X | | Service life of relay MO/MZ at CONTROL exceeded *(parameter Relay of service life)* |
| 30 | Reset | X | | Non-standard Reset of unit induced *(watchdog etc.)* |
| 31 | ROM | | X | Wrong control sum of program in ROM |
| 32 | CAN version * | X | | Sensor, LCD display or module Fieldbus have incompatible versions of firmware |
| 33 | Wrong command * | | X | Commands Open and Close entered at the same time |
| 34 | Wrong inertia | – | – | Wrong inertia measured by autocalibration *(for autocalibration only)* |
| 35 | Wrong run-down | – | – | Wrong run-down measured by autocalibration *(for autocalibration only)* |
| 41 | Wrong position | | X | Servo-drive is in position 25 % behind working stroke |

*[1]) Assignment can vary depending on the version of firmware of the sensor control unit.*

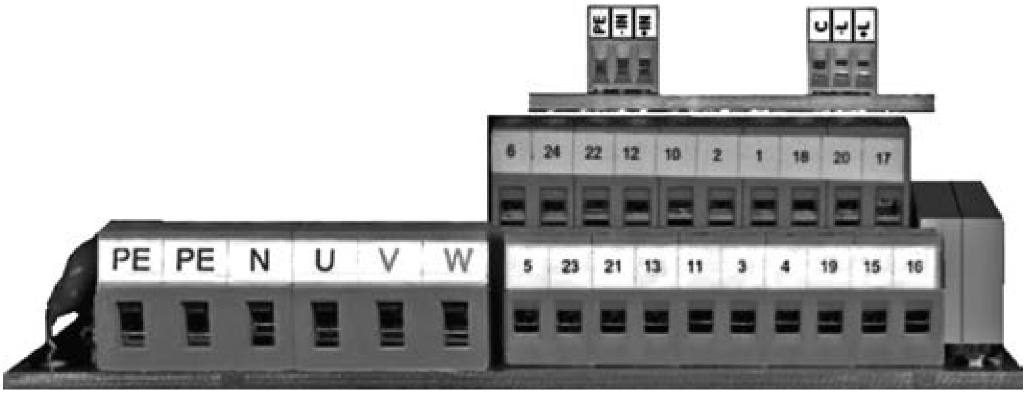
* *Applies to DMS2 only.*

## Memory of number of induced errors

- For all ascertained warnings and errors, DMS2 uses counters of occurrence of these warnings and errors during operation of the system.
- Values of the counters are stored to the EEPROM memory and are preserved even in case of the power supply fall-out.
- Reading of the counters is possible by means of the program for PC
- Clearing of the counters is possible by means of the program for PC with the level of authorization *"SERVICE".*

– In version DMS2ED with display is shown number of the current error in the display.
– Errors / warnings EEPROM, RAM, ROM, Reset are internal electronics errors
  – for EEPROM warning restore parameters from a backup, unless you have not saved the last state as a backup, if so check and reset of some parameters is necessary.

  Restoring parameters from backup – can be done from PC or by using buttons on the sensor:
  – turn off power of electronics
  – press and hold O + C buttons
  – turn the power on *(all LED lit)*
  – wait for blink of yellow and red LED, by this writing of back up parameters is signalled
  – RAM error is in operation corrected automatically by reloading parameters from EEPROM to RAM
  – ROM error signals overwrite of program memory, this sensor must be replaced

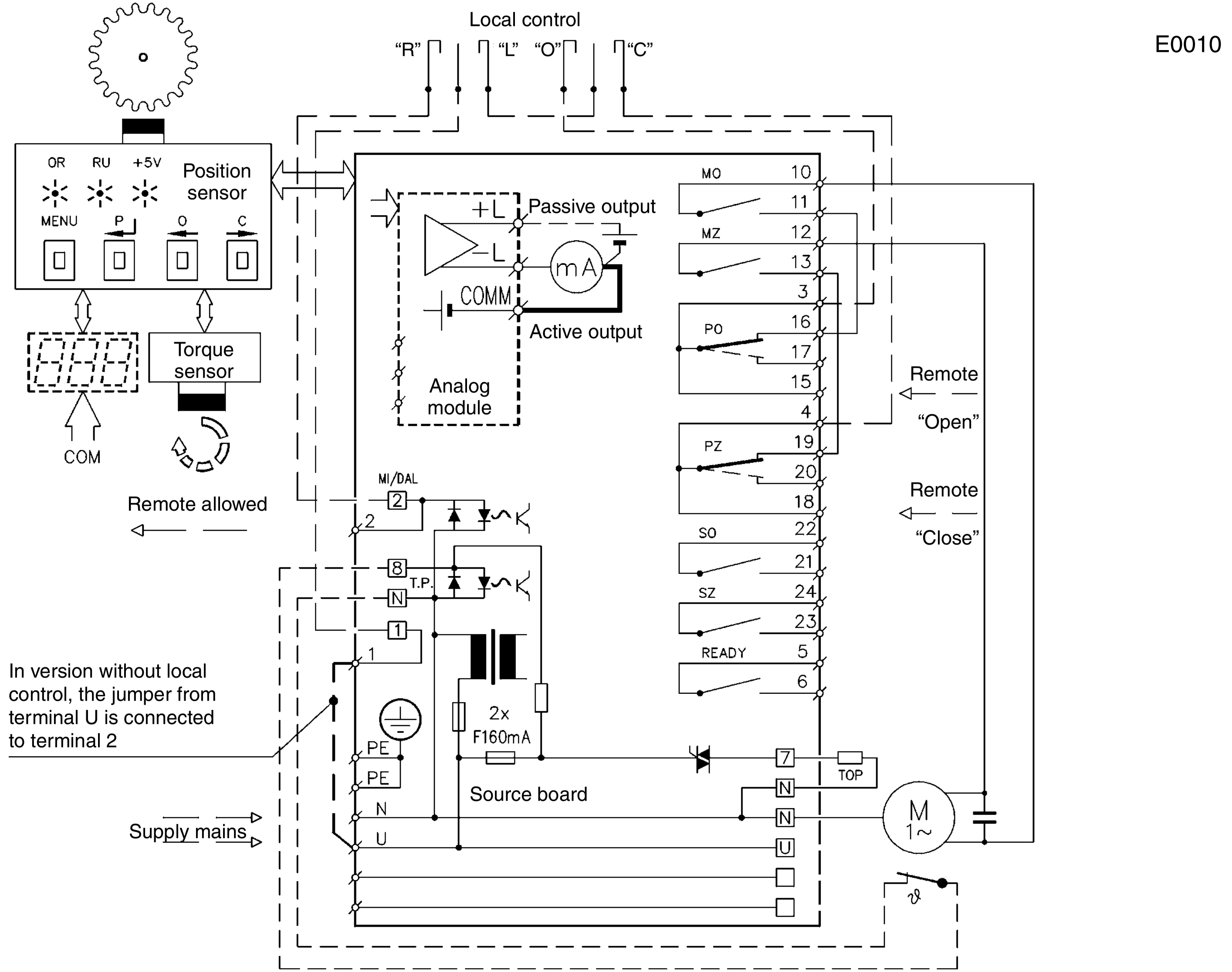



**Terminal board of the actuator with DMS2 ED electronics**

If the actuator is of the single-phase version the power supply is connected only to terminals **PE, N, U.** The terminals **V, W** remain non-connected. If the actuator is of the version *"Replacement of electric-mechanical board"* with three-phase electric motor without power relays, the electric motor is connected to a separate terminal board *(not shown here).*

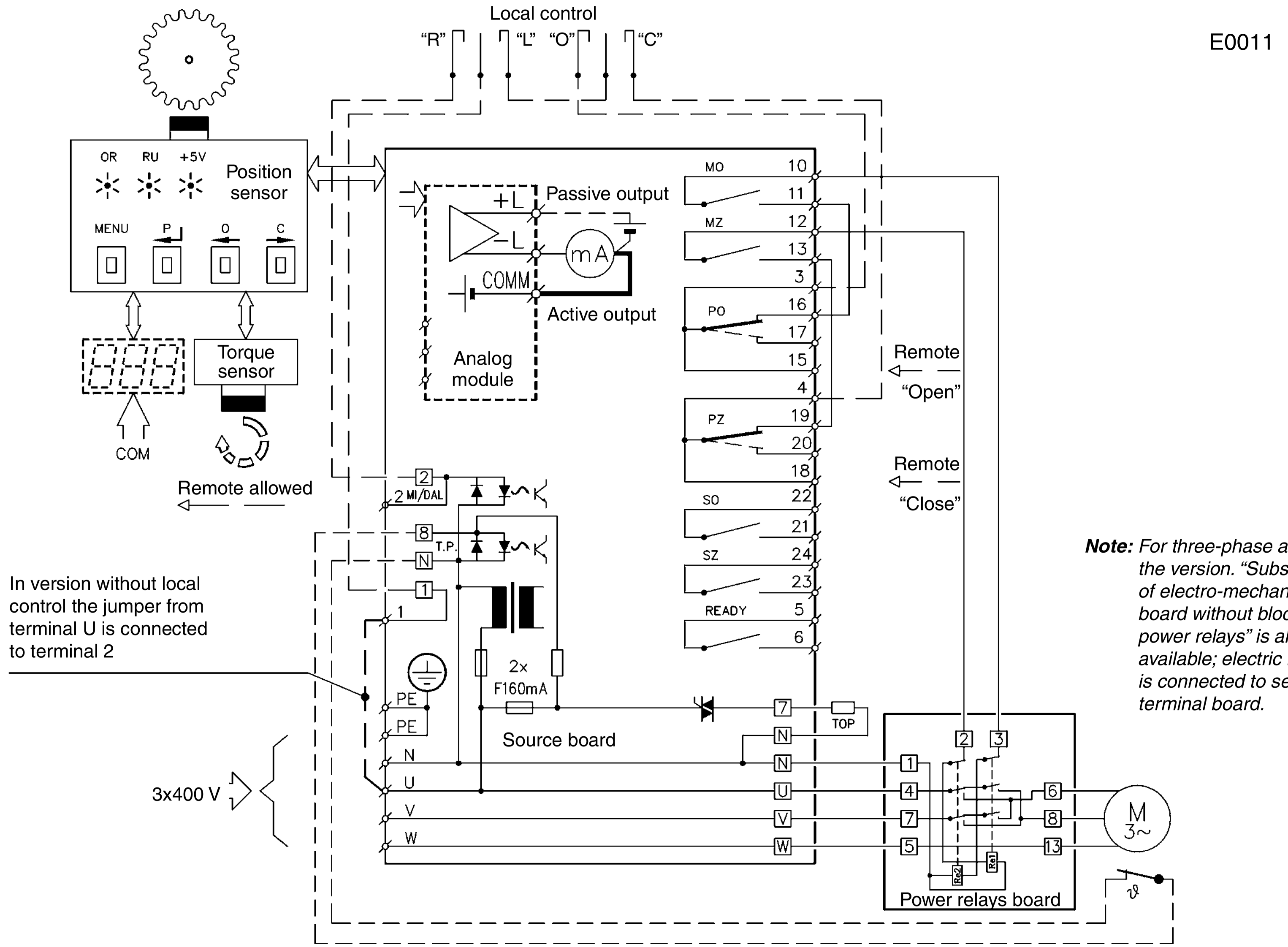
## Example of wiring diagram of electronics **DMS2 ED** in version **Substitution of electro-mechanical board** with single-phase electric motor

E0010




***Note:*** *Here, contacts of relay MO, MZ, SO, SZ are shown with power supply switched off; with power supply switched off contacts PO, PZ are shifted to the position drawn in dashed line.*

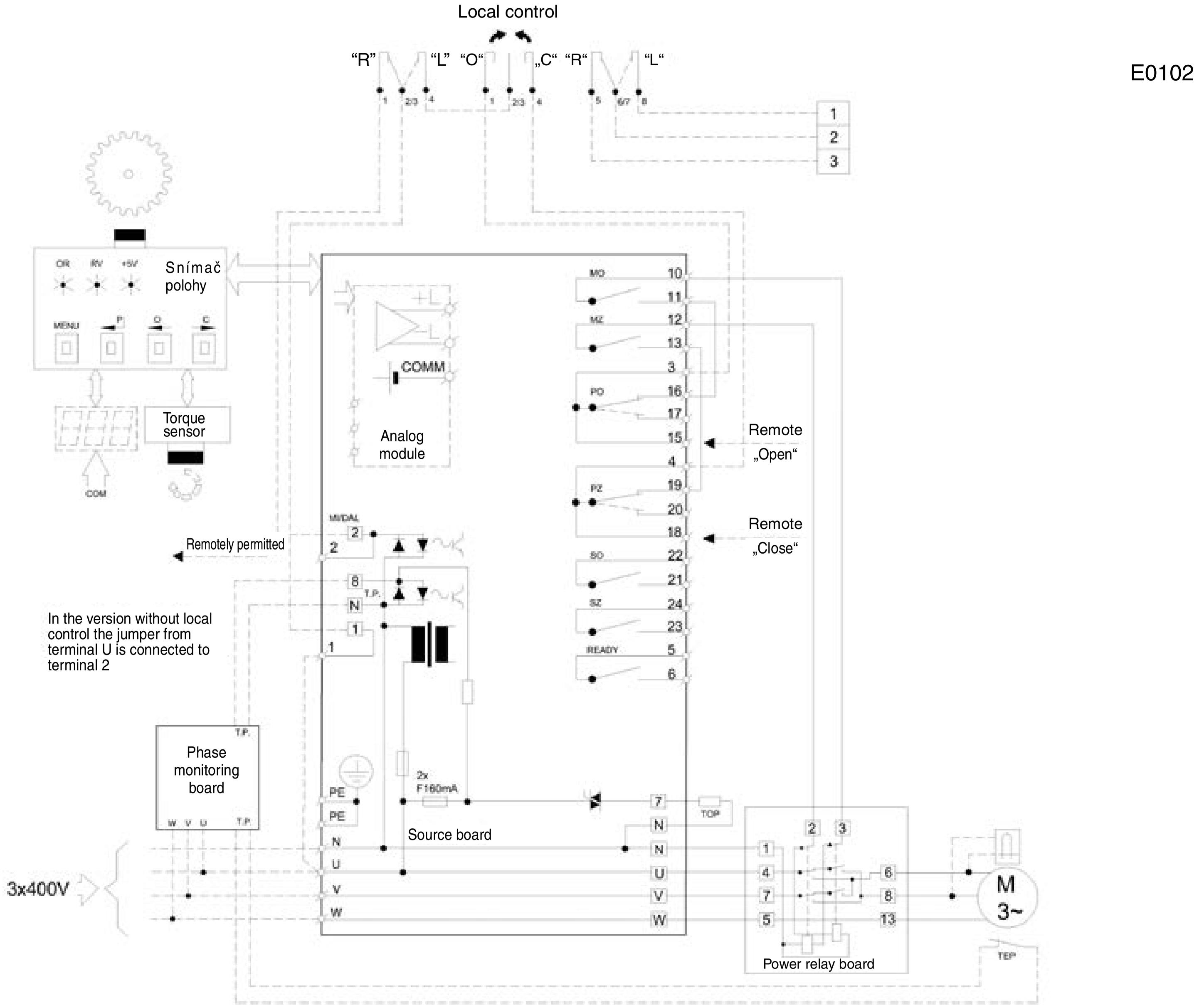
## Example of wiring diagram of electronics **DMS2 ED** in version **Substitution of electro-mechanical board** with three-phase electric motor



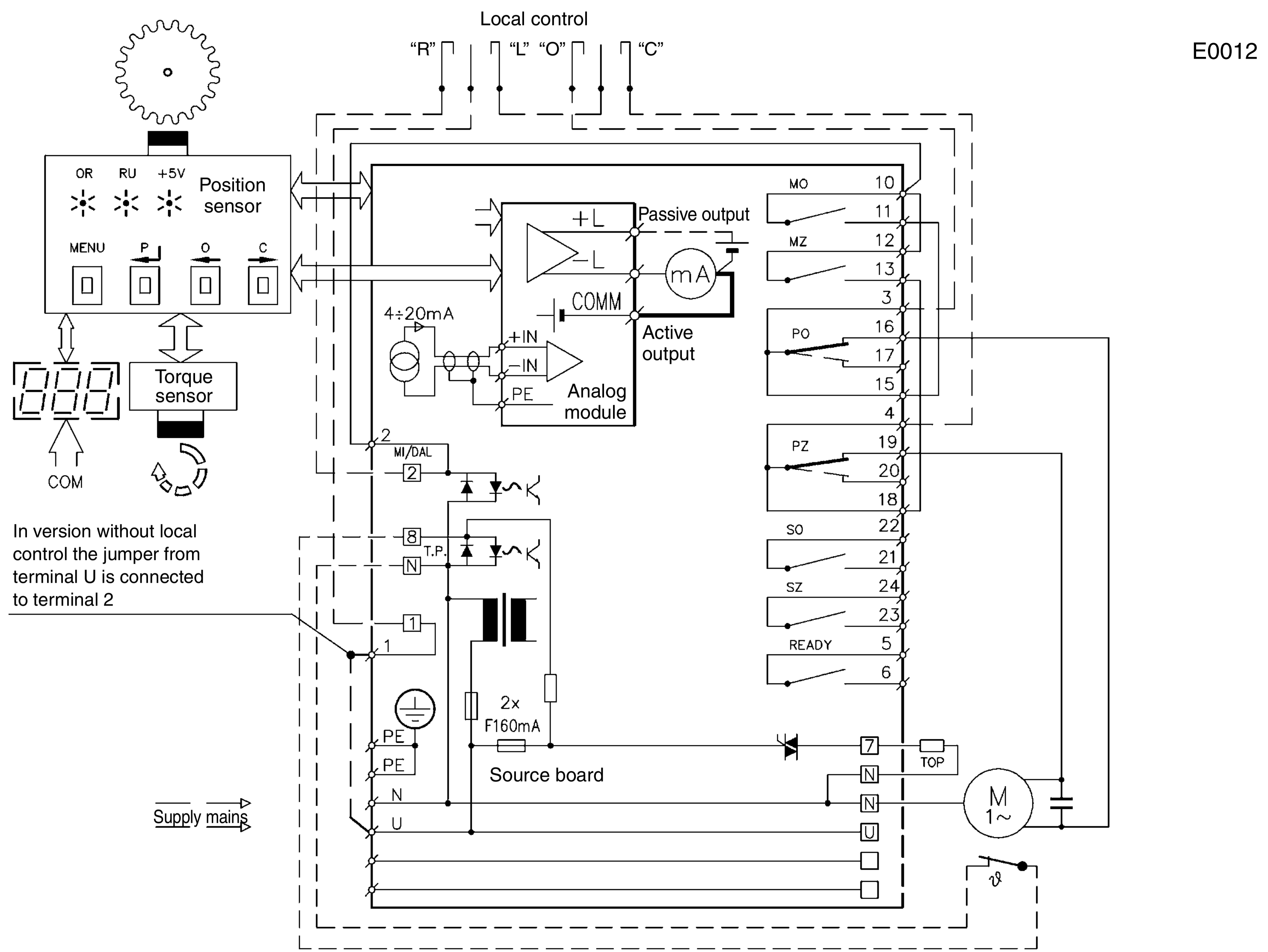

***Note:*** *For three-phase actuator, the version. "Substitution of electro-mechanical board without block of power relays" is also available; electric motor is connected to separate terminal board.*

***Note:*** *Here, contacts of relay MO, MZ, SO, SZ are shown with power supply switched off; with power supply switched off contacts PO, PZ are shifted to the position drawn in dashed line.*

Example of connection of **DMS2ED electronics with phase tripping monitoring** module dual local control switch

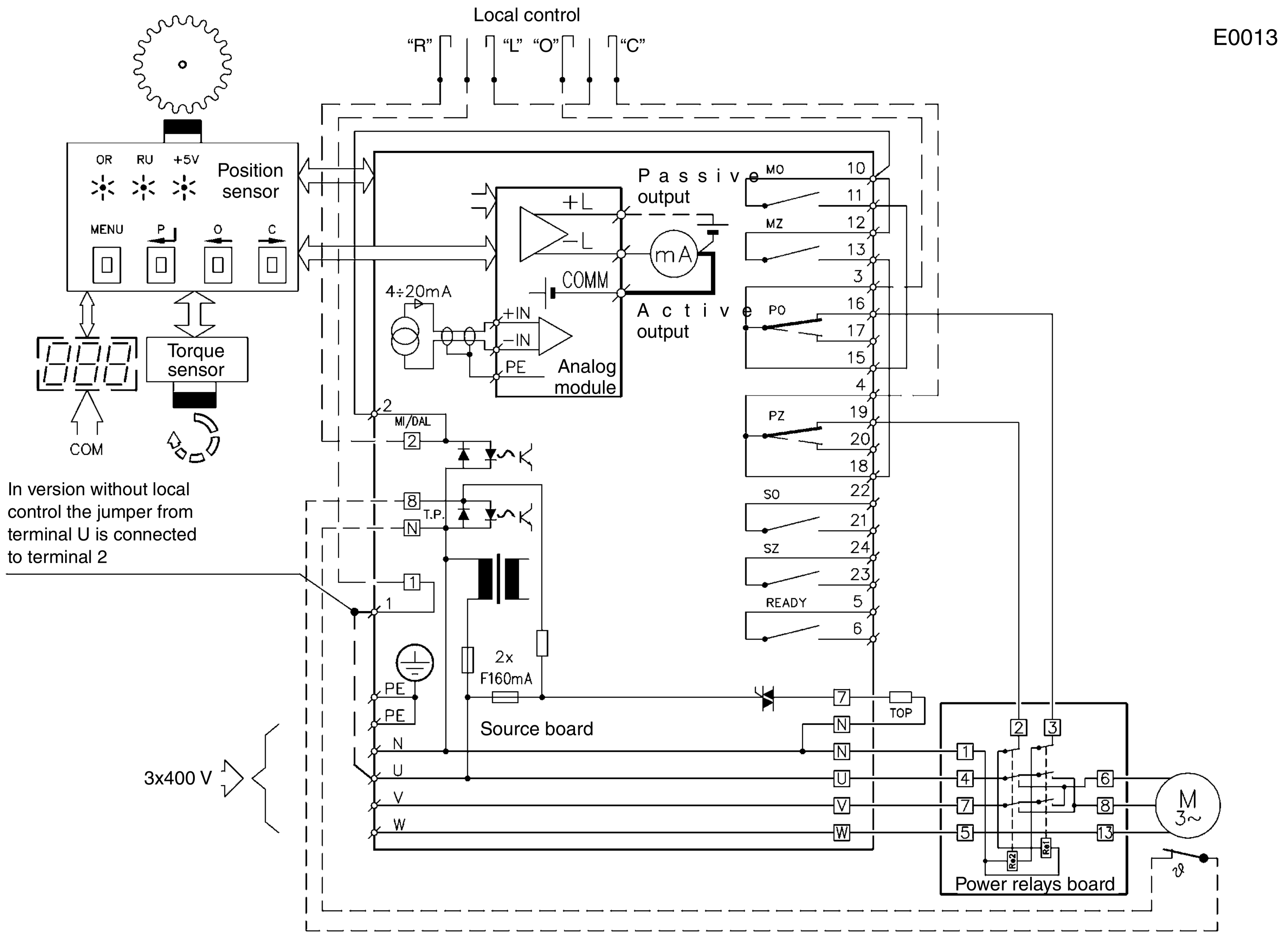


## Example of wiring diagram of electronics **DMS2 ED** in version **Control** with single-phase electric motor




***Note:*** *Here, contacts of relay MO, MZ, SO, SZ are shown with power supply switched off; with power supply switched off contacts PO, PZ are shifted to the position drawn in dashed line.*

## Example of wiring diagram of electronics **DMS2 ED** in version **Control** with three-phase electric motor




***Note:*** *Here, contacts of relay MO, MZ, SO, SZ are shown with power supply switched off; with power supply switched off contacts PO, PZ are shifted to the position drawn in dashed line.*

# DMS2 SYSTEM

## Main properties of DMS2 electronics:

– Complete control of the actuator run of the two- and three-position regulation or connection to the industrial bus Profibus.
– Synoptic signalization of operation and service data on the character LCD display.
– Autodiagnostics of error reports on the LCD display, memory of recent failures and number of occurrences of respective failures.
– Setting of parameters by the PC program and by local control provided that the actuator is fitted with local control.

## Basic outfit of DMS2:

The **control unit** is the main part of the system DMS2; it comprises:
– Microcomputer and memory of parameters
– Position sensors
– 2 signalling LED
– Connectors for connecting the torque sensor, relay board, and two-position inputs, source board, communication adapter, LCD display, and local control

**Torque unit** provides for scanning torque by the contactless sensor.

The **source unit** consists of:
– Power supply for electronics.
– 2 relays for electric motor control,
– Ready relay with change-over contact separately led on a terminal board
– 1 – 4 signalling relays with one pole of contact switch led on terminal board. Second poles of relay contacts 1 – 4 are connected to COM terminal.
– User terminal for supply voltage and output relays connection.

The unit allows connection of the heating resistor and its control with thermostat.

The unit controls power switches of the electric motor *(reversing relay)* and can directly control a low power single phase electric motor.

**Display unit –** dual line display, 2 x 12 alphanumeric characters
**Button unit –** buttons sensor ***"open", "close", "stop"*** and rotary switches ***"local, remote, stop."***
**Power relays –** for three-phase electric motor *(according to design).*

***Note:***

*DMS2 electronics – in 2P or 3P control design are motor relays for controlling of the actuator (associate torque and position function) connected directly to the contactors and not to the terminal board. Four relay contacts R1 to R4, led to the terminal board, have only a secondary function and are used like a signalling switches to indicate the status of the actuator.*

DMS2 electronic system as DMS2ED electronic system designed for 2P or 3P regulation has **contact Ready** led to the terminal board for error and non-standard states signalling according to the following list:

| | | |
|---|---|---|
| OFF | warnings + errors | torque O or Z |
| warning | errors + not remote | |
| error | errors + warnings + not remote | |

Electronics DMS2 in version Profibus communicates with the master control system exclusively via industrial bus, no other signals are brought out.

## Optional DMS2 electronics outfit *(in the actuator must be one of these units):*

**The two- and three-position control unit** – allows controlling the actuator by moving to the *"open"* and *"closed"* positions or by analog signal 0 *(4)* – 20 mA.

**Profibus connection unit** – allows you to control actuator by PROFIBUS.

## Technical parameters of DMS2 electronics:

| | |
|---|---|
| Scanning of position | contact-less, magnetic |
| Scanning of torque | contact-less, magnetic |
| Working stroke see | 90° |
| Torque blocking | 0 – 20 s at reversing in limit positions |
| Input signal | 0*(4)* – 20 mA with switched on 3P regulator function |
| | Open, Close 15 – 60 V AC/DC with switched on 2P regulator function |
| | Safe 15 – 60 V AC/DC |
| | Local/remote control, local open, stop, local close |
| Output signals | 5 x relay 250 V AC 3A *(R1, R2, R3, R4, READY)* |
| | Position signal 4 – 20 mA, max. 500 Ω, active/passive, galvanic-isolated |
| | LCD display 2 x 12 alpha-numeric characters |
| Power supply | 230 V AC, 50 Hz, 4 W, over-voltage category II |
| | Monitoring the presence and sequence of a phase |

# PROCEDURE OF SETTING PARAMETERS BY PROGRAM DMS2

Before putting the actuator into operation, it is necessary to set some parameters of the system by means of program DMS2 on PC.

***Warning:***

*For safety reasons (reduced risk of damage to the actuator by wrong wiring), the system is delivered in the state of the induced error of calibration when the functions are limited and, during controlling the actuator from program DMS2, its run is stopped if any torque is induced.*

***Note:***

*The setting program is the same for electronics DMS2 ED. See the figure on page 12 for the main window and the window of Selection of electronics.*

## Working torque

– Check and, if necessary, set the value of the working torque 50 – 100 % in DMS2 program.

## Tripping in end-limit positions

– Check and, if necessary, set the way of tripping in the end-limit positions:
  – Torque
  – Torque+position O
  – Torque+position Z
  – Torque+position O+Z

## End-limit positions – working stroke

– Position Z
  – Shift to position Closed either manually or by means of menu Motor in program DMS2.
  – The actuator can only be controlled by means of the program **if no torque is induced.** The torque should be left manually.
  – Press **push-button Z** to confirm consent with the record.

– Position O
  – Shift to position Open either manually or by means of menu Motor in program DMS2.
  – The actuator can only be controlled by means of the program **if no torque is induced.** The torque should be left manually.
  – Press **push-button O** to confirm consent with the record.m.

## Autocalibration

– The autocalibration can only be started by means of the program **if no torque is induced.** The torque should be left manually.

– The autocalibration is started by push-button **Start in program DMS2.**
– Wait until the autocalibration is completed; information on its course is signalized next to push-button Start.

## Other parameters

Check and, if necessary, change other parameters:

| | | | | |
|---|---|---|---|---|
| Control signal | 4 – 20 mA | 20 – 4mA | 0 – 20 mA | 20 – 0 mA |
| | 2 position | Bus | | |
| Insensitivity | 1 – 1 0 % | | | |
| Function SAFE | Open | Close | Stop | To position |
| Active SAFE | 0 V | 230 V | | |
| Time of blocking torque in end-limit positions | 0 – 20 s | | | |
| Position of blocking torque in end-limit positions | 1 – 10 % | | | |
| Output of position signal | 4 – 20 mA | 20 – 4 mA | | |
| READY function | Combined error | Error code | | |
| Ready – Local | Switched off | Switched on | | |
| Relay 1 – 4 | Switched off | Position O | Position Z | |
| | Torque O | Torque Z | | |
| | Torque and position O | | Torque and position Z | |
| | Opening | Closing | Movement | |
| Position Relay 1 – 4 | 0 – 100% | | | |

***Note:***

*SAFE – input information on the error of an external device can be set so that the actuator would respond as to its own error.*

## Autodiagnostics

The table List of errors – same as for electronics DMS2 ED *(page 13)*

### Memory of number of induced errors

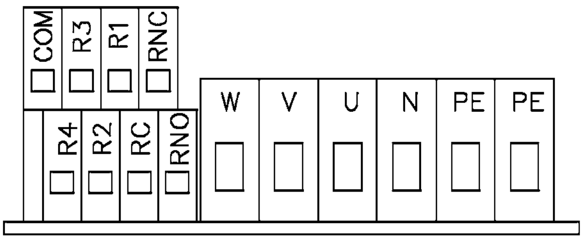
– same as for the DMS2 ED electronics

### Memory of recently induced errors

– DMS2 stores 3 recently induced errors to the memory EEPROM.
– DMS2 provides for displaying the errors by means of the PC program or the switches of the local/ remote control.
– Reading and clearing of the counters with the local / remote control switches:
  – Display – OFF position and the O or C position.
  – Reset – after switch from errors to remote control.

## Terminal board of actuator with electronics DMS2

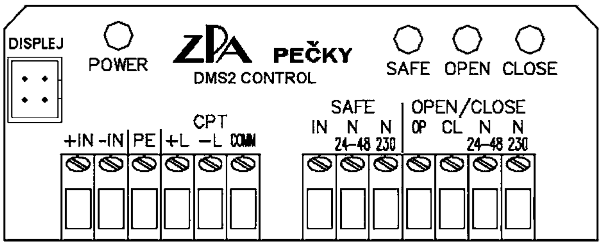
– Terminals on source board




***Terminals on source board***

***Note:***

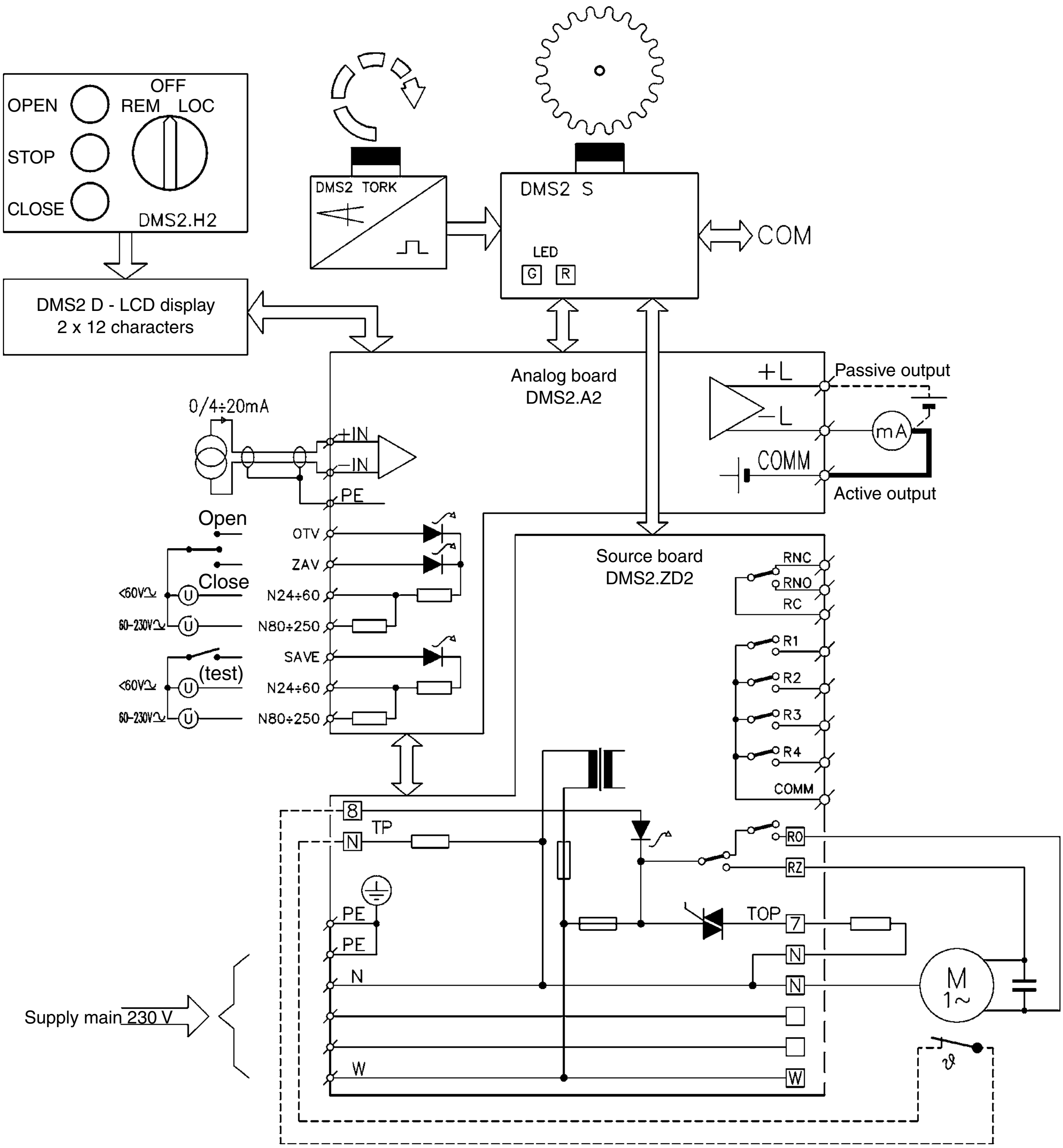
*If the actuator is of the single-phase version the power supply is connected to terminals **PE, N, U** only. Terminals **V, W** remain unconnected.*




***Terminals in local control box***

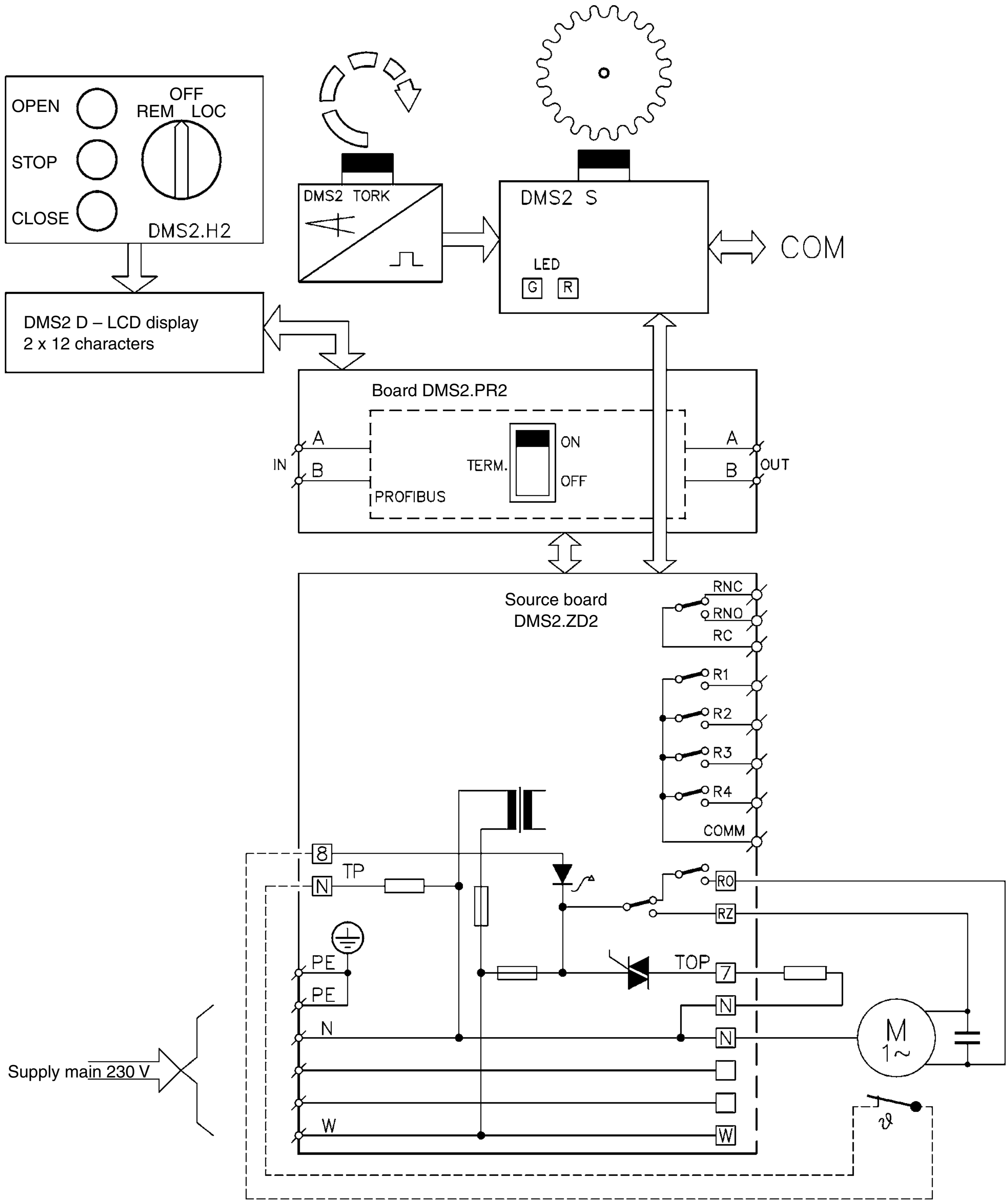
Example of wiring diagram of system **DMS2** in version for control with signals *"open"* and "close" or in version for control with analog current signal with single-phase electric motor

E0014



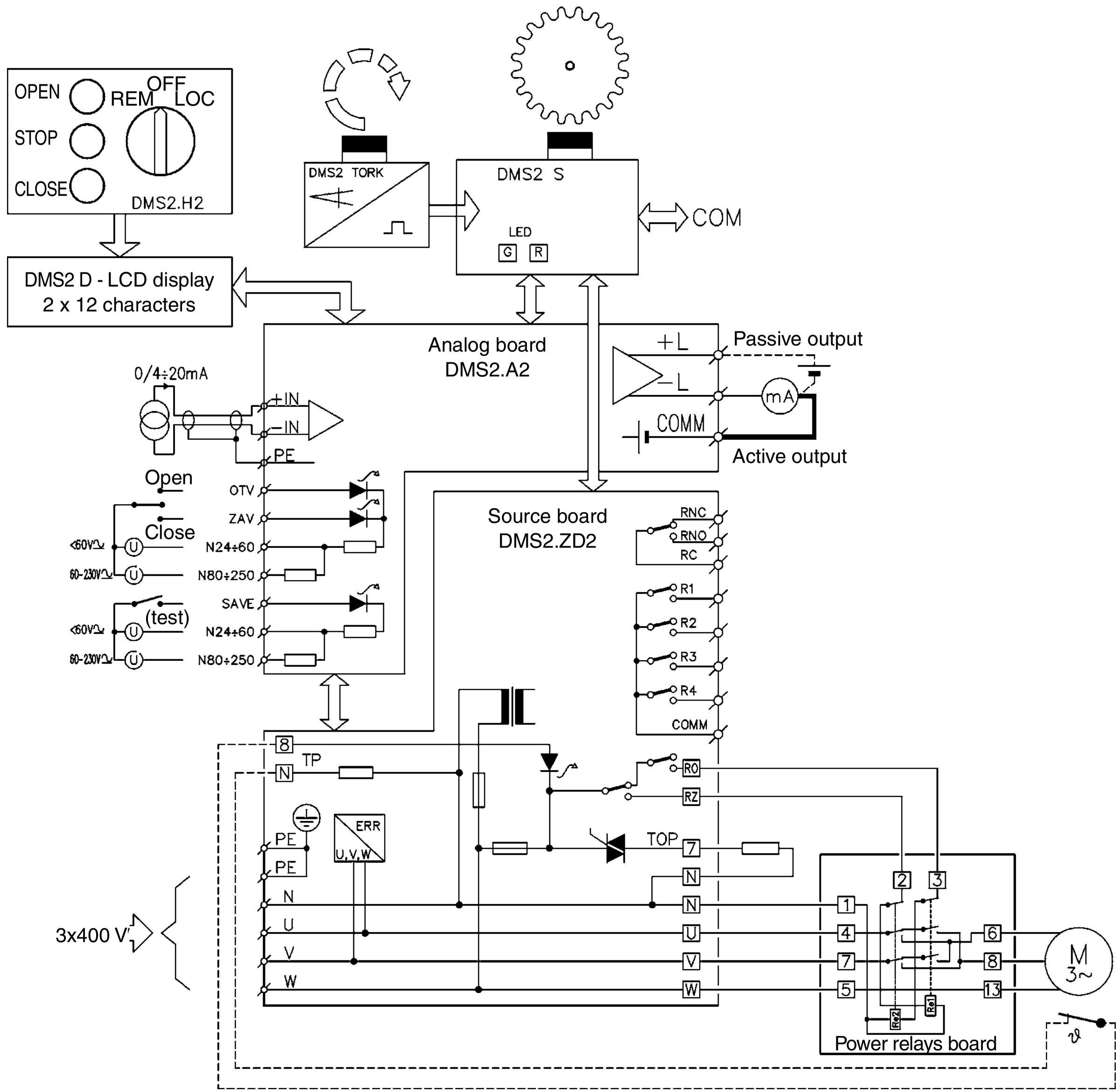
Example of wiring diagram of system **DMS2** in version Profibus
with single-phase electric motor

E0015

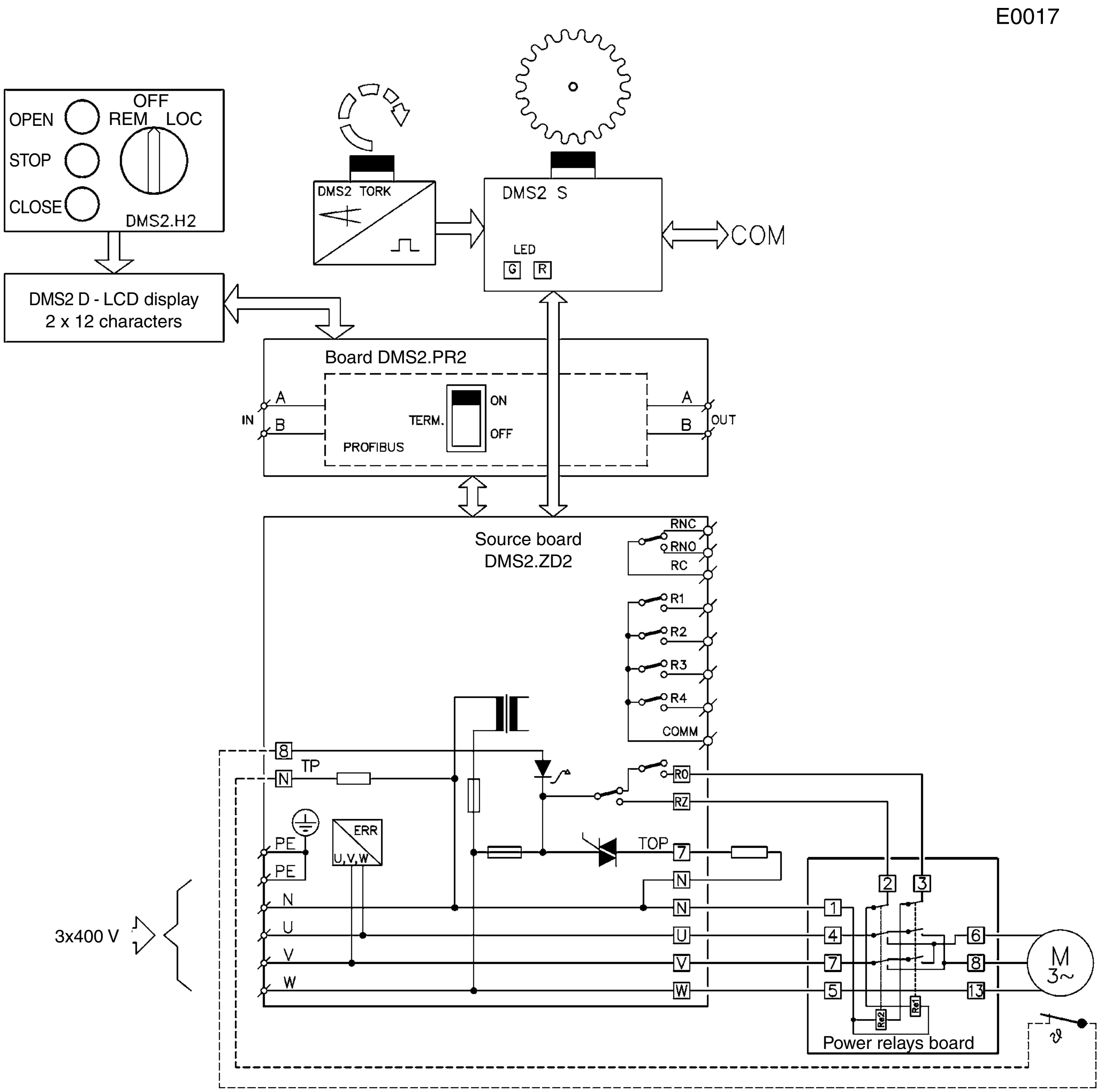


Example of wiring diagram of system **DMS2** in version for control with signals “open” and “close” or in version for control with analog current signal with three-phase electric motor

E0016

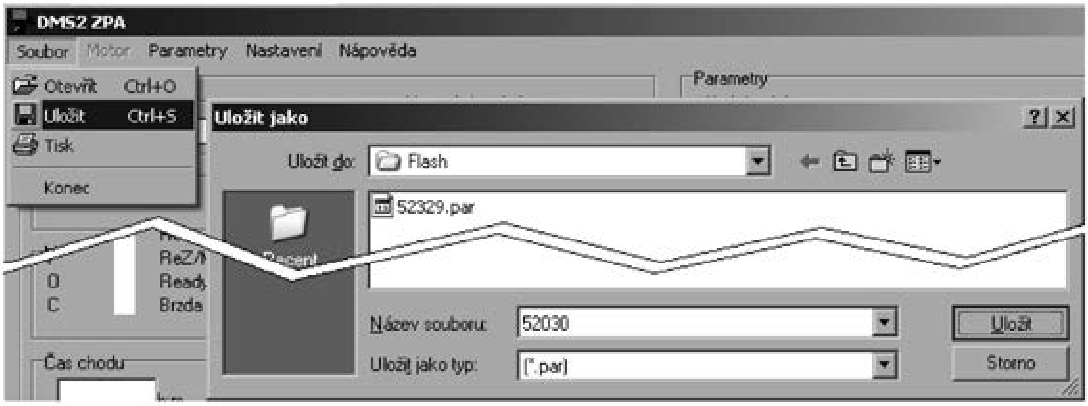


Example of wiring diagram of system **DMS2** in version Profibus
with tree-phase electric motor



***Note:***

*The setting program enables data to be copied from the memory of parameters of the electronics DMS2 and DMS2 ED into the computer as a file with suffix **"par"** (in the example in the figure the file **52 030.par** is created in the directory **Flash**). The file can serve as a back-up for the case that it will be necessary to replace the position sensor in the given actuator and to set it in the same way as the replaced one; or it can be sent as an enclosure to e-mail to the manufacturing or service firm in solving possible problems.*




# 9. ASSEMBLING AND PUTTING THE ELECTRIC ACTUATOR INTO OPERATION

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. Putting into operation is excluded in this case. 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. 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 is inadmissible. Before putting the actuator into operation, excess grease 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 desiccant in the terminal box.

The user can only put into operation electric installations with compliance documented by a report of the initial revision.

Before fitting in place, the actuator should be carefully inspected, particularly in case that it has been stored for a prolonged period; the following should be checked:

– condition of parts and connections forming explosion-proof closure;
– insulation resistance of the motor winding;
– possible damage during storage.

It should also be checked that location corresponds to provisions of the par. *"Working conditions".* If different way of assembly is required by local conditions the manufacturer should be contacted.

The protective conductor must be connected to a protective terminal marked according to ČSN IEC 417. On the actuator, the protective terminals are located on the body and inside the actuator, on the control board at the terminal board.

## Connection

The actuator should be connected according to the wiring diagram placed inside the cover in such a way that power supply wires have permanent good contact with the connecting terminals. The supply voltage must correspond to the voltage stated on the rating plate of the actuator. Internal space of the cover should be clean and dry. No free wires may stick out of the connected conductors.

## Protection

Electric motors of the actuators are fitted with a built-in automatically restoring thermal protection according to ČSN EN 600034-11. For the actuators type no. 52320 with single-phase electric motors ES 7150-2AL, ES 7130-4AL and FCJ2B52D, it is connected in series with the electric motor winding; hence, it controls the motor directly and is not connected to the terminal board of the actuator. For other electric motors, the thermal cut-out is connected by two separate outlet wires to the terminal board of the electric motor and the motor is controlled by means of another device *(contactor, relay, etc.).*

## Insulation resistance

Before putting the actuator into operation or restarting it after a longer idle time, it is necessary to check that insulation conditions have not been worsened and that there is no danger of the winding damage or electric shock. Insulation conditions should also be checked during inspections in compliance with provisions of ČSN 34 3205 and standards valid for non-explosive electric installations. Insulation resistance of electric control circuits against the frame and against each other should be min. 20 Mohm. Insulation resistance of the electric motor should be min 1.9 Mohm. Insulation resistance of the current transducer is 20 Mohm at 50 V DC.

The actuators with a lower insulation resistance must not be put into operation. The cause can lie in a damaged winding or excess humidity. Damp motors with insulation resistance lower than the stated value must be carefully dried before being put into operation. By drying the winding, moisture is removed from the insulation and insulation resistance is thus increased to the prescribed value. Drying can be carried out in different ways. Drying directives are given by the standard ČSN 35 0010 or local recommended methods can be applied.

## Supply line and wiring

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

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

Threaded holes for cable entries are marked M20x1,5 or M25x1,5 in accordance with article 13 of ČSN EN 60079-1.

These entries are sealed by appropriate plugs.

**The customer is obliged to establish electrical connection for direct entry to the flameproof enclosure, that corresponds to the requirements of ČSN EN 60079-14 and the protective enclosure is at least IP67.**

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

| Cable diameter | Gland | Threaded entry |
|---|---|---|
| CR-U/25 | M25x1,5 | 11,7 – 20,0 mm |
| ICG 623/B | M25x1,5 | 13,0 – 20,2 mm |
| CR-U/20 | M20x1,5 | 9,5 – 14,0 mm |
| ICG 623/A | M20x1,5 | 11,0 – 14,3 mm |

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

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

## Brief Description

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

***Warning:***

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

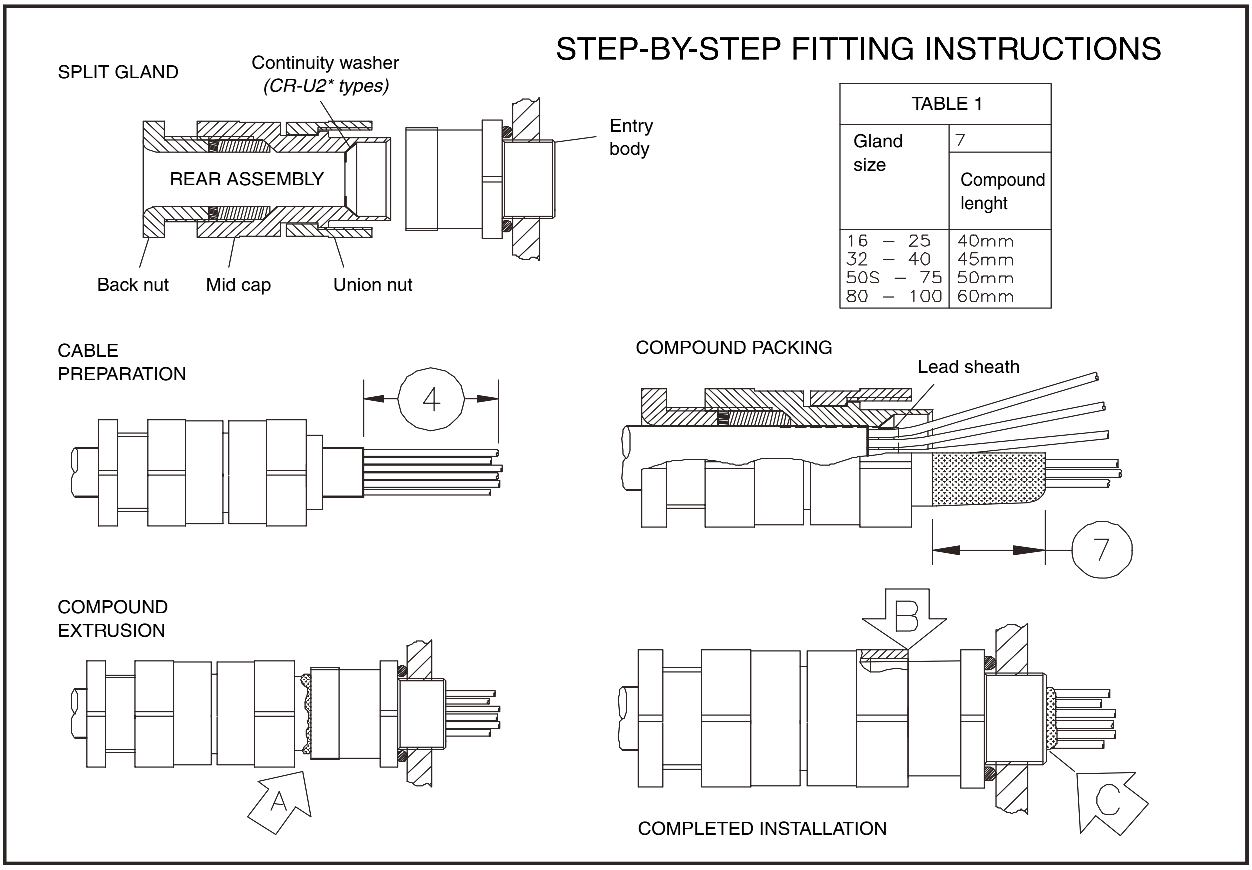



TABLE 1

| Gland size | 7 Compound lenght |
|---|---|
| 16 – 25 | 40mm |
| 32 – 40 | 45mm |
| 50S – 75 | 50mm |
| 80 – 100 | 60mm |

## STEP-BY-STEP FITTING INSTRUCTIONS

1. Split gland as shown in the figure.
2. Fit Entry Body. Hand-tighten, then using wrench tighten a further 1/2 turn. DO NOT EXCEED MAX TORQUE FOR ENCLOSURE.
3. Slide Rear Assembly (locking nut, central enclosure and cap nut) onto cable as shown in the figure.
4. CABLE PREPARATION
   Strip jacket so that cores are fully exposed in the compound chamber, length to suit installation. Lead sheath must be cut to push through the continuity washer. Remove protective foils, and any cords/fillers from around and between the cores. Take care not to cut the insulating sleeves of the cores. Pigtail and sleeve any screens to be passed through compound.

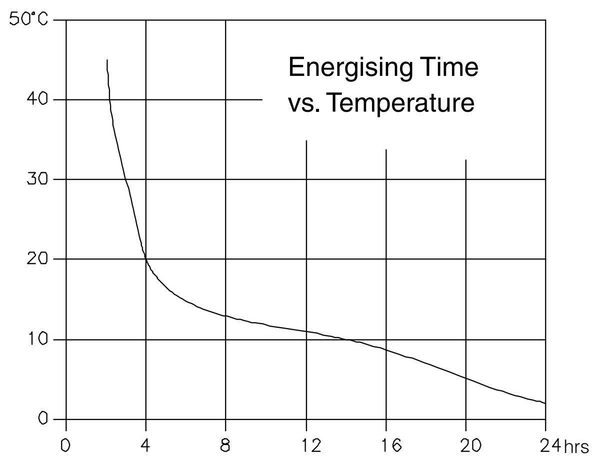
**HEALTH AND SAFETY WARNING The resin used in the compound can cause eye and skin irritation. For your personal protection, wear the gloves supplied while mixing and applying. The uncured compound should not be allowed to come into contact with foodstuff.**

**A COMPREHENSIVE SAFETY DATA SHEET PROVIDED BY THE COMPOUND MANUFACTURER IS AVAILABLE ON REQUEST.**

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

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

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




## Installation Guidance

**Point Advice**

1. BS EN 60079-10:2003 Classification of Hazardous areas
   BS EN 60079-14:1997 Electrical Installations in hazardous areas *(other than mines)*
   BS 6121, Part 5 Selection, Installation and Maintenance of Cable Glands
2. Installation should only be carried out by a competent electrician, skilled in cable gland installation.
3. NO INSTALLATION SHOULD BE CARRIED OUT UNDER LIVE CONDITIONS.
4. To maintain Ingress Protection ratings above IP54, use IP washers or O-rings for parallel threads. For taper threads use thread sealant.

5. To ensure the stated IP rating is maintained, at the point of interface the surface of the enclosure should be flat, free from debris and rigid with the hole drilled straight as a maximum of 1.5 mm above the thread diameter.
6. Once installed do not dismantle except for routine inspection. The gland is not serviceable and spare parts are not supplied.
7. Parts are not interchangeable with any other design. If manufacturers parts are mixed, certification will be invalidated.

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

| **Feature** | **Comment** |
|---|---|
| Enclosure entry thread | The female thread in the entry enclosure must comply with clause 5.3 of EN 50018:2000 or with a paragraph 5.3 of the IEC 79-1 standard.<br>Do not damage threads on assembly. Check that the number of fully engaged threads is at least 5. |

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

| **Cable Gland Type and Size** | |
|---|---|
| **CR** | Product range |
| **U** | Gland over the counter for unarmoured cable<br>Seal type: epoxy resin-based sealant<br>*(temperature -60 °C to +85 °C)* |
| **2** | Continuity washer option for lead sheathed cable |
| **B** | Main component material, B=brass, S=stainless steel SIRA Certification Body |
| **20S** | Gland size IP68 Protection Code |
| **PG16** | Entry thread type and size Year code: XX |
| | |
| **ATEX marking *(directive 94/9/ES)*** | |
| **Ex** | European explosive atmosphere symbol acc. to EU |
| **I M2** | Mining equipment, category M2 |
| **II 2** | Non-mining equipment,<br>suitable for use in category 2, zone 1, 2, 21, 22 |
| **G** | For use with potential explosive gas mixtures |
| **D** | For use with flammable types of dust |

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

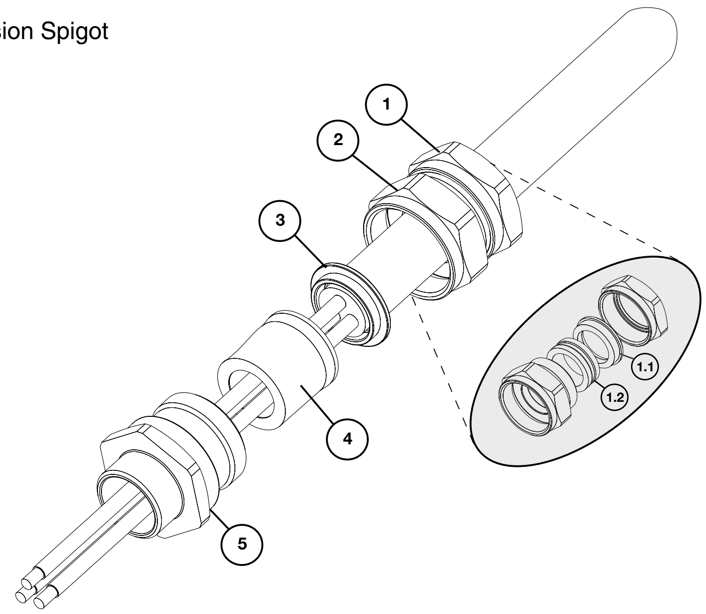
In the case of using ICG outlet glands the customer is obliged to connect the electric actuator in accordance with the following instructions, sealing the individual cable cores.

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

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

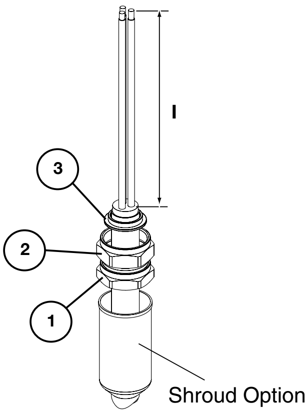
**Assembly Instructions for cable gland: ICG 623 EExd IIC/EExe II**
Certificate BASEEFA No. BAS 01 ATEX 2079X *(Ex)* II 2 GD IP66 CE 623 EExd I/EExe I
Certificate BASEEFxA No. BAS 02 ATEX 0177X *(Ex)* IM 2 IP66 CE
Operating temperature range -60 °C +80 °C

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

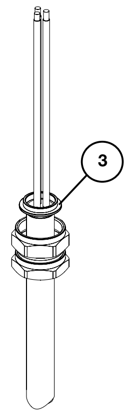


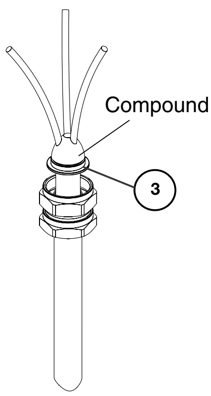

Detail for specification.
The parts 1 and 2 should not be dismounted.

***Cable Preparation***




***Gland Preparation***

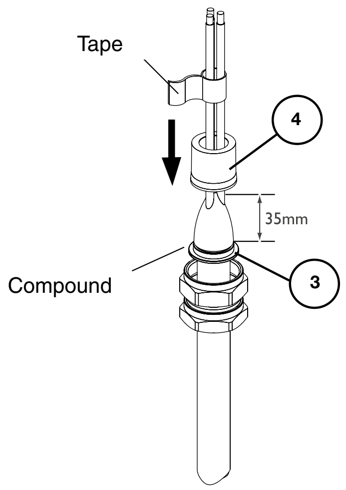


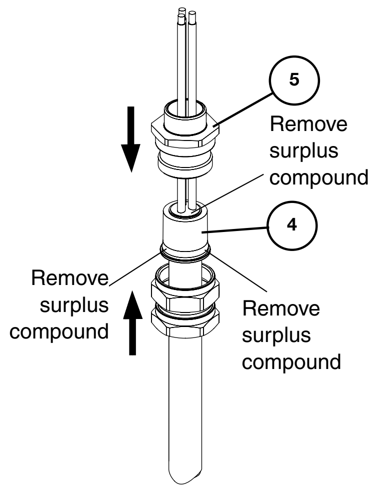



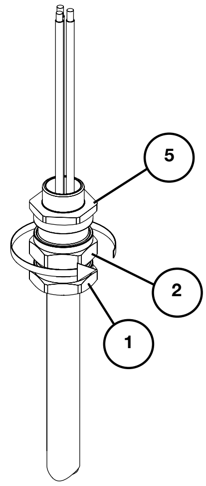

### A
Strip Cable to suit equipment as shown above,
removing all cable fillers.
Length l to suit equipment.
If required, fit shroud.
See Notes re. Drain Wires.

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

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



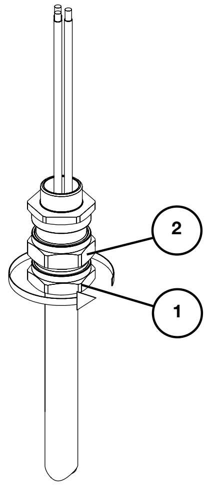



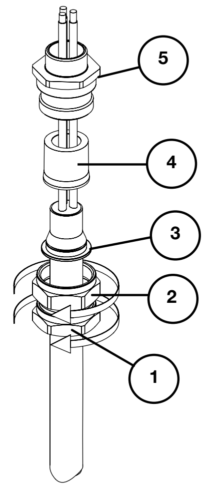



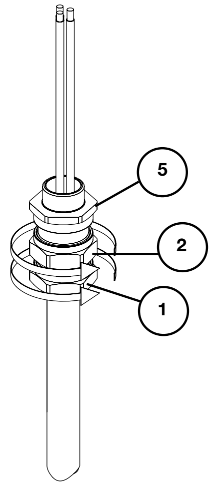

## D
With all gaps and voids filled, bring the conductors back together and pack more compound around the outside of the conductors. Tape the conductors together to prevent disturbance of the compound seal. Pass the rubber pot *(4)* over pot cap *(3)* and remove any surplus compound from the top of rubber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

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

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




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

***Important note:***
*The conductors must not be moved for a minimum of four hours.*

## H
Allow the compound to cure. *(See Fig. 7 for Curing Times).*
Untighten firstly the backnut *(1)* from *(2)* and secondly the middle nut *(2)* from the entry *(5).* The rubber pot *(4)* may be removed for inspection to ensure that the packing is satisfactory. Add further compound if necessary.

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

# EPOXY COMPOUND PREPARATION

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

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

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

## Drain wire preparation

**1.0. Insulating drain wires with heat shrink or cold shrink tubing**

1.1. Fold back the armour I braid and bend it to right angles from the inner sheath.
1.2. Remove foils and tape level with the outer sheath. exposing the drain wires and insulated conductors. Cut back a further 10 mm of inner sheath.
1.3. Pass 100 mm length of heat shrink or cold shrink tubing over the drain wire until it comes into contact with the foils, then shrink the tubing evenly down onto the drain wire so that no air pockets occur.
1.4. To insulate the joint between the foils and the tubing a suitable piece of 10 mm long shrink tubing or neoprene stretch tubing or a 10 mm wide lap of PVC tape may be used.
1.5. After completing 1.1 to 1.4 on each drain wire, lay the armour I braid parallel to the cable, if applicable, then carry out instruction B.

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

2.1. Fold back the armour I braid and bend to right angles from the inner sheath.
2.2. Remove a further I 5mm of inner sheath *(See Fig. I).*
2.3. Unravel one or two groups of wires from the screen wires, then remove the remainder of the screen wires *(See Fig. 2).*
2.4. Twist the group of screen wires into a pigtail and cut to 15 mm long.
2.5. Crimp an insulated conductor to the pigtail with a suitable insulated butt ferrule *(or soldered connection),* leaving enough length of the insulated conductor to enable the remote end to be connected to the earth terminal in the equipment. *(See Fig. 3).*

***Note:*** *There shall be a minimum of 10 mm of compound on both ends of the crimped I soldered joint.*

2.6. To insulate the joint between the screen wires and the insulated conductor, place one lap of PVC insulating tape over the exposed metallic joint.
2.7. After completing 2.1 to 2.6 on each drain wire. lay the armour I braid parallel to the cable. Then carry out instruction B.

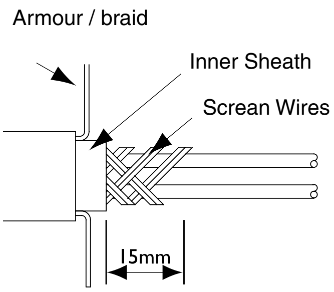



**Fig. 1**

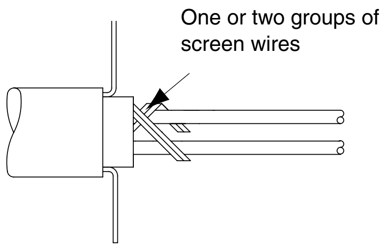



**Fig. 2**

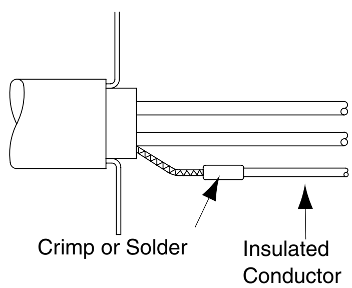



**Fig. 3**

**3.0. Insulating drainwires with insulating varnish or paint**

3.1. Fold back the armour I braid and bend it at right angles from the inner sheath.
3.2. Remove the foil and tape level with the inner sheath exposing the drain wires and conductor pairs.
3.3. Cut back a further 10 mm of inner sheath *(See Fig. 4).*
3.4. Spray or paint the drain wires with insulating varnish or paint, then leave to dry *(See Fig. 5)*
3.5. To insulate the foil ends a suitable piece of 10 mm long shrink tubing or neoprene stretch tubing or a 10 mm wide lap of PVC tape may be used *(See Fig. 6).*
3.6. After completing the steps as per point 3.1 to 3.5 on each drain wire, lay the armour I braid parallel to the cable. Then carry out instruction B.

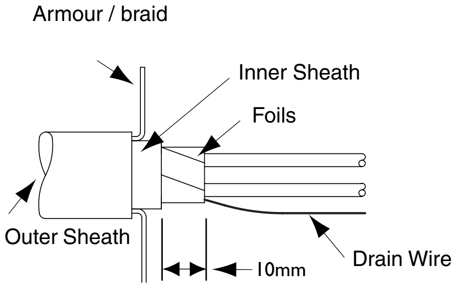



**Fig. 4**

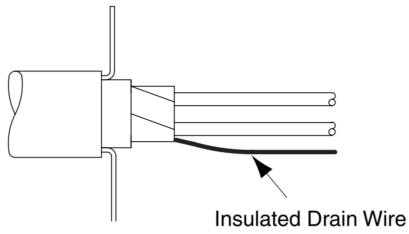



**Fig. 5**

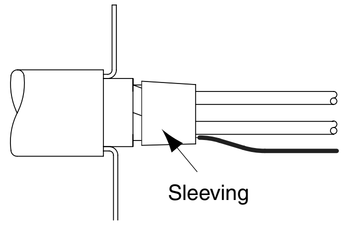



**Fig. 6**

## Epoxy Compound Cure Time Vs. Temperature

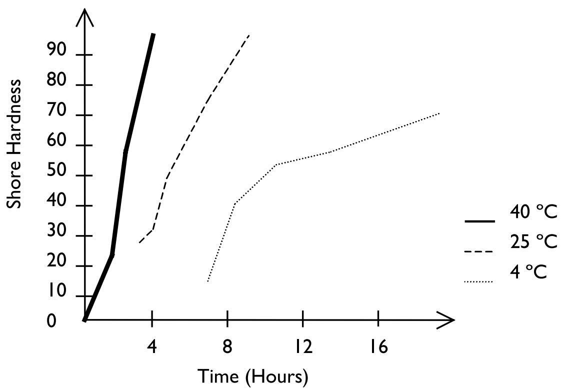



**Fig. 7**

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

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

**CABLE GLAND SELECTION TABLE**

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

**Limiting conditions:**

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

**Accessories:**

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

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

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

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

***Important warning!***

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

*2) When the thermal protection is disconnected, is necessary to realize that – if the power supply is on the terminals – after cooling of the thermal protection the actuator will start automatically.*

After adjusting the actuator check its function by means of the control circuit. Especially check whether the servo actuator correctly starts up and whether the electric motor after turning off the respective relay is not energized. If not, switch off the actuator power supply off immediately to prevent damage to the electric motor, and find the case of the fault.

# 10. OPERATION AND MAINTENANCE OF ELECTRIC ACTUATORS

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

The operator should take care that a prescribed maintenance is carried out, the electric actuator is protected against dangerous effects of the environment and weather conditions which are not listed in the chapter *"Working Conditions".* Moreover, care should be taken to prevent abnormal heating-up of the surface of the solid closure of the electric actuator. Make sure to avoid exceeding the nameplate values and abnormal vibrations of the actuator, maintain quiet operation of the actuator, ensure proper tightening of bolted joints of the parts of the flameproof enclosure, check insulating state after a longer break Sometimes it is necessary to make sure that all connecting and earthing terminals are tight and that they do not heat up during operation.

## Maintenance

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

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

## Cleaning – general inspection

The electric actuators should be kept clean and care should be taken to prevent their clogging by impurities and dust. Cleaning should be carried out regularly and as often as required by operating conditions. Surface temperature of the actuator 80 °C *(T6)* should be determined without a dust layer. General inspection of the electric actuator is recommended to be carried out once a year unless otherwise stated in revision regulations of electric devices.

## Checking  the parts of non-explosive closure

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

In all relevant repairs of the non-explosive closure which effect its safety it is recommended to have the electric actuator ex repaired at the manufacturer who can, on the basis of approved documentation and prescribed tests, put the closure into a state corresponding to ČSN EN 60079-0 and ČSN EN 60079-1.

## *Table 1 – Electric actuators MODACT MOKPED Ex – basic technical parameters*

| Type | Type number | Shifting time [s/90°] | Tripping torque [Nm] | Electric motor | | | | | | Weight [kg] |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Power [W] | Type | RPM [1/min] | Voltage [V] | Current [A] | Capacity µF | |
| MOKPED 100 Ex | 52320.x=1+ED | 10 | 25 – 100 | 74 | ES 7150-2AL | 2750 | 1 x 230 | 0,67 | 7 | 9,7 |
| | 52320.x=2+ ED | 20 | | 74 | ES 7150-2AL | 2750 | 1 x 230 | 0,67 | 7 | |
| | 52320.x=3+ ED | 40 | 25 – 85 | 15 | FCJ2B52D | 2780 | 1 x 230 | 0,37 | 3,5 | |
| | 52320.x=4+ ED | 80 | 25 – 100 | 17 | ES 7130-4AY | 1300 | 1 x 230 | 0,27 | 3,5 | |
| | 52320.x=5+ ED | 10 | 16 – 32 | 15 | FT2B52C | 2680 | 3 x 400 | 0,10 | - | |
| | 52320.x=6+ ED | 20 | 25 – 90 | 15 | FT2B52C | 2680 | 3 x 400 | 0,10 | - | |
| | 52320.x=7+ ED | 40 | 25 – 100 | 15 | FT2B52C | 2680 | 3 x 400 | 0,10 | - | |
| MOKPED 250 Ex | 52321.x=1+ ED | 10 | 63 – 125 | 90 | EAMRB56N02 | 2780 | 1 x 230 | 0,9 | 8 | 18,5 |
| | 52321.x=2+ ED | 20 | 100 – 250 | 90 | EAMRB56N02 | 2780 | 1 x 230 | 0,9 | 8 | |
| | 52321.x=3+ ED | 40 | | 40 | EAMRB56N04A | 1380 | 1 x 230 | 0,55 | 5 | |
| | 52321.x=4+ ED | 80 | | 40 | EAMRB56N04A | 1380 | 1 x 230 | 0,55 | 5 | |
| | 52321.x=5+ ED | 10 | 63 – 200 | 90 | EAMR56N02L | 2790 | 3 x 400 | 0,25 | - | |
| | 52321.x=6+ ED | 20 | 100 – 250 | 90 | EAMR56N02L | 2790 | 3 x 400 | 0,25 | - | |
| | 52321.x=7+ ED | 40 | | 60 | EAMR56N02A | 2790 | 3 x 400 | 0,20 | - | |
| | 52321.x=8+ ED | 80 | | 20 | EAMR56N04A | 1440 | 3 x 400 | 0,20 | - | |
| MOKPED 600 Ex | 52322.x=1+ ED | 10 | 250 – 510 | 180 | EAMR63N04 | 1370 | 3 x 400 | 0,6 | - | 31 |
| | 52322.x=2+ ED | 20 | 250 – 600 | 120 | EAMR63N04L | 1390 | 3 x 400 | 0,45 | - | |
| | 52322.x=3+ ED | 40 | | 60 | EAMR63L02A | 2790 | 3 x 400 | 0,20 | - | |
| | 52322.x=4+ ED | 80 | | 20 | EAMR63L04A | 1440 | 3 x 400 | 0,20 | - | |
| | 52322.x=5+ ED | 160 | | 20 | EAMR63L04A | 1440 | 3 x 400 | 0,20 | - | |
| | 52322.x=6+ ED | 20 | 250 – 450 | 180 | EAMRB63N04 | 1320 | 1 x 230 | 1,35 | 10 | |
| | 52322.x=7+ ED | 40 | 250 – 550 | 90 | EAMRB63L02 | 2780 | 1 x 230 | 0,90 | 8 | |
| | 52322.x=8+ ED | 80 | 250 – 600 | 40 | EAMRB63L04A | 1380 | 1 x 230 | 0,55 | 5 | |
| | 52322.x=9+ ED | 160 | | 40 | EAMRB63L04A | 1380 | 1 x 230 | 0,55 | 5 | |

## The type number shall include:

| Place in type number | 1. | 2. | 3. | 4. | 5. | | 6. | 7. | 8. | 9. | 10. | 11. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Type number | 5 | 2 | 3 | 2 | x | . | x | = | x | + | ED | x |

$6^{th}$ place: – **the letter "U",** if there is letter **C, P, R** or **S** on the $7^{th}$ place *(electric actuator is fitted with electronics DMS2),*
– **the letter "T"** if there is letter **C** or **R** $7^{th}$ place – the actuator is not equiped with display and block of local control
– **character from Table 2,** if there is letter **E** on the $7^{th}$ place *(electronics DMS2 ED)*

### *Table 2 – actuator with electronics DMS2 ED*

| **Character** | | **0** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **A** | **B** | **C** | **D** | **E** | **F** | **H** | **J** | **K** | **L** | **M** | **N** | **P** | **R** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Local control | | | x | | x | | x | | x | | x | | x | | x | | x | | x | | x | | x | | x |
| Display | | | | x | x | | | x | x | | | x | x | | | x | x | | | x | x | | | x | x |
| Power relays | | | | | | x | x | x | x | | | | | x | x | x | x | | | | | x | x | x | x |
| Analog module | transmitter | | | | | | | | | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x |
| | regulator | | | | | | | | | | | | | | | | | x | x | x | x | x | x | x | x |

$7^{th}$ place: **E** – electric actuator is fitted with electronics DMS2 ED
**P** – electric actuator is fitted with electronics DMS2 for connection to Profibus, power relays
**S** – electric actuator is fitted with electronics DMS2 for connection to Profibus
**R** – electric actuator is fitted with electronics DMS2 for two- or three-position control **), power relays
**C** – electric actuator is fitted with electronics DMS2 for two- or three-position control **)

**) Two- or three-position regulation of the actuator is set at the manufacturer. Unless otherwise specified in the order, the actuator will be set for three-position regulation *(control by signal 4 – 20 mA).*

$8^{th}$ place – adjusting time, tripping torque - according to Table 1

$9^{th}$ place – mechanical connection – the numeber or letter according to Table 3

$10^{th}$ place – **ED** – actuators with DMS2 or DMS2 ED electronic system

$11^{th}$ place – surrounding temperature

| | |
|---|---|
| For surrounding temperature from -25 °C till +55 °C | no designation |
| For surrounding temperature from -50 °C till +55 °C | F |

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

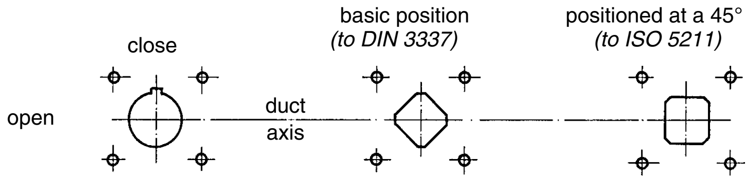
The version 52 32x.xxxxF is only available with three-phase electric motors.

## *Table 3 – Way of connecting MODACT MOKPED Ex electric actuators*
## *– specifying of the 9th place in type number*

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

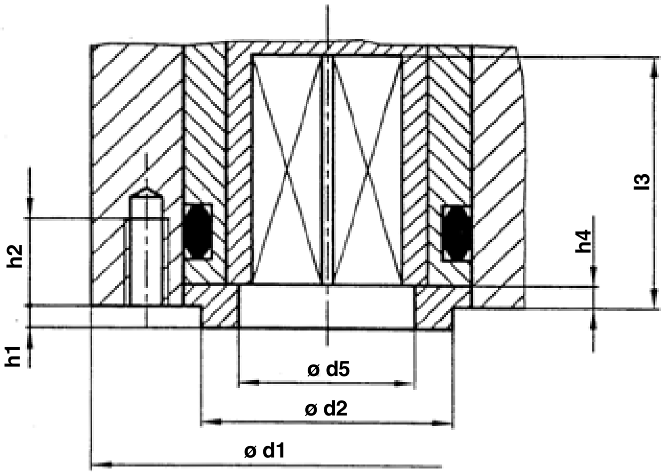
**Actuator output shaft position**
*(when viewing towards the local position indicator).*
The handwheel tallies with the CLOSED position

**Keyway connection** **Square**

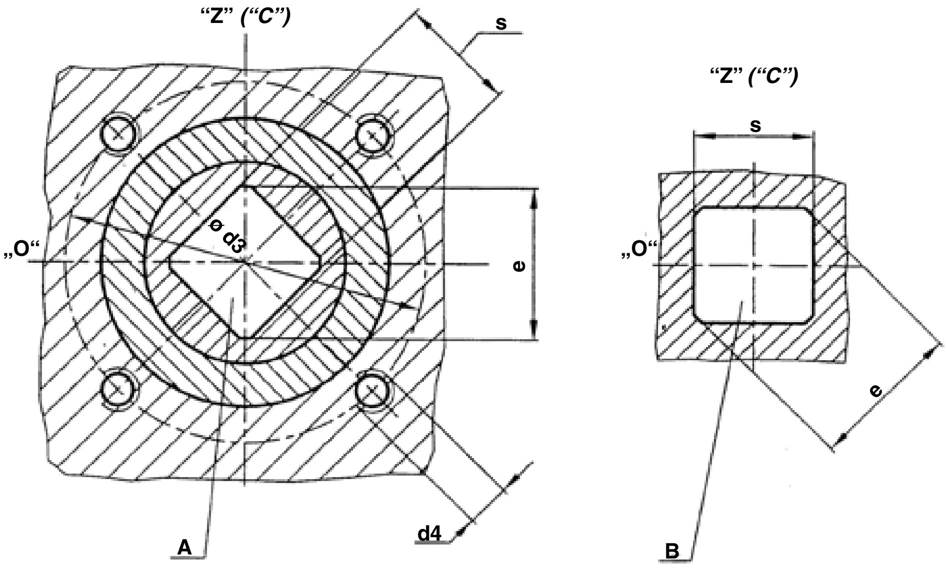



Another connection of electric actuators on demand.

## Connecting dimensions of **MODACT MOKPED Ex** electric actuators for valves and control devices - connecting with square



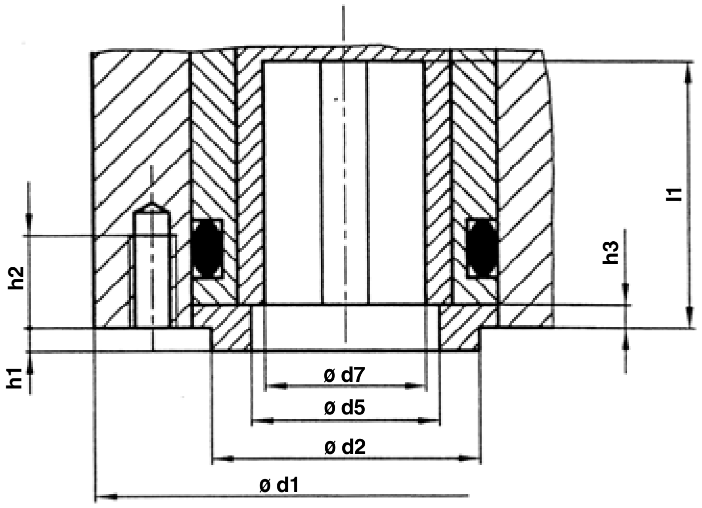

The position of the square hole in end position of electric actuator.
The position “Opened” is to the left of the position “Closed” when viewing in the direction to the local indicator of position.
The square hole is according to DIN 79:2013-02.
Connecting dimensions are according to DIN 3337 or ISO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



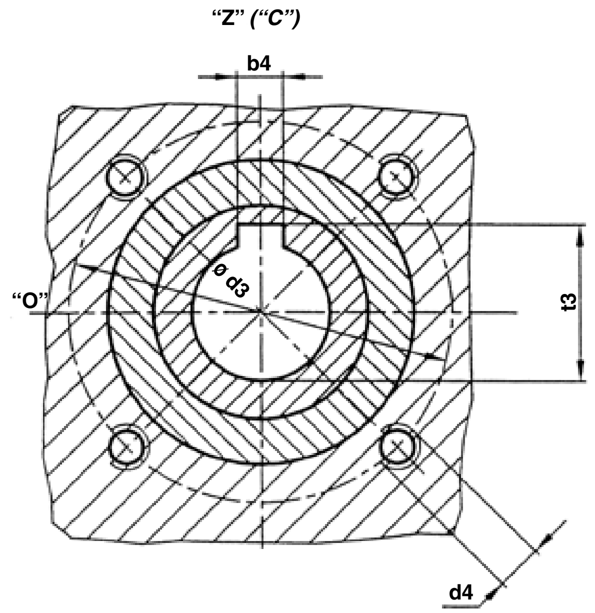

A – connection by square in basic position
B – connection by square turned by 45 °

| Flange | ø d1 | ø d2 f8 | ø d3 | d4 | h4 min. | h4 max. | h2 min. | h1 max. | l 3 min. | s H 11 | e min. | ø d5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| F04 | 65 | 30 | 42 | M6 | 1,5 | 0,5 | 12 | 3 | 15,1 | 11 | 14,1 | 25 |
| | | | | | | | | | 16,1 | 12 | 16,1 | |
| F05 | 65 | 35 | 50 | M6 | 3 | 0,5 | 12 | 3 | 19,1 | 14 | 18,1 | 28 |
| | | | | | | | | | 22,1 | 16 | 21,2 | |
| F07 | 90 | 55 | 70 | M8 | 3 | 0,5 | 13 | 3 | 23,1 | 17 | 22,2 | 40 |
| | | | | | | | | | 26,1 | 19 | 25,2 | |
| F10 | 125 | 70 | 102 | M10 | 3 | 1 | 16 | 3 | 30,1 | 22 | 28,2 | 50 |
| | | | | | | | | | 33,1 | 24 | 32,2 | |
| | | | | | | | | | 37,1 | 27 | 36,2 | |
| F12 | 150 | 85 | 125 | M12 | 3 | 1 | 20 | 3 | 37,1 | 27 | 36,2 | 70 |
| | | | | | | | | | 44,1 | 32 | 42,2 | |

## Connecting dimensions of **MODACT MOKPED Ex** electric actuators for valves and control devices – connecting with keyway

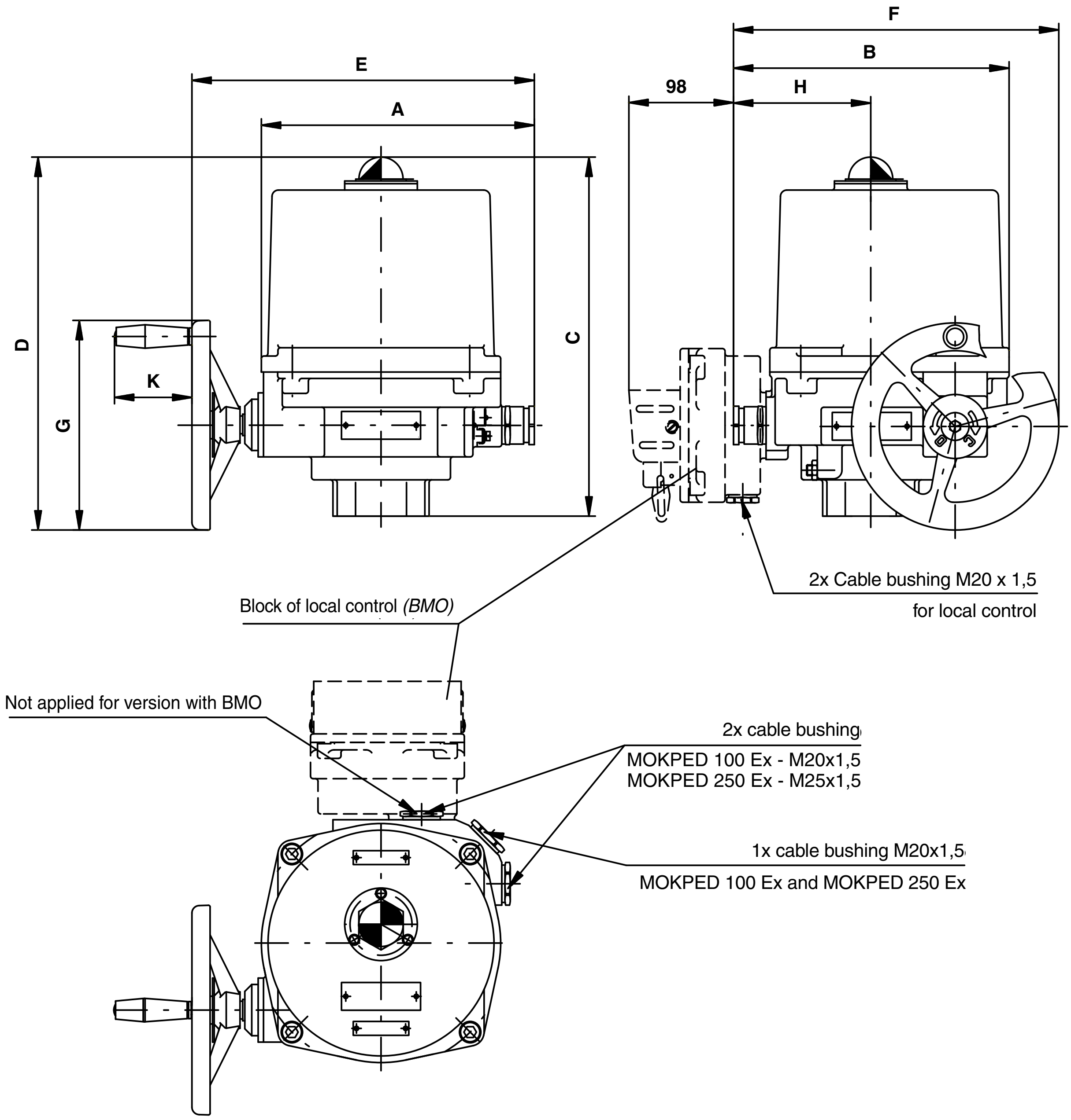



The position of groove for keyway according to ISO 5211 and DIN 3337 is in the position “Closed”. The position “Opened” is to the left of the position “Closed” when viewing in the direction to the local indicator of position. The position “Z” *(“C”)* of the groove for keyway is identical with the position “Z” *(“C”)* on the local indicator of position.



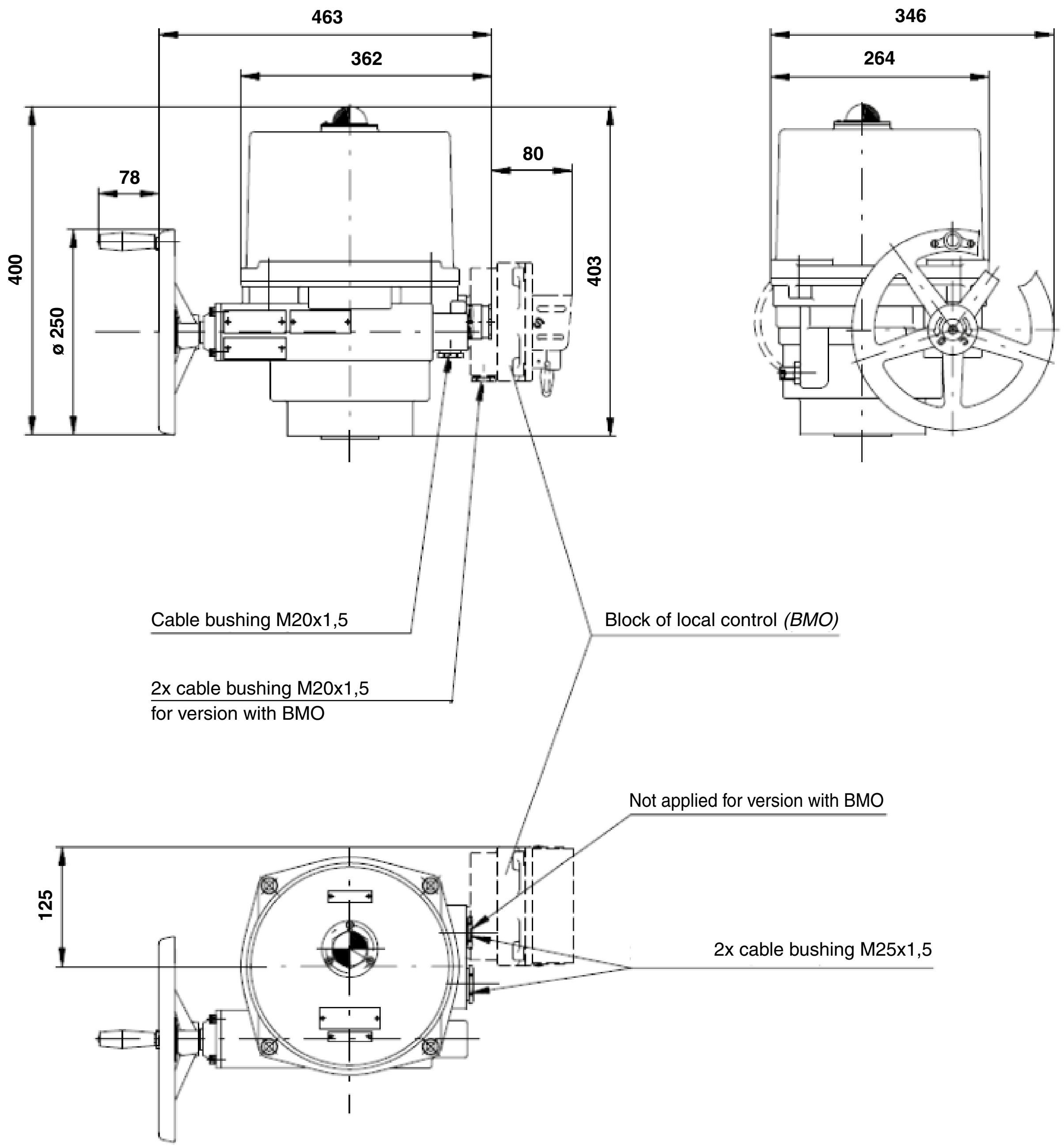

| Flange | ø d1 | ø d2 f8 | ø d3 | d4 | d7 H9 | h3 max. | h2 min. | h1 max. | l1 min. | b4 Js 9 | $t3^{+0,4}_{+0,2}$ | ø d5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| F04 | 65 | 30 | 42 | M6 | 18 | 3 | 12 | 3 | 26 | 6 | 20,5 | 25 |
| F05 | 65 | 35 | 50 | M6 | 22 | 3 | 12 | 3 | 30 | 6 | 24,5 | 28 |
| F07 | 90 | 55 | 70 | M8 | 28 | 3 | 13 | 3 | 35 | 8 | 30,9 | 40 |
| F10 | 125 | 70 | 102 | M10 | 42 | 3 | 16 | 3 | 45 | 12 | 45,1 | 50 |
| F12 | 150 | 85 | 125 | M12 | 50 | 3 | 20 | 3 | 55 | 14 | 53,5 | 70 |

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




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

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



## Spare parts

| Name | Order number | Type | Using, note |
|---|---|---|---|
| Sealing ring 180x3 | | 52 320 | Sealing between cover and gear box |
| Sealing ring 210x3 | | 52 321 | Sealing between cover and gear box |
| Sealing ring 250x3 | | 52 322 | Sealing between cover and gear box |
| Source board DMS2.ED.ZT | 2339620300 | DMS2.ED | |
| Position sensor DMS2.ED.ST90 | 2339620302 | DMS2.ED | |
| Torque sensor DMS2.TORK | 2339620003 | | For DMS2.ED and DMS2 |
| Analogue module DMS.ED.CPTT | 2339620304 | DMS2.ED | |
| Power relays board DMS2.FIN | 2339620031 | | For 3-phase only |
| Relay Finder 62.33.8.230.0040 | 2334513109 | | For 3-phase only |
| Sensor-torque cable K.TORK | 2339620007 | | For DMS2.ED and DMS2 |
| Sensor-source board cable K.ZED2 | 2339620009 | DMS2.ED | |
| Sensor-analogue module cable K.AED2 | 2339620011 | DMS2.ED | |
| Sensor-COM cable K.COM | 2339620040 | | For DMS2.ED and DMS2 |
| Display DMS2.ED.DT | 2339620305 | DMS2.ED | |
| Display cable | | DMS2.ED | |
| Source board DMS2.ZD2 | 2339620024 | DMS2 | For analogue and profibus |
| Analogue board DMS2.A22 | 2339620042 | DMS2 | |
| Profibus board DMS2PR2 | 2339620026 | DMS2 | |
| Position sensor DMS2.S90 | 2339620039 | DMS2 | |
| Display DMS2.DP | 2339620018 | DMS2 | |
| Local control board DMS2.H3 | 2339620041 | DMS2 | |
| Source-sensor cable K.ZDR2 | | DMS2 | |
| Display-control cable K.H2 | | DMS2 | |
| Source-analogue/profibus cable K.ZA | | DMS2 | |
| Source-display cable K.D2 | | DMS2 | |
| Sensor-analogue K.SA2 cable | | DMS2 | Analogue |

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**MODACT MOA**
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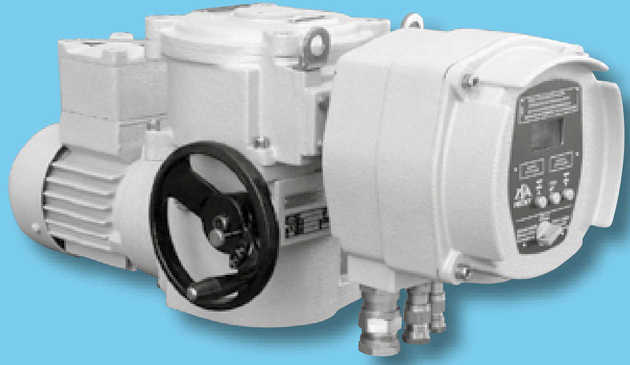

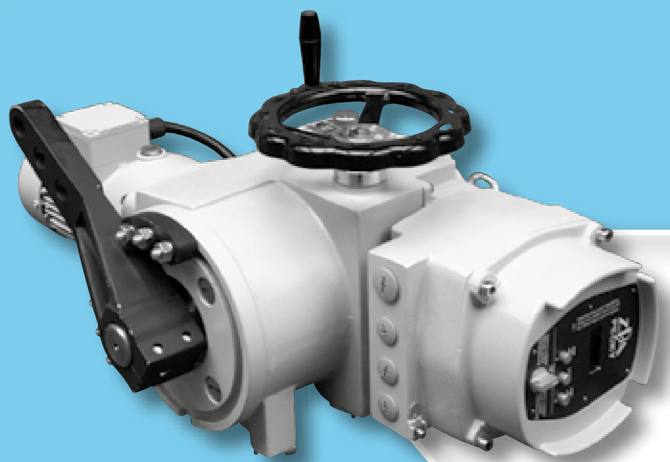

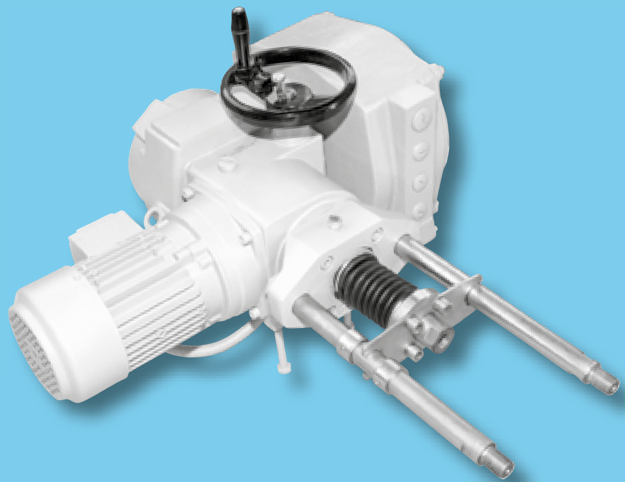

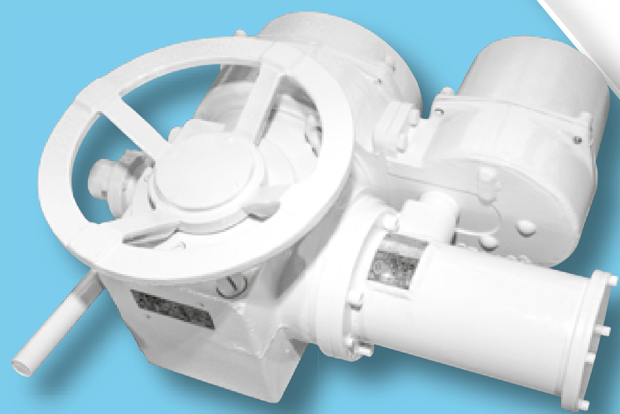

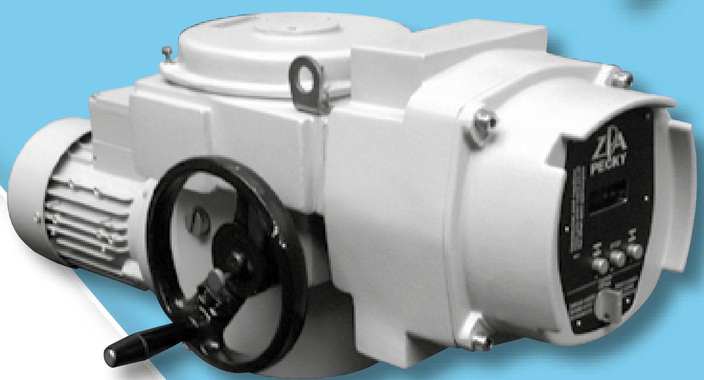

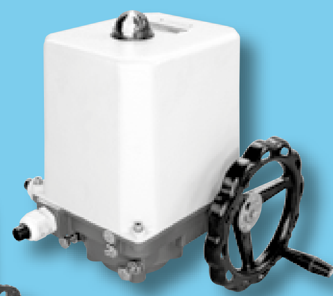

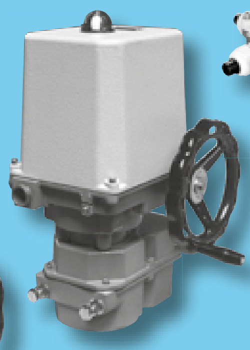

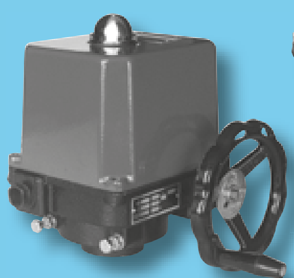

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