





CE 1026

INSTALLATION, SERVICE AND MAINTENANCE INSTRUCTIONS



***Explosion-proof electric part-turn
actuators SP 2-Ex, SP 2.3-Ex, SP 2.4-Ex***

TEST CERTIFICATE

EXPLOSION-PROOF ELECTRIC PART-TURN ACTUATOR SP 2-Ex, SP 2.3-Ex, SP 2.4-Ex	
Type number	Power supplyVHz
Serial number	Switch-off torque..... Nm
Production year	Operating speeds/90°
Wiring diagram	Operating stroke°
Warranty period months	Transmitter.....
Serial number of electric motor	
Serial number of transmitter	
Serial number of controller	
Explosion-proof version:  II 2 G Ex db eb h IIB T5 Gb and  II 2 D Ex h tb IIIC T100°C Db	
Final report No.: FTZÚ 03 ATEX 0272X	
Design and type tests are in accordance with the following standards: EN 60 079-0 – Electrical apparatus for explosive gas atmospheres – Part 0: General requirement EN 60 079-1 – Electrical apparatus for explosive gas atmospheres – Part 1: Flameproof enclosures “d” EN 60 079-7 – Explosive atmospheres Part 7: Equipment protection by increased safety “e” EN/IEC 60 079-31: Explosive atmospheres – Part 31: Equipment dust ignition protection by enclosure „t”.	
Tests made in accordance with TP 74 0742 00	
Tests made by	
Date	Signature and stamp

COMPLETENESS CERTIFICATE

Used valve	
Assembled by: Firm	
Name	
Warranty period months	
Date	Signature and stamp

INSTALLATION CERTIFICATE

Location	
Installed by: Firm	
Name	
Warranty period months	
Date	Signature and stamp

Please read these instructions carefully before mounting and operating the actuator!

Preventive and safety-measures applied on the actuator can not offer required safety level till the actuator and its safety systems are not applied by required and described way and if installation and maintenance is not applied according to applicable instructions and rules!

Contents

1. General data	2
1.1 Purpose and applications.....	2
1.2 Safety instructions	2
1.3 Product influence to environment.....	2
1.4 Data specified on electric actuator	3
1.5 Terminology.....	4
1.6 Instructions for staff training	5
1.7 Warning for safety use	5
1.8 Warranty conditions	6
1.9 Under-guarantee and after-guarantee service	6
1.10 Operation conditions.....	6
1.11 Packing, transport, storing and unpacking	8
1.12 Assessment of the product and packaging and removal of contamination	8
2. Description, function and specifications.....	9
2.1 Description and function	9
2.2 Basic specifications	10
3. Installation and dismantling of actuator.....	13
3.1 Mechanical connection	13
3.2 Electric connection and checking of function.....	14
3.3 Dismantling.....	16
4. Adjusting of actuator.....	16
4.1 Adjustment of torque unit	16
4.2 Adjustment of position-indicating unit (Fig.3).....	17
4.3 Adjustment of resistant transmitter (Fig. 4).....	17
4.4 Adjustment of the Electronic Position Transmitter (EPV) - the Resistive Transmitter (Potentiometer) with the Converter PTK 1.....	18
4.5 Adjustment of the Capacitive Transmitter CPT1/A (Fig.7)	19
4.6 Resetting of operation angle and setting of stop end screws (Fig. 8)	20
4.7 Adjustment of position controller (Fig. 9).....	21
5. Service, maintenance and troubleshooting.....	24
5.1 Service	24
5.2 Maintenance - extent and periodicity.....	24
5.3 Maintenance to assure inexplosiveness.....	24
5.4 Troubleshooting	26
6. Accessories.....	26
7. Enclosures	27
7.1 Wiring diagrams.....	27
7.2 Dimensional drawings.....	31
7.3 List of contractual after-sales service centre	35

The Installation, Service and Maintenance Instructions are drawn up according to requirements of EC Executive Nr. 89/392/EEC "Uniform requirements for machines and devices from the point of view of safety and health care", to save life and health of users and to avoid material damages and exposure environment to danger.

1. General data

1.1 Purpose and applications

Explosion - proof electric part-turn actuators (hereinafter EA) types **SP 2-Ex, SP 2.3-Ex, SP 2.4-Ex** (hereinafter SP X-Ex) resp. EA with controller types are high-powered electric-mechanical products, designed for direct installations onto controlled devices (regulating bodies -valves, etc.). EA are provided for remote control of closing bodies, and EA with controller for automotive control of regulating bodies in both directions of their movement. They can be equipped with means of measuring and control of technological processes where an unified analogue direct current or voltage signal is an information bearer on their input and/or output. They can be used in heating, energy, gas, air-conditioning and other technological systems, which they are suitable for, regarding their features. They are connected with controlled devices with a flange according to ISO 5211 and a coupling or using a stand and a coupling/a lever.



1. **Do not count with tight closing performed by control signals of EA with controller.**
2. **It is forbidden to use EA as a lifting mechanism!**
3. **Switching of actuator by a semiconductor switches have to be consulted with producer.**

1.2 Safety instructions

In order to demonstrate the compliance with the requirements of the European Council directive on machinery 2006/42/EC, European Parliament and Council Directive **2014/34/EU** on equipment and protective systems intended for use in potentially explosive environment (designated as Directive ATEX 100a), directive of the Council 2014/35/EU on LVD and Council Directive 2014/30/EU on EMC, the electric actuators are subject to certification by authorized certification facilities.

The product meets the essential safety requirements according to EN 60204-1 and is in compliance with EN 55011/A1 within valid edition.

1.3 Product influence to environment

Product characteristics from risk point of view

EA of **SP X-Ex** types are reserved technical devices with higher rate of danger (group A), with possibility of installation in areas specially danger regarding casualties caused by electric current. Electric actuators are according to directive LVD 2014/35/EU and standard EN/IEC 61010-1 within valid edition assigned for installation category II (overvoltage category).

Product influence to environment

Electromagnetic compatibility (EMC): the product complies with the requirements of the Directive 2014/30/EU of the European Parliament and of the Council on the approximation of the laws the Member States relating to the electromagnetic compatibility and with the requirements of EN standards as well EN/IEC 61000-6-4+A1, EN/IEC 61000-6-2, EN/IEC 61000-3-2 and EN/IEC 61000-3-3 within valid edition.

Vibrations caused by the product: product influence is negligible.

Noise produced by the product: The maximum allowable noise level (A) of the product measured in a place of operation is 80dB (A).

Electric actuators are made in explosion-proof version $\text{Ex} \text{ II 2 G Ex db eb h II B T5 Gb}$ and $\text{Ex} \text{ II 2 D Ex h tb IIIC T100°C Db}$, pursuant to:

EN/IEC 60079-0: Explosive atmospheres – Part 0 : Equipment general requirements – General requirements

EN/IEC 60079-1: Explosive atmospheres – Part 1 : Equipment protection by flameproof enclosures "d"

EN/IEC 60079-7: Explosive atmospheres - Part 7: Equipment protection by increased safety "e".

EN/IEC 60079-31: Explosive atmospheres – Part 31: Equipment dust ignition protection by enclosure „t“, within valid edition.

Electric parts EA are proposed:

- as devices of the group **II resp. III** for others threatened areas (excluding mines)
- of the category **2** with demanding requirements for safety
- for use in zone 1, 2, 21 a 22.
- for atmospheres **G** (gases, vapors or mists) or **D** (combustible conductive dusts)
- topressure range from 0.8 to 1.1 bar.

Design version is :

- flameproof enclosures “**db**”, increased safety “**eb**” or level dust ignition protection by enclosure “**tb**”
- with explosion protection group **IIB** or **IIIC**
- and temperature class **T5** (max. permissible surface temperature +100°C).

Zones for installation of explosion-proof electric actuators and conditions for equipment installation are defined in the following standards:

- EN/IEC 60079-10: Electrical apparatus for explosive gas atmospheres
Part 10: Classification of hazardous areas
- EN/IEC 60079-14: Electrical apparatus for explosive gas atmospheres
Part 14: Electrical installations in hazardous areas

Non-electric parts of electric actuators are designed, engineered, manufactured, tested and identified in compliance with the requirements for safety of machinery according to the following standards:

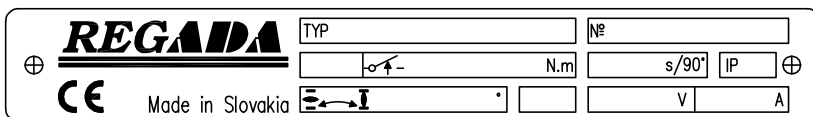
- EN 1127-1: Explosive atmospheres – Explosion prevention and protection
Part 1: Basic concepts and methodology
- EN ISO 80079-36 Explosive atmospheres — Part 36: Non-electrical equipment for explosive atmospheres — Basic method and requirements
- EN ISO 80079-37: Explosive atmospheres — Part 37: Non-electrical equipment for explosive atmospheres — Non-electrical type of protection constructional safety "c", control of ignition sources "b", liquid immersion "k".

Equipment identification consists of the following characters:

- Ex** - electric equipment complies with standard EN/IEC 60 079-0. and related standards for the corresponding types of explosion protection.
- db** - identification of the explosion protection type - "flameproof enclosure" according to EN/IEC 60 079-1.
- eb** - identification of the explosion **protection type** – „increased safety" according to EN/IEC 60 079-7.
- tb** - identification of dust ignition protection by enclosure „t" according to EN/IEC 60 079-31.
- II or III** - identification of the class of non-explosive electric device according to the standard EN/IEC 60 079-0.
- B or C** - identification of the **sub-class II** or **III** of non-explosive electric devices according to the standard EN/IEC 60 079-0.
- T5 or T100°C** - identification of the **temperature class** of non-explosive electric device class II or III according to the EN/IEC 60 079-0.
- Gb** - (EPL Gb) - identification of the equipment designated for explosive gaseous atmospheres, with "high" level of protection, which is not a source of initiation in standard operation or in case of expected failures.
- Db** - (EPL Db) - identification of the equipment designated for explosive dust atmospheres, having a "high" level of protection, which is not a source of ignition in normal operation or during expected malfunctions.

1.4 Data specified on electric actuator

Nameplate for



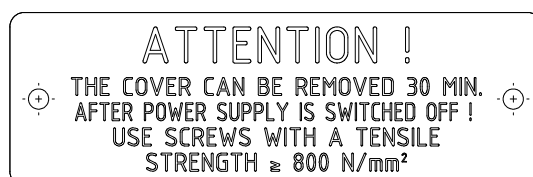
Warning plate:







Nameplate contains the basic data concerning identification, performance and electricity: indication of producer, type, serial number, max. load thrust and switching-off thrust, operating speed, protection code, operating stroke, supply voltage and current.

Warning label:

- with identification of the waiting time and requirements for strength of screws.








Non-explosive label: identifying the manufacturer, certificate number, type identification, version identification, serial number and version for ambient temperature: from -25°C up to +55°C or from -50°C up to +40°C or –from 50°C up to +55°C or from -60°C up to +55°C

 Strojnica 7 SK-08001 Prešov	No.CERT	 II 2D Ex h tb IIC T °C Db II 2G Ex db eb h IIB T Gb	 °C<Ta<+ °C	 1026
	-Ex			
	No			

Graphic symbols on electric actuator

The graphic symbols used on electric actuator substitute the text messages. Some of them are in accordance with EN ISO 7010, ISO 7000 and IEC 60417 within valid edition.

	Dangerous voltage	(EN ISO 7010-W012)
	Stroke of the electric part-turn actuator	
	Switching-off torque	
	Manual control	(0096 ISO 7000)
	Protection terminal	(5019 IEC 60417)

1.5 Terminology

Potentially explosive environment - an environment where explosive atmosphere can occur.

Explosive gas atmosphere - a mixture of flammable substances (in form of gases, vapors or mist) with air under atmospheric conditions, which upon initiation enables the propagation of the combustion in unconsumed mixture.

Maximum surface temperature - maximum temperature occurring during operation in most adverse conditions (but within accepted tolerance limits) at any part of the surface of the electric device, that could result in ignition of the surrounding atmosphere.

Enclosure - all walls, doors, covers, cable glands, shafts, rods, draw bars, etc., that contribute to the level of protection against explosion or to the level of protection (IP) of the electric device.

Flameproof enclosure "db" - type of protection wherein the parts capable of igniting an explosive atmosphere are located within the enclosure, in case of explosion of an explosive mixture within the enclosure, such enclosure will withstand the pressure of the explosion and prevent the propagation of explosion to the surrounding atmosphere.

Increased safety "eb" - type of protection applied to electrical apparatus in which additional measures are applied so as to give increased security against the possibility of excessive temperatures and of the occurrence of arcs and sparks in normal service or under specified abnormal conditions.

Dust ignition protection by enclosure "tb" – type of protection for explosive dust atmospheres where electrical equipment is provided with an enclosure providing dust ingress protection and a means to limit surface temperatures.

Combustible dust - finely divided solid particles, 500 µm or less in nominal size, which may be suspended in air, may settle out of the atmosphere under their own weight, may burn or glow in air, and may form explosive mixtures with air at atmospheric pressure and normal temperatures.

Conductive dust - combustible dust with electrical resistivity equal to or less than $10^3 \Omega \cdot m$.

Combustible flyings - solid particles, including fibres, greater than 500 µm in nominal size which may be suspended in air and could settle out of the atmosphere under their own weight.

1.6 Instructions for stuff training

Requirements for specialized skills of persons performing assembly, operation and maintenance



Electric connection can be performed only by an acquainted person, i.e. an electrical engineer with professional education of electrical engineering at an apprentice school or a technical school (secondary, complete secondary or university education) and whose qualification was verified by an educational facility authorised to verify professional qualification.



Service can be performed only by workers professionally qualified and trained by the producer or contracted service centre!

1.7 Warning for safety use

1. Products are assigned for operation in environment consist of gas, steam and vapours, with temperature range from -25°C up to $+55^{\circ}\text{C}$; and special version for ultra low temperatures from -50°C up to $+40^{\circ}\text{C}$, from -50°C up to $+55^{\circ}\text{C}$ or from -60°C up to $+55^{\circ}\text{C}$, to pressure range from 0.8 to 1.1 bar. EA can be installed at areas specified as zone 1, 2, 21 a 22.



It matters about following products:

- group II or III
 - for type of the environment **G or D**
 - the category **2**
 - subgroup **B and C**
 - temperature class **T5**.
2. Products are designed according to standards for electrical and non-electrical devices assigned for areas with danger of explosion:
 - for electric parts: EN/IEC 60079-0, EN/IEC 60079-1 and EN/IEC 60079-7 and EN/IEC 60079-31.
 - for non-electric parts: EN 1127-1, EN ISO 80079-36 and EN ISO 80079-37.
 3. The maximum surface temperature of the actuator for given group **T5** is not allowed to exceed $+100^{\circ}\text{C}$.
 4. If the actuator is placed on device which regulate medium with higher temperature than $+55^{\circ}\text{C}$, protect the actuator by additional construction in order to maintain ambient temperature max. $+55^{\circ}\text{C}$ and also to stop temperature transmitting through junction component!
 5. Cable glands blinds are assigned only for transport and storage period, i.e. for period till the actuator is builded into operation with danger of explosion, than blinds must be replace by connecting cable.
 6. If any of the cable glands are not used to install a cable, it must be replaced with certified Ex plug of the approved type.
 7. CAUTION !: The cover can be removed 30 minutes after power supply is switched off! Use screws with a tensile strength of $\geq 800 \text{ N/mm}^2$.
 8. **WARNING – POTENTIAL ELECTROSTATIC CHARGING HAZARD.**
During operation of EA it must be prevented any process with intensive formation of electrostatic charge stronger than manual friction of his surface.

Product protection

EA does not have own short-circuit protection, therefore there must be included suitable protective device into the supply power (circuit breaker, or fuse), which serves at the same time as main switch.

Type of equipment from a connection point of view: The equipment is designed for permanent connection.

1.8 Warranty conditions

The supplier is responsible for completeness of the delivery and guarantees these specifications of the product which are stated in the Contract.

The supplier is not responsible for any deterioration of parameters caused by the customer during storage, unauthorised installation or improper operation.

1.9 Under-guarantee and after-guarantee service

Our customers are provided with professional service of our firm in installation, operation, service, maintenance, revision and help in troubleshooting for all our products.

Under-guarantee service is performed by the service department of the production plant.

In case of occurring of any fault please let us know it and state:

- type code, serial number
- ambient parameters (temperature, humidity...), duty cycle including frequency of switching, type of switching-off (position or torque), set switching-off torque
- type of fault - description of claimed fault
- it is recommended to place also Installation certificate.

It is recommended to have **after-guarantee service** performed by the service department of the production plant, or by a contracted service centre.

1.10 Operation conditions

1.10.1 Product location and operation position



Electric actuators may be installed and operated in enclosed locations of industrial facilities with no temperature and moisture regulation, protected from direct climatic effects (such as direct sunlight). Installation and operation of EA is possible in **any position**. Vertical position of output part axis and with the control part above the valve is usual.

Warning:



When the EA is installed in open air, **it must be** sheltered lightly to protect is against direct effects of atmosphere.

When installed in the areas with relative humidity more than 80%, in open air under a shelter is needed to connect the space heater directly – without a thermal switch.

1.10.2 Operation environment

According to valid standard IEC 60 721-2-1, there are delivered these versions of electric actuators:

- 1) Version „**temperate**“ for type climate temperate
- 2) Version „**cold**“ - for type climate cold
- 3) Version „**tropical**“ for type climate tropical and dry
- 4) Version „**marine**“ for type climate marine
- 5) Version „**arctic**“ for type climate very cold.

In accordance with IEC 60 364-1, IEC 60 364-5-51 and IEC 60 364-5-55 within valid edition the EA have to resist external effects and operate reliably:

In the conditions of the following types of environment:

- warm mild to very hot dry with temperatures -25°C to +55°C AA 7*
- cold, warm mild to hot dry with temperatures -50°C to +40°C AA 8*
- cold, hot dry to slightly hot dry with temperatures -50°C to +55°C AA 8*+AA 7*
- cold to slightly hot dry with temperatures -60°C to +55°C AA 1*+AA 7*
- with relative humidity 10÷100%, including condensation with maximum content 0,028kg of water in 1kg of dry air, with temperatures stated above AB 7*
- with relative humidity 15÷100%, including condensation with maximum content 0,036kg of water in 1kg of dry air, with temperatures stated above AB 8*

- with relative humidity 10÷100%, including condensation with maximum content 0,036 kg of water in 1kg of dry air, with temperatures stated above AB 8*+AB 7*
- with relative humidity 10÷100%, including condensation with maximum content 0,036 kg of water in 1kg of dry air, , with temperatures stated above AB 1*+AB 7*
- with elevation up to 2000 m, with barometric pressure range from 86 kPa up to 108 kPa AC 1*
- with shallow dive – (product in protection IP x 7) AD 7*
- with strong dustiness – with a possibility of influences of inflammable, non-conducted and non-explosive dust; the middle layer of dust; the dust drop more than 350 but not more than 1000 mg/m² per day (products with protection enclosure of IP 6x) AE 6*
- with occasional or casual appearance of corroding and polluting substances (occasional or casual expose to corroding or pollute chemical substances during producing or using of these substances); at places where is handled with small quantity of chemical products and these can accidentally get in contact with an electric device AF 3*
- with a possibility of influences of mechanical stress:
 - medium sinusoid vibrations with frequency in range 10 up to 150 Hz, with shift amplitude of 0,15 mm for $f < f_p$ and acceleration amplitude 19,6 m/s² for $f > f_p$; (transition frequency f_p is from 57 up to 62 Hz) AH 2*
 - medium impacts, shocks and vibrations AG 2*
- with serious danger of plants and mould growing AK 2*
- with serious danger of animal occurrence (insects, birds, small animals) AL 2*
- with detrimental influence of radiation:
 - of stray current with intensity of magnetic field (direct or alternate, of mains frequency) up to 400A.m⁻¹ AM2*
 - of sun radiation with intensity > 500 and ≤ 700 W/m² AN 2*
- with effects of medium seismic activity with acceleration > 300 Gal ≤ 600 Gal AP 3*
- with indirect endanger by storm AQ 2*
- with quick air movement and strong wind AR 3 , AS 3*
- stand on a conductive bottom) BC 3*
- with a danger of inflammable gases and vapours explosion - for Ex of version BE 3N2*
- fire risks BE 2*

* Marking in accordance with IEC 60364-1, IEC 60 364-5-51 and IEC 60 364-5-55 within valid edition

1.10.3 Power supply and duty cycle

Power supply:

electric motor.....	230V AC \pm 10%,3x400 \pm 10%,24V AC/DC \pm 10%
control	230 V AC \pm 10% (24 V AC/DC \pm 10%)
potentiometer transmitter	max. $\sqrt{P \times R}$ V DC/AC
electronic positional transmitter (EPV) without power supply	15 up to 30 V DC, or 24 V DC
capacitive transmitter without power supply	18 up to 28 V DC
power supply frequency.....	50 Hz, or 60* Hz \pm 2 %

* Note: At frequency of 60 Hz closing time is reduced by 1.2 times.

Duty cycle (according to EN 60304 within valid edition):

ES SP-Ex are designed for **remote control**:

- short-time operation S2-10 min
- intermitted operation S4-25%, max. 90 cycles per hour

ES SP-Ex with controller are designed for **automotive regulation**:

- intermitted operation S4-25%, 90 up to 1200 cycles per hour

Note:

1. Duty cycle consist of load type, load factor and switching rate.
2. EA SP-Ex is possible connect with an external controller and use this EA as controlled EA, for this EA stands duty cycle and power parameters as for type SP-Ex with built-in controller.

1.11 Packing, transport, storing and unpacking

Surfaces without surface treatment are treated by conservation preparation MOGUL LV 2-3 before packaging .

Conservation is not necessary if the following storage conditions are complied with:

- Storage temperature: -10 to +50 °C
- Relative air humidity max.80 %
- Electric actuators and their accessories must be stored in dry, well ventilated covered spaces, protected against impurities, dust, soil humidity (by placement to racks, or on pallets), chemicals and foreign interventions
- There shall be no corrosive gases present in the storage areas.

The of EA are delivered in solid packages guaranteeing resistance in accordance with EN/IEC 60 654.

Package is a box. Products in boxes is possible to load on the pallets (pallet is returnable). On the outer side of the package is stated:

- manufacturer label,
- name and type of product,
- number of pieces,
- other data – notices and stickers.

The forwarder is obliged to secure packed products, loaded on transportation means, against self-motion; if open transportation means are used, to secure their protection against atmospheric precipitations and splashing water. Displacement and securing of products in transportation means must provide their stable position, exclude the possibility of their inter-collision and their collision with the vehicle walls.

Transportation can be executed by heatless and non hermetic spaces of transportation vehicles with influences within the range:

- temperature: -25°C up to +70°C (a strange version –50 ° C up to +45 ° C)
- humidity: 5 up to 100 %, with max. water content 0.029 kg/kg of dry air
- barometric pressure 86 up to 108 kPa

After receiving EA check whether during transport or storage the actuator was not damaged. Compare also whether the parameters on their nameplates are in accordance with accompanying documentation or the Contract. If any discrepancy or fault occur inform immediately your supplier.

If the actuators and accessories are not immediately installed, they have to be stored in dry, well-ventilated sheltered rooms, protected against dirt, dust, soil humidity (with placing onto shelves or onto pallets), chemical impacts and encroachment, at ambient temperature from -10°C up to +50 °C and relative humidity max. 80 %, in special version at temperature –50°C do +40°C.

- It is forbidden to store EA outside or in areas not prevented against direct impact of climate.
- Strains of the surface finishing should be promptly removed if any – it can prevent the product against corrosion damages.
- While storing more than one year it is necessary to check lubrication filling before the actuator is put into operation.
- The EA installed but not operated are to be protected the same way as when storing (e.g. with a wrapping).
- After it is mounted onto a valve in free and wet areas or in areas where temperature is changing it is necessary to connect the space heater – to prevent the actuator against corrosion resulted from water condensed in the control part.
- Remove odd conservation grease as late as before putting into operation.

1.12 Assessment of the product and packaging and removal of contamination

The product and its package are made of recycling materials. Do not throw the single parts of the package and of the product after their life but sort them according to instructions in corresponding executives or regulations of environment protection, and allow their recycling.

The product and its packing are not a source of any environment pollution or contamination and do not contain any dangerous waste.

2. Description, function and specifications

2.1 Description and function

The **SP-Ex** EA consist of two parts differing in their function.

The **gear part** is made up by a flange and a connected part for connection onto a controlled device, and gears placed in the bottom; on the other side drive mechanisms for control part units are surfaced.

The **control part** is placed on a control board consisting of:

- an electric motor (with capacitor for single-phase electric motor)
- a torque unit (controlled with a worm axial shift)
- a position-signalling unit with a position transmitter - positioner (resistive - potentiometer, capacitive or an electronic position transmitter) and with a mechanical local position indicator
- a space heater with a thermal switch.

Terminal board is located in the separate terminal box with cable bushings and connected with control part by 21-core bushing.

Additional accessories:

Manual control: made up by a handwheel with a worm gearing

Local electric control module

The **SP-Ex** version is equipped with an **electronic controller**.

2.2 Basic specifications

Basic EA specifications:

max. load torque [Nm], closing time [s/90°], operation stroke [°], switching-off torque [Nm], and electric motor parameters are given in Table 1.

Table 1: Basic specifications

Type/ Type number	Operating speed ±10[%] ¹⁾	Operating stroke	Max. load torque ²⁾ SP-Ex with controller	Switching-off torque ±10 [%]	Weight	Electric motor ³⁾					
						Power supply nominal voltage		Nominal			Capacitor capacity
							[V]	power	speed	current	
1	[s/90°]	[°]	[Nm]	[Nm]	[kg]	8	9	10	11	12	13
SP 2-Ex type number 292	5	60°, 90°, 120°, 160°, without stop ends 360°, without stop ends and without transmitter >0°, <360°	63	72	12,0 – 14,5	Single-phase	230	60	2750	0,7	7/400
	10										
	20		125	145				20	1350	0,4	5/400
	40										
	80		Single-phase/ direct current- voltage	24 AC/ DC		95	3300	4,9	-		
	5									63	72
	10										
	20									125	145
	40										
	5		Three-phase	3x400		90	2740	0,35	-		
	10										
	20										
40											
SP 2.3-Ex type number 293	20		17,0 - 17,5	250	290	Single-phase	230	60	2750	0,7	7/400
	40										
	80							20	1350	0,4	
	160										
	20			Single- phase/ direct current- voltage	24 AC/ DC	95	3300	4,9	-		
	40										
	80										
	20									Three-phase	3x400
40											
80											
20	250		290								
40											
80											
SP 2.4-Ex type number 294		40		20,5 - 21,0	500	575	Single-phase	230	60	2750	0,7
	80										
	160	20	1350						0,40	7/400	
	40										Single-phase/ direct current- voltage
	80										
	40										
	80										
	40	Three-phase	3x400		90	2740	0,35	-			
	80										
	40										
80											

¹⁾ Anomaly of operating speed: -15% at temperatures under -10°C
± 10% at 230 V (or 3x400 V) AC
-50 up to +30% in dependence on load at 24 V AC/DC.

2) For automotive regulation (intermitted operation S4-25%, from 90 up to 1200 cycles per hour) the maximum load torque equals the maximum switching torque multiplied by 0.8 for remote control (short-time operation S2-10 min, or intermitted operation S4-25%, max. 90 cycles per hour).

3) Switching elements for different type of load (also for EA) defines standard EN 60 947-4-1.

Additional technical data:

EA protection enclosure: **IP 66/ IP 67** (EN 60 529 within valid edition)

Mechanical ruggedness:

sinusoidal vibrations: with frequency in range 10 to 150 Hz,
 with shift amplitude of 0,15 mm for $f < f_p$,
 with acceleration amplitude of $19,6 \text{ m/s}^2$ for $f > f_p$,
 (transition frequency $f_p = 57$ to 62 Hz)

drop resistance: 300 drops with acceleration 2 m.s^{-2}

seismic resistance: amplitude of the shock off 6 on Richter scale

Self-locking: with mechanical brake

Electric motor protection: with thermal switch

EA braking: with mechanical brake

Output part backlash: $< 1,5^\circ$ at load of 5%-of maximum torque

Switching-off

Voltage max. 250 V; 50/60 Hz; 2 A, or 250 V DC; 0,1 A

Hysteresis of position switches..... max. 3%

Switching-off torque is adjusted to maximum value with tolerance $\pm 15 \%$ if not agreed else.

Operating stroke is adjusted at producer according to specified value.

Space heater (E1)

Space heater - supply voltage: corresponding with motor supply voltage (max. 250 V AC)

Space heater power output:..... max. 10 W / 55°C

Thermal switch of space heater (F2)

Supply voltage: corresponding with motor supply voltage (max. 250V AC)

Switching-off temperature: $+30^\circ \text{C} \pm 3\text{K}$

Switching-on temperature: $+20^\circ \text{C} \pm 4\text{K}$

Position transmitters

Resistive position transmitter

Resistance (single **B1**) 100; 2 000 Ω

Resistance (double **B2**) 2×100 ; $2 \times 2000 \Omega$

Operating life of transmitter 10^6 cycles

Load capacity 0,5 W do 40°C , (0 W/ 125°C)

Maximum current load..... 100 mA

Maximum current of sliding contact max.35 mA

Maximum supply voltage $\sqrt{P \times R}$ v DC/AC

Potentiometer linearity error $\pm 2,5 [\%]^1$

Potentiometer hysteresis max. 2,5 $[\%]^1$

Potentiometer values at limit positions:

for **SP-Ex**: "O" (open)..... $\geq 93\%$, "Z" (closed)..... $\leq 5\%$

for **SP-Ex with controller**: "O" (open)..... $\geq 85\%$ and $\leq 95\%$, "Z" (closed)..... $\geq 3\%$ and $\leq 7\%$

Capacitive (B3): non-contact, life 10^8 cycles

2-wire connection with power supply or without power supply

The current signal **4** , **20 mA** (DC) is acquired from the capacitive transmitter supplied from the internal or an external voltage supply source. The electronics of the transmitter is protected against eventual wrong polarity and current overloading. The entire transmitter is galvanic insulated so several transmitters can be connected to one external voltage source.

Power supply voltage (with power supply) 24 V DC

Power supply voltage (without power supply) 18 to 28 V DC

Ripple voltage..... max. 5%

Max power input 0,6 W

Load resistance 0 to 500 Ω

Load resistance can be single side grounded.

Influence of resistance on output current 0,02%/100 Ω

Influence of voltage on output current.....	0,02%/1V
Temperature dependency.....	0.5% / 10 °C
Output signal values at limit positions: "O".....	20 mA (clamps 81; 82)
"Z".....	4 mA (clamps 81; 82)
Values tolerance of output signal of capacitive transmitter "Z".....	+0,2 mA
"O".....	±0,1 mA
capacitive transmitter linearity error.....	±1,5[%] ¹⁾
capacitive transmitter hysteresis.....	max. 1,5 [%] ¹⁾

Electronic positional transmitter (EPV) - converter R/I (B3)

a) 2-wire version - without built-in power supply

Current signal.....	4 ÷ 20 mA (DC)
Power supply voltage.....	15 to 30 V DC
Load resistance.....	max. $R_L = (U_n - 9V) / 0,02A$ [Ω]
.....	(U_n - power supply voltage [V])
Output signal values at limit positions: "O".....	20 mA (clamps 81; 82)
"Z".....	4 mA (clamps 81; 82)
Values tolerance of output signal of EPV: "Z".....	+0,2 mA
"O".....	±0,1 mA

b) 3-wire version - without built-in power supply, or with built-in power supply

Current signal.....	0 ÷ 20 mA (DC)
Current signal.....	4 ÷ 20 mA (DC)
Current signal.....	0 ÷ 5 mA (DC)
Power supply voltage (at version without built-in power supply).....	24 V DC ±1,5%
Load resistance.....	max. 3 kΩ (for 5mA)
Output signal values at limit positions: "O".....	20 mA, or 5 mA (clamps 81; 82)
"Z".....	0 mA, or 4 mA (clamps 81; 82)
Values tolerance of output signal of EPV and capacitive transmitter: "Z".....	+0,2 mA
"O".....	±0,1 mA

EPV linearity error.....	±1,5[%] ¹⁾
EPV hysteresis.....	max. 1,5 [%] ¹⁾

1) from rated value of transmitter referred to output values

Electronic position controller (N)

Controller software equipment:

A) Function and parameters

programmable **functions**:

- with functional buttons SW1, SW2 and LED diodes D3, D4 directly placed on controller
- with computer or terminal equipped with corresponding programme, using RS 232 interface.

programmable **parameters**:

- control signal
- response to SYS-TEST signal
- mirroring (ascending/descending characteristics)
- insensitiveness
- EA limit positions (only with computer and ZP2 programme)
- way of regulation

B) Operation states of controller

Error message from error memory: (using LED diodes and RS 232 and personal computer)

- control signal missing or faulty
- input value of current control signal under 3.5 mA
- existence of SYS-TEST signal
- activity of switches
- failure of feedback position transmitter

Statistic data: (using RS 232 and personal computer)

- number of controller operation hours
- frequency of relay switching in direction "opening"
- frequency of relay switching in direction "closing"
- Supply voltage:** terminal 61 (L1) -1(N)..... 230 V AC, ±10%
- Frequency:** 50/60 Hz ±2%
- Input control signals - analogue:** 0 - 20 mA
- 4 - 20 mA
- 0 - 10 V
- (Actuator opens at rising of control signal.)
- Controller linearity:** 0.5 %
- Controller insensitiveness:** 1 - 10% (adjustable)
- Feedback (position transmitter):** resistive 100 up to 10,000 Ω
- current 4 up to 20 mA
- Power outputs:** 2x relay 5 A/250 V AC
- Digital outputs:** 4x LED (supply, error, adjustment, "opening", "closing" - with two-colour LED)
- Error status:** control switch 24 V, 2W - POR
- Reaction at error situation:** transmitter error - error message LED
- Control signal missing:** error message LED
- SYS mode:** error message LED
- Adjusters:** communication connector
- 2x calibrating and adjusting button

Manual control: with hand wheel; rotating clockwise (counterclockwise) EA output part is moving in direction "Z" - closed ("O" - open)

Mechanical connection: Basic and connecting dimensions are given in dimensional drawings.

Electric connection

- with terminal board (X):** - max. 21 terminals – connecting cable size 0,2-2,5 mm²
- - 2 cable bushings – cable diameter from 9 to 13 mm
- with protection terminal:** - external and internal, mutually connected and marked with protection earthing mark.

Electric connection - according to **wiring diagrams**.

3. Installation and dismantling of actuator



Abide by safety measures!

Note:

Check again if placement of EA reply to chapter "Operation conditions". In case that operation conditions are different from recommended, consultation with producer is needed.

Before starting of mounting the EA onto the valve:

- Check again whether the EA was not damaged during storing.
- Check whether the adjusted operation stroke and connecting dimensions of the actuator (see the nameplate) are in compliance with the valve parameters.
- In case of inconsonance, perform adjusting according to the part "Adjustment".

3.1 Mechanical connection

EA is by the producer adjusted to parameters according to the nameplate, with connecting dimensions according to the corresponding dimensional drawing and put it to a mid-position.

Before installation put the hand wheel on.

3.1.1 Mechanical flange connection

- Properly defat contact surfaces of the EA, connecting flange and the valve/gearing.
- Coat the valve/gearing output shaft firmly with a grease not containing any acid.
- Reset the EA to the limit position "closed"; put the valve to the same limit position.
- Put the EA onto the valve to have the output shaft reliably in the valve/gearing coupling.
- Use the handwheel to turn the EA if needed to reach compliance between holes in the EA flange and the valve.
- Check whether the connecting flange clings to the valve/gearing.
- Fix the flange with four screws (with mechanical ruggedness min. 8G) tightened to allow moving of EA. Then the fixing screws tighten uniformly crosswisely.

3.1.2 Mechanical lever connection

- Clean contact surfaces of the stand and the base and coat the EA shaft and the pull-rods sliding surfaces with grease.
- Fix the EA to the device with two screws.
- Put the controlled device to the limit position; put the EA with stop ends to the corresponding limit position.
- Put the lever or another output element corresponding with the position as much as possible, in case that the position is not in compliance with required, tune it with the handwheel in range $\pm 15^\circ$.
- Connect the EA with the device with the pull-rod consisting of two ball pins and a 1/2" tube according to STN 42 5711 threaded on both ends.
- In EA without stop ends operation angle position can be adjusted with the handwheel, along the whole circumference without changing of setting of the lever.
- While installing take care to have the angle between the lever and the pull-rod at least 15° and at most 165° (Fig.1).

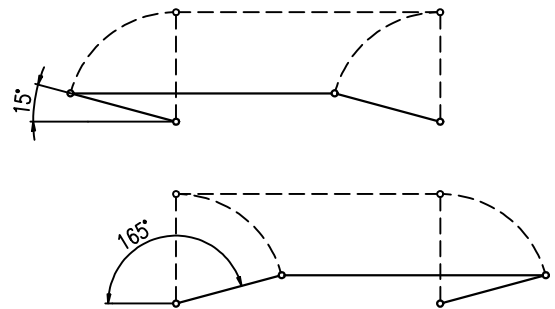


Fig.1

Notes:

1. Minimum mechanical ruggedness of screws is 8G.
 2. If adjustment of the position-signalling unit, the transmitter or the position indicator in the production plant do not correspond with the EA connected this way, adjust the units. If adjustment of the stop ends was changed, it is needed to adjust the stop end screws again.
- In the end of mechanical connection check correctness of the connection with the valve/gearing with rotating the handwheel.

3.2 Electric connection and checking of function

Follow up with connecting the EA with mains or master system.



1. Follow instructions in the part "Requirements for professional qualification"!
2. While laying electrical line abide by the instructions for heavy current installations.
3. Cables to terminal boards or connectors lead through screw bushings.
4. Before initiation ES into operation internal and external protection terminals are needed to be connected.
5. Feeding cables are to be fixed to the solid construction at most 150 mm from the bushings.

Connecting with the master system:

The EA can be controlled with:

- a built-in position controller
 - an external position controller



1. If the EA is controlled with an external controller using unified signal from a two-wire transmitter (capacitive or resistive with a converter in two-wire connection), it is needed to arrange connecting of the two-wire transmitter loop to electrical earth of the successive external controller!
2. Connection can be performed only in one point, in any part of loop out of the EA.

3. Electronics of the two-wire transmitters is galvanically insulated that is why it can serve as an external source for supplying of several transmitters (their number depends on current which the source can supply).

4. Do not connect and disconnect live connectors!

Connecting to terminal board

- Check whether the type of current, supply voltage and frequency correspond with data on the nameplate of electric motor.
- Remove the upper cover.
- In case of the single-phase version the phase L1 and the lead N connect to the corresponding terminals. In case of the three-phase version connect the phase cables L1, L2 and L3 to U, V, W (terminals 2, 3, 4), the protection cables to the marked places of internal and external protection terminals.
- Connect the control cables according to the wiring diagram placed into the internal side of the cover.
- Put the cover on and tighten it uniformly crosswisely.
- Tighten the cable bushings firmly to assure the protection enclosure rate.

Notes:

1. The EA are delivered with bushings, which in case of tight putting on the leads assure protection enclosure up to IP 67. For required protection enclosure it is needed to use rings according to the actual cable diameter.
2. While fixing the cable it is needed to count with allowed bend radius to avoid damaging or deformation of the sealing element of the bushing. The leads are to be fixed with the solid construction at most 150 mm from the bushings.
3. It is recommended to use screened cables to connect remote transmitters.
4. The face areas of the control part cover have to be before re-mounting clean, coated with a grease without any acid (e.g. vaseline) and sealing not damaged to avoid joint corrosion.
5. Reversation of the EA is sure, if the period between switching-off and switching-on of power supply for the reversed movement of the output part is minimally 50 ms.
6. Delay after switching-off, i.e. time since a reaction of switches till the motor is dead can be maximally 20 ms.
7. It is recommended to have the corresponding direction protection switched-off directly with the corresponding position or torque switches.



Abide by instructions of valve producers, whether switching-off in limit positions is to be realised with position or torque switches!

After electric connection perform checking of function:

- Put the valve manually to a mid-position.
- Connect the EA electrically for the chosen direction of movement and watch the output part movement.
- If it does not correspond change the order of feeding phases (valid for 3x400V version), or change leads of the feeding phase to the corresponding terminals (valid for 230V version).
- Check the control unit switches connection with switching consequently the contacts of the corresponding switches with pressing the control elements at running of the EA (at proper connection) to the chosen direction. In case of proper connection the EA stops or indicates the adjusted position according to switching of the chosen switch. If any of the functions is fault check connecting of the switches according to wiring diagrams.



In the SP-Ex version with the built-in electronic controller it is needed to perform autocalibration for assuring optimal functioning.

The procedure is as follows

Set the actuator to a mid-position (position and torque switches are not switched)

Press the button **SW1** for about 2 sec (i.e. till the **D3** diode is got on) to set the controller to the **autocalibration** mode. During this process the controller checks the feedback transmitter and the sense of turning, puts the EA to the positions open and closed, measures inertia mass in the directions "opening" and "closing", and loads the adjusted parameters into the EEPROM memory. In case that during the initialisation process an error occurs (e.g. in connection or adjustment) the initialisation process will be interrupted and the controller with the **D4** diode reports about the type of the error. Else after finishing the initialisation process the controller is put into the **regulation mode**. If needed to change adjusted parameters of the controller follow instructions given in the part Adjusting of actuator.

3.3 Dismantling



**Before dismantling it is required to disconnect the EA from mains!
Do not connect and disconnect live connectors!**

- Disconnect the EA from mains.
- Disconnect the leads from the EA terminal boards and loosen the cables from bushings. Pull out the connectors in case of the connector version.
- Loosen the fixing screws of the EA flange and coupling screws and disconnect the EA from the valve.
- While sending the EA to be repaired put it into a package solid enough to avoid damages of the EA during transportation.

4. Adjusting of actuator



Abide by safety measures!

After mechanical connection, electrical connection and checking of connection and function start setting and adjustment of the device. The adjustment can be performed at a mechanically and electrically connected EA. This part describes adjustment of EA to specified parameters in case that any unit of EA is reset. Laying of adjusters of the control board is shown on Fig. 2

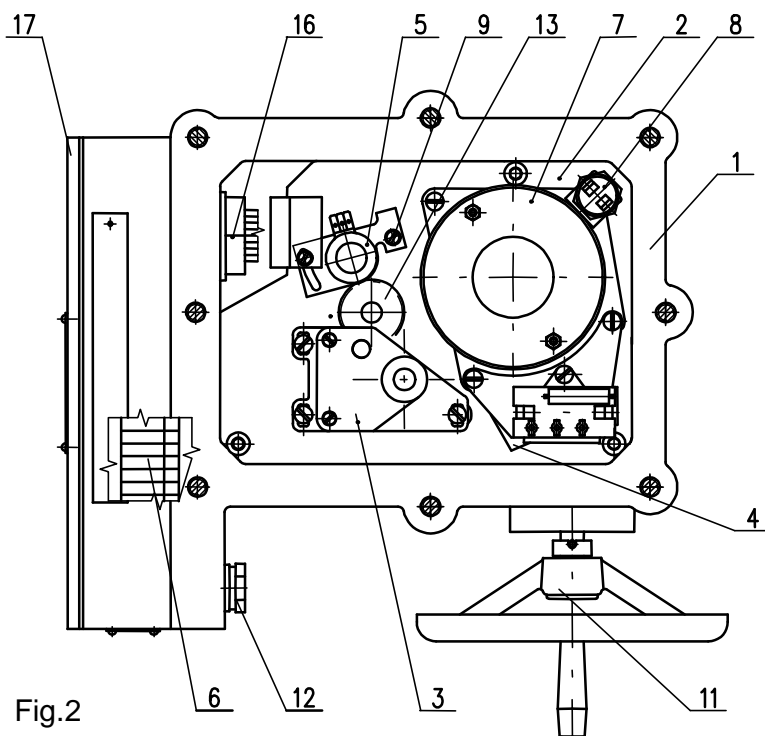


Fig.2

4.1 Adjustment of torque unit

In the production plant switching-off torque for both the "opening" direction (the torque switch S1) as well as for the "closing" direction (the torque switch S2) are adjusted to specified value $\pm 15\%$. If not agreed else they are adjusted to maximum value.

Adjustment and setting of the torque unit to other values without any testing device for torque measuring is not possible.

4.2 Adjustment of position-indicating unit (Fig.3)

The EA are in the production plant adjusted to a fixed angle (according to the specification), given on the nameplate. While setting, adjusting and resetting follow these steps (Fig. 3):

- In the version with a transmitter put the transmitter out of mesh.
- Loosen the nuts (23) fixing cams still having the Belleville spring creating axial pressure.
- Put the EA to the position "open" and turn the cam (29) clockwise until the switch S3 (25) switches.
- Change setting of the EA by the angle, where the position "open" is to be indicated and turn the cam (31) clockwise until the switch S5 (27) switches.
- Put the EA to the position "closed" and turn the cam (28) counterclockwise until the switch S4 (24) switches.
- Turn the EA back by the angle, where the position "closed" is to be indicated and turn the cam (30) counterclockwise until the switch S6 (26) switches.
- Having the EA adjusted lock the cams with the central milled nut and counter-nut (23).

If not agreed else the signalling cams are set next to the limit positions. The signal possibility is available along the whole operation angle in both directions, i.e. 100%.

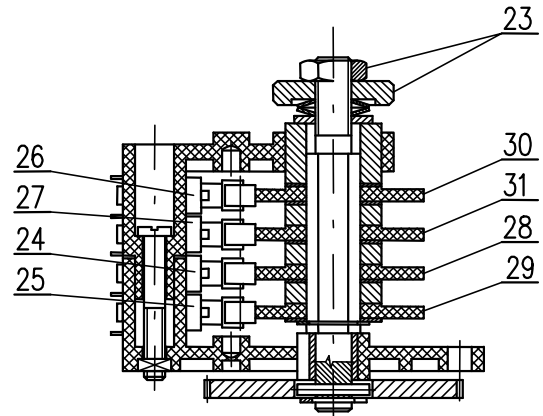


Fig. 3

4.3 Adjustment of resistant transmitter (Fig. 4)

The **resistant transmitter** is in the EA **SP-Ex** used to function as a remote position indicator; in the EA **SP-Ex with controller** to function as a feedback in the position controller and if needed also in the position of a remote resistant position indicator. Before the resistant transmitter adjustment the position switches have to be adjusted. Adjustment consists in setting of the resistance in the defined limit position of the EA.

Notes:

In case that the EA is not used in the whole stroke range given on the nameplate, the resistance in the limit position "open" is proportionally reduced.

*In the EA **SP-Ex with controller** 2000W resistant transmitters are used. In the other cases if the resistant branch is lead to the terminal board the resistance of the transmitters is according to the customer's specification.*

To adjust the transmitter follow these steps:

- Loosen the fixing screws (9) of the transmitter holder and push the transmitter out of mesh.
- Connect a meter for resistance measuring to the terminals 71 and 73 of the EA **SP-Ex** terminal board, or to the terminals 7 and 10 of the EA **SP-Ex with controller** terminal board.
- Put the actuator to the position "closed" (with the hand wheel, or with the local electric position control until the corresponding position switch S2 or S4 switches).
- Rotate the transmitter shaft until resistance of $\leq 5\%$ of the nominal transmitter resistance can be read on the meter in case of EA **SP-Ex**, or 3 up to 5% of the nominal transmitter resistance in case of EA **SP-Ex with controller**, or in case of EA **SP-Ex with EPV**, i.e. with the resistant transmitter with the converter PTK1
- In the position put the transmitter to mesh with the drive wheel and fix the fixing screws on the transmitter holder.
- Disconnect the meter from the terminal board.

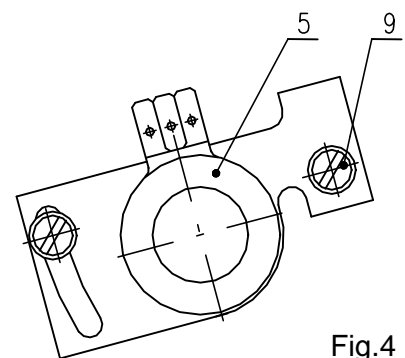


Fig.4

4.4 Adjustment of the Electronic Position Transmitter (EPV) - the Resistive Transmitter (Potentiometer) with the Converter PTK 1

4.4.1 EPV – the 2-wire version (Fig. 5)

The position transmitter with the converter PTK1 is in the plant adjusted to have the output current signal on the terminals 81-82 as follows:

- in the position "open" 20 mA
- in the position "closed" 4 mA

If the transmitter requires a new adjustment follow these steps:

Adjustment of the EPV in EA SP-Ex:

- Put the actuator to the position "closed" and switch the power supply off.
- Adjust the resistive transmitter according to the previous chapter. The resistance is to be metered on the terminals X-Y (Fig. 5). The used transmitter resistance is 100 Ω .
- Switch the converter's power supply on.
- Turn the adjusting trimmer ZERO (Fig. 5) to adjust the output current signal rate measured on the terminals 81-82 to 4mA.
- Set the actuator to the position „open“.
- Turn the adjusting trimmer GAIN (Fig. 5) to adjust the output current signal rate measured on the terminals 81-82 to 20mA.
- Check the output signal of the converter in the both limit positions, and repeat the procedure if needed..

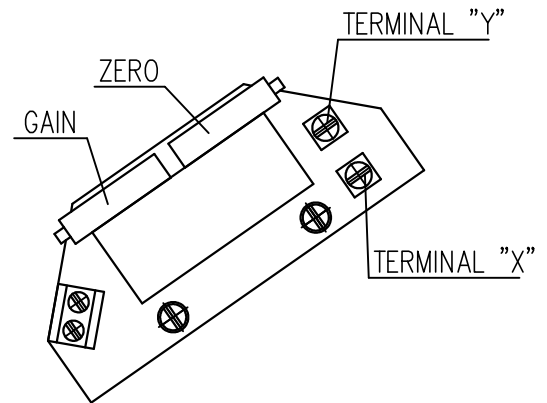


Fig.5

Note:

The output signal of 4-20mA can be adjusted at the range from 75 up to 100% of the rated stroke stated on the actuator's nameplate. At values less than 75% the value 20mA is reduced proportionally.

4.4.2 EPV – 3-wire version (Fig. 6)

The resistive transmitter with the converter is in the plant adjusted to have the output current signal metered on the terminals 81-82 as follows:

- in the position "open" 20 mA or 5 mA
- in the position "closed" 0 mA or 4 mA

according to the specified version of the converter.

If the transmitter requires a new adjustment follow these steps:

- Put the actuator to the position "closed" and switch the power supply off.
- Adjust the resistive transmitter according to the previous chapter. The resistance is to be metered on the terminals X-Y (Fig. 6). The used transmitter resistance is 2000 Ω or 100 Ω .
- Switch the converter's power supply on.
- Turn the adjusting trimmer ZERO (Fig. 6) to adjust the output current signal rate measured on the terminals 81-82 to 0 mA or 4mA.
- Set the actuator to the position "open“.
- Turn the adjusting trimmer GAIN (Fig. 6) to adjust the output current signal rate measured on the terminals 81-82 to 20mA or 5 mA..
- Check the output signal of the converter in the both limit positions, and repeat the procedure if needed.

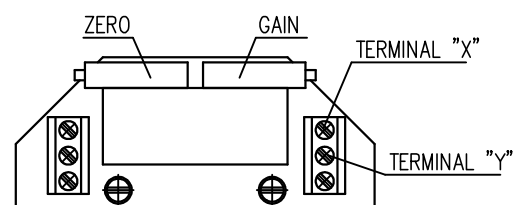


Fig.6

Note:

The output signal of (0-20mA, 4-20mA or 0-5mA - according to the specification) can be adjusted at the range from 85 up to 100% of the rated stroke stated on the actuator's nameplate. At values less than 85% the value of the output signal is reduced proportionally.

4.5 Adjustment of the Capacitive Transmitter CPT1/A (Fig.7)

The chapter describes adjustment of the capacitive transmitter to the specified parameters (standard values of output signals) in case they are reset. The capacitive transmitter serves as a position transmitter of electric actuators with unified output signal of 4÷20 mA in electric actuators **SP-Ex**, or as a feedback of a position controller, or if required it functions also as a remote position transmitter of electric actuators with unified output signal of 4÷20 mA in electric actuators **SP-Ex with controllers**.

Note:

In case that reversed output signals are needed (in the position "OPEN" minimum output signal) contact personnel of service centres.

The capacitive transmitter CPT1/A is adjusted by the producer to the fixed operation stroke according to the order and wired according to the wiring diagrams placed into the cover. Check the power supply of the user after connecting to terminal of the terminal board before the transmitter is electrically checked. Adjustment of the capacitive transmitter can be performed when the position switches are adjusted. The adjustment is performed with the power supply of 230 V/50 Hz and ambient temperature of 20±5°C.

The following versions of electric actuators with built capacitive transmitters can be specified :

- A) The version without any power supply** (2-wire version) for EA **SP-Ex**
- B) The version with a power supply** (2-wire version) for EA **SP-Ex**
- C) The version CPT as a feedback to the position controller** for EA **SP-Ex with controllers**

A.) Adjustment of the Capacitive Transmitter without any Power Supply

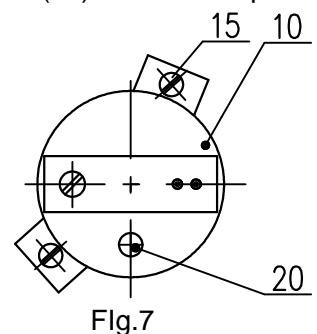
Before connecting check the power supply. The measured voltage should be in range from 18 up to 28 V DC.



The voltage of the power supply must not be in any case higher than 30 V DC. The transmitter can be irreversibly damaged

While checking or adjusting the output signal of 4÷20 mA follow these steps:

- Connect a mA meter of precision class 0,5 and loading resistance lower than 500Ω serially with the transmitter (pole „-“; terminal 82)
- Put the actuator to the position "CLOSED", the signal value should decrease.
- Check the signal value for the position "CLOSED" (4 mA).
- Tune the signal with loosening the fixing screws (15) and turning the trimmer (10) until the required value of 4 mA is reached. Tighten the fixing screws.
- Put the actuator to the position "OPEN", the signal value should raise.
- Check the signal value for the position "OPEN" (20 mA).
- Tune the signal with turning the trimmer (20) until the required value of 20 mA is reached.
- Check the signal value for the position "CLOSED" and then for the position "OPEN".
- Repeat the procedure until the change from 4 to 20 mA is reached with deviation less then 0,5 %.
- Disconnect the meter and lock the screws with a varnish.



B.) Adjustment of the Capacitive Transmitter with the Power Supply:

- 1.) Check the power supply: 230 V AC ±10% on the terminals 78,79
- 2.) While checking or adjusting the output signal of 4÷20 mA follow these steps:
 - Connect a mA meter of precision class 0,5 and loading resistance lower than 500Ω on the terminals 81,82.
 - Follow the procedure described in the previous chapter A.

C.) Adjustment of the Capacitive Transmitter Served as a Feedback of the Position Controller

While checking or adjusting the output signal of 4÷20 mA follow these steps:

- Disconnect the circuit on the terminals 81 and 82 removing the jumper.
- Connect power supply to the terminals 1 and 61.
- Disconnect the control signal from the terminals 86 and 88.
- Put the actuator to the direction "OPENING" or "CLOSING" with the hand wheel or connecting power supply to the terminals 1 and 200 for the direction "OPENING", or 1 and 24 for the direction "CLOSING".
- Connect a mA meter of precision class 0,5 (e.g. digital) and loading resistance lower than 500Ω on the terminals 81,82.
- Follow the procedure for the version without any power supply described in the previous chapter A.
- Having the transmitter adjusted put the jumper again on the terminals 81 and 82 in case that the output signal wont be used (the circuit through the terminals 81 and 82 should be closed).
- Connect the control signal to the terminals 86 and 88



The user has to arrange grounding of the 2-wire circuit of the capacitive transmitter to the electrical ground of a joined controller, computer, etc. The grounding should be performed only in one place in any part of the circuit outside the electric actuator!

Note:

The trimmer (20) can be used to adjust the output signal of the capacitive transmitter to any value of operation stroke in range from ca 40% up to 100% of the value of the operation stroke adjusted by the producer and stated on the actuator's nameplate.

4.6 Resetting of operation angle and setting of stop end screws (Fig. 8)

The valve operation angle position is defined with the stop end screws which allow to change the position from the position "Z" (closed - 0°) and from the position "O" (open - 60°, 90°, 120°, 160°) by a value of ±15°. For better understanding see Fig. 8 where the output shaft is in the position "Z" for the operation angle of 90°. The stop end screws serve as mechanical limits of the operation angle position at manual control or as end travel points for torque switching-off, else the mechanical gearing could be damaged.

Note:

The stop end screws allow to extend or to reduce the operation angle by 30° in the adjusted EA, but output shaft position cannot be tuned. Also the position unit is to be adjusted to this angle and the transmitter has to be out of mesh.

4.6.1 Setting of stop end screws at position-unit switching-off

If the EA is equipped with the torque switches they function as limit switches in case of position-unit switching-off failure, or as protection against overload.

The procedure is as follows:

- Loosen the counter-nut of the stop end screw "Z".
- Rotate the stop end screw to right until you feel an increased resistance while touching the end. From this status turn the screw min. by 1/2 of revolution back to avoid torque switching.
- Lock the screw with the counter-nut.
- Use similar steps to set the stop end screw for the position "O".

4.6.2 Setting of stop end screws at torque switching-off (Fig.8)

In case the stop ends screws function as limit points (stop ends) of the EA output shaft travel the EA torque unit is to be adjusted not to have the switching-off torque exceeded.

The procedure is as follows:

- Put the EA with the handwheel to the position "Z" (closed).
- Loosen the counter-nut of the stop end screw "Z".
- Rotate the stop end screw to right until you feel an increased resistance while touching the end - lock the screw with the counter-nut.
- Use similar steps to set the stop end screw for the position "O".
- Adjust the position-signalling unit to switch-off before torque switching-off.

TYPE of EA	A	B	C	D	J
SP 2-Ex	46	18,5	16	M10	16
SP 2.3-Ex	34	12,5	10	M12	19
SP 2.4-Ex	44	15,5	12,5	M14	22

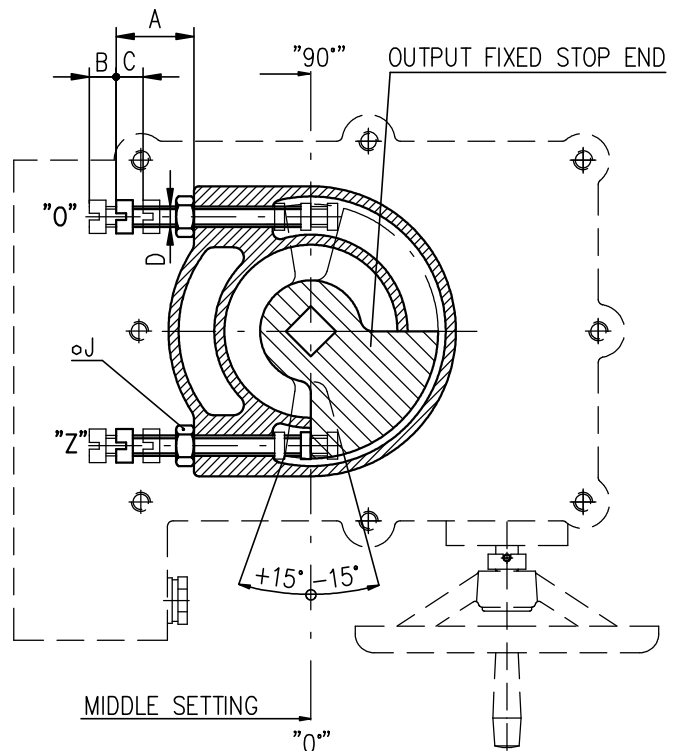


Fig.8

4.7 Adjustment of position controller (Fig. 9)

The built-in position controller REGADA of new generation is a user-friendly control system to control actuators with an analogue signal. The controller takes advantages of high-power RISC processor MICROCHIP to perform all functions. It provides also continuous automotive diagnostics of the system, error messages as well as number of relay switching and number of controller's operation hours. Placing an analogue signal onto the input terminals of the terminal board 86/87 (GND, -) and 88 (+) causes that the EA output is reset.

Required parameters and functions can be programmed using function buttons SW1 - SW2 and LED diodes D3 - D4 placed directly on the controller, see Table 2.

4.7.1 Setting of controller

The controller's microprocessor unit is in the production plant programmed to parameters given in **Table 2** (Note 2).

Setting of the controller is performed using buttons and LED diodes.

Adjust the position and torque switches and the position transmitter before adjustment of the controller.

Laying of adjusters and signalling elements on the board of the REGADA controller is shown on Fig.9:

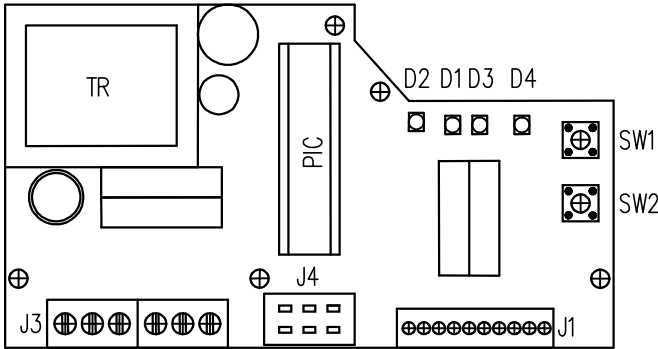


Fig. 9

SW1 button	starts an initialisation routine an allows listing in the adjust menus
SW2 button	setting of parameters in the chosen menu
D1 diode	power on indication
D2 diode	motion to the direction "opening" indication (green) - "closing" (red) indication
D3 diode	(yellow light) number of blinking codes indicates chosen adjust menu
D4 diode	(red light) number of blinking codes indicates adjusted parameter of the controller from the chosen menu

Table 2

D3 (yellow) diode number of blinking	Adjust menu	D4 (red) diode number of blinking	Adjusted parameter
1 blink	control signal	1 blink	0-20mA
		2 blinks	4-20 mA (*) (**)
		3 blinks	0-10V DC
2 blinks	response for signal SYS-TEST	1 blink	EA opens receiving signal SYS
		2 blinks	EA closes receiving signal SYS
		3 blinks	EA stops receiving signal SYS (*)
3 blinks	mirroring (ascending/descending characteristics)	1 blink	EA CLOSING at increasing of control signal
		2 blinks	EA OPENING at increasing of control signal (*)
4 blinks	insensitiveness of controller	1 to 10 blinks	insensitiveness of controller of 1-10% (3% set by the producer) (*)
5 blinks	way of regulation	1 blink	narrow torque
		2 blinks	narrow position (*)
		3 blinks	wide torque
		4 blinks	wide position

Notes:

1. The controller at autocalibration automatically sets the feedback type - resistant/current
2. (*) Parameters set in the production plant, if customer has not stated else.
3. (**) Input signal 4 mA - position "closed" 20 mA - position "open"

Standard setting of controller (programmed RESET of controller) - in case of any problems with setting of the parameters it is possible with pressing both **SW1** and **SW2** at the same time and then switching power on to set the standard parameters.

Controller setting procedure:

- Set the actuator into a mid-position.
The initialisation routine starts at the switched-on controller, zero system deviation and short pressing of the SW1 button for ca 2 sec (i.e. until the diode D3 got on). Loosing the button some of the default menus starts (usually control signal) what is shown with 1 blink on the D3 diode as well as one of the default parameters (usually control signal of 4-20mA) what is shown with 1 blink on the D4 diode. Then the required parameters of the controller can be changed according to Table 2:
 - press shortly the SW1 button to list the menu shown with the blinking number on the D4 diode.
 - press shortly the SW2 button to set parameters shown with the blinking number on the D4 diode.
- After changing of the parameters according to user's wishes, put the controller to autocalibration with pressing the SW1 button for ca 2 sec (i.e. until the diode D3 got on). During this process the controller performs the feedback transmitter and turning sense checking, sets actuator to the positions

"open" and "closed", measures inertia mass in the directions "opening" and "closing", and loads the adjusted parameters into the EEPROM memory. In case that during the initialisation process an error occurs (e.g. in connection or adjustment) the initialisation process will be interrupted and the controller with the D4 diode reports about the type of the error. Else after finishing the initialisation process the controller is put into the regulation mode.

Error messages of the controller with D4 diode at initialisation:

- 4 blinksimproper connection of the torque switches
- 5 blinksimproper connection of the feedback transmitter
- 8 blinksbad sense of actuator's turning direction or adverse connection of the feedback transmitter

4.7.2 Watching operation and error states

Watching operation and error states is possible with the EA open.

a.) Operation status with the D3 LED diode indicating:

- it is continuously lighting - the controller regulates
- it is continuously not lighting - system deviation in the insensitiveness range - the EA has stopped

b.) Error state with the D4 and D3 LED diodes indicating - D4 continuously lighting, D3 indicates error state with blinking

1 blink (repeated):	- indication of the "TEST" mode - the EA is put to the position according to the signal in the "TEST" menu (at connecting the 66 and 86/87 terminals)
2 blinks (repeating after short pause):	- missing of control signal - the EA is put to the position according to the signal in the "TEST" menu
4 blinks (repeating after short pause):	- thrust switches activity indication (the EA switched-off with the thrust switches in a mid-position)
5 blinks (repeating after short pause):	- failure of the feedback transmitter - the EA is put to the position according to the signal in the "TEST" menu
7 blinks (repeating after short pause):	- control signal (current at range 4-20mA less than 4mA (3.5mA))

5. Service, maintenance and troubleshooting

5.1 Service



1. In general it is provided that service of the EA is performed by a qualified worker in accordance with requirement given in Chapter 1!
2. After putting the EA into operation it is needed to verify whether during manipulation any scratch on surface occurred, it is to be removed to prevent actuator against corrosion!

The EA SP-Ex or SP-Ex with controller requires just negligible service. Proper putting into operation is a recondition of reliable operation.

The service of the EA leads from the operation conditions and usually resides in information processing for further arranging of required functions. EA could be controlled by electric remote control or a manual control directly on place of installation. EA can be operated manually by hand wheel.

The stuff has to perform prescribed maintenance to prevent the EA during operation against impacts of environment, which exceed the frame of allowed influences.

Is necessary to pay attention to avoid overwearing of surface resisting closure EA compare to name plate values and overvibration of EA.

Manual control:

If needed (during adjusting, function checking, failure etc.) the stuff can change setting of the controlled body using the hand wheel. While rotating the hand wheel clockwise the output part moves in the direction "Z - closed".

5.2 Maintenance - extent and periodicity

During inspections and maintenance it is needed to tighten all screws and nuts which influence tightness and protection enclosure.

Another maintenance resides in greasing. Changing or filling grease up during first years operation is not required. To refill or to replenish the grease is needed during revisions. Intervals between two prevention inspections are four years.

Lubricators – grease HF 401/0 (GLEIT- μ) or GLEITMO 585 K

- in versions for climate with temperatures -50°C till $+40^{\circ}\text{C}$ grease ISOFLEX TOPAS AK 50.
- in versions for climate with temperatures -60°C till $+55^{\circ}\text{C}$ grease DISCOR R EP – 000.



Greasing of the valve spindle is independent on maintenance of the EA!

Every six months it is recommended to perform one check move in frame of adjusted operation stroke to verify reliability of functioning with setting back to the original position.

If the audit rules do not determine else the inspection of EA is performed ones a year and tightening of all connecting and grounded screws have to be checked to avoid overheating.

After 6 months and once a year it is recommended to check tightening of fixing screws between the EA and the valve.

5.3 Maintenance to assure inexplosiveness

A half an hour before removing of the actuator cover it is needed to switch power supply off. The given period is required to assure cooling of the electric motor and the space heater below the admissible temperature value of the temperature class T5 (100°C).

The fixing screws of the upper cover have to be always in full numbers, i.e. 8 pcs, with flexible washers and tightly fastened.

The actuators with damaged closing surfaces, e.g. scratches, rifts, etc. have to be immediately put out of operation.

While electric connection or disconnection of EA check the sealing of the cable bushing – damaged and outworn sealing replace by original sealing!

Keep EA clean and pay attention on removing dirt and dust. Do the cleaning regulary according to operating possibilities or demands.

Reparation of EA (basically the parts the resisting closures consist with, have substantial influence on safety) is allowed perform only by producer, which according to certificated documentation and by performing of required tests (inclusive of static pressure test of resisting clouser parts) guarantee the fulfil required standardes and rules for this products.

The closing surfaces are (Fig.10):

- the connecting surface of the upper cover and the lower case (1),
- the cylinder part of the manual control mechanism flange and shaft (2),
- the cylinder part of the lower case and the cylinder part of the manual control mechanism flange (3),
- the cylinder part of the lower case and the cylinder part of the crown wheel flange (4).
- the cylinder part of the crown wheel and of the indication shaft (5)
- the cylinder part of the lower case and the cylinder part of the crown wheel (6) valid for ES SP 2.3-Ex, SP 2.4-Ex.
- the cylinder part of the crown wheel and pinion (7) valid for ES SP 2.3-Ex, SP 2.4-Ex
- the cylinder part of pinion and indication shaft (8) valid for ES SP 2.3-Ex, SP 2.4-Ex.

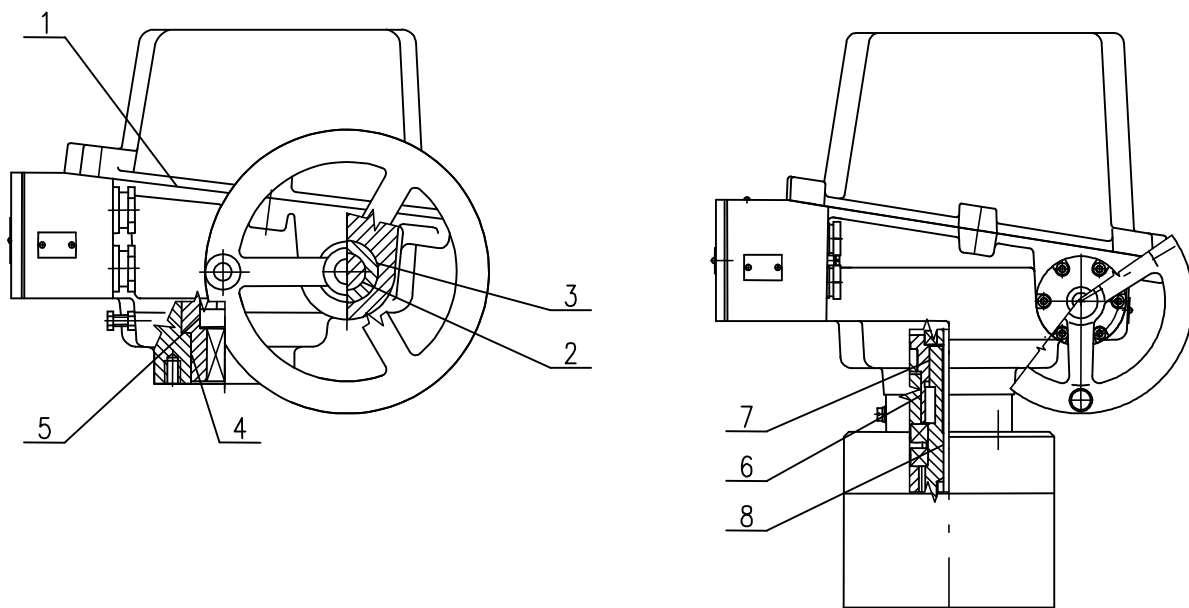


Fig. 10

Enclosure joint surfaces are designed according to the requirements of table 2 and 3, EN 60079-1,

To seal the gaps against entry of fluids and dust, O-rings are used from the outside except for the gap of flameproof enclosure.



Caution:

After disassembly and re-assembly of top enclosure and bottom enclosure (see gap of flameproof enclosure 1 in chapter 5.3) the sealing O-ring must be replaced according following table:

O- Ringlet	PNm	Material	Manufacturer
Bottom upper cover and the lower case	62 732 XXX	NBR	TRELLEBORG SEALING SOLUTIONS resp. MEGAbelt SK, s.r.o.

5.4 Troubleshooting

- In case of a mains failure the EA stands in the position where it was before the failure occurred. If needed the EA can be reset using the manual control (with the handwheel). When necessary EA can be manually operated (hand wheel), at doing this, pay attention to keep the movement of the EA output part within the range of the set stroke so as to avoid losing the adjustment of the limit position switches or position transmitter or regulator. After supply voltage recovery EA is prepared for operation.
- In case of a failure of a part of the EA the part can be replaced by a new one. The exchange is to be committed by the producer or a contracted service firm.
- In case of an EA failure, which cannot be eliminated directly in operation, follow instructions for under-guaranty and after-guaranty service.
- For controller repair a F1,6 A subminiature fuse for PCB should be used, alternatively also F 2A, 250 V e.g. Siba type 164 050.1,6 or MSF 250, and for DB voltage source repair a M160 mA, 250V fuse, e.g. Siba, or MSF 250.

Note: If the EA has to be dismantled follow the procedure of the Chapter "Dismantling"



The EA can be dismantled to be repair purpose by qualified and trained persons only! The training can be performed by the producer or by a contracted service firm.

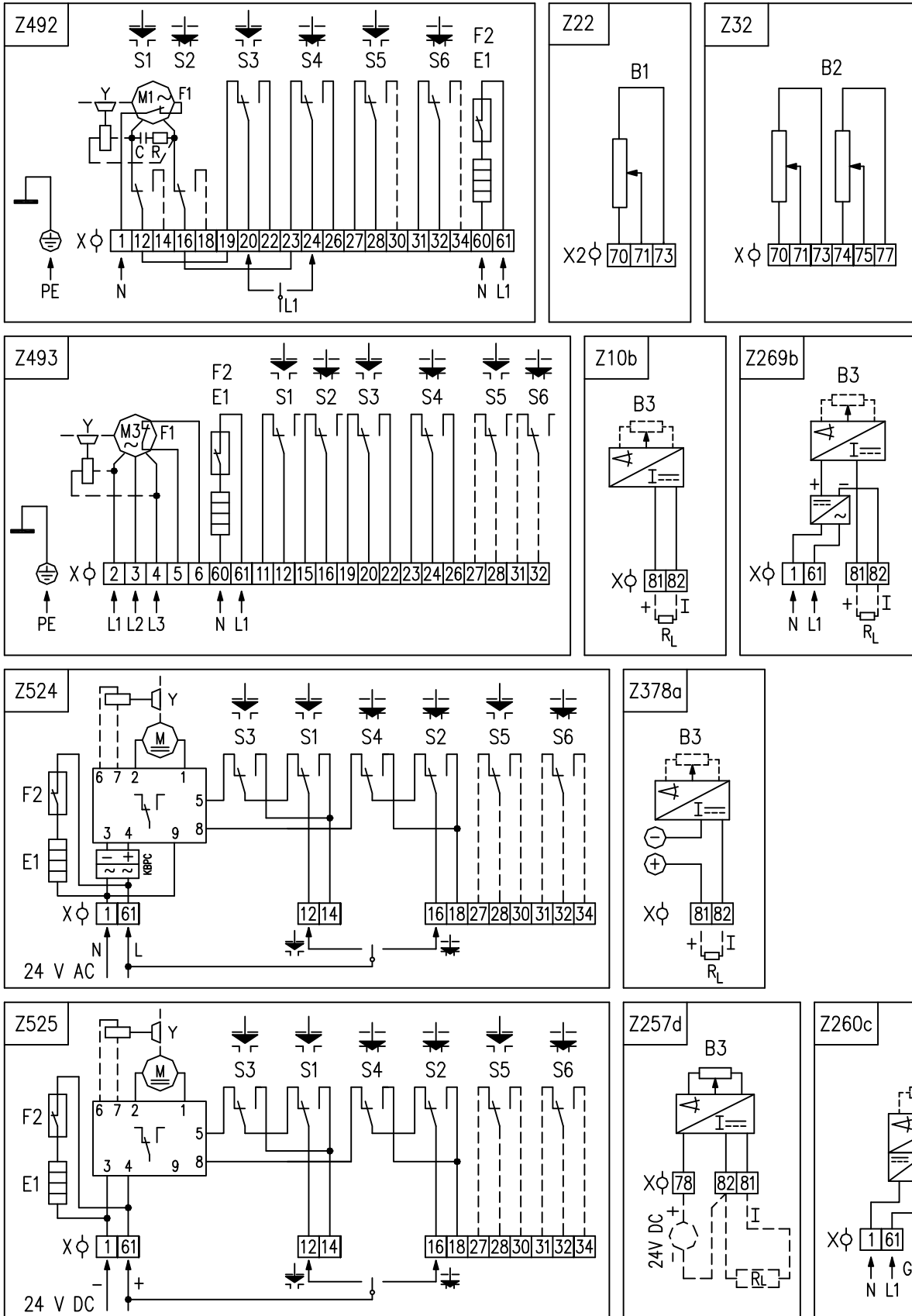
6. Accessories

The EA is delivered with the **hand wheel**.

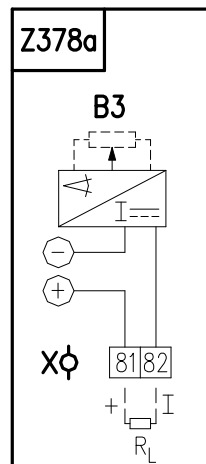
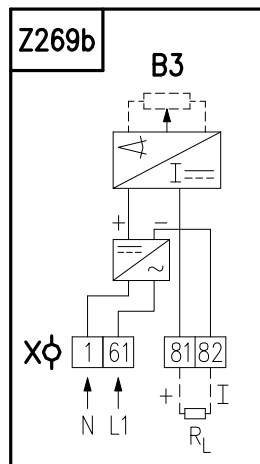
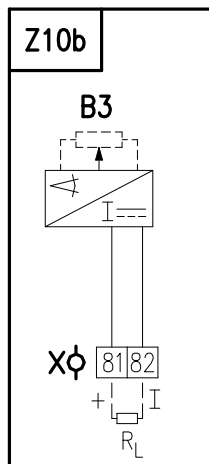
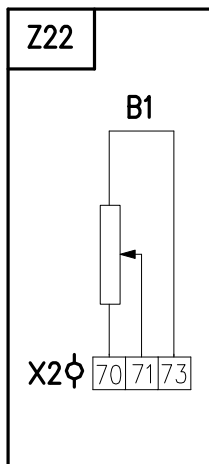
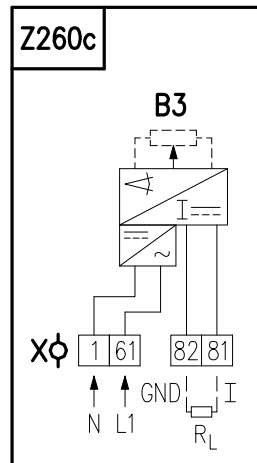
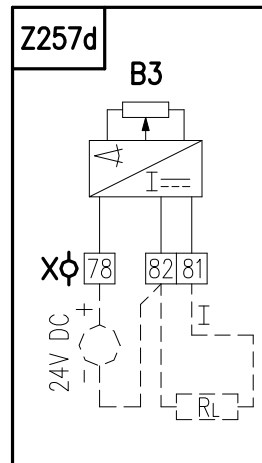
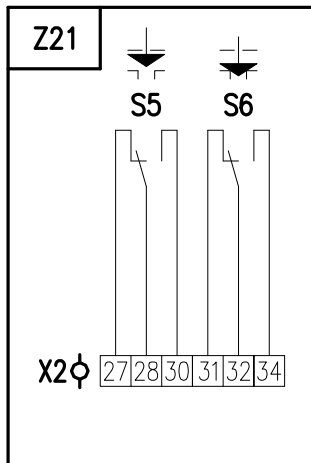
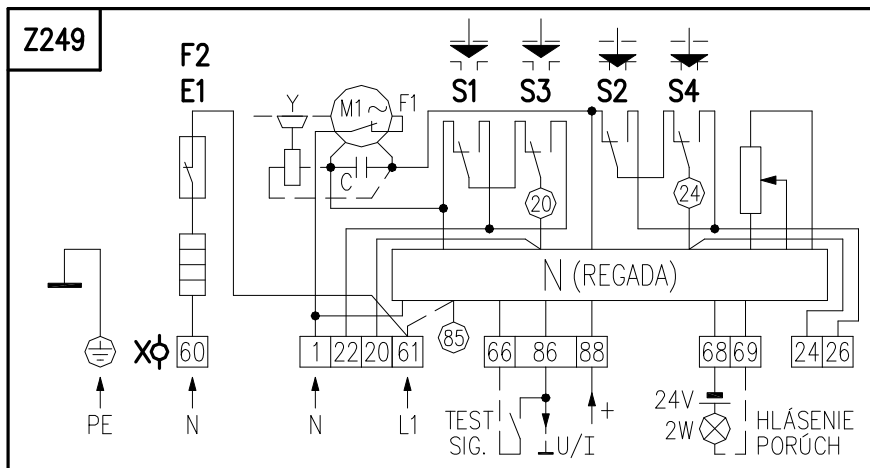
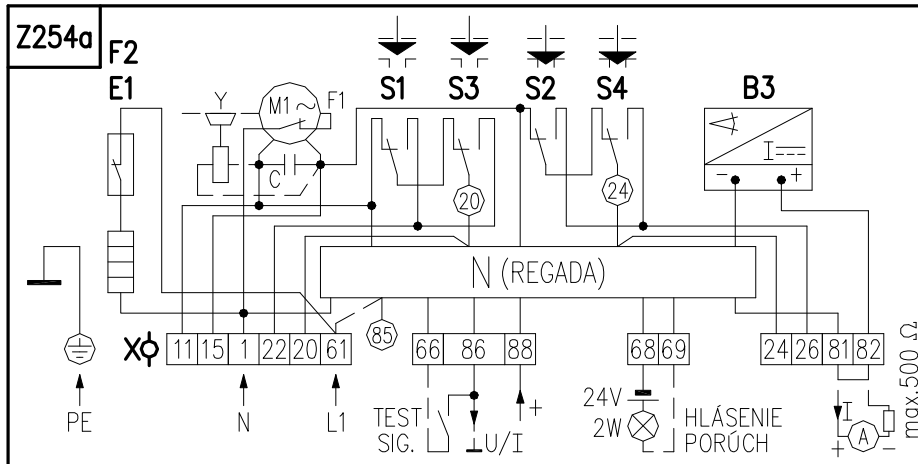
7. Enclosures

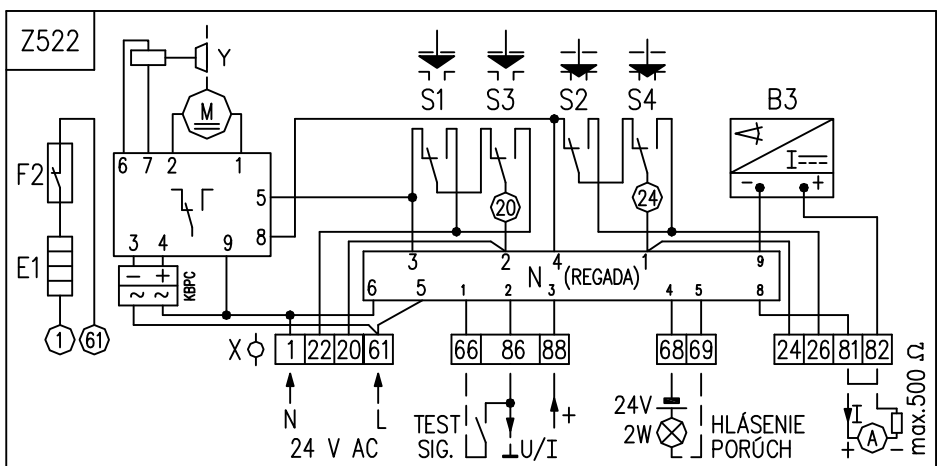
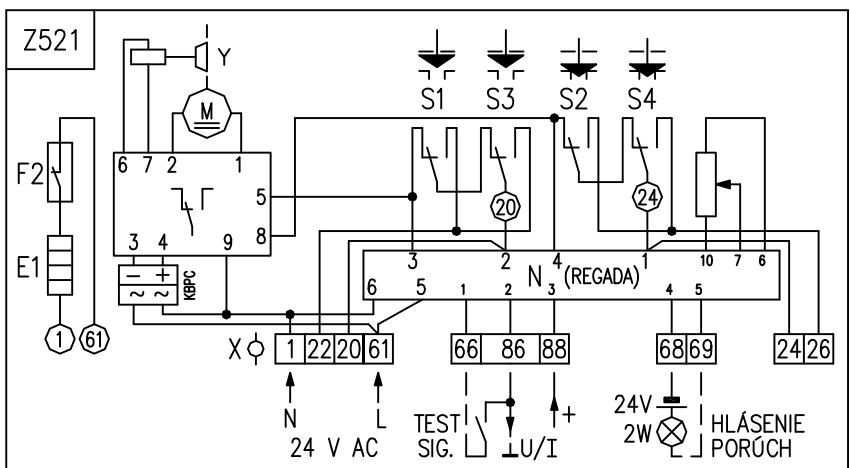
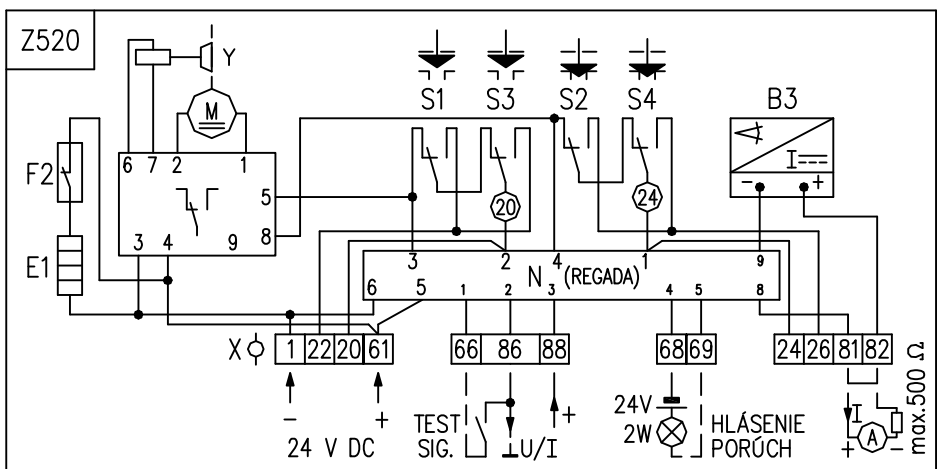
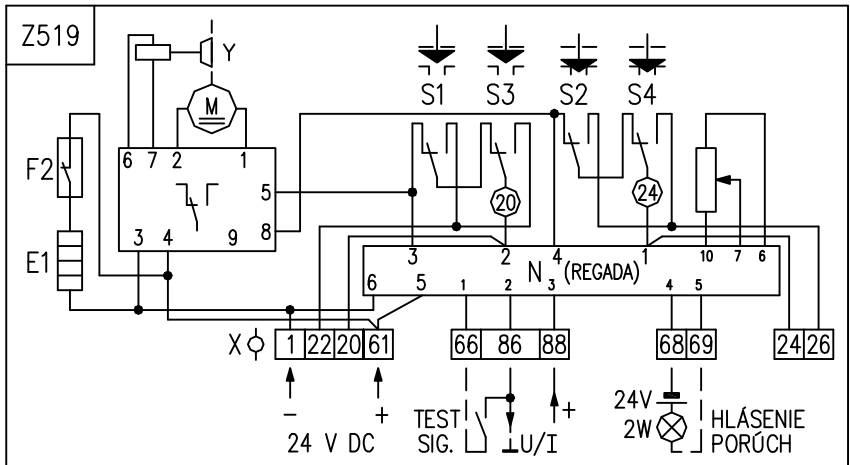
7.1 Wiring diagrams

Wiring diagrams EA SP 2-Ex, SP 2.3-Ex, SP 2.4-Ex



Wiring diagrams EA SP 2-Ex, SP 2.3-Ex, SP 2.4-Ex with controller





Legend:

Z10bwiring diagram of resistive with current converter or capacitive transmitter – 2 - wire without supply
 Z21wiring diagram of additional switches for version with controller
 Z22wiring diagram of single resistant transmitter
 Z32wiring diagram of double resistant transmitter
 Z249wiring diagram of EA SP - Ex with controller with resistant feedback – for 230 V AC
 Z254awiring diagram of EA SP - Ex with controller and current feedback for electric motor – for 230 V AC
 Z257d3-wire version of EPV - without power supply connection
 Z260cwiring diagram of resistive transmitter with current converter - 3-wire version with power supply
 Z269bwiring diagram of resistive transmitter with current converter or capacitive transmitter -2-wire version with power supply
 Z525wiring diagram of EA of electric motor 24 V DC
 Z524wiring diagram of EA with electric motor 24 V AC
 Z521wiring diagram of SP- Ex with controller and resistant feedback for electric motor – for 24 V AC
 Z522wiring diagram of SP- Ex with controller and current feedback for electric motor – for 24 V AC
 Z519wiring diagram of SP- Ex with controller and resistant feedback for electric motor – for 24 V DC
 Z520wiring diagram of SP- Ex with controller and current feedback for electric motor – for 24 V DC
 Z378awiring diagram of resistive with current converter or capacitive transmitter 2 and 3 - wire with supply – for 24 V DC
 Z492wiring diagram of EA with electric motor 230 V AC
 Z493wiring diagram of EA with electric motor 3x400 V AC

B1 single resistant transmitter	M3 three-phase electric motor
B2 double resistant transmitter	R voltage-dropping resistor (for 230V only)
B3 capacitive transmitter, or EPV	N position controller
M1 single-phase electric motor	S1 torque switch "open"
C capacitor	S2 torque switch "closed"
E1 space heater	S3 position switch "open"
F1 electric motor thermal protection	S4 position switch "closed"
F2 space heater thermal switch	S5 additional position switch "open"
X terminal board	S6 additional position switch "closed"
I/U input/output current (voltage) signals	Y brake of electric motor
R _L voltage-dropping resistor	

Note 1: In case, that output signal from the capacitive transmitter (wiring diagram Z254a, Z377c, Z375b) is not used (incomplete circuit between terminal 81 and 82), it is required to connect clamps 81 and 82 by jumper (jumper is connected at manufacturing plant for connecting to terminal board only). By using output current signal from capacitive transmitter it is needed to remove jumper.

Note 2: In the version equipped with the controller device while using the feedback from transducer CPT; when using the output signal there has been no galvanic isolation of the signal from the input one!

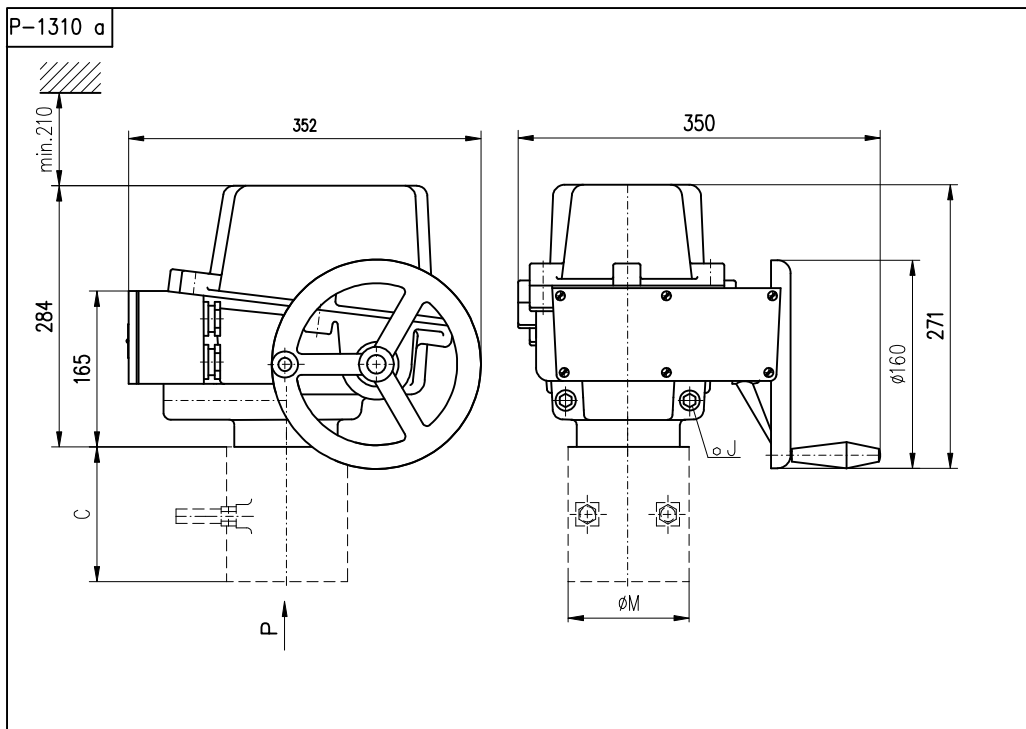
Note 3: In case that galvanically separated output signal is needed it is necessary to use galvanical separation element (is not part of delivery), e.g. NMLSG.U07/B (producer SAMO Automation s.r.o.). After discussion this module could be supplied by EA producer.

Note 4: Terminals 14, 18, 30 and 34 are not terminated in wiring diagram Z492 for specification with double resistant transmitter. Terminals 14 and 18 are not terminated in version as for specification with single resistant transmitter or 3-wire electronic position transmitter, without power supply.

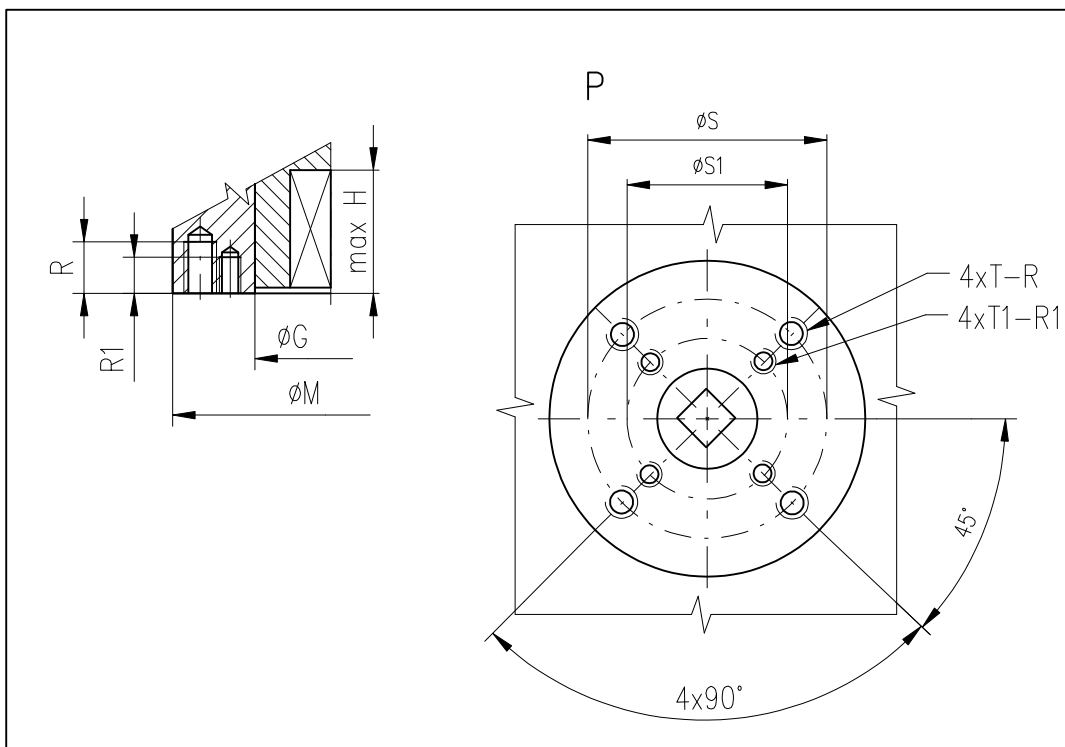
Note 5: There is no option to specify double resistant transmitter in wiring diagram Z493.

Terminals 27, 28, 31 and 32 are not terminated in wiring diagram Z493 for version as for specification with other transmitters.

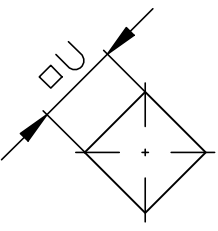
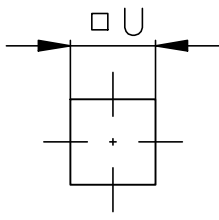
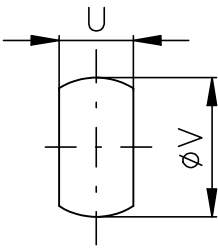
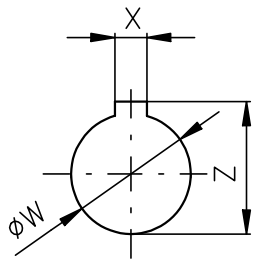
7.2 Dimensional drawings



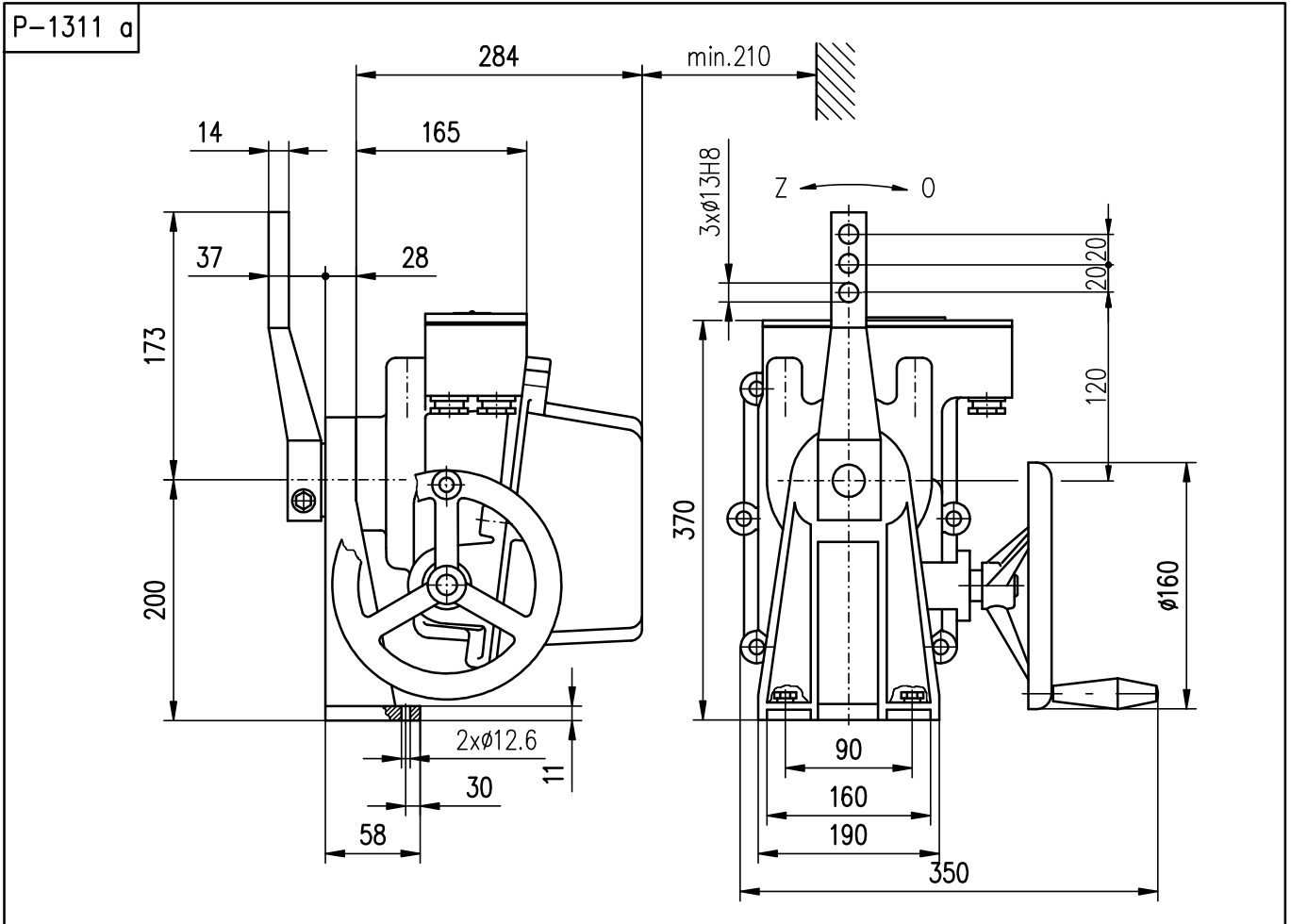
Coupling shapes – flange version



	C	J	M	G	H	R	R1	S	S1	T	T1	Flange size
SP2-Ex	—	8	90	40 45	37	18	18 —	70	50 —	M8	M6 —	F05/F07 F07
SP2.3-Ex	112	19	125	45 55	56	20	20 —	102	70 —	M10	M8 —	F07/F10 F10
SP2.4-Ex	127	22	150	65	71	25	25	125	102	M12	M10	F10/F12

Shape D-xx (Axx)		Shape L-xx (Bxx)		Shape H-xx (Cxx)			Shape V-xx (Dxx)			
										
D-xx	U	L-xx	U	H-xx	U	V	V-xx	W	Z	X
D-14	14	L-14	14	H-14	14	22	V-20	20,0	22,5	6,0
D-17	17	L-17	17	H-11	11	16	V-22	22,0	24,5	6,0
D-22	22	L-22	22	H-8	8	13	V-28	28,0	30,9	8,0
D-27	27	L-27	27	H-17	17	25	V-42	42,0	45,1	12,0
				H-13	13	19	V-50	50,0	53,5	14,0
				H-22	22	32				
				H-16	16	22				
				H-27	27	48				
				H-19	19	28				

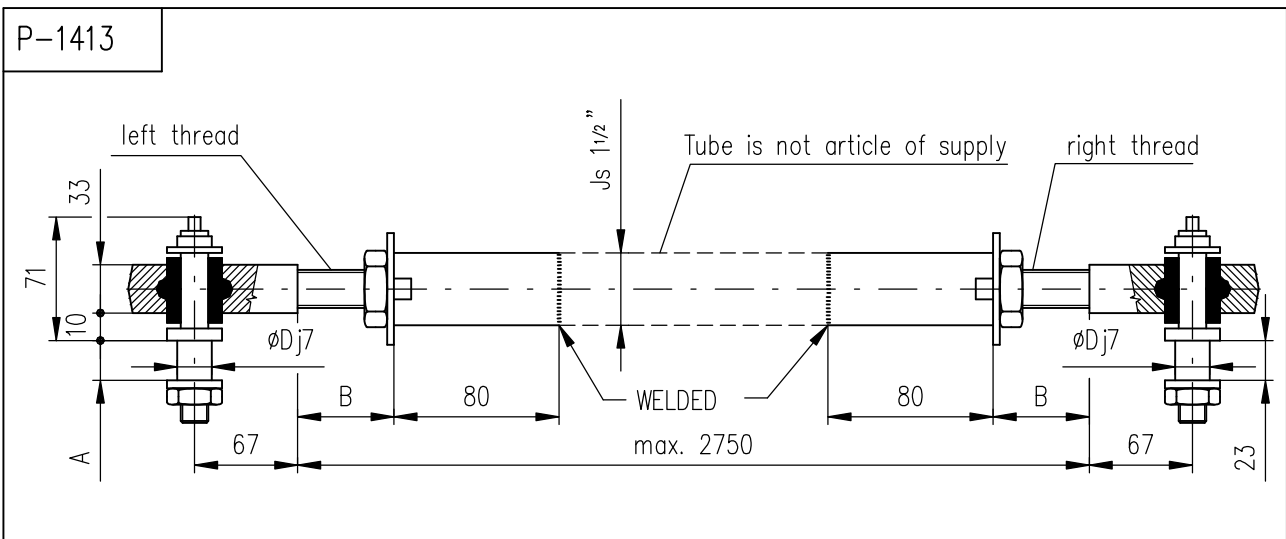
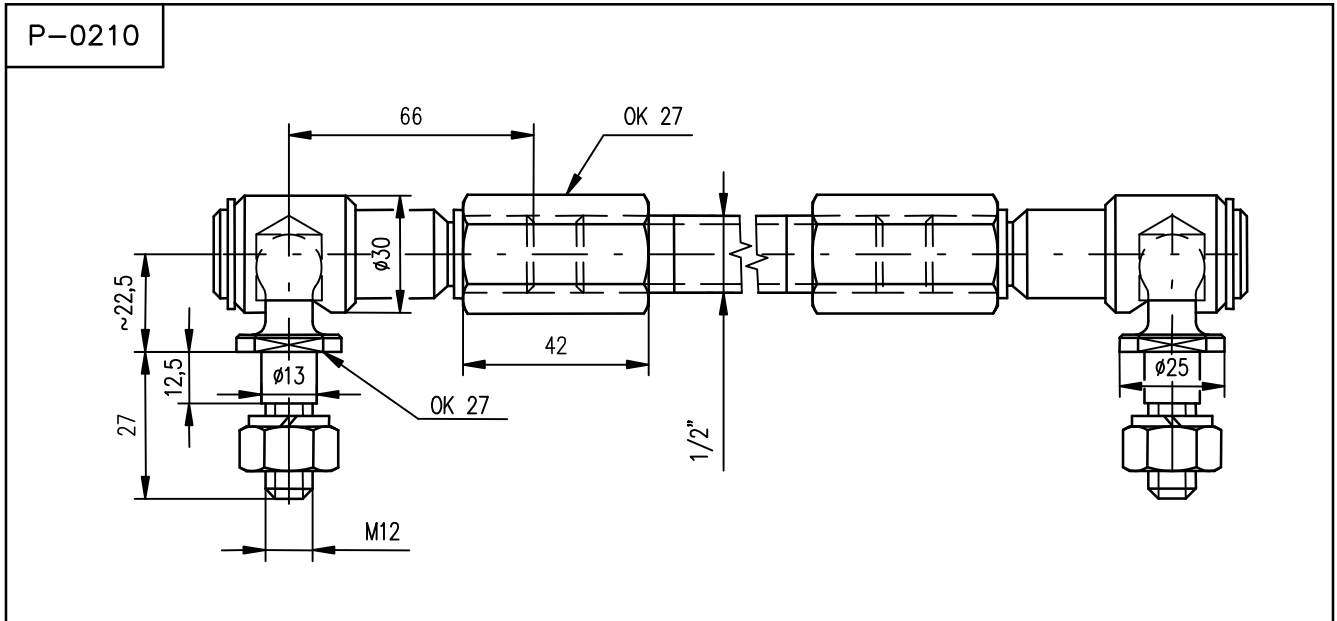
Stand + large lever



Coupling shape:

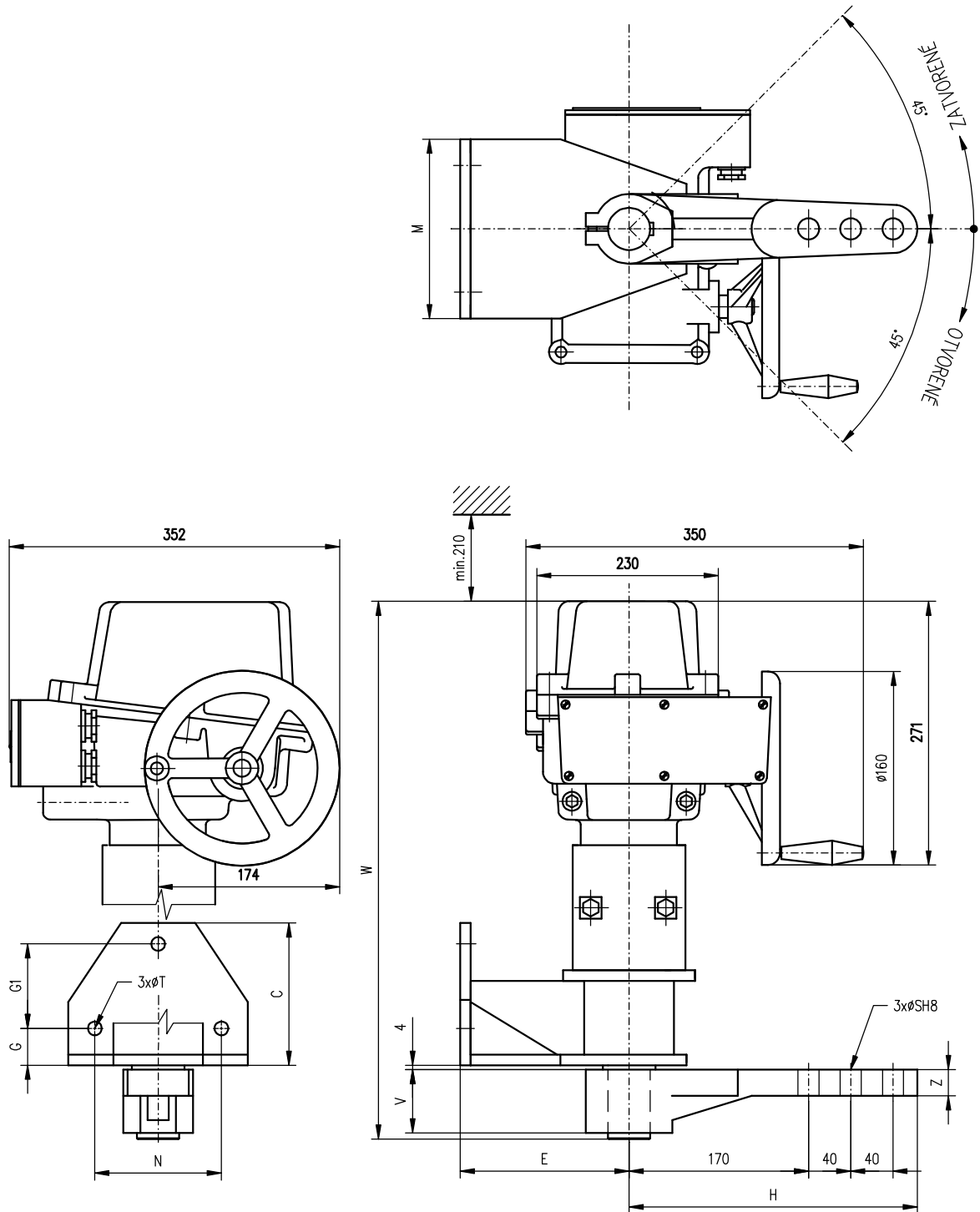
	TYPE	H	S	U	V	Z	Y	Y1	Coupling shape
	SP2-Ex SPR2-Ex	27,9	25	8	35	28	2	2	E02
	SP2.3-Ex SPR2.3-Ex	43,1	40	12	66	56	4	7	E03
	SP2.4-Ex SPR2.4-Ex	53,8	50	16	82	70	4	7	E04

Pull-rod TV360:



VERSION	Pull-rod version	A	B	D
P-1413/A	TV 40-1/20	23	MIN 30	20
P-1413/B	TV 50-1/25	28	MAX 50	25

P-1415 a



TYPE	C	E	G	G1	H	W	M	N	S	T	V	Z
SP2.3-Ex	135	160	35	80	273	556	170	120	20	13	60	25
SP2.4-Ex	200	220	60	120	278	617	228	170	25	17	80	30

7.3 List of contractual after-sales service centre

Slovak Republic:

Regada, s.r.o.,
Strojnícka 7,
080 01 Prešov
Tel.: +421 (0)51 7480 460,
Fax: +421 (0)51 7732 096,
E-mail: regada@regada.sk

Czech Republic:

Exclusive representation Regada, s.r.o. (Ltd.) for sale of electric actuators

Regada Česká, s.r.o.
Nám. 5. května 17,
252 25 Jinočany,
PRAHA – západ,
Tel.: +420 257 961 302
Fax: +420 257 961 301

Notes: