INTELLIGENT ELECTRIC ACTUATORS
Electric actuators by ABS ZEiM Automation are designed for remote and local control of actuation of process regulating units (МЭО series), control of pipeline valve shutoff and control units by part-turn action (МЭОФ series), multi-turn (ПЭМ series) and linear action (ПЭП series) according to commands from regulating and controlling devices in industrial processes automated control systems.

Field of application – oil and gas, power generation, mechanical engineering, metal, food industry, water supply, ventilation systems, etc.

Electric motor (valve) control and provision of data on actuator state is carried out by actuator controlling units КИМ3, КИМ2, КИМ1 being an integral part of actuator. КИМ controlling units configuration is determined by a basic set of inputs and outputs and by additional options allowing to select the best control method and connection to high level devices. КИМK controlling unit is a microprocessor-based adjustable device allowing electric actuator (valve) control, control modes management, adjustment, indication of actuator and valve state. Controller is equipped with a built-in temperature-controlled heater for internal space heating to prevent moisture condensation and to maintain optimal internal temperature while ambient temperature is as low as -60°C thus ensuring proper functioning of the device.

The present publication contains information on features and functions of intelligent actuators by ABS ZEiM Automation.

КИМ3 is available in general industrial use or in explosion-proof version featuring “flameproof enclosure” d explosion-protection type under ГОСТ P IEC 60079-1-2011 and electric equipment explosion protection level “Gb” with the following marking: “1Ex d IIC T4 Gb” (or “1Ex d IIB T4 Gb”) under ГОСТ P МЭК 60079-0-2011.

Technical features:
- Mounted either directly on actuator or on wall.
- КИМ3 body and its front panel can be rotated according to actuator position.
- Two types of displays available: graphic and text.
- Contactless reversing thyristor starter.
- Control of currents and voltage, actuator protection.

Third generation intelligent controlling unit КИМ3 is applied for control of electric actuators designed after 2008: single-turn МЭО and МЭОФ actuators, multi-turn ПЭМ and linear ПЭП actuators and features advanced functionality.
Fig. 2 ПЭП-А25000-E3-IICT4-12 IP67 actuators

Application of КИМ3 extends actuator functionality and allows to improve actuator and valve control and monitoring accuracy, provide safety of operation, convenience of parameters setting up and storing, keep logs, protect actuator and valve in emergency situations, reduce number of connection lines and power supply cables, reduce actuator installation and maintenance costs. КИМ3 receives commands from a controller, controls electric motor, performs functions of a starter, provides feedback on actuator and valve state.

Functional features
- Local or remote control of actuator output unit allowing precise stopping in a set position.
- Various remote control sources:
  - discrete signals OPEN, CLOSE, STOP, FAILURE (ESD), Versatile input 1;
  - analog signal (positioner);
  - digital signals over RS-485 interface (Modbus RTU) or Profibus DP (backed up).
- Built-in PID regulator.
- Valve seating option.
- Indication of actuator state, errors and settings on a display.
- Indication of limit and torque switches state, battery condition, main power source status, MALFUNCTION LEDs signal.
- Storing of settings in non-volatile memory.
- Adjustment of actuator output unit average relative speed.
- Control of state and protection from overcurrent and current imbalance, incorrect connection of electric motor, phase loss, sensor malfunction, unauthorized access, jamming or full travel time exceeding.
- Self-diagnostics of non-volatile memory, sensors and main components of controlling unit, actuator state control and protection.
- Local or remote control of actuator output unit with precise stopping in a set position.
- Partial stroke testing (PST).
- Motor protective shutdown at:
  - exceeding of set torque at output shaft;
  - overheating;
  - absence of movement;
  - full travel time exceeding;
  - detection of actuator malfunction.
- Actuator parameters setup including adjustment of limit switches, torque threshold, protection settings, etc. Can be performed either using local control panel or an Android-based device via Bluetooth or using a PC via USB.
- Automatic control of electronics compartment heater according to ambient temperature.
- Controlling unit creates actuator performance and state log in non-volatile memory. Log consists of four parts: statistics, events, activity, output unit torque and motor current graphs.
- Using a Configurator application (included in the scope of КИМ3 delivery) archive data can be exported into text files for further analysis and determination of correctness of functioning, degree of wear for timely prevention of breakdowns and maintenance.

Available options
- TORQUE analog signal – torque analog output signal.
- RS-485-1 – first RS-485 channel.
- RS-485-2 – second RS-485 channel.
- ZigBee – ZigBee wireless interface for connection with IFH-3 setting console.
- Bluetooth – Bluetooth wireless interface.
- Profibus-1 – first channel for connection to Profibus DP network.
- Profibus-2 – second channel for connection to Profibus DP network.
- Backup power supply input – socket for connection of 24 V external backup power source.
- RPM control – motor rotation speed control by a frequency transducer allowing smooth start and rotation speed adjustment.

Fig. 3 ПЭП-А25000-E3-IICT4-12 IP67 actuators

Configurations
- Configuration М – remote control by discrete signals Open, Close, Stop, Failure, Versatile input 1. Output signals: LSO (closing limit switch), TSO (opening torque switch), TSC (closing torque switch), TSO (opening torque switch), M1, M2, Ready, Malfunction. No extra options.
- Configuration Д – remote control by discrete signals Open, Close, Stop, Failure, Versatile input 1. Output signals: LSC (closing limit switch), LSO (opening limit switch), TSC (closing torque switch), TSO (opening torque switch), M1, M2, Ready, Malfunction and analog Position signal.
- Configuration A (positioner) – Position setting analog signal is used for remote control. Other features are identical to configuration Д.
- Configuration С – signal via RS-485 interface or Open, Close, Stop, Failure, Versatile input discrete signals are used for remote control. Digital interface is used for output. Information on controller state including current position and switches state is transmitted via RS-485 interface.
- Configuration T – unlike configuration C this configuration features discrete output signals LSO (Opening Limit Switch), LSC (Closing Limit Switch), TSC (Closing Torque Switch), TSO (Opening Torque Switch), M1, M2 and analog signals Position, Ready, Failure.
- Configuration P – analog PID-regulator algorithm determined by settings is used for actuator control. Signals from temperature detectors, pressure meters, flow meters, etc. can be used as input signals. Other signals are identical to configuration A.

КИМ3 front panel is equipped with: a three-digit text display (1) and a graphic display (3) – for indication of general information during operation, setup, in case of malfunction; LED indicators (2) showing rotation direction, limit positions, overtorque, malfunction, requirement to replace a battery; control modes switch (4) and control and setting buttons (5).
Examples of designation of actuator equipped with КИМ3

- МЭОФ-400(600)/25-0,25ЕЗД16-10К У1 IP67 (discrete control and Bluetooth);
- МЭОФ-1600/25-0,25Е3А00-1СТ4-08К УХЛ1 IP67 (analog control, explosion-proof configuration);

Major specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>General industrial use configuration</th>
<th>Explosion-proof configuration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Climatic version under ГОСТ 15150-69</td>
<td>Y1 with a temperature range from (-40) to (+60) °C</td>
<td>YХЛ1 with a temperature range from (-60) to (+60) °C</td>
</tr>
<tr>
<td>Voltage</td>
<td>single-phase supply: 220, 230 or 240 V, 50 or 60 Hz; three-phase supply 380, 400 or 415 V, 50 or 60 Hz</td>
<td>9 A or 16 A</td>
</tr>
<tr>
<td>Consumed power, up to</td>
<td>Open, Close, Stop, Failure, Versatile input 1 logical 0 – (0-8) V; logical 1 – (18-40) V regardless of polarity LSO (Opening Limit Switch), LSC (Closing Limit Switch), TSO (Opening Torque Switch), TSC (Closing Torque Switch), Ready, Malfunction M1 and M2 (versatile output)</td>
<td></td>
</tr>
<tr>
<td>Maximum current of power switch output circuits in intermittent-periodic mode with up to 1500 starts per hour and duty rating of 25%, up to</td>
<td>9 A or 16 A</td>
<td></td>
</tr>
<tr>
<td>Discrete inputs</td>
<td>Dry contact type discrete outputs switching capacity</td>
<td>– maximum switched current 1 A; – maximum switched voltage 220 V.</td>
</tr>
<tr>
<td>Discrete outputs</td>
<td>Position setting analog input signal range</td>
<td>(0,5), (0-20), (4-20) mA or 0-10 V</td>
</tr>
<tr>
<td>Position and torque analog output signal range</td>
<td>(4-20) mA</td>
<td></td>
</tr>
<tr>
<td>Digital interfaces</td>
<td>RS-485, Modbus RTU – 2 channels; Profibus DP – 2 channels without restrictions</td>
<td></td>
</tr>
<tr>
<td>Operating position</td>
<td>IP65, IP67, IP68</td>
<td></td>
</tr>
<tr>
<td>Average life of a controlling unit</td>
<td>at least 15 years</td>
<td></td>
</tr>
<tr>
<td>Protection rating</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Temperature-controlled heater power, up to</td>
<td>Y1 – 220 W YХЛ1 – 320 W</td>
<td></td>
</tr>
<tr>
<td>Motor temperature protection</td>
<td>on demand Installed</td>
<td></td>
</tr>
</tbody>
</table>

Electric actuators with КИМ3

КИМ2 is available in general industrial use or explosion-proof version. Explosion protection type – “flameproof enclosure "d" under ГОСТ P IEC 60079-1-2011, explosion protection level – Гb, explosion protection marking – “1Ex d IIC T4 Gb” (or “1Ex d IIB T4 Gb”) under ГОСТ P МЭК 60079-0-2011

Technical features

- Mounted directly on an electric actuator.
- Can be operated in severe conditions (temperature of up to +85 °C and strong vibrations).
- Local control panel accommodating digital display, LED indicators of state, control and adjustment buttons OPEN, CLOSE, operation modes switch “Remote/Stop/Local”.
- Local control panel can be rotated depending on actuator position.
- Control and setup without requirement to open an enclosure:
  - using local control panel;
  - via Bluetooth using original application and an Android-based device (range up to 10 m);
  - using a PC (and Configurator application) or a ПН1 setting console.
- Settings can be saved in non-volatile memory.
- Built-in stabilized power source =24 V, 50 mA for external circuits activation.
- Contactless (thyristor) reversing starter.
- Absolute contactless digital position and torque sensor.
- Events archive (full running hours, number of starts, number of torque exceedings, etc.).
Functional features

- Reversible control of valve according to controller commands.
- Means of connection to controllers and other devices:
  - discrete signals OPEN, CLOSE, FAILURE;
  - analog signal (positioner);
  - two Profibus DP channels allowing backing up of a link to controller (Siemens, etc.) or two RS-485 channels (Modbus RTU), allowing backing up of connection to a controller.
- Indication of actuator state (output signals):
  - discrete signals OPEN, CLOSED, READY, MALFUNCTION, versatile outputs M1, M2 and M3 optional);
  - analog signals;
  - digital signals via two RS-485 channels (Modbus RTU) or via two Profibus DP channels allowing backing up.
- Three operating modes are available:
  - remote control by an external device;
  - local control using a local control panel (front panel);
  - settings adjustment.
- Actuator diagnostics and protection (power supply control, automatic correction of running direction in case of phase shift, protection from overcurrent or imbalance of currents, phase loss);
- Protective shutdown of motor in case of overheating, exceeding of full travel time.
- Valve “seating”.
- Automatic control of electronics compartment heater according to ambient temperature.

Available options

- RS-485-2 – second (backup) RS-485 channel (Modbus RTU) for connection to high level device.
- Bluetooth – Bluetooth wireless interface for connection of an Android-based device to a controlling unit.
- Profibus-1 – first channel for connection to Profibus DP network.
- Profibus-2 – second (backup) channel for connection to Profibus DP network.
- Backup power input – socket for external 24 V backup power source connection.

Configurations

- Configuration М – remote control is carried out by discrete signals; output signals – discrete (no additional options installed).
- Configuration Д – remote control by discrete signals; output signals – analog position signal and discrete signals.
- Configuration А (positioner) – Position setting analog signal is used for remote control. Other features are identical to configuration Д.
- Configuration С – RS-485 is used for remote control and feedback.
- Configuration Т – signals identical to those in configurations С and Д are used for remote control and feedback.

Major specifications

<table>
<thead>
<tr>
<th>General industrial use configuration</th>
<th>Explosion-proof configuration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Climatic version under ГОСТ 15150-69</td>
<td>УХЛ1 with a temperature range</td>
</tr>
<tr>
<td>Voltage</td>
<td>from -40 to +85 °C</td>
</tr>
<tr>
<td>Consumed power, up to</td>
<td>from -60 to +60 °C</td>
</tr>
<tr>
<td>Maximum current of power switch</td>
<td>single-phase supply ≈220, 230</td>
</tr>
<tr>
<td>output circuits in intermittent</td>
<td>or 240 V, 50 or 60 Hz;</td>
</tr>
<tr>
<td>periodic mode with up to 1500</td>
<td>three-phase supply ≈380, 400</td>
</tr>
<tr>
<td>starts per hour and duty rating of 25%</td>
<td>or 415 V, 50 or 60 Hz.</td>
</tr>
<tr>
<td>Discrete inputs</td>
<td>10 W when heater is off</td>
</tr>
<tr>
<td>Discrete outputs</td>
<td></td>
</tr>
<tr>
<td>Digital interface</td>
<td></td>
</tr>
<tr>
<td>Temperature-controlled heater power, up to</td>
<td></td>
</tr>
<tr>
<td>Protection rating</td>
<td></td>
</tr>
<tr>
<td>Motor temperature protection</td>
<td></td>
</tr>
</tbody>
</table>
Electric actuators with КИМ1

INTelligent unit КИМ1 is designed for control of electric actuators developed prior to 2008: single-turn МЭО, МЭОФ, linear МЭП, МЭПК and multi-turn Г3М actuators. КИМ1 receives commands from a controller, controls electric motor, performs functions of a starter, provides feedback on actuator and valve state.

Fig. 8 МЭПК-6300/50-30E1A00-ИСCT4-02 IP65 (analog control, explosion-proof version);
МЭО-40/25-0,25Е1ЕО0-ИСCT4-01 IP67 (discrete control, explosion-proof version).

Technical features
- Built-in power source for activation of external discrete circuits (in explosion-proof version).
- Cable connections using quickly-detachable connectors.
- Contactless (thyristor) reversing starter.
- Absolute contactless position sensor.

Functional features
- Reversing control of valve by controller commands.
- Connection to controller and other devices: – discrete signals OPEN, CLOSE, Failure; – analog signals (Positioner); – digital signals via RS-485 (Modbus RTU).
- Indication of actuator state: – discrete signals OPEN, CLOSED, READY, MALFUNCTION, versatile outputs (M1, M2); – digital signals via RS-485 (Modbus RTU); – analog signals.
- Operating mode: – remote control by an external device; – control from a local control panel; – parameters adjustment.
- Mechanical and electronic position indicator.
- Adjustment without enclosure opening using a local control panel, ГН-2 console or Android-based device.
- Settings storing in non-volatile memory.
- Protective shutdown of motor at: overcurrent, overtorque, overheating, absence of movement, exceeding of maximum full travel time
- Valve “seating” option.
- Automatic control of electronics compartment heater determined by ambient temperature.

Configurations
- Configuration D – discrete signals are used for control, output signals – discrete signals and analog position signal.
- Configuration A (positioner) – Position setting analog signal or additional discrete signals are used for remote control. Output signals are identical to configuration D.
- Configuration C – digital or additional discrete signals are used for remote control, digital output signals.
- Configuration T – digital and discrete signals are used for remote control, output – digital and discrete signals.
- Configuration M – only for explosion-proof version. No additional options installed.

Available options
- RS-485-2 – second (backup) RS-485 (Modbus RTU) channel for connection to high level device.
- Bluetooth – Bluetooth wireless interface for connection of an Android-based device to КИМ1.
- Compatibility with Profinbus networks provided by application of a БШ-2ПП gateway together with a group of actuators.

Examples of designation
- Г3М Б7-ЖД (discrete control);
- МЭПК–6300/50-30Е1А00-ИСCT4-02 IP65 (analog control, explosion-proof version);
- МЭО–40/25-0,25Е1ЕО0-ИСCT4-01 IP67 (discrete control, explosion-proof version).

Special features

<table>
<thead>
<tr>
<th>General industrial use configuration</th>
<th>Explosion-proof configuration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Climatic version under ГОСТ 15150-69</td>
<td>Y1, Y2 with a temperature range from -40 to +60 °C; Y1 with a temperature range from 40 to +60 °C</td>
</tr>
<tr>
<td>Protection rating</td>
<td>IP54, mounted inside actuator enclosure</td>
</tr>
<tr>
<td>Overall dimensions, mm</td>
<td>168 х 258 х 308</td>
</tr>
<tr>
<td>Power supply</td>
<td>Three-phase 380 V or single-phase 220 V, 50 or 60 Hz</td>
</tr>
<tr>
<td>Consumed power, up to</td>
<td>10 W while heater is off</td>
</tr>
<tr>
<td>Maximum current of power switch output circuits in intermittent-periodic mode with up to 1500 starts per hour and duty rating of 25%, up to</td>
<td>15 W</td>
</tr>
<tr>
<td>Temperature-controlled heater power, up to</td>
<td>Y1 – 5 W</td>
</tr>
<tr>
<td>Discrete control inputs, parameters</td>
<td>YX1 – 290 W</td>
</tr>
<tr>
<td>Wireless interface</td>
<td>IR</td>
</tr>
<tr>
<td>Discrete indication outputs, parameters</td>
<td>Ready, Malfunction, Open, Closed, M1, M2 (versatile outputs).</td>
</tr>
<tr>
<td>Digital interface</td>
<td>Single RS-485 channel, Modbus RTU protocol</td>
</tr>
<tr>
<td>Position indicator</td>
<td>Electronic and mechanical</td>
</tr>
<tr>
<td>Position analog output</td>
<td>(0-5), (0-20), (4-20) mA</td>
</tr>
<tr>
<td>Position setting analog output</td>
<td>(4-20) mA</td>
</tr>
<tr>
<td>Built-in power source for discrete control inputs power supply</td>
<td>no</td>
</tr>
<tr>
<td>Life cycle</td>
<td>at least 10 years</td>
</tr>
<tr>
<td>Motor temperature protection</td>
<td>installed</td>
</tr>
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### Electric actuators with КИМ. Comparative table

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<th>КИМ2</th>
<th>КИМ1</th>
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<td><strong>Application</strong></td>
<td>General industrial use version</td>
<td>Explosion-proof version</td>
<td>General industrial use version</td>
</tr>
<tr>
<td></td>
<td>General industrial use and explosion-proof electric actuators МЭО(Ф), ПЭМ, ПЭП (developed after 2008)</td>
<td></td>
<td>General industrial use and explosion-proof electric actuators МЭО(Ф), МЭПК (developed before 2008)</td>
</tr>
<tr>
<td><strong>Control</strong></td>
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<td></td>
<td></td>
</tr>
<tr>
<td><strong>Discrete</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Analog</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Positioning 4…20 mA signal, position feedback signal 4…20 mA</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Network</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Modbus RTU allowing backing up, Profibus DP allowing backing up</td>
<td>Modbus RTU</td>
<td>Modbus RTU allowing backing up</td>
<td></td>
</tr>
<tr>
<td><strong>Indication</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Discrete outputs</strong></td>
<td>LSO, LSC, TSO, TSC, M1, M2</td>
<td>Open, Closed, M1</td>
<td>Open, Closed, M1</td>
</tr>
<tr>
<td><strong>Analog outputs</strong></td>
<td>position 4…20 mA</td>
<td></td>
<td>position 4…20 mA</td>
</tr>
<tr>
<td><strong>Digital interface</strong></td>
<td>Modbus RTU, Profibus DP</td>
<td></td>
<td>Modbus RTU</td>
</tr>
<tr>
<td><strong>Controlling unit state indication output</strong></td>
<td>Malfunction, Ready, Local control*, Remote control*</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Position indicator</strong></td>
<td>Graphic and symbol LCD with autonomous power supply</td>
<td>Electronic</td>
<td>Electronic and mechanical</td>
</tr>
<tr>
<td><strong>Local control panel</strong></td>
<td>Display, LED indicators, Buttons Open, Close, Stop, Reset</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Control modes switch (selector)</strong></td>
<td>Remote/Stop/Local Mechanical locking</td>
<td>Remote/Stop/Local Electronic locking</td>
<td>Remote/Stop/Local Mechanical locking</td>
</tr>
<tr>
<td><strong>Configuration tool</strong></td>
<td>ПН-3 console via Zigbee; PC (Windows-based) or Android-based device with a Configurator application via Bluetooth</td>
<td>PC (Windows-based) or Android-based device with a Configurator application via Bluetooth</td>
<td>ПН2 console via IR port</td>
</tr>
<tr>
<td><strong>Advanced features</strong></td>
<td>Built-in PID regulator. Built-in variable frequency drive.</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

LSO – opening limit switch; LSC – closing limit switch; SSO – opening stroke switch; SSC – closing stroke switch; TSO – torque switch opening; TSC – torque switch closing; М1, М2, М3 – versatile outputs; * – to be adjusted for versatile outputs.