FY400

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smar

OPERATION, MAINTENANCE
AND INSTRUCTION MANUAL

Smart Valve Positioner

HART COMMUNICATION PROTOCOL

NOV / 15

FY400

VERSION 2

FY400ME

smar

www.smar.com

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Up-to-date address information is available on our website.

web: www.smar.com/contactus.asp

This instructions manual includes information about specification, in stallation, operation and maintenance for the Smart Valve Positioner **FY400** Series. The manual describes all **FY400** Smar Valve Positioner Series functionalities.

Only qualified personnel should install, operate and perform **FY400** maintenance.

Any doubt involving these instructions or (for) information not included in this manual, please contact the Smar Marketing Department for clarifications or more information.

SMAR - MARKETING DEPARTAMENT: +55 16 3946-3519

THIS MANUAL CONTAINS:

This manual contains the sections listed below. Each section has it own index. Consult the index of each section for a complete list of subsections.

INTRODUCTION

Informs the manual content and describes the **FY400 in short**.

Section 1 - INSTALLATION

Shows information about installation on actuators and the **FY400** electric and pneumatic connections.

Section 2 - OPERATION

Clarifies details on the operation, how the **FY400** works.

Section 3 - SPECIFICATIONS

Describes the **FY400** specifications and other related information.

Section 4 - LOCAL ADJUSTMENT

Shows the **FY400** local programming instructions.

Section 5 - CONFIGURATION

Details the **FY400** configuration instructions.

Section 6 - MAINTENANCE

Describes troubleshooting and their solutions, and **FY400** maintenance procedures.

Section 7 - SPARE PARTS

FY400 spare parts and materials.

INTRODUCTION

The FY400 is a smart positioner for linear or rotary control valves, which may use single action (spring return) pneumatic actuators or double action actuators.

It is based on a field-proven piezo flapper and non-contacting Hall-effect position sensor that provides reliable operation and safe performance. The digital technology used in the **FY400** enables the choice of several types of flow characterizations of the final control element. In addition, it has an easy interface between the field and the control room among several interesting features that considerably reduce installation, operation and maintenance costs.

The **FY400**, besides the normal functions offered by other conventional positioners, offers the following functions:

Table – through a 16-point table, the user may configure his own characterization curve, in addition to the regular valve characterization functions, such as linear, same percentage and quick hyperbolic opening.

Local Adjustment - not only for travel adjustment, but also flow characterization, tuning, operation mode, indication, set point and PID (proportional, integral, and derivative) parameters.

Password - three levels for different functions.

Operation Counter - shows the number of changes in each function.

Auto Tuning - Automatic tuning of valve travel and PID parameters.

Auto Setup - It is an automatic procedure that allows the positioner to check the valve stroke limits, giving, at the end of the procedure, a diagnosis indicating possible assembling problems.

Diagnostic - Permanent valve monitoring condition for preventive or predictive maintenance.

Get best results of the **FY400** by carefully reading this instruction manual.

WARNING
Throughout the operation of the positioner, including self setup, do not touch the moving parts of the valve/actuator/positioner set as they may unexpectedly move. Make sure to disconnect the air supply before touching any moving parts.

NOTE
This manual is compatible with version 2.XX, where 2 indicates software version and XX software release. The indication 2.XX means that this manual is compatible with any release of software version 2.

Waiver of responsibility

The contents of this manual abides by the hardware and software used on the current equipment version. Eventually there may occur divergencies between this manual and the equipment. The information from this document are periodically reviewed and the necessary or identified corrections will be included in the following editions. Suggestions for their improvement are welcome.

Warning

For more objectivity and clarity, this manual does not contain all the detailed information on the product and, in addition, it does not cover every possible mounting, operation or maintenance cases.

Before installing and utilizing the equipment, check if the model of the acquired equipment complies with the technical requirements for the application. This checking is the user's responsibility.

If the user needs more information, or on the event of specific problems not specified or treated in this manual, the information should be sought from Smar. Furthermore, the user recognizes that the contents of this manual by no means modify past or present agreements, confirmation or judicial relationship, in whole or in part.

All of Smar's obligation result from the purchasing agreement signed between the parties, which includes the complete and sole valid warranty term. Contractual clauses related to the warranty are not limited nor extended by virtue of the technical information contained in this manual.

Only qualified personnel are allowed to participate in the activities of mounting, electrical connection, startup and maintenance of the equipment. Qualified personnel are understood to be the persons familiar with the mounting, electrical connection, startup and operation of the equipment or other similar apparatus that are technically fit for their work. Smar provides specific training to instruct and qualify such professionals. However, each country must comply with the local safety procedures, legal provisions and regulations for the mounting and operation of electrical installations, as well as with the laws and regulations on classified areas, such as intrinsic safety, explosion proof, increased safety and instrumented safety systems, among others.

The user is responsible for the incorrect or inadequate handling of equipments run with pneumatic or hydraulic pressure or, still, subject to corrosive, aggressive or combustible products, since their utilization may cause severe bodily harm and/or material damages.

The field equipment referred to in this manual, when acquired for classified or hazardous areas, has its certification void when having its parts replaced or interchanged without functional and approval tests by Smar or any of Smar authorized dealers, which are the competent companies for certifying that the equipment in its entirety meets the applicable standards and regulations. The same is true when converting the equipment of a communication protocol to another. In this case, it is necessary sending the equipment to Smar or any of its authorized dealer. Moreover, the certificates are different and the user is responsible for their correct use.

Always respect the instructions provided in the Manual. Smar is not responsible for any losses and/or damages resulting from the inadequate use of its equipments. It is the user's responsibility to know and apply the safety practices in his country.

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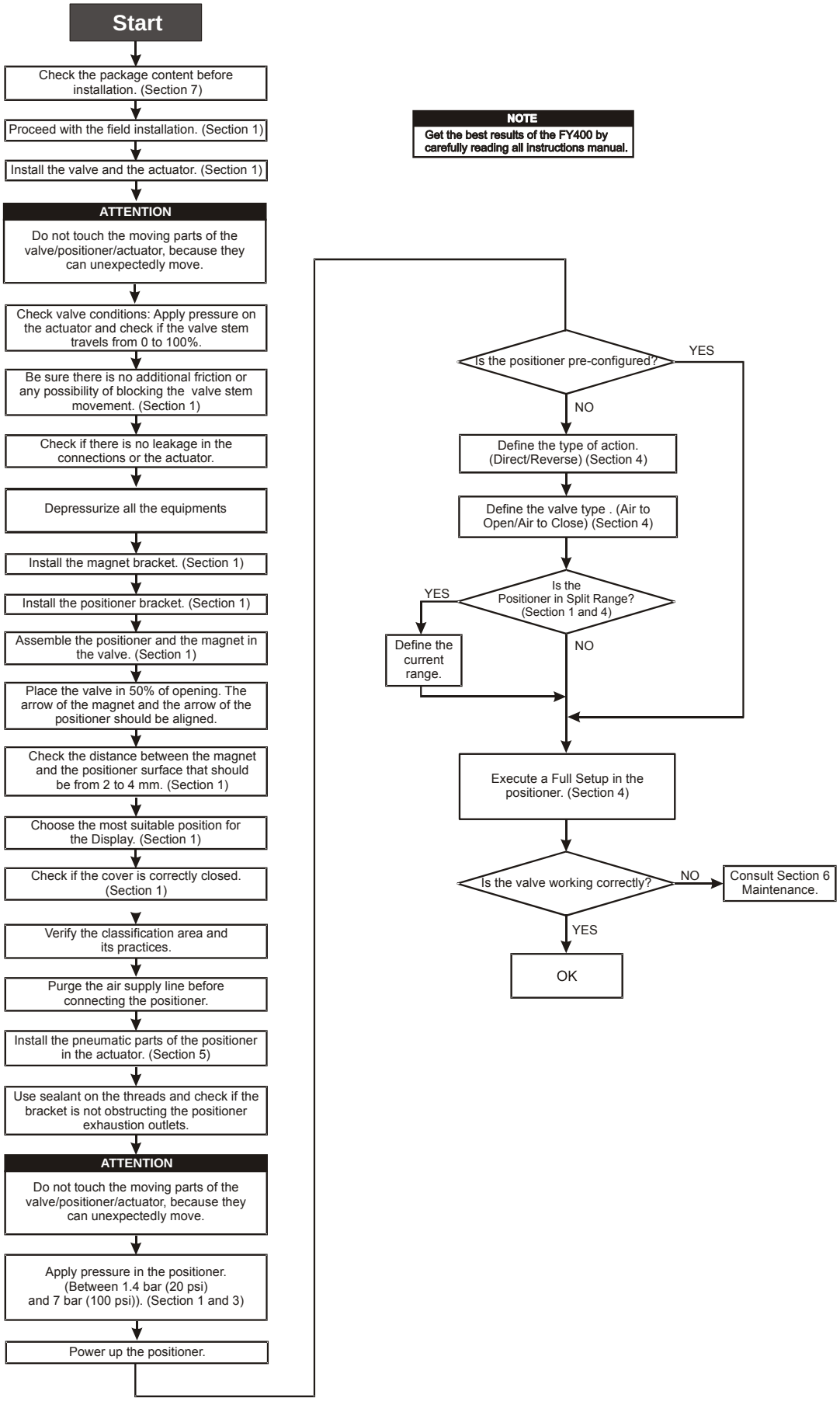

Start
Check the package content before installation. (Section 7)
Proceed with the field installation. (Section 1)
Install the valve and the actuator. (Section 1)
ATTENTION
Do not touch the moving parts of the valve/positioner/actuator, because they can unexpectedly move.
Check valve conditions: Apply pressure on the actuator and check if the valve stem travels from 0 to 100%.
Be sure there is no additional friction or any possibility of blocking the valve stem movement. (Section 1)
Check if there is no leakage in the connections or the actuator.
Depressurize all the equipments
Install the magnet bracket. (Section 1)
Install the positioner bracket. (Section 1)
Assemble the positioner and the magnet in the valve. (Section 1)
Place the valve in 50% of opening. The arrow of the magnet and the arrow of the positioner should be aligned.
Check the distance between the magnet and the positioner surface that should be from 2 to 4 mm. (Section 1)
Choose the most suitable position for the Display. (Section 1)
Check if the cover is correctly closed. (Section 1)
Verify the classification area and its practices.
Purge the air supply line before connecting the positioner.
Install the pneumatic parts of the positioner in the actuator. (Section 5)
Use sealant on the threads and check if the bracket is not obstructing the positioner exhaustion outlets.
ATTENTION
Do not touch the moving parts of the valve/positioner/actuator, because they can unexpectedly move.
Apply pressure in the positioner. (Between 1.4 bar (20 psi) and 7 bar (100 psi)). (Section 1 and 3)
Power up the positioner.
NOTE
Get the best results of the FY400 by carefully reading all instructions manual.
Is the positioner pre-configured?
YES
NO
Define the type of action. (Direct/Reverse) (Section 4)
Define the valve type . (Air to Open/Air to Close) (Section 4)
Is the Positioner in Split Range? (Section 1 and 4)
YES
NO
Define the current range.
Execute a Full Setup in the positioner. (Section 4)
Is the valve working correctly?
NO
Consult Section 6 Maintenance.
YES
OK

Section 1

INSTALLATION

General

NOTE
The installation carried out in hazardous areas should follow the recommendations of the IEC60079-14 standard.

The overall accuracy of measuring and control depends on several factors. In spite of the excellent performance, the positioner must be adequately installed so that it may work well.

Among all factors that may affect the positioner accuracy , environmental conditions are the most difficult to control. But there are ways to reduce the effectsof temperature, humidity and vibration.

Installing the positioner in ar eas protected from extreme environmental changes can minimize temperature fluctuation effects. In warm environments, the positioner should be installed to avoid, as much as possible, direct exposure to the sun. Installation close to lines and vessels subjected to high temperatures should also be avoided. If not possible to avoid it, consider using the remote position sensor version.

Use thermal isolation to protect the positioner from external heart sources, if necessary.

Humidity is fatal to electronic circuits. In areas subjected to high relative humidity, the O-rings for the electronic housing covers must be correctly placed and the covers must be completely closed by tighten them by hand until y ou feel the O-rings being compressed. Do not use tools to tight the covers. Removal of the electronics cover in the field should be reduced to the minimum necessary, since each time it is removed; the circuits are exposed to the humidity.

The electronic circuit is protect ed by a humidity proof coating, but frequent ex posures to humidity may affect the protection provided. It is also important to keep t he covers tightened in place. Every time they are removed, the th reads are exposed to corrosion, si nce painting cannot protect these parts. Sealing methods should be employed on conduit entering of the positioner.

IMPORTANT
Avoid to use thread sealant tapes on the air input and outputs connections, since small pieces of this type of sealant may block the air flow inside the positioner, affecting the overall equipment performance.

Although the positioner is practica lly vibration resistant, it is not recommended to install it near pumps, turbines or other equipament producing too much vibration. If not possible to avoid it, consider using of remote position sensor version.

Mounting

The FY400 mounting depends on the type of actuator, its actions, si ngle (with spring return) or double, and the movement characteristic (linear or rotary). It requires two mounting brackets: one for the magnet and another for t he positioner. Smar supplies both acco rding to the specified ordering code (see Page 7.6 for mounting bracket ordering code).

Additionally, a great variety of customized mounting brackets is ava ilable, covering several control valves models from different manufacturers.

Check the availability and select the most adequate mounting bracket to your need, by visiting our web page on the Internet: http://www.smar.com. Select "Valve Positioner" option to access the product specific page. After enter y our login and password, click on the **Bracket for FY** link and choose the most appropriate mounting bracket to your application.

See below an example showing the Positioner with rotary and linear magnets.

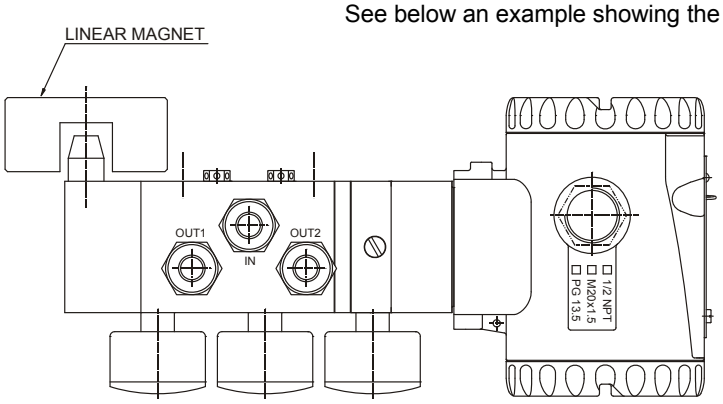


Figure 1.1 – Positioner and Linear Magnet

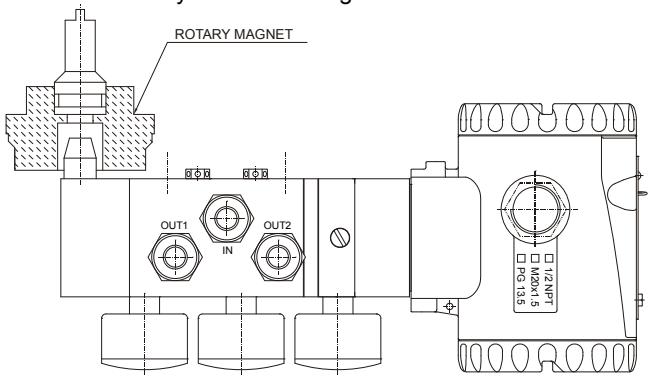


Figure 1.2 – Positioner and Rotary Magnet

IMPORTANT
Smar web site (www.smar.com) has options of mounting brackets available for several actuators of several manufacturers and models and the related dimensional drawings.

Rotary Movement

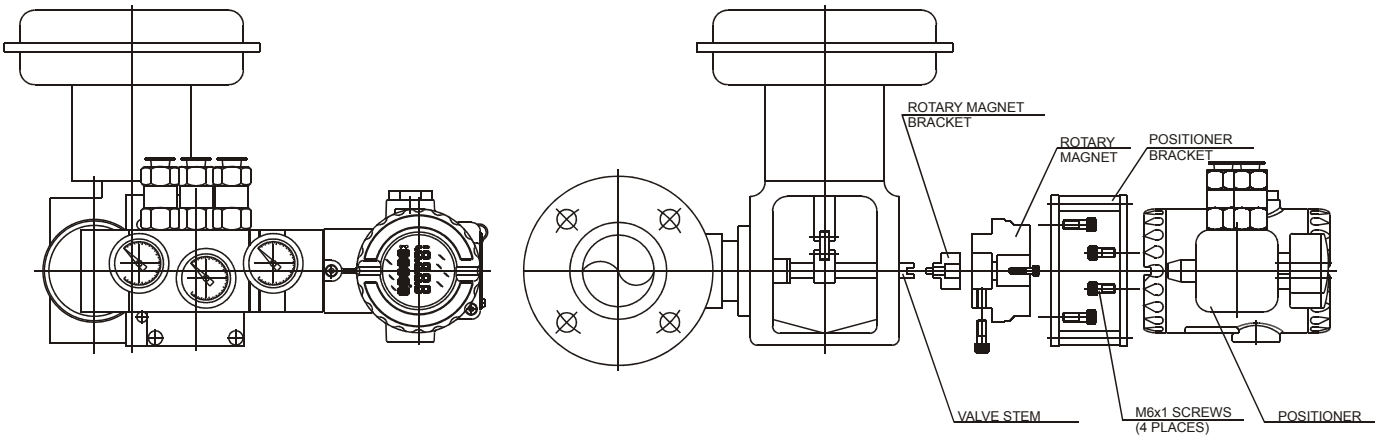


Figure 1.3 – Positioner with Rotary Actuator

NOTE
Included in the package content the **centralizer device of rotary magnet.** See figure 1.21-B.

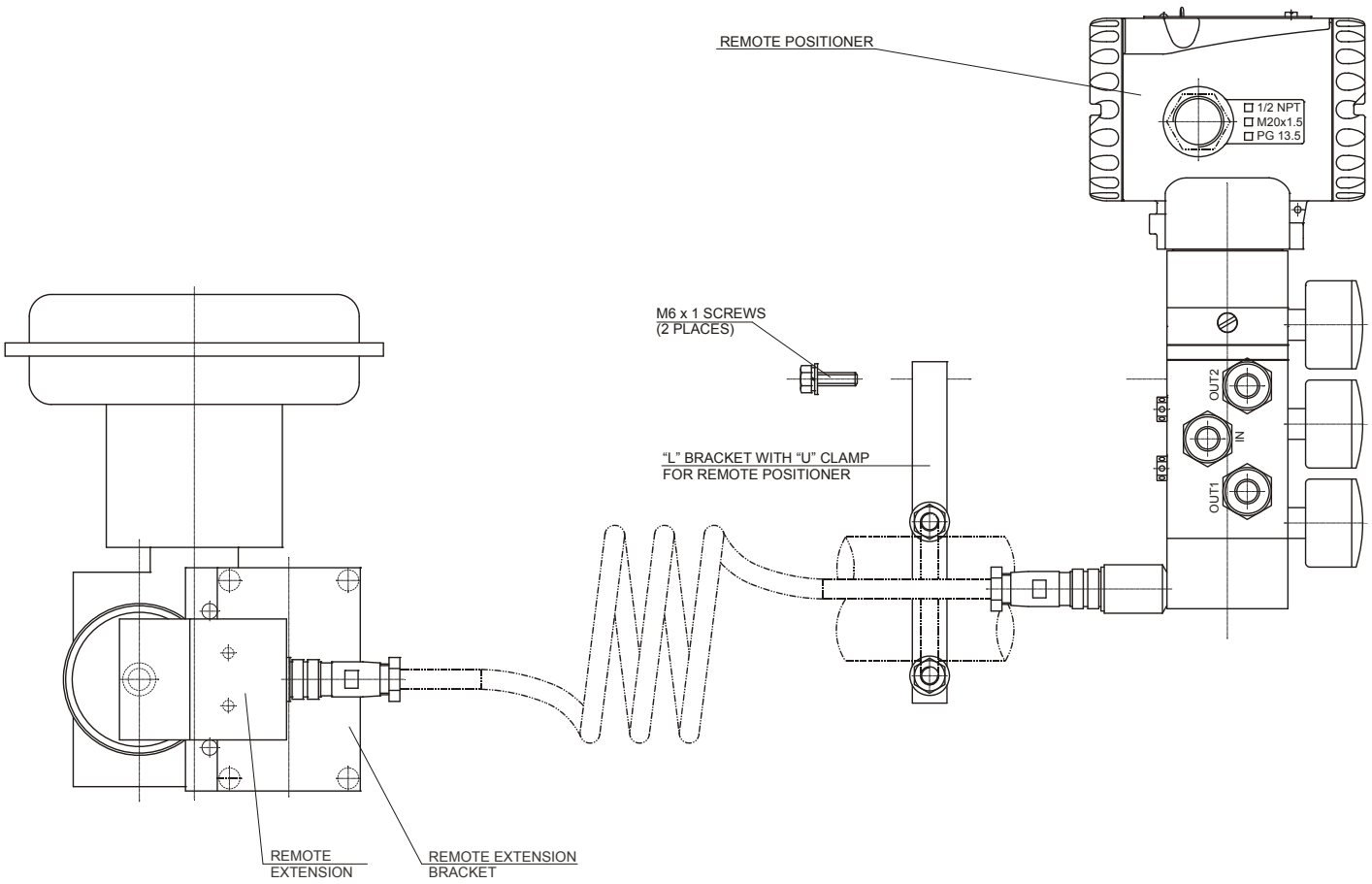


Figure 1.4 – Positioner in Rotary Actuator with Remote Position Sensor

Install the magnet on the valve stem using the its proper bracket, according to the Figure 1.3.

Then, install the positi oner bracket on the actuator. Usually , the actuador is designed according to the VDI/VDE 3845 standard, and, in this case, tight en the four screw s with their lock washeers on the proper bracket.

NOTE
Make sure that the arrow engraved on the magnet coincides with the arrow engraved on the positioner when the valve is in mid travel. When mounting the magnet, be sure that: 1. There is no attrict betw een the internal magnet face and the position sensor salience during the travel (rotary or linear), through the magnet. 2. The magnet and the salience of position sensor must not be distant. A minimum distance of 2 mm and a maximum distance of 4mm are recommended betw een the magnet external face and the positioner face. For that, a cent ralizer device (linear or rotary) must be used. The centralizer device is in the positioner packing.

Case the positioner installation or magnet change or if any other modification is done, the positioner will require a re-calibration. See Section 5 for Auto-Setup procedure.

See item "Pneumatic Connections" as recommended practice to insta ll the positioner to the valve type.

Linear Movement
Install the magnet on the valve stem using its proper bracket, according to Figure 1.5.

Install the positioner bracket on t he actuator. The fastening of the actuator br acket may follow the NAMUR/IEC 60534-6-1 standard or be in accordance w ith the user specified boring. Mount the positioner on the bracket by fastening the four screw s in the holes of the pressure gauges opposite face. Use lock washers to avoid loosening the screws.

The linear magnet movement must be orthogonal in relation to t he main axis of the position positioner. For example, if the li near magnet movement is vertical, the positioner main axis must be horizontal, as show in Figure 1.5.

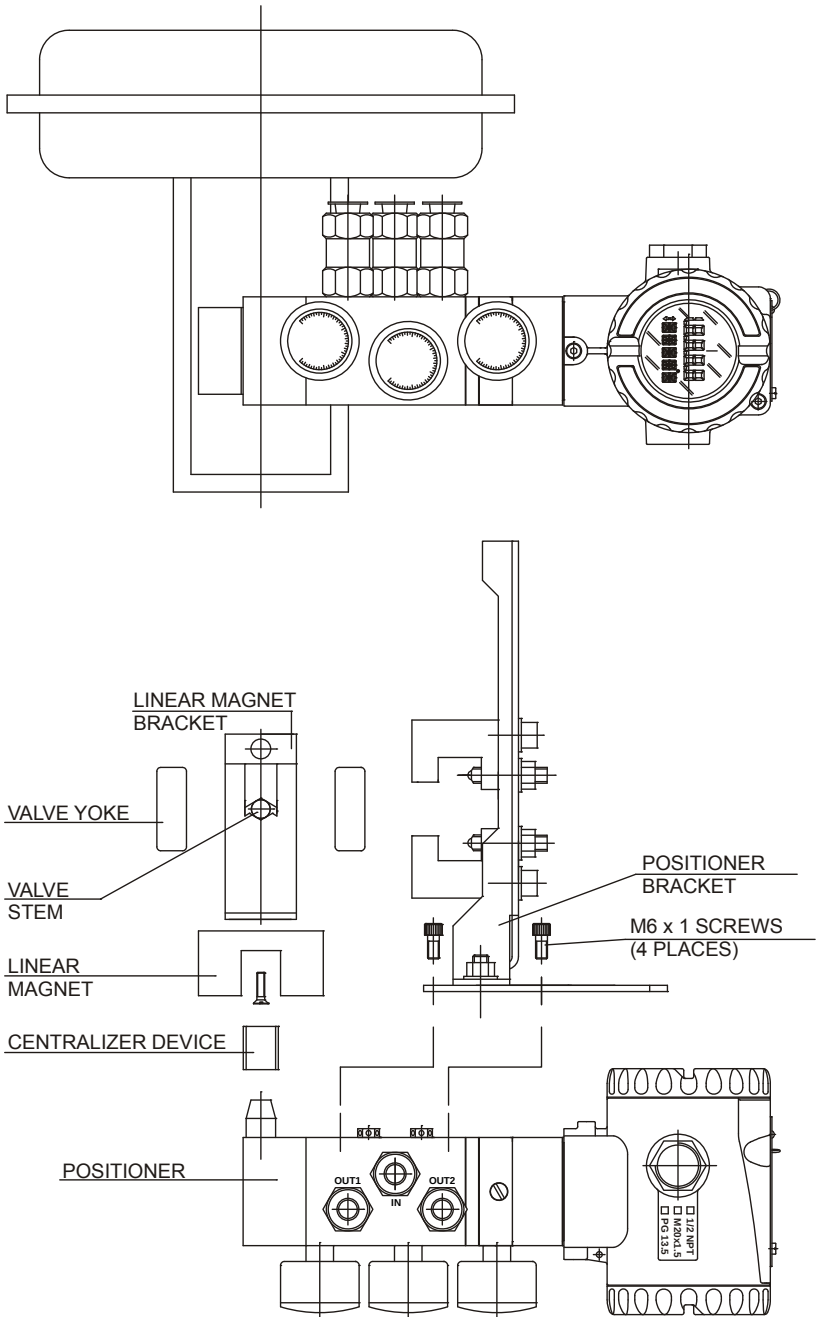


Figure 1.5 – Positioner in Linear Actuator

NOTE
Included in the package content the **centralizer device of linear magnet.** See figure 1.21-A.

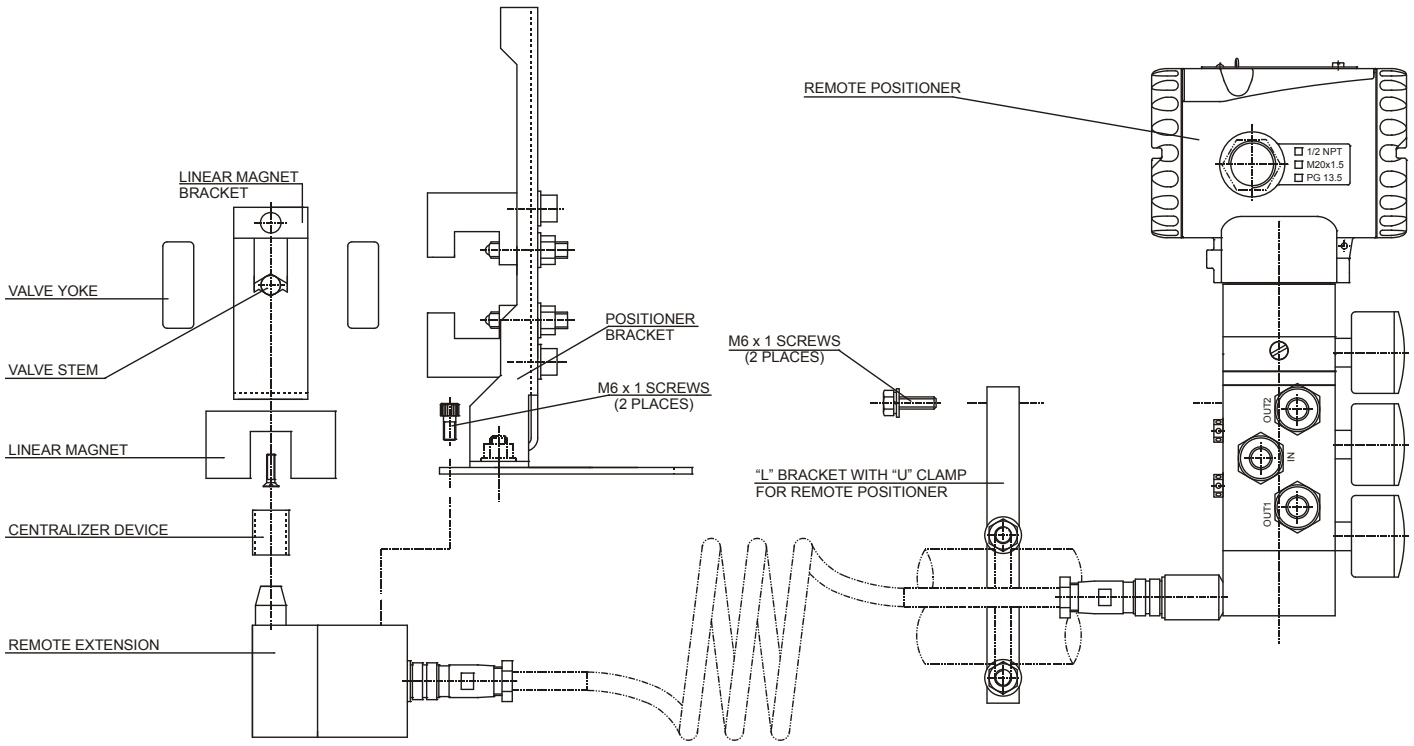


Figure 1.6 – Positioner in Linear Actuator with Remote Position Sensor

Make sure the bracket does not obstruct the exhaust outputs.

NOTE
Make sure that the arrow engraved on the magnet coincides with the arrow engraved on the positioner when the valve is in mid travel. When mounting the magnet, be sure that: 1. There is no attrict betw een the internal magnet face and the position sensor salience during the travel (rotary or linear), through the magnet. 2. The magnet and the salience of position sensor must not be distant. A minimum distance of 2 mm and a maximum distance of 4mm are recommended betw een the magnet external face and the positioner face. For that, a cent ralizer device (linear or rotary) must be used. The centralizer device is in the positioner packing.

Case the positioner installation or magnet change or if any other modification is done, the positioner will require a re-calibration. See Section 5 for Auto-Setup procedure.

Pneumatic Connections

The FY400 requires instrument air quality , following the best practices for pneumatic installations. Consult the American National St andard "Quality Standard for Instrum ent Air" (ANSI/ISA S7.0.01 - 1996) for detailed information.

The **FY400** comes with input and output stainless steel air filters, but these filters do not exclude the preliminary instrument air treatment. Periodical f ilter cleaning is recommended at every 6 months or less, if the air quality is not good. Please, check the maintenance section for clean the filters.

The **FY400** supply air pressure varies from 1.4 bar (20 psi) minimum, to 7.0 bar (100 psi) maximum. The actuator working pressure mu st follow these limits. Consider the use of boosters, if required. Pressure below this range shall affect the posit ioner performance. Pressure above this range may damage the positioner.

The two pneumatic outputs, marked as “OUT1” and “OUT2”, work in opposite directions to open or close the valve.

IMPORTANT
If a failure occurs on the **FY400**, such as power loss (4-20 mA input signal), the output marked OUT1 goes to zero pressure and the output marked OUT2 goes to the air supply pressure value.

The positioner can have pressure gages (see the ordering code table) attached to the supply air input and in each output. The indications on gages are references only and does not have the same overall positioner accuracy.

The pneumatic connections are marked with IN for the air supply and OUT1 and OUT2 for Output1 and Output2, respectively. Use 1/4 NPT connections with sealing material for the NPT screw threads. Connect the air supply on the connection marked IN. Be sure the air supply does not exceed the maximum allowed pressure of the positioner or the actuator.

IMPORTANT
When using tape sealant type on the thread connections, be sure not spread small residues inside, since they may clog the air flow inside the positioner and even impair the equipment efficiency.

The **FY400** has five protected exhaust orifices with filters. Do not block any of these exhaust, as the air must circulate freely through them. If painting the positioner block, remove the filters before, to prevent them from beign obstructed by paint. The orifices must be inspected on a regular basis to ensure they not blocked, granting the air to flow smothly.

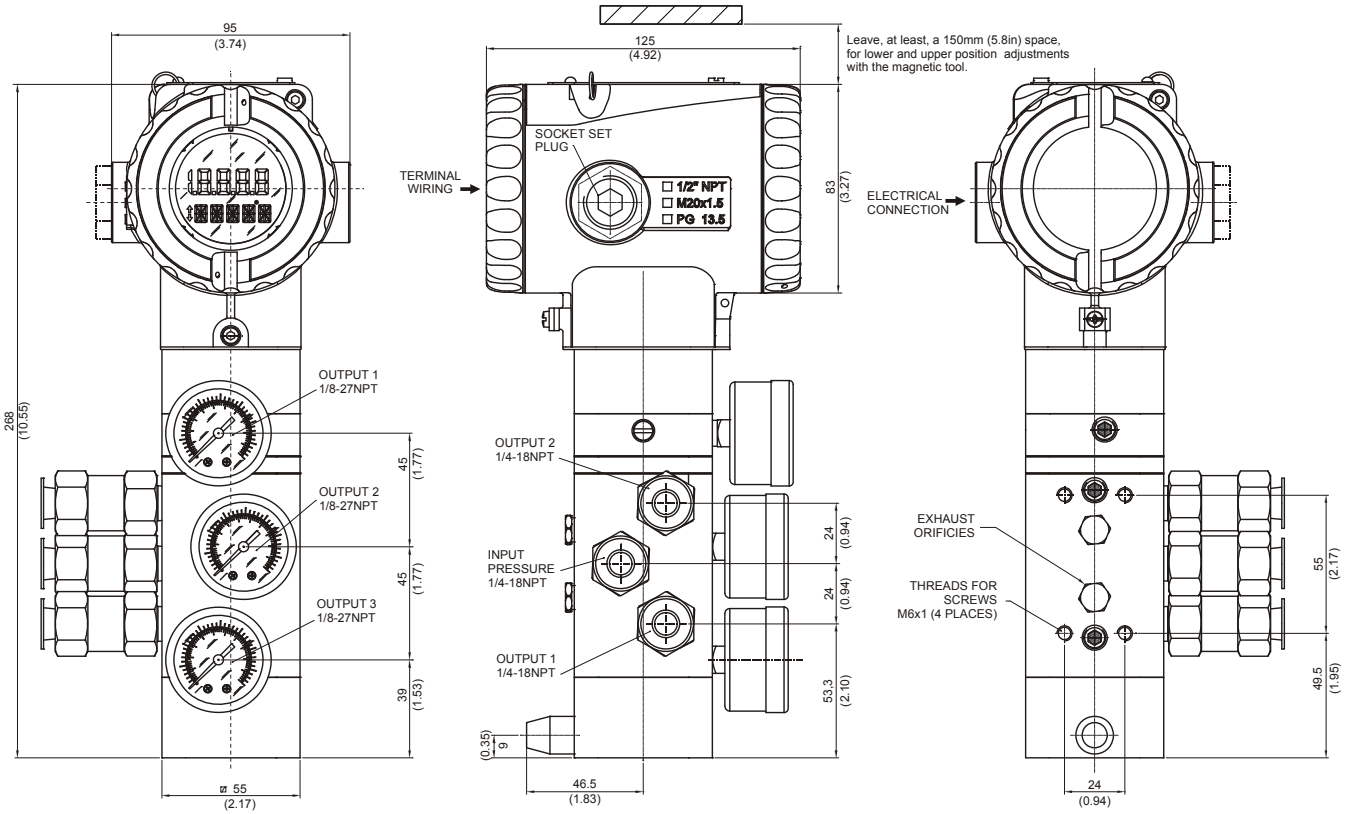
Double Action – Air to open (Close on failure)
Connect the positioner OUT1 output on the actuator connection marked with “OPEN” and connect the positioner OUT2 output on the actuator connection marked with “CLOSE”.

Double Action – Air to close (Open on failure)
Connect the positioner OUT2 output on the actuator connection marked with “OPEN” and connect the positioner OUT1 output on the actuator connection marked with “CLOSE”.

Single Action
Connect the positioner OUT1 output on the actuator input. Use a plug to block OUT2. Pay attention to the safe logic on the actuator for the specific process. If necessary, invert the connections. Take into consideration that in case of power failure the output marked OUT1 goes to zero pressure and the output marked OUT2 goes to the air supply pressure value.

Dimensional Drawing

POSITIONER



DIMMENSIONS IN mm (in)

REMOTE SENSOR POTION

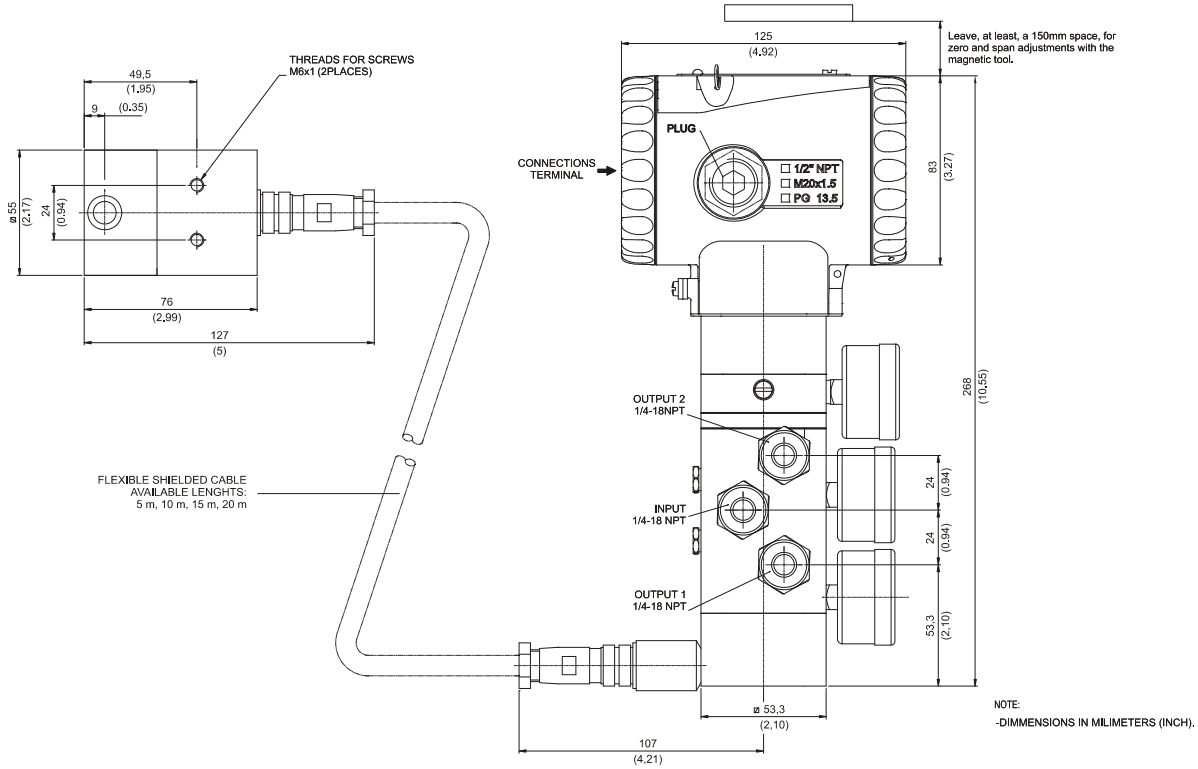
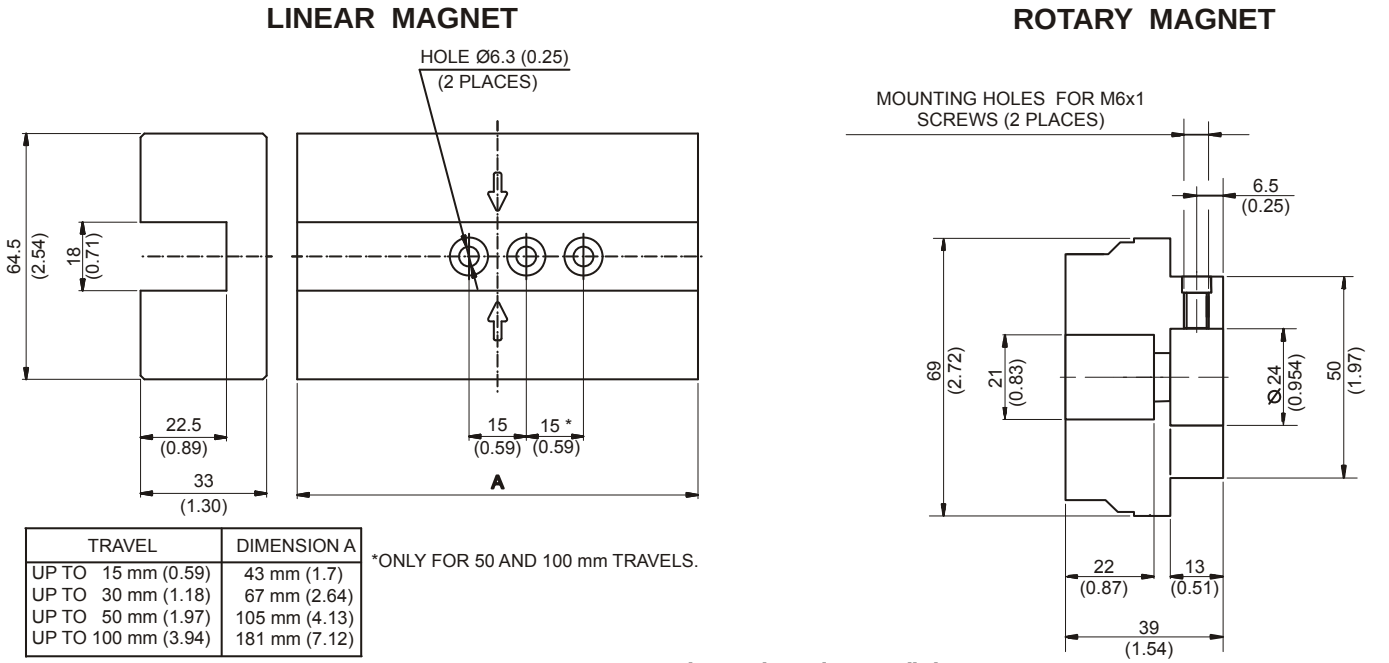


Figure 1.7 – FY400 Dimensional Drawing



TRAVEL	DIMENSION A
UP TO 15 mm (0.59)	43 mm (1.7)
UP TO 30 mm (1.18)	67 mm (2.64)
UP TO 50 mm (1.97)	105 mm (4.13)
UP TO 100 mm (3.94)	181 mm (7.12)

*ONLY FOR 50 AND 100 mm TRAVELS.

Dimensions in mm (in)

Figure 1.8 – Magnet Dimensional Drawing

Electronic Housing Rotation

The electronic housing can be rotated to offer a be tter Display position and/or better access to the field cables. To rotate it loose the Housing Locking Screw as shown on Figure 1.9 below.

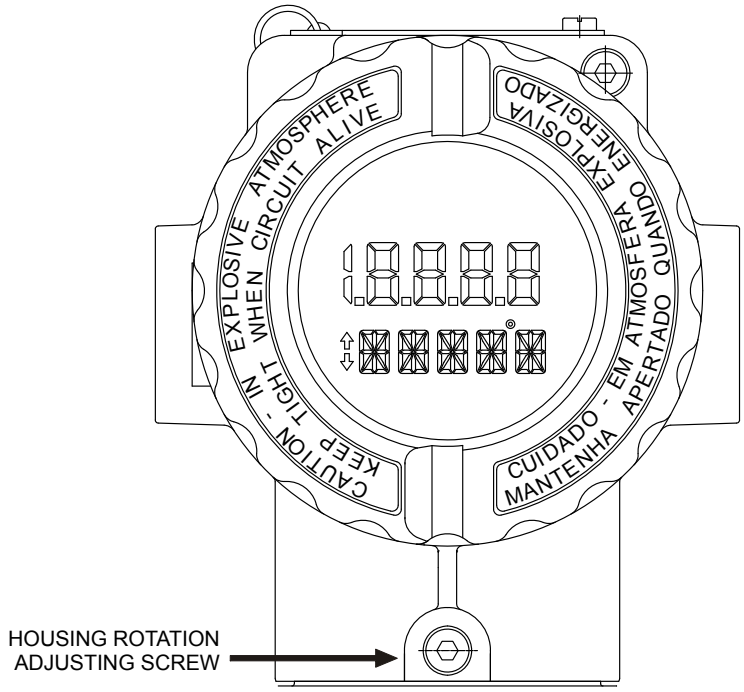


Figure 1.9 – Housing Rotation Adjusting Screw

Electrical Wiring

To access the terminals block loosen the cover locking screw to release the cover as show n in Figure 1.10.

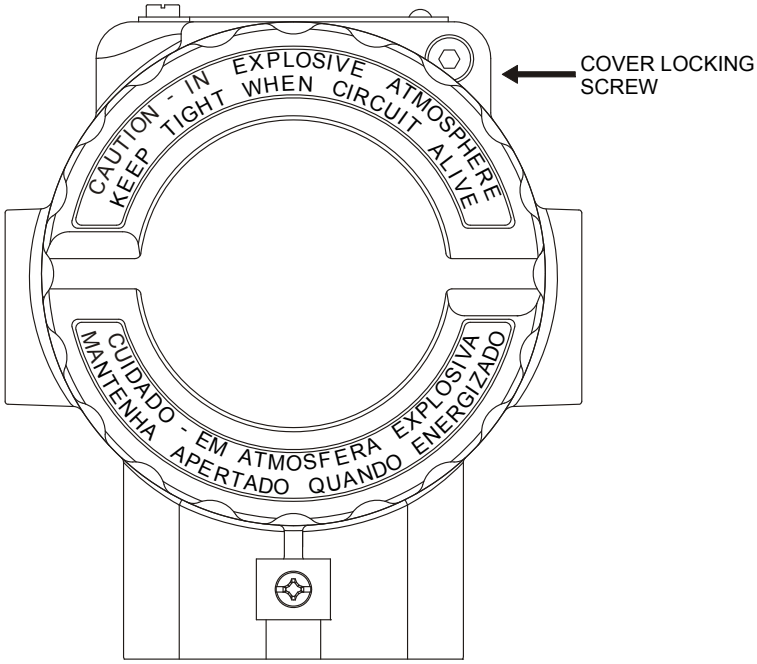


Figure 1.10 – Cover Locking Screw

The wiring block has screws is suitable for fork or eye terminals.

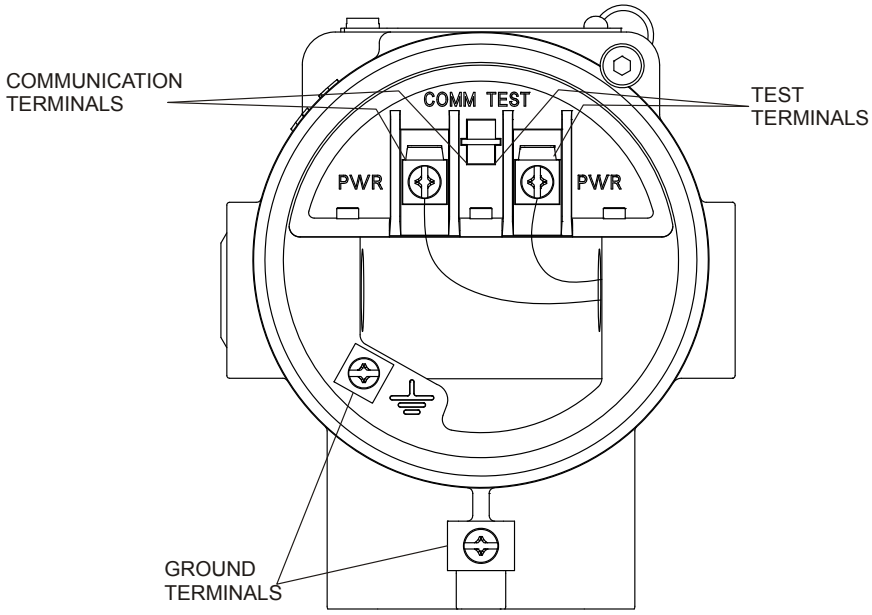


Figure 1.11 – Terminal Block

The FY400 terminal block was developed to allow signal connections regardless their polarity.

Test and Communication terminals allow, respectively, to measure the current in the 4 - 20 mA loop, without opening the circuit, and also to communicate with the Positioner via HART protocol. T he "Test Terminals" is used to measure the current. T he "COMM" terminal is used for HART communication. The terminal block has screws where fork or ring-type terminals can be fastened.

For convenience, **the positioner has two ground terminals**: one internal and one external, both located near the conduit inlet.

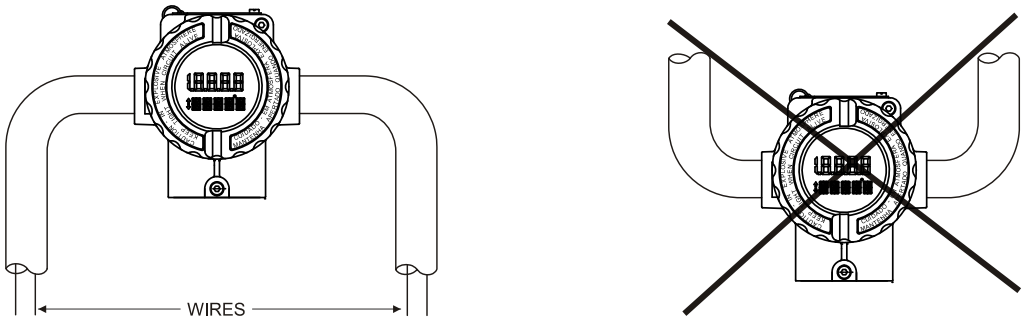


Figure 1.11-A - Conduit Installation Diagram

Use of twisted pair cables (22 AW G or greater) is recommended. F or environments with high EMI interference levels, the use of shielded cables should be observed.

Avoid routing signal wiring near to power cables or switching equipment.

The duct threads must be sealed according to the hazardous area standards.

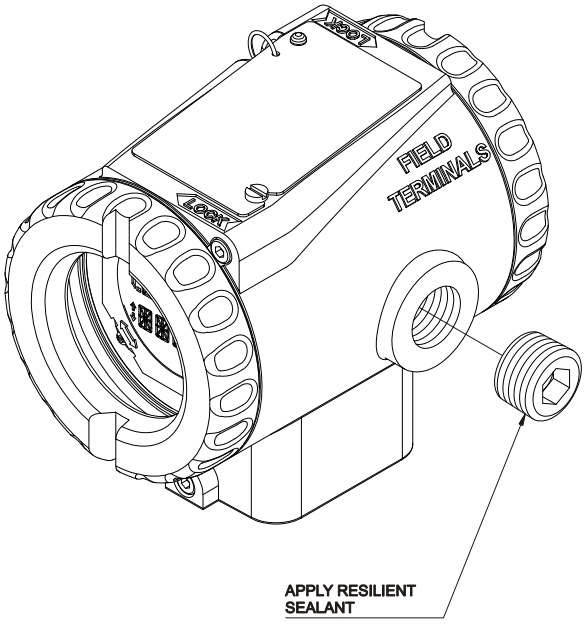


Figure 1.12 – Plug Mounting

The unused cable entries should be plugged and sealed accordingly to avoid humidity entering, which can cause the loss of the product's warranty (see figure 1.12).

Options of Display Assembly

It is possible to turn the Display in four diffe rent positions, making easie r the reading. T he mark ▲, enrolled on the top of Display indicates the reading position. See figure 1.13 below.

After opening the electronic housing cover, release the four screw s of Display. Choose the most appropriate position and re-assembly the whole set.

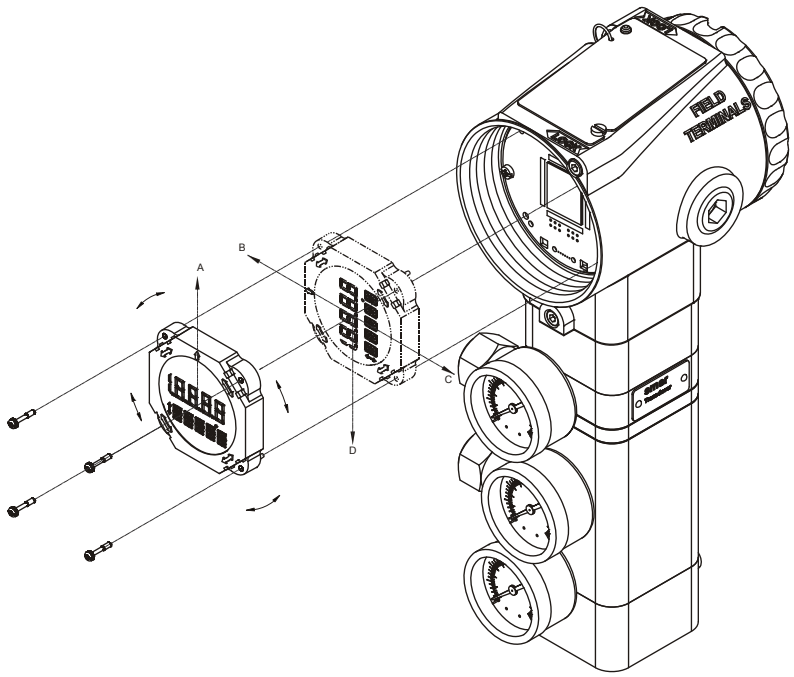


Figure 1.13 – Positions four of Display

Put back the Main Electronic Circuit Board and the Display with your screws.

Typical Installation fot the Hart® Protocol

The **FY400** connection should be made accordingly follwing examples.

Conect the hand held configurator to the communication terminals of positioner or at any point of the cable.

The Hand-Held Terminal can be connected to the co mmunication terminals of the transmitter or at any point of the signal line by using the alligator clips. It is also recommended to ground the shield of shielded cables at only one end. The ungrounded end must be carefully isolated. On multi-drop connections, the circuit loop integrity must be assur ed, with special care to prevent short-circuit between the circuit loop and the housing.

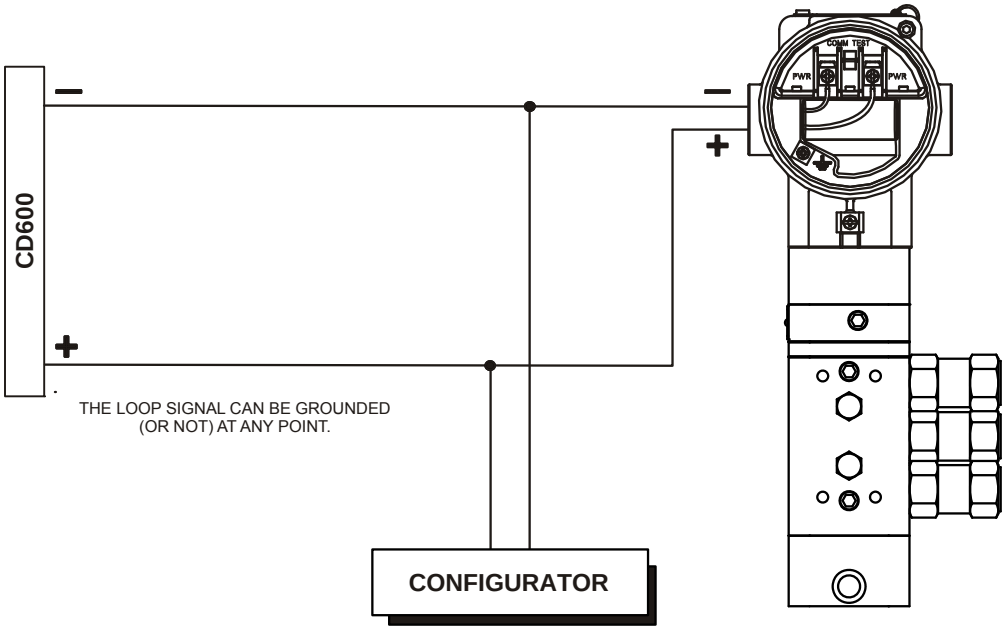


Figure 1.14 – Hart FY400 Wiring Diagram, wiht the CD600

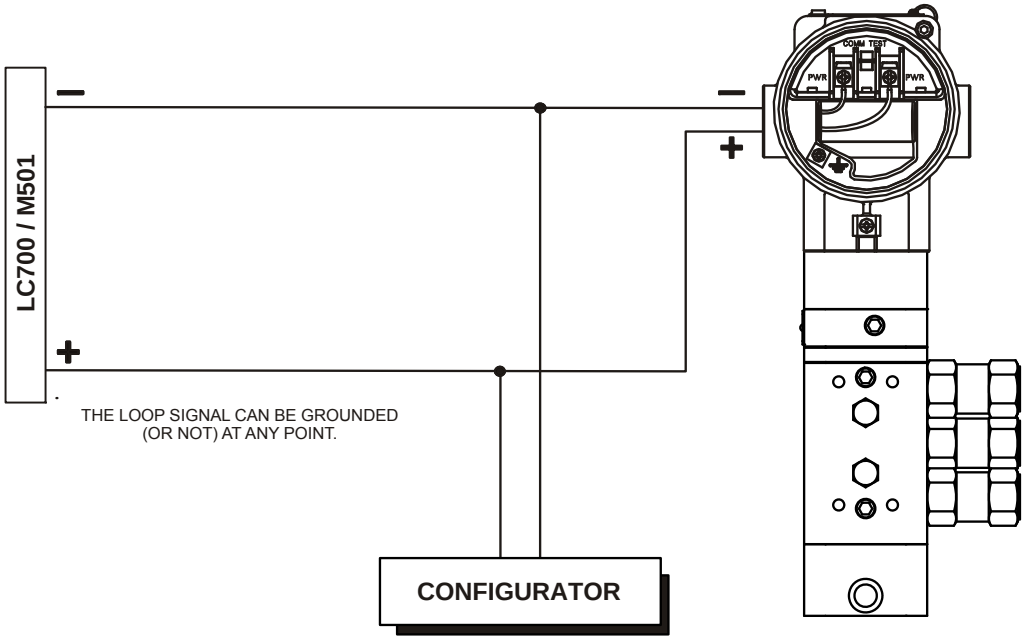


Figure 1.15 - Hart FY400 Wiring Diagram, wiht LC700/M501

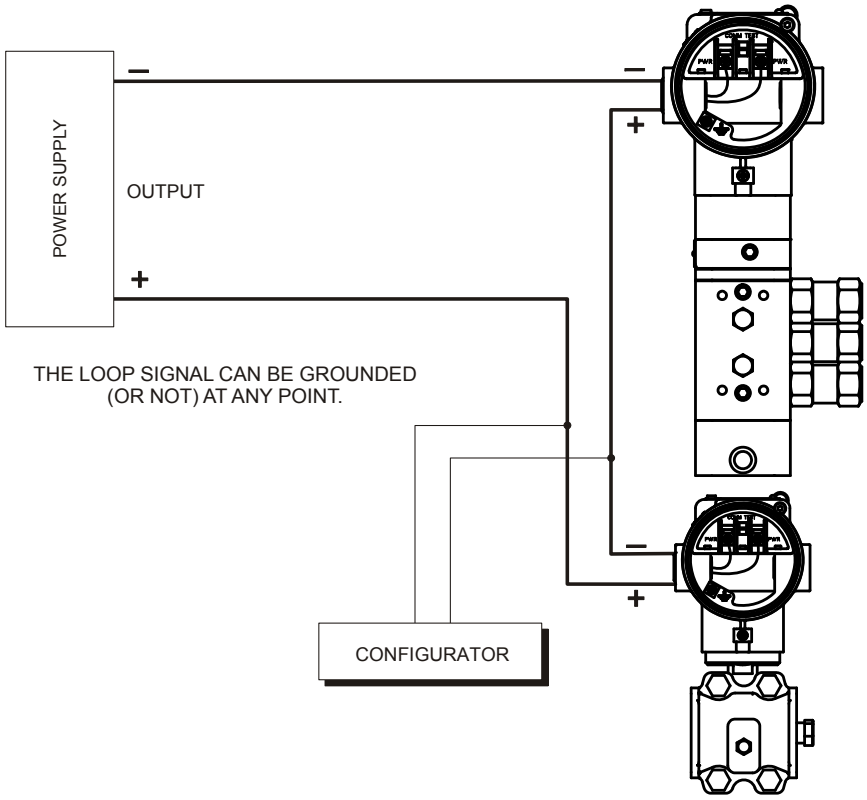


Figure 1.16 - Connected FY400 the a Transmitter Smar working as Controller

The FY400 has an equivalent impedance of 550 Ohms. T herefore, check if t he power supply, the DCS, CLP analog output, or single loop controller powering the positioner is capable to handle a voltage drop of 11 V for the positioner.

IMPORTANT
When having two positioners working in the Split Range mode, connected to only one 4 to 20 mA current source, their impedances are added, resulting 1100 Ohms (in the case of 2 Posicionadores). The maximum voltage drop for the two positioner is 22 Volts. Be sure that the current source is able to drive the 4 o 20 mA for both positioners.

What is a Split Range control?
That type of control involves two positioners connected in series into just one analogical output, each one controlling its own valve. For instance:

- **Positioner 1**: 4 - 12 mA = 0 - 100%;
- **Positioner 2**: 12 - 20 mA = 0 - 100%;

The examples on Figure 1.17 and 1.18 shows a typical installation of a device driving an output of 4 to 20 mA in combination with a power distributor isolator IS400P, granting power both positioners to work in a Split Range application.

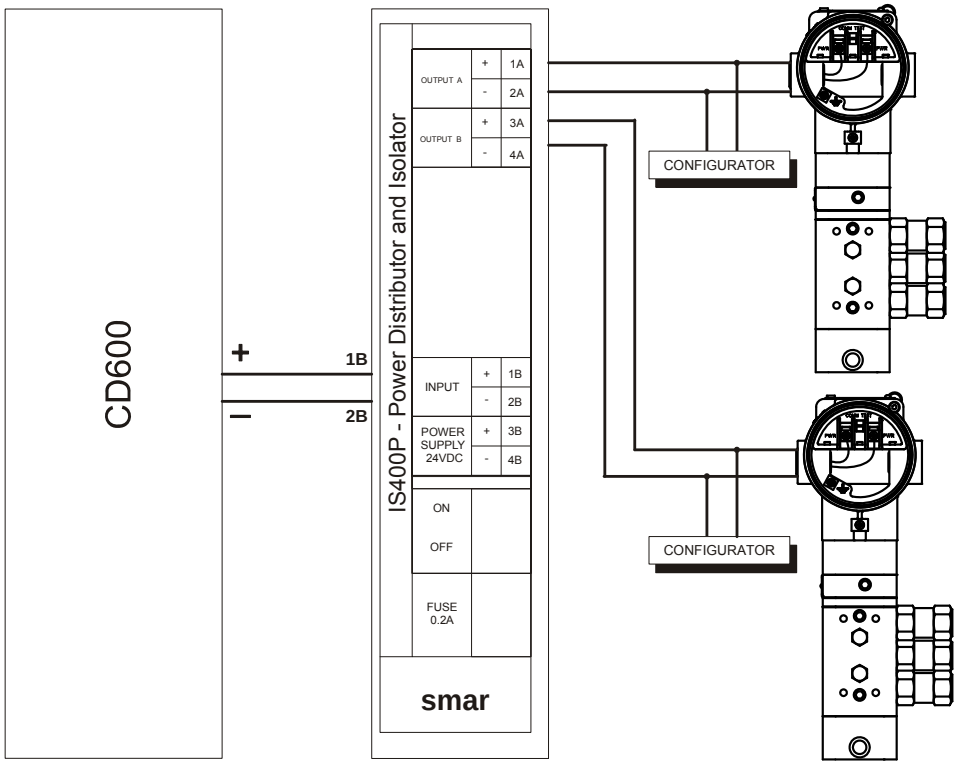


Figure 1.17 – Potitioners Wiring Diagram with CD600, in Split Range.

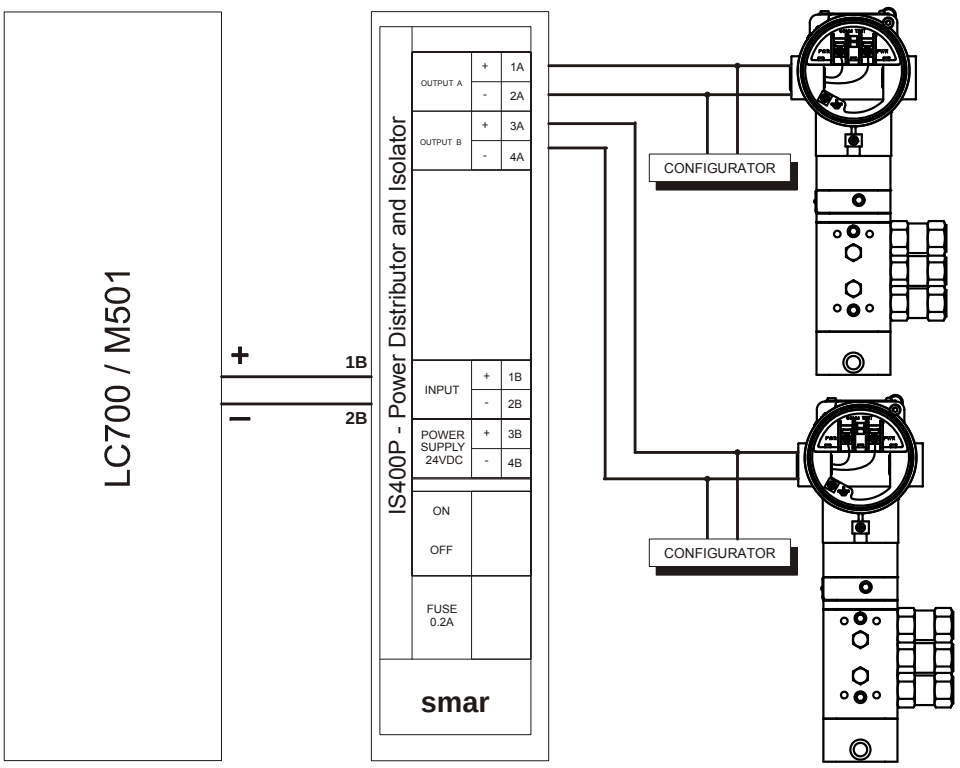


Figure 1.18 - Wiring Diagram of Positioners with LC700/M501, in Split Range.

Air Supply

The FY400 is designed and manufacture to work with good quality instrumentation air. The following issues are some recommendations based on field practices w hich will increase the **FY400** performance and lifetime.

Before connecting the instrument air supply to the positioner, it is strongly recommended to open the tubing freely for 2 to 3 minutes to blow out any possible contamination present inside the installation.

Use a white paper towel direct into the instrument air flow and check visually if there is any water, oil, or any other undesirable material. Case the ins pection shows the presence of contaminants and/or humidity please refers to the “Recommendations for Instrument Air Supply System” below.

Once the positioner is pressuri zed and powered, an internal air fl ow will improve protection against corrosion and prevent the moisture getting inside it. For this reason, the air supply should alw ays pressurize the equipment, even when the process is not operating.

Recommendations for Instrument Air Supply System

To get the best F Y400 performance and to increase its lifetime, the instrum ent air quality shall be superior to that of industrial compressed air. Humidity, suspended particles and oil contamination, even lubricating oil, may impair the instrument operation, either temporarily or permanently in case of internal parts wearing.

As per the ANSI/ISA Standard S7.0. 01 - 1996 - Quality Standard for Inst rument Air, instrument air shall the following characteristics:

Dew point	10ºC below minimum instrument temperature.
Size of particles	40 µm (maximum).
Oil content	1 ppm w/w (maximum).
Contaminants	Free of corrosive contaminants and hazardous gases.

The mentioned standard recommends to place the compressor intake in an environment free from process spills, contaminants, and to use adequate filters. Also, t he compressors must be of non-lubricated type to prevent the pres ent of lubrificants. When using lubricated compressors, the plant must have resources to remove the lubricant from the instrument air supplied.

The Figure 1.19 shows a typical for air supply and air quality adequacy:

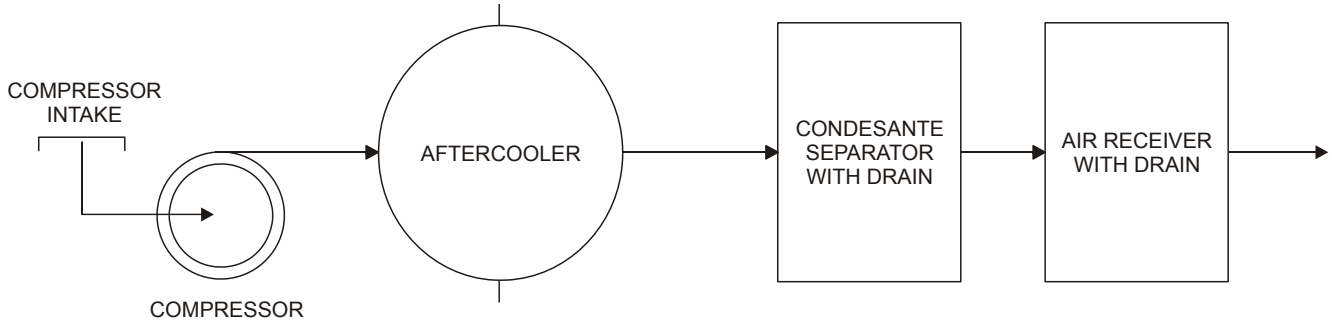


Figure 1.19 – Air Supply System

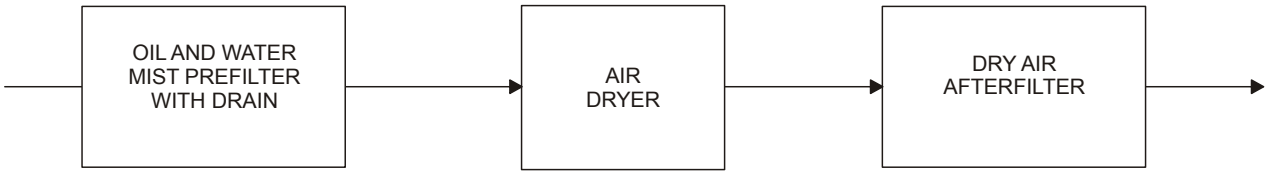


Figure 1.20 – Air Quality Conditioning System

Rotary and Linear Magnet

The Magnet models are linear (up to 30 mm, 50 mm and 100 mm) and rotary (30º - 120º), for utilization on linear and rotary actuators, respectively.
The white bars on the linear magnet indicate the limit for using the magnet.

Figure 1.21 – Linear and Rotary Models

Magnet Centralizer Device

NOTE
Centralizer device of linear magnet is used for all type of linear bracket.

Figure 1.21-A – Centralizer device of linear magnet

NOTE
Centralizer device of linear magnet is used only for universal rotary bracket.

***Figure 1.21-B - Centralizer* device of rotary magnet**

Remote Sensor Position

The remote sensor potion is an accessory recommended for high temperature and extreme vibration applications. It prevents excessive wear of the equipment and, consequently , the reduction of its lifetime.

For an appropriate installation of the sensor, c heck if the engraved arro w on the magnet matches the positioner arrow when the valve is at half way course.

The magnet mounting in relation to the position sensor should follow procedure below:

1. There is no friction betw een the magnet internal face, linear of rotary , and the remote position sensor bulge when excursioning for opening or closing the valve.
2. The magnet and the remote sensor bulge are not too far.

It is recommended to keep a minimum 2 mm space and maximum 4 mm distance betw een the magnet external face and the remote sensor face. There is a centralizing device, for both linear and rotary installations, inside the positioner packing w hich will help you to correctly install the positioner and remote sensor.

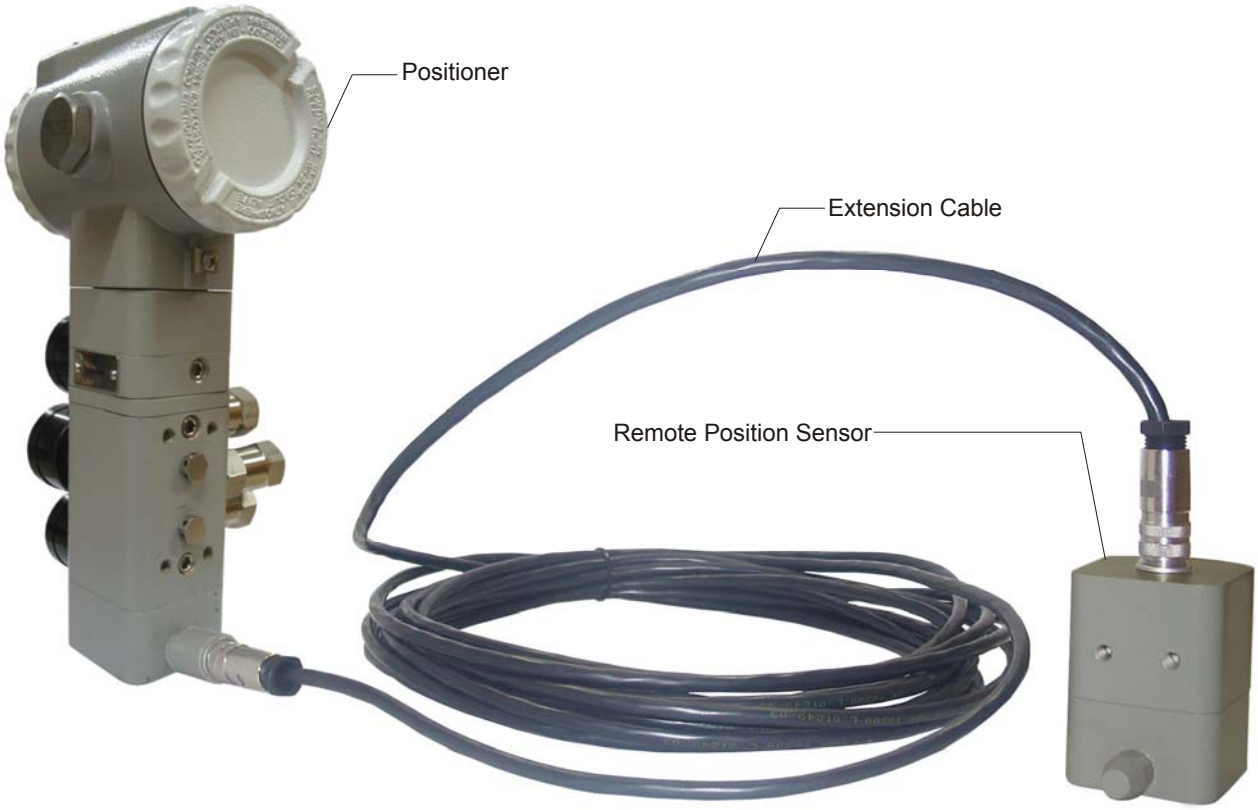


Figure 1.22 – Remote Position Sensor

The electric signals in the remote sensor cable are of low intensity. Therefore, when installing the remote sensor cable inside the conduit (maximum limit 20 meters length), w e recommend to avoid the proximity of possible inducti on sources and/or magnetic interf erence. The supplied cable is shielded for protection against electromagnetic interference, but despite this protection avoid the cable sharing the same conduit with other cables. See the figure 1.6.

The connector for remote position sensor is easy handle and simple installation. See the installation procedure as per Figures 1.23 and 1.24:

Figure 1.23 – Connecting the Cable to the Remote Position Sensor

Figure 1.24 – Connecting Cable to the Positioner

Installation in Hazardous Areas

WARNING
Explosions could result in death or serious injury, besides financial damage. Installation of this positioner in explosive areas must be carried out in accordance with the local standards and the protection ty pe adopted. Before continuing the installation make sure the certificate parameters are in accordance with the classified area where the equipment will be installed. The instrument modification or parts replacement supplied by other than authorized representative of Smar is prohibited and will void the certification. The positioners are marked with options of the protection type. The certification is valid only when the protection type is indicated by the user. Once a particular ty pe of protection is selected, any other type of protection can not be used. The electronic housing and the position sensor installed in hazardous areas must have a minimum of 6 fully engaged threads. Lock the housing using the locking screw (Figure 1.10). The cover must be tighten w ith at least 8 turns to av oid the penetration of humidity or corrosive gases. The cover must be tighten until it touches the housing. Then, tighten more 1/3 turn (120°) to guarantee the sealing. Lock the covers using the locking screw (Figure 1.10). Consult the Appendix A for further information about certification.

Explosion/Flame Proof

WARNING
In Explosion-Proof installations the cable entries must be connected or closed using metal cable gland and metal blanking plug, both with at least IP66 and Ex-d certification. As the positioner is non-ignition c apable under normal conditions, the statement “Seal not Required” could be applied for Explosion Proof Version. The standard plugs provided by Smar are certified according to the standards at FM, CSA and CEPEL. If the plug needs to be replaced, a certified plug must be used. The electrical connection w ith NPT thread must use w aterproofing sealant. A non-hardening silicone sealant is recommended. **Do not remove the positioner covers when power is ON.**

Intrinsically Safe

WARNING

In hazardous zones with intrinsically safe or non-incendive requirements, the circuit entity parameters and applicable installation procedures must be observed.

To protect the application the positioner **must be connected to a barrier**. Match the parameters between barrier and the equipment (Consider the cable parameters). Associated apparatus ground bus shall be insulated from panels and mounting enclosures. Shield is optional. If used, be sure to insulate the end not grounded. Cable capacitance and inductance plus Ci and Li must be smaller than Co and Lo of the associated Apparatus (see appendix "A" for Ci and Li values).

For free access to the Hart bus in the explosive environment, ensure the instruments in the loop are installed in accordance with intrinsically safe or non-incendive field wiring practices. Use only Ex Hart communicator approved according to the type of protection Ex-i (IS) or Ex-n (NI).

It is not recommended to remove the positioner cover when the power is ON.

NOTE

To obtain all the available certifications consult **www.smar.com**.

OPERATIONAL

Positioner Functional Description

The FY400 Hart® senses the actual stem valve position and takes the corrective action according to a fully user configurable strategy. The “non-contact” position sensor (Hall effect based) prevents the inadequacy of links and levers.

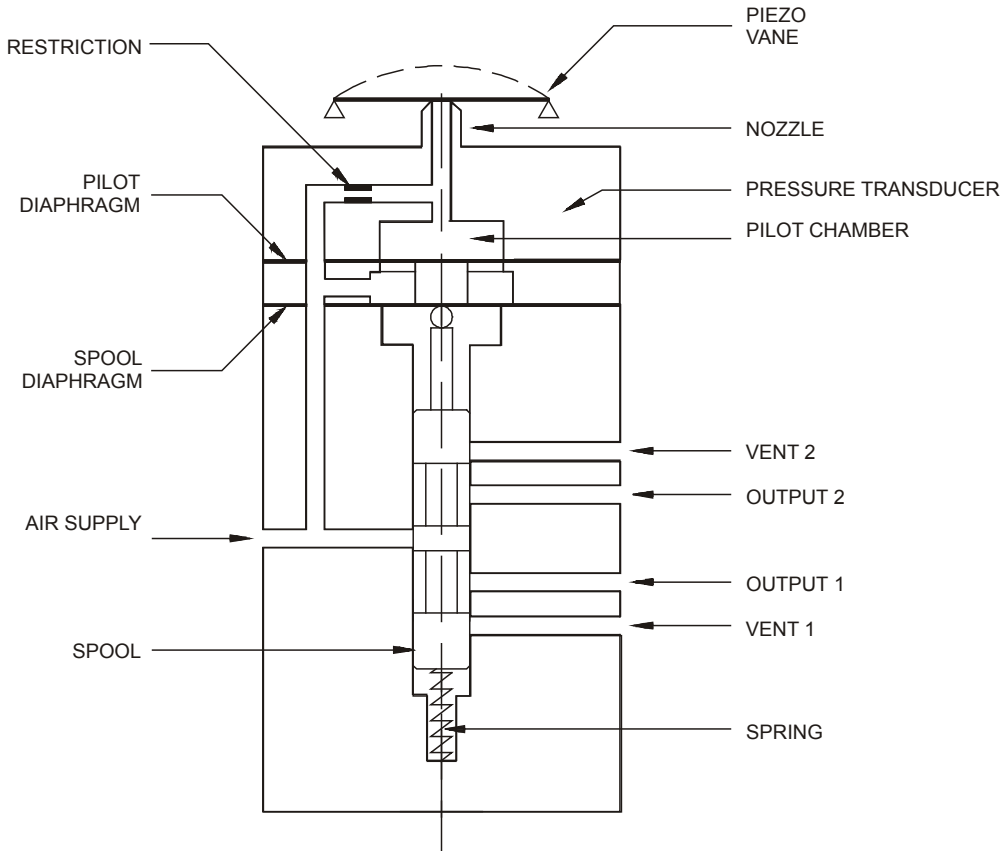


Figure 2.1 – Pneumatic Transducer

The 4 to 20 mA signal (from the controller) is processed at the main digital circuit board. The analog board gets the information from the main circuit board and generates a low power voltage signal to a piezo electric disc in the pressure transducer. It results in a inflection in such disc, moving it nearer or further away from a nozzle in the pressure transducer. This inflection provides a (pilot) pressure variation proportional to the loop controller.

The diaphragm block amplifies the force related to the pilot pressure and pushes down the spool valve, allowing the supply pressure into the valve actuator. On the other hand, the spool valve movement reliefs the pressure from the valve actuator to the atmosphere.

The valve stem will move in response to spool valve movement up to the correct position. The magnet sensor reads the actual valve position (Hall effect) and feed it back to the main circuit board. With the position information (readback signal), the microprocessor will drive a signal to the analog circuit, correcting the valve position.

Circuit Functional Description

To understand the electronic operation of the **FY400** positioner, refer to the blocks as per Figure 2.2.

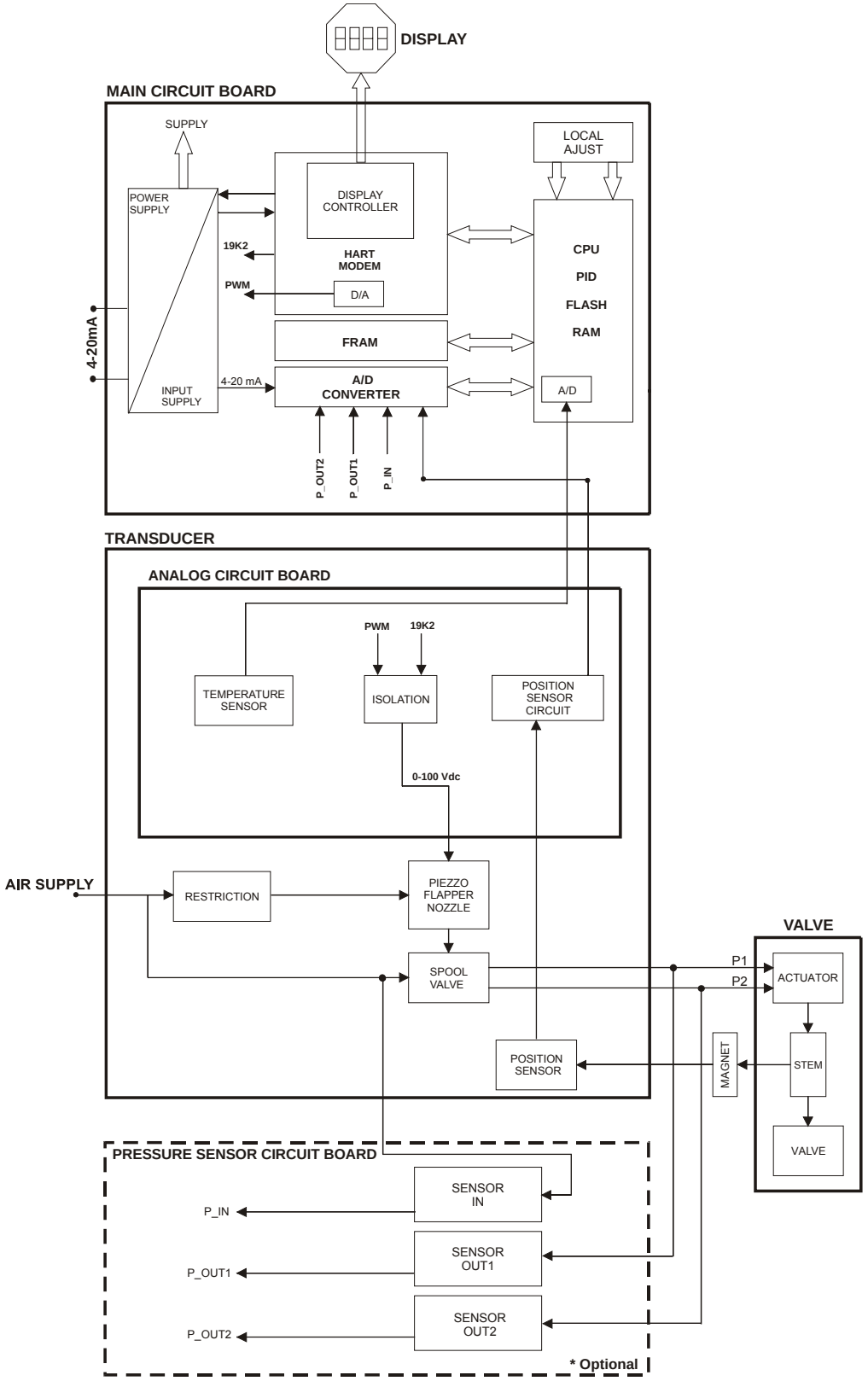


Figure 2.2 – FY400 Block Diagram

Current Power Supply
To power the positioner circuit , it is used a current source of 4-20 mA, in general supplied by a controller or through a transmission line of the sign (two-cable system). It needs at least of 3,8 mA to work properly and to drive a necessary power to maintain the current through a load of 550 ohms.

A/D
It is a digital 16-bits converter used for reading of the following signs: 4-20 mA input, position sensor, input pressure signal, the output 1 pressure and output 2 pressure and converts them into a digital format for the CPU.

FRAM (Ferroelectric Crystal Memory)
It is a non-volatile memory where the configuration data are stored. Examples of such data are: calibration, diagnosis and configuration of the valve.

HART® Modem
The function of this component is to make possible to exchange information between the Smar hand-held programmer and the positioner though the frequency modulation HART® protocol digital communication. Thus, the positioner demodulates the digital information from the current line transmitted by the Smar hand-held programmer and, after processing it, modulates the result on the line again. The “1” represents 1200 Hz and the “0” represents 2200 Hz, according to the NAMUR NE-43 standard. The frequency signal is symmetrical and so does not affect the DC level on the 4-20 mA current. The display controller and D/A are embodied in this component.

D/A
It communicates with the CPU and applies a voltage output on the piezoelectric disk, proportional to the position desirable by the controller. The signal is sent via modulation by pulse (PWM) based on a reference frequency (19K2).

Display Controller
It receives data from CPU and manages the information to the liquid crystal display (LCD).

Central Processing Unit (CPU), RAM, FLASH e PID
The central processing unit (CPU) is the intelligent part of the positioner, which is responsible for its management, operation, control, self-diagnostic and communications. The firmware is stored in the FLASH memory. For temporary data storage, the CPU has an internal RAM. The PID controls the valve desired position.

Local Adjustment
Two keys are activated magnetically without any external contact, electric or mechanical, through a magnetic tool.

Temperature Sensor
It measures the temperature of the transducer circuit.

Isolation
Its function is to isolate the control signal of the piezoelectric disc voltage.

Position Sensor by Hall Effect
It measures the valve real position, conditioning the signal and sending it to the CPU for the PID control execution.

Restriction
The restriction and the nozzle form a pressure division circuit. The air is supplied for the nozzle through a restriction.

Baffle-Nozzle
The baffle-nozzle unit converts the piezoelectric disc movement in one sign of control pressure in the pilot chamber.

Spool Valve
The spool valve assures the fast valve positioning amplifying the air flow.

Pressure Sensors (optional)
They make the readings of the positioner input and outputs pressures for diagnostic purposes.

Pressure Sensor Circuit Board

Sensor IN: Measures the Input pressure.

Sensor OUT1: Measures the Output 1 pressure.

Sensor OUT2: Measures the Output 2 pressure.

NOTE
The Pressure Sensor Circuit Board is optional (in the ordering code, K1 option).

Display

The digital display LCD is necessary to show the information and for operation in the local adjustment mode.

During the normal operation, the FY400 stay in the monitoring mode and the display shows the valve position in percentage. During the configuration process, there is an option to show the setpoint on the display. The local programming mode is activated by approximating the magnetic tool to the hole marked by the letter "Z", on the top of the electronic housing.

The Figures 2.3 and 2.4 show the possible configuration indications and monitoring information.

When powering the **FY400**, the display shows the **FY400** model and the firmware version (X.XX).

Monitoring

During normal operation, the **FY400** remains in the monitoring mode. The display on Figure 2.3 shows the valve position percentage.

This indication changes when approaching the magnetic tool near to the hole marked with "Z" (Local Adjustment), and shows the programming mode through local adjustment.

On the indicator, one can see the result of inserting the magnetic tool in holes marked with “Z” and “S”, which allows, respectively, browse through the programming tree and select option. (More details in the Section 4).

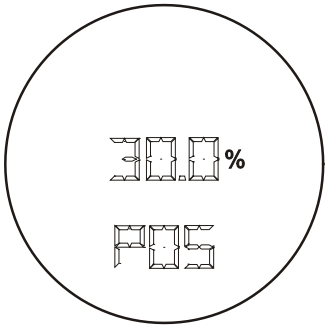


Figure 2.3 – Typical Display

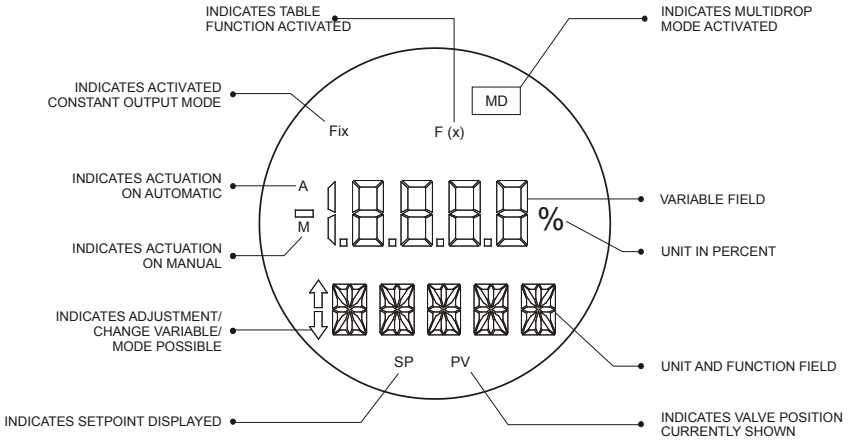


Figure 2.4 – Local Display

Section 3

TECHNICAL CHARACTERISTICS

Functional Specifications

Travel
Linear Motion: 3 - 100 mm.
Rotary Motion: 30° - 120° rotation angle.

Input and Communication Protocol
Two-wires, 4-20 mA, according to NAMUR NE43 specification, with super-imposed digital Hart® Protocol.

Power Supply
4 to 20 mA Loop-powered. No external supply required.
Built-in circuit protection against overvoltage up to 60 Vdc.
Built-in circuit protection against overcurrent up to 25 mA.
Context saving in case of power failure. The critical variables used in the positioner are saved in the memory, avoiding the startup being affected by missing data in the registers and positioner variables.

Input Impedance
550 Ω.

Minimum Current
3.8 mA.

Configuration
Local Adjustment (partially) with magnetic tool. No need to open the cover.
Remotely through:
- CONF401 Windows Based configuration software;
- HPC401 PalmOS Based Configurator;
- FDT/DTM Applications (Field Device Tool/Device Type Manager)
- Asset Management Applications (AssetView);
- Other configurations tools based on EDD.

Protection against Reverse Polarity
Electrical connection without polarity.

Built-in transient protection
Supports the instantaneous maximum voltage of 65 V_{peak} without damage to the electronic components.

Output
Output from 0% to 100% pressure supply to the actuator. Single or double action.

Pressure Supply
1,4 - 7 bar (20 - 100 psi). Free of grease, dust and water, according to ANSI/ISA S7.0.01 – 1996 standard.

Indication
4½ - numeric al digits and 5-character alphanumerical digits Liquid Crystal Display indicator. Function and status icon.

Temperature Limits

Operation:	-40	to	85°C	(-40	to	185°F)	
Storage:	-40	to	90°C	(-40	to	194°F)	
Display:	-10	to	75°C	(14	to	167°F)	Operation.
	-40	to	85°C	(-40	to	185°F)	Without damage.
Remote Sensor:	-40	to	105°C	(-40	to	221°F)	

Humidity Limits
0 to 100% RH (Relative Humidity).

Flow Characterization
Linear, equal percentage, quick opening and 16 freely selectable points by operator.

Auto Setup
It is an autom atic adjustment of the positioner to the va lve and actuator set, in others words, an auto-calibration procedure of the equipment. During this procedure, the positioner checks the 0% and 100% of the valve stroke related to the magnet and also calculates the conv erter A/D gain for position readings.

Proportional Gain, Integral and Derivative Rates
Adjustable locally or by communication.
Adjusted automatically during the Auto Tuning or Full Setup procedure.

Travel Time
Adjustable locally or by communication.

Position Sensor
Non-contact Sensor by Hall effect. It is also available for the integral or remote assembling version. Optional 4 to 20 mA for position measurement.

Pressure Sensor (optional request in the ordering code)
0 to 100 psi range.

Performance Specifications

Resolution
0.1 % F.S.

Repeatability
0.1 % F.S.

Hysteresis
0.1 % F.S.

Consumption
0.35 Nm³/h (0.20 SCFM) to 1.4 bar @ 20 psi air supply.
1.10 Nm³/h (0.65 SCFM) to 5.6 bar @ 80 psi air supply.

Output Capacity
13.6 Nm³/h (8 SCFM) to 5.6 bar @ 80 psi air supply.

Ambient Temperature Effect
0.8%/20 °C F.S.

Pressure Supply Effect
Negligible.

Vibration Effect
± 0.3 % /g of span during the following conditions:
5-15 Hz to 4 mm constant displacement.
15-150 Hz to 2g.
150-2000 Hz to 1g.
as per the IEC60770-1 Standard.

Electromagnetic Interference Effect
Designed to comply with the IEC801 Standards and European EN50081 and EN50082 directives.

Physical Specifications

Electrical connections
½ -14 NPT, Pg 13.5 or M20 x 1.5.
Certified Hazardous Locations (CEPEL). See Appendix “A”.

Pneumatic Connections
Air Supply and output: 1/4 - 18 NPT.
Gage: 1/8 - 27 NPT.

NOTE
The pressure gages for input, output 1 or output 2 pressures will be supplied with the external housing in SS316 and the wet parts in brass.

Construction Material
Injected low copper aluminum with polyester painting or 316 Stainless Steel housing, with Buna N o-rings on covers (NEMA 4X, IP66).

Equipment Weight
Without display and mounting bracket:
- 5.8 kg (Stainless Steel);
- 2.7 kg (Aluminum).

Add for the digital display: 0.1 kg.
Add for the remote position sensor: 550 g.
Add for the cable and connectors of the remote sensor: 100 g (cable) and 45 g/m (for each connector).

Diagnostics

- What is diagnostic?
Diagnostic is a group of methods to detect, locate and eventually indicate the corrective actions for problems or failures in the actuator-valve set.

- What's this for?
Using the diagnostics functions, it is possible to monitor permanently the actuator-valve set condition and to configure the parameters aiming at predictive and proactive maintenances. Besides, it shows the equipment general conditions, allowing preventive actions to be taken on time. The predictive maintenance prevents malfunctions in the actuator-valve set for continuous working equipment, in other words, the diagnostic makes the actuator-valve set more reliable, improving the process stability and keeping it safer.

- When should I configure the diagnostic?
The diagnostics configuration can be made only once, and the positioner will run the diagnostic procedure continually. The user can change diagnostic configuration whenever necessary, since each diagnostic can be enabled separately.

- **What tool is necessary for the diagnostic?**
The diagnostic is automatically performed by the positioner and the user can enable, configure and visualize the diagnostic parameters through a configurator such as CONF401 or HPC401, or additionally with asset management applications existing in the market that support EDD structure.

- Is it possible to configure the diagnostic WITH or WITHOUT configurator?
The diagnostic will only be configured via a configurator that supports the positioner. The HPC401 enables and configures the simplest diagnostics, while the CONF401 makes possible the use of the most advanced functions, besides, with through diagnostics graphs. The diagnostics functions and configurations can also be accessed via application software based on the FDT/DTM standard.

STROKE LIMIT & REVERSALS

Stroke Limit - Characterizes the situation which the valve (or actuator) reaches an upper or lower position, to the maximum or minimum limits, respectively, configured by the user, generating an alarm.

Related parameters:

Parameters	Description
Stroke Limit High	Maximum limit value for the valve travel, before being considered Stroke Limit.
Stroke Limit Low	Minimum limit value for the valve travel, before being considered Stroke Limit.
Stroke Limit Deadband	Dead zone on the Stroke Limit High and Low values.
Stroke Limit Counter	Counter of the number of times in that the Stroke Limit was reached.
Stroke Limit Counter Limit	Maximum value allowed to the Stroke Limit counter, before generating an alarm.
Stroke Limit Counter Alarm	Generated alarm when the counter of Stroke Limit exceeds the Counter Limit.
Stroke Limit Counter First Activation	Time when the first occurrence of Stroke Limit happened.
Stroke Limit Counter Last Activation	Time when the last occurrence of Stroke Limit happened.
Stroke Limit Alarm Time Limit	Maximum value of time in Stroke Limit allowed, before generating an alarm.
Stroke Limit Alarm	Alarm generated when the time in Stroke Limit exceeds the Alarm Time Limit value.
Stroke Limit Operation Time	Total operation time of the Stroke Limit diagnostic.
Stroke Limit Measured Time	Total time the valve set was in Stroke Limit.

Configuration example:

Parameters	Value (%)
Stroke Limit High	98%
Stroke Limit Low	2%
Stroke Limit Deadband	1%
Stroke Limit Counter Limit	10
Stroke Limit Alarm Time Limit	60.0 second

Following the example, when the valve position value goes smaller than 2% (Stroke Limit Low) the equipment will consider Stroke Limit reached and it will increment by 1 (one) the counter. While the valve position value does not arise again for an upper value to 3% (Stroke Limit Low + Stroke Limit Deadband) the equipment will continue understanding as one Stroke only, and it won't increment the counter. If the valve position value increases to a larger value than 3% and goes down again to 2%, the process is repeated and Stroke Limit counters are incremented again by 1 (one). In a similar way, when the valve position goes up to 98% (Stroke Limit High), the Stroke Limit is reached, and also the counter is incremented by 1 (one).

Still according to the example, when the value of the Stroke Limit counter reaches 10 (ten), the equipment will generate an alarm (Stroke Limit Counter Alarm). Similarly, when the valve set stays in Stroke Limit for a time over to 60.0 seconds, an alarm of the exceeded time will be generated (Stroke Limit Alarm).

Reversals - Characterizes the situation when the valve movement direction (opening - closing).

Related parameters:

Parameters	Description
Reversal Deadband	Dead zone of the reversal. If the change in direction is larger than the value of the dead zone, the equipment will assume it as reversion.
Actuator ou *Valve Reversal Counters*	Counter that shows the number of reversals of the equipment, for valve or actuator, separately.
Actuator ou *Valve Reversal Counter Limits*	Maximum value of reversals allowed to the counter before generating an alarm. Configuration for valve or actuator, separately.
Actuator ou *Valve Reversal Counter Alarm*	Alarm generated when the counter of Reversals exceeds the respective Reversal Counter Limit value.
Actuator ou *Valve Reversal Counter First Activation*	Time when the first Reversal happened.
Actuator ou *Valve Reversal Counter Last Activation*	Time in that the last occurrence of Reversal happened.
Actuator ou *Valve Reversal Operation Time*	Total operation time of the Reversal diagnostic.

Configuration example:

Parameters	Value (%)
Reversal Deadband	1%
Actuator Reversal Counter Limit	5
Valve Reversal Counter Limit	5

For every change in direction when the displacement is larger than 1% (Reversal Deadband), the positioner will consider it a reversal and it will increment the respective counters by 1 (one).

When the value of the counters (Reversal Counter Limit) reaches 5 (five), the positioner will generate the respective alarm (Reversal Counter Alarm) for the actuator and the valve, given that the reversal counters of the actuator and that of the valve are independent. The reason for the counters to be independent, in spite of being increased together is that when maintenance is done in just one of the set of elements, the respective counter can be zeroed by the user, independently of the other.

MILEAGE

Valve Mileage - mileage or total travel of the valve and actuator. It can adopt percentage values, of length units or angular units. It also has a limit value for an alarm to be generated (Mileage Limit Alarm) when its value is exceeded.

Related parameters:

Parameters	Description
Mileage Deadband	Dead zone inside which a displacement is not considered as movement in the Mileage count. This value is always configured in percentage.
Actuator ou *Valve Mileage*	Actuator or valve mileage. It is the sum of the displacements larger than the dead zone, executed by the respective equipment.
Actuator ou *Valve Mileage Limit*	Maximum value allowed to Mileage, before generating an alarm.
Actuator ou *Valve Mileage Limit Alarm*	Alarm generated when the respective Mileage exceeds the Mileage Limit value.
Travel Range	Travel measurement of the valve-actuator set, in other words, total travel in engineering units. The Mileage values of the actuator are converted into engineering units starting from this value.
Eng. Unit	Engineering Unit in which Travel Range and Mileage will be visualized.

SUPPLY PRESSURE

The pressure diagnostic checks if the power supply pressure of the positioner is between the limits configured by the user. This diagnostic have two limits, one lower and another upper limit that make possible to check if the pressure is good or generate alarms of too low or too high pressure in the positioner status (Supply Pressure Status).
For this diagnostic to work correctly it is necessary to use a positioner model that has pressure sensors installed.

Related parameters:

Parameters	Description
Supply Pressure High Limit	Upper value limit for the supply pressure.
Supply Pressure Low Limit	Lower Value limits for the supply pressure.
Supply Pressure Status	Indicates the actual state of the supply pressure: too low, good or too high.
Supply Pressure Alarm Time Limit	Allowed time maximum value, for the power supply pressure to be outside the limits before generating an alarm.
Supply Pressure Alarm	Alarm generated when the time when the pressure is out of the limits exceed the value of the Alarm Time Limit.
Supply Pressure Problem Counter	Total (problems in the power supply pressure.
Supply Pressure Problem First Activation Time	Time of the first occurrence of a problem in the supply pressure.
Supply Pressure Problem Last Activation Time	Time of the last occurrence of a problem in the supply pressure.
Supply Pressure Problem Accumulated Time	Accumulated time in which the supply pressure was out of the limits: *too low or too high.*
Supply Pressure Problem Operation Time	Total time of operation of the diagnostic of Supply Pressure.

PST (Partial Stroke Test) & LOAD FACTOR

PST (Partial Stroke Test) - This diagnostics executes a test to verify if the valve is not locked, besides measuring the necessary pressure for the valve to move. During its execution, the Load Factor is calculated.

Related parameters:

Parameters	Description
PST Mode	It configures the valve to be tested: safety or control type.
PST Type	It configures the test as valve opening or closing, in the case of a safety valve.
PST Offset	Percentage displacement value of the valve position for the test.
PST Pause	Time awaited by the test, after the valve starts moving, to return to the original position.
PST Timeout	Maximum time a waited for the test to be executed entirely, before generating an alarm.
PST Timeout Alarm	Alarm generated when the test time exceeds the value of PST Timeout.
PST Breakout Value	Time elapsed for the valve to leave the inertia and begin its movement.
PST Breakout Limit	Maximum time allowed for the PST Breakout Value, before generating an alarm.
PST Breakout Alarm	Alarm generated when the Breakout Value exceeds the PST Breakout Limit value.
PST Cycle Time	Period when the equipment will execute the PST automatically (for manual PST, this parameter should be zero).
PST SP Change Alarm	Alarm that indicates if the Setpoint was changed during the PST execution. The result invalidates the test.
PST Aborted Alarm	Alarm that indicates an error in the valve positioning before beginning the PST. The result invalidates the test.
Valve Spring Range	Spring range, for simple action valves. It can be calculated automatically by the equipment or configured by the user.

When the PST Mode is configured as safety valves, the PST should be executed starting from the position 0%, in the case of a PST Type configured to open. Or then, 100%. If the PST Type was configured to close.

Some checks are made during the test and can generate its cancellation and a respective alarm:

- time of the test exceeds PST Timeout;
- PST Breakout Value exceeds PST Breakout Limit;
- the initial valve position doesn't correspond to the initial position configured for the test to begin (for safety valves);
- The Setpoint is altered during the test.

Load Factor - This diagnostics attributes the percentage of the pressure used to move the valve from one point to another, indicating a diagnostics related to the attrition of the valve. It is calculated during the PST.

Related parameters:

Parameters	Description
Load Factor Value	Value calculated for the Load Factor.
Load Factor Limit	Maximum value allowed for the Load Factor, before generating an alarm.
Load Factor Alarm	Alarm generated when the Load Factor Value exceeds the value of the Load Factor Limit.
Load Factor First Calculation Time	Time of the first Load Factor calculation.
Load Factor Last Calculation Time	Time of the last Load Factor calculation.
Load Factor OperationTime	Total operation time of the Load Factor diagnostics.

DEVIATION

This diagnostics indicate if the position error, in relation to the Setpoint is above the maximum defined by the user.

Related parameters:

Parameters	Description
Deviation Value	Maximum deviation value allowed by the user.
Deviation Deadband	Dead Zone in relation to the deviation value, used to avoid that the same deviation is counted more than once.
Deviation Time	Necessary time for a position error to be considered as a deviation provided that it is above the Deviation Value.
Deviation Counter	Counter of the number of times when a Deviation occurred.
Deviation Counter Limit	Maximum value allowed to the Deviation counter, before generating an alarm.
Deviation Counter Alarm	Alarm generated when the Deviation Counter exceeds the Counter Limit value.
Deviation Counter First Activation Time	Time when the first Deviation occurred.
Deviation Counter Last Activation Time	Time when the last Deviation occurred.
Deviation Counter Accumulated Time	Total time when the set was in Deviation.
Deviation Alarm Time Limit	Maximum time value allowed in Deviation, before generating an alarm.
Deviation Alarm	Alarm generated when the time in Deviation exceeds the Alarm Time Limit value.
Deviation Operation Time	Total operation time of the Deviation diagnostics.
Deviation Measured Value	Deviation value when the time alarm is generated.
Deviation Measured Time	Deviation time when the time alarm is generated.

ALARMS

Besides the specific alarms of each diagnostics already mentioned, some additional alarms are also present in status format, even after the setup or during the control process.
They are:

Parameters	Description
Temperature out of range	Indicates that the temperature is out of the acceptable e equipment limits.
No movement or low air supply	Indicates that the valve is locked or that the air supply is insufficient.
Fail Hall	Indicates no-reading or a reading problem with the Hall-magnet sensor set.
SP out of limits	Indicates that the Setpoint is out of the range specified as useful for the user.
Magnet not centralized	Indicates that the magnet is not centralized with the valve travel.
Piezo voltage out of range	Indicates Piezo base voltage out of calibrated range, required for the control. Refer to section 6, in item: **Checking the Calibration of the Piezo Base Set**, in this manual.
Low current supply	Indicates insufficient electric current to supply the equipment circuits.

GRAPHS

DEVIATION GRAPH
The travel deviation indicates the difference between the Setpoint and the valve position. The user then can configure the tolerance of acceptable deviations for his process.
The Deviation Graph shows the deviation values along the time.

Related parameters:

Parameters	Description
Graph Operation Time	Indicates the graph operation time.
Device Total Operation Time	Indicates the total graph operation time.

PST GRAPH
The Partial Stroke Test verifies the valve response to a certain course, together with the necessary pressure to execute the movement. The PST Graph illustrates the valve opening and closing test process to the positions configured by the user.

LOAD FACTOR GRAPH
The Load Factor indicates the total valve inherent attrition. The Load Factor Graph shows the Load Factor values calculated along the time.

Related parameters:

Parameters	Description
Graph Operation Time	Indicates the graph operation time.
Device Total Operation Time	Indicates the total positioner operation time.

HISTOGRAM
The Histogram indicates the amount of time the valve stayed in a certain position. It shows the positions in intervals of 5% and the time the valve stayed in each position when the diagnostic was enabled.

Related parameters:

Parameters	Description
Histogram Operation Time	Indicates the total Histogram operation time.
Device Total Operation Time	Indicates the total positioner operation time.

VALVE SIGNATURE
The Valve Signature is a graph that shows the equipment performance curve, in relation to the used pressure, for the whole valve course, in the valve opening and closing. Therefore, in time the user can analyze if the system is being degraded, as well as diagnose some problem with the actuator-valve system.

Section 4

LOCAL PROGRAMMING

Local Adjustment

The **FY400** positioner has under the identification plate two shallow holes, where the magnetic tool is placed to execute the local adjustment.

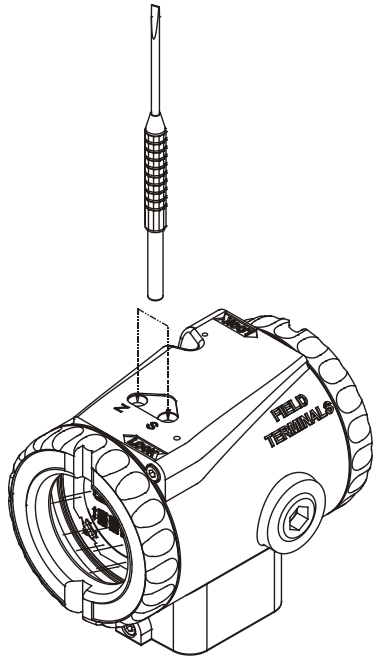


Figure 4.1 – Shallow holes for Local Adjustment/Configuration and Magnetic Tool

NOTE
In this section the “Magnetic Tool” will be referred to as “TOOL”, and the hole identified by “S” and “Z” will be “HOLE S” and “HOLE Z”, respectively.

The holes identified with Z (Zero) and S (Span) will be indicated by (Z) and (S). The table shows the action accomplished by the magnetic tool when inserted in (Z) and (S) according to the adjustment selected.

ORIFICE	ACTION
Z	Moves between the functions.
S	Selects the display function.

The digital display is necessary to visualize the programming tree via local adjustment.

Magnetic Tool

With the magnetic tool, it is possible to configure **FY400** locally, eliminating the need of additional configurators in many basic applications.

W1 and W2 Jumpers Connection

Write Protection

- *W1 Jumper connected in OFF*
  If the W1 jumper is connected in OFF, the write protection is disabled.
- *W1 Jumper connected in ON*
  If the W1 jumper is connected in ON, the write protection is enabled.

Local Adjustment

- *W2 Jumper connected in OFF*
  If the W2 jumper is connected in OFF and the local adjustment is disabled, the programming tree parameters cannot be modified.
- *W2 Jumper connected in ON*
  If the W2 jumper in ON and the local adjustment is enabled, the programming tree parameters can be modified.

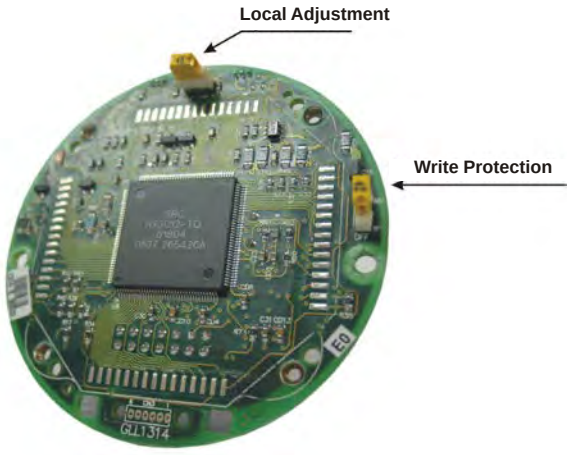
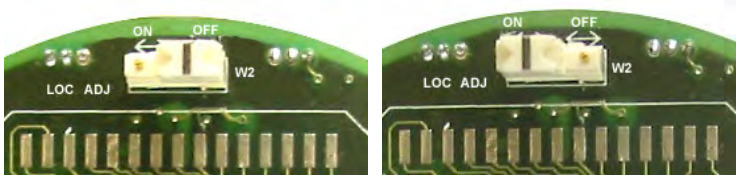


Figure 4.2 – Main Board

To configure the local adjustment, place the main board jumpers as indicated in the Figures 4.3 and 4.4.

LOCAL ADJUSTMENT



Disabled **Enabled**

Figure 4.3 and 4.4 – Local Adjustment Options

To configure the write protection, place the main board jumpers as indicated in the Figures 4.5 and 4.6.

WRITE PROTECTION

Enabled **Disabled**

Figure 4.5 and 4.6 – Write Protection Options

Local Programming Tree

The programming tree is structured with menus of the main software functions.

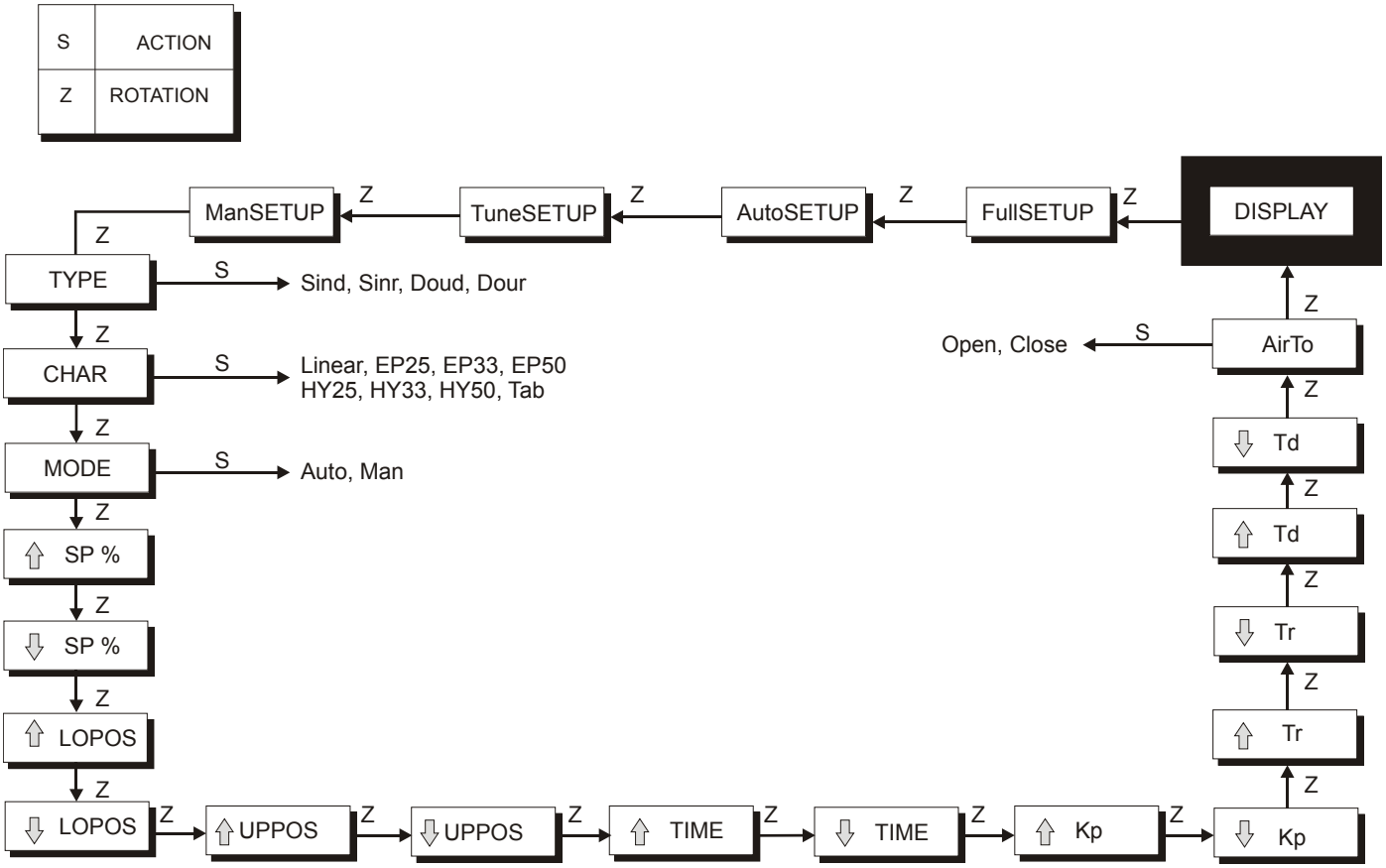


Figure 4.7 – Local Programming Tree

With local adjustment enabled, it is possible to travel through all the configuration options maintaining the magnetic tool in the hole marked with "Z". To select the option, after choosing the option by the previous way, place the tool in the hole marked with "S".

By keeping the tool in “S” hole it is possible to continuously operate the selected parameter, since this is a numeric value. Incrementing actions are performed by repeatedly placing and removing the magnetic tool until reaching the desired value.

NOTE
Do all changes and c onfigurations very carefully since all modifications in the parameters are recorded automatically and do not need user confirmation to save the configuration.

Adjustable Parameters

FULL SETUP
Executes the AUTO SETUP and the AUTOTUNING for full valve adjustment, including the PID control parameters.

AUTO SETUP
During this adjustment, the positioner checks the 0% and 100% valve travel in relation to the magnet and then calculates the AD converter gain for position readings.

AUTOTUNING
Performs the PID control tuning through automatic selection of the Kp, Tr and Td values.

MANUAL SETUP
Executes the AUTO SETUP steps but it needs user confirmation between steps.

The user must confirm the current step conclusion only when the valve is not active. The steps are described below:

Step 1: Valve closing to check the 0% position.
Step 2: Valve opening to check the 100% position.
Step 3: Valve closing to begin calculating the AD converter gain.
Step 4: Valve opening to end the calculation of the AD converter gain

NOTE
The **MANUAL SETUP** is recommended in cases where it is not possible to activate the AUTO SETUP due to very unstable environment.

NOTE
Do not touch the moving parts of the valve/positioner/actuator, because they may unexpectedly move automatically.

TYPE – Valve Type
Through this parameter, the user configures the valve type and the type of action associated to valve.
See valve type options:
- **Sind**: Single action and Direct;
- **Sinr:** Single action and Reverse;
- **Doud**: Double action and Direct;
- **Dour**: Double action and Reverse.

CHAR - Characterization Curves
Through this parameter, the user configures the characterization curve of the valve.
See the existing options:
- **Linear**: linear
- **EP25; EP33; EP50**: equal percentage
- **QO25; QO33; QO50**: hyperbolic (quick opening)
- **Tab**: table of 16 points (configurable)

Allows choosing the mode in operation. When activating the positioner, it will be always in automatic mode.
Operation Mode options:
- **Auto - Automatic Mode**
  In the automatic mode, the position is adjusted according to the 4 to 20 mA current signal input. This mode does not allow the local access to the SP% parameter.
- **Man - Manual Mode**
  In the manual mode, the position is adjusted according to the SP% parameter value, independently of the input current. Only this mode allows the operation in the SP% parameter.

SP % - Set Point
This parameter represents the desired position value. In the “Manual” mode, this parameter may be operated remotely, independently from the input current. The desired value from the input current level is calculated in the “Auto” mode.

LOPOS - Lower Position adjustment
This parameter allows the user to calibrate the desired lower position, associated to the input current. This is also useful to calibrate the lower Split Range position.

UPPOS - Upper Position Adjustment
This parameter allows the user to calibrate the desired upper position, associated to the input current. This is also useful to calibrate the upper Split Range position..

TIME - Setpoint Variation Time
Allows to configure the Setpoint variation rate by selecting the desired time for the valve open or close. The unit is shown in seconds.

Kp - Proportional Gain
Allows to adjust the proportional gain of the digital PID control.

Tr - Integral Time
Allows to adjust the integral time of the digital PID control.

Td - Derivative Time
Allows to adjust the derivative time of the digital PID control.

AIRTO - Air to Open or Air to Close
This option allows to adjust the positioner according to the valve actuation. If the actuator works with "air to open" or "air to close", the positioner should be configured for AirTo OPEN or AirTo CLOSE, respectively.

CONFIGURATION VIA HART®

The positioners may be connected in a point-to-point type or multidrop network. In a point-to-point connection, the equipment must be on "0". In a multidrop network, once the devices are recognized by their addresses, the positioners should be configured with a network address between "1" and "15".
If the acknowledgement is via tag, the positioners addresses may be on "0" and keep controlling the valve, even in a multidrop configuration.

NOTE

In case of a multidrop network configuration for classified areas, the entity parameters allowed for the area must be strictly observed. Therefore, the following should be checked:

$Ca \geq \Sigma Ci_j + Cc \qquad La \geq \Sigma Li_j + Lc$

$Voc \leq min\ [Vmax_j] \quad Isc \leq min\ [Imax_j]$

Where:

Ca, La = Allowed Capacitance and Inductance on the bus;

Ci_j, Li_j = Non -protected internal Capacitance/Inductance of positioner *j (j = up to 15);*

Cc, ***Lc*** = Cable capacitance and Inductance;

V_{oc} = open circuit tension of the intrinsic safety barrier

I_{sc} = short circuit current of the intrinsic safety barrier

$Vmax_j$ = Maximum allowable voltage to be applied to the positioner *j;*

$Imax_j$ = Maximum allowable current to be applied to the instrument *j.*

The FY400 Smart Valve Positioner includes a wide variety of Hart® command functions that makes it possible to access whatever functionality implemented on it. These commands work according to the Hart® protocol specifications and are grouped as Universal Commands, Common Practice Commands and Specific Commands.

Smar developed configurators for its Hart® devices: CONF401 configurator or DDCON100 for Windows or HPC401 for Palms. It provides a simple configuration, field device monitoring, and ability to analyze data and modify field device performance.

For the user's safety the FY400 has two kinds of write protection in its memory, one hardware and the other a software mechanism. The hardware is selected by a H-H switch with priority over the software (See in the Section 4, Local Programming).

NOTE

The operation and use characteristics of each one of the configurators are in their specific manual. Consult the configurator updates and their manuals, on http://www.smar.com.

Figures below show the front of the Palm and the CONF401 screen with active advanced configuration.

Figure 5.1 - Smar Configurator

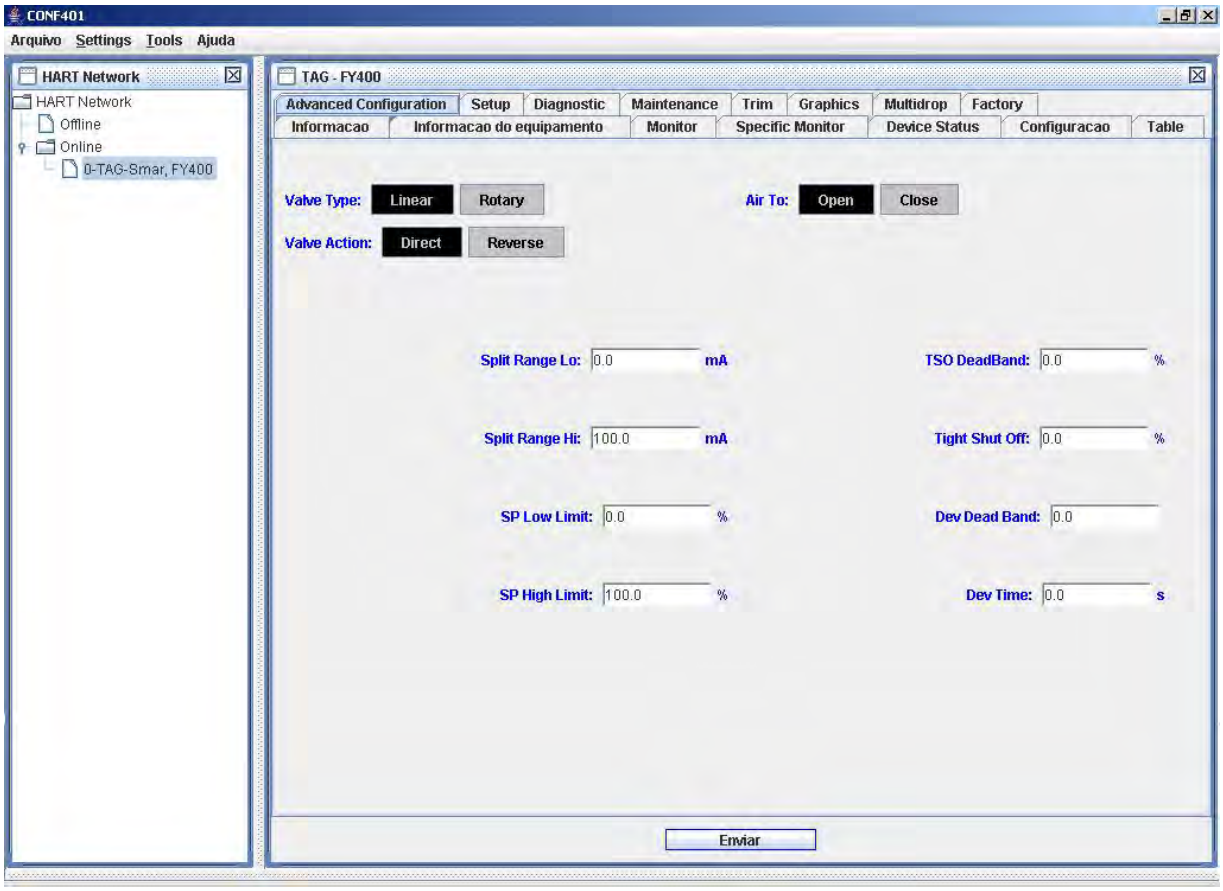


Figure 5.2 - CONF401 Screen - Advanced Configuration

DDCON 100 - DDL Based HART Configurator
See the manual in the site http://www.smarresearch.com to configure.

Figure 5.3 – DDCON 100 - DDL Based HART Configurator

Configuration Resources

By means of the Hart® configurator, the FY400 firmware allows the following configuration features to be accessed; see below:

- Positioner Identification and Manufacturing Data;
- Remote Setpoint;
- Special valve characterization function according to a 16-point configurable curve;
- Flow characterization (Linear, Equal percentage and Quick opening);
- Monitoring of all device variables: position, setpoint, deviation and temperature;
- Positioner diagnostic, preventive maintenance and failure determination;
- PID Controller Configuration;
- Device Configuration;
- Device Maintenance.

The configurator can be connected to the same pair of wires as the 4-20 mA signal, up to 2 kilometers away from the positioner.

Identification and Manufacturing Data

The following information about the **FY400** manufacturing and identification data is available:

TAG
8-character alphanumeric field for identification of the positioner.

DESCRIPTION
16-character alphanumeric field for additional identification of the positioner. May be used to identify service or location.

MESSAGE
32-character alphanumeric field for any other information, such as the name of the person who made the last calibration, some special care to be taken, or if a ladder is needed for physical access to the positioner.

DATE
The date may be used to identify a relevant date, such as the last calibration, the next calibration or the installation. The date is stored in the American standard e.g.: Oct 16, 2007) and is automatically assumed after the choice of these items.

UNIQUE ID
Used to identify the device and in the construction of the Hart® long form address.

DEVICE INFORMATION
Allows to read the equipment identification data recorded in the factory.

NOTE
These items related to **EQUIPMENT INFORMATION**, engraved in the factory cannot be modified. They are read directly from the circuit memory.

Monitoring

This function allows remote monitoring of positioner variables. The time to start the reading is around 5 seconds. The values are always updated. Among others, some of the variables that can be monitored are: valve actual position in percentage, input in percentage of the adjusted current range (before the flow limits and linearization), input current in mA or %, device temperature in Celsius and in Fahrenheit degrees, etc.

Device Configuration

NOTE
WRITE PROTECTION – The configurator only shows that the writing is authorized if the **W1 jumper** from main board is connected to the pins over the word **ON** or if the protection is enabled by software.

Besides the equipment configuration and operation services, the **FY400** allows Auto Setup (Calibration) and Auto Tuning. See below the configuration options:

- **CHARACTERIZATION FUNCTION**
  This function can change valve flow characteristics. For example, if an equal percentage flow characterization is applied to a valve with linear flow characteristics, it will work as an equal percentage valve. Manufacturer documentation contains the valve inherent characteristic. The options for flow characterization are:

LINEAR	UNALTERED
Equal percentage	1:25
Equal percentage	1:33
Equal percentage	1:50
Quick opening	1:25 (Hyperbolic)
Quick opening	1:33 (Hyperbolic)
Quick opening	1:50 (Hyperbolic)
Table	16 pairs (X, Y)

- **DISPLAY**
  The FY400 digital display has three well-defined fields: information field with icons informing the active status of the configuration, 4 ½ numerical digit fields for value indication and alphanumeric field with 5-digit for status information and units. The parameters that can be selected for visualization are showed below:

PARAMETERS	DESCRIPTION
PV %	Process variable in percentage.
SP %	Setpoint in percentage.

- **TABLE CONFIGURATION**
  Through this button, a flow characterization curve with up to 16 points can be configured. This allows the construction of a special flow characterization curve, like linear combinations and equal percentage or other characterizations.

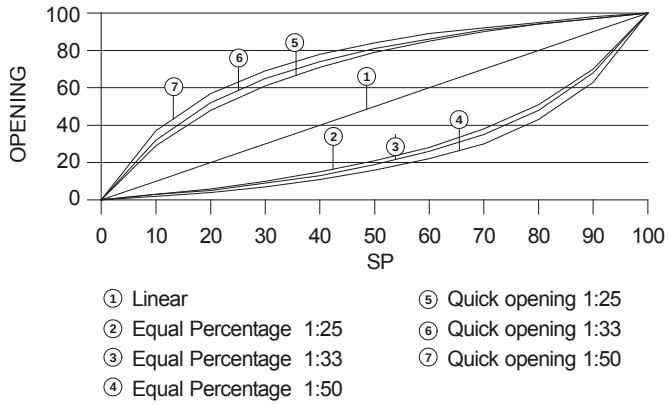


Table 5.1 - Valve Characteristic Curve

Advanced Configuration

This function affects valve advanced configurations. With advanced configuration it is possible to configure the valve type, if it is air-to-open or air-to-close, valve action, setpoint limits and split range.

Device Maintenance

This group includes maintenance services related to obtaining necessary information for the device maintenance and performance test. Some of the available services are: position adjustment and valve performance test, general information about the actuator and the valve, operations count, password level, code number model, performance and others.

Trim

There are two trim operations: current trim and temperature trim. They are configured via HPC401 for Palms or Advanced Configuration via CONF401.

- **CURRENT TRIM** allows to check the positioner input current reading. There are two types of current trims available:

  4 mA TRIM: is used to adjust the input current reading correspondent to 0%.

  20 mA TRIM: is used to adjust the input current reading correspondent to 100%.

- **TEMPERATURE TRIM** is the temperature reference for the positioner temperature sensor.

Automatic Configuration

This function allows to calibrate the valve travel automatically (Auto Setup and Auto Tuning), the points of the totally opened or totally closed stroke with higher precision (lower and higher position), to adjust the opening and closing times and the proportional, integral, and derivative actions of the PID (Proportional, integral, derivative) control, the state of air supply, the magnet conditions, the position sensor, setup and the piezo voltage conditions.

Setup Stages for FY400
(Full Setup, Auto Setup, Auto Tuning)

HALL
Sends the valve to the end of travel, open or closed, depending on mounting.
(0%, 0%, -)

GAIN
Verifies if the valve movements up to the other extremity and finds the A/D gain.
(5%, 25%, -)

SPAN
Calibrates the valve travel, with limit values for the position sensor.
(10%, 50%, -)

SAVE
Saves calibration data in FRAM memory.
(15%, 75%, -)

TIME
Finds opening and closing times for the valve.
(20%, 100%, -)

CNTRL
Starts Auto tuning in 50% position.
(25%, - , 0%)

TUNE1
Oscillates the system for PID parameters calculation.
(55%, - , 30%)

TUNE2
Oscillation values acquisition.
(60%, - , 35%)

WAIT
Beginning of PID parameters calculation.
(65%, - , 40%)

PARAM
Saves the calculated parameters and returns to the control at the setup end (calibration).
(100%, - , 98%)

Multidrop Configuration

ADDRESSING
FY400 contains a variable that defines the device address in a Hart® network. Hart® addresses assume values from "0" to "15", the addresses "1" to "15" being specific addresses to multidrop connection. When the FY400 is configured for multidrop, it means that the display is showing “MD” and the address is a value from "1" to "15". FY400 is factory-configured with address "0".

Diagnostic

This function allows engineering unit configuration, the parameters for diagnostic purposes and shows the positioner general conditions. Consult the “Section 3” for more details about the available functions for the diagnostic.

Pressure Sensor

This function allows pressure trim adjustment for the positioners that have optional pressure sensor. Besides visualize the status of the applied pressure and to configure the positioner input pressure in order to activate the alarm via Hart® communication, if the applied input pressures are not in accordance with the configured values.

Factory

This option is used only in the factory, and the user cannot access it.

Section 6

MAINTENANCE

General Information

NOTE
Equipment installed in hazardous atmospheres must be inspected in compliance with the IEC60079-17 standard.

As a guarantee of quality, the FY400 Valve Positioners are extensively tested and inspected before delivery to the end user. Nevertheless, they were designed to provide an easy periodic cleaning and repair, when necessary.

In general, it is recommended that the end user do not try to repair printed circuit boards. Instead, replace the pieces and, for this, he should have spare circuit boards, which may be ordered from Smar whenever necessary. See list of recommended spare parts on page 7.3.

The maintenance procedure is a set of techniques with the purpose of keeping the positioners with higher useful life, to operate in safe conditions and to promote costs reduction. The different types of maintenance are described during this section.

The positioner should be disassembled and undergo cleaning procedures, every time the final element of control is subject to maintenance.

FY400 Corrective Maintenance

Unplanned maintenance intends to locate and repair malfunction in the positioners or final elements of control operating in continuous work, or, specifically to suppress already existing defects.

Diagnostics are a set of methods to detect, to locate and eventually to correct errors and problems or even verify failures in the final element of control and in the positioner.

FY400 Diagnostics without Configurator

In order to carry out the diagnostics, refer to Table 6.1.

SYMPTOM	SOURCE / SOLUTION
POSITION NOT ON DISPLAY	**Power Supply must be a current source** Check input signal current. Minimum current for positioner operation is 3.8 mA. **Electronic Circuit Failure** Check the boards for malfunctions and replace faulty boards for spare ones.
NO RESPONSE FOR THE INPUT SIGNAL	**Pressure Output Connections** Check for air leakeage. **Air Supply Pressure** Check the air supply pressure. Input pressure to the FY400 must be between 20 and 100 psi. **Calibration** Check the positioner calibration points. **Obstructed Restriction and/or Blocked Output Connection** Refer to the procedures described in this Manual: OUTPUT CONNECTION and RESTRICTION CLEANING.
OSCILLATING ACTUATOR	**Calibration** Adjust tuning parameters.
SLOW ACTUATOR RESPONSE	**Adjustment Parameters are Too Low** Adjust tuning parameters.
ACTUATOR RESPONDS TOO FAST	**Adjustment Parameters are too High** Adjust tuning parameters.

Table 6.1 - FY400 Diagnostics Without Configurator

FY400 Diagnostics with Configurator

If the positioner is on and with the communication circuit and the processing unit working, the configurator can be used for diagnostics. The configurator should be connected to the positioner according to the wiring diagram showed on page 1.8.

Error Messages
The error messages inform which diagnostics were found through errors and malfunctioning self-diagnosing. When the configurator is communicating with the positioner, the user is informed on any problem found, through the self-diagnosis. At the FY400 positioner, the error messages always alternate with the information on the top line of the configurator display. The table lists the error messages and more details on the corrective action.

STATUS	POTENTIAL SOURCE
PARITY ERROR	• Excessive noise or ripple in the line. • Low level signal. • damaged Interface • Power supply or battery voltage of the configurator lower than 9 V.
OVERRUN ERROR	
CHECK SUM ERROR	
FRAMING ERROR	
BUSY LINE	• Other device using the line.
CMD NOT IMPLEMENTED	• Software version not compatible between configurator and positioner.
BUSY DEVICE	• Positioner carrying out an important task, e.g., local adjustment.
POSITIONER MALFUNCTION	• Disconnected Transducer. • Transducer with damage. • Stuck valve.
COLD START-UP	• Start-up or power supply failure.
FIXED OUTPUT	• Operating in local mode with fixed position.
NO RESPONSE	• Positioner line resistance is not according to technical characteristics. • Positioner without power supply. • Interface disconnected or damaged. • Positioner configured in multidrop mode being accessed by ON_LINE_ÚNICO_INSTR. • Interface damaged. • Power supply or battery voltage of the configurator lower than 9 V.

Table 6.2 – FY400 Diagnostics with the Configurator

Disassembly Procedure for Maintenance

1. Apply air pressure in the positioner inlet, without applying power supply. Verify if there is any air leakage in output 1 (OUT1). In case of air leakage in outlet 1, remove power supply and check the mechanical parts.

2. Remove the base restriction, without disassembling the transducer. Verify if the restriction is not obstructed. (See Restriction Cleaning Procedure, page 6.11).

Have the following tools at hands:
- Allen Key
- Screwdriver

Disassemble the equipment as shown:

Removal of the Electronic Housing Transducer

IMPORTANT
Follow correctly the disassemble steps, avoiding damaged parts or equipment.

1. Disconnect the electrical connections (on the side marked: FIELD TERMINALS);

2. Remove the cover. It has a **cover locking screw** that needs to be rotated in a clockwise direction to be loosened. By reversing the process the cover will be locked. See figure 6.1.

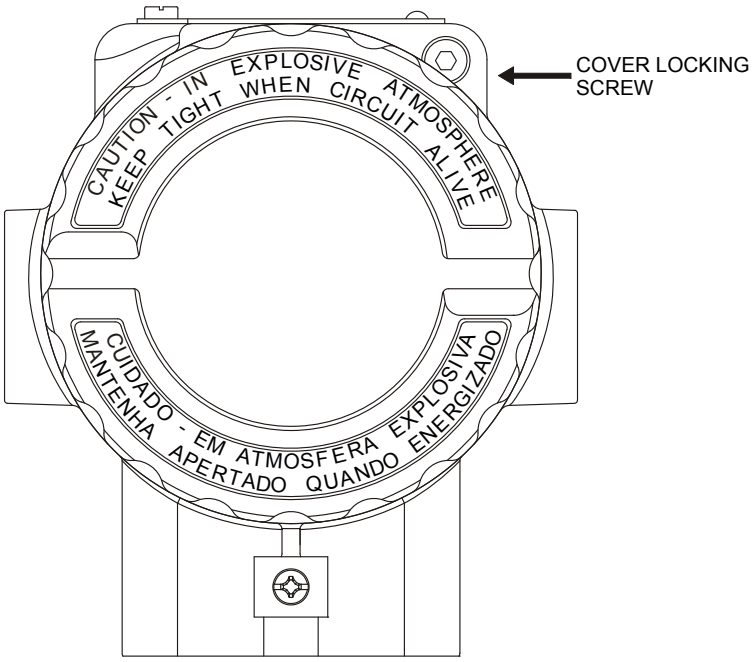


Figure 6.1 – Cover locking screw

3. Release the two screws that tighten the main board, to remove the main board and the housing display.

4. Disconnect the power supply cable and the main board flat cable (It has two lockers, release them to disconnect both cables easily).

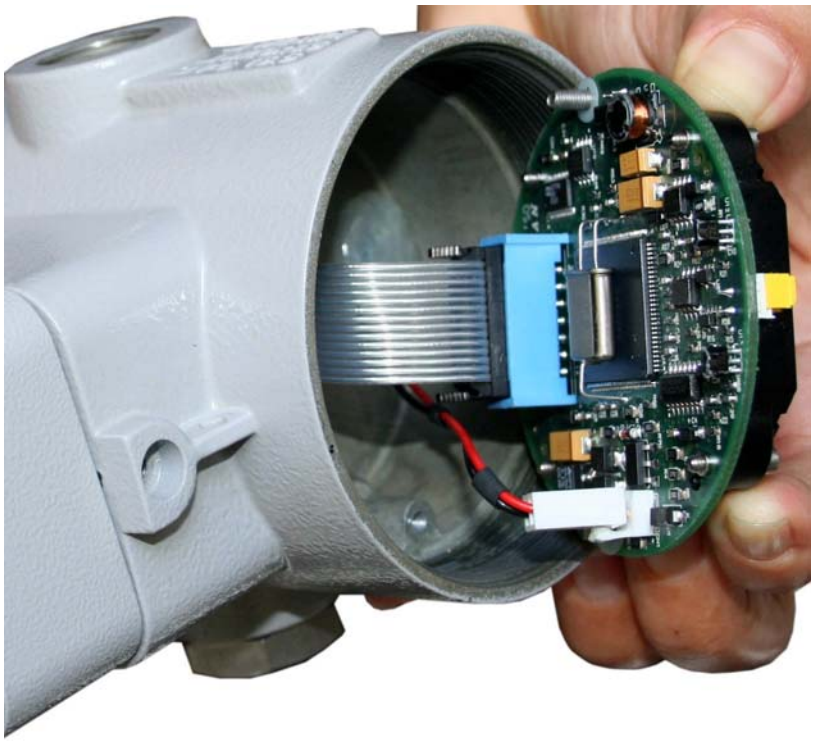


Figure 6.2 – Disconnecting the main board cables

5. Loosen the housing rotation locking screw (rotating in a counterclockwise direction).

IMPORTANT
Not rotate the housing without loosening the rotary locking screw, because that can damage the housing thread and consequently it will need to be changed.

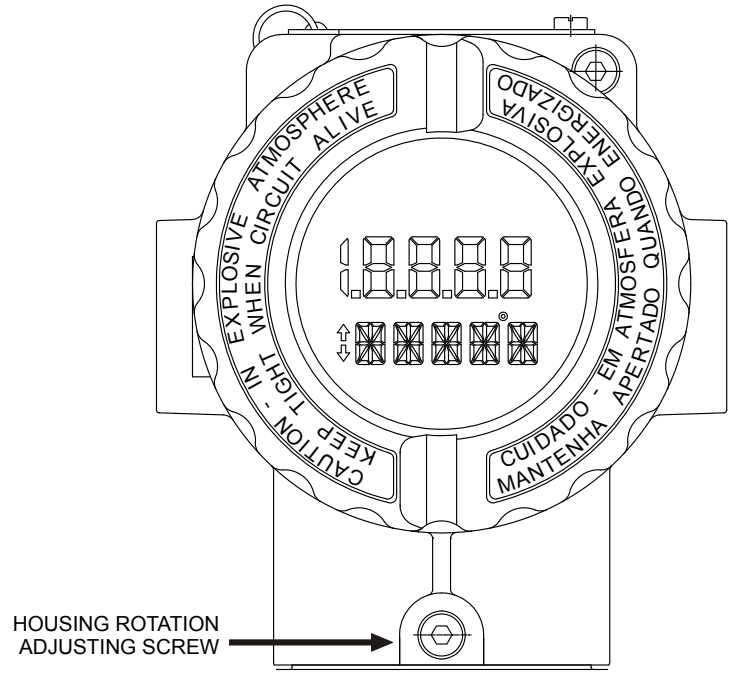


Figure 6.3 – Housing rotary locking screw

IMPORTANT
Do not rotate the electronic housing more than 270° without disconnecting the electronic circuit from the power supply.

Figure 6.4 – Transducer rotation

Loosen carefully the electronic cover of the transducer without twisting the flat cable. Remove the housing transducer, rotating them in opposite directions and loosening the housing internal lock at each turn.

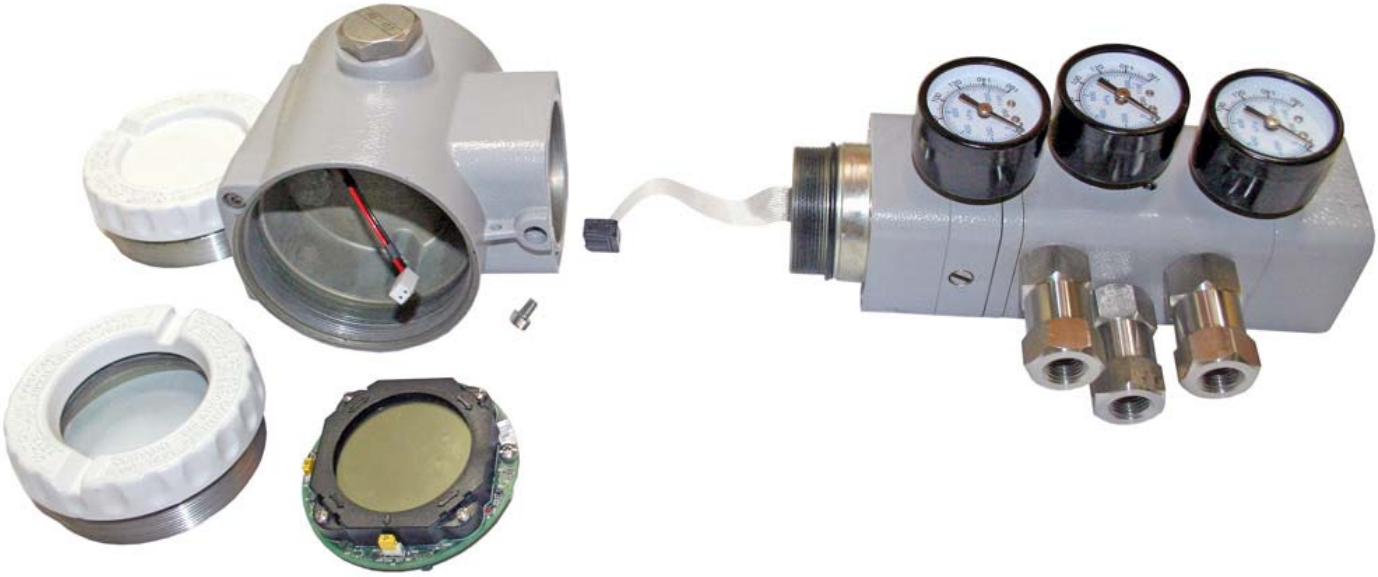


Figure 6.5 – Disassembled housing with disconnected transducer

Disassembled Transducer

1. Remove anticlockwise the Allen screws that fix th e assembled connection cover (this part cannot be washed).

IMPORTANT
Before loosening the assembled connection cover, remove the position sensor cover, at the other positioner end. See the indicated parts in the figure below or in the drawing exploded view.

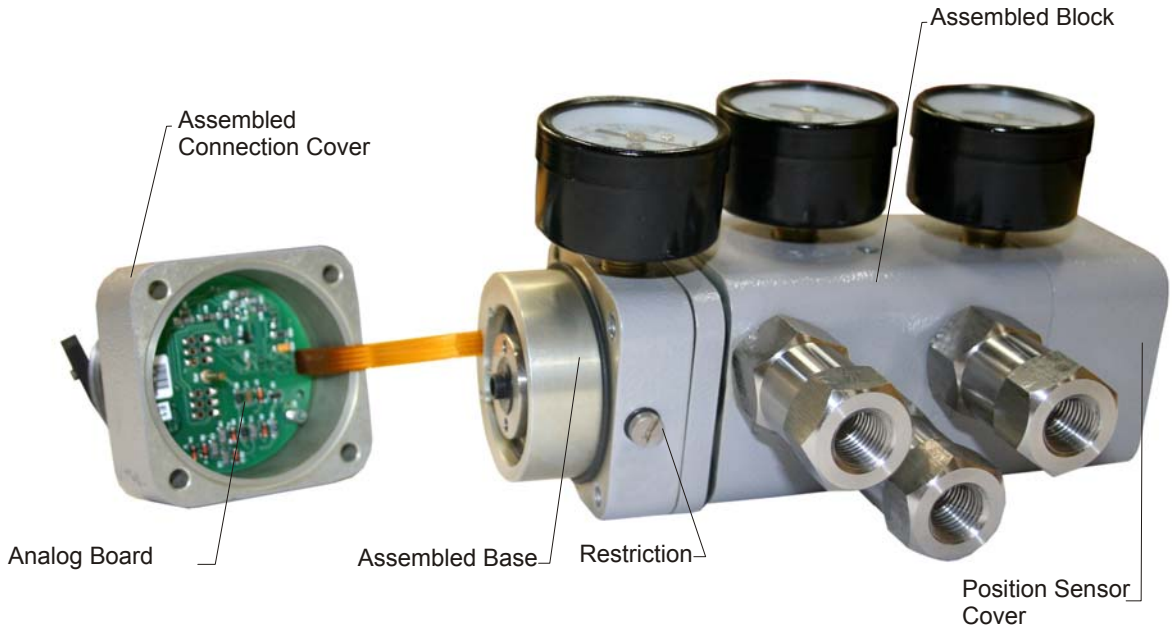


Figure 6.6 – Disassembled connection cover

2. Remove, with care, the asse mbled connection cover not to damage the main electronic circuit board with the flat cable, because it is fragile (this part cannot be washed); See figures below:

Figure 6.7 – Loosening the Assembled Base Connection Cover

Figure 6.8 – Loosened Connection Cover

3. Remove, with care, the main electronic circuit board, which is firmly fitted. Remove and inspect it for damages (oxidation, etc); See figures below:

Figure 6.9 – Removing the connection cover main board

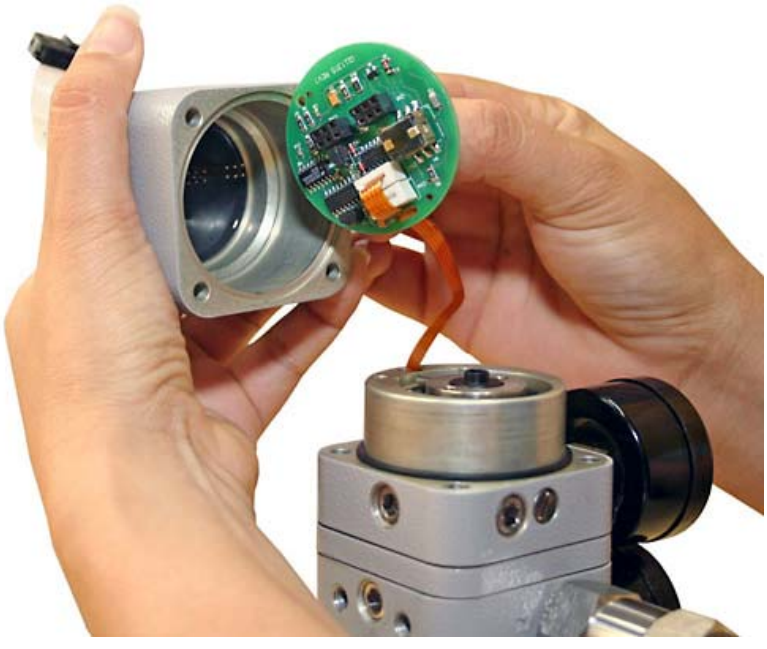


Figure 6.10 – Main board loosened from the assembled base

4. Remove the flat cable from the main board. Pull the lock that fixes the position sensor to the main circuit board, and this will loose easily. Check if the position sensor flat cable is not twisted, broken or oxidized, etc; See figures below:

Figure 6.11 – Pulling, with the nail, the lock that fixes the flat cable to the main board

Figure 6.12 - Flat Cable loosened from the connector

5. Remove the transducer. This part cannot be washed It is calibrated from the factory and is protected with a sealing wax to avoid inadequate handling. The re-calibration can be made by the user, see the item: Check the calibration of the piezo base set.

6. Remove the transducer restriction. Check if it is not blocked, see: Restriction Cleaning Procedure.

7. Remove the diaphragm set. Check visually if the diaphragm is not damaged, with small holes or sealing failures. Wash the parts of the diaphragm set carefully with water and neutral detergent; then wash it with alcohol and dry well before assembling.

8. Remove the spool valve. This spool valve moves against a spring located in the spool valve conditioning hole; take care when handling the block so that the spool valve spring isn't lost during the cleaning procedure, it is very small. Wash the spool valve with water and neutral detergent and then with alcohol and dry the part well before re-assembling it in the pneumatic block. This part should be set up without any lubrication.

9. Remove the position sensor cover (or transducer) carefully not to damage the flat cable (the four screws must be removed when disassembling the transducer block). Inspect the part visually, for indications of humidity infiltration or other foreign element. This part cannot be washed.

10. Remove the hall effect position sensor with the flat cable.

11. The pneumatic block can be washed in water and neutral detergent, and then with alcohol. Be careful not to lose the small spool valve. Blow dry compressed air in all hoses to clean any dirt.

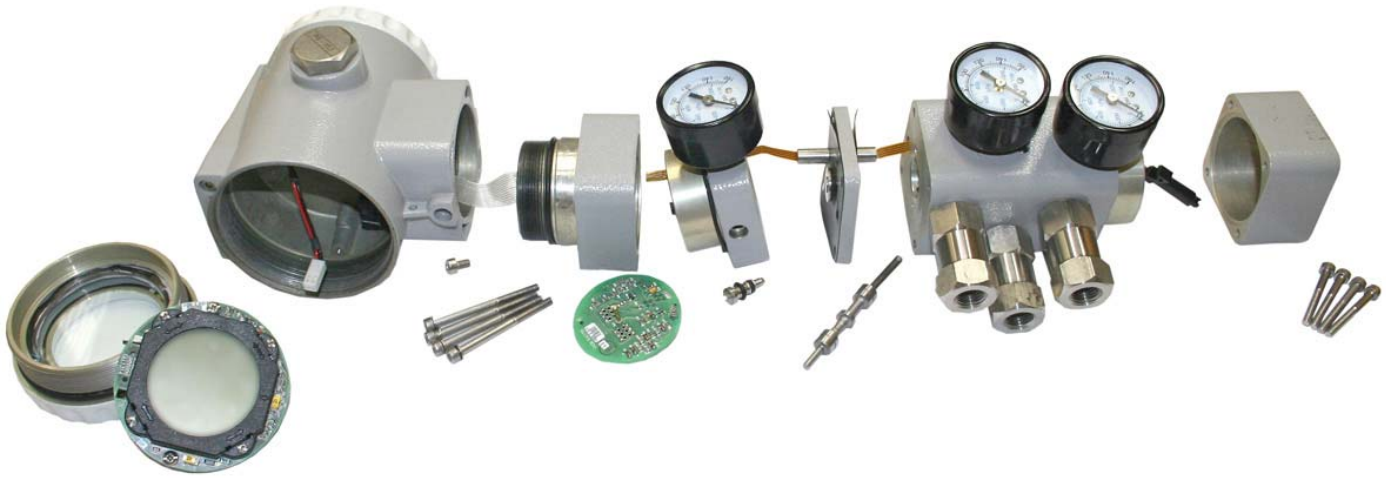


Figure 6.13 – Disassembled FY400

Checking the Piezo Base Set Calibration

A good FY400 performing depends on the Piezo Base calibration integrity. Due to its continuous use is expected a small variation on the piezo work voltage. If the piezo work voltage is close to 30 V or 70 V, this may be an indication the Piezo Base needs to be recalibrated soon.

Using the Hand-Held configurator, its possible re ad the pi ezo work voltage. This should be do ne periodically. Additionally, the FY400 monitors the piezo work voltage at intervals defined by user. By using the CONF401 application the user can observe a graph (see Figure 6.13a) which shows the calibration deviation trend.

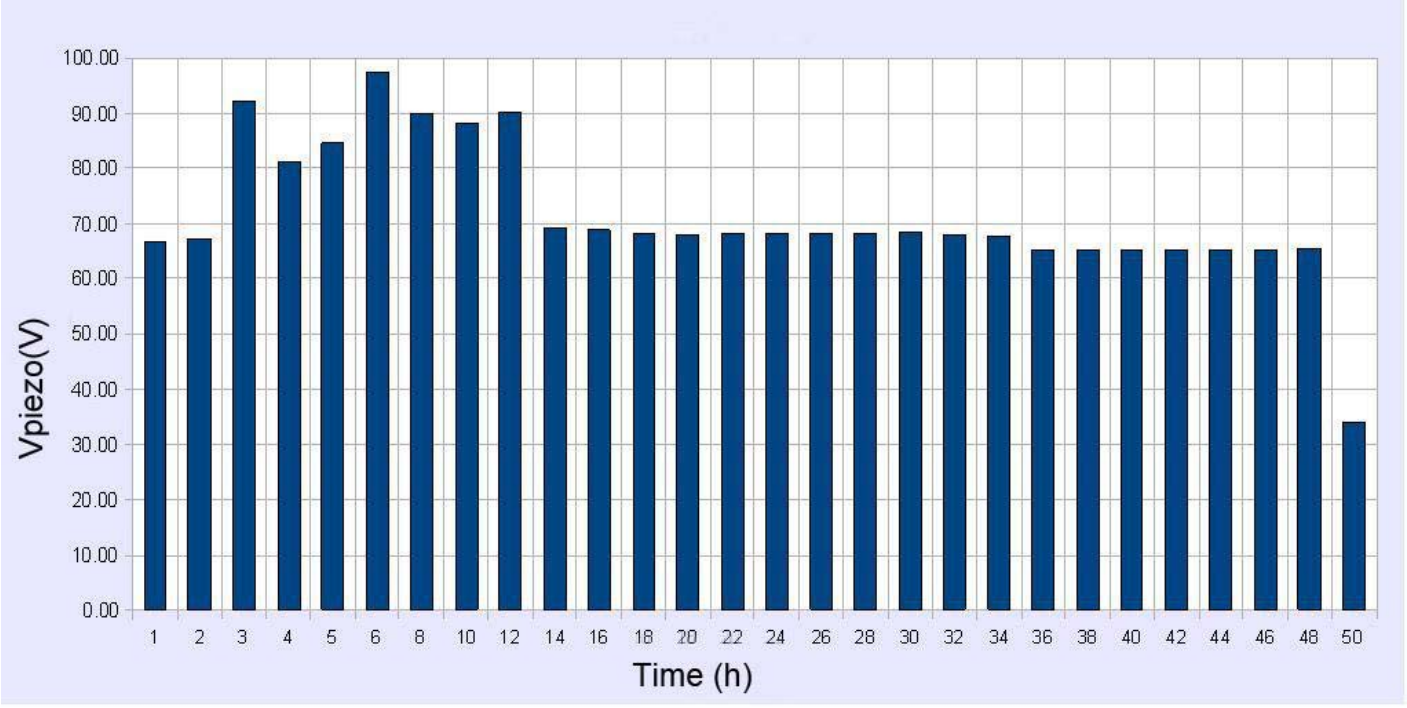


Figure 6.13a – Characteristic – Piezo Voltage Trend Graph

ATTENTION
More information on the Calibration Procedure, r efers to the F YCAL manual (Calibration Device f or Pressure Transducer) by visiting our web page on the Internet: http://www.smar.com.

1. Assemble the base in the FYCAL according to the figure 6.14:

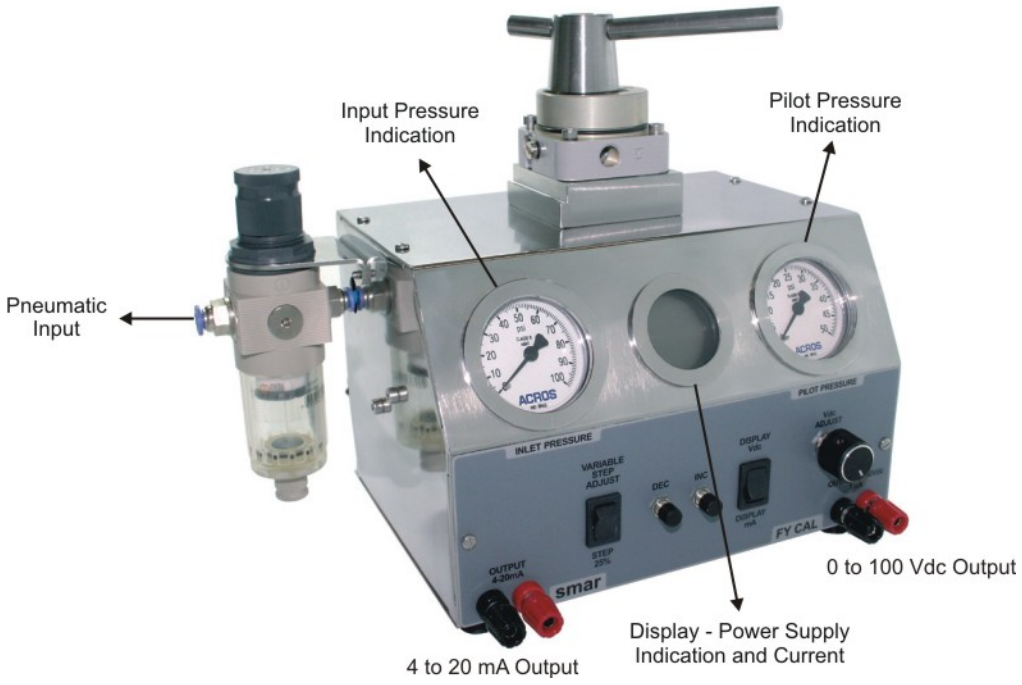


Figure 6.14 – FYCAL – Piezoelectric calibration

2. Assemble the piezoelectric sensor on the jig, by tightening the four screws to ensure good sealing.

CALIBRATION TABLE FOR FYCAL		
A	B	C
Input Pressure (psi)	***Power Supply (Vdc)***	***Pilot Pressure (psi)***
20	40	7.5 to 8.5
40	40	12 to 13
60	40	16 to 17
80	40	20 to 21
100	40	24 to 25

Table 6.3 – FYCAL Calibration Table

3. Apply the appropriate (psi) input pressure – As column **A;**

4. According to the calibration table above, apply 40 DC Volts to the piezoelectric sensor (independently from the input pressure applied). With the calibration tool, turn carefully the piezo position on the base, to get the corresponding pilot pressure on the gauge. The pilot pressure measured on the gauge corresponds to the pilot pressure values (psi) indicated in column **C** in the **FYCAL** calibration table.

   Example: When applying 40 DC volts to the piezoelectric sensor, for an input pressure of 60 psi, result must be a pressure between 16 to 17 psi in the pilot chamber.

5. In case the value for the pilot pressure is not a value defined in the FYCAL calibration table (as per the Column **C**), adjust the upper disk of the piezoelectric sensor set by turning it with the appropriate tool. Repeat the calibration procedure to obtain the values for the pilot pressure defined in Table 6.3, as expected for the required range.

After calibrating the piezoelectric sensor, check the positioner. Then assemble and setup the positioner.

If the positioner is checked while assembled with all its electronic components, the **FYCAL** 4 to 20 mA output may be used to power the positioner.

The **FYCAL** may also be used as power supply for any Smar Hart line product, as it generates a 4 to 20 mA current.

Maintenance - Mechanical Parts

1. Verify if the spool valve (**28**) is moving freely.

2. Verify if the spool valve is not obstructed with dirty (**28**).

ATTENTION
Never use oil or grease to lubricate the spool valve; otherwise the positioner performance will be impaired.

3. Verify if there is any obstruction inside the FY pneumatic block (**19** to **35**) and at the exhausts.

4. Verify the diaphragm (**26**) integrity.

5. Verify if the transducer block (base) (**24**) is dirty with oil, water, etc.

6. Verify if the restriction (**20**) is dirty. See Restriction Cleaning Procedure.

Maintenance – Electronic Parts

Electronic Circuit

NOTE
The numbers indicated between parentheses refer to exploded view figure.

To remove the main board (**5**) and the display (**4**) of the circuit, first release the cover locking screw (**6**) from the side not marked "Field Terminals", and after that release the cover (**1**).

ATTENTION
The circuit boards have CMOS components that can be damaged by electrostatic discharges. Verify the correct procedures to manipulate CMOS components. Also it is recommended to store the circuit boards in packings with electrostatic load proof.

Release the two screws (**3**) that fix the main board and display.

Assembly the device in a valve to test it inside a laboratory. Apply power pressure according to the pressure of the actuator that is being used and power on the equipment with a variable power supply from 4 to 20 mA. If the device does not initialize, i.e., the display does not light on, proceed with the following procedures:

1. Disconnect the main board from the main electronic circuit board, disconnecting the flat cable connector in the housing;

2. Case the equipment initializes, change the main electronic circuit board (GLL1315) (**18** - part number 400-0914). If it does not, change the main board (GLL1314) (**5** - part number 400-0909).

Proceed with full setup. After the setup, verify if the positioner is working properly. For that, apply 12mA and be sure that the valve goes to the position correspondent to the 50% of the valve travel. If it does not occur, do the following:

1. Apply 4 mA and verify through the configurator if SP% is equal to 0%;

2. Apply 20 mA and verify through the configurator if SP% is equal to 100%;

3. If the values above were different, execute the 4 mA and 20 mA current trim.

NOTE
Via software HPC401 for Palms or CONF401 it is possible to execute the CURRENT TRIM that allows to calibrate the positioner input current reading. There are two types of current trims available: – **4 mA TRIM**: is used to adjust the input current reading correspondent to 0%. – **20 mA TRIM:** is used to adjust the input current reading correspondent to 100%.

4. Verify the Hall-effect position sensor reading through the configurator. Apply pressure directly to the valve actuator and check the Hall reading (65000 means that the hall is not being read). Case there is no change at the Hall reading or the value is 65000, the defect can be the GLL1314 (**5** - part number 400-0909), GLL1315 (**18** - part number 400-0914), GLL1316; or Hall flat cable (GLL1019);

5. Verify the piezo base/transducer voltage in the configurator;

6. The piezo base/transducer voltage value must be between 30 and 70 Volts.

To verify the hall value and the piezo base/transducer voltage, do the following:

1. Set the valve in 50% of the opening or closing travel;

2. With the configurator, go to the “monitoring” mode and choose two parameters: Hall value and piezo voltage;

3. The hall values must be between 28000 a 37000;

4. The Voltage values of the base or piezo transducer should be between 30 and 70 Volts. If the tension is not among those values, to proceed to the piezo calibration using the FYCAL checking and calibration device for Smar valve positioner, see item: Calibration Checking of the Piezo Base Set.

FY400 Preventive Maintenance

Planned Maintenance consists of a set of procedures and anticipated actions to keep the device functioning, in other words, mainly to prevent failures, through adjustments, proves and measures according to previously specified values. The preventive maintenance is recommended in the maximum period of one (1) year, or when the process stops.

Restriction Cleaning Procedure

The instrument air flows to the nozzle through a restriction. From time to time the restriction must be cleaned to assure good performance to the positioner.

1. Disable the positioner power supply and disconnect the instrument air pressure;

2. With an appropriate screwdriver remove the restriction screw;

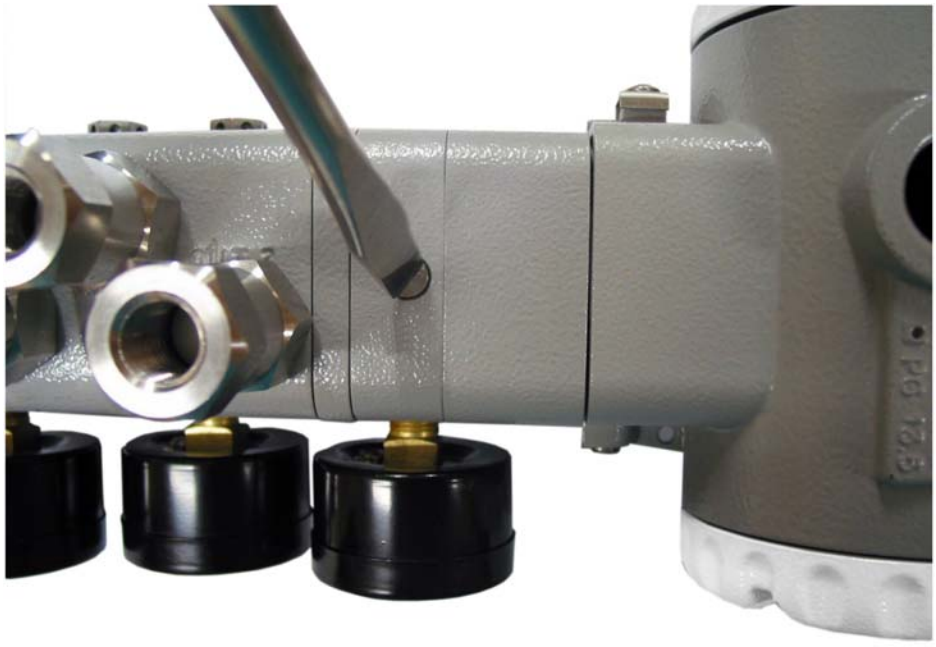


Figure 6.15 – Removing the Restriction Screw

3. Remove the o-ring's with an appropriate tool;

4. Wash the part with water and neutral detergent and dry it with compressed air (apply the compressed air directly to the smaller orifice for the air to get out through the bigger hole).

5. Insert the cleaning needle (PN 400-0726) into the restriction hole to prevent any possible obstructions;

Figure 6.16 - Restriction and Restriction Cleaning Needle

Figure 6.17 - Cleaning Procedure

6. Mount the o-rings again and screw the restriction in the positioner;

7. The equipment can be supplied with air again.

Change of the Filters Elements

Change the positioner filter elements with a minimum stated period of 1 (one) year (See exploded view figure (**27**)). The air supply must be clean, dry and non-corrosive, according standards set by the American National Standard *"Quality Standard for Instrument Air"* - ANSI/ISA S7.0.01 - 1996. If the instrumentation air does not comply with the above mentioned standards, the user should consider changing the positioner filter elements more frequently.

ATTENTION
The **Filtering Element** has two threaded Stainless Steel mechanical parts. Inside them is the Filter Element with an o-ring.

How to disassemble the Filtering Element?
Firstly, remove the air filter set of the positioner (See exploded view figure (**30**)) and then unthread the two mechanical parts. Refer to the drawing exploded view (**27**) to identify the Filtering Element that is between the two mechanical parts of the dismounted air filter.

EXHAUST OUTLETS
Air is vented to the atmosphere through an outlet located beside the restriction and 4 outlets on the opposite side to the gauge. A foreign object interfering or blocking exhaust port provides a way to increase the output. Cleaning by spraying it with a solvent.

ATTENTION
Never use oil or grease to lubricate the spool valve, otherwise the positioner performance will be impaired.

Section 7

SPARE PARTS AND MATERIALS

Package Content

Verify the package content. The items marked with (*) must be in accordance with the number of positioners supplied.

- Positioner
- Positioner Mounting Screws
- Magnet
- Magnetic Tool (*)
- Magnet Centralizer device (*)
- Restriction Cleaning device (*)
- Instructions Manual (*)

Exploded View

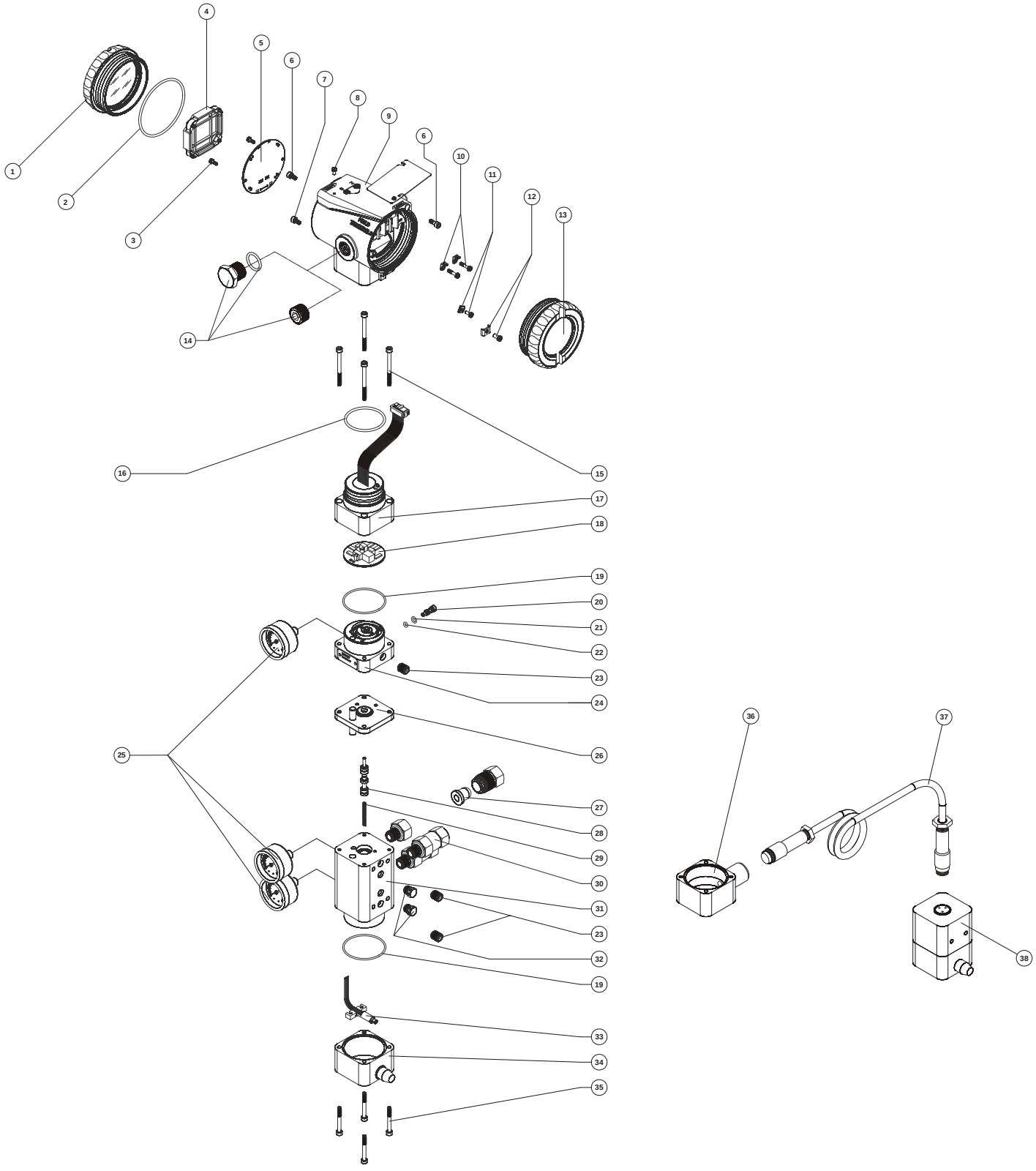


Figure 7.1 – Exploded View

Accessories

ACCESSORIES	
ORDERING CODE	**DESCRIPTIONS**
SD-1	Magnetic tool for configuration via local adjustment.
HPC401*	PalmOS Platform, including the HPC401.installation and initialization software.
HPI311	Hart® Interface.
400-0726	Restriction Cleaning needle.
400-1176	Teflon guide for linear magnet.
400-1177	Teflon guide for rotary magnet.

* For updates of the HPC401 equipment and software, visit: **http://www.smarresearch.com.**

Spare Parts List

SPARE PARTS LIST				
PARTS DESCRIPTION		**POSITION**	**CODE**	**CATEGORY (NOTE 4)**
Cover with Display (O-ring included)	*Aluminum*	**1**	400-0824	-
	316 Stainless Steel	**1**	400-0825	-
Cover o-ring (with and without display) **NOTE 1**	*Buna-N*	**2**	204-0122	B
Main Board screw	*Carbon Steel – for Aluminum housing*	**3**	400-0905	B
	316 Stainless Steel	**3**	400-0832	B
Digital Display - includes fixation screws	-	**4**	400-0828	A
Main Board	-	**5**	400-0909	A
Cover locking screw	*316 Stainless Steel*	**6**	204-0120	-
Housing Rotation Locking Screw, 316 Stainless Steel	*M6 - Without Head*	**7**	400-1121	-
Identification Plate screw	*316 Stainless Steel*	**8**	204-0116	-
Housing, Aluminum **(NOTE 2)**	*1/2 - 14 NPT*	**9**	400-1193	-
	M20 x 1,5	**9**	400-1194	-
	PG 13,5 DIN	**9**	400-1195	-
Housing, 316 Stainless Steel **(NOTE 2)**	*1/2 - 14 NPT*	**9**	400-1196	-
	M20 x 1,5	**9**	400-1197	-
	PG 13,5 DIN	**9**	400-1198	-
Toothed Communication Terminal and Terminal Screw	*316 Stainless Steel*	**10**	400-0827	B
Internal ground screw and square washer	-	**11**	400-0833	-
External ground screw	*Self-cutting stainless steel for Aluminum housing*	**12**	400-0904	-
	316 Stainless Steel	**12**	400-0826	-
Cover without display (included O-ring)	*Aluminum*	**13**	400-0822	-
	316 Stainless Steel	**13**	400-0823	-
1/2" NPT (Ex d) Six-sided internal plug	*Bichromatized Carbon Steel*	**14**	400-0808	-
	304 Stainless Steel	**14**	400-0809	
1/2" NPT Six-sided internal plug	*Bichromatized Carbon Steel*	**14**	400-0583-11	-
	304 Stainless Steel	**14**	400-0583-12	-
M20x1.5 (Ex d) Six-sided external plug	*316 Stainless Steel*	**14**	400-0810	-
PG13.5 (Ex d) Six-sided external plug	*316 Stainless Steel*	**14**	400-0811	-
3/4" NPT (Ex d) Retention Bushing	*316 Stainless Steel*	**14**	400-0812	-
Connection cover screw	-	**15**	400-0073	-
Neck O-RING	*Buna-N*	**16**	204-0113	B
Assembled Connection Cover	*Aluminum*	**17**	400-0910	-
	316 Stainless Steel	**17**	400-0911	-
Connection Cover Set	*Aluminum*	**15 a 18**	400-0912	A
	316 Stainless Steel	**15 a 18**	400-0913	A
Main Electronic Circuit Board	-	**18**	400-0914	-
Base and Block O-ring	-	**19**	400-0915	B
Piezo Base Set	*Aluminum*	**19 a 25**	400-0916	A
	316 Stainless Steel	**19 a 25**	400-0917	A
Restriction	-	**20**	344-0165	B
O-ring	*Restriction External*	**21**	344-0155	B

SPARE PARTS LIST				
PARTS DESCRIPTION		**POSITION**	**CODE**	**CATEGORY (NOTE 4)**
Synthesized Bushing	-	**23**	400-0033	B
Assembled Base	*Aluminum*	**24**	400-0918	A
	316 Stainless Steel	**24**	400-0919	A
Analog indicator (Gage) (**NOTE 5**)	*316 Stainless Steel and Brass*	**25**	400-1120	B
Assembled Diaphragm	*Aluminum*	**26**	400-0920	B
	316 Stainless Steel	**26**	400-0921	B
Filtering Element	-	**27**	400-0655	A
Spool Valve	-	**28**	400-0653	-
Spool Valve Spring	-	**29**	400-0787	-
Air Filter - 1/4" NPT	*304 Stainless Steel*	**30**	400-1383	B
Assembled Block	*Aluminum*	**31**	400-0923	A
	316 Stainless Steel	**31**	400-0924	A
Block Set	*Aluminum*	**19,23,25,27,28,29,30,31,32**	400-0925	-
	316 Stainless Steel		400-0926	-
Block Set with Pressure Sensor	*Aluminum*	**19,23,25,27,28,29,30,31,32**	400-1074	-
	316 Stainless Steel	**19,23,25,27,28,29,30,31,32**	400-1075	-
Vent Plug	*304 Stainless Steel*	**32**	400-0654	-
Position sensor Support + Position Sensor + Flat Cable	-	**33**	400-0927	B
Position sensor Cover Set	*Aluminum*	**34**	400-0928	-
	316 Stainless Steel	**34**	400-0929	-
Position sensor Cover Screw	-	**35**	400-0092	-
Position sensor Cover Set	*Aluminum*	**33, 34, 35**	400-0930	A
	316 Stainless Steel	**33, 34, 35**	400-0931	A
Remote Position Sensor Cover Set	*Aluminum*	**36**	400-0932	-
	316 Stainless Steel	**36**	400-0933	-
Position Sensor Cable Set + Connector	*5 m*	**37**	400-0857	-
	10 m	**37**	400-0858	-
	15 m	**37**	400-0859	-
	20 m	**37**	400-0860	-
Remote Extension Position Sensor Set	*Aluminum*	**38**	400-0934	-
	316 Stainless Steel	**38**	400-0935	-
Transducer Set **(NOTE 3)**	*Aluminum*	**15 a 35**	400-0936	A
	316 Stainless Steel	**15 a 35**	400-0937	A
Magnets	*Linear magnet up to 30 mm*	**-**	400-0748	-
	Linear magnet up to 50 mm	**-**	400-0035	-
	Linear magnet up to 100 mm	**-**	400-0036	-
	Rotary magnet	**-**	400-0037	-
MOUNTING BRACKET SCREW FOR POSITIONER ASSEMBLY (packaged with 12 units)	-	**-**	400-1190	-

Note 1 - The O-rings are packaged with 12 units.
Note 2 - Includes terminal isolator, screws (cover lock, ground and terminal isolator) and identification plate without certification.
Note 3 - Includes all transducer spare parts.
Note 4 - For category **A** it is recommended to keep in stock a set for each 25 parts installed and a set for each 50 for category **B**.
Note 5 - The pressure gages for in-let, output 1 or output 2 pressures, will be supplied with the brass.wet parts.

Ordering Code

MODEL

FY400 **INTELLIGENT VALVE POSITIONER**

COD	Communication Protocol
H	HART® & 4 to 20 mA

COD	Safety Options
0	Standard – For use in measurement and control

COD	Local display
1	With local display

COD	Mounting Bracket
0	Without mounting bracket
1	With mounting bracket

COD	Electrical Connections
0	1/2" - 14 NPT
A	M20 X 1.5
B	PG 13.5 DIN

COD	Type of Actuator	COD	Type of Actuator
1	Rotary - Single Action	8	Linear up to 100 mm - Double Action
2	Rotary - Double Action	A	Linear up to 30 mm - Single Action
5	Linear up to 50 mm - Single Action	B	Linear up to 30 mm - Double Action
6	Linear up to 50 mm - Double Action		
7	Linear up to 100 mm - Single Action		

COD	Indication Gage	COD	Indication Gage
0	Without Gage	4	With 2 Gages - Output 1 and 2
1	With 1 Gage - Input	5	With 3 Gages
2	With 1 Gage - Output 1	Z	Others - Specify
3	With 2 Gages - Input and Output 1		

COD	Certification Type	COD	Certification Type
D	Explosion Proof	I	Intrinsic Safety
G	Explosion Proof + Increased Safety	N	Without Certification
H	Intrinsic Safety + Explosion Proof + Increased Safety	P	Protection by Enclosure (Ex-tb; Explosive Dust - Zone 21)

COD	Certifying Body
0	Without
5	CEPEL: Ex-d, Ex-ia, Ex-dem, IP

SPECIAL OPTIONS (Leave it blank for no optional items)

COD	Housing
H0	Aluminum Housing (IP/Type)
H1	316 SST Housing (IP/Type)
H2	Aluminum Housing for saline atmosphere (IPW/Type X) **(1)**
H3	316 SST Housing for saline atmosphere (IPW/Type X) **(1)**

COD	Painting
P0	Gray Munsell N 6.5 Polyester
P8	Without Painting
P9	Safety Blue Epoxy – Electrostatic Painting
PD	Safety Blue Polyesters – Electrostatic Painting
PH	Special Painting

COD	Mounting Sensor
RO	Integral Mounting
R1	Remote Sensor - 5 m Cable
R2	Remote Sensor - 10 m Cable
R3	Remote Sensor - 15 m Cable
R4	Remote Sensor - 20 m Cable
R5	Feedback 4 to 20 mA - 5 m Cable **(2)**
R6	Feedback 4 to 20 mA - 10 m Cable **(2)**
R7	Feedback 4 to 20 mA - 15 m Cable **(2)**
R8	Feedback 4 to 20 mA - 20 m Cable **(2)**

COD	Special Sensor
K0	Without Pressure Sensors
K1	With Pressure Sensors for air Input and Output

COD	Optional Items
ZZ	Leave it blank for no optional items

FY400	-	H	0	-	1	1	-	0	6	5	N	0	·	*	/	*	/	*	/	*	/	*	⬅ TYPICAL MODEL NUMBER

NOTES

(1) IPW/TYPEX tested for 200 hours according to NBR 8094 / ASTM B 117 standard.
(2) Consult Smar for applications in hazardous areas. See note for mounting bracket on BFY ordering code.

BFY	BRACKET (1)

CODE	Mounting Bracket Position (2)
0	Without Bracket
1	Universal Rotary
2	Universal Linear - Yoke and Pillar Type
3	Linear - Yoke Type
4	Linear - Pillar Type
Z	Others - Specify

CODE	Magnet Mounting Bracket
0	Without Mounting Bracket
1	Rotary
2	Linear up to 30 mm
3	Linear up to 50 mm
4	Linear up to 100 mm
Z	Others - Specify

COD.	Positioner Mounting Bracket Material
7	Carbon Steel Bracket and Accessories in SST
C	Carbon Steel Bracket
I	Stainless Steel Bracket
N	Not applicable
Z	Others - Specify

COD.	Magnet Bracket Material
C	Carbon Steel Bracket
I	Stainless Steel Bracket
N	Not applicable
Z	Others - Specify

COD.	Optional Items
ZZ	Leave it blank for no optional items

BFY	-	1	0	7	C	.	*

TYPICAL MODEL NUMBER

NOTES
(1) Consult www.smar.com for customized mounting bracket. **(2)** When choosing the remote sensor version, an additional “L” shape bracket is included for 2” tube mounting.

Appendix A

CERTIFICATIONS INFORMATION

This appendix covers all the information related to the certificates for this equipment. Its content was generated by the Smar Certification Team.

European Directive Information

European Directive Information

Authorized representative in European Community.
Smar Gmbh-Rheingaustrasse 9-55545 Bad Kreuzanach
This product complies with following European Directive:

EMC Directive (2004/108/EC) –"Electromagnetic Compatibility"
The EMC test was performed according to IEC standard: IEC61326-1:2005 and IEC61326-2-3:2006
Tests performed using twisted pair wire.
If using shielded cable, keep the shield insulated at the instrument side, connecting the other one to the ground.

Immunity test requirements for equipment intended for use in industrial locations.
(Table 2, clause 6, IEC61326-1:2005)

PORT	Phenomenon	Basic Standard	Test Value	Performance Criteria
Enclosure	Electrostastic discharge (ESD)	IEC61000-4-2	6KV/8KV contact/air	B
	EM Field	IEC61000-4-3	10V/m (80 to 1GHz) 3V /m (1,4GHz to 2GHz)	A
	Rated power frequency magnetic field	IEC61000-4-8	30A/m	A
I/o signal /control	Burst	IEC61000-4-4	1KV(5/50nS, 5KHz)	B
	Surge	IEC61000-4-5	1KV (line to ground)	B
	Conducted RF	IEC61000-4-6	3V (150KHz to 80MHz)	A

Emission requirements (clause 7, IEC61326-1:2005).
According to the standards: CISPR11, IEC61000-3-2, IEC61000-3-3

PORT	TEST	Standard	Frequency Range	Test Value
DC supply	Conducted Emission	IEC 61000-3-2 IEC 61000-3-3	0 to 2KHz	(not apply for transmitters)
		CISPR11 Class A	150KHz to 500KHz	79dB(µv) QP, 66dB(µV) AV
			500KHz to 5MHz	73dB(µV) QP, 60dB(µV) AV
			5MHz to 30 MHz	73B(µV) QP, 60dB(µV) AV
Housing	Radiated Emission	CISPR11 Class A	30MHz to 230 MHz	40dB(µV) QP (A=10m)
			230MHz to 1000MHz	47dB(µV) QP (A=10m)

ATEX Directive (94/9/EC) – "Electrical equipment and protective system intended for use in potential explosive atmospheres"
According to the standards: IEC60079-0:2006, IEC60079-1:2007, IEC60079-7:2001, IEC60079-11:2007, IEC60079-15:2005
Notified body Nemko for QAM and QAR number CE0470
(Certification in process, declaration not issued yet)

LVD Directive 2006/95/EC – "Electrical Equipment designed for use within certain voltage limits " According the LVD directive Annex II the equipment under ATEX "Electrical equipment for use in an explosive atmosphere" directive are excluded from scope from this directive.
For additional information access EST-DE-0063-10.
(Product excluded from scope, not require declaration)

Hazardous Locations Approvals

Warning: Explosions could result in death or serious injury, besides financial damage.
Installation of this instrument in an explosive environment must be in accordance with the national standards and according to the local environmental protection method. Before proceeding with the installation check the certificate parameters according to the environmental classification.

Notes:

Ingress Protection (IP)

- Ingress protection (IP W): Supplementary letter W meaning special condition defined as default by Smar the following: Saline Environment approved - salt spray exposed for 200 hours at 35ºC.
  (Ref: IEC60529)
- Ingress protection (Type X): Supplementary letter X meaning special condition defined as default by Smar the following: Saline Environment approved - salt spray exposed for 200 hours at 35ºC.
  (Ref: NEMA 250)

Marking Label
Once a device labeled with multiple approval types is installed, do not reinstall it using any other approval types. Scratch off or mark unused approval types on the approval label.

Maintenance and Repair
The instrument modification or replaced parts supplied by any other supplier than authorized representative of Smar Equipamentos Industriais Ltda is prohibited and will void the Certification.

For Ex-d protection application

- Only use Explosion Proof/Flameproof certified Plugs, Adapters and Cable glands.
- As the instrument is non-ignition capable under normal conditions, the statement “Seal Not Required” could be applied for Explosion Proof version regarding to conduits connection. (CSA Approved)
- In an Explosion-Proof/ Flame-Proof installation, do not remove the instrument housing covers when powered on.

- **Electrical Connection**
  In Explosion-Proof installations the cable entries must be connected or closed using metal cable gland and metal blanking plug, both with at least IP66 and Ex-d certification. The unused cable entries should be plugged and sealed accordingly to avoid humidity entering, which can cause the loss of the product’s warranty. For water-proof applications all NPT thread parts apply the proper water-proof sealant. (A non-hardening silicone group sealant is recommended).

For Ex-i protection application

- Connect the instrument to a proper intrinsically safe barrier.
- Check the intrinsically safe parameters involving the barrier, equipment including the cable and connections.
- Associated apparatus ground bus shall be insulated from panels and mounting enclosures.
- When using shielded cable, isolate the not grounded cable end.
- Cable capacitance and inductance plus Ci and Li must be smaller than Co and Lo of the Associated Apparatus.

CEPEL (Centro de Pesquisa de Energia Elétrica)

Protections Methods:

Intrinsic Safety (CEPEL-EX-1686/08)
Br-Ex iad, Group IIC, Temperature Class T5

- Entity Parameters: Ui = 30 V Ii = 100mA Ci = 10 nF Li = Desprezivel
- Ambient Temperature: -20 to 65 ºC for Pi=0,8W
  -20 to 85 ºC for Pi=0,7W

Explosion Proof (CEPEL-EX-1685/08)
Ex d, Group IIC, Temperature Class T4, T5, T6

- Ambient Temperature: -20 to 40 ºC Temperature class T6
  -20 to 60 ºC Temperature class T5
  -20 to 85 ºC Temperature class T4

Increased Safety (CEPEL-EX-1685/08)
Ex dem, Group IIC, Temperature Class T4,T5,T6

- Ambient Temperature: -20 to 40 ºC Temperature class T6
  -20 to 60 ºC Temperature class T5
  -20 to 85 ºC Temperature class T4

Environmental Protection (CEPEL-EX-1685/08 and CEPEL-EX-1686/08)
Options: IP66 W or IP66

Drawings for manuals:

- Label Plates: 102A-1595 / 102A-1596 / 102A 1597 / 102A 1598 / 102A1599 and 102A 1600.

Certification Types issued;

FY400 HART			
Certification Type	**Label Plate-drawing**	**Description Plate**	**Housing Type**
I	102A1596	Ex iad IP66	H0 / H1
	102A1599	Ex iad IP66W	H2 / H3
D / G	102A1595	Ex d/ Ex dem IP66	H0 / H1
	102A1598	Ex d/ Ex dem IP66W	H2 / H3
H	102A1597	Ex d/ Ex dem/ Ex iad IP66	H0 / H1
	102A1600	Ex d/ Ex dem/ Ex iad IP66W	H2 / H3

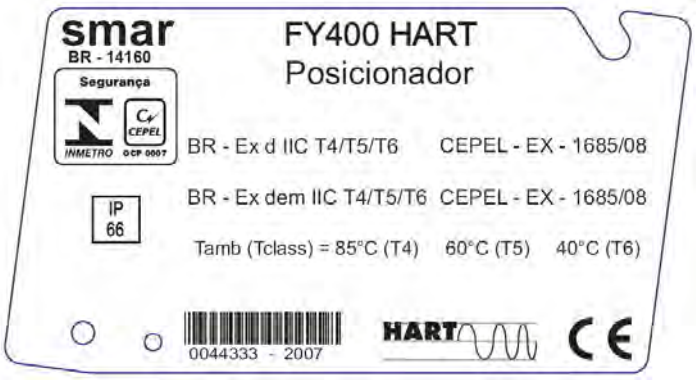
Electrical Connection Certified;

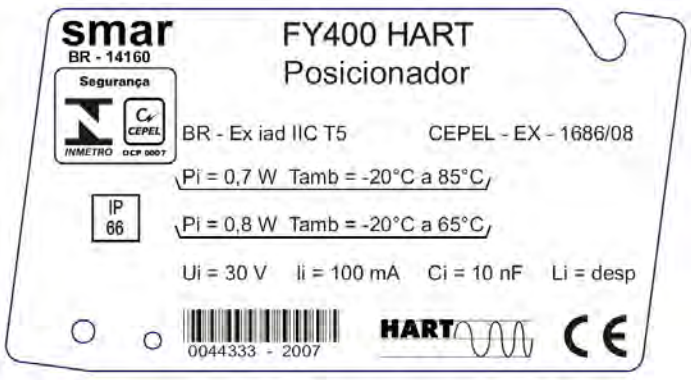
Connection Type	Description
0	½-14 NPT
1	½-14 NPT X 3/4 NPT (AI316) - with adaptation
A	M20 X 1,5
B	PG 13,5 DIN

Obs: Exclusive certificate for plugs and adapter CEPEL EX0998/06

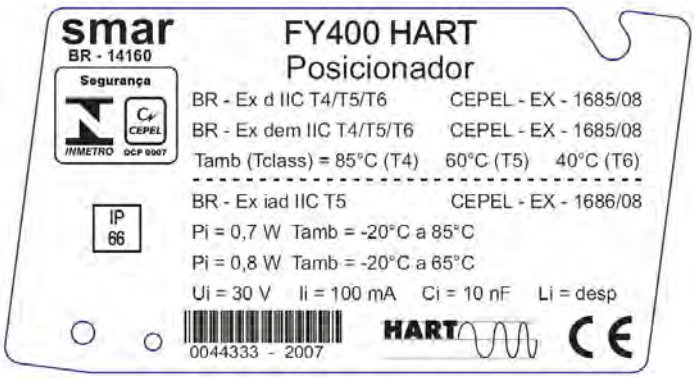
Identification Plate

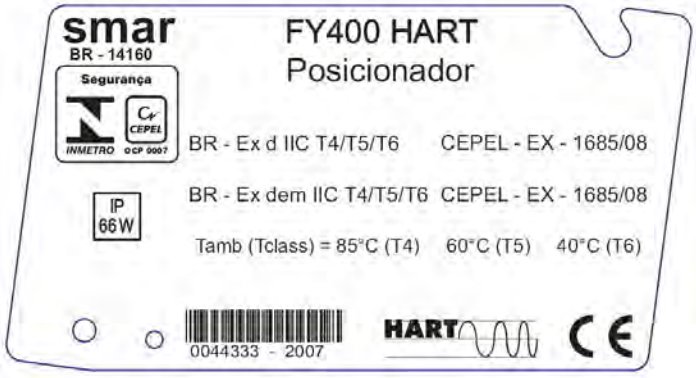
- Label Plates: 102A-1595 and 102A-1596.



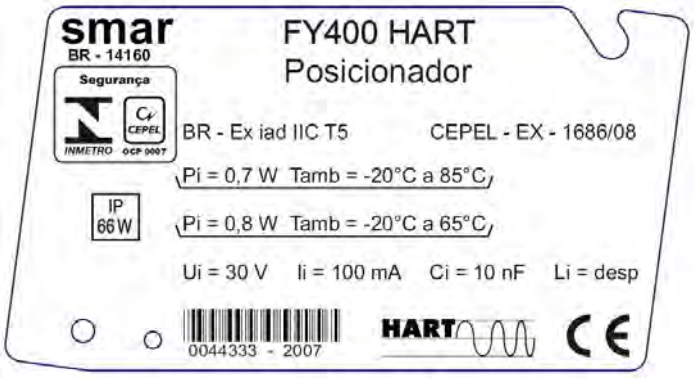


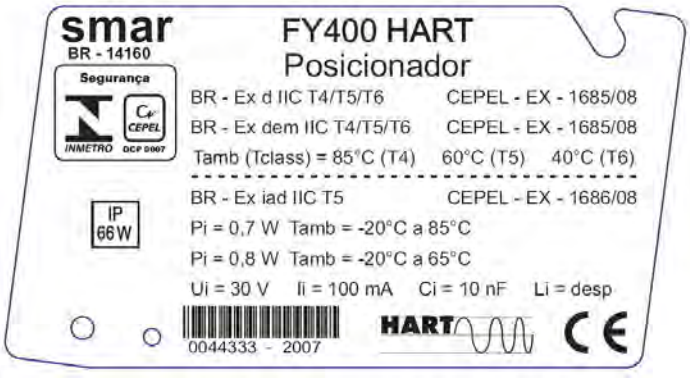
- Label Plates: 102A-1597 and 102A-1598.





- Label Plates: 102A-1599 and 102A-1600.





Appendix B

smar

SRF – Service Request Form

FY Positioner

GENERAL DATA

Model: FY290 ( ) Firmware Version: _____ FY301 ( ) Firmware Version: _____
FY302 ( ) Firmware Version: _____ FY303 ( ) Firmware Version: _____
FY400 ( ) Firmware Version: _____

Serial Number: _____ **Sensor Number:** _____

TAG: _____

Remote Position Sensor? Yes ( ) No ( )

Pressure Sensor? Yes ( ) No ( )

Action: Rotary ( ) Linear ( )

Travel: 30 mm ( ) 50 mm ( ) 100 mm ( ) Other: _____ mm

Configuration: Magnetic Tool ( ) Palm ( ) Psion ( ) PC ( ) Software: _____ Version: _____

FINAL CONTROL ELEMENT DATA

Type: Valve + Actuator ( ) Pneumatic Cylinder (ACP) ( ) Other: _____

Size: _____

Travel: _____

Manufacturer: _____

Model: _____

AIR SUPPLY

Conditions: Dry and Clean ( ) Oil ( ) Water ( ) Other: _____

Work Pressure: 20 PSI ( ) 60 PSI ( ) 100 PSI ( ) Other: _____ PSI

PROCESS DATA

Hazardous Area Calssification Non-Classified ( ) Chemical ( ) Explosive ( ) Other: _____

Interference Types Vibration ( ) Temperature ( ) Eletromagnetic ( ) Others: _____

SITUATION DESCRIPTION

_____

_____

_____

_____

SERVICE SUGGESTION

Adjustment ( ) Cleaning ( ) Preventive Maintenance ( ) Update / Up-grade ( )

Other: _____

USER INFORMATION

Company: _____

Contact: _____

Title: _____

Section: _____

Phone: _____ _____ _____ _____ **Extension:** _____

E-mail: _____ **Date:** _____/ _____/ _____

For warranty or non-warranty repair, please contact your representative.
Further information about address and contacts can be found on www.smar.com/contactus.asp.

Returning Materials

If necessary to return the converter and/or configurator to SMAR, simply contact our office, informing the defective instrument serial number, and return it to our factory.

In order to speed up analysis and solution of the problem, the defective item should be returned with a description of the failure observed, with as much details as possible. Other information concerning the instrument operation, such as service and process conditions, is also helpful.

Instruments returned or to be revised outside the guarantee term should be accompanied by a purchase order or a quote request.

Appendix C

SMAR WARRANTY CERTIFICATE

1. SMAR guarantees its products for a period of 24 (twenty four) months, starting on the day of issuance of the invoice. The guarantee is valid regardless of the day that the product was installed.

2. SMAR products are guaranteed against any defect originating from manufacturing, mounting, whether of a material or manpower nature, provided that the technical analysis reveals the existence of a quality failure liable to be classified under the meaning of the word, duly verified by the technical team within the warranty terms.

3. Exceptions are proven cases of inappropriate use, wrong handling or lack of basic maintenance compliant to the equipment manual provisions. SMAR does not guarantee any defect or damage caused by an uncontrolled situation, including but not limited to negligence, user imprudence or negligence, natural forces, wars or civil unrest, accidents, inadequate transportation or packaging due to the user's responsibility, defects caused by fire, theft or stray shipment, improper electric voltage or power source connection, electric surges, violations, modifications not described on the instructions manual, and/or if the serial number was altered or removed, substitution of parts, adjustments or repairs carried out by non-authorized personnel; inappropriate product use and/or application that cause corrosion, risks or deformation on the product, damages on parts or components, inadequate cleaning with incompatible chemical products, solvent and abrasive products incompatible with construction materials, chemical or electrolytic influences, parts and components susceptible to decay from regular use, use of equipment beyond operational limits (temperature, humidity, etc.) according to the instructions manual. In addition, this Warranty Certificate excludes expenses with transportation, freight, insurance, all of which are the customer's responsibility.

4. For warranty or non-warranty repair, please contact your representative.

   Further information about address and contacts can be found on www.smar.com/contactus.asp

5. In cases needing technical assistance at the customer's facilities during the warranty period, the hours effectively worked will not be billed, although SMAR shall be reimbursed from the service technician's transportation, meals and lodging expenses, as well dismounting/mounting costs, if any.

6. The repair and/or substitution of defective parts do not extend, under any circumstance, the original warranty term, unless this extension is granted and communicated in writing by SMAR.

7. No Collaborator, Representative or any third party has the right, on SMAR's behalf, to grant warranty or assume some responsibility for SMAR products. If any warranty would be granted or assumed without SMAR's written consent, it will be declared void beforehand.

8. Cases of Extended Warranty acquisition must be negotiated with and documented by SMAR.

9. If necessary to return the equipment or product for repair or analysis, contact us.
   See item 4.

10. In cases of repair or analysis, the customer must fill out the Revision Requisition Form (FSR) included in the instructions manual, which contains details on the failure observed on the field, the circumstances it occurred, in addition to information on the installation site and process conditions. Equipments and products excluded from the warranty clauses must be approved by the client prior to the service execution.

11. In cases of repairs, the client shall be responsible for the proper product packaging and SMAR will not cover any damage occurred in shipment.

12. In cases of repairs under warranty, recall or outside warranty, the client is responsible for the correct packaging and packing and SMAR shall not cover any damage caused during transportation. Service expenses or any costs related to installing and uninstalling the product are the client´s sole responsibility and SMAR does not assume any accountability before the buyer.

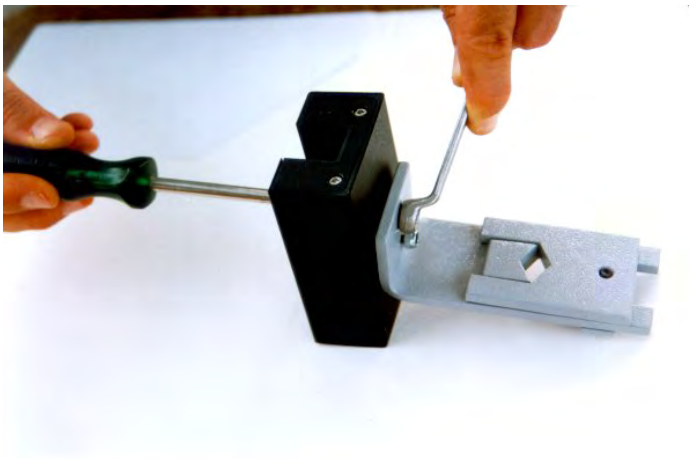
13. It is the customer's responsibility to clean and decontaminate products and accessories prior to shipping them for repair, and SMAR and its dealer reserve themselves the right to refuse the service in cases not compliant to those conditions. It is the customer's responsibility to tell SMAR and its dealer when the product was utilized in applications that contaminate the equipment with harmful products during its handling and repair. Any other damages, consequences, indemnity claims, expenses and other costs caused by the lack of decontamination will be at tributed to the client. Kindly, fill out the Declaration of Decontamination prior to shipping products to SMAR or its dealers, which can be accessed at www.smar.com/doc/declarationofcontamination.pdf and include in the packaging.

14. This warranty certificate is valid only when accompanying the purchase invoice.

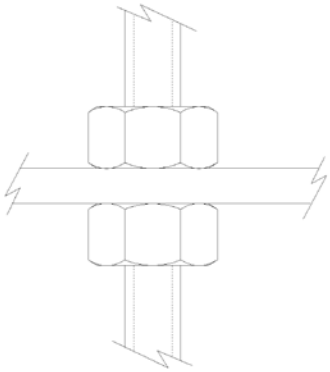
APPENDIX

MOUNTING BRACKET FOR POSITIONER – LINEAR STROKE VALVE MOUNTING INSTRUCTIONS

1 –Attach the magnet to the magnet bracket support before connect them to the valve stem.



2 - The stem nuts should be used to fasten the magnet bracket.

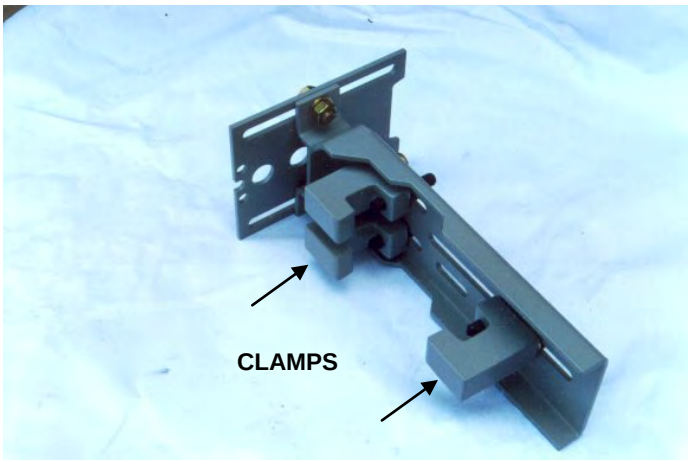


3 – Mount the magnet assembly using the nuts of the valve stem. The mounting bracket has two parts that should be mounted to the stem.

4 – Tighten the hex screw that join the two parts of the magnet bracket. It will avoid sliding of the two parts of the bracket during the fastening of the stem nuts.

5 – Tighten the stem nuts.

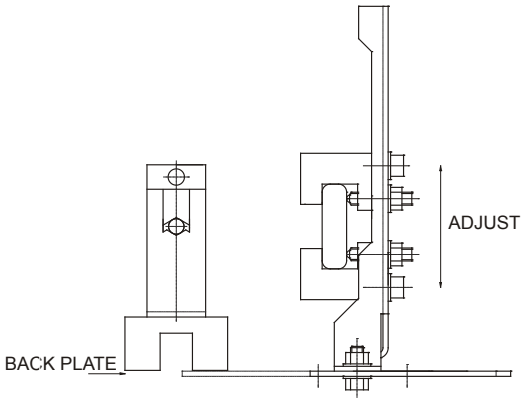
6 – Attach the “clamps” to the positioner bracket.
If your actuator is pillar type, go to step 15 to see the instructions.



7 – Adjust the clamps according to the width of the yoke and tighten the bolts finger tight.

8 – Mount the positioner back plate. Tighten the nuts finger tight.

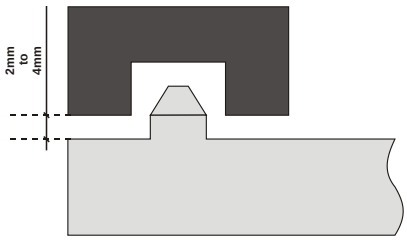
9 – Use the plate as a guidance to adjust the position of the positioner so that the back plate is about 1 mm apart from the magnet.



10 – Fasten the nuts to fix the positioner bracket to the yoke.
If the actuator is pillar type, fasten the U-clamp nuts.

11 – Mount the positioner to the plate and tighten the hex screws. You can take the back plate apart to facilitate the assembling.

12 – Move the positioner as to adjust the Hall sensor tip in the center of the magnet. Tighten the nuts after the adjustment.



ATTENTION:

A minimum distance of 2mm and a maximum distance of 4mm is recommended between the magnet external face and the positioner face. For that, a centralizer device (linear or rotary) must be used. The centralizer device is in the positioner packing.

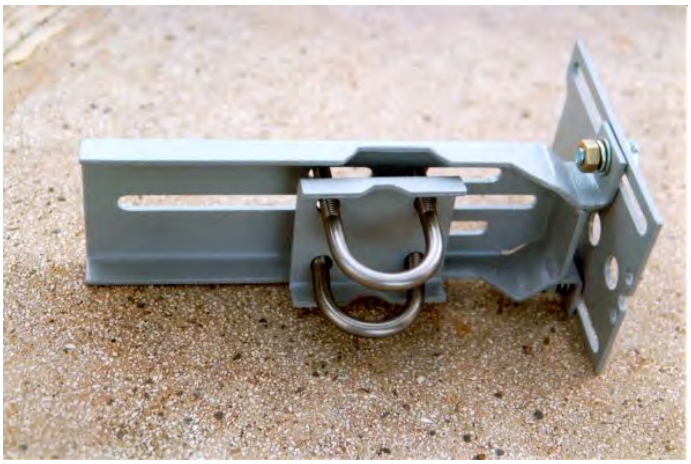
13 – Put the pressure equivalent to the half of the stem travel and adjust the height of the bracket assembly to have the arrows matching.

14 - Tighten the bolts to fasten the clamps to the yoke.

If the actuator is pillar type, fasten the U-clamp nuts.

MOUNTING DETAILS FOR THE PILLAR TYPE ACTUATOR

15 - This is the mounting bracket using U-clamps to be mounted on pillar type actuators.

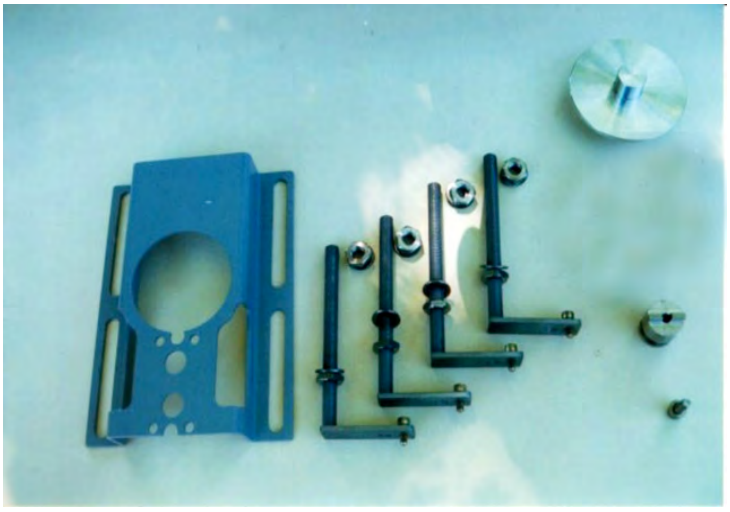


16 – After assembling the U-clamps, follow the steps 8 to 13.

ROTARY VALVE POSITIONER BRACKET

MOUNTING INSTRUCTIONS

Rotary Valve Positioner Bracket Parts.



1- Attach the clamps to the threaded orifices existent on the actuator.
Do not tight them completely.

The bolts are not supplied with the mounting bracket and they must be in accordance with size and thread of the actuator holes.

2- Attach the magnet bracket to the Actuator extremity (NAMUR).

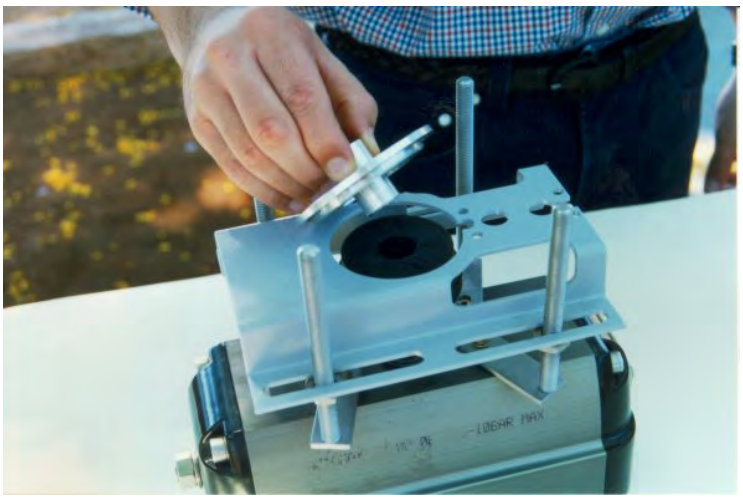
The end the valve shaft must comply with Namur Standard.

3 – Fasten the hex screw.

4 – Attach the magnet to the NAMUR adapter.
Do not fasten the bolts completely, allowing the magnet rotation.

5 – Mounting the positioner bracket through the threaded rods.

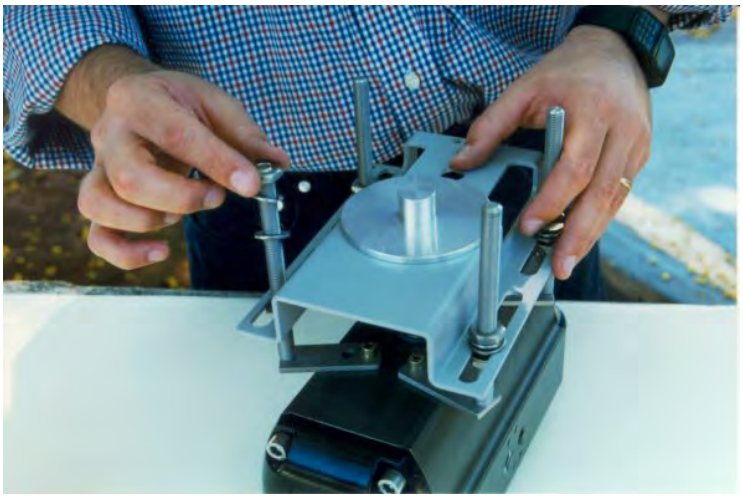
6 – Use the centralizer gadget to get the bracket centralized with the magnet.



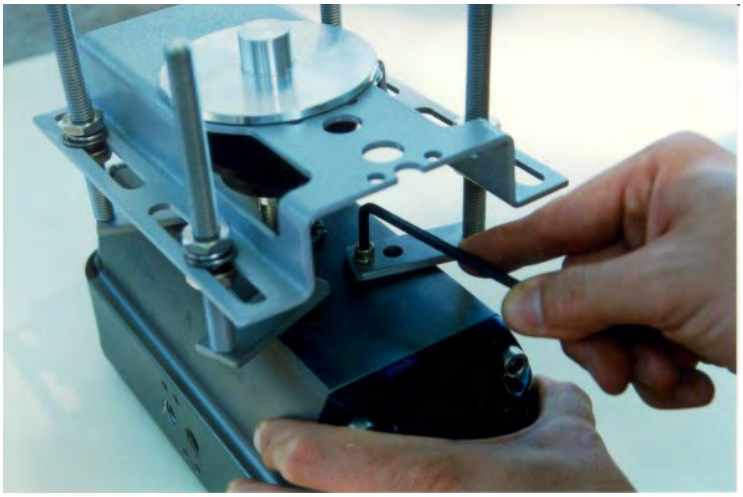
7 – Adjust the positioner bracket using the centralizer gadget and the nuts to get the height.

8 – Place the nut and washers.

Do not fasten the nuts completely.

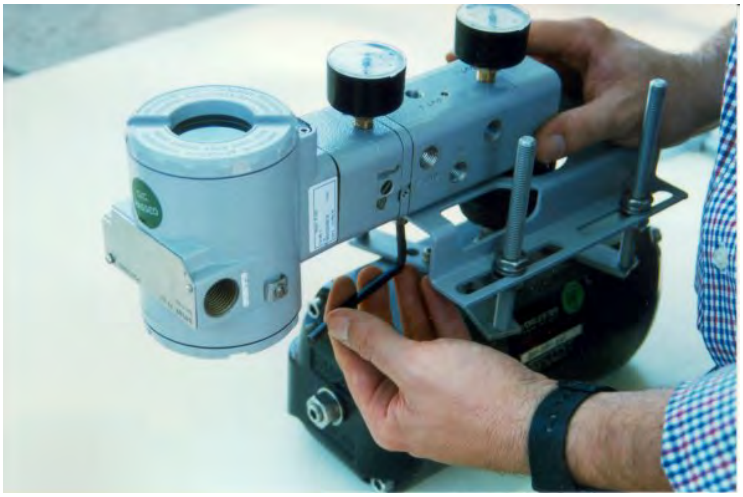


9 – Tighten the clamp bolts to fasten them to the actuator.

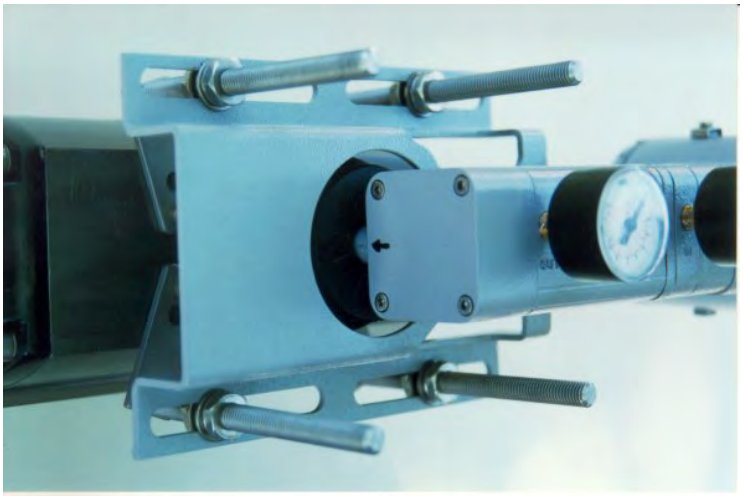


10 – Fasten the positioner bracket bolts to the clamps fastening.

11 – Remove the centralizer gadget and fasten the positioner to the positioner bracket.



12 – Put the pressure equivalent to the half of the stem and adjust the magnet position to have the arrows matching.



13 – Tighten the bolts to fasten the magnet to the magnet bracket.