POSITIONING SYSTEM FOR A MECHANICALLY JOINTED RODLESS CYLINDER WITH A ELECTRO-PNEUMATIC POSITIONER

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Abstract. The paper presents the possibility of realizing an mechatronic positioning system for various applications of a mechanically jointed rodless cylinder using an a electro-pneumatic positioner controlled by an stepper motor. The applications of the system are various and extend in the area of automatic storage and retrieval systems, flexible manufacturing systems, automated mounting and assembly systems.

1. THE USED COMPONENTS

1.1. MY1M SERIES MECHANICALLY JOINTED RODLESS CYLINDER.

The MY1M series mechanically jointed rodless cylinder is manufactured by SMC corporation. The product is designed for integration is systems where are necessary linear movements and it provides a slide table accuracy of approx. ±0.12mm. The high accuracy is obtained by using an slide bearing assembly. The cylinder cam be mounted in several positions, but depending on the position the maximum moment and the maximum load differ. In figure 1 are presented the possible mounting positions of the mechanically jointed rodless cylinder.

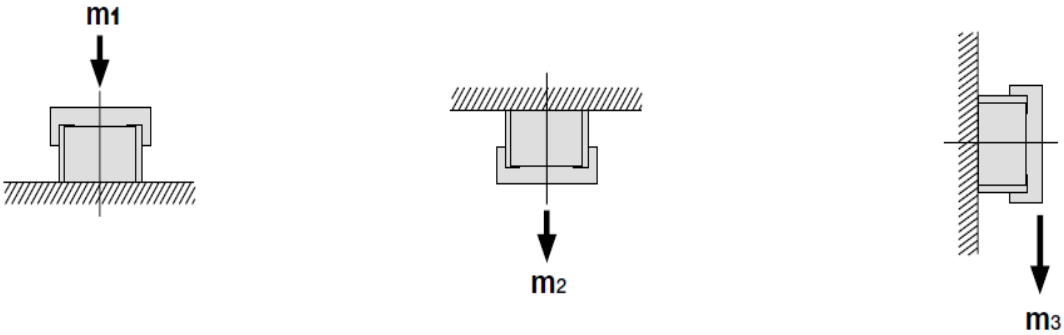

Figure 1. Mounting positions for the MY1B mechanically jointed rodless cylinder [1]

In the application presented in tis paper the MY1M-63 model is used. The maximum allowable moment and the maximum allowable load is presented in table 1.

Table 1-maximum moment and load for the SMC MY1M-63 cylinder [1]

maximum allowable moment (N m)			maximum allowable load (kg)		
m1	m2	m3	m1	m2	m3
140	60	19	180	72	21

In figure 2 is presented the moment –speed diagram for the MY1M-63 mechanically jointed rodless cylinder.

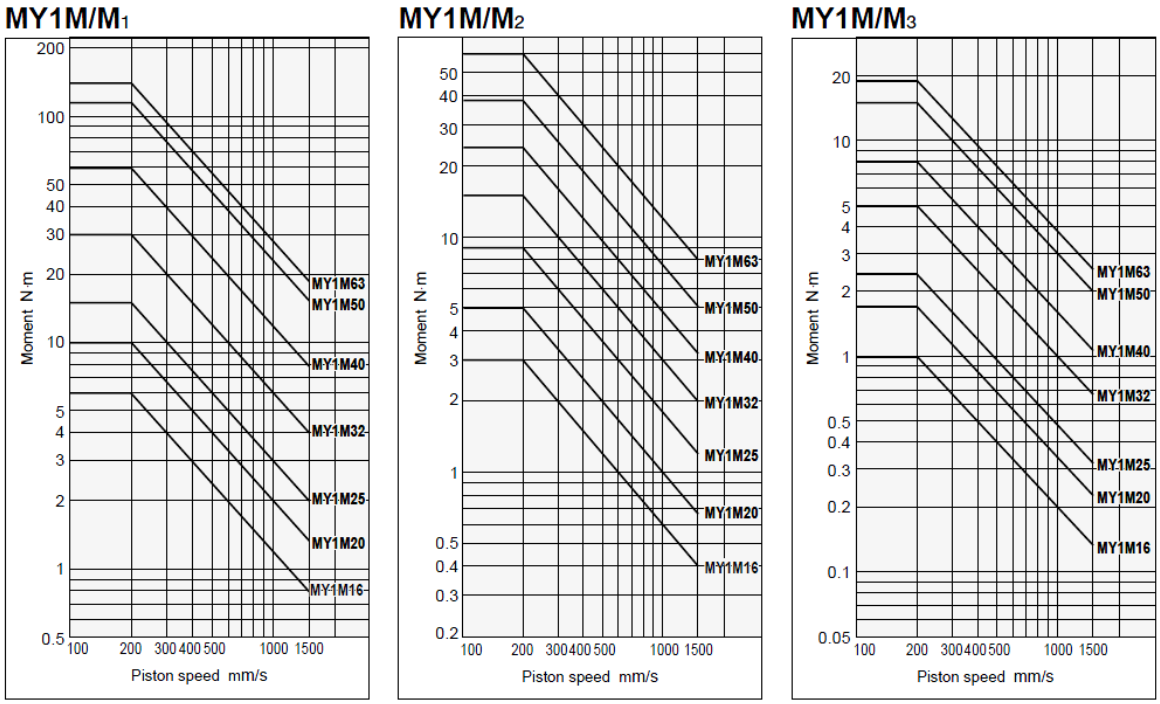

Figure 2. Moment –piston speed diagram for the MY1M-63 cylinder[1].

In figure 3 is presented the load – speed diagram for the MY1M-63 mechanically jointed rodless cylinder.

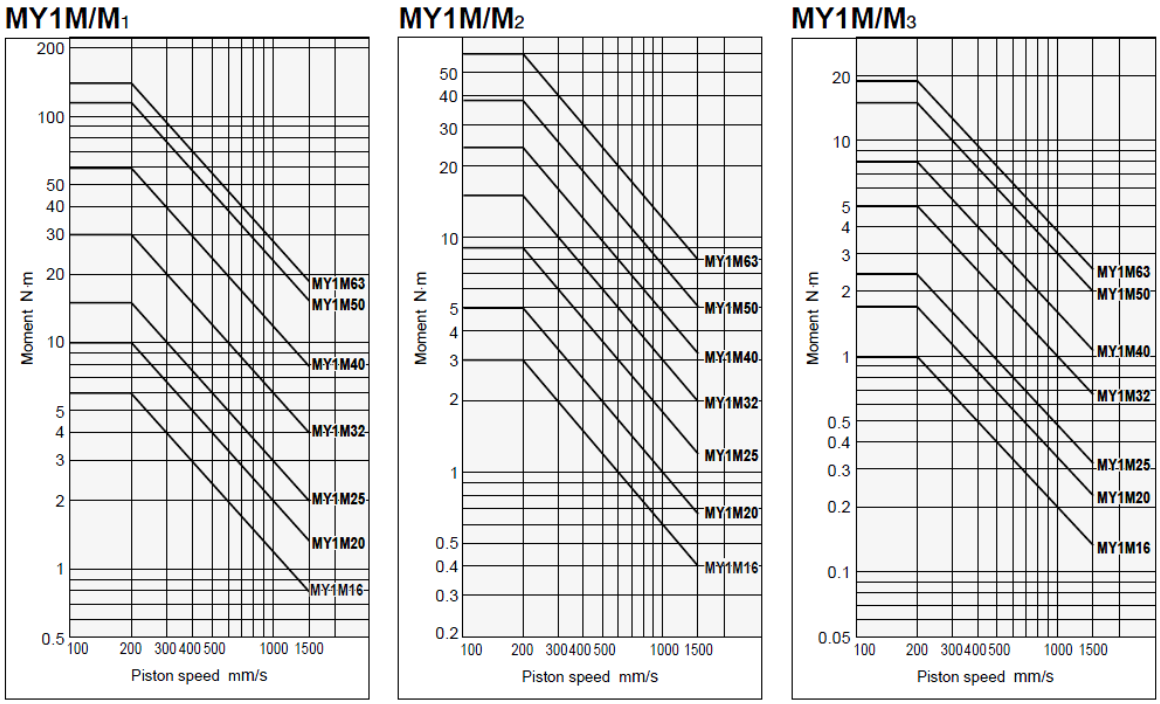

Figure 3. Moment – piston speed diagram for the MY1M-63 cylinder[1].

Figure 3. The MY1M-63 mechanically jointed rodless cylinder [1].

1.2. ELECTRO-PNEUMATIC POSITIONER.

The electro-pneumatic positioner used is manufactured by SMC Corporation. The used model is Series IP6000-31 is presented in figure 4.

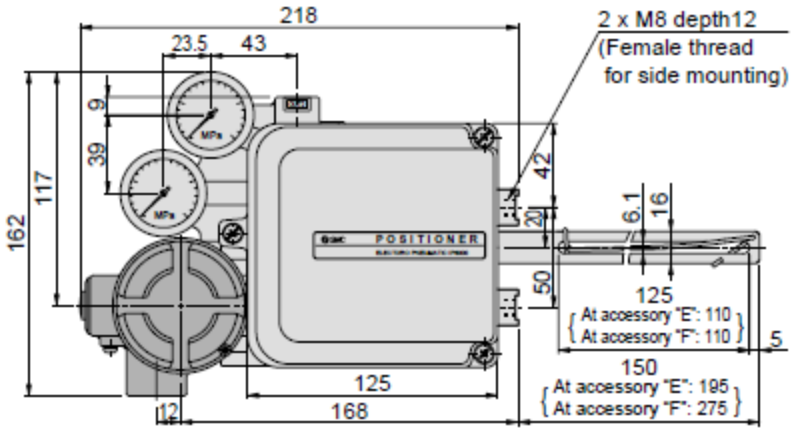

Figure 4. The electro-pneumatic positioned series IP6000-31 [2]

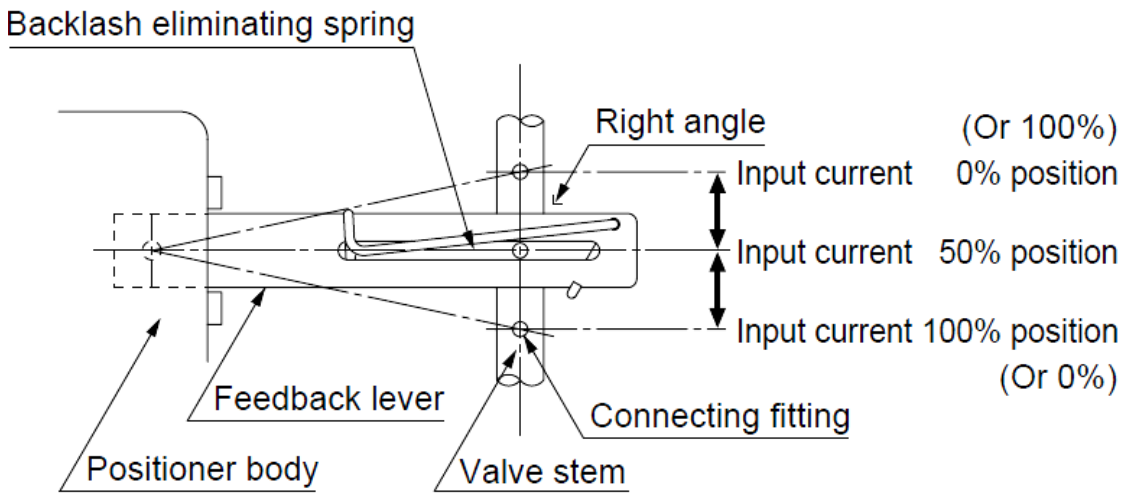

Figure 5. The work principle of the electro-pneumatic positioner, lever type [2]

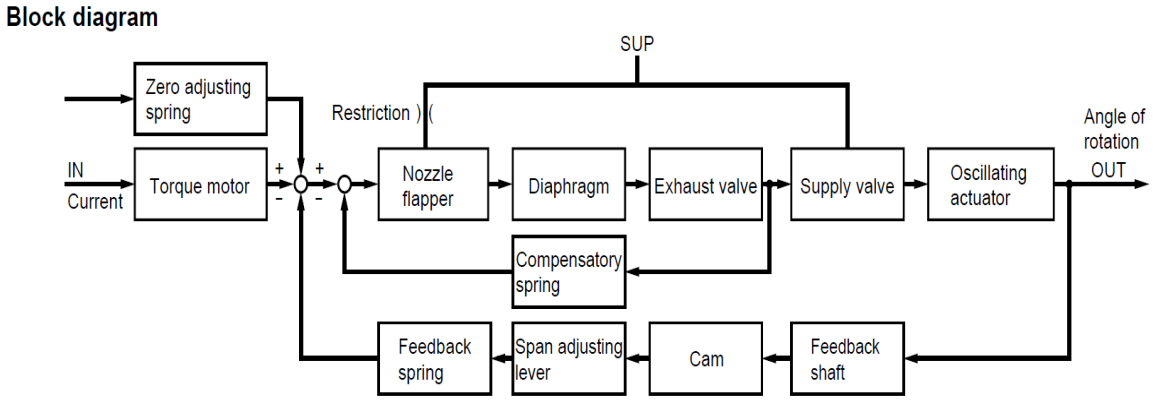

Figure 5. The work principle diagram of the electro-pneumatic positioned [2]

2. POSITIONING SYSTEM

The positioning system is designed to position the mechanically jointed rodless cylinder using a stepper motor. The structure of the system is presented in figure 6.

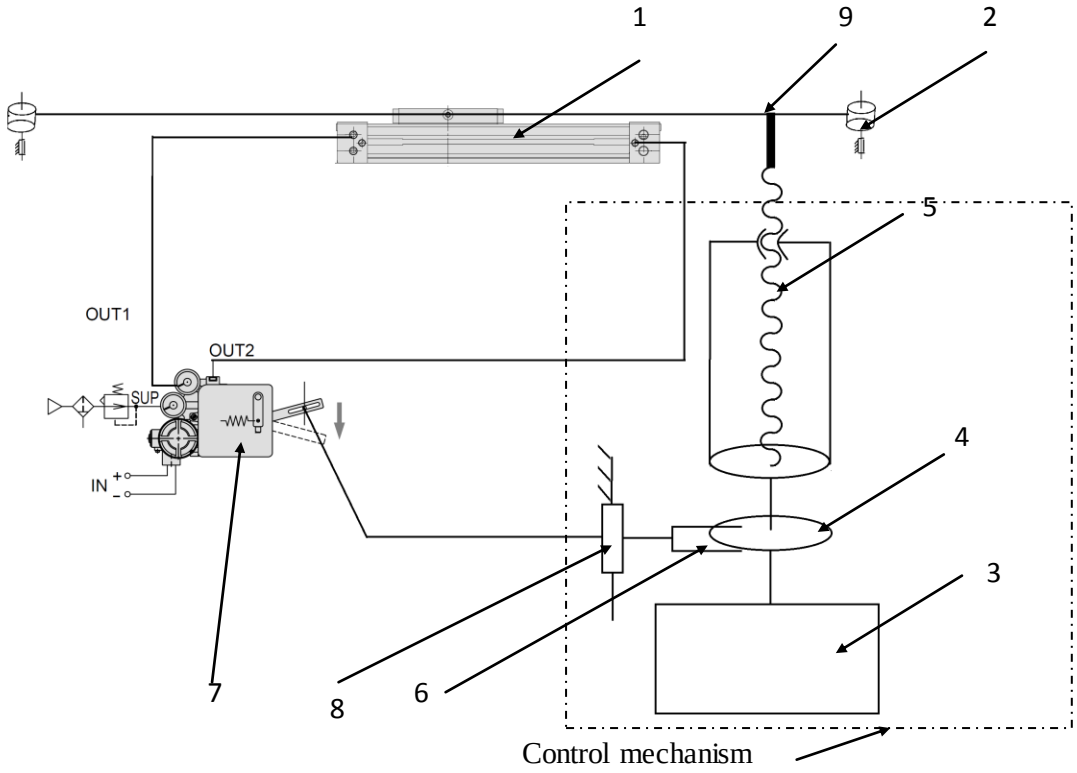

Figure 6. Structure of the positioning system

To the rodless cylinder's carriage a steel cable is fixed, cable which is wrapped around two rollers (2). One of the rollers has the possibility of adjusting the tension in the steel cable. In order to stop the carriages in a programmed position the positioning regulator will be used (7). The signal to the position regulator will be realized using the mechanism formed by the disc (4) and the fork (6). The control mechanism is composed from the stepper motor (position 3), the fork (6), the disk (4) and the nut screw mechanism (position 5). The fork-disk mechanism slides with the help of the joint (8) and the nut screw

mechanism (position 5). The screw is rotated due to the movement of the cable which is wrapped around a pulley (position 9).

When the carriage will move to the left/right the nut will move down/up proportionally to the movement of the carriage, the dimension of the pulley and the screw step. The movement signal will be transferred trough the control mechanism to the leaver of the positioning regulator (position 7).

In order to set a new stop position to the carriage it is possible to lower or rise the position of the disc 4 in relation to the fork 6 by using the stepper motor 3 which is mounted on the axis of the screw.

Initially is necessary a calibration of the system in order to ensure a correct positioning of the electro-pneumatics lever.

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