Instruction, installation and maintenance manual

DigitalTrak POSITIONER

SUMMARY

1. GENERAL INFORMATION

1.1 General warnings

	This Instruction Manual is an integral part of the device, it should be carefully read before carrying out any operation and it should be kept for future references. This Instruction Manual covers only the DT2 positioner. This Instruction Manual is realized in accordance with the Directive 2006/42/CE.

1.2 Generalities

STI S.r.l positioners are conceived, manufactured and controlled according to the Quality Control System in compliance with EN-ISO 9001 international regulation.

1.2.1 Applicable regulation

UNI EN ISO 12100-1: 2005: Safety of machinery – *Basic notions, general design principles. Part 1-Basic terminology, method.*
UNI EN ISO 12100-2: 2005: Safety of machinery – *Basic notions, general design principles. Part 2-Technical principles and specification.*
2006/42/EC: Machine directive.
2006/95/EC: Directive for low voltage equipment.
2004/108/EC: Directive for the electromagnetic compatibility.

1.2.2 Terms and conditions

STI S.r.l. guarantees that all the items produced, if installed, used and subject to maintenance, are without material and manufacturing defects, and comply with specifications in force. The period of warranty is of one year, starting from the date of installation by the first user of the product, or of eighteen months as of the date of shipment to the first user, depending on which event occurs first.
The warranty does not cover special products or components not covered by warranty in their turn by subcontractors, or materials that were used or installed inappropriately, which were modified or repaired by unauthorized staff.
If the failure was caused by inappropriate installation, maintenance or use, or by irregular working conditions, the repairs will be charged according to the applicable fees.

1.3 Manufacturer

With respect to Machinery Directive 2006/42/EC the Manufacturer of the described product, is STI S.r.l. as specified on nameplate.

Address: **STI S.r.l.**
Via Dei Caravaggi 15
24040 Levate (Bergamo) – ITALY

1.4 Safety precautions

1) Throughout the operation of the positioner, including auto setup, do not touch it.
2) Make sure to disconnect air supply before making any maintenance work on the positioner
3) The products must be correctly installed, operated and maintained.

1.5 Packing list

1) DT2 Intelligent Electropneumatic valve Positioner.
2) User Manual.
3) Ordered kits as option.

1.6 Safety notices

In order to make you better use this manual and ensure your safety, when debugging, running, repairing this equipment, please pay attention to the use of following symbols:

Symbol	Slogan	Explanation
	**Warning**	Refers to the potential dangers, if can't avoid, it may damage the product itself or the surrounding objects. (Hazardous materials).
	**Caution**	Refers to the things which are useful or special neglected affecting the operating conditions or production function (Not contain dangerous or harmful situations).

Please read this manual careful before installation and debugging.

1.7 Positioner and manufacturer's identification

It is forbidden to modify the information and the marks without previous written authorization by STI S.r.l.
The following plate is fastened on the positioner housing:

2. DESCRIPTION

DT2 Intelligent Electro pneumatic Positioner is a loop powered instrument produced by STI s.r.l. As a control part of the pneumatic valve set, DT2 Intelligent Electro pneumatic valve Positioner is widely used in petroleum, chemical, electric power, metallurgy, paper, light industry and other fields of automation systems.
DT2 Intelligent Electro pneumatic valve Positioner accepts the 4÷20mA valve setting signal from the control system; at the same time, it gets the actual valve signal through the location sensors; the two signals are compared by instrument software in order to control the feeding and exhaust of the gas to actuator, driving the valve to reach set point (as Figure 1).
DT2 Intelligent Electro pneumatic valve Positioner is based on microprocessor technology. It can overcome friction and the imbalance power on the control valve well, and improve the response speed of control valve, which makes the position set rapidly and accurately. It is not only able to completely substitute conventional valve positioner, but also is able to directly access HART network, exchanging information between control system and positioner.

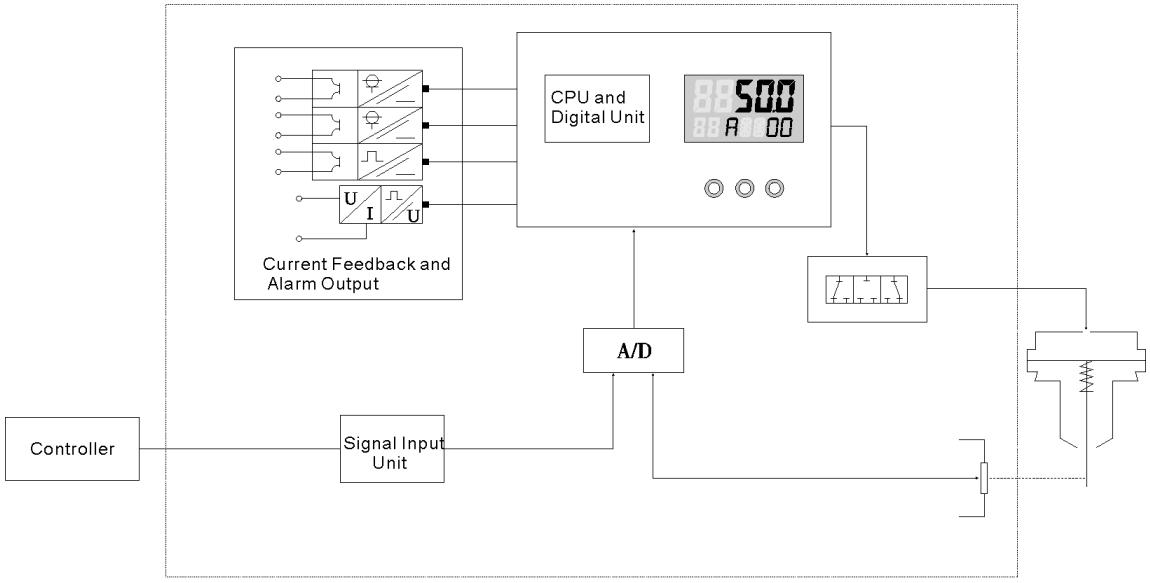


Figure 1: DT2 Intelligent Electropneumatic valve Positioner Principle

2.1 Description of Function instruction

- Self-adaptive function: automatic search the Zero and Span of valve, optimize the valve's control parameters and improve the control precision.
- Configuration function: valve characteristics curve, action mode, dead band, stroke range, shut-off value and alarm events.
- Self-diagnosis function: show the value of setpoint current, travel time, and dead band.
- Fault mode function: Fail safe or fail freeze.
- Communication function: HART communication protocol.
- Valve position feedback function: 4~20mA DC valve position feedback signal, switch valve feedback signal.

2.2 Performance

- Position precision: 0.5% F.S.
- Manual setting operation allowed directly on the positioner, without opening the cover.
- Simple and compact design, modular construction.
- Automatic initialization, automatic diagnosis, valve characteristic curve.
- Reduced number of mechanical parts, good vibration resistance performance.
- Local or remote parameter setting.
- Low power, low air consumption, low running cost.
- Two-wire supply in 4-20mA standard.
- Integrated lighting protection module can be used to reduce the damage probability, due to surge of lighting.

3. TECHNICAL PARAMETERS

PNEUMATIC	***Air supply pressure***	0.14 ÷ 0.7 mMPa
	Air consumption in stable state	< 36 L / H
	Air supply quality	According to ISO 8573-1 Size and density of particulates: Class 4 Oil concentration: Class 4 Dew point: Class 4 or at least 10K below surrounding environment
	Valve leakage (in fail freeze)	< 0.6 L / H
INPUT / OUTPUT	***Actuator***	Single acting, double acting
	Communication	HART
	Input Current	4 ÷ 20mA DC, minimum input current 3.8 mA, split range start and end point adjustable.
	Feedback Output	4-20 mA DC
	Digital Input	One dry contact
	Digital output	Electronic switch: 2 channels
	Piezo Valves Switch Time	Average failure free time: >2 billion
	Output Characteristic	Linear, 1:30, 30:1, user defined (20 points)
	Stroke	Linear actuator 10 ÷ 100mm (10-20mm, 1:6 transmission ratio is optional) Rotary actuator 30 ÷ 105°
	Electrical connection	M20x1.5 or NPT1/2
	Pneumatic connection	G ¼ or NPT1/4
DISPLAY	***LCD***	2x7 digitals, dimensions : 22x38 mm
OPERATE	***Manual***	3 keys on the front panel
	Self tuning	Automatic calibrate the zero and span, dead band
	Self diagnostic	Show value of input current, travel time, dead band, etc.
PRECISION	***Dead band***	0,1 ÷ 10% adjustable
	Hysteresis	0.2% F.S.
	Linearity	0.5% F.S.
ENVIRONMENT	***Environmental temperature***	-40 ÷ +80°C
	Environmental humidity	5 ÷ 95% RH
	Vibration Resistance	15 ÷ 150 Hz @2g
	Enclosure degree of protection	IP65
APPEARANCE	***Weight***	2 kg
	Dimension	170×96×96mm
	Shell material	Aluminum Die Casting

4. ASSEMBLY

4.1 Dimensional drawings

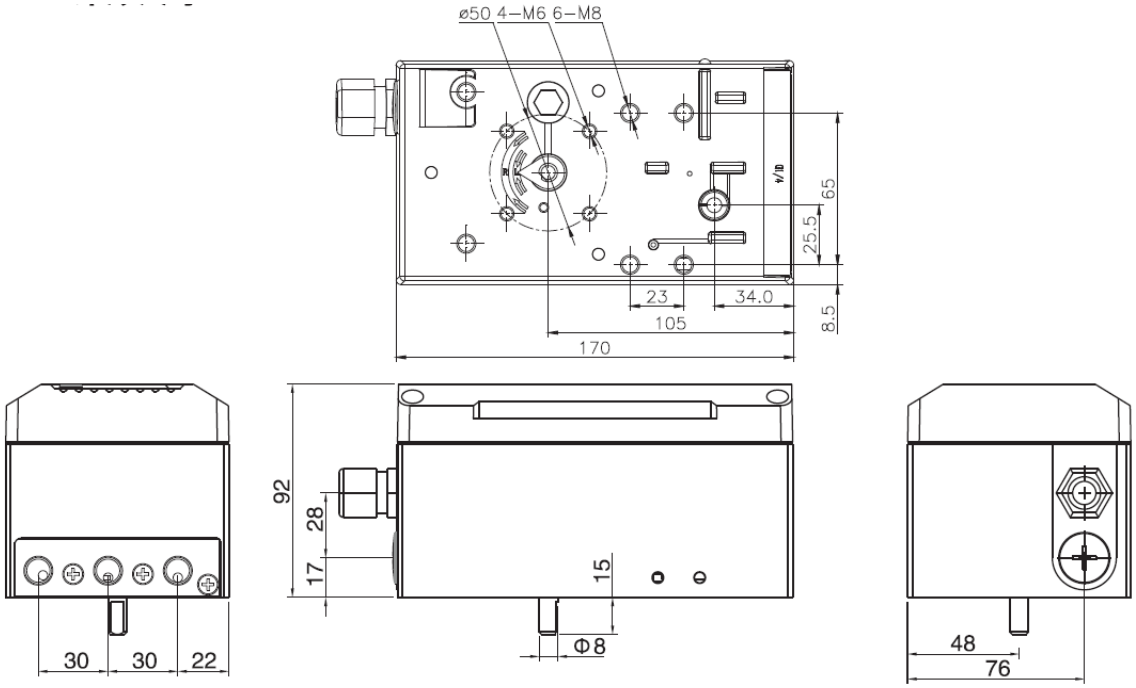


Figure 2: Dimensional drawing

4.2 Installation

To install correctly the rotate angle of the positioner stem should comply to the required reading angle range. Figure 3-a shows the positioner feedback indicator and the arrow marking indicator's rotating range. Solid line shows the middle position of the indicator (when uninitialized, the LCD feedback value should be around 50.0 and the bottom row displays NOINIT). The two dotted lines show the limit positions of the feedback rotating range in normal status.

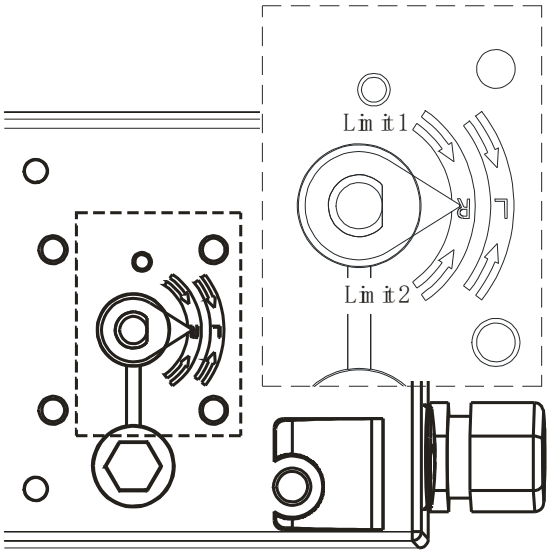


Figure 3

4.3 Assembly for linear actuator

For linear actuator SC63 with lever feedback:

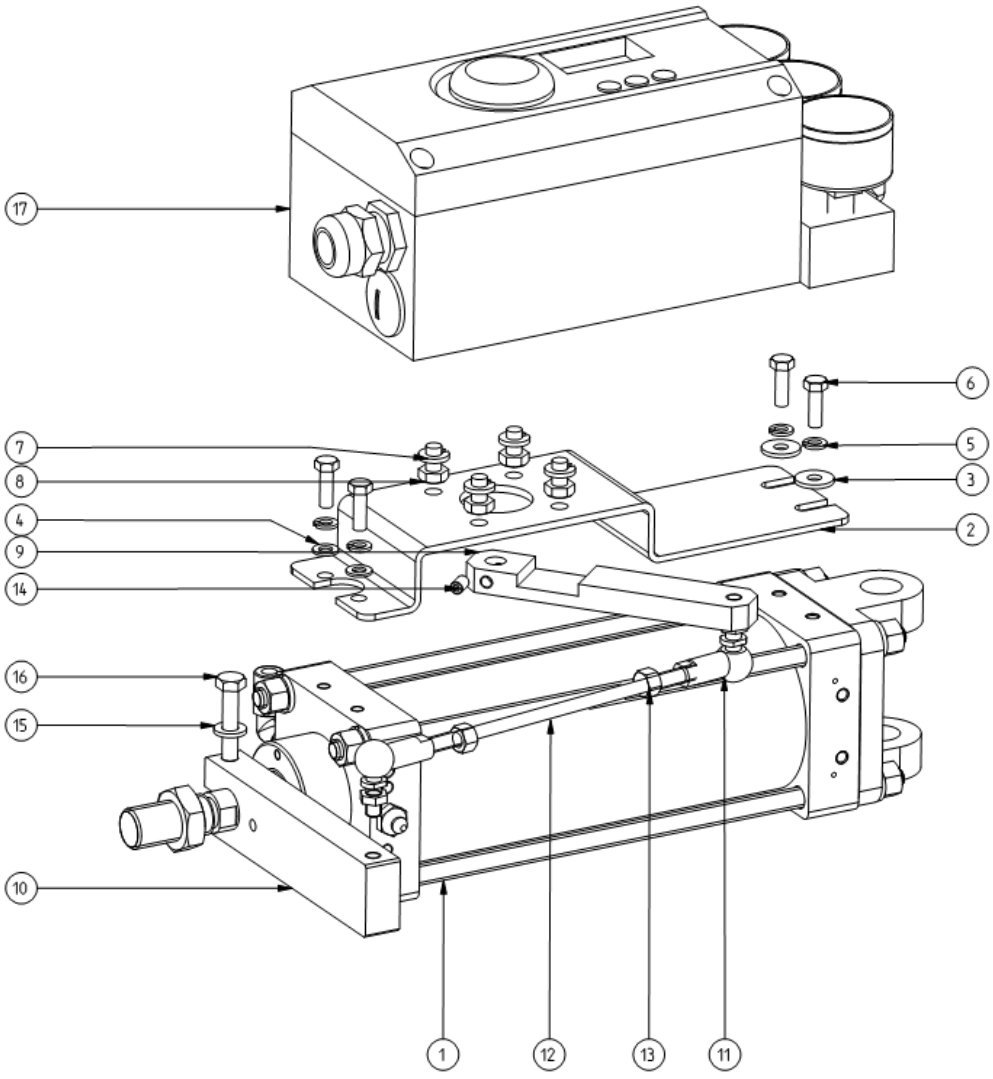


Figure 4-a

The positioner is installed on the side of the actuator. Through the adjustable feedback lever actuator connected with actuator's putting lever (as Figure 4-a), the installation steps as follows:

- Fix the support plate [# 2] on the actuator through the four screws [# 6+4+3].
- Fix the positioner [# 17] on the plate through the four screws [# 7+8].
- Connect the lever [#9] to the positioner shaft and insert the screw [#14] into the lever on the side of the lever.
- Move the actuator shaft to 50% to the stroke, rotate the lever [#9] perpendicular to the support plate, if necessary adjust the length of the treaded rod [#12] unloosing the nuts [#13], rotating the bar and fixing again the nuts.
- Adjust the rotate angle of the feedback lever so that it complies to the requirement in 4.2.1.and fix tight the screw [#14].
- Move the actuator shaft from 0% of the stroke to 100% checking that there is not mechanical interference of the linkage components.

For actuators with motion converter feedback linkage:
Positioner installed on the side of the actuator. Through the motion converter STI model MC, connected with actuator's shaft with rod and cam; the installation steps are the following

- Fix the support [# 1] on the motion converter with the four screws [# 3+455]

- Fix the positioner on the support [# 1] the four screws [# 6+7]
- Connect the upper lever to the positioner shaft and the lower [# 2] to the motion converter shaft.
- For motion converter adjustment please see Instruction manual 2051
- Adjust the rotate angle of the feedback lever so that it complies to the requirement in 4.2.1.and fix tight the screw [#13]
- Move the actuator shaft from 0% of the stroke to 100% checking that there is not mechanical interference of the linkage components.

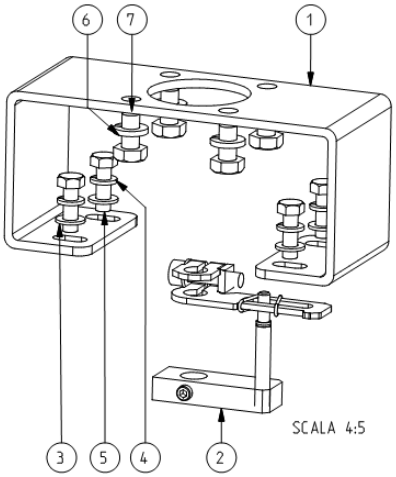
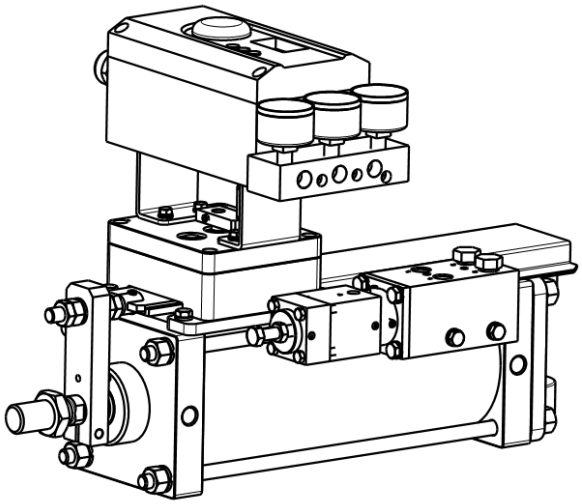


Figure 4-b



4.4 Assembly for rotary actuator

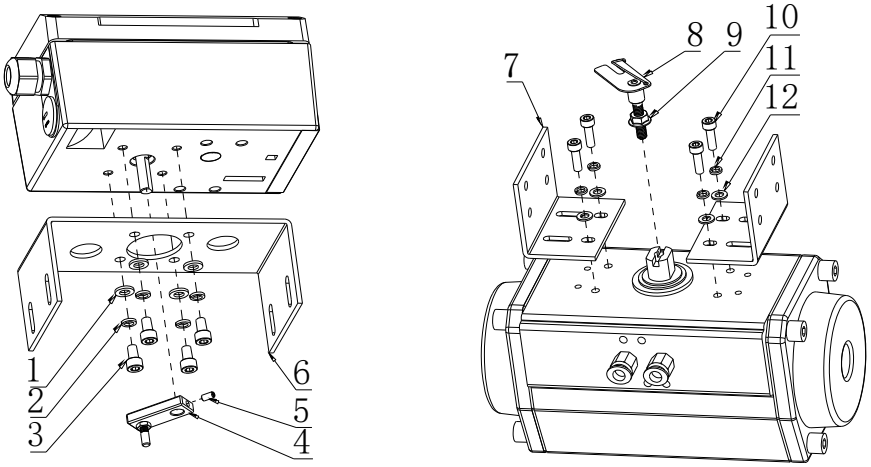


Figure 5-a

No.	Amount	Name	Spec.
1	8	Washer	D6
2	8	Elastic washer	D6
3	8	socket cap screw	M6×12
4	1	set screw	M5×5
5	1	Feedback lever	
6	1	Bracket 2	
7	2	Bracket 1	

8	1	U shape feedback lever	
9	1	socket cap screw	M6
10	4	Socket cap screw	M5×12
11	4	Elastic washer	D5
12	4	Washer	D5

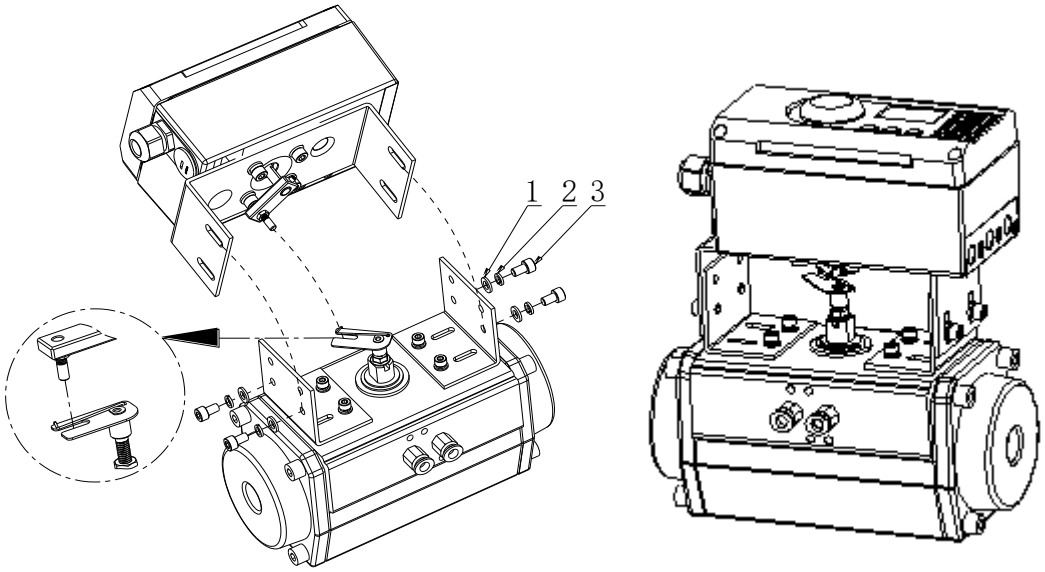


Figure 5-b

The installation steps as follow:

- Attach the Bracket 2 (6) to the positioner with socket cap screws (3), elastic washers (2) and washers (1).
- Attach the feedback lever (4) to the shaft and fix with the set screw (5).
- Attach the Bracket 1 (7) to the actuator with socket cap screws (10), elastic washers (11) and washers (12).
- Attach socket cap screws (9) to the U shape feedback lever (8) and attach the U shape feedback lever (8) to the actuator.
- Put the positioner carefully on the actuator. The pin of the feedback lever (4) should be in the through of the U shape feedback lever (8). Adjust the height of the positioner, lock screw on the pin of the feedback lever (4) and fix the positioner with socket cap screws (3), elastic washers (2) and washers (1). Adjust the rotate angle of the feedback lever so that it complies to the requirement in 4.2.1

4.5 Pneumatic connection

Pneumatic Connections is on the right of positioner, positioner provides two kind of connection types: G1 / 4 and NPT 1/4 (refer to ordering data). See the specific marks on the housing and choose correct type according to the marks.

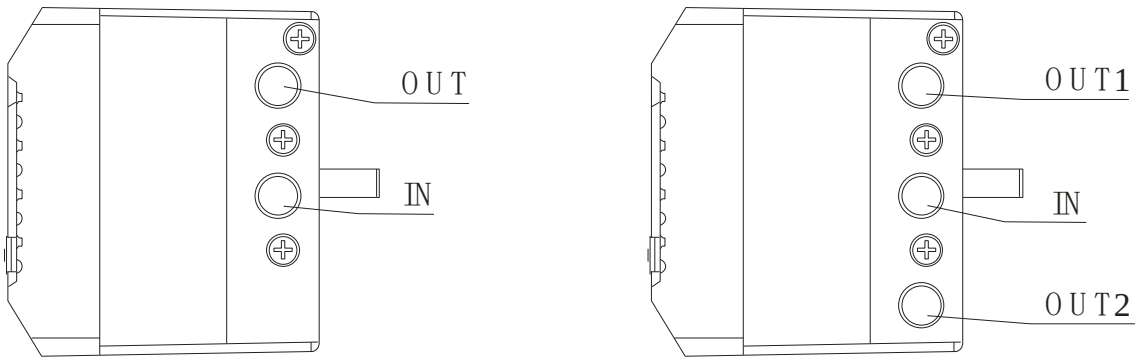


Figure 6: Pneumatic Connection

Installation Steps:
1. Connect to the output of the DigitalTrak2 smart positioner to the input of the actuator.

	WARNING: Any fitting leakage is harmful to the good operation, use soapy water inspection air tightness of joint connection.

2. Connect the IN port of DigitalTrak2 smart positioner with the air supply. The compressed air through the positioner must be filtered and regulated.

Air requirements:
a) Air pressure must be 0.14 ~ 0.7 MPa, depending on the actuator.
b) Air supply must be clean dry air without visible oil steam, oiil or another liquid / vapor.
c) Air supply must be no significant corrosion air, steam and solvents.
d) Size and density of particulates is Class 4, oil concentration Is Class 4.
e) The air dew point under work pressure should be at least 10 ℃ lower than its work positioner environment temperature.

4.6 Electric connections

Electrical connections should be strictly in accordance with the connection diagram, should be firmly secured, and not be loose.
Cable connector has to be a standard waterproof connector. Outer diameter of the signal cable should be at least 8mm and the connector cover should be locked when installing to avoid IP protection level.

4.6.1 Input electric connection (Figure 6)

Type: Loop Power Supply system
Input signal: 4-20mA
The min. working current: 3.8mA DC
Input impedance: 455Ω @20mA (without HART), 575Ω @20mA (with HART)

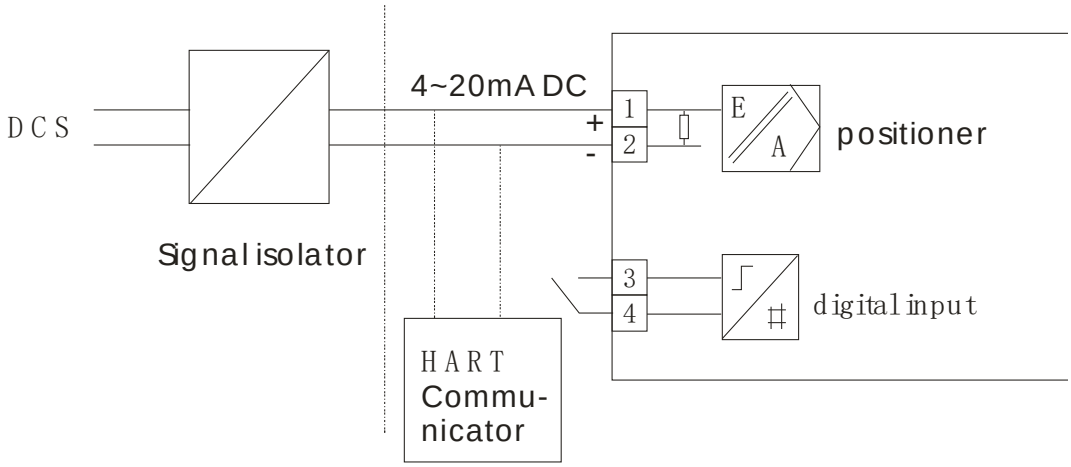


Figure 7: Electric input connection

4.6.2 Analog feedback module electric connection (Figure 8):

Feedback signal type: Two-wire system, 4÷20mA
Temperature influence: ≤100ppm/°C
Working range: 3.6 ÷ 20.5 mA DC
Precision: ≤0.1%
Working voltage: 12÷35V DC

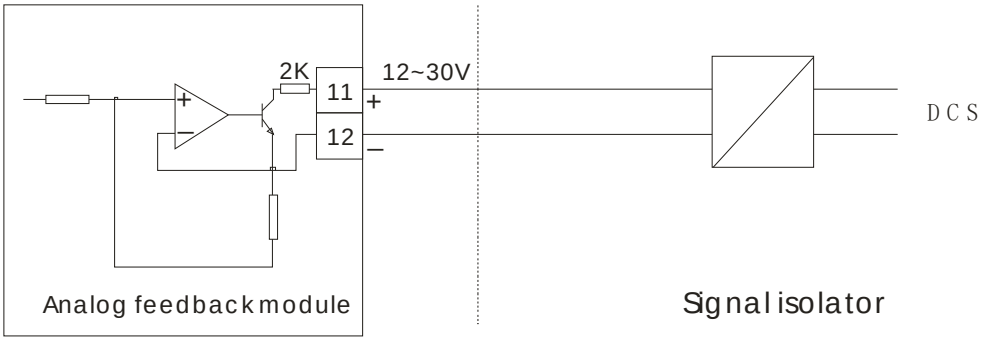


Figure 8: Analog Feedback Model Electronic Connection

4.6.3 Digital output module electric connection (Figure 9):

Working Voltage: 12÷35V DC
Output Signal (Current):

Signal status "high"	≥2.1 mA
Signal status "low"	≤1.2 mA

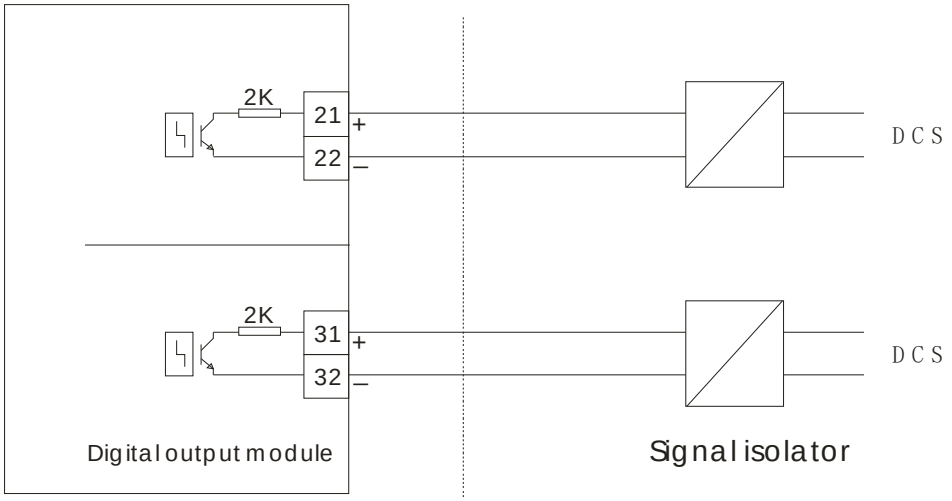


Figure 9: Digital Output Module Electric Connection

5. OPERATING REGULATION

5.1 Interface description

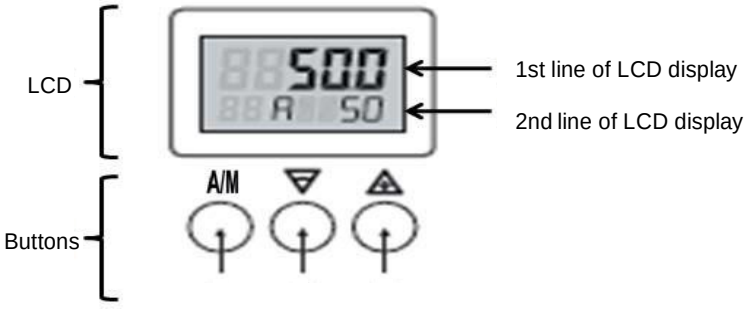


Figure10: Operation Interface

Display:
The LCD display has two lines:

- in the normal mode the first line shows the position, the second line from left to right shows direction of the valve-action, the state of running and the setpoint.
- in the Configuration menu mode, the first line shows the parameter value, the second line from left to right shows parameter number, the parameter name.

	NOTE: If the positioner is operated in ranges with temperatures below -10°C the liquid crystal display becomes sluggish and the display refresh rate is reduced obviously.

Buttons:
The positioner has three buttons.

- Operation mode key A/M [ENTER]
- Decrease ▼[DOWN]
- Increase ▲[UP]

	NOTE: 1) Normal Mode Press button **A/M**, sub mode switch between auto control mode (2nd line of LCD shows "A"), manual control mode (2nd line of LCD shows "M"), position sensor angle check mode (2nd line of LCD shows "SENS". 2) Manual Control Mode Hold down button ▲, valve position increase; at the same time hold down the ▼, valve position fast increase. Hold down button▼, valve position decrease; at the same time hold down the ▲, valve position fast decrease.

5.2 Configuration Mode

1) Enter configuration mode

In the normal mode, press button "A/M" for at least 3 seconds, to enter in Configuration Mode.

2) Choose parameters for configuration

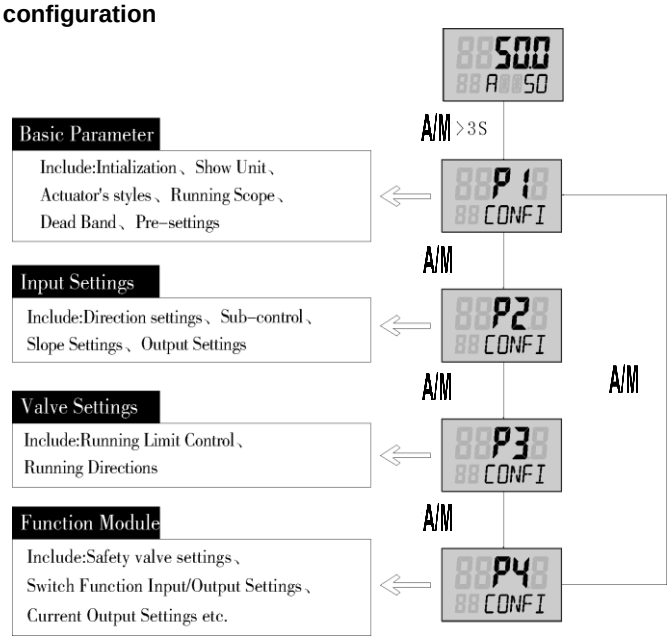


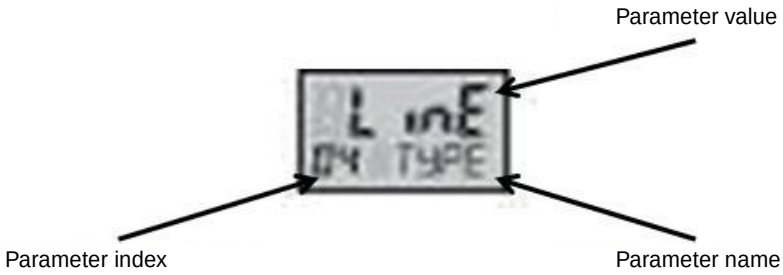
Figure 11: Choose User Menu parameter

In Configuration Mode, user can choose 4 different parameters group: P1, P2, P3 and P4.

Choosing the parameter of any parameters group:

- Press the increase button ▲, the menu turns forward circularly.
- Press the decrease button ▼the menu turns backward circularly.

Here display the contents of parameters:



Two digits in the front of the 2nd line show parameters index number, letters in the back display the name of parameter.

3) Changing a parameter

Press the button A/M to enter the parameter configure mode, the parameters on the screen will be blinking, such as 

For numerical parameters:

- Press the button ▲ parameter value will increase. Press the button for longer time, the parameter value increases quickly.
- Press the button ▼, parameter value will decrease. Press the button for longer time, the parameter value quickly.

For character parameters:

- Press the button ▲, parameter value moves forward.
- Press the button ▼, parameter value moves reverse.

For reset user parameters:

- Select PRST parameter.
- Press the button A/M to enter parameter configure mode. Parameters on the screen will be blinking.
- Press the ▲ button, LCD shows "STRT" on the first line, after 3 seconds user parameters are reset and configure mode is closed.

	NOTE: • In the menu state, if there is no operation in 1 minute, the valve positioner will return to normal state. • When parameter is modified, you must press button A/M to close configure mode to save parameters.

4) Exit configuration mode

Press the button A/M for 3 seconds to exit the user menu and return to normal mode.

5.3 Calibration

When smart electro-pneumatic valve Positioner installation is completed, it must be initialized. When initializing, the valve will open and close automatically, please check the working conditions and take measures to ensure that the valve movement does not affect the process and personal safety.
There are two ways to initialize: automatic tuning and manual tuning.

5.3.1 Ready to initialize

Check the positioner installation and electrical connection is in line with the requirement of chapter 4 of the manual. Connect the air supply and the power/ signal. Control the valve manually to run it from fully open to fully close and confirm the installation is correct.
Into the position sensor angle check mode, the 1st line shows feedback lever angle.
Press▲ or▼ to control the valve movement, when the valve is opened to half, the displayed angle value is about 0 degrees.

Press▲ or▼ to control the valve to reach the fully open and fully closed position of the value, the positioner should not have an UP or DOWN alarm. The feedback lever should not interfere with other objects.

5.3.2 Auto-tuning

1) After electrical and pneumatic positioner connection, press and hold A/M more than 3 seconds to enter the configuration mode.

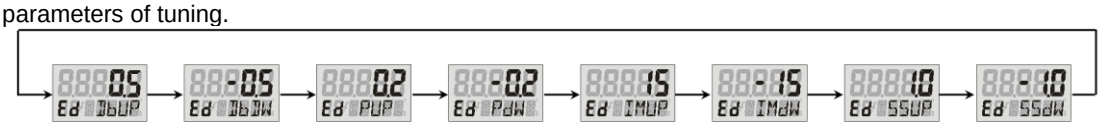
2) Press ▲, up shows "N0", down shows "INIA",

3) Press function key A/M, the down showing will be blinking, enter the parameter configure state.

4) Press ▲ for more than 3 seconds, up shows "STRT", enter the auto-tuning.

5) The whole procedure goes from "STEP1" to "STEP5", and shows the current steps on the down line

6) After tuning, up show the values of parameters, the down shows the "ED XXXX", XXXX means the relevant parameters of tuning.



7) Press and hold A/M 3 seconds to return to normal mode.

	NOTE: During tuning process, press the function button A/M more than 3 seconds, to exit tuning state and enter automatically in normal mode

5.3.3 Manual tuning

1) Positioner is in normal mode after power-on. Press and hold **A/M** for more than 3 seconds to enter the user menu state.

2) Press ▲ to choose the parameter, till the second row shows "INITM".

3) Press the button **A/M**, the down line will be blinking, enter the parameter amending state.

4) Press ▲ for more than 3 seconds, up shows "STRT", then it enters the manual tuning. Down shows "ZERO",

5) Press ▲ or ▼ to choose the start point.

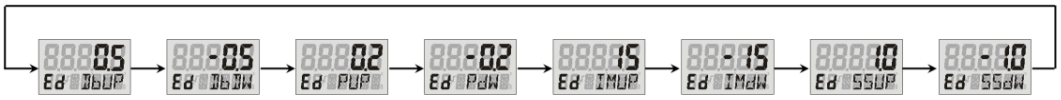
6) Press **A/M** to confirm, At this time, the down line shows "SPAN"

7) Press ▲ or ▼ to choose the end point

8) Press **A/M** to continue the procedure. The whole procedure is according to the "STEP1" to "STEP5" and shows the current steps on the down line.

In the process of tuning, press the function key **A/M** for more than 3 seconds to exit tuning state and enter automatic state.

9) After tuning, up shows parameters value; the down shows the "ED XXXX", XXXX means the relevant tuned parameters.



10) Press **A/M** for 3 seconds to return the normal state.

5.4 Diagnosis Mode

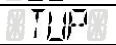
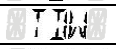
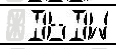
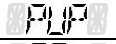
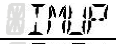
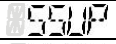
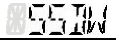
5.4.1 Entering diagnosis mode

In normal mode, press the button **A/M** and ▲ 3 seconds to enter the diagnosis state. Upper line displays the value of parameter; lower line displays the name of the parameter.
Press the button ▲, the parameter moves forward circularly
Press the button ▼, the parameter moves revise circularly

5.4.2 Exiting diagnosis mode

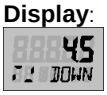
In the state of diagnosis: Press the button **A/M** for 3 seconds to exit the diagnosis mode and return to normal mode.

5.4.3 The auto-diagnostic parameter list of valve Positioner

No	Parameters	Display	Meaning	Value/Range	Unit
01	CURR		Input current	4.00~20.00	mA
02	TUP		Travel time up	0~200	S
03	TDW		Travel time down	0~200	S
04	DBUP		Dead band up	0.1~10.0	%
05	DBDW		Dead band down	-0.1~-10.0	%
06	PUP		Prediction up	1~100	%
07	PDW		Prediction down	1~100	%
08	IMUP		Impulse length up	2~200	ms
09	IMDW		Impulse length down	2~200	ms
10	SSUP		Short step zone up	0.1~100.0	%
11	SSDW		Short step zone down	0.1~100.0	%

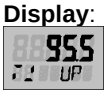
5.5 Alarm

5.5.1 Zero point of position sensor too low

In sensor angle check mode, if the feedback position value is less the -52.0, LCD displays "DOWN":
Display:


Solution:
Check whether installation of feedback components is accordance with 4.2.2 or 4.2.3 in this manual.
Fine-tune the installation bracket position.

5.5.2 Span point of position sensor too high

In sensor angle check mode, if the feedback position value is greater than 52.0, LCD displays "UP":
Display:


Solution:
Check whether installation of feedback components is accordance with 4.2.2 or 4.2.3 in this manual.
Fine-tune the installation bracket position.

5.5.3 Initialization error

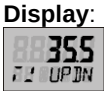
During the positioner tuning, step 1 is error.

Display:

Solution:
Check the air supply pressure
In manual control mode, check whether the valve can be moved up and down
Check if the pneumatic output have gas

5.5.4 Measurement span is insufficient

During the positioner tuning, the feedback range is less than 20.0.
Display:



Solution:
Adjust the slider on the control rod components, making the feedback value range greater than 20.0.

5.5.5 User characteristics setting error

When the user defines the characteristics profile of the valve, the characteristics is non-monotonic up / down.
Display:

Solution:
Reset the parameters. Check positioner and valve connections

5.5.6 Feedback over limits

Feedback value is> 110% or <-10%.
Display:

Solution:
Check feedback sensor and, if necessary, replace the sensor.
Re-initialize the positioner.

5.5.7 Input current out of work range

If the input current value is greater than 21.6mA (>110%) or less than 3.8mA (<-10%).
Display:

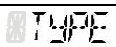
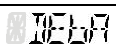
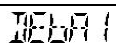
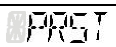
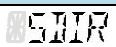
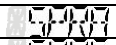
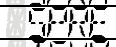
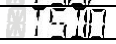
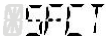
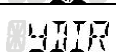
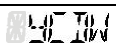
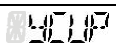
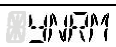
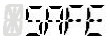
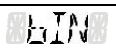
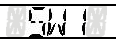
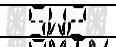
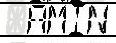
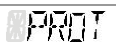
Solution:
Check the input signal.

5.5.8 Actuator error

For some reason, the positioner cannot drive the valve to a specific position.
Display:

Solution:
Cleaning valve.
Check the valve connected institutions.

5.6 Parameter list

Parameter		Show code	Function	Content / Scope	Factory Settings	UM
P1						
01	INIA		Automatic initialization: Not start /Start	NO/STRT	NO	
02	INIM		Manual initialization: Not start /Start	NO/STRT	NO	
03						
04	TYPE		Actuator types: linear actuator / rotary actuator	LINE/TURN	TURN	
05						
06	DEBA		Controller dead band	AUTO 0.1÷10.0	AUTO	%
07	PRED		Controller 1 dead band	AUTO 0.1 ÷100.0	AUTO	%
08	PRST		restore the factory settings: not activated / factory set to start	NO/STRT	NO	
P2						
09	SDIR		Setpoint direction Rising/falling	RISE/FALL	RISE	
10	SPRA		Split range start	0.0 ÷100.0	0.0	%
11	SPRE		Split range end	0.0 ÷100.0	100.0	%
12	TSUP		Setpoint ramp up	AUTO 0÷400	0	s
13	TSDO		Setpoint ramp down	AUTO 0÷400	0	s
14	SFCT		Setpoint function: Valve characteristics linear Equal percentage Inverse equal percentage 21 points freely adjustable 3 points freely adjustable	LINE 1:30 30:1 FrEE 3-POT	LINE	
15÷35	SP00÷SP20		Setpoint tuning points	0.0 ÷100.0		%
P3						
36	YA		Start of manipulated variable limiting	0.0 ÷100.0	0.0	%
37	YE		End of manipulated variable limiting	0.0 ÷100.0	100.0	%
38	YDIR		Direction of manipulated variable for display Rising/Falling	RISE/FALL	RISE	
39	YCDW		Value for tight closing, bottom	OFF 0.0 ÷49.9	OFF	%
40	YCUP		Value for tight closing, top	OFF 50.1 ÷100.0	OFF	%
41	YNRM		standardization of manipulated variable To mechanical travel / To flow	MPOS/FLOW	MPOS	
P4						
42	SAFE		Safe valve: Off / Freeze / Close / Settings / Open	OFF / KEEP / CLOSE / 0.1÷99.9 / OPEN	OFF	%
43	BIN		Digit Input functions: enable “safe position” function	ON/OFF	OFF	
44	DO1		Digital output 1 function: Fault alarm Fault + Non-auto Fault + Non-auto+BIN Under setting value Higher than the setting value	FAULT NA NAB LMVPT HMVPT	FAULT	
45	SW1		setting value	0.0 ÷100.0	0.0	%
46	DO2		Digital output 2 function: Auto/ Manual Under setting value Higher than the setting value	A/M LSET HSET	A/M	
47	SW2		setting value	0.0 ÷100.0	0.0	%
48	AMIN		Min output current	4.0÷20.0	4.0	mA
49	AMAX		Max output current	4.0÷20.0	20.0	mA
50	ADIR		Current output direction	RISE/FALL	RISE	
51	PROT		White project for HART	ON/OFF	OFF	

6. PARAMETERS

1. INIA: Automatic initialization (Chap.5.2.2 Choosing a parameter for configuration)
By selecting “Strt” and pressing the button ▲ for at least 5 seconds, automatic initialization is started. The initialization process is displayed by “RUN 1” to “RUN 5”.

2. INIM Manual calibration （see chapter 5.3.3）
By selecting “Strt” and pressing the button ▲ for at least 5 seconds, manual initialization is started.

3. RESERVE

4. TYPE
Type of actuator.
The actuator is a linear actuator (LINE) or rotary actuator (TURN).

5. RESERVE

6. DEBA: Dead band of the controller
At DEBA = AUTO the dead zone in automatic operation is adapted continuously to the requirements of the control circuit. The dead zone is gradually increased on detecting a control oscillation. The reverse adaptation takes place by a time criterion.
In the other discrete settings, the fixed value is used for the dead zone.

7. DEBA1: Dead band of the controller 1
When DEBA1 = AUTO, the DEBA1 is equal to the DEBA value, which will change according to the operating conditions during the running process. When the valve position changes cause oscillation (such as pipeline leakage), the appropriate increase of the DEBA1 can be alleviated. oscillation.
When DEBA1 has other values, the controller dead zone 1 is a fixed value set.

8. PRST: Preset (factory setting)
Establishing the factory settings and resetting the initialization

	**NOTE:** The positioner must be re--initialized after ”Preset”. All previously determined maintenance parameters are cleared.

9.SDIR: Setpoint direction (see figure 12)
The setting of the setpoint direction serves to reverse the direction of action of the setpoint. It is used mainly for the split range mode and in single--acting actuators with the safety position “up”.

10.SPRA: Split range start (see figure 12)

11.SPRE: Split range end (see figure 12)
In Menu P2, the parameters "10.SPRA" and "11.SPRE" and "9.SDIR" restrict the active set point range. In this way, split range tasks can be done by the following characteristics.

- rising / falling
- falling / rising
- falling / falling
- rising / rising

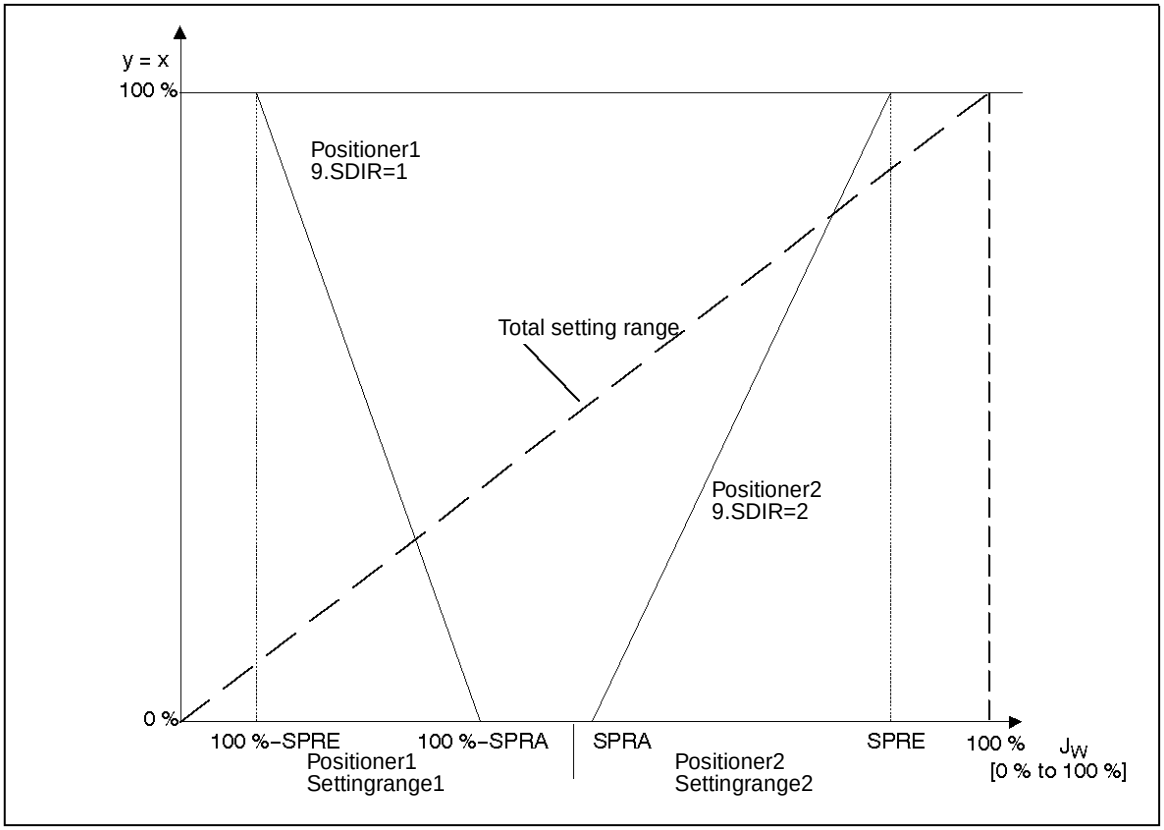


Figure 12: Split range-operation with two positioners

12. TSUP: Set point ramp UP

13. TSDO: Set point ramp DOWN
The setpoint ramp is effective in automatic operation and limits the speed of alteration of the active setpoint. When switching over from manual operation to automatic the active setpoint is adjusted to the setpoint on the positioner with the setpoint ramp.
This bumpless manual/automatic switchover avoids excessive pressure increases on long pipelines.
In the position TSUP = Auto the slower of the two travel times determined during initialization is used for the setpoint ramp. TSDO is then ineffective.

14. SFCT: Set point function
Non-linear valve characteristics can be linearized with this function and any flow characteristics simulated in linear valve characteristics.
Four valve characteristics are stored in the positioner
- Linear (14.SFCT = LINE, factory setting)
- equal percentage 1:30 (14.SFCT=1:30)
- quick open 30:1 (14.SFCT=30:1)
- custom (14.SFCT=FREE)

15. SP00 to 35. SP20: Set point turning points
A flow parameter can be assigned to the respective set point turning value at an interval of 5 %. These points lead to a polygon chain with 20 straight lines which therefore represents a projection of the valve characteristic.
The set point vertex values can only be input at 14.SFCT=FrEE. You may only enter a strictly monotonous characteristic, and two consecutive vertex values must differ by at least 0.2 %.

36. YA: Manipulating variable limiting start

37. YE: Manipulating variable limiting end

38. YDIR: Zero position
With this parameter you can assign the zero position of the display to the zero position of the valves and fittings. It also allows you to select the direction of rotation of the sensor shaft (looking at the open housing).

39. YCDW: Value for tight closing, bottom

40. YCUP: Value for tight closing, top
With this function the valve can be driven to the seat with the maximum actuating force of the actuator (continuous contact of the piezo-valves).
The tight closing function can be activated on one side or for both limit positions.
The tight closing function can be activated when the setpoint is below the value set with parameter “YCDO” or above that set with parameter “YCUP”.

41. YNRM: Manipulated variable standardization
Using the "YA" and "YE" parameters, you can limit the manipulated variable. This limitation causes two different scaling types, MPOS or FLOW, for the digital display and for the position feedback through the current output. See the figure below.
The MPOS scaling type shows the mechanical position from 0 to 100% between the hard stops of the initialization. The position is not influenced by the "YA" or "YE" parameters. The parameters "YA" and "YE" are shown in the MPOS scale.
The FLOW scale is a scaling from 0 to 100% over the range between the "YA" and "YE" parameters. Over this range, the setpoint w is also always 0 to 100%. This results in a more or less flow-proportional display and position feedback "AO". The flow-proportional display and position feedback" AO " also results from the use of valve characteristics.
In order to calculate the regulation difference, the setpoint in the digital display is also shown to the corresponding scale.
The following uses the example of an 80-mm linear actuator to illustrate the dependence of the stroke on the scaling as well as the parameters "YA" and "YE".

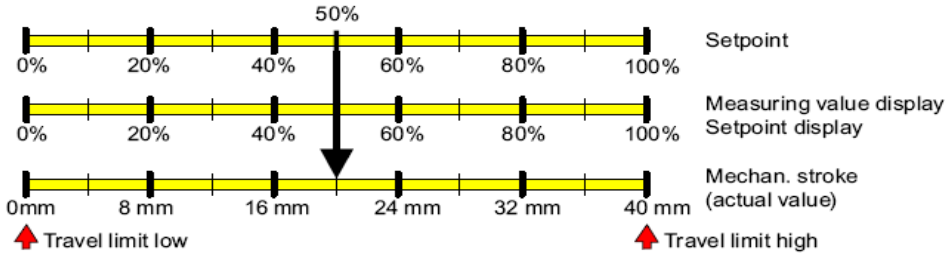


Fig.13: YNRM = MPOS or YNRM = FLOW; default: YA = 0 % and YE = 100 %

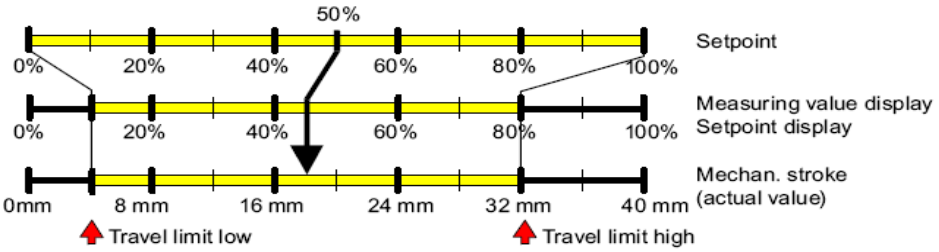


Fig.14: Example: YNRM = MPOS with YA = 10 % and YE = 80 %

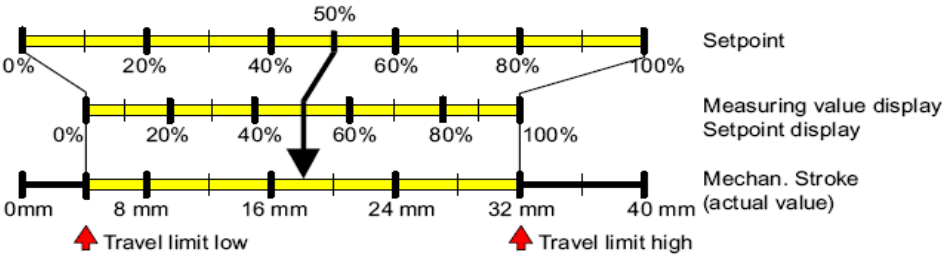


Fig.15: Example: YNRM = FLOW with YA = 10 % and YE = 80 %

42. SAFE: Safe position
Only when 43.BIN is set to be ON, Safety valve is effective
If binary input is 0, valve will be drive to the position specified by this value.

43. BIN: Digit input functions
Enable/disable safe position function.

44. DO1: Digit output function 1
When positioner detected set fault, channel 1(DO1) of binary output module state is "high".

45 SW1: DO1 set value
When DO1 = LSET, valve position is less than the SW1, channel 1(DO1) of binary output module state is "high".
When DO1 = HSET, valve position is greater than the SW1, channel 1(DO1) of binary output module state is "high".

46 DO2: Digit output function 2
When positioner detected set fault, channel 2(DO2) of binary output module state is "high".

47 SW2: DO2 set value
When DO2 = LSET, valve position is less than the SW2, channel 2(DO2) of binary output module state is "high".
When DO2 = HSET, valve position is greater than the SW2, channel 2(DO2) of binary output module state is "high".

48 AMIN: Min output current.
Min output current for the 0% position.

49 AMAX: Max output current.
Max output current for the 100% position.

50 ADIR
Relation between the output current of position feedback module and valve position. There are two choices: rise and fall. When choosing rise, output current will be 4mA when valve position is 0%; output current will be 20mA when valve position is 100%. When choosing fall, the result will be opposite.

51 PROT: Write project for HART
When PROT = ON, write parameter is allowed by PC or field communicator with HART protocol.
When PROT = OFF, write parameter is not allowed by PC or field communicator with HART protocol.

7. FAULT AND MAINTENANCE

7.1 Trouble shooting

When positioner failed, follow these steps to eliminate fault,
If you cannot solve the fault according to steps as bellow, please contact STI.

Fault	Reason	Action to be taken
Actuator no action in manual /auto state	Air pressure too low	Air pressure adjustment > 0.14MPa
	Actuator jammed	Solve problem of actuator jammed
Actuator does not move or moves slowly	Air pressure low	Regulate the air pressure to above 0.14MP
	Exit initialization before finish	Re-initialize
Move frequently (not oscillation)	Leakage in air loop	Check the air pipes
Oscillation	User configuration incorrect	Contact manufacturer if positioner leak
		Set larger dead band, larger setpoint ramp
	Volume of actuator is too small	Set larger dead band, larger setpoint ramp
	Return difference is large	Adjust installation of bracket and feedback position. Re-initialize, if need.
Valve cannot be fully opened or closed	Air pressure too low	Increase air pressure
	Initialization data incorrect	Re-initialize
	Position limit is set	Check user configuration
	Tighten close not set	Active tighten close function
No display	Signal too small(<3.6mA)	Check input signal
	Electrical connection terminal screws loose	Tighten the terminal screws
	Main board failed	Change the main board
Exhaust not smooth	Exhaust plug	Clean exhaust
No position feedback current	Position feedback module failed	Change the module
	No external power, position feedback module doesn't work	Provide 24V power to the module
	Polarity reversal of external connection	Rewire
Feedback current mismatch actual position	Position feedback module failed	Change the module
	Zero or Span drift	Tune the zero or span trimmer of module
Position display on LCD mismatch actual position	Actuator travel range mismatch the scale	Manual initialize

7.2 Maintainance

1) Positioner is an instrument which should be regularly maintained. The air supply of positioner should be kept dry and clean. Regularly exhaust water and pollution of the regulator connecting the positioner in order to keep the positioner normally.
2) Feedback connection may be loose due to long term work. Check the feedback connection regularly. If loose, tighten at once and decide whether to initialize or not according error of zero and span.
3) In order to see whether the positioner is normal, keep the pressure gauge clear.

8. Transport and storage

1) Check whether all kinds of sign are integrality, fully, and the package is firm before storage. Finally, check the reliability and safety of enswathement.
2) The transport should be light disposal, prohibit impacting, compression, and damp.
3) Stored at -40 ÷ 80°C, relative humidity should be no more than 75% of the room, the air should not contain harmful and corrosion impurities instrument.
4) Place according to the box's surface marker, do not reverse.