



**INSTRUCTION MANUAL  
ACTUATOR CLASSE I  
TYPE MA, MB**

**B BERNARD**

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## **PRODUCT DESCRIPTION**

### **GENERAL DESCRIPTION**

#### **CLASS I ACTUATOR DESIGN**

The answer to intensive and fast electric modulation demand is the L. BERNARD Class I actuators. A complete actuator program ranging from direct quarter turn to linear actuators as well as rotary systems with operating levers : a unique Class I program.

Powerful brushless DC motor with low inertia associated to a high mechanical efficiency is proof that guarantees a product particularly adapted to modulating requirements in all fields of industry with difficult environments.

L. BERNARD gear trains are constructed of heat-treated steel and special bronze wheel for durability and long life. Fast rotating shafts are all with ball bearings. The planetary gear reduction has the advantage of greatly reducing motor speed and at the same time obtaining a very high mechanical efficiency. The secondary reduction wheel and worm which follows consequently has a low input speed requiring only a small reduction and therefore obtaining also a high mechanical efficiency. However, if the main actuator reduction were obtained by means of a wheel worm, a large reduction on this type of gearing would produce a poor mechanical efficiency.

Because of its high mechanical efficiency, the planetary gears system allows the use of a compact motor with a very low inertia rate, where as a far more powerful and heavier motor would be needed for a system with low mechanical efficiency.

The first distinctive sign of a modulating actuator is therefore a highly compact motor. In fact, a compact motor has a low inertia rate and as all motorized unit, inertia comes from the motor rotor, the more compact the motor, the more precise and accurate the regulation will be.

As an actuator with a too high inertia rate would be unable to reach the position required quickly, a phenomenon known as "hunting" caused by the motor inertia will happen.

It is also necessary that the actuator has a minimum of backlash between the motor output-shaft and the position sensor. The connection is mechanically direct between the motor and the output shaft without the need for dog-clutching, clutch engaging, hammer blows, causing backlash in the gearing and connections in the regulation.

the second essential characteristic is the use of a modulating motor with a tendency to frequent changes in direction and which can bear high star-up rates. The motor, proposed for this type of actuator, is a brushless DC motor.

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## **BRUSHLESS DC MOTOR**

For a short time response, the actuator needs a motor with low inertia, a high starting torque and speed control. The brushless DC motor is the best choice to move the Class I actuators. The motor samarium cobalt magnets produce a high magnetic field to assure high starting torque and high efficiency. The special DC motor design without brushes is a reliable system requiring no maintenance.

The motor digital sensor gives the angular rotor position and also a speed feedback signal.

Through PRECIGAM power electronic, rotation, speed and torque are controlled. In spite of important torque variations during the stroke of the valve, this control guarantees the modulation precision.

## **POSITION FEEDBACK SIGNAL**

For a high precision positioning, a special plastic film potentiometer is fitted inside the actuator. For a long life, the wiper is a multicontacts precious metal and the axis is driven through ball bearing.

- Precision :  $\pm 0.50\%$
- Ohmique value : 1 KOhm
- Life time :  $\geq 100 \times 10^6$  travels

## **PRODUCT SPÉCIFICATION**

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#### Actuator

Ambient temperature :	-10°C to +60°C
Enclosure :	IP67
Voltage supply :	DC 500V
Type of cooling :	Surface cooling
Insulation class :	F
Duty :	100%
Motor protection :	Built-in thermal protection embedded in winding connected to terminal. When motor becomes too hot the contact is interrupted.
Travel limit switches :	2 contacts SPDT type for control circuit
Torque limit switches :	2 contacts SPDT type for control circuit
Mechanical dial position indicator:	
Position transmitter :	Potentiometer
	Linearity $\pm 0.5\%$

#### Positioner PRECIGAM

- Cabinet
  - metallic box
  - Front door with key
  - Cable entries: 2 Pg16 for actuator  
3 Pg16 for user
  - Option: connectors
- Ambient temperature : -10°C to + 60°C
- Enclosure : IP55
- Voltage supply : 3 phase, 380V, 50Hz ( $\pm 10\%$ )
- Input signal : 4 - 20 mA (270 $\Omega$ )
- Output signal : 4 - 20 mA (load 300  $\Omega$  maxi)  
*This signal is not electrically isolated from the input signal*
- Remote impulsional command
- Precision of positioning :  $\pm 0.5\%$
- Alarm relay *This relay is normally activated and released in case of :*
  - Motor thermal overload
  - Torque switch tripped either way
  - Fault electronic card voltage supply
- Electronic chassis
  - Aluminum housing with mother board and 4 slots.
  - The 4 electronic boards are :*
    - Positioner board GAMX
    - Control board CONT1
    - Control board CONT2
    - Power board with heatsink P400
- Technology :
  - Logic : CMOS
  - Power: MOSFET or IGBT transistors

## INSTALLATION

## STORAGE

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The actuators should be stored under shelter in a clean, dry place and protected from constant changes in temperature.

Avoid placing the actuators directly on the floor. For the actuators equipped with heat resistance, it is recommended that you connect and give supply to it especially if the place of storage is humid (standard voltage 230 volts, unless otherwise specified).

Check that temporary sealing plugs of the cable entries are well in place. In case of humidity, use metal plugs.

Make sure that the covers and the boxes are well closed to ensure weatherproof sealing.

## **CONTROL AFTER STORAGE**

1. Storage not exceeding one year :

- Maintain a visual check of electric equipment.
- Operate manually the microswitches, buttons, selectors, etc. to insure the correct mechanical function.
- Operate apparatus manually.
- Verify the correct grease consistency.
- Follow instructions included in the commissioning instruction here given.

2. Storage exceeding one year :

- Long time stocking change grease consistency. The grease thin thickness on stem dries up. Remove all the old grease of the actuator mechanical parts and replace with new grease.
- Maintain a visual check of electric equipment.
- Operate manually the microswitches, buttons, selectors, etc. to ensure the correct mechanical function.
- Follow instructions included in the commissioning instruction here given.

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## **UNPACKING**

L Bernard actuators are packed in standardized cardboard. Actuators mounted on valves are strapped to a skid and crated. After unpacking, the wooden platform may be used to transport the actuator to the installation site.

## **HANDLING**

Do not attach to the actuator ropes or hooks to lift valve by hoist. Handling a heavy valve through the actuator may damage coupling between valve and actuator.

## **INSTALLATION - MECHANICAL**

**Caution: For installation, actuator and valve should not be uncoupled otherwise a new adjustment is necessary.**

## **INSTALLATION - ELECTRICAL**

Verify cable maximum length between actuator and positioner PRECIGAM is less than 50m. Verify cable diameter is in concordance with cable gland. Check wiring very carefully between actuator terminals and positioner terminals before connecting power.

**Caution: Always close covers and positioner door immediately after installation or service to prevent moisture or other foreign matter from entering the actuator or electronic positioner box.**

Refer to the wiring diagram furnished with positioner for proper AC power and signal connections. It is advisable to provide normal short circuit protection on the AC power line. For safety and electrical noise protection the actuator and the positioner box should be grounded. Control cable between actuator and positioner box should be a screened cable. Connect the screen to terminal 95 (only positioner side) and isolated from ground. Do the same with input signal cable.

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## **START-UP INSTRUCTIONS**

After the actuator and positioner are mounted and their wiring connections are made, it is ready to be tested for proper operation.

**Note: Actuator mounted on the valve is ready for installation. No electrical adjustments are required before placing them in operation.**

Turn on the power supply. Operate the actuator with the manual control knob inside the positioner box PRECIGAM and with the switch on manual position. Run the actuator through its full stroke, both directions. Observe that the actuator travels through its desired stroke. If satisfactory, set the switch on AUTO position.

**Note: If there is no input signal the actuator stay in its last position**



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## **COMMISSIONING INSTRUCTIONS**

### **DESCRIPTION**

Actuator is designed for modulating duty. Housing includes a brushless dc motor, a planetary gear and a worm and wheel. Rotating shaft drives a nut / power screw system for a linear movement. Equipment includes a travel limit switch and a torque limit switch for each direction of rotation. To control feedback position a potentiometer measures valve stem movement through the output shaft of actuator. This sensor is located inside the actuator . A separate box includes electronic positioner PRECIGAM. Input signal for remote control is 4 to 20 mA. Impulsional command, open, close is also possible after selecting this mode remotely. When opening positioner box a local auto/man switch allows driving the actuator for test with a manual control knob.

### **COMMISSIONING INSTRUCTIONS**

#### ***1 notes concerning the electrical connection***

Positioner PRECIGAM is located in a separate box. This positioner has to be wired to actuator with 2 cables: one for power and one for control. Control cable has to be separated from power cable and to be of shielded type. Electrical screen has to be isolated from earth and connected only on positioner box on terminal 95 (0v electric). Also control cable coming from control room has to be shielded type. To avoid interference a distance of minimum 10 cm will be maintained between other cables. Electrical screen has to be isolated from earth and connected only on positioner box on terminal 71 (0v electric).

#### ***2 direction of rotation***

After assembly of actuator and valve achieve wiring between actuator and positioner box, check this wiring. Push and turn handwheel until actuator is in intermediate position. Open terminal box of actuator (close to cable entries) and also positioner box. Check remote impulsional command is not active (no link on 19-34, 35 and 36). Put the switch auto/man of card GAMX on manual: « MAN ». Supply positioner with power (see electrical wiring). Direction of rotation verification: GREEN LED on, open the valve or RED LED on, close the valve. In any other case, disconnect immediately power supply and check that the wiring between actuator and positioner is correct. Then with the incorporated manual control knob of GAMX card check that positioner works correctly. An ORANGE LED is on when the torque limit switch is tripped. This protection is effective even in the case of a wrong direction of rotation of the motor.

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### **3 setting of dead band**

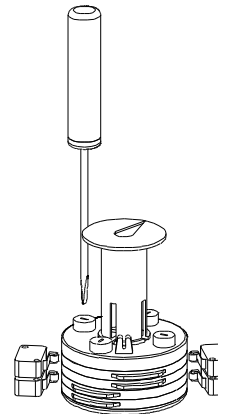
This setting is already done in our works. If it is necessary to adjust this dead band use a little screwdriver to operate, on GAMX card, potentiometer « dead band ». (Dead band will decrease when potentiometer is turned CCW). If setting is too narrow, actuator is hunting. Note: If dead band is excessively narrow, actuator may operate in one direction only.

### **4 Setting of travel limit switching with cam bloc system**

Ends of travel settings are done in actuator. The cam block is equipped with 4 cams different colors. White and black cams for end of travel limits. Use manual control knob on GAMX card to operate the actuator in a closed or open direction. Put the actuator in open position. Using a screw driver rotate the cam to the position in which it can trip the limit switch.

Then put the actuator in close position. Using a screw driver rotate the cam to the position in which it can trip the limit switch.

Open and close the valve again to check at 0% position actuator stops just before valve seat and RED and ORANGE LED are off.



#### To stop when valves are closed by torque limiter

If the valve must to be closed on torque limit switch, cam will not trip the switch in close direction before valve tight. Adjust the cam beyond the stop position.

Option: Auxiliaries travel limit switches are adjusted with gray and beige cams. Rotate the cam to trip the switch just before actuator stops.

### **5 setting of 0 %**

Turn manual control knob clockwise until mechanical stop is reached (0% position). Actuator starts in a closed direction and stops before reaching the closed position. Loosen the fixing screw of feedback potentiometer and carefully rotate the potentiometer to move actuator just before touching valve seat. RED AND ORANGE LED are off. Tighten the fixing screw to lock the potentiometer.

#### Special case:

Actuator starts in closed direction and doesn't stop before reaching closed position. In this case, loosen fixing screw of feedback potentiometer and carefully rotate the potentiometer until RED LED is off.

Tighten the fixing screw to lock the potentiometer.

Open and close the valve again to check at 0% position actuator stops just before valve seat and RED and ORANGE LED are off.

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## 6 setting of 100%

Span of positioner is done in our works and is in accordance with valve stroke. Therefore no adjustment is necessary.

## ADDITIONAL TECHNICAL INFORMATIONS

### 1 how to use the output signal of the positioner

Connect a millimeter on terminals 72+ and 73-. No supply voltage is required from outside. Important note: This signal is not electrically isolated from the input signal.

### 2 Fail safe position

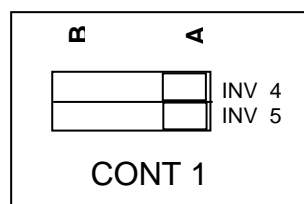
Fail-safe position if input signal is out of range.

Fail safe position is configured in close position.

To configure the fail safe position, switch off the current, remove the board CONT1 and configure the switches INV4 and INV5

3 choices :

Switches on board CONT1	INV 4	INV 5
actuator stays in position	A	A
actuator closes	A	B
actuator opens	B	A



GAMX	CONT1	CONT2	P400

## MAINTENANCE

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## **ACTUATOR**

A minimum of inspection is sufficient during normal life of actuator. A visual inspection is in order to verify that the connection with positioner PRECIGAM is intact and because of possible vibration that all terminal screws are tightened.

### ***Lubrication***

Periodic lubrication is not required on L.BERNARD actuator. Only in most severe applications, and during major shut downs, the linear system nut and screw can be inspected to determine the need to relubricate this gear.

### ***Repair and replacement***

The following sections describe the procedures to follow to remove and replace various components of L.BERNARD actuator. Refer on drawings for location of components.

### ***Gaskets***

During routine service, inspect the covers, motor and control box and change gaskets for wear or damage. In order to protect internal components worn or damaged gaskets and O-rings should be replaced. Remove all of the old gasket material from the body housing and cover before fitting a new gasket.

### ***Mechanical component, bearings or seals of main housing***

Field replacement of these components is not recommended.

### ***Motor***

Field- repair of the motor is not recommended. Disassembly of the motor will result in loss of precise position between cam and rotor.

To remove the motor, first disconnect the motor wires in the terminal compartment of the actuator (9 wires). Remove the 4 mounting screws and motor. Don't remove intermediate module between motor and main housing. Carefully remove the motor with its wires.

To install the motor, insert the 9 wires through the sleeve in the wire hole and inside the terminal compartment. Carefully engage motor shaft with its key and drive wire to be sure not to damage them. Reconnect the motor wires.

## **POSITIONER PRECIGAM**

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Positioner PRECIGAM doesn't require special maintenance. Verify connection is intact and terminals for tightness. This section describes the procedures to follow for replacement of electronic boards. Note that electronic boards are not field-repairable.

To remove an electronic board, first disconnect power supply.

**Caution: Electronic board should not be removed under voltage.**

Remove up and down screws and carefully slide the board out of the positioner block. To install a new board, carefully slide it into guide slots and fix it with screws. Take care not to interchange 2 boards of different tag. Reconnect electric power.

#### Fuses protection

Fuses located on P400 electronic board

Power fuse: FUS1 - 6.3 x 32mm - Fast fuse - 4A / 400v-500v.

Control circuit fuse: FUS2 - 5 x 20mm - Fast fuse 500mA.

Fuse located on power supply AL 24 for feedback sensor:

FUS - 5 x 20mm - Temporized 100mA