Instruction manual
for assembly and maintenance
with positioners

SMC
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1.- GENERALITIES

1.1 Scope.

This instruction manual is of a general character. It should be considered that in some cases variations occur with respect to the specifications presented here. These are always in response to the clients requirements.

The following instructions apply to the following models:

Ø Assemblies:

- Cylinder based:
  
  - Pneumatic pos. IP200
  - Pneumatic pos. IP5100-031
  - Electropneumatic pos. IP6100-030
  - Electropneumatic pos. IP6100-031
  - Electropneumatic pos. IP6100-030-X14
  - Electropneumatic pos. IP6100-031-X83
  - Electropneumatic pos. IP6100-031-X83-I

* 1.- Positioner Model.

  — Pneumatic pos. IP200
  N - Pneumatic pos. IP5100-031
  E1 - Electopneumatic pos. IP6100-030
  E2 - Electopneumatic pos. IP6100-031
  E3 - Electopneumatic pos. IP6100-030-X14
  E4 - Electopneumatic pos. IP6100-031-X83
  E5 - Electopneumatic pos. IP6100-031-X83-I
  E6 - Electropneumatic pos. IP6100-030-I

* 2.- Cylinder Diameter.

* 3.- Cylinder Stroke.

* 4.- Emergency. (only IP5100 and IP6100)

  A1 - Piston extended.
  A2 - Piston retracted.

* 5.- Reservoir. (only IP5100 and IP6100)

  C1 - 10 Litres
  C2 - 25 Litres
  C3 - 50 Litres
  C4 - 100 Litres
  C5 - 200 Litres
- Rotary actuator based:

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>IP6100-030-PN1</td>
<td></td>
</tr>
<tr>
<td>IP6100-031-X83-PN1</td>
<td></td>
</tr>
<tr>
<td>IP6100-031-X83-I-PN1</td>
<td></td>
</tr>
<tr>
<td>IP6100-030-I-PN1</td>
<td></td>
</tr>
<tr>
<td>IP6100-030-X14-PN1</td>
<td></td>
</tr>
</tbody>
</table>

- About Actuators for control valves (vertical displacement):

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>IP5100-031-PN1</td>
<td></td>
</tr>
</tbody>
</table>

1.2 Basic characteristics.

The assemblies described here are designed to respond highest demands in exterior installations and in environments where corrosion is important.

The most typical applications of the SMC assemblies are regulation for valve control in cogeneration, chimneys, by-pass systems, sluices, valves controlled by rotary actuators etc, in general wherever signals of 4 to 20 mA or 0.2 to 1 bar are required. In the electropneumatic version of the positioner, the possibility also exists of supplying an ancillary signal 4+20 mA and/or including ends of stroke.

Besides the option is included of an emergency system based on electropneumatic valves and pressure switch, which detects a drop in voltage or pressure in the mains, moving the piston of the cylinder to an emergency position.

1.3 Air and flow consumptions.

The range of SMC, positioners incorporates from the pneumatic models IP200, IP5100-03*, and IP5000-03*, to the electropneumatic model IP6100-03*-.*-* and IP6000-030.

The consumption and the flow of these can be calculated according to the system working pressure. (See appendix).
1.4 Operation.

In the following section the operation is briefly described of positioners based on cylinders and positioners based on rotary actuators. In both cases, the form of actuation is defined by the user for double action actuators. At the same time this can be modified, interchanging the pneumatic connections between the cylinder or actuator chambers, and inverting the feedback lever inside the positioner. It is essential to carry out both operations. (See appendix).

1.4.1- Cylinder-positioner regulation system:

The regulation of the cylinder stroke is carried out using a 4 + 20 mA signal obtained from a power supply in the electropneumatic case and 0.2 + 1 bar in the case of the pneumatic. This signal causes air to be introduced into the cylinder chamber provoking a movement proportional to this input signal. (See figures 1 and 2).

The positioner IP200, IP5100 and IP6100 are regulated and adjusted via the SMC specifications. (See appendix).

![Figure 1](image1.png)

![Figure 2](image2.png)

1.4.2- Cylinder-positioner regulation system with emergency manoeuvre:

(Only for IP6100 and IP5100) The assembly consists of a cylinder (1) around the side of which the electropneumatic valves (5) are fitted between the electropneumatic positioner (8) and the cylinder. This element (8) is mounted directly on the cylinder by means of a coupling mechanism. The positioner has an output by means of a shaft used as feedback to achieve the correct regulation of the cylinder movement. (See figures 3 and 4).

The regulation of the cylinder stroke is carried out using a 4 + 20 mA signal obtained from a power supply in the electropneumatic case and 0.2 + 1 bar in the case of the pneumatic. This signal causes air to be introduced into the cylinder chamber provoking a movement proportional to this input signal.

The positioner IP200, IP5100 and IP6100 are regulated and adjusted via the SMC specifications. (See appendix).
1.4.2.1- Emergencies:

The assembly responds to three possible emergency cases (only for IP6100 and IP5100):

When this occurs, the cylinder piston goes to the extended or retracted position.

✶ **1st Case: Voltage drop.**

At the moment when the voltage supply to the electrovalves (5) drops these move to their default position. In this position, the supply of air from the auxiliary reservoir enters into the cylinder chamber through one of the valves and causes the retraction or extension of the piston.

✶ **2nd Case: Loss of signal in the positioner.**

In the case of a loss of the input signal the positioner sets the actuator in emergency position.

✶ **3rd Case: Drop of the mains pressure.**

This is detected by means of the pressure switch (13), which previously regulated at a particular pressure. In the assembly the pressure switches normally open contact is connected in series, in a terminal box, to deactivate the electrovalve coils and reset them to their default positions. In all three cases the retraction or extension of the cylinder piston is carried out due to the air pressure and volume stored in the reservoir (16).
1.4.3- Actuator based positioner regulation system:

(Only for IP6100 and IP5100) The actuators can be single or double action. The regulation of the actuator stroke is carried out by a signal of $4 + 20$ mA provided by a power supply in the electropneumatic case and $0.2 + 1$ bar in the pneumatic one. This signal causes the air to be introduced into the actuator chamber inducing the movement. A particular stroke is induced as a function of the input signal. (See figures 5, 6, 7 and 8)

The positioners **IP6100** and **IP5100** are regulated and adjusted by means of the SMC specifications. (See appendix).
1.5 Components.

1.5.1 - IP6100 and IP5100 Cylinder based positioners:

The metallic elements which compose the motion and feedback system between cylinder and positioner are of stainless steel AISI 304. Stainless steel nuts and bolts. Torsion spring of stainless steel. Duroglis plastic parts making up the guide and transmission elements.
Base plate manifold for electrovalves, in Aluminium.
IP65 pressure switch, terminal box and packing gland.
To see the cylinder characteristics consult the SMC catalogue.
In the following page a graphic description is given of the characteristics of the cylinder-positioner assembly with valves and emergency pressure switch.

1.5.2 - IP6100 and IP5100 Actuador based Positioners:

The metallic elements, coupling plate to the positioner and feedback shaft are of stainless steel AISI 304. Stainless steel nut.
Positioner: IP6100-*.PN1. Components:
- PAP6100-3 (coupling plate).
- Namur 6100 shaft (feedback shaft).
Positioner: IP5100-*.PN1. Components:
- PAP5100-3 (coupling plate).
- Namur 5100 shaft (feedback shaft).
Positioners for Cylinders

Position control positioner
Can be...
- Pneumatic. IP5100 Series
- Electropneumatic. IP6100 Series (with the possibility of options)
- Intelligent. IP7100 Series (in preparation)

Cam guide made of stainless steel

Air pressure control pressure switch, adjustable

Pipe
- Copper
- Stainless steel
- Copper + Nylon

Fitting
- Brass
- Stainless steel

Mechanical guide system constructed of stainless steel and plastic. (Both resistant to corrosion)

Possibility of clevis or ball-joint installation

Base plate standardised for each type of manoeuvre.

SY electrovalves to control the emergency manoeuvres.

Cylinder Series
- C95
- CP95
- C92
- CS1

ISO - VDMA
Diameters 40 to 100
Stroke of 50 to 700 mm
CETOP RP-53-P
Diameters 125 and 160
Stroke of 50 to 700 mm
Diameters 200, 250 and 300
Stroke of 80 to 700 mm

Connectors DIN IP65

Terminal box for IP65 connection

Packing gland IP65

Pipe
- Copper
- Stainless steel
- Copper + Nylon

Fitting
- Brass
- Stainless steel
2.- SETTING UP

2.1 Transport and installation.

Ø Ensure that the most protruding parts (manometers, electrovalve coils, pressure switch) are protected against any exterior action or covering in the packing or transport.
Ø Ensure that the air supplied is filtered and dry in accordance with the instructions recommended by SMC in their catalogue.
Ø Check that the power supply and input connections of the pneumatic positioner are correct. An incorrect connection could affect permanently the positioner operation.
Ø Do not fit elements near the feedback lever of cylinder based positioners. This should slide the length of the cylinder tube free of obstacles.
Ø Respect the measure (23.4 mm) indicated in figure 9, in the case of cylinder based positioners.
Ø Consult the appendix for precautions during manipulation.

![Figure 9](image.png)
2.2 Supply.
Ø Do not exceed the maximum recommended pressure in the supply to the positioners. Pressure maximum 7 bars. SMC recommends air filtered to 5 l and dry.
Ø Electric cabling in the terminal box: The no. marked are the connections for the client. The R and S connections are for the voltage needed by the electrovalves used in each case. See figure 10.

3.- MAINTENANCE

3.1- Preventive Maintenance.
Ø Check periodically that the air supply is clean (filtration 5 l) and dry.
Ø Clean the moving parts of dirt or dust accumulations or deposits.
Ø Consult the appendix for maintenance and revisions.
Ø To eliminate the dampness due to condensation from the air, it is recommended to evacuate the water accumulated in the auxiliary air reservoir.
Ø It is necessary to keep the security valve seal intact.
Ø Check periodically the correct functioning of the reservoir manometer and regulator filter.
Ø In general it is recommended to check annually the integrated security elements.

3.2- Recommended Replacements.
Ø Replacement kit for positioner (see appendix).
Ø Pressure switch.
Ø Cylinder Gasket Kit.
Ø Electrovalve.
3.3- Maintenance and use of the reservoir and accessories.

USER INSTALLATION AND MAINTENANCE INSTRUCTIONS

- These recipients have been designed for use as accumulators of air or nitrogen.
- The safety of its installation, as well as its optimum use, is assured by correct use and adequate maintenance of the recipient by the user.
- It is dangerous if the internal pressure exceeds permanently the maximum pressure of service (PS), even though a momentary pressure up to 10% is permissible.
- Visual inspection of the interior of the recipient is advised annually, or at shorter intervals if the working hours and the conditions of use of the container so require, via the orifices or apertures designed for it.
- Ensure the air is vacuumed from the recipient each time it is to be subjected to revision.
- To eliminate the dampness produced by condensation from the air, it is necessary to evacuate the water accumulated in the recipient. To do so use the purge tap.
- It is necessary to preserve the valve safety seal intact, keeping permanent control of it, in order to avoid serious risks.
- The proper functioning of the manometer is to be checked permanently to ensure adequate control of the air pressure.
- At intervals of five years, at maximum, the structure of the recipient should be verified, checking the wall thicknesses, safety elements and its general state.
- The recipient must be sufficiently protected against corrosion, so it is necessary to monitor continually the optimum state of the paintwork.
- These recipients should be subjected every ten years, at least, to a visual inspection of the interior and exterior and a pressure test, to check that the established conditions are fulfilled.
- The pressure test is the same as the first test.
- These periodic tests are to be supervised by the competent Territorial Body of the Public Administration, by an Inspection and Regulation Control Entity, drawing up a formal statement and providing a copy to the said Body of the Administration, another to the user of the recipient and another remaining in the possession of the Inspection and Regulation Control Entity.
- It is the responsibility of the owner of the recipient to request supervision of the aforementioned periodic tests from the competent Territorial Body of the Public Administration or from the Inspection and Regulation Control Entity sufficiently in advance.
- The safety equipment integrated into the recipient should be subjected to at least one revision each year, to be carried out by the user.

4.- APPENDIX

The data referred to here has been drawn from chapter 7 of the SMC, IN-2, Instrumentation Catalogue.

For further information the “Valves and Cylinder based Positioners Catalogue “ edited by SMC can also be consulted.
Applications
The IP200 system permits a cylinder most precise and perfect positioning. It can be applied for repeatability in the most wide ranging situations in which the stroke of the cylinder is proportional to the range of control signals (0.2-1 bar). An already incorporated position control system and a special regulation system, reduce the influence on the cylinder of external forces.
The IP200 is especially appropriate to a remote positioning or stroke regulation, dose units, pumps, gears, drives, velocities, proportional aperture of valves, etc.

Characteristics
The extraordinary smoothness of movement of the cylinder and the combination of the positioner system, lead to great precision and exactitude of position. This repeatability, as well as the hysteresis, in reference to the total cylinder capacity, is less than 1 %.
The signal pressure acts directly on the servopositioning system, in such a way that a modification or change in pressure of the signal is transformed immediately into a movement of the piston.
Zero point and working range adjustment is easy and simple, even from outside. The retraction spring is protected by a telescopic sheath against any contact or involuntary movement.
The cylinder unit, as well as its fittings, comply with the ISO-CETOP standard.
The measurements of the cylinders are not modified, throughout the range appropriate for working with magnetic detection.

Technical characteristics

<table>
<thead>
<tr>
<th>Diameter of the piston (mm)</th>
<th>40</th>
<th>50</th>
<th>63</th>
<th>80</th>
<th>100</th>
<th>125</th>
<th>160</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diameter of the rod (mm)</td>
<td>16</td>
<td>20</td>
<td>20</td>
<td>25</td>
<td>30</td>
<td>32</td>
<td>40</td>
</tr>
<tr>
<td>Rod thread</td>
<td>M12x1.25</td>
<td>M16x1.5</td>
<td>M16x1.5</td>
<td>M20x1.5</td>
<td>M20x1.5</td>
<td>M27x2</td>
<td>M36x2</td>
</tr>
<tr>
<td>Range of strokes</td>
<td>25 to 300 mm</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Standard strokes</td>
<td>50, 100, 160, 200, 250, 300</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stroke tolerances</td>
<td>up to 250 mm + 1.0/0. up to 250 + 1.4/0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ambient</td>
<td>Compressed air, 5 micron filtered, without lubrication</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pressure range</td>
<td>3 to 7 bar</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Signal pressure range</td>
<td>0.2 to 1 bar</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Connection thread</td>
<td>G 1/4&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Manometer connection thread</td>
<td>G 1/8&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flow</td>
<td>Output 1: 255Nl/min.; Output 2: 270Nl/min. at 5 bar</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Air consumption</td>
<td>&lt; 22 Nl/min. at 5 bar</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Linearity</td>
<td>&lt; 2 % Independent of stroke length</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hysteresis</td>
<td>&lt; 1 %</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Repeatability</td>
<td>&lt; 1 %</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Threshold</td>
<td>&lt; 1 %</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Primary pressure sensitivity</td>
<td>0.1 % / 0.1 bar</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Working temperature</td>
<td>-5 ~ 60°C highest or lowest temperatures, for consultation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

How to order

The IP200 pneumatic positioner can be ordered separately; mounted on different series of cylinders such as our C95 series according to VDMA standards, or other specified.
Consult us about your special design, our technical team will collaborate with you to offer an individual and personalised solution.

References for separate positioners

<table>
<thead>
<tr>
<th>Reference</th>
<th>Stroke (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>IP200-50</td>
<td>50</td>
</tr>
<tr>
<td>IP200-100</td>
<td>100</td>
</tr>
<tr>
<td>IP200-160</td>
<td>160</td>
</tr>
<tr>
<td>IP200-200</td>
<td>200</td>
</tr>
<tr>
<td>IP200-250</td>
<td>250</td>
</tr>
<tr>
<td>IP200-300</td>
<td>300</td>
</tr>
</tbody>
</table>

Other strokes, by consultation.

Pneumatic positioner mounted on a C92 series cylinder, according to standards ISO-CETOP

<table>
<thead>
<tr>
<th>Type</th>
<th>Diameter</th>
<th>Stroke</th>
</tr>
</thead>
<tbody>
<tr>
<td>C92</td>
<td>40</td>
<td>40</td>
</tr>
<tr>
<td>P</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>D</td>
<td>63</td>
<td>63</td>
</tr>
<tr>
<td>D</td>
<td>80</td>
<td>80</td>
</tr>
<tr>
<td>D</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>D</td>
<td>125</td>
<td>125</td>
</tr>
<tr>
<td>D</td>
<td>160</td>
<td>160</td>
</tr>
</tbody>
</table>

Models in stock.
Adjustment of the equipment. Zero point and span regulation

1. Connect pressure supply and pilot to the IP200 with 0.2 bar and adjust the "0" point until the system begins to move. To adjust the "0" the safety screw (10) must be unlocked and regulate the screw (9).

2. Pilot the IP200 with 1 bar and adjust the span to achieve the maximum run of the cylinder stroke. To adjust the span proceed as follows:
   - Bring the cylinder to any point of its run (for example half of its stroke).
   - Remove the fastening screws from the protective tube/sheath (11). The adjustment of the span (8) will be left accessible.

3. Adjustment of the span modifies the "0" slightly and vice versa so operations 1 and 2 will have to be repeated various times until the system is left correctly regulated.

4. Fit the sheath and tighten the safety screw (10).

---

**Block diagram**

---

**Equilibrium Condition**

\[ \text{Pa} \cdot \text{Smp} = \text{Ptorque} \cdot \text{Smg} \]

\[ \text{Ppar} = f(x_1) \]

\[ \text{Pp1} \cdot \text{Sd} = \text{Fm} \]

**Legend:**

- **Pa:** System pressure
- **Pp1:** Signal pressure (pilot)
- **Ptorque:** Pressure in the chamber of the A diaphragm
- **Smg:** Surface of the A diaphragm
- **Smp:** Surface of the B diaphragm
- **Sd:** Surface of the pilot signal input chamber
- **X1:** Separation between film/nozzle
- **Fm:** Force of the spring
The service air for the regulation signal must be dry, clean and free of oil. It is recommended to treat the air supplied using a SMC microfilter of the EAFM series and using a standard filter of the EAF series, connected previously.

The velocity of the piston must not be so great as to exceed the stroke time indicated on the diaphragm, for each 100 mm. The velocity of adjustment can cause instability and stroke exceeding if it reaches fast levels. The velocity of the pistons can be regulated by the incorporation of throttle valves (Fig. 1). For greater cylinder diameters, rapid exhaust valves are mounted and exhaust regulation valves (Fig. 2).

The position elements must be protected against any vibration, given that otherwise, they themselves could cause oscillations in the retraction springs and a generally unstable behaviour. The sensitivity to these vibrations increases in proportion to the total development of the cylinder capacity. Naturally they can be damped, reducing the work pressure or also using the regulation valves, as was mentioned previously.

The 0 point must be regulated and adjusted by the manufacturer so that it is at 0.2 bar in the signal pressure, which means that the minimum increase of this signal pressure above the value of 0.2 bar indicated, can lead to a movement output of the position element (See diagram SIGNAL PRESSURE -STROKE). If the position element is already at less than 0.2 bar with the movement output beginning the initial drive or, on the other hand, at pressures over 0.2 bar no movement results, then the zero point needs to be readjusted. To carry out this operation the safety screw must be loosened before proceeding to adjust the 0 point.

The manufacturer will make sure to regulate correctly the positioner in the exact range of work regime that corresponds to the cylinder stroke. Also in this respect, corrections can also be made if necessary, in which case the exterior tube screws must be loosened and a signal pressure of 0.6 bar applied, revealing perfectly the adjustment screw. With the help of this adjustment field variation screw, more or less spirals of the spring can be made active, offering greater and wider activity and work (span) regime. Once this regulation point has been achieved, the zero point must be found again.
## Trouble Shooting

<table>
<thead>
<tr>
<th>INCIDENT</th>
<th>POSSIBLE CAUSES</th>
<th>SOLUTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>The cylinder does not move when the pilot pressure increases or decreases</td>
<td>The exhaust orifice is blocked</td>
<td>Remove the plug from the orifice and clean with a 0.4 mm diameter pin.</td>
</tr>
</tbody>
</table>
| The cylinder responds to the signal intermittently | - There is dust in some part of the slide  
- The exhaust orifice is blocked | - Clean the slide and the cylinder tube  
- Clean the exhaust orifice |
| The cylinder does not move when the pilot pressure exceeds 0.2 bar or it moves when that pressure is less than 0.2 bar | The zero adjustment screw is not correctly regulated | Loosen the locking screw and adjust the zero point |
| The cylinder movement is not linearly related to the pilot pressure (0.2 to 1 bar) | The span adjustment, gain, is not correct | Remove the protective tube from the feedback spring and optimise the adjustment of the span while maintaining the pilot pressure at 0.6 bar. The span is adjusted by modifying the number of spirals effective in the spring. Afterwards the zero must be adjusted. |

### Accessories-Replacements

<table>
<thead>
<tr>
<th>Part number</th>
<th>Part name</th>
</tr>
</thead>
<tbody>
<tr>
<td>390221</td>
<td>Retraction spring damper (*)</td>
</tr>
<tr>
<td>390218</td>
<td>Assembly plate Ø50~100</td>
</tr>
<tr>
<td>390233</td>
<td>Assembly plate Ø125~160</td>
</tr>
<tr>
<td>G43-2-01</td>
<td>0~2 bar manometer</td>
</tr>
<tr>
<td>G43-10-01</td>
<td>0~10 bar manometer</td>
</tr>
</tbody>
</table>

(*) The retraction spring damper is used to absorb the vibrations of the spring in the long stroke IP200 positioners.

### Dimensions (mm)

![IP200 series dimensions diagram]
Description

The IP5000 series of pneumatic positioners are mounted with pneumatic actuators. The pneumatic pilot valve is activated by the pilot pressure, originating from and adjusted from another device, and controls the actuator movement.

Technical specifications

<table>
<thead>
<tr>
<th>CHARACTERISTICS</th>
<th>TYPE</th>
<th>IP5000</th>
<th>IP5100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fluid</td>
<td>Non lubricated and 5µ filtered air</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Supply air pressure</td>
<td>0.14 ~ 0.7 MPa (1.4 ~ 7 bar)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pilot pressure</td>
<td>0.02 ~ 0.1 MPa (0.2 ~ 1 bar)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stroke</td>
<td>0<del>85mm (standard); 4</del>10mm (short stroke)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>60° ~ 100°</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sensitivity</td>
<td>≤0.1% F.S.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>≤0.5% F.S.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Linearity</td>
<td>≤±1% F.S.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>≤±2% F.S.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hysteresis</td>
<td>≤0.75% F.S.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>≤1% F.S.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Repeatability</td>
<td>≤0.75% F.S.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>≤1% F.S.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>≤0.5% F.S.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Output flow (Note 1)</td>
<td>80 Nl/min or more (SUP = 1.4 bar)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>200 Nl/min or more (SUP = 4 bar)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Air consumption (Note 2)</td>
<td>5 Nl/min or less (SUP = 1.4 bar)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>11 Nl/min or less (SUP = 4 bar)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ambient and fluid</td>
<td>-20 ~ 80°C (Standard Version)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>-5 ~ 100°C (High Temperature Version)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>-30 ~ 60°C (Low Temperature Version)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Temperature coefficient</td>
<td>Within 0.1% F.S.,°C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Air port</td>
<td>Rc (PT) 1/4 (Standard)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Material</td>
<td>Aluminium diecast, stainless steel, brass and rubber</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weight</td>
<td>~ 1.4 Kg</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>~ 1.2 Kg</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dimensions</td>
<td>118x102x86 (Body)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>118x92x77.5 (Body)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Protection</td>
<td>IP55 (IEC Pub 529 compliant)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>IP55 (IEC Pub 529 compliant)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vibration resistance</td>
<td>1G~5G a 200Hz</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes 1 and 2: Standard values: Air temperature 20°C (298°K); Absolute pressure: 760 mm. Hg; Relative humidity: 65%

To derive the output flow and air consumption at different pressures, see graphs 1 and 2 on the following page.

* Split range: optional (0.2 ~ 0.6 bar, 0.6 ~ 1 bar)

How to order

IP5000 - 0 3 0 - X12

Type

000 Cam/Lever type
100 Rotary type

Type of pilot pressure

0 Standard 0.2 ~ 1 bar
1 0.2 ~ 0.6; 0.6 ~ 1 bar
2 0.4 ~ 2 bar

Type of manometer (Feedback and output)

0 None
1 2 bar
2 3 bar
3 10 bar

With angular display (display)

0 No
1 Si

Ambient

T High temperature -5 ~ 100°C
L Low temperature -30 ~ 60°C

Connection for manometers

N (Standard) PT
F NP

Models in stock.

Notes
1. If two or more accessories are ordered the part numbers should be given in alphabetical order (ex. IP5000-030 AD)
2. When accessories E or F are ordered the standard lever will not be provided.
When the SIG pressure increases, the bellows pushes the balance lever up separating the flapper from the nozzle under the action of the connecting spring, causing a pressure drop in the chamber at the right of the pilot valve (see figure), introducing an unbalance between pilot valve pressures and, consequently, a displacement of the slide to the right opening valve B allowing air to pass from the supply towards the diaphragm of the exterior valve, through the output 1, and causing its downward movement. This movement makes the feedback cam move which acts in turn upon the feedback arm making it oscillate towards the right and tensing the feedback spring until reaching equilibrium in the balance lever.

During the whole time that the external valve diaphragm is in motion, until the tension of the feedback spring equals that of the bellows, the displacement is constantly adjusted and proportional to the SIG signal. When the SIG signal decreases, operation occurs reverse to the explanation given above.
Installation of the IP5000 type (lever type feedback)

The brackets of the positioner must be fabricated to suit the desired installation method. The positioner must be fastened tightly to the bracket with screws through the mounting holes located on one side or on the bottom of the positioner.

For side installation the fastening screws marked with a "P" are interchangeable with the IP300 positioner and those marked "E" are interchangeable with the IP600 and IP6000 positioners.

Example of installation on the actuator

The positioner is fastened to the case of the valve, or yoke, using screws into the side face of the positioner.

**Fig. 8. Mounting directly on the diaphragm valve.**

The positioner is fastened to the front part of the valve case, or yoke, using an "L" shaped bracket.

**Fig. 9. Mounting of "L" type bracket.**

The positioner is fastened to the front of the valve case, or yoke, using a bracket screwed to the threaded holes in the back of the positioner.

**Fig. 10. Mounting with front bracket**

Connection of the feedback cam

1. Install the valve rod and the feedback cam so that they are in the middle of their span when the input signal is 50%.

2. The span of the cam must be between 10° minimum and 30° maximum (α).

Bracket mounting according to DIN IEC 534 standard

Bracket mounting of the positioner (series IP5000 or IP6000) according to DIN IEC 534 standard.

Part number: INI-224-0-56-1

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Description</th>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Namur bracket plate</td>
<td>INI-224-0-56</td>
</tr>
<tr>
<td>2-4</td>
<td>Screw M8x16 DIN933-Zn5bkcB</td>
<td></td>
</tr>
<tr>
<td>3-4</td>
<td>Screw M8x20 DIN933-Zn5bkcB</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Nuts M8 DIN934-Zn5bkcB</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Flat washers B8.4 DIN125-Zn5bkcB</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Grower washers B8 DIN127-Zn5bkcB</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Clasp 100 320-4480</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Joining rod M6x70</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Nuts M6</td>
<td></td>
</tr>
</tbody>
</table>
**Series IP5000-5100**

**Installation of the IP5100 type (rotary type)**

**Mounting of the actuator aperture degree indicator (display)**

(1) Lock the lever and the zero point and span adjustment regulators (See following pages). Then set the opening degree of the indicator disk (display) by tightening a M3 screw. At this moment the opening angle indicating arrow must point to the centre of the roller, as indicated in figure 17. Please refer to columns (I) and (II) of table 2 (so that the display indicates the zero position of the opening degree).

(2) The mounting of the display when the actuator works in the opposite sense to that explained above can be seen in the columns (III) and (IV) of the table 2 (To start in the 90° opening position as indicated in the display).

---

**Table 2**

<table>
<thead>
<tr>
<th>Operation mode</th>
<th>0° - 90°</th>
<th>90° - 0°</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive</td>
<td>B</td>
<td>C</td>
</tr>
<tr>
<td>Reverse</td>
<td>C</td>
<td>B</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Valve starting point</th>
<th>A</th>
<th>A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cam mounting</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Opening degree</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

**Fig. 17. Example of the installation of the opening angle display**
Double action

Positive operation
Operation: The cylinder rod moves in the direction of the arrow when the signal increases.

Reverse operation
Operation: The cylinder rod moves in the direction of the arrow when the signal increases.

Single action

Positive operation
Operation: The rod moves in the direction of the arrow when the signal increases.

Reverse operation
Operation: The rod moves in the direction of the arrow when the input signal increases. (Normal operation when the valves reverse position is used).
Adjustment and set up of the equipment

Before beginning the adjustment, please verify the following:
1. The pipes are connected to the supply points, SIG and outputs 1 and 2.
2. The positioner is firmly mounted on the actuator.
3. In the case of the IP5000 type, the feedback arm is mounted in the appropriate way (see tables on the previous page).
4. In the case of the IP5100 type, the cam face is appropriate and the nut that fastens it is locked (see table 2, previous pages).

Adjustment of the span and zero point.

**IP5000 type**

1. Set the input signal to 0%, 0.2 bar, then set the actuator so that it is about to move by regulating the zero adjusting screw.
2. Vary the input signal and monitor the span of the actuator. When the span is insufficient with 1 bar of SIG, in other words too large, adjust in accordance with the diagram.
3. Set the input signal to 0% once again and adjust the zero point again as in (1).
4. Repeat operations (1), (2) and (3) until the span of the actuator, beginning and end, coincides with the minimum and maximum SIG.

**IP5100 type**

- **Increase of the starting point**
- **Decrease of the starting point**

Adjustment of the sensitivity

The graph in fig. 19 shows the input/output pressure characteristic for OUT 1 and 2 of the pilot valve. In the factory the output pressure is adjusted for optimum conditions. A subsequent adjustment is normally unnecessary.

In any case the sensitivity adjustment is only effective in the double action actuators. When the sensitivity is insufficient due to the type of actuator or to the load conditions, turn the sensitivity adjustment screw clockwise. When oscillations appear, turn it anticlockwise (the number of turns to carry out the sensitivity adjustment depends on the type of actuator for which the range must be between $1/16$ and $1$ turn. After adjustment, lock the sensitivity regulation screw with the lock screw, please do not lose it).

* When oscillations appear in small volume actuators see the section "Pilot valve with restricted output" on page 7-35.
Maintenance

(1) A contaminated air supply can cause problems in the positioner. The filtering system of the compressed air must be inspected periodically to keep the air clean constantly.

(2) Please apply grease to the O-rings that are released from the internal surface of the pilot valve when it is removed. (Grease: Toray SH45 silicone grease).

(3) When the fixed orifice becomes blocked with carbon particles (dirt) separate the pilot valve in two parts (See Fig. 20) and clean the orifice with a 0.3mm diameter pin.

(4) The positioner should be inspected superficially once a year. If any significant damage has occurred to a diaphragm or gaskets, such as O-rings, they must be replaced especially in places exposed to aggressive atmospheres such as in coastal areas where such changes must be carried out as promptly as possible.

Precautions

(1) Excessive vibration of the positioner during its transport or during operation can cause problems of malfunctioning.

(2) When the positioners operate with overtemperatures, the materials of the O-rings deteriorate more rapidly than normal over and above the risk incurred of breakdown.

(3) If it is intended to leave the positioner unsupervised it is advised to cover it with a protective cover against rain or foreign objects.

(4) Protect the positioners against dew formation which may occur due to high temperatures and high humidity during transport.

(5) Since the zero point is a function of the mounting position, it should be adjusted after installation of the apparatus.

Trouble shooting

1. The positioner does not start
   - Remove the cover and move the balance cam manually

   Outputs 1 and 2 of the pilot valve operating
   - There is input signal
     - The zero point is adjusted properly
       - Check leaks of the input signal
     - The zero point is not adjusted properly
       - Adjust the zero appropriately.

   Outputs 1 and 2 of the pilot valve are not operating properly
   - There is no input signal
     - Check the input signal
   - The feedback spring is loose
     - Support the spring appropriately
   - Dirt in the exhaust port or in the nozzle
     - Check and clean the nozzle and the exhaust port
TROUBLESHOOTING

1. The actuator oscillates (connecting and disconnecting)
   - The feedback arm mounting is inadequate (IP5000)
   - The cam is not on the correct face (IP5100)
   - The connections of the outputs 1 and 2 are incorrect
   - Check the feedback arm mounting
   - Check the cam mounting
   - Check the pipe connections

2. The air consumption is high
   - There are leaks in the pipes or in the connections
   - Dust is blocking the interior of the pilot valve
   - Check for cracks in the O-rings or gaskets in the actuator
   - Disassemble the valve and examine it
   - Check the pipe connections

3. Balances
   - The actuator volume is small
   - The exhaust port is blocked
   - The type of the actuator is inappropriate
   - (The restriction of the actuator gaskets is large)
   - Install restrictors in the output of the valve
   - Clean the exhaust port
   - Check the pipe connections

4. The air consumption is high
   - There are leaks in the pipes or in the connections
   - Dust is blocking the interior of the pilot valve
   - The actuator volume is small
   - The exhaust port is blocked
   - Check the feedback arm mounting
   - Check the cam mounting
   - Check the pipe connections

5. Poor linearity
   - The supply pressure is variable
   - The adjustment of the zero and span are not good
   - There is dirt in the interior of the positioner
   - Clean the exhaust port
   - Install restrictors in the output of the valve
   - Check the pipe connections
   - Check the feedback arm mounting
   - Check the cam mounting
   - Clean and examine the locks of the covers

6. Poor hysteresis
   - The sensitivity is not well adjusted (only for double action)
   - Poor physical linearity between the joint of the positioner and the actuator
   - Loosening of the a screw in the interior of the positioner
   - Adjust the sensitivity
   - Correct the misalignment
   - Check the internal screws and tighten them well
Electro-Pneumatic positioners
Series IP6000•6100

**Description**

In the 6000 series electro-pneumatic positioners the pneumatic valve is activated by the input current signal acting on the positioner so that it controls at all times the motion of the actuator or valve.

**Technical specifications**

<table>
<thead>
<tr>
<th>CHARACTERISTICS</th>
<th>IP6000</th>
<th>IP6100</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Lever type cam</td>
<td>Rotary type cam</td>
</tr>
<tr>
<td>Input current</td>
<td>Single action</td>
<td>Double action</td>
</tr>
<tr>
<td>Coefficient of linearity</td>
<td>≤ ±0.1% F.S.</td>
<td>≤ ±0.5% F.S.</td>
</tr>
<tr>
<td>Coefficient of repeatability</td>
<td>≤ ±1% F.S.</td>
<td>≤ ±2% F.S.</td>
</tr>
<tr>
<td>Coefficient of sensitivity</td>
<td>≤ ±0.75% F.S.</td>
<td>≤ ±1% F.S.</td>
</tr>
<tr>
<td>Output flow</td>
<td>≤ ±0.1% F.S.</td>
<td>≤ ±0.5% F.S.</td>
</tr>
<tr>
<td>Supply air pressure</td>
<td>≤ ±0.1% F.S.</td>
<td>≤ ±0.5% F.S.</td>
</tr>
<tr>
<td>Standard stroke</td>
<td>10<del>85 mm (10</del>30°)</td>
<td>60~100°</td>
</tr>
</tbody>
</table>
| Type of explosion proof     | Type of explosion proof Prot.
| Material                    | Aluminium diecast body |

**How to order**

<table>
<thead>
<tr>
<th>Type</th>
<th>Construction</th>
<th>Pressure gauge (SUP and OUT)</th>
<th>Input current</th>
<th>Models in stock, other possibilities upon request.</th>
</tr>
</thead>
<tbody>
<tr>
<td>IP6000-030</td>
<td>IP6100-030</td>
<td>IP6000-031</td>
<td>IP6100-031</td>
<td>IP6000-030-X14</td>
</tr>
</tbody>
</table>

**Types of accessories**

(1) If two or more accessories are ordered the part numbers should be placed in alphabetical order (ex.: IP6000-030 AG).

(2) The option A is a restrictor for use with 90 cm³ capacity actuators. The option B is a restrictor for use with 180 cm³ capacity actuators.

---

(*) : A 1:2 split range with the standard type can be obtained using the span adjustment.

(1) : Possibility of operating in rapid aperture or isopercentage (consult).

(2) : The external cam can span an angle of 10°~30° and a short stroke (6~12mm) model exists.

(3) : To see the values of output flow and air consumption, refer to figs. 1, on the next page.

(4) : To see the values of output flow and air consumption, refer to figs. 2, on the next page.

(5) : ANR : Values given for the following conditions: Temperature 20°C, absolute pressure: 760 mmHg (~1 bar) and humidity of 65%. 

---

**How to order**

<table>
<thead>
<tr>
<th>Type</th>
<th>Construction</th>
<th>Pressure gauge (SUP and OUT)</th>
<th>Input current</th>
<th>Models in stock, other possibilities upon request.</th>
</tr>
</thead>
<tbody>
<tr>
<td>IP6000-030</td>
<td>IP6100-030</td>
<td>IP6000-031</td>
<td>IP6100-031</td>
<td>IP6000-030-X14</td>
</tr>
</tbody>
</table>

**Types of accessories**

(1) See accessories on the following pages.
**Operation and block diagram**

### IP6000 type

When the input current increases, the armature (13) exerts a force against the spring sheet (11), due to the torque exerted by the motors magnetic field, moving towards the left and causing the clearance between the flapper (5) and the nozzle (6) to increase reducing the back pressure on the nozzle. As a result the exhaust valve (7), slide, moves towards the right, the pressure of OUT 1 increases and the driven diaphragm (15) lowers its rod. As it descends it acts upon the feedback spring (10) through the feedback cam (8), the transmission cam (14) and the span adjusting lever (9). The actuator will carry on falling until equilibrium is reached with the force generated by the variation of input current. The compensation spring (2) acts immediately after the exhaust valve, slide (7), begins to move due to the movement of the counter weight (4) contributing to the increased stability of the control loop.

For the zero point adjustment, the tension of its adjustment spring must be modified by regulating the corresponding adjustment control.

---

**IP6000 type (Lever type), with single action operation.**

For reverse operation set the span adjusting lever to its opposite position. At the same time move the span adjusting screw upwards. (For more detail see the section about pneumatic installation on the following pages).
Installation of the IP6000 type

Example of installation on the actuator

The mounting of the IP6000 positioner is compatible with that of the IP600 type, i.e., where an IP600 is already in operation it can be substituted by an IP6000 using the same bracket.

It is mounted directly using the threaded holes in the side of the positioner and the threaded holes in the yoke of the diaphragm valve.

Fig. 7. Example of direct mounting on the body of the valve.

It is mounted using the threaded holes located on the side of the positioner and the threaded holes on the front of the diaphragm valve.

Fig. 8. Example of mounting using an L bracket.

It is mounted using the threaded holes on the lower part of the positioner and the threaded holes on the front of the diaphragm valve.

Fig. 9. Example of mounting using a front bracket.

Connection of the external feedback lever

Mounting of the positioner (series IP6000 or IP5000) on the bracket according to DIN IEC 534 standard.

Part number:

INI-224-0-56-1

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Description</th>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Namur plate bracket</td>
<td>INI-224-0-56</td>
</tr>
<tr>
<td>2</td>
<td>Screw</td>
<td>M8x16 DIN933-Zn5bkcB</td>
</tr>
<tr>
<td>3</td>
<td>Screw</td>
<td>M8x20 DIN933-Zn5bkcB</td>
</tr>
<tr>
<td>4</td>
<td>Nuts</td>
<td>M8 DIN934-Zn5bkcB</td>
</tr>
<tr>
<td>5</td>
<td>Flat washers</td>
<td>B8,4 DIN125-Zn5bkcB</td>
</tr>
<tr>
<td>6</td>
<td>Grower washers</td>
<td>B8 DIN127-Zn5bkcB</td>
</tr>
<tr>
<td>7</td>
<td>Clasp</td>
<td>100 320-4480</td>
</tr>
<tr>
<td>8</td>
<td>Joining rod</td>
<td>M6x70</td>
</tr>
<tr>
<td>9</td>
<td>Nuts</td>
<td>M6</td>
</tr>
</tbody>
</table>

Mounting on bracket according to DIN IEC 534 standard

1. Mount the positioner so that the valve shaft and the cam form an angle of 90° when the input current is at 50%.

2. Mount the positioner so that the displacement angle is in the range between 10° and 30°.

3. The valve moves downwards while the input current increases (Positive operation). In this case the spring tensor rests on the upper part of the connecting fitting (See fig.11). The valve moves upwards while the input current increases (Reverse operation). In this case the spring tensor rests on the lower part of the connecting fitting (See fig.11).
(1) Lock the cam and then adjust the zero point and the span (See how to adjust on the following pages). Then fix the display, opening degree indicator, to the axle using the M3 display locking screw M3. At the same time move the opening degree indicator to the reference line A, as illustrated in fig.16. In this way the starting position is set to 0° in la display window.

(2) Columns III and IV if table 2 show the locking positions of the cam for 90°-0° indicating the opening degree. Use the opening degree indicator, display, for reference.

<table>
<thead>
<tr>
<th>Indicator method</th>
<th>0° - 90°</th>
<th>90° - 0°</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type of operation</td>
<td>Positive</td>
<td>Reverse</td>
</tr>
<tr>
<td>Indicating display of the aperture degree and reference position</td>
<td>A</td>
<td>A</td>
</tr>
<tr>
<td>Mounting of the cam and of the indicating display of the opening degree.</td>
<td>Clockwise</td>
<td>Anticlockwise</td>
</tr>
<tr>
<td>Opening degree indicating window</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 2. Installation of the opening degree display indicator
### Double action

#### Positive operation
Operation: The rod moves in the direction of the arrow when the signal increases.

#### Reverse operation
Operation: The rod moves in the direction of the arrow when the signal increases.

#### IP6000 type (Lever type)
- Positive operation
- Reverse operation

#### IP6100 type (Rotary type)
- Positive operation
- Reverse operation

#### Single action

#### Positive operation
Operation: The rod moves in the direction of the arrow when the input current increases.

#### Reverse operation
Operation: The rod moves in the direction of the arrow when the input current increases.

#### IP6000 type (Lever type)
- Positive operation
- Reverse operation

#### IP6100 type (Rotary type)
- Positive operation
- Reverse operation

### Anticlockwise rotation actuator
The actuator shaft rotates anticlockwise when the input current increases.

### Clockwise rotation actuator
The actuator shaft rotates clockwise when the input current increases.

### Span adjustment
- Adjusts the normal position of the cam.
- Adjusts the reverse position of the cam.

### OUT 1: is plugged
- OUT 2: is plugged
- OUT 1: is plugged
- OUT 2: is plugged

### Cam positioning
- Should be set on the DA surface.
- Should be set on the RA surface.
**Positioner with terminal box**

1. Connect the output terminals (+) and (-) of the current source to the corresponding input screws (+) and (-) of the terminal box. The diameter of the input connection of the cables is of type G (PF) 1/2 and has a female 16.5 mm. long. (Deep) thread.

2. A terminal box is supplied, with two input ports, A and B marked in fig. 17. Do not use these as support (The input B is used in the sketch of the fig. 17).

**Positioner without terminal box**

1. Connect the (+) and (-) output terminals of the current source to the corresponding (+) and (-) input screws of the terminal box. The diameter of the cable input port is of type G (PF) 1/2 and has a 10 mm. long. (Deep) female thread.
Adjustments, set up of the equipment

Prioritise the following points when carrying out the adjustment.
1. Check that the pneumatic connections of the different pipes (SUP, OUT 1 and OUT 2) have been made correctly.
2. Check that the electric wiring is perfect (+, -, and ground terminals).
3. Check that the actuator and the positioner are tightly joined.
4. Check that the locking screw of the automatic/manual selector of the IN valve is tight (it is tightened by turning clockwise).
5. Check that the lock of the internal feedback cam span adjustment (Type IP6000) is fitted correctly (Positive or reverse position). See page 49.
6. Check that the fitting of the cam surface (positive or reverse) in the IP6100 type and that the bordered nut that holds it is perfectly locked (See table 2, page 48)

Adjustment of the zero point and span.

**IP6000 Type**

- **Zero adjustment screw**
- **Start very low (Advanced)**
  - Clockwise: Zero adjustment
- **Start very high (Delayed)**
  - Clockwise: Zero adjustment
- **Span adjustment screw**
  - **Span very short**
    - Clockwise: Span very large
    - Anticlockwise: Span very small
  - **Span very large**
    - Clockwise: Span very small
    - Anticlockwise: Span very large
- **Locking screw**
  - When the screw is turned clockwise the span increases. When turned anticlockwise it decreases.

**IP6100 Type**

- **Span adjustment screw**
  - When the screw is turned clockwise the span increases. When turned anticlockwise it decreases.

(1) Set the input current to 0% (4 mA DC in the standard specification) and turn the adjustment button until the actuator begins to move.
(2) Afterwards, increase the current to 100% (20 mA DC in the standard specification) and control the actuator stroke. At this point, depending on whether the span (stroke) is too large or small, loosen the locking screw and adjust the span as illustrated in the diagram above.
(3) Set the current to 0% and adjust the zero point again as explained in step 1.
(4) Repeat the previous operations until the actuator stroke, start and finish, coincides with the minimum and maximum input current signals.
**Maintenance and revisions**

1. If the air supply is dirty the positioner cannot work correctly. Service the compressor and the air filtration system periodically and ensure that the air supply is always clean.

2. When the input valve is removed, apply grease to the O-rings in the affected area (Use Toray silicone grease SH45)

3. When the restrictor orifice becomes blocked with carbon or other particles, remove the Manual/Automatic selector screw (inside of which the orifice is found) and clean it with a ø 0.2 mm pin. If it must be replaced with a new one, remove the supply pressure and loosen the input valve locking screw.

4. The positioner must be inspected once a year. When a diaphragm, O-ring, packing or any other component is seen to be deteriorated it must be replaced with a new one. The treatment and periodic revisions are especially important if the positioner is used in places with aggressive environments such as in coastal areas.

**Precautions during manipulation**

1. Do not apply strong vibrations or impacts to the positioner to avoid problems. The positioner must be manipulated with great care during its transport and when it is in operation.

2. If the positioners are used at temperatures outside the specifications the joint materials deteriorate more rapidly cause the positioners not to function correctly.

3. Do not remove the cover of the positioner during operation.

4. If the positioner is left out of service in the work place a long time, place a cover over it so that it is protected from the rain. If the environment is at high temperature or high humidity take measures to avoid condensations in its interior. Control of the degree of the condensation must be done carefully during transport or shipment.

**Trouble shooting**

1. The positioner does not start
   - Open the cover and gently tap the flapper or nozzle to activate
   - The two outputs 1 and 2 of the input valve are working
   - Incorrect connection of the input current + and -
   - Check the electrical connections (See page 50)
   - The two outputs 1 and 2 of the input valve do not work
   - The M/A selector is not in the correct position
   - Check the M/A selector (see section/manual automatic operation, page 52)
   - The restrictor or nozzle orifices are blocked
   - Check and clean the restrictor and the nozzle (See maintenance section on p. 52)
2. The actuator connects and disconnects

- The two position cam (normal and reverse) is not being used correctly
  - Check the cam support (See page 47)

- Pneumatic connections to the outputs 1 and 2 are incorrect
  - Check the pneumatic connections (See page 49)

3. The actuator oscillates (it rocks)

- The actuator being used has small capacity
  - Use an input valve with restricted output (See next page)
  - Clean the orifice (See maintenance section, page 53)
  - Check the actuator
  - Change the compensation spring from standard to A (ref. P22401123)

---

4. Excessive air

- There are leaks in the pipes
  - Check for and locate the leak

- There are leaks in the actuator
  - Check the possibility that the O-rings or gaskets in the actuator are cracked

- There is dust in the input valve of the positioner
  - Disassemble and service the input valve

5. Poor linearity

- The air supply pressure is variable
  - Check the air supply regulation

- The zero and span adjustments are not good
  - Readjust the zero and the span

- The external feedback cam is not being used adequately
  - Check the feedback cam support (See page 46)

---

6. Poor Hysteresis

- Inadequate adjustment of the sensitivity screw
  - Readjust the screw (See page 52)
  - *Only for double action actuators*

- Play in the connection between the positioner and the actuator
  - Remove the play

- The connection screw in the positioner has become loose
  - Check and tighten the screw again
In the IP6100 series of electropneumatic positioners, the pneumatic valve is activated by the input current signal, which in its turn acts on the positioner, so that it controls continuously the movement of the actuator or valve. With the electronics card, a 4–20mA tracking signal is provided that indicates the real position.

Technical specifications

<table>
<thead>
<tr>
<th>Model</th>
<th>IP6100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input current</td>
<td>4–20mA DC (Standard)</td>
</tr>
<tr>
<td>Input resistance</td>
<td>235 ±15Ω (4–20mA DC)</td>
</tr>
<tr>
<td>Air supply</td>
<td>(0.14–0.7MPa) 1.4–7 Kgf/cm²</td>
</tr>
<tr>
<td>Standard stroke</td>
<td>60° ~ 100°</td>
</tr>
<tr>
<td>Stroke angle indicator</td>
<td>YES</td>
</tr>
<tr>
<td>Sensitivity</td>
<td>&lt; 0.5 F.S. (full scale)</td>
</tr>
<tr>
<td>Linearity</td>
<td>&lt; ±2% (F.S.)</td>
</tr>
<tr>
<td>Hysteresis</td>
<td>&lt; 1% (F.S.)</td>
</tr>
<tr>
<td>Repeatability</td>
<td>&lt; ±0.5 (F.S.)</td>
</tr>
<tr>
<td>Temperature coefficient</td>
<td>&lt; ±0.1% (F.S.)</td>
</tr>
<tr>
<td>Fluid</td>
<td>Non-lubricated and 5µ filtered air</td>
</tr>
<tr>
<td>Output flow</td>
<td>80Nl/min at 1.4 bar / 300Nl/min at 6 bar</td>
</tr>
<tr>
<td>Air consumption</td>
<td>&lt;5Nl/min at 1.4 bar / 12Nl/min at 6 bar</td>
</tr>
<tr>
<td>Ambient temperature</td>
<td>-20 ~ 80°C</td>
</tr>
<tr>
<td>Protection class</td>
<td>IP55</td>
</tr>
<tr>
<td>Vibration test</td>
<td>5G to 200Hz</td>
</tr>
<tr>
<td>Air port</td>
<td>Rc(PT) 1/4</td>
</tr>
<tr>
<td>Electrical connection</td>
<td>G(PF) 1/2</td>
</tr>
<tr>
<td>Material</td>
<td>Aluminium diecast body</td>
</tr>
<tr>
<td>Approximate weight</td>
<td>2.6 kg</td>
</tr>
</tbody>
</table>

Technical specifications of the ends of stroke

<table>
<thead>
<tr>
<th>Type</th>
<th>V3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Velocity of operation</td>
<td>from 0.1mm to 1m/s in piston</td>
</tr>
<tr>
<td>Frequency of operation</td>
<td>Mechanical: 600 operations/min. Electrical: 60 operations/min</td>
</tr>
<tr>
<td>Contact resistance</td>
<td>30mΩ max. at (initial)</td>
</tr>
<tr>
<td>Isolation resistance</td>
<td>100mΩ min. at (300V)</td>
</tr>
<tr>
<td>Dielectric rigidity</td>
<td>100 V AC, 50/60Hz for 1 min. between terminals/discontinuous 1500 V AC 50/60Hz for 1 min. between conducting and insulating elements, as well as between each terminal and ground.</td>
</tr>
<tr>
<td>Resistance to vibrations</td>
<td>Mechanical durability: from 10 to 55Hz; 1.5 mm p.p. approx. 392 m/s²</td>
</tr>
<tr>
<td>Resistance to shocks (mechanical/durability)</td>
<td>approx. 100 m/s²</td>
</tr>
<tr>
<td>Resistance to shocks (durability to malfunction)</td>
<td></td>
</tr>
<tr>
<td>Ambient temperature</td>
<td>Service from -25 ~ 80°C</td>
</tr>
<tr>
<td>Ambient humidity</td>
<td>85% HR max.</td>
</tr>
<tr>
<td>Useful mechanical life</td>
<td>50,000,000</td>
</tr>
<tr>
<td>Useful electrical life</td>
<td>500,000</td>
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<tr>
<td>Weight</td>
<td>Aprox. 6.2 g</td>
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<tr>
<td>Contact configuration</td>
<td>Switched (3 wires, COM, NO, NC)</td>
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</tbody>
</table>

Electrical specifications

<table>
<thead>
<tr>
<th>Type</th>
<th>Voltage</th>
<th>Current</th>
</tr>
</thead>
<tbody>
<tr>
<td>3A</td>
<td>250VAC</td>
<td>3</td>
</tr>
<tr>
<td>3A</td>
<td>8VDC</td>
<td>3</td>
</tr>
<tr>
<td>3A</td>
<td>30VDC</td>
<td>3</td>
</tr>
<tr>
<td>3A</td>
<td>125VDC</td>
<td>0.2</td>
</tr>
<tr>
<td>3A</td>
<td>250VDC</td>
<td>0.1</td>
</tr>
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</table>

*Note: The consumptions are with a resistive load.
How to order

IP6100-03 [X83] [I]

Construction

<table>
<thead>
<tr>
<th></th>
<th>0</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Without terminal box</td>
<td>With terminal box</td>
</tr>
</tbody>
</table>

Option with a 4~20mA output

Option with ends of stroke

(1) The models X83 (with 4~20mA output) whether or not with ends of stroke, are equipped with a terminal box (IP6100-031).

(2) The ends of stroke are mechanical. For inductive ends of stroke NPN, PNP, etc., contact SMC.

Models in stock. Other possibilities upon request.

<table>
<thead>
<tr>
<th>Part number</th>
<th></th>
</tr>
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<tbody>
<tr>
<td>IP6100-030</td>
<td></td>
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<tr>
<td>IP6100-031</td>
<td></td>
</tr>
<tr>
<td>IP6100-031-X83</td>
<td></td>
</tr>
<tr>
<td>IP6100-031-X83-I</td>
<td></td>
</tr>
<tr>
<td>IP6100-030-I</td>
<td></td>
</tr>
</tbody>
</table>

Graph of the transfer flow

(Real tests)

Graph of the air consumption

(Real tests)

Fig. 1. Ranges of flow

Fig. 2. Air consumption
**Pneumatic installation**

### IP6100 type (Rotary type). Double action

**Positive operation**
Operation: The actuator main shaft rotates clockwise when the input signal increases.

**Reverse operation**
Operation: The actuator main shaft rotates anticlockwise when the input signal increases.

### IP6100 type (Rotary type). Single action

**Positive operation**
The actuator shaft rotates clockwise when the input signal increases.

**Reverse operation**
The actuator shaft rotates anticlockwise when the input signal increases.

### Electric wiring

The signal input to the positioner, which will control the actuator, must be from a current source 4~20mA D.C. The positive goes to the connection 1 and the negative to the 2. To obtain a tracking signal it is necessary to apply a voltage source to supply the electronic card.

With regard to the connection of the ammeter or measuring element, the 2 wire technique is used, placing the measuring element in series and taking the precaution to apply the correct polarity (see figure).

The permitted load resistance depends on the voltage source employed and is determined using the following formula: \[ \text{load resistance} \leq \frac{(\text{voltage} - 12V)}{20mA} \]
If this formula is not fulfilled a correct tracking signal will not be obtained. Confirm the internal resistance of the measuring element.