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KEY FIGURES

40 Nm
Max. load torque

15–130 s/90°
Operating time

IP 67
EA protection enclosure

0/4–20 mA
Input control signal (0/2–10 V by version)

APPLICATIONS

- Heating
- Energy
- Gas
- Air-conditioning
- Other technological systems

MECHANICAL CONNECTION

- Flange according to ISO 5211
- Stand and lever and pull-rod

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ELECTRIC PART-TURN ACTUATOR

EAR-0

Electric Actuator Regulated With DMS 3 Electronic Control



Purpose and applications

Electric part-turn actuators (hereinafter referred as EA only) with the DMS electronic control of the EAR-0 type are set up by the program to be controlled on the 24VDC voltage level; are set up by the program to be controlled by **analogue input signal**.

Electric part-turn actuators are high-powered electric-mechanical products designed for direct installations onto controlled devices (regulating bodies - valves, etc.). EA of EAR-0 types are provided for remote control of closing bodies, or 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 connecting component or using a stand and connecting component / lever.

> **Notes:** It is forbidden to use EA as a lifting mechanism!

Safety and conformity

Directive / standard	Electric actuators are according to directive LVD 2014/35/EU and standard EN 61010-1:2010+A1:2019 assigned for installation category II (overvoltage category), pollution degree 2.
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 standards as well EN IEC 61000-6-4:2019, EN IEC 61000-6-2:2019, EN IEC 61000-3-2:2018 and EN 61000-3-3:2013+A1:2019.
Vibrations caused by the product	product influence is negligible.
Noise produced by the product	during operation the noise level A at the service area can be at least 62 dB (A).

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Description and function

The EAR-0 electric actuator is controlled by 24V DC voltage fed to the electric actuator's terminals according to the wiring diagram, resp. by 0/4/12 to 20 mA, 4 to 12 mA (0/2 to 10 V) input control signal and provides for moving the output part of the EA automatically to a position corresponding to the value of the input signal, and other functions as well.

The electric actuator consists of these main parts (fig. 1):

The electric actuator is driven by an electric motor (1) supplied and controlled from the source board (3) and control unit (2) of the DMS3 electronics.

Position of output element of EA is scanned by contactless absolute sensor (4).

On the electronic board DMS3 there is electronic transmitter (EPV) without power supply (passive) with output signal 4 - 20 mA.

Space heater (6) is placed at the control board.

In case of power cut or damage of switches the actuator can be controlled manually.

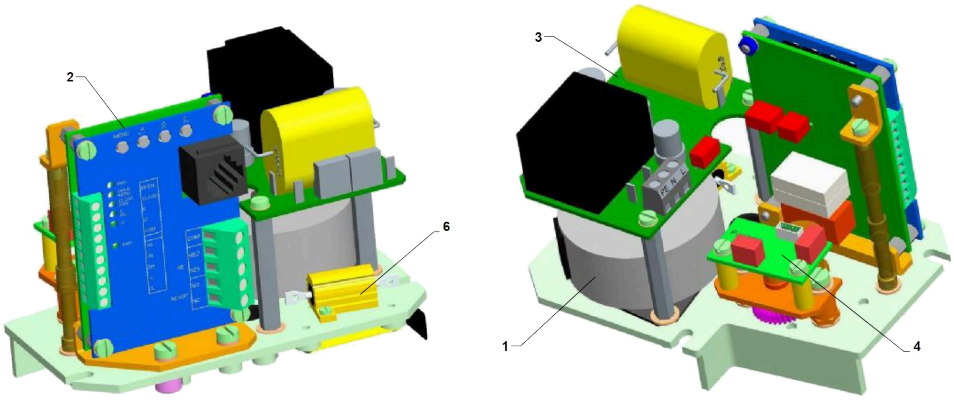


Fig. 1

Standard equipment of electronic module DMS3

- **Control unit (2)** – main part of system DMS3 – it contains microprocessor, 6 signal LED and 4 buttons for simple adjustment and control of EA, connectors for connection of torque scanner and sourcing board and communication connector (connection to PC for adjustment and diagnostic), 2 free programmable relays R1 a R2, 1 relay READY and terminals for electric connection.
- **Sourcing board (3)** – secures power supply of electronic, it contains user terminal board, switching circuits, connector for connection with control unit.
- **Position scanning unit (4)** – secures contactless magnetic position scanning of output element.

Warning for safety use

Product protection	There must be included suitable protective device into power supply (circuit breaker or fuse) which serves at the same time as main switch. EAR-0 has own short-circuit protection of motor power supply circuits and space heater.
Type of equipment from a connection point of view	The equipment is designed for permanent connection.

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Basic specifications

Max. load torque [Nm], operating time [s/90°], operating angle [°] and electric motor parameters are given in Table 1.

Table 1: Basic EA specifications

OPERATING TIME ±10[%] [s/90°]	MAX. LOAD TORQUE REMOTE CONTROL [Nm]	MAX. LOAD TORQUE REGULATION MODE [Nm]
130	40	32
15	12[1)]	10[1)]
30	25[1)]	20[1)]
60	32	25
100	40	32

Operation angle[4)] [°]	60° - 120°[4)]; 90° - 160°[4)]; 160° - 360°[4)]; 90°[3)]; 120°[3)]
Weight [kg]	1,8 – 2,4
Electric motor	
Type	Single-phase
Power supply nominal voltage [V] ±10%	230/220 AC, resp. 24 AC resp. 110/120 AC
Nominal power [W]	2,75
Nominal speed [1/min]	375
Nominal current [A] – 24 V AC	0,04 – for 230/220 V AC 0,38 – for 24 V AC 0,08 – pre 110/120 V AC
Nominal current [A] – 230 V AC	0,27/500 – for 230/220 V AC 25/63 – for 24 V AC 1,5/500 – for 110/120 V AC

[1)] Actuators with max. load torque 12 (10) Nm are self-locking up to torque value 7 Nm, only. Actuators with max. load torque 25 (20) Nm are self-locking up to torque value 15 Nm, only.

[3)] It applies to the variant with stop ends.

[4)] It applies to the variant without stop ends. Required operating angle must be specified in your order, otherwise the actuator will be set to the minimum angle of the specified range

[5)] The total current of EA is the sum of the electronics current (0.15 A) and the electric motor current according to the EA version.

Other specifications

EA protection enclosure	IP 67 EN 60 529 (IEC 60 529) within valid edition According to definition for EA, enclosure IP68 fulfills following requirements: - water column max 10m - time of contunious submersion in water max 96 hours
Mechanical ruggedness	
sinusoid vibrations	see Operation Environment
resistance by drops	300 drops with acceleration 5 $m.s^{-2}$
seismic resistance	6 degrees of Richter's scale
Self-locking	guaranteed within 0% till 100% load torque except load torques listed in the Table 1
Electric motor protection	thermo-contact

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Control and connection

Electric control

remote control (movement of output part of the electric actuator is controlled by binary inputs 24 V DC or by unified input signal 0/4/12 to 20 mA, 4 to 12 mA, resp. 0/2 to 10 V by of version.

Supply source for the electronics

for supplying voltage to electronics modules built-in EA a supply source Z1 is used, protected with a protection fuse the size of which is given in Fuses.

Position scanning

Contactless absolute magnetic.

Limit positions adjustment

Limit position relays are adjusted with accuracy to specific operating angle ± 2°.

Output relay

3x relays (**READY, R1, R2**) max.250 V AC/0,5 A; max.30 V DC/2A
Relays **READY**, **R1**, **R2** are free programmable (their function can be changed with buttons on the control unit or through a PC with the program)

READY relay: - program selection options – error indication, error or warning, error or not remote, error or warning or not remote.

R1 and R2 relays: - program selection options – disabled, Position O (position open), Position C (position close), (Torque O (torque open), Torque C (torque close), TorqueO or Torque C, Torque O or Position O, Torque C or Position C – this options not valid for this type EA), opens, closes, movement, movement – flasher, to position, from position, warning, control – remote, control – local, (not valid for EA without local control), control OFF.

Transmitter (output signal)

Electronic position transmitter (EPV) passive, 2-wire connection (without power supply)

Current signal	4-20, resp. 20-4 mA (DC)
Voltage at connection of EPV passive	18 up to 30 V DC ±10%
Load resistance	max. R_L = 500 Ω
Tolerance of value of output signal of electronic transmitter in end positions	±0,5 %[1)]
Tolerance of linearity of transmitter	±1 [%][1)]
Hysteresis of transmitter	max. 1 [%][1)]
Galvanic separation	output signal is galvanically separated from input control signal

[1)] from nominal value of transmitter referred to output values

Program possibilities of output signal: 4-20 mA, 20-4 mA.

Electronic position controller (N) – actuation by input control signal

Input control signals - analogue	0-20 mA (0-10 V by version) 4-20 mA (2-10 V by version) 12-20 mA 4-12 mA	20-0 mA (10-0 V by version) 20-4 mA (10-2 V by version) 20-12 mA 12-4 mA
Input resistance for signal 0/4/12 to 20 mA. 4 to 12 mA	Rin = 120 Ω	
Input resistance for signal 0/2 to 10 V	Rin = 30 kΩ	
Tolerance of controller's linearity	0,5 %	
Dead of controller	1 – 10 % - (adjustable)	

Control by binary inputs 24 V DC

by feeding of 24 V DC to terminals CLOSE and OPEN

Programming possibilities of binary inputs I1 and I2 (change is possible only through the programme of PC):

- for the input **I1**: DISABLED; ESD; DBL (local releasing, remote releasing - not valid for this type of the EA); STOP
- for the input **I2**: DISABLED; ESD; DBL (local releasing, remote releasing - not valid for this type of the EA); 2P (the EA can undergo control for the opening direction or closing with the controller ON and I2 input activated with 24 V DC voltage supplied to the terminals to OPEN or CLOSE).

Programming possibilities of reaction SAFE: OPEN, CLOSE, STOP, TO POSITION

Manual control

use the handwheel once the transmission is disengaged. Turning the handwheel clockwise causes the electric actuator output shaft to move in "O" direction (Open).

Output part clearance: max. 1° (at 5 % of maximum switching torque load)

Adjustable elements

The EA is possible to adjust with or resetting to different parameters operating the control unit buttons, local control buttons (following the version) or once it is connected to the PC using the programme and the communication cable connected to the EA control unit communication connector and the EA cover removed.

Space heater (E1)

Space heater - supply voltage	**corresponding with motor supply voltage**
Space heater power output	**cca 10 W/55°C**

Electronic board provides switching of heating element. It is possible to change switching temperatures of the switch from -40°C to +70°C with help of PC and particular software. Factory's setup for shut down of heating element (thermostat) is +25°C.

Mechanical connection

- with flanges
- stand and lever and pull-rod

Main and connecting dimensions are given in the dimensional drawings.

Electric connection – to the terminal board (X, X1)

- 3 clamps (PE, N, L) on the sourcing board with intersection of connection wire 0,05 - 1,5 mm^2 for solid wire, 0,05 - 1,5 mm^2 for flexible wire. Max. terminal screw tightening torque 0,5 N.m., max. voltage 300 V
- 7 clamps (READY, R1, R2) with intersection of connection wire 0,05 – 1,5 mm^2 for solid wire, 0,05 - 1,5 mm^2 for flexible wire. Max. terminal screw tightening torque 0,5 N.m., max. voltage 300 V
- 10 clamps (COM, CLOSE, OPEN, I1, I2, +IN, -IN, +L, -L) with intersection of connection wire 0,05 – 1 mm2 for solid wire, 0,05 - 1,5 mm^2 for flexible wire. Max. terminal screw tightening torque 0,19 N.m., max. voltage 300 V

Attention: Thermic resistance incoming wires must be minimum +80°C

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Operation conditions

Power supply and duty cycle

Power supply:

- electric motor: 230/220V AC ±10%, resp. 24V AC/DC ±10%, resp. 110/120V AC ±10%
- control EAR-0: binary inputs 24V DC ±10%, input control signal 0/4/12 to 20 mA, 4 to 12 mA resp. 20 to 0/4/12 mA, 12 to 4 mA or 0/2 to 10 V, resp. 10 to 0/2 V
- electronic positional transmitter (EPV) without power supply (passive): 18 up to 30 V DC ±10%

Frequency of power supply: 50 Hz or 60 Hz ± 2%

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

Duty cycle (according to IEC 60034-1 within valid edition):

EAR-0 designed for remote control:

- short-time operation S2-10 min
- intermitted operation S4-25%, 6 up to 90 cycles per hour

designed for automatic regulation:

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

Note: The operation modes consist of the loading type, load factor and connection/switching frequency.

Life of actuators

The lifetime of an electric actuator (EA) is at least 6 years.

EA used for closing mode (closing valves) comply with the requirements for at least 15,000 working cycles (cycle C – O – C: for part-turn EA)

EA used for regulating/modulating operation (control valves) comply with the below stated numbers of operating hours at the total number of 1 million start-ups:

Switching frequency	Max. 1,200 [h^{-1}]	1,000 [h^{-1}]	500 [h^{-1}]	250 [h^{-1}]	125 [h^{-1}]
Minimal lifetime expectancy – number of operating hours	850	1,000	2,000	4,000	8,000

Time of net operation is min. 200 hours, max. 2,000 hours.

Lifetime at operating hours depends on loading and switching frequency.

Note: High switching frequency does not ensure better regulation. Setting of regulation parameters should be therefore made with the inevitably necessary switching frequency needed for the process in question.

Product location and operation position

- The assembly and operation of electric actuators in standard make can be on covered places of industrial objects without the regulation of temperature, humidity and with protection against direct exposure of climate influence (e.g. direct sun shine).
- Electric actuators must be placed with access to the manual control wheel, to the button for disengaging the transmission, to the cover of control box, to control box, to cable glands.
- Installation and operation of actuators is possible in either position. Common position is the one with vertical position of exit part axis and control box above. Avoid to arrange the electric actuator under the armature if possible.

Warning! Actuator installed on the open place must be protected against a direct climate effects by shelter, mainly from sunshine. In case of placing the actuator in an ambient of the relative moisture exceeding 80%, in an outer ambient under a shed, the thermostat temperature must be set up (increased) by a PC and the program so as it doesn't effect the heating resistor switching-off.

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Operation Environment

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

1. Version “standard” for type climate temperate
2. Version “tropical wet” for type climate tropical wet
3. Version “tropical dry and dry” for type climate tropical dry and dry
4. Version “marine” for type climate marine

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 temperature in range -25°C to +55°C	**AA 7***
with relative humidity 10 to 100 %, including the condensation of up to 0,028 kg water content per 1 kg of dry air at 27°C, with temperatures from -25°C up to +55°C	**AB 7***
with height above sea level 2,000 m, with barometric pressure range 86 to 108 kPa	**AC 1***
with spraying or jet water from all directions (protection enclosure IP x4)	**AD 4***
with shallow dive – (product with protection IPx7)	**AD 7***
with submersion – (product with protection IPx8)	**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 atmospheric occurrence of corrosive and pollution media (with high degree of atmosphere corrosive aggressiveness); important presence of corrosive pollution	**AF 2***
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<fp and acceleration amplitude 19.6 m/s2 for f>fp; (transition frequency fp is from 57 up to 62 Hz)	**AH 2***
• medium impacts, shocks and vibrations	**AG 2***
with serious danger of plants and moulds growing	**AK 2***
with serious danger of animals occurrence (insects, birds, small animals)	**AL 2***
with detrimental influence of radiation:	
• of stray current with intensity of magnetic field (direct and alternating of power supply frequency) to 400 A.m-1	**AM 2***
• of sun radiation with intensity > 500 a ≤ 700 W/m2	**AN 2***
with effects of medium seismic activity with acceleration > 300 Gal ≤ 600 Gal	**AP 3***
with indirect danger of storm activity	**AQ 2***
with fast moving of air and strong winds	**AR 3*, AS 3***
with persons frequent touching earth potential (persons often touch conductive parts or they stand on the conductive basement)	**BC 3***
without occurrence of dangerous media in the object	**BE 1***

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

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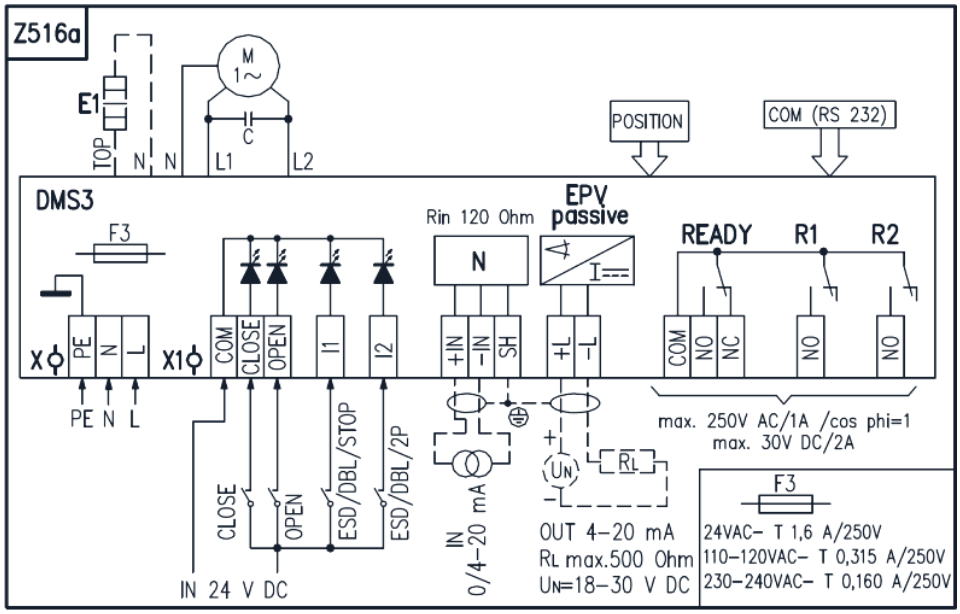
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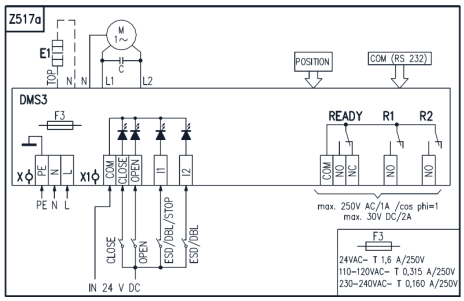
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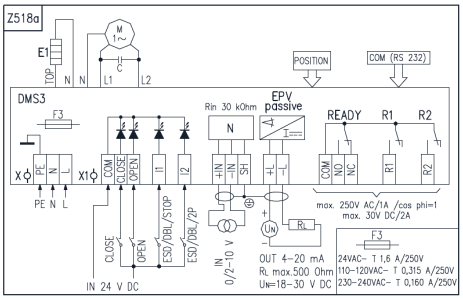
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Wiring diagrams

Wiring diagrams for EAR-0







Legend

Z516a	wiring diagram of EA SPR 0PA for control ON/OFF or for analogue input 0/4/12 up to 20 mA, 4 up to 12 mA and output signal 4 to 20 mA
Z517a	wiring diagram of EA SPR 0PA for control ON/OFF
Z518a	wiring diagram of EA SPR 0PA for control ON/OFF or for analogue input 0/2 up to 10V and output signal 4 to 20 mA

C	capacitor
COM(RS232)	possibility for connecting the control unit to a PC
EPV passive	electronic position transmitter is passive
E1	space heater
F3	fuse of voltage supply source
M	single phase electric motor
N	controller
POSITION	position scanning
RL	load resistance
R1	free programmable relay
R2	free programmable relay
READY	READY relay (free-programmable)
DMS3	electronic module
U_N	voltage for EPV
X	voltage supply source terminal board with screw terminals
X1	terminal board with screw terminals on the control unit

Terminals

PE, N, L	terminals (0,05-1,5 mm^2) of supply 230/220 V AC or 24 V AC 50/60 (according to the specification)
COM, CLOSE OPEN, I1, I2	terminals (0,05 - 1 mm^2) of control inputs 24 V DC
+IN, -IN, SH	terminals (0,05 - 1 mm^2) of unified input current signal resp. voltage signal
+L, -L, SH	terminals (0,05 - 1 mm^2) of output current signal (passive) 4-20 mA
COM, NO, NC	terminals (0,05 – 1,5 mm^2) of relay READY
COM, NO	terminals (0,05 – 1,5 mm^2) of relay R1, R2

Note 1

230/220 V AC eventually 24 V AC supply voltage is to be fed to the N,L terminals of the voltage supply source terminal board (X) according to the chosen variant of the electric actuator. PE ground wire does not need to be connected when 24 V AC power supply is used.

Note 2

Program possibilities for R1, R2 shut off, open position, close position, open, close, movement, movement flasher, to the position, from the position, warning, remote control, local control, control shut off.

Program possibilities for READY relay: faults, faults or warnings, faults or no remote, faults or warnings or no remote.

Program possibilities for output signal (from EPV passive): 4 to 20 mA, 20 to 4 mA.

Control programme options (regulating): 2P, 3P, 3P/2P I2.

Program possibilities for input control signal (N): 4 to 20 mA, 20 to 4 mA, 0 to 20 mA, 20 to 0 mA.

Program possibilities for inputs I1: SHUT OFF, SAFE, DBL (local releasing, remote releasing), STOP.

Program possibilities for inputs I2: SHUT OFF, SAFE, DBL (local releasing, remote releasing), 2P (for control programme option 3P/2P I2) allows control using the binary 24V AC / DC inputs with I2 input activated.

Program possibilities of reaction SAFE: OPEN, CLOSE, STOP, INTO POSITION. The identical functions cannot be set on I1 &I2 inputs in addition to the OFF state (e.g., if the SAFE function is set on I1 input, it is not possible to select the SAFE function on I2 input at the same time.

Cable glands

3-cable glands – diameter of cable 6 to 10,5 mm.

Fuses

Actuator power supply board is installed with power supply fuse (F3).

Fuse values and parameters:

for voltage 24 V AC	T 1,6 A /250V
for voltage 110-120 V AC	T 0,315 A /250V
for voltage 220-240 V AC	T 0,160 A /250V

Warning: Minimum thermal resistance of power supply cables and wires must be +80°C.

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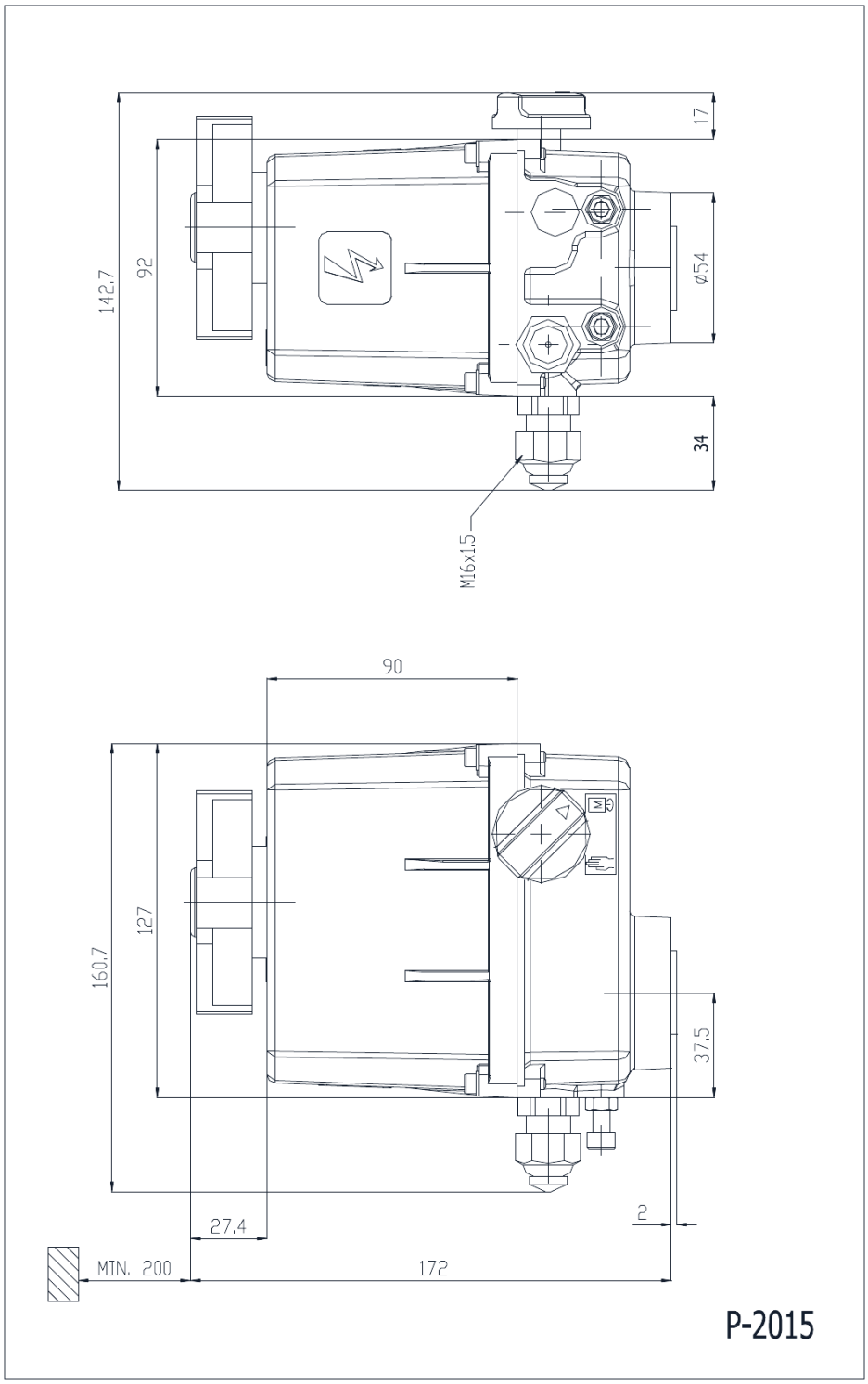
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Dimensional drawings

EAR-0 dimensional drawing – The part common for the following dimensional sketches where the mechanical interconnection methods have only been indicated.



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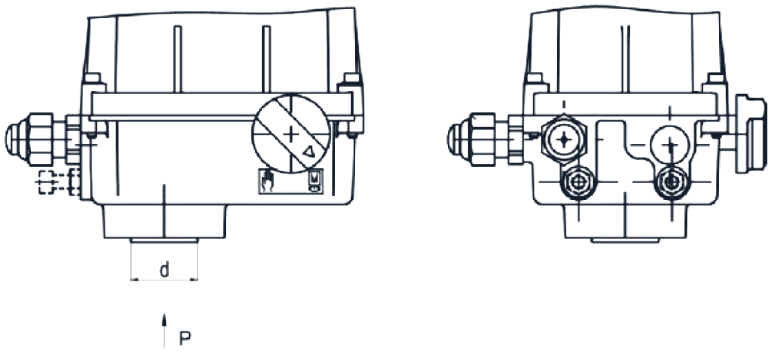
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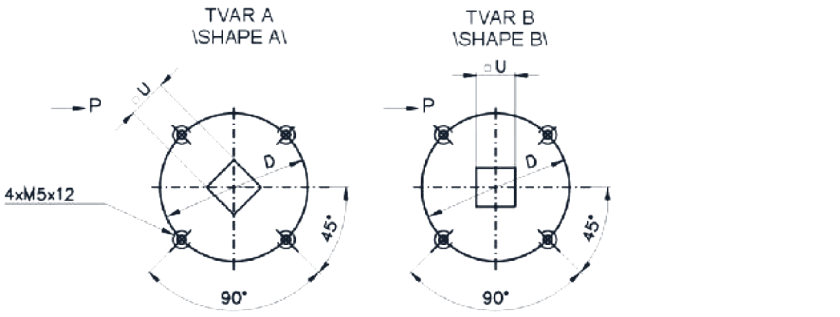
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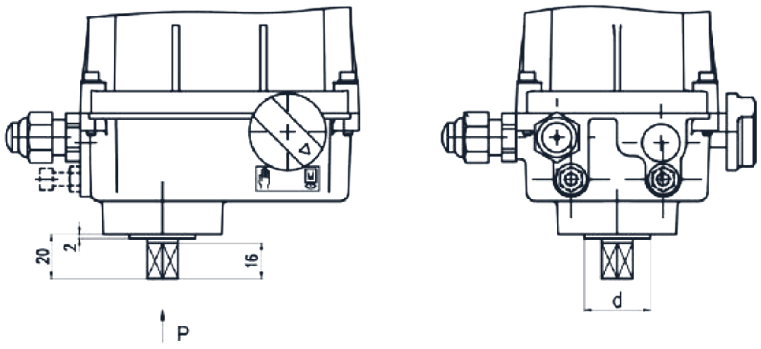
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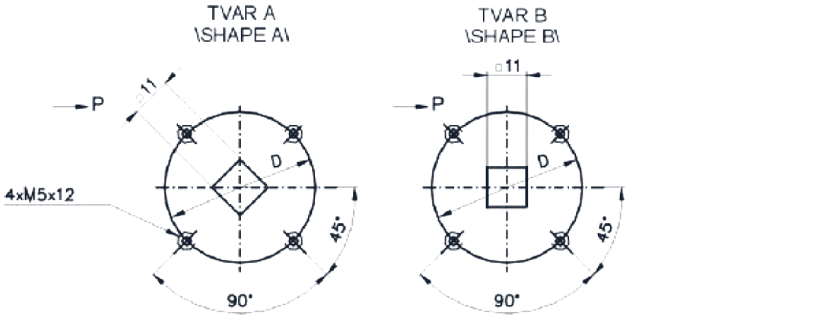




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F 04	⌀42	⌀30f8	11
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F 04	⌀42	⌀30f8
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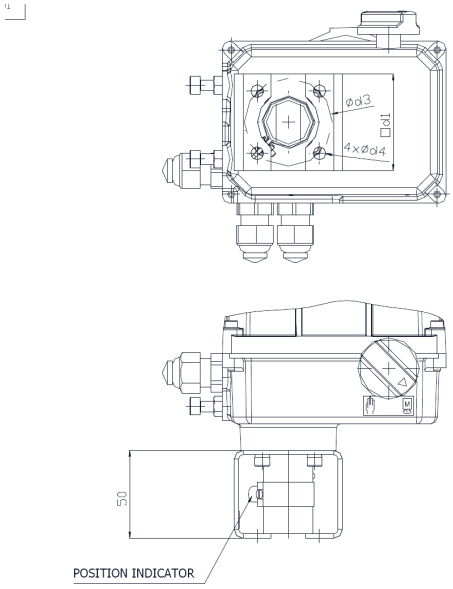
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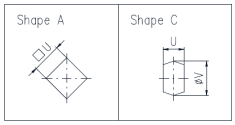
Sales +45 00 00 00 00
Support +45 00 00 00 00

mal@siemex.tech
Siemex.tech

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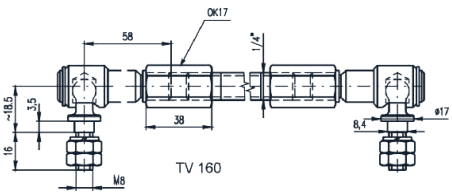
P-1451



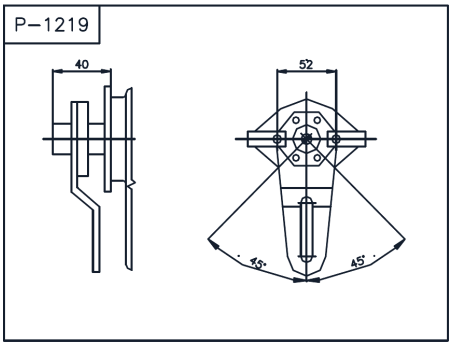


P-1451/F	F07	14	–	70	70	9	C
P-1451/E		14	18				A
P-1451/D		8	13				A
P-1451/C	F05	14	18	55	50	7	C
P-1451/B		11	–				A
P-1451/A		14	–				A
Version	Flange	U	øV	□d1	ød3	ød4	Shape

P-0100



P-1219



P-1221

