Instruction manual for software & settings

What is new starting from release 1.8 :

- *Option pack 1 : Diagnostic for Critical Severe Service Valves*
  - *Valve Signature*
  - *Step Response*
- *Option pack 2 : Improved control and diagnostic for High Dynamic Valves*
  - *Stability Control*
  - *Signal Generator for frequency analisys*
  - *Soft Approach to seat*
- *4mA action inversion -std*

What is new starting from release 1.6 :

- *Feedback linearization*
- *Graph tool : compare function*
- *Graph tool : window length*
- *New diagnostic messages*

-Increased control performances (new PID control algorithm)

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Sw installation

- Insert the CD (or download the installation file)
- Run setup.exe
- Follow the instructions on the screen.

RemoteControl sw connection

HART interface connection :

Connect your HART interface at the same cables of the 4-20mA input signal (J3).

If the 4-20mA signal generator is not HART compliant communication problems may be expected

TTL High speed serial connection :

Connect the special cable at connector J7.

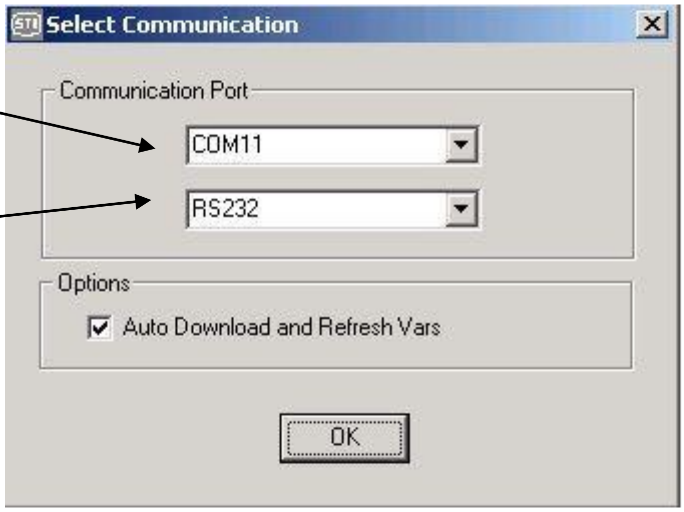
DANGER

The TTL High speed interface is not Intrinsically Safe.
Use this type of interface only in a Safe Area or take all the necessary precautions before using.

Starting the sw

- Run the sw starting from the desktop icon or from the Windows Start menu.

  The 'Select Communication' page is displayed.

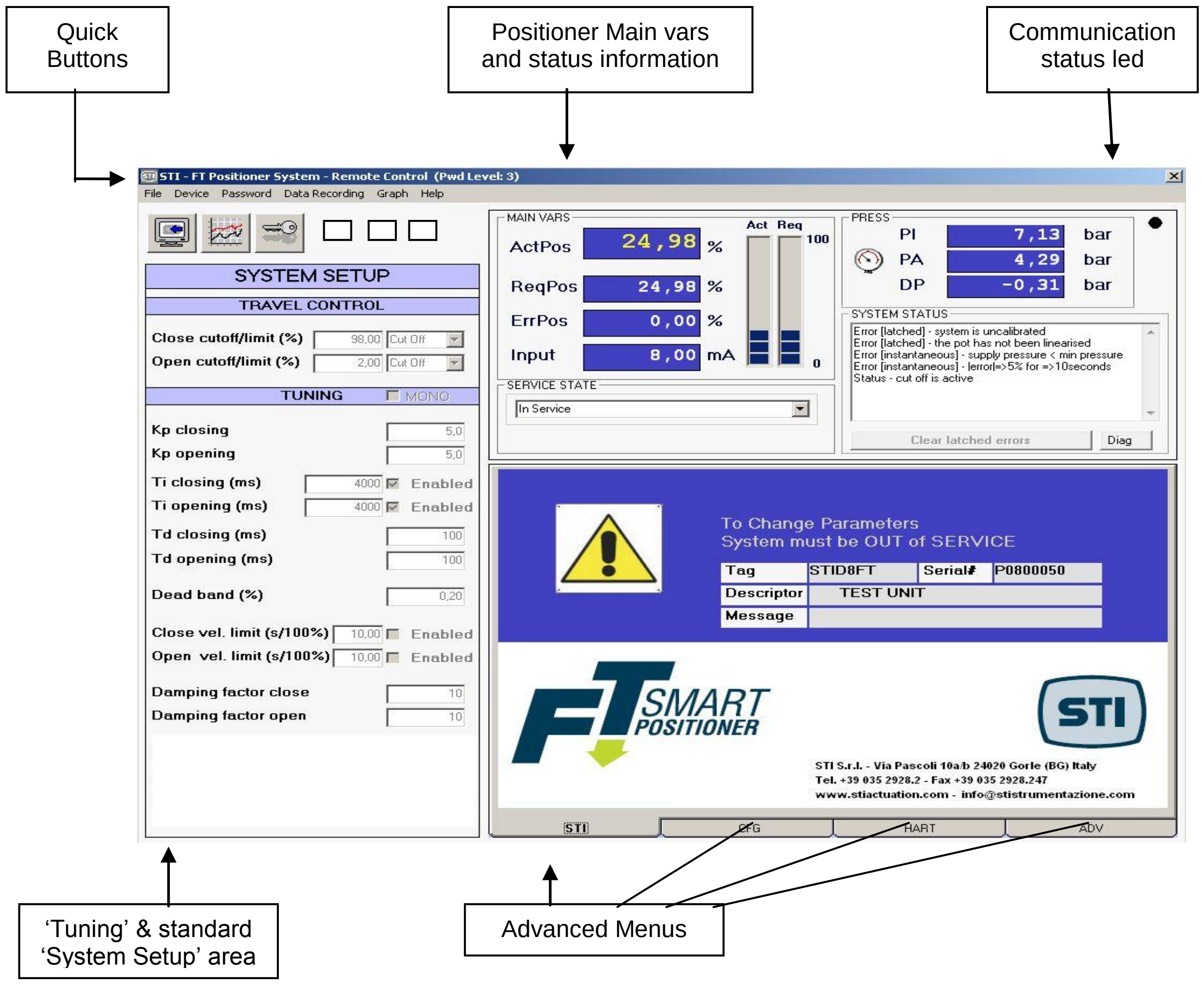


- Select the right communication port

Only the available communication ports are displayed in the combo box.

- Select the Communication mode (TTL or HART)
- Disable 'AutoDownload and Refresh Vars' if you want to reduce the refresh rate (and the traffic on the communication line)
- Press the 'OK' button

The Main page



- ‘Main vars’ and ‘Status Information’ are normally refreshed automatically.
- The other parameters are refreshed manually with the ‘Download’ command
- The refresh rate depends on the communication mode (HART or TTL)
- If the ‘Autodownload and Refresh vars’ option is disabled, use the ‘Download’ command to refresh the parameters use the ‘Refresh’ button (located near the ‘Communication Status Led’ when ‘Autodownload’ is disabled) to refresh the main variables.

Quick Buttons

Download button

Download all the parameters from the FT positioner.
At the end of the download the values displayed on the RC sw are the same as the FT positioner

Graph button

Open the Graph window

Password button

Open the Login window
In order to change the parameters or to access configuration windows, a login is required.
The default standard password is : 12345

'Tuning' & standard 'System setup' area

Important : to modify the parameters it needs click two times on field, in this way another windows will open and it's possible to write the new value for that parameter.

Definitions :

Limit : when a limit is configured the Requested position is limited to this value
Example : Set the Limit at 95%. Even if the signal input is 20mA and the theretical Request position is 100%, the applied Request position is 95%

CutOff : When a cutoff is configured, if the Requested and Actual position falls inside the Cutoff area the Request position is fixed at the min (or max) value.
Example : Set the cutoff at 5%. When the Request position is less of 5% and the Actual position is less of 5% a fixed pressure is applied in order to put the actual position at 0%.

Tight (open/close) pressure : this defines the pressure applied when a cutoff is active. (Advanced parameter)

Open/Close : Information related to 'Signal Fail Action' configuration.

WARNING
The signal Fail Action setting informs the Positioner about what happens when the electrical power supply fails. This behaviour is determined by the pneumatic connection and is not software configurable.

WARNING
On some type of valves it is mandatory to enable a cutoff to ensure that the valve works properly (to ensure full trust on seat)

Travel control :

Open Limit [50..100 %]:
Specify if a Limit or a CutOff is configured in the open direction
(see also the Soft Approach to seat paragraph)

Close Limit [0..50 %]:
Specify if a Limit or a CutOff is configured in the close direction.
(see also the Soft Approach to seat paragraph)

Tuning :

A lot of parameters are configurable with different settings for the open and close directions. This is to maximize the performance of the system.
If the *Mono* flag is checked the first value of each parameter is automatically copied into the second one.

Kp [0,1 .. 25]:
Proportional gain is the multiplier of the error (difference between input signal and actuator actual position) and it is expressed in percent. It is active only for an error which is bigger than dead band value.
A different gain for each stem direction can be selected.

Ti [OFF- 10 .. 100000 ms]:

Integral factor.
The integral term accelerates the movement of the process towards setpoint and eliminates the residual steady-state error that occurs with a proportional only controller. However, since the integral term is responding to accumulated errors from the past, it can cause the present value to overshoot the setpoint value.
A small 'Ti' value is equal to an aggressive integral effect.
A different integral factor for each stem direction can be selected.

Td [0..1000] :

Derivative factor
The derivative term slows the rate of change of the controller output.
Setting Td equal to '0' disable; the derivative factor. Increasing the value increases the derivative action.

Dead Band [0..10] :

Dead band prevents (at expense of the accuracy) that the valve, in the controlled condition, keeps continuously hunting for the target position. The dead band setting can be used to reduce continues cycling ("hunting") around the target position. Increasing the value reduces the accuracy, but can improve stability.

Velocity Limit [0..655 sec]:

Velocity limit is the value expressed in seconds of the stroking time for each direction

Damping Factor [0..255]:

Apply a damping effect at the signal rate of change. Increasing the damping factor causes a smooth effect on the signal rate of change.

(The function 'Switched Ctrl err threshold' is not standard starting from version 1.6, it is available in the ADV menu but not necessary in many cases)

Switched ctrl err threshold[0..100 %]:

When the error is greater than this threshold :

- the positioner tries to impose a fixed ΔP in order to maximize the speed.
- the Integral contribution is reset to zero.

Sweep pressure[0..10 bar]:

Fixed ΔP applied when the error is greater than 'Switched ctrl err threshold'.

Switched control function Enabled[ON/OFF]:

Turn ON/OFF the 'Switched control function'

Normally the following settings work well:

- sweep pressure equal to the line pressure
- the Switched ctrl err threshold equal to [100/min(Kp)]*['sweep pressure'/10] with a maximum of 20%

Main vars and status

This window reports information about the status of the positioner.
The LED in the top-right position informs the user about the information status :
YELLOW LED blinking : the communication is running
RED LED : communication problem

ActPos [%] :

Actual position measured by the positioner.

ReqPos [%]:

Input signal or the request position. The source of the requested position depends on the 'service state'. While 'in service' the requested position comes from the 4-20mA input signal and the split range setting. While 'out of service' the requested position comes from the manual setpoint setting

ErrPos[%]:

ReqPos-ActPos

Input [mA]:

Current read by the 4-20mA loop current Input channel.

The user can calibrate the value displayed using the commands in the 'CFG' area

PI [bar]:

Line pressure

PA [bar]:

Pressure measured at port A of the positioner.

DP[bar]:

Differential pressure measured : portB-portA

System Status :

Displays the status of the device (the same information is also available with CMD48 in the HART protocol) :

[latched] means that the error happened but it is not running now (i.e. there was a low pressure but now the pressure is good). In order to clear the latched errors the button 'Clear latched errors' must be pressed.
[instantaneous] means that the error is running now

"Error [latched] - user configuration has been reset"
"Error [latched] - user configuration data failed recovery"
"Error [latched] - factory settings have been reset"
"Error [latched] - factory settings were corrupt at power on"
"Error [latched] - a watchog timeout caused the last system reset"
"Error [latched] - system has not been configured (perhaps first power on?)
"Error [latched] - system is uncalibrated"
"Error [latched] - the pot has not been linearised"

"Error [instantaneous] - too close physical limits"
"Error [instantaneous] - position encoder out of range"
"Error [instantaneous] - DP sensor out of range"
"Error [instantaneous] - supply pres sensor out of range"
"Error [instantaneous] - portA sensor out of range"
"Error [instantaneous] - supply pressure < min pressure"
"Error [instantaneous] - |error|=>5% for =>10seconds"

"Error [latched] - too close physical limits" '
"Error [latched] - position encoder out of range"
"Error [latched] - supply pressure sensor out of range"
"Error [latched] - supply pressure sensor out of range"
"Error [latched] - portA sensor out of range"
"Error [latched] - supply pressure < min pressure"
"Error [latched] - |error|=>5% for =>10seconds"

"Status - setpoint is being clamped (lower clamp)"
"Status - setpoint is being clamped (upper clamp)"
"Status - cut off is active"
"Status - cut off is active"
"Status - the DP clamp is active"
"Status - system not in service"
"Status - position <= limit 1"
"Status - position => limit 2"
"Status - Digital In 1 is on"
"Status - Digital In 2 is on"
"Status - Digital Out 1 is on"
"Status - Digital Out 2 is on"
"Status - digital input has activated system override"

"Communication Lost"

"Operation failed"
"System calibration completed"
"System calibration in progress"
"System calibration failed"
"Hard limits calibr.completed"
"Hard limits calibr.in progress"
"Hard limits calibr.failed"
"Loop curr.ADC 4mA calib.completed"
"Loop curr.ADC 4mA calib.in progress"
"Loop curr.ADC 4mA calib.failed"
"Loop curr.ADC 20mA calib.completed"
"Loop curr.ADC 20mA calib.in progress"
"Loop curr.ADC 20mA calib.failed"
"Pos.ADC 0degrees calib.completed"
"Pos.ADC 0degrees calib.in progress"
"Pos.ADC 0degrees calib.failed"
"Pos.ADC 90degrees calib.completed"
"Pos.ADC 90degrees calib.in progress"
"Pos.ADC 90degrees calib.failed"
"DP Press.Sens.0bar calib.completed"
"DP Press.Sens.0bar calib.in progress"
"DP Press.Sens.0bar calib.failed"
"DP Press.Sens.6bar calib.completed"
"DP Press.Sens.6bar calib.in progress"
"DP Press.Sens.6bar calib.failed"

"PI Press.Sens.0bar calib.completed"
"PI Press.Sens.0bar calib.in progress"
"PI Press.Sens.0bar calib.failed"
"PI Press.Sens.6bar calib.completed"
"PI Press.Sens.6bar calib.in progress"
"PI Press.Sens.6bar calib.failed"
"PA Press.Sens.0bar calib.completed"
"PA Press.Sens.0bar calib.in progress"
"PA Press.Sens.0bar calib.failed"
"PA Press.Sens.6bar calib.completed"
"PA Press.Sens.6bar calib.in progress"
"PA Press.Sens.6bar calib.failed"
"Inner loop drive DAC 0bar calib.completed"
"Inner loop drive DAC 0bar calib.in progress"
"Inner loop drive DAC 0bar calib.failed"
"Inner loop drive DAC 6bar calib.completed"
"Inner loop drive DAC 6bar calib.in progress"
"Inner loop drive DAC 6bar calib.failed"
"Dec TE Offset by 0.1deg calib.completed"
"Dec TE Offset by 0.1deg calib.in progress"
"Dec TE Offset by 0.1deg failed"
"Inc TE Offset by 0.1deg calib.completed"
"Inc TE Offset by 0.1deg calib.in progress"
"Inc TE Offset by 0.1deg calib.failed"
"Analog out DAC 4mA calib.completed"
"Analog out DAC 4mA calib.in progress"
"Analog out DAC 4mA failed"
"Analog out DAC 20mA calib.completed"
"Analog out DAC 20mA calib.in progress"
"Analog out DAC 20mA calib.failed"
"Store RAM to user flash completed"
"Store RAM to user flash in progress"
"Store RAM to user flash failed"
"Store RAM to factory flash completed"
"Store RAM to factory flash in progress"
"Store RAM to factory flash failed"
"Restore to factory settings completed"
"Restore to factory settings in progress"
"Restore to factory settings failed"
"Unknown state"

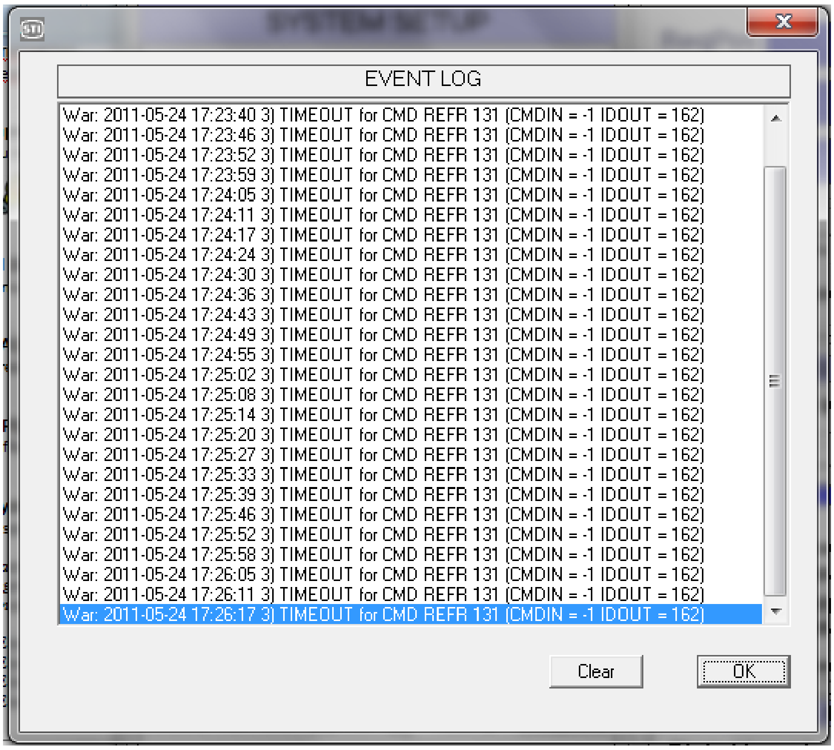
"Invalid AutoConfig Request"
"Limits Phase1: Encoder Out Of Range Before Stroke"
"Limits Phase1: UpStepTime Max Exceeded"
"Limits Phase1: DownStepWait Time Exceeded"
"Limits Phase1: DownStepTime Max Exceeded"
"Limits Phase1: Encoder Out Of Range During Stroke"
"Physical Limits: Min Diff Not Met"
"Time Phase1: StepWaitTime Exceeded UpStep"
"Time Phase1: Invalid RiseTime"
"Time Phase1: PostStepSettleTime Max Exceeded UpStep"
"Time Phase1: StepWaitTime Exceeded DownStep"
"Time Phase1: Invalid FallTime"
"Time Phase1: PostStepSettleTime Max Exceeded DownStep"
"Map Phase1: UpStrokeTime Max Exceeded"
"Map Phase1: DownStrokeTime Max Exceeded"
"Map Phase2: PreMoveWaitTime Exceeded"
"Map Phase2: MoveTime Max Exceeded"

"Map Phase2: SetpointErr Max Exceeded1"
"Map Phase2: SetpointErr Max Exceeded2"
"Map Phase3: PreMoveWaitTime Exceeded"
"Map Phase3: MoveTime Max Exceeded"
"Map Phase3: SetpointErr Max Exceeded1"
"Map Phase3: SetpointErr Max Exceeded2"
"Tune Phase1: PreStepSettleTime Max Exceeded"
"Tune Phase1: StartStepWaitTime Max Exceeded"
"Tune Phase1: PreStepWaitTime Exceeded"
"Tune Phase1: PostStepSettleTime Max Exceeded"
"Tune Phase1: Oscillated Before Step"
"Tune Phase1: Num Setpoint Incs Max Exceeded"
"Tune Phase1: Position Move Too Small"
"Tune Phase1: Could Not Calculate Pid Params"
"Digital Input Abort"
"User Abort"
"Feature Not Implemented"
"Calibration in progress (step " ... ")"

Diag (button)

It is to have access to a window that summarizes the communication errors.
When the button is with a RED led it means that at least an error happens.
Pressing the button a window appears with the list of the communication errors.

Press 'clear' to erase the content of the Event Log window, 'OK' to close the window.

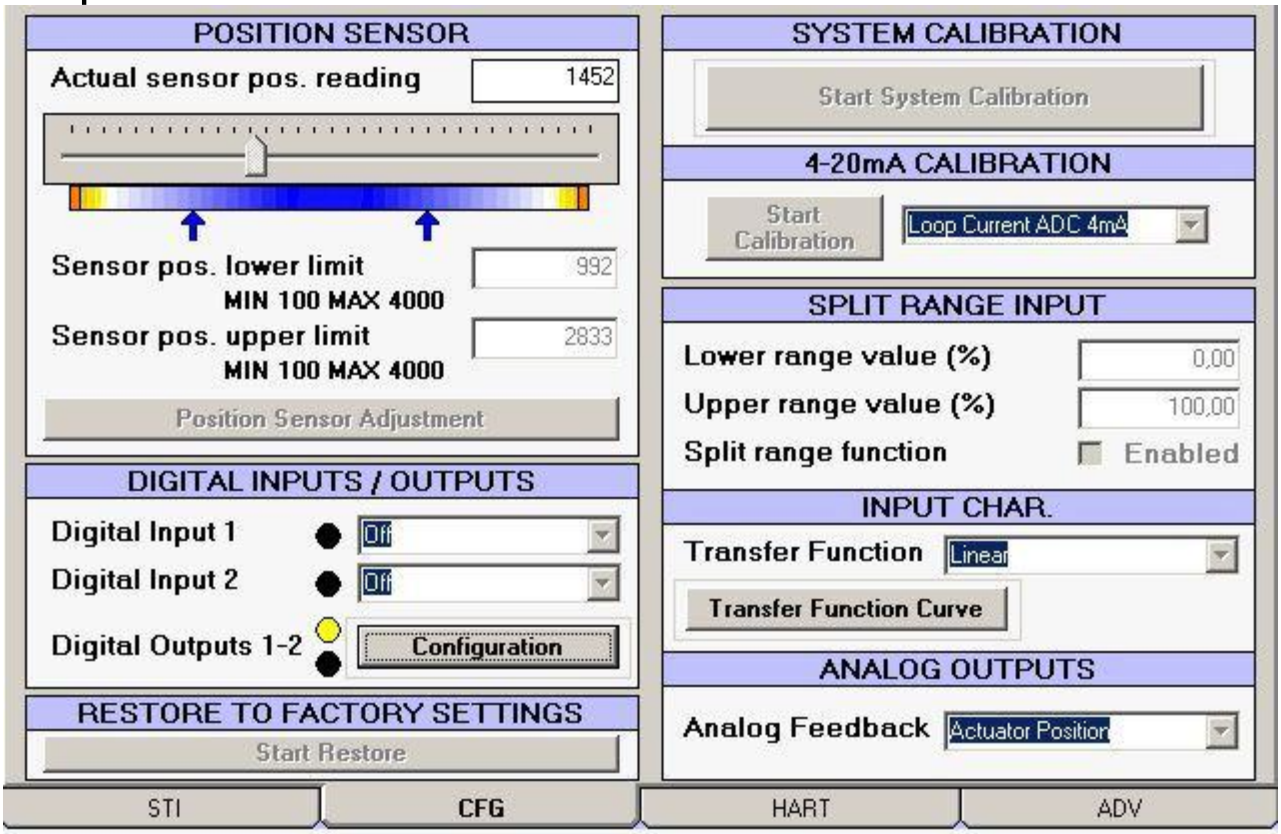


Service State / Mode :
Allow the selection of the Service State.

- In Service : the Requested Position is evaluated continually by the positioner starting from the 4-20mA signal value.
- Out Of Service (Manual) : the Requested Position comes from the manual setting in the window. When the Service Mode is set to 'Out Of Service (Manual)' the first manual setpoint is equal to the last 'Actual position' in order to minimize the movement of the system
- Out of Service : special mode selected automatically when the system is not calibrated. In this mode port B is fully pressurized and port A is depressurized

WARNING
Changing from 'Out of Service' to 'In Service' can cause the actuator to move.
When the positioner is turned ON it starts automatically in 'In Service' or 'Out of Service' based on the position sensor calibration status.

CFG panel


POSITION SENSOR
Actual sensor pos. reading
1452
Sensor pos. lower limit
992
MIN 100 MAX 4000
Sensor pos. upper limit
2833
MIN 100 MAX 4000
Position Sensor Adjustment
DIGITAL INPUTS / OUTPUTS
Digital Input 1
Off
Digital Input 2
Off
Digital Outputs 1-2
Configuration
RESTORE TO FACTORY SETTINGS
Start Restore
SYSTEM CALIBRATION
Start System Calibration
4-20mA CALIBRATION
Start Calibration
Loop Current ADC 4mA
SPLIT RANGE INPUT
Lower range value (%)
0,00
Upper range value (%)
100,00
Split range function
Enabled
INPUT CHAR.
Transfer Function
Linear
Transfer Function Curve
ANALOG OUTPUTS
Analog Feedback
Actuator Position
STI
CFG
HART
ADV

Position sensor:

Pos. raw ADC reading (bits)

This is the read value of the position sensor measured value before calibration.
The same value is shown in the scroll bar below.
During the mechanical linkage adjustment the user can use this scroll bar to verify the alignment : the raw ADC value must fall inside the range. The best condition is when the 50% mechanical position is near the middle value of the scroll bar (2048 +/- 500).

Important: to limit the travel of actuator it needs to find the raw ADC value in correspondence of hard limit and to set manually the raw ADC with a value desired. For example if for the lower hard limit the raw ADC read is 1000 and for the upper hard limit the raw ADC read is 3000 and it wants reduce the actuator travel of 5% on lower limit and 10% on upper limit, the raw ADC value needs set are: 1100 for lower limit and 2800 for upper limit. Then check the actual positions on end stroke and adjust if necessary.

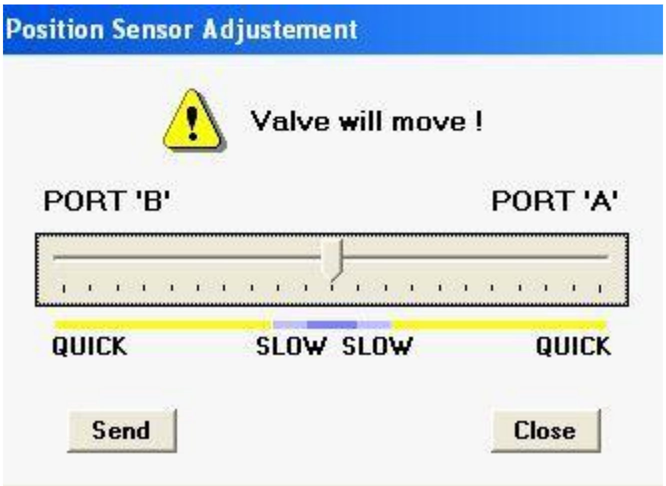
Position sensor adjustment :

This button opens a window that helps the user to move the actuator.
The slide bar enables the user to select a safe speed to move in one direction or in the other.

Move the slide to the desired position and press 'Send'.
To increase the movement speed, move the slider far from the middle position.

WARNING

When the send button is pressed the system can move.



Digital inputs/outputs

Refer to the ‘electrical connection’ for information about the use of ‘Digital inputs/outputs’ in Intrisically Safe area and proper connection to an IS barrier.

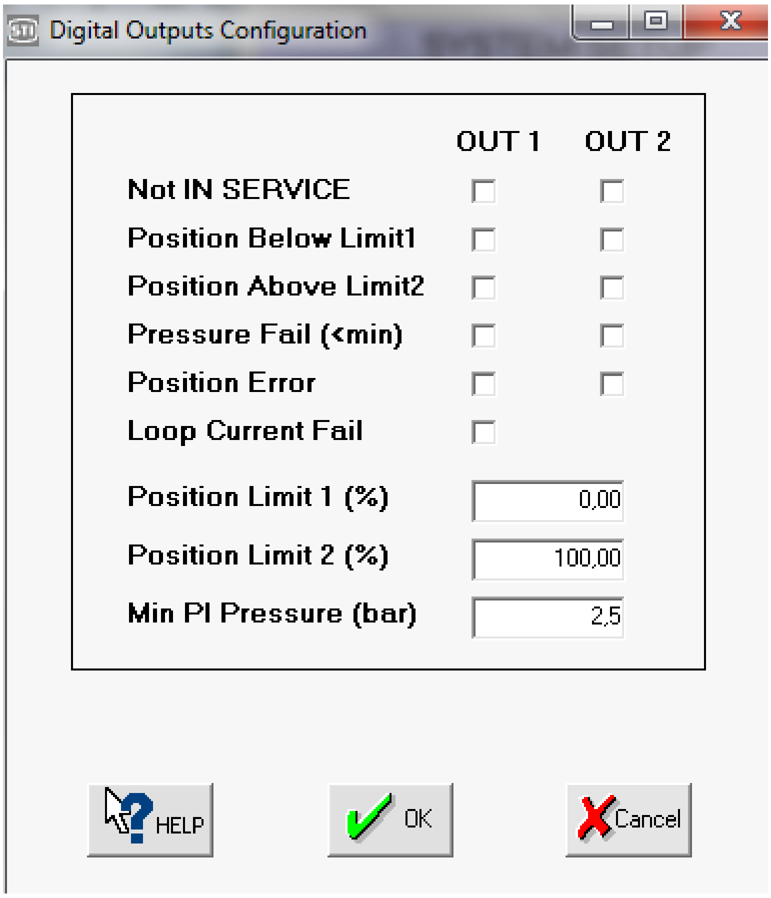
Digital Input 1:
Configure the action that the positioner will do when Digital Input 1 is activated.

- Shut down : the I/P is de-energized and the spool goes in the default position -> Port B is fully pressurized.
- Pressurize Port ‘A’: the I/P is fully energized and Port A is fully pressurized.

WARNING
The ‘Pressurize Port A’ option is not ‘safety’ : if the 4-20mA signal or air is fail, the system can move

Digital Input 2:
Same as Digital Input 1.

Digital Outputs :
Open the Digital Outputs configuration window.



For each digital outputs it is possible to select the rules of activation.

Not IN SERVICE :
Digital output is activated when the system is not IN SERVICE

Position Below Limit 1 :
Digital output is activated when the actual position is below the limit specified in ‘Position Limit 1’

CAUTION
Don’t use this is a virtual limit switches for a safety application.

Position Above Limit 2 :
Digital output is activated when the actual position is above the limit specified in ‘Position Limit 2’

CAUTION
Don’t use a virtual limit switches for a safety application.

Pressure Fail :
Digital output is activated when the pressure of the line (PI) is below the limit specified in Min PI Pressure

Position error :
Digital output is activated when the system is IN SERVICE and the position error is >= 5% for at least 10 sec.

Loop current Fail :
Digital output 1 is used with a piezo valve in order to implement the ‘[Loop current] Fail Freeze’ function.
The option requires not only a sw activation but also a piezo valve and pneumatic valves.
When this option is selected only the ‘pressure fail’ option is also available in order to implement the ‘[Low Pressure] Fail Freeze’.
Digital Outputs are not available for the customer when this option is used.

SYSTEM CALIBRATION

Starts the calibration and self-tuning procedure.

The 'Only HARD LIMITS' option allows the calibration of the travel without performing self tuning.

WARNING
When the 'Start Calibration' button is pressed the system will move.

4-20mA CALIBRATION

Start the calibration of the selected option :
CAUTION
Be sure that you are supplying the positioner with a stable, accurate 4mA and 20 mA reference.

Loop Current ADC 4mA
Reads the actual value of the input current and calibrate the internal system to always read this value as 4mA.

Loop Current ADC 20mA
Reads the actual value of the input current and calibrates the internal system to always read this value as 20mA.

SPLIT RANGE INPUT

Enables the split range function.
The values in Lower range value and Upper range value are referred to the 4-20mA input.
A minimum distance of 20% is required between Lower and Upper value, so up to 5 split range area can be configured in different concatenated positioners.
The result of the split range is then evaluated by the 'Transfer Function Curve'.

If the Low range value is equal to 0% and Upper range value is equal to 100% the positioner interprets 4mA as the 0% Request position and the 20mA as 100%.
If the Low range value is equal to 0% and Upper range value is equal to 50% the positioner interprets 4mA as the 0% Request position and the 12mA as 100%.

Lower range value (%) :
Specifies the Lower range value.

Upper range value (%) :
Specifies the Upper range value.

Setpoint range function (enabled) :
Enable or disable the split range function

The 'Transfer Function Curve' shows the effect of Split Range Function in a graphical way.

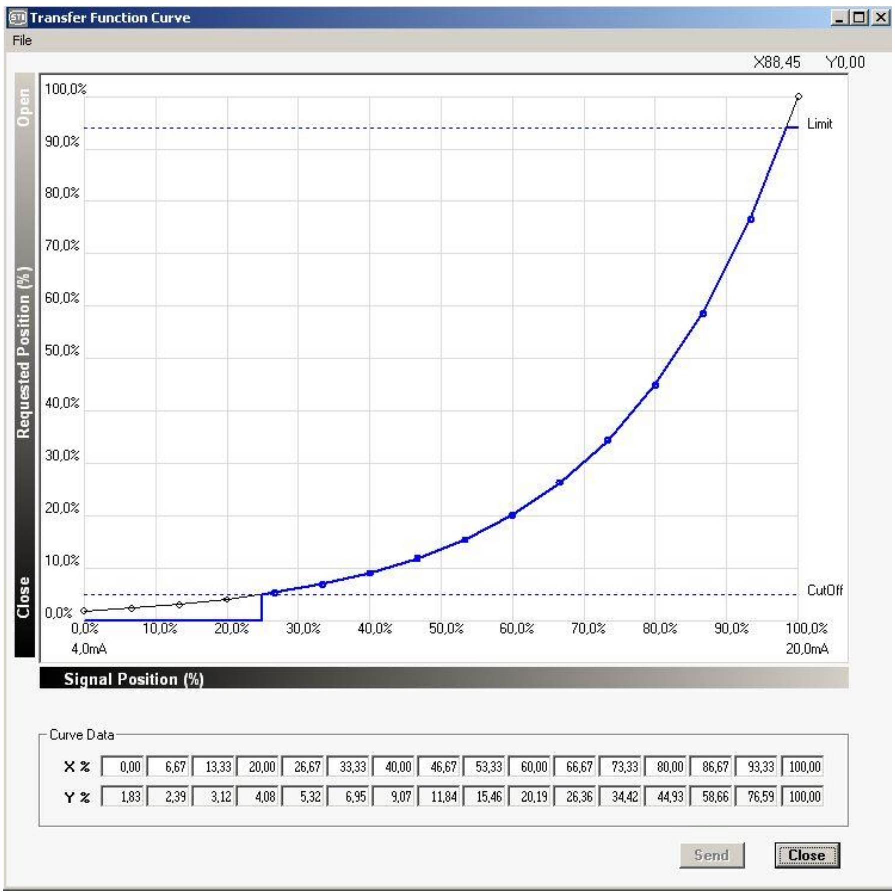
INPUT CHAR

The Characterization specifies the relationship between the Input signal and the Requested Position.

Transfer Function :
Select one of this characterization :

- Linear
- Standard 1-50 : equipercentage 1:50
- Standard 50-1 : inverse equal percentage 1:50
- User : user defined
- Standard 1-25 : equipercentage 1:25
- Standard 25-1 : inverse equal percentage 1:25
- Standard 1-30 : equipercentage 1:30
- Standard 30-1 : inverse equal percentage 1:30

Transfer Function Curve button :
Open the Transfer Function Curve window



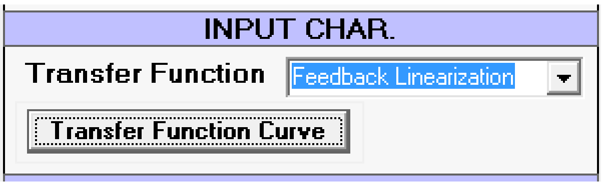
- The ‘Close’ and ‘Open’ label in the ‘Requested position’ axis shows the effect of the ‘Signal Fail Action’ selection.
- The ‘4.0mA’ and ’20.0mA’ in the ‘Signal Position’ show the effect of the ‘Split Range’ setup.
- The effect of ‘Limit’ and ‘CutOff’ are showed on the graph,
- Only the ‘User Curve’ can be modified, the other curves are fixed → if you want to start from a standard curve and generate a user curve you can :
  - Select the starting curve
  - Save the Table (File → Save Table).
  - Select ‘User Curve’
  - Load the saved Table
  - Modify the table
- To ‘Send’ a ‘User Curve’ to the Positioner press the ‘Send’ button.
- The Signal Position steps are fixed, you can only change the Requested position value
- You can change a value in the table or click_&_drag the dot in the graph
- If you hold down the shift key and click on two dots, the system will automatically do a linear interpolation between these two points.

Feedback linearization

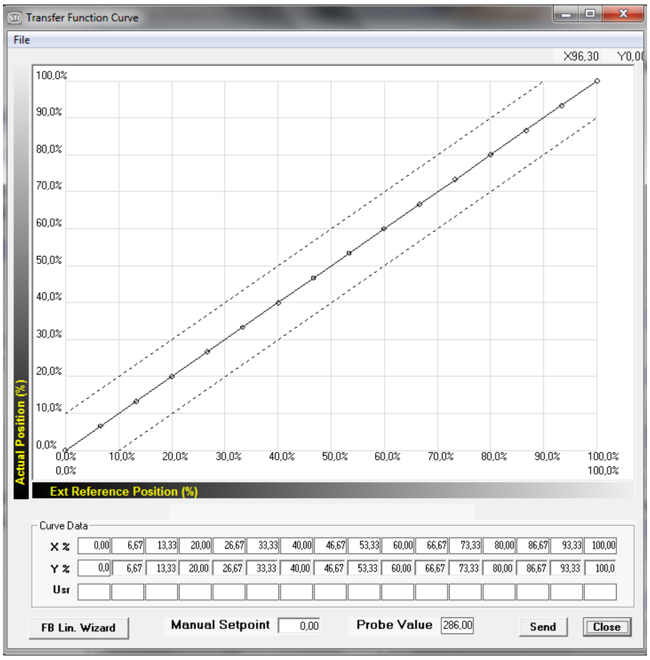
The transfer function has the option 'Feedback Linearization'.
With this feature it is possible to 'compensate' the position error that comes from the mechanical linkage and/or from the sensor.

Choosing 'Feedback linearization', all the other characteristic options are disabled (the Feedback linearization is applied to a 'linear' transfer curve).

In order to activate the Feedback Linearization , select 'Feedback Linearization' in 'Transfer function'.



Pressing the 'Transfer Function Curve' button the input panel appears :



X axis : external reference scale (gauge or meter that must be used to have a secure reference)

Y axis : actual position seen by the FT

FB Lin Wizard button : button to start the wizard that help you to align your external reference

Manual SetPoint : if the 'Service State' is 'Out Of Service (Manual) ' it is possible to move the valve manually using this tool.

Probe value : shows the 'actual position' of the system that must be used for the linearization (this value is not affected by the 'Feedback linearization' effect)

Send : send the Feedback curve to the positioner.

Example of Feedback linearization :

1) Apply a gauge or meter on the actuator/valve in order to have a secure position reference
2) Be sure to have 'Service State' = 'Out Of Service (Manual) ' and 'Transfer function = Feedback Linearization'
3) Press 'FB Lin Wizard' and insert the value on the gauge when you are in the 0% position and in the 100% position (for example 120mm and 30mm)
4) The 'Usr' row is filled with the gauge value at different points based on your input

Curve Data

X %	0,00	6,67	13,33	20,00	26,67	33,33	40,00	46,67	53,33	60,00	66,67	73,33	80,00	86,67	93,33	100,00
Y %	0,0	6,67	13,33	20,00	26,67	33,33	40,00	46,67	53,33	60,00	66,67	73,33	80,00	86,67	93,33	100,0
Usr	120,00	114,00	108,00	102,00	96,00	90,00	84,00	78,00	72,00	66,00	60,00	54,00	48,00	42,00	36,00	30,00

5) Move the 'Manual Setpoint' until you read on the gauge (with reference to the example) 102mm
6) Copy the value in 'Probe value' in Y%[20] (below X%=20)
7) The point in the graph related to X%[20]is moved in X=20 Y = value and now it appears in 'bold'
8) Move the 'Manual Setpoint' until you read on the gauge (with reference to the example) 84mm
9) Copy the value in 'Probe value' in Y%[40] (below X%=40)
10) The point in the graph related to X%[40]is moved in X=40 Y = 'value' and now it appears in 'bold'

11) Repeat the last 3 steps for a subset (or all) the points in the table
12) If some points are missing you can linearize them with reference to the 'known' ones (keep 'SHIFT' pressed and click of the two [known] points around the one that is 'missing')
13) Press 'Send' in order to store the linearization curve in the positioner

Take in account that :

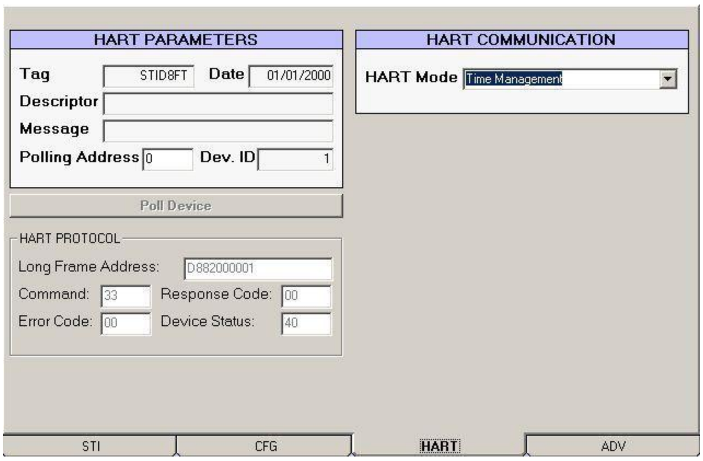
a) The linearization can be performed on much more points (up to 16)
b) The linearization consider 'linear' the error between two consecutive points
c) The linearization cannot affect resolution of the actuator/valve

Analog Output

Analog Feedback

- Selects the Analog Output (4-20mA signal out) report the 'Actuator position' or the 'Reverse Actuator Position'

HART panel



HART PARAMETERS

Tag :

- The Tag is a 8 character label assigned by the end user based on the location and use of the field device. It's a 8 character (6 byte) Packed ASCII string used to identify the field device. The term originated when physical tags were attached to instruments for this purpose.

Date :

- The date is represented by three 8-bit binary unsigned integers representing, respectively, the day, month and year (minus 1900). It's a date code, used by the Master for record keeping (e.g. last or next calibration date).

Descriptor :

- The Descriptor is a 16 character (12 byte) Packed ASCII string used by the Master for record keeping.
- The default value is a blanked string, 16 bytes long.

Message :

- The Message is a 32 character (24 byte) Packed ASCII string used by the Master for record keeping.
- The default value is a blanked string, 32 bytes long.

Polling address:

- In the HART Protocol, the polling address is an integer used to identify the field device. It is used to construct the Short Frame Address. The Polling Address is set to 0 in point to point installations.

Dev. ID :

- This number is different for every device manufactured with a given Manufacturer ID and Device Type, it corresponds to serial number (see page 7).

HART Protocol

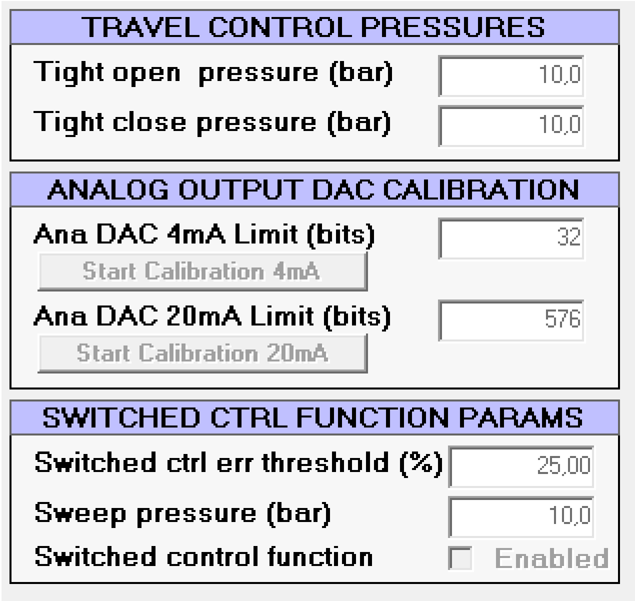
- Show some communication parameters which may be useful for debugging communication problem.

HART Communication

Hart Mode :

- *'Time management'* and *'Time management (performance)'* are two different way to manage the Hart modem. If you experience of communication problems try changing this option.

ADVANCED Panel
(only for advanced users)



Travel Control Pressures

It allows to set the pressure that isused when in fully open/close position with CUTOFF enabled.
The default value is 10bar, it means that all the pressure available in the line is used.
In order to speedup the movement of the valve from the fully close (open) position could be useful to reduce the pressure used.

WARNING
Reducing the pressure could be that the valve is not fully closed and some leakage appears : the valve can be damaged.

WARNING
The pressure limitation is valid only when the positioner is working. Removing the power supply (4-20mA loop) the output from the positioner is equal to the line : actuator and valve must be able to manage the full pressure.

Analog output DAC calibration

The analog output (4-20mA passive loop) is calibrated during the production. If some adjustment is required it can be done in this window.
In order to 'invert' the output a specific function is provided in the 'CFG' window (see 'Analog Feedback'), this calibration must not be used.

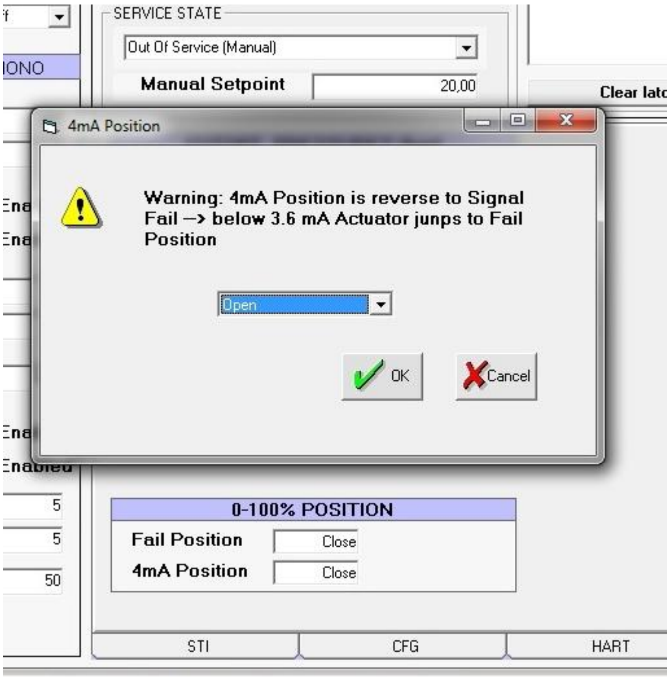
4mA calibration :
Move the actuator in the 4mA position , check that CUTOFF is active in this position in order to have a 'stable' signal.
If the measured output is different from 4mA, change the value of the DAC calibration ('32' in the picture).
Increase the value is the measured output is less than 4mA or decrease the value.
When you are satisfied press the 'Start Calibration 4mA' button

20mA calibration :
Move the actuator in the 20mA position , check that CUTOFF is active in this position in order to have a 'stable' signal.
If the measured output is different from 20mA, change the value of the DAC calibration ('576' in the picture).
Increase the value is the measured output is less than 20mA or decrease the value.
When you are satisfied press the 'Start Calibration 20mA' button

Switched CTRL function params

This is a function used in the previous sw release (before 1.6) but available in case it is necessary. This function is not used by default.

0-100% position (4mA action inversion)



The ‘0-100% Position’ panel is useful to set the relationship between the 4mA value and the valve status (‘Close’ or ‘Open’).

The basic rule is that by design the FasTrak positioner when the power is removed (4-20mA signal) has :

- Port ‘A’ connected to the atmosphere
- Port ‘B’ fully pressurized

So the position of the valve when the power is removed depend on the pneumatic connection.

(an exception to the above rule is when the ‘Fail Freeze’ option devices is used, in this case –by a special electronic and 3 way valves – the position when the signal is lost is the last valid)

By default we have that the ‘4mA position’ is the same of the power fail position.

During the ‘SelfTune’ phase the sw ask if the valve is ‘close’ or ‘open’ when the power is removed, this is to make a relationship between the parameter used for the tuning and the effect on the valve : it is not a way to adjust the movement direction because this depend from the pneumatic connection.

The ‘Fail Position’ field shows what was selected during the Selftune, if required it can be changed.

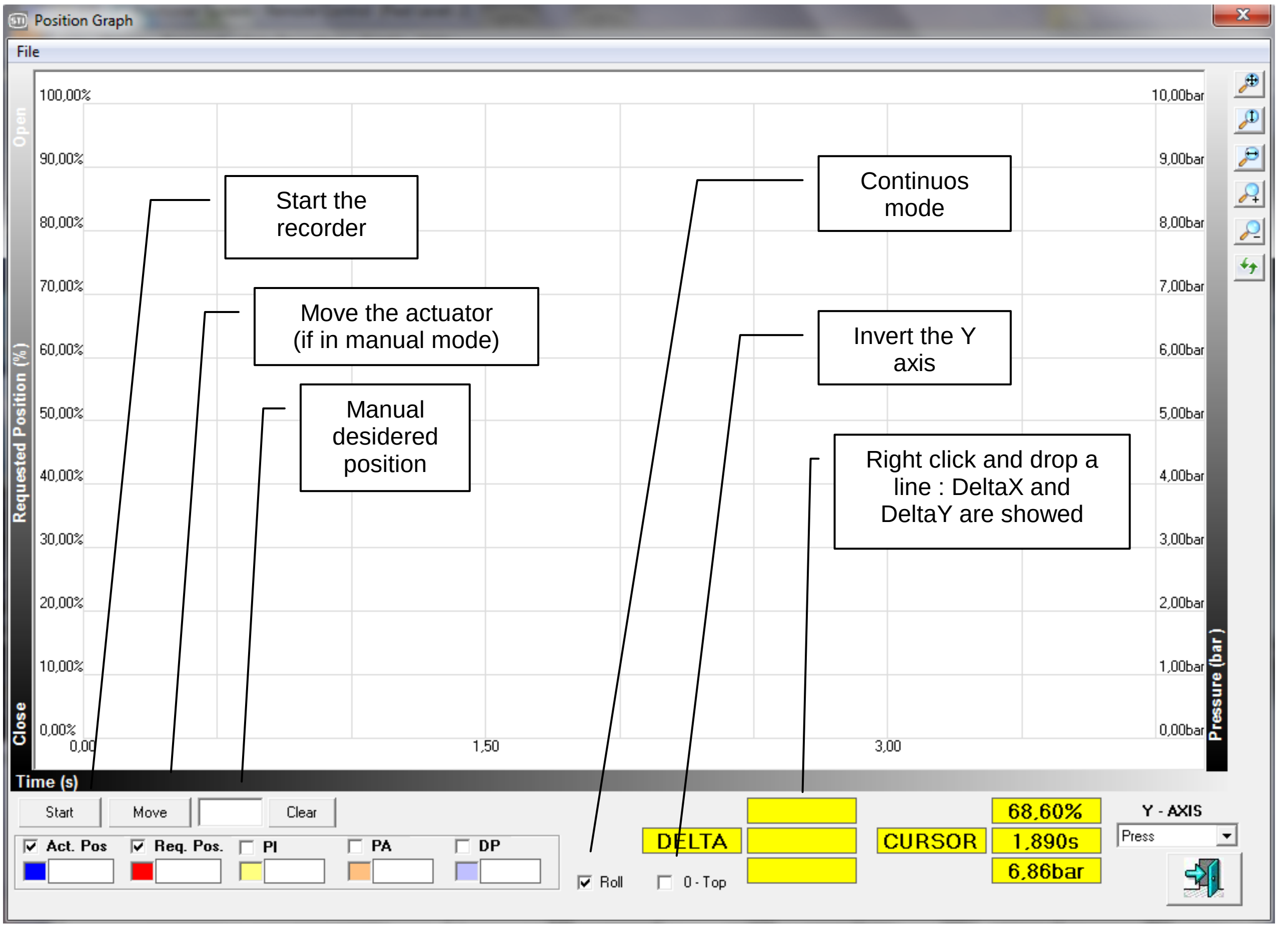
The ‘4mA Position’ field allows to change the ‘4mA position’ vs ‘Fail Position’.

WARNING

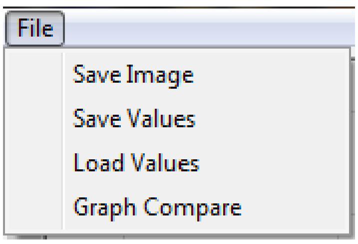
Set ‘4mA Position’ different from ‘Fail position’ can be dangerous : you can have for example that with 4mA the valve is fully open, when the signal go below the minimum threshold the valve moves in the fully close position. If the signal is instable and close to the minimum value may happens that the valve continuously moves between the close and the open position.

The Graph window

This feature allows user to record set point and position signal waveforms for 10 seconds. Moreover, it comes with some tools to analyze the acquired waveforms. This feature is only available on the *“Remotectrl”* program with a TTL connection.



Using the up/down and right/left arrows on the keyboard it is possible to move in the graph’s window.
It’s also possible to *“zoom in”*:hold the left mouse button, define the window to be zoomed in, release the left mouse button.



File-> Save Image : The graph is saved like a bitmap picture
File->Save Values : The graph is saved like a ‘collection of data’. It can be useful in order to reload it in a second time.
File->Load Values : Load a graph saved with ‘Save values’
File->Graph Compare : Load a second graph to make a comparison with the actual one (the actual can be a new graph or loaded with ‘Load values’. In order to ‘align’ the two images keep ‘SHIFT’ pressed, the mouse ‘right button’ pressed and move in the graph area (left or right)

The Menu

Menu : File

Load:
Load a saved set of parameters into the RC interface
Save :
Save the current set of parameters in a .qtp file

Report :
Create a document in .rtf format with the actual parameters (similar to the Save command but the file format is compatible with text editing software)

Exit :
Close the application.

Menu : Device

Download
Performs the same function as the quick button.

Upload Param
Sends the displayed parameters to the positioner.

Upload Param + Calib data
The same as the Upload Param command but additionally sends information about the calibration.

Menu : Password

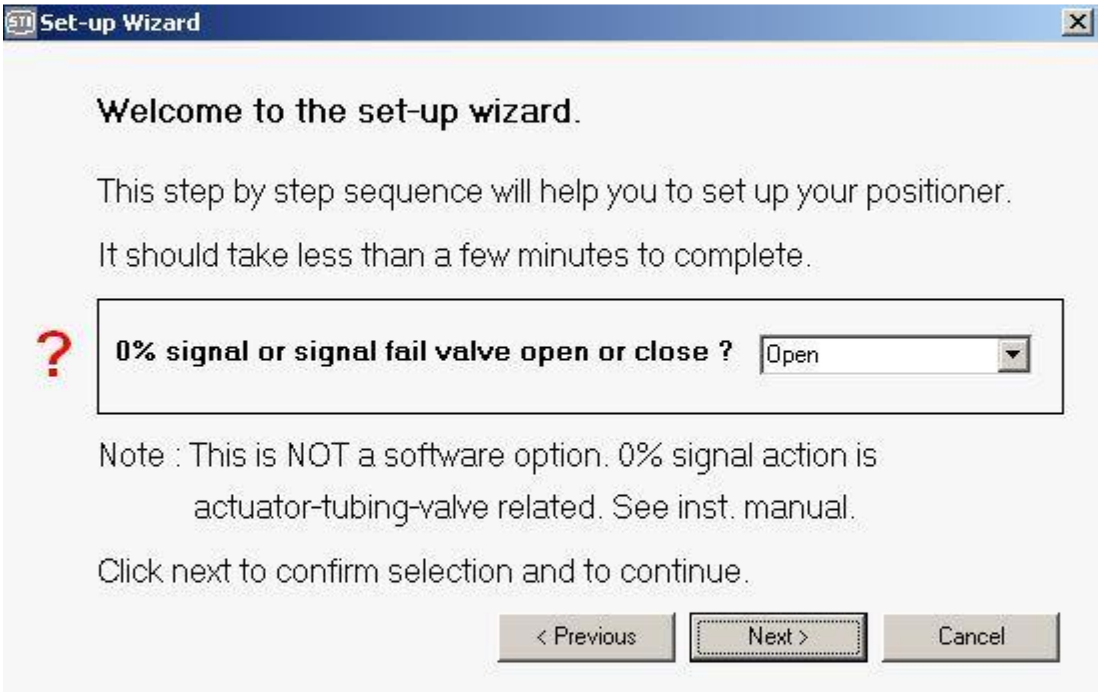
Login
Performs the same function as quick button

Change
Changes the password

System Calibration : Self Tune

The ‘self tune’ wizard can be started by pressing the ‘start system calibration’ button.
You can find more information about this procedure in the specific ‘Installation Instruction Manual’

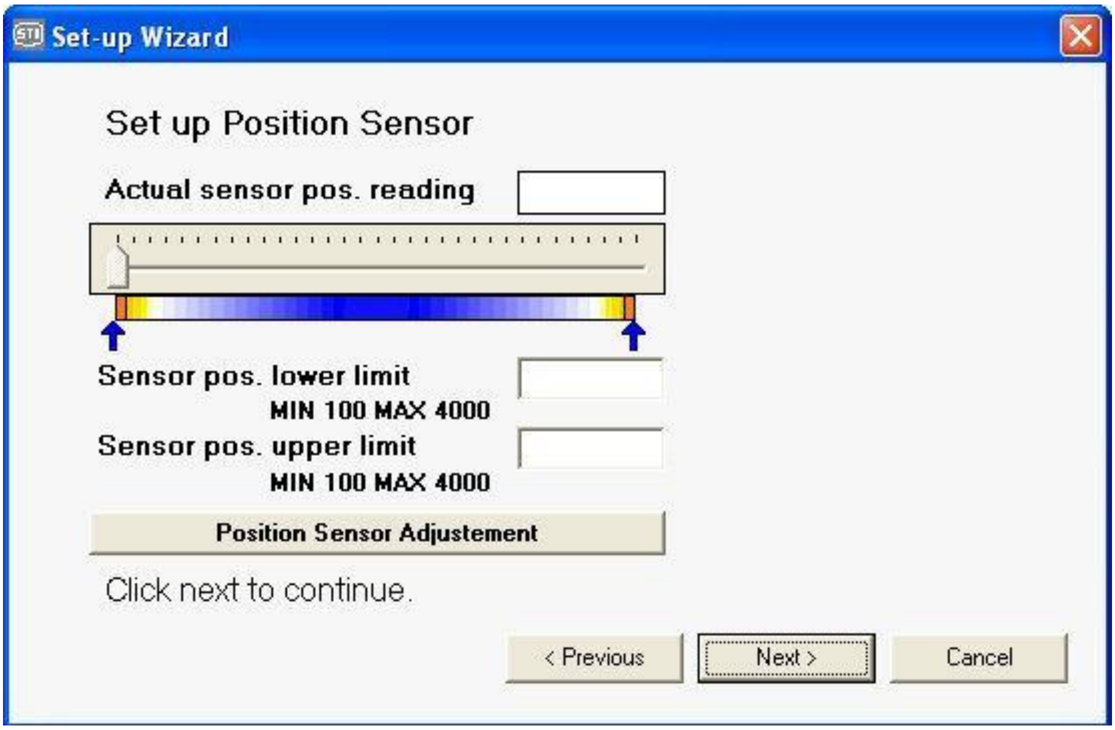
Starting page



You must specify what happens when the 4-20mA signal is removed (with the air present). Based on the pneumatic connection the actuator moves in one direction or in the other (when the 4-20mA signal is removed, portB is fully pressurized).

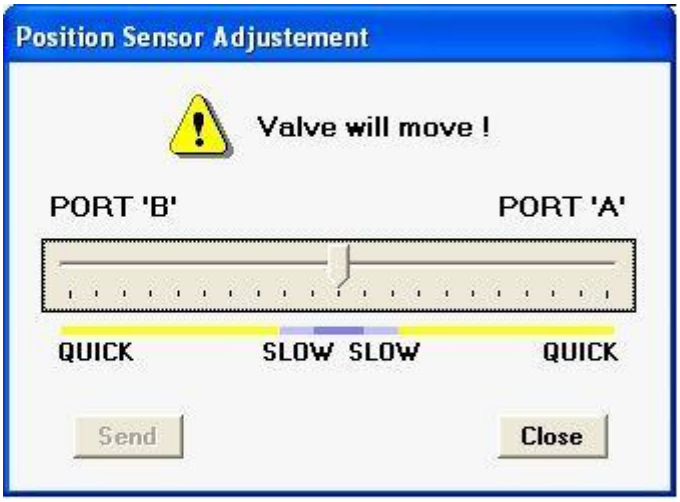
WARNING
This panel is to inform the positioner about the action and is not to specify the user desired behaviour. The positioner is not able to change the mechanical default piston by itself.

Position sensor alignment



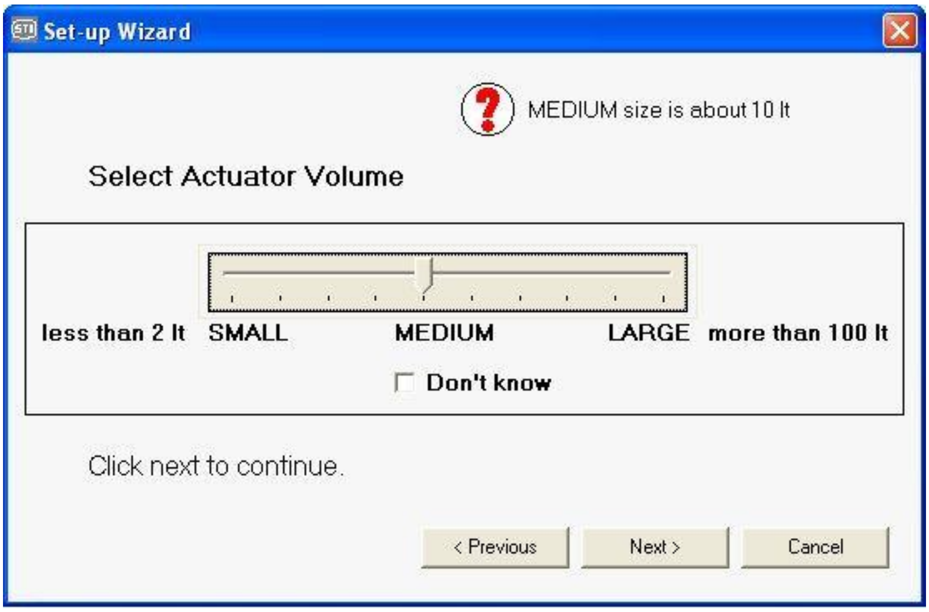
This page helps you align the position sensor.

Pressing the 'Position sensor adjustment' button opens a window where you can find a tool that allows you to move the valve.



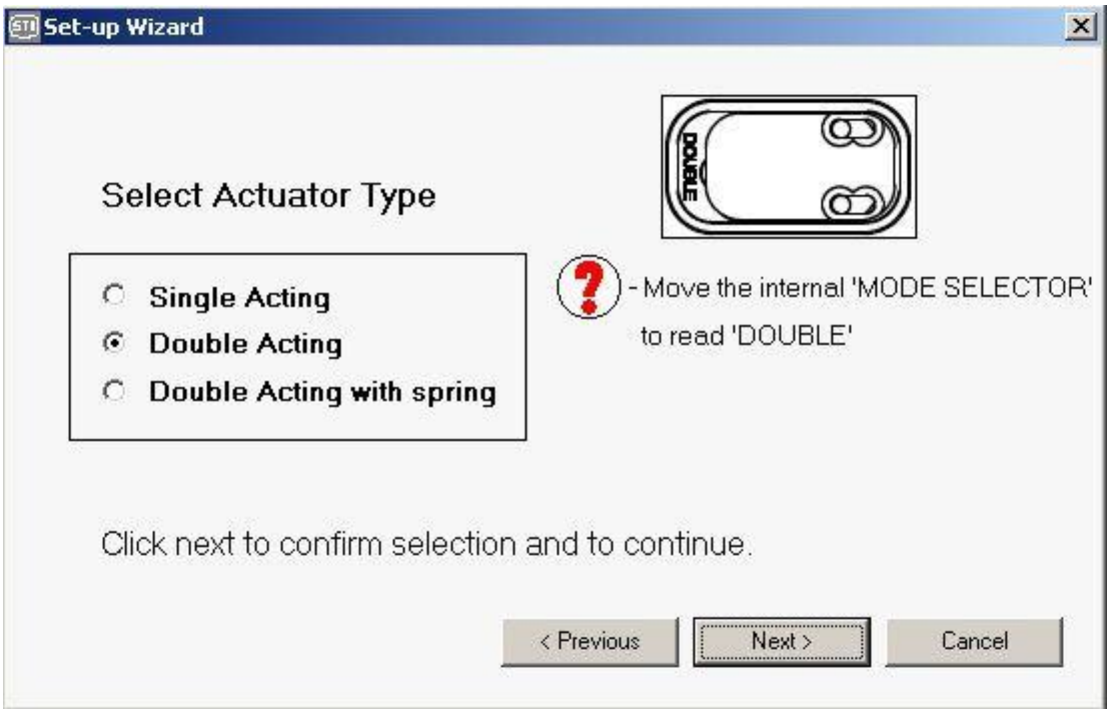
Actuator volume

Specify the size of the actuator

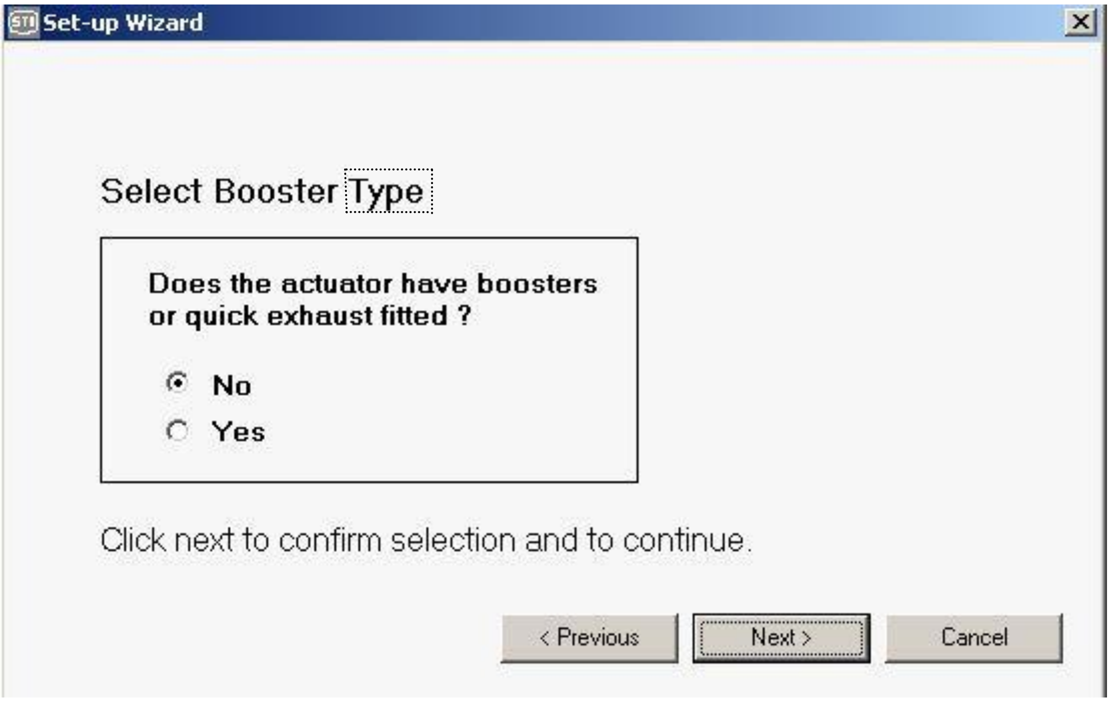


Actuator Type

Specify the type of actuator. Remember to check the position of the *'Mode select plate'* inside the positioner.



Booster type



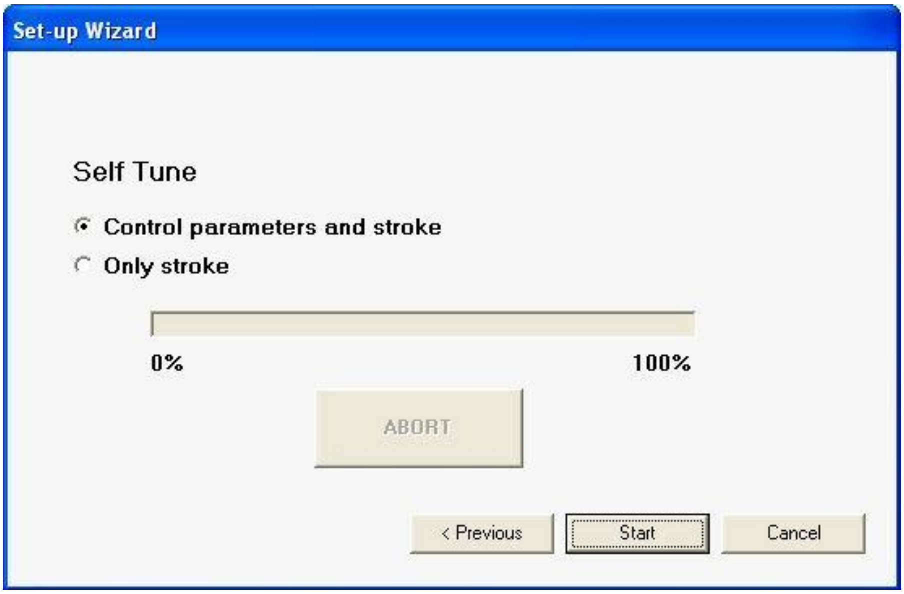
'Only stroke' or 'full calibration'

Select *'Control parameters and stroke'* if you want to perform a full SelfTune procedure.

Select *'Only stroke'* if you want only to update the hardware limits of your valve.

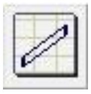
Press *'Start'* the perform the SelfTune .

The progress bar informs you about the *'SelfTune'* status.



Option pack 1 : Diagnostic for Critical Severe Service Valves

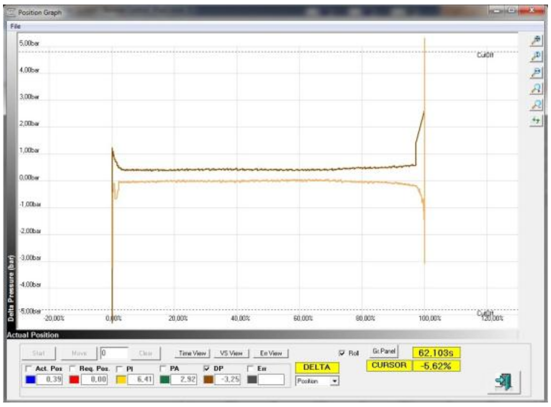
This option pack add important diagnostic features.
To activate option 1 a specific key must be typed on main menu Password➔Key



Valve Signature

The ValveSignature option allow to check the status of the valve.

The valve is moved in a configurable stroke range, data are collected and the report shows the deltaPressure (trust) vs position.

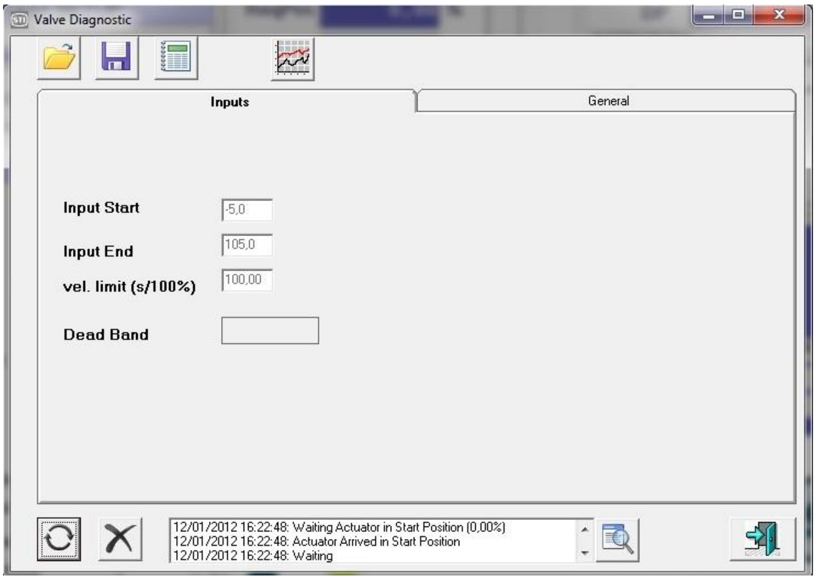


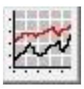
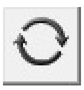
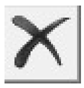
DANGER

The ValveSignature move the valve regardless the 4-20mA setpoint.
This action can be dangerous for peoples or for the process.
Before to start a ValveSignature doublecheck that all the safety requirements are satisfied.

In order to start the ValveSignature procedure press the button in the main page :

The ValveSignature configuration window appears :



	Open a saved 'ValveSignature' test.		Save the actual 'ValveSignature' results
	Create a report with the results		See in a graphical way the collected data (also when the test is running)
	START the ValveSignature		STOP a running ValveSignature
	See the details about the 'ValveSignature' process status		Exit

Input Start :
Specify the starting point for the test

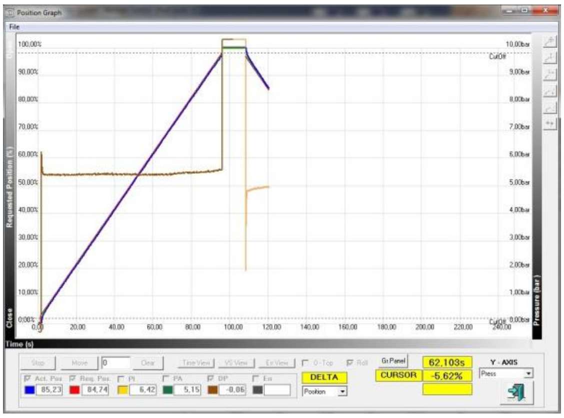
Input End :
Specify the final point for the test

Velocity Limit :
Specify the stroke speed that must be used for the test. Usually for a good investigation a long time is required.

In order to start the test the FasTrak must be in 'Manual' mode. If it is in 'InService' the sw is able to change the status, a specific panel ask for it.

During the ValveSignature it is possible to see what happens (actual position, DeltaP).

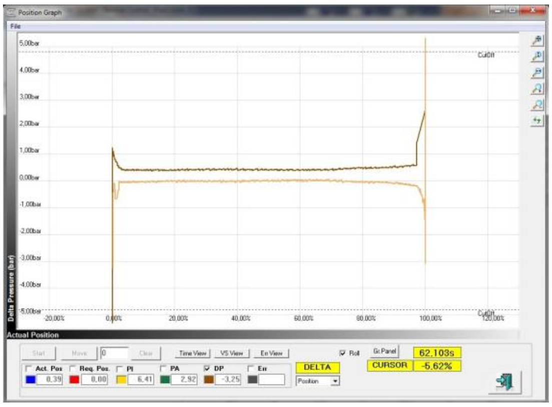
The DeltaP appears with two different colours, one for the UP movement, the other for the down movement.
In this phase the Graph shows the data (position, pressure) versus the time.



When the ValveSignature is completed the Graph appears with DeltaPressure versus position.

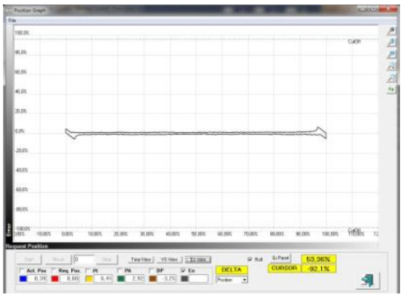
With the buttons 'Time view', 'VS view', it is possible to change the visualization.

It is possible load another ValveSignature to make a comparison,

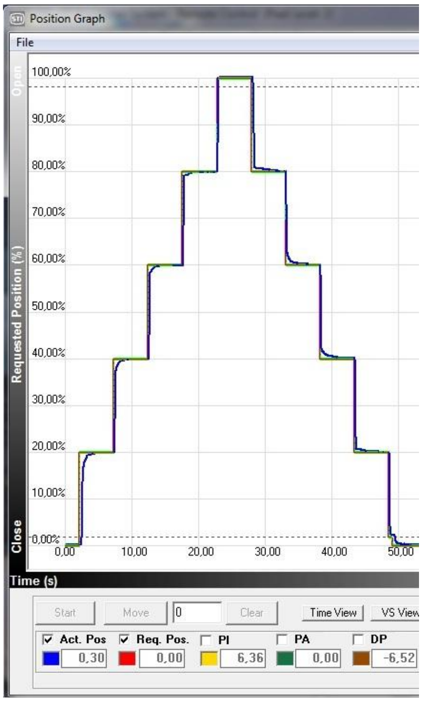


Dynamic Error

The button 'Err view' is used to show the dynamic error (error during the movement at the different positions).



Step Response



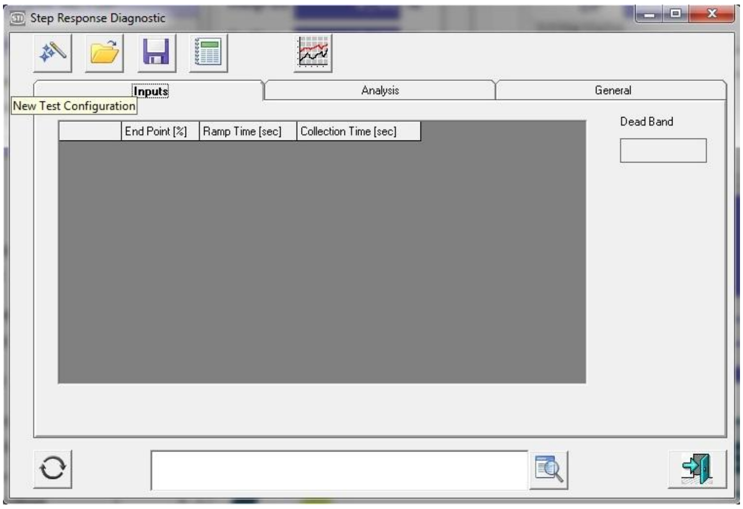
The StepResponse option allow to stroke the valve in different position based on a list of endpoints.

DANGER

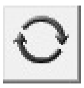
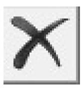
The StepResponse moves the valve regardless the 4-20mA setpoint.
This action can be dangerous for peoples or for the process.
Before to start a StepResponse doublecheck that all the safety requirements are satisfied.

In order to start the StepResponse procedure press the button in the main page :

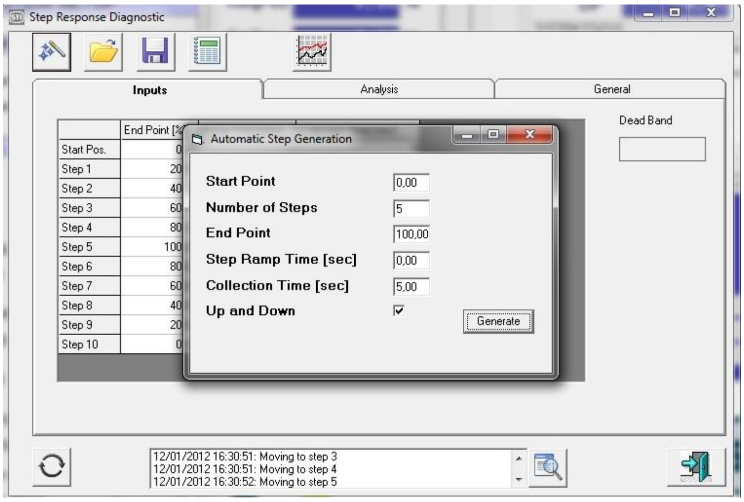
The StepResponse configuration window appears :



 Step Response Wizard

	Open a saved 'StepResponse' test.		Save the actual 'StepResponse' results
	Create a report with the results		See in a graphical way the collected data (also when the test is running)
	START the StepResponse		STOP a running StepResponse
	See the details about the 'StepResponse' process status		Exit

Pressing the 'Step Response Wizard' button the 'Automatic Step Generation' window appears and help the step table generation :



Start Point :
First Position for the test

Number of Steps :
Number of points in the table

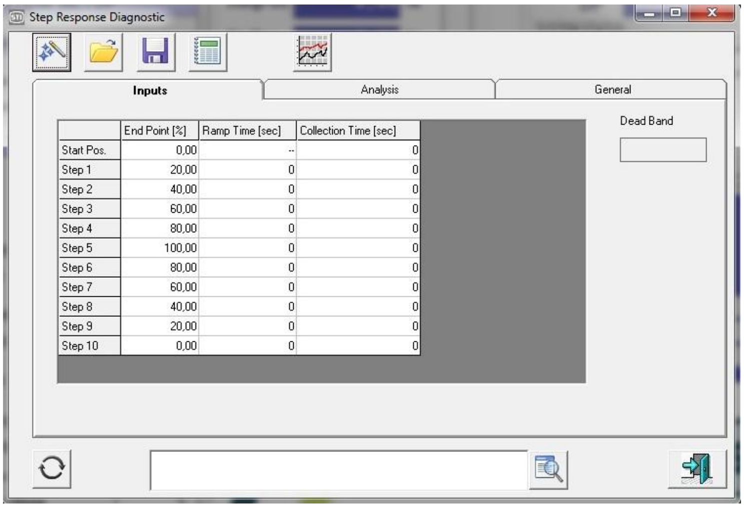
End Point :
Final position

Step Ramp Time [sec]:
Stroke time applied for the specific step

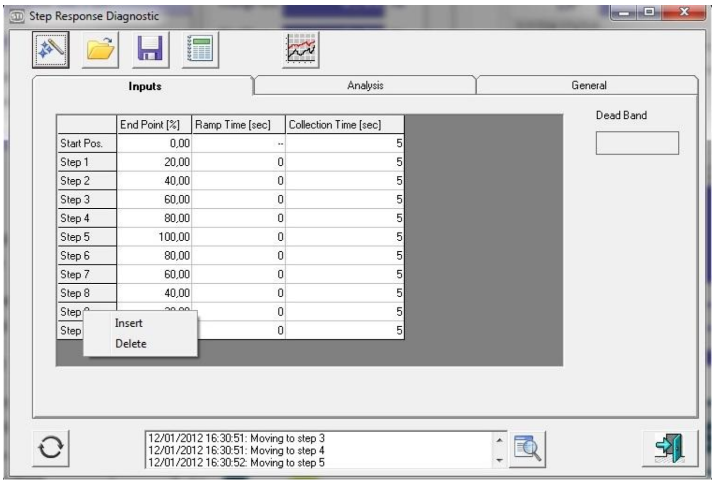
Collection Time [sec] :
Time after the step execution

Up and Down flag :
If this option is selected the table has 2 x 'Number of Steps' and the table has step in the UP direction and in the DOWN direction

The '**Generate'** button starts the creation of the table.



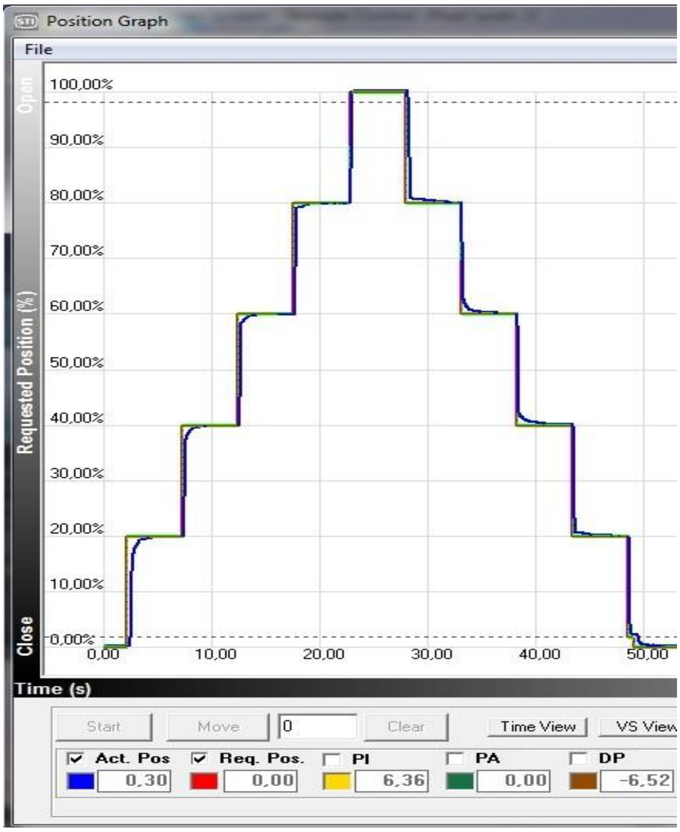
It is possible to change the values in the table.
It is also possible to remove or add a new line in the table (to do it, with the mouse pointer on the table, press the right button and a specific menu appears)



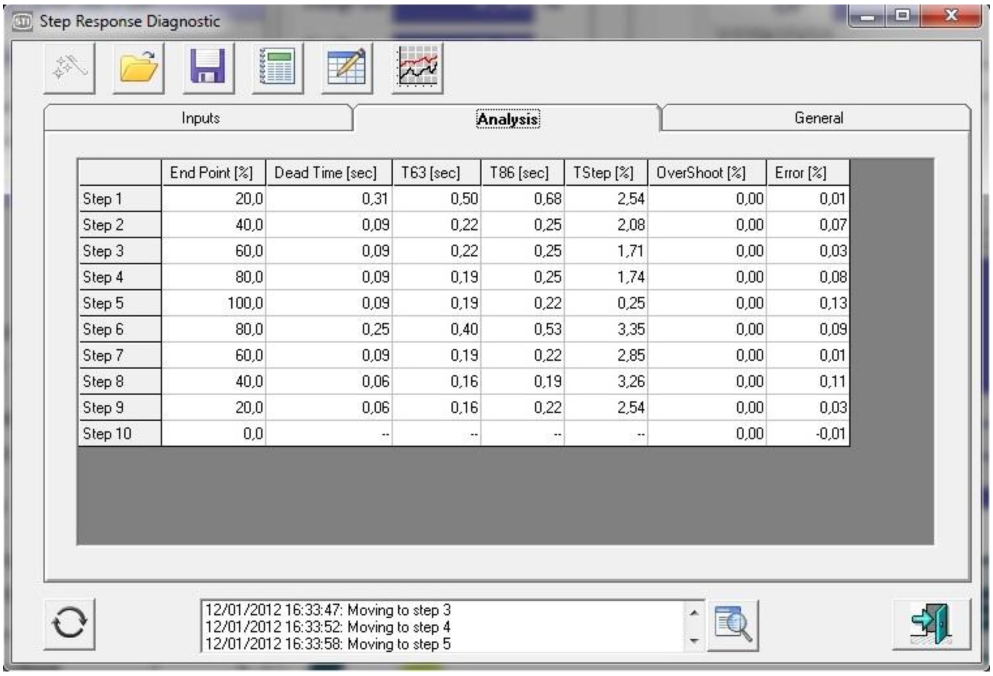
In order to start the test the FasTrak must be in 'Manual' mode. If it is in 'InService' the sw is able to change the status, a specific panel ask for it.

Press the 'Start' button to initiate the test.

Pressing the 'Graph' button it is possible to see the test in the while it is running.



At the end of the test it is possible to see the details of the test with information about the dead time, the T63 and T86 of the specific step, the overshoot (with % of the overshoot related to the specific step).



	End Point [%]	Dead Time [sec]	T63 [sec]	T86 [sec]	TStep [%]	OverShoot [%]	Error [%]
Step 1	20,0	0,31	0,50	0,68	2,54	0,00	0,01
Step 2	40,0	0,09	0,22	0,25	2,08	0,00	0,07
Step 3	60,0	0,09	0,22	0,25	1,71	0,00	0,03
Step 4	80,0	0,09	0,19	0,25	1,74	0,00	0,08
Step 5	100,0	0,09	0,19	0,22	0,25	0,00	0,13
Step 6	80,0	0,25	0,40	0,53	3,35	0,00	0,09
Step 7	60,0	0,09	0,19	0,22	2,85	0,00	0,01
Step 8	40,0	0,06	0,16	0,19	3,26	0,00	0,11
Step 9	20,0	0,06	0,16	0,22	2,54	0,00	0,03
Step 10	0,0	--	--	--	--	0,00	-0,01

Pressing  the ‘Create Report’ button a detailed report is generated with all the results and the details of each step.

Disclaimer:

The automatic output data analysis can be affected by imprecision generated from different causes ex noise on signal, multiple overshoot ...
Any data can be verified on graph record.

Option pack 2 :
Improved control and diagnostic for High Dynamic Valves

To activate option 2 a specific key must typed on in the main menu Password→Key.
Inserting the qualification key for 'option pack 2' also the features of 'option pack 1' are activated.

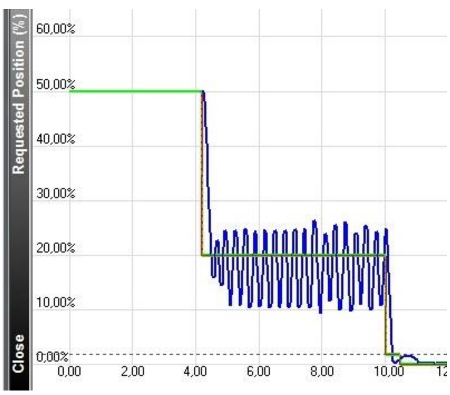
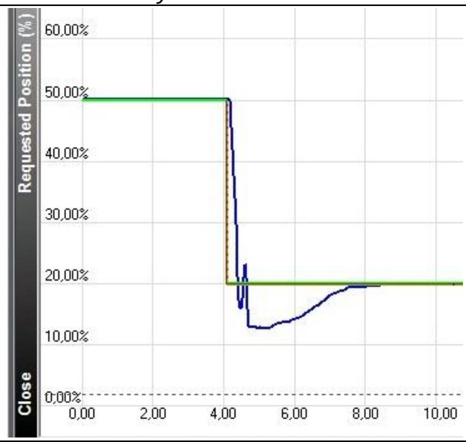
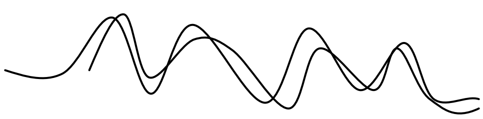
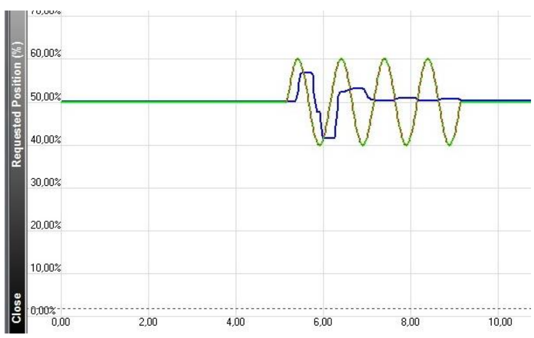
Stability Control

This feature turn on a special algorithm able to control the valve when an instability appears.
The benefit of this special function is that the damping action is performed only when an instability appears.

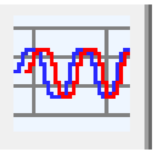
In the TUNING window a parameter called 'Stability control factor' is available to turn on and adjust this feature.
This parameter can assume the values :

- '0' (zero) : turn OFF the functionality
- 5-200 : (low values activate the stability control only for high frequency oscillations, big values activate the stability control also for low frequency oscillations)

Examples :

	Without the stability control	*With the stability control*
STEP response		
Sinusoidal signals		

Details : The 'stability control' algorithm works damping the positioner output in order to stabilize the system. The algorithm is effective only when an instability is measured on the actual position and terminate the effect when the actual position is stable and also the setpoint is not oscillating.

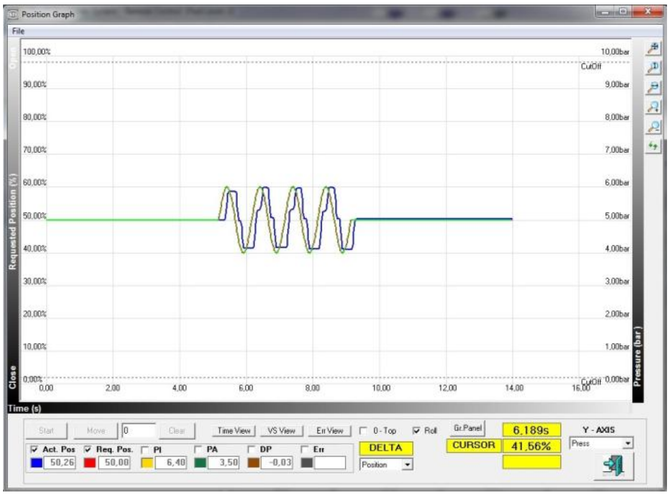


Signal Generator for frequency analysis (Dynamic tests)

This tool automatically generate a sinusoidal setpoint in order to evaluate the valve performances.

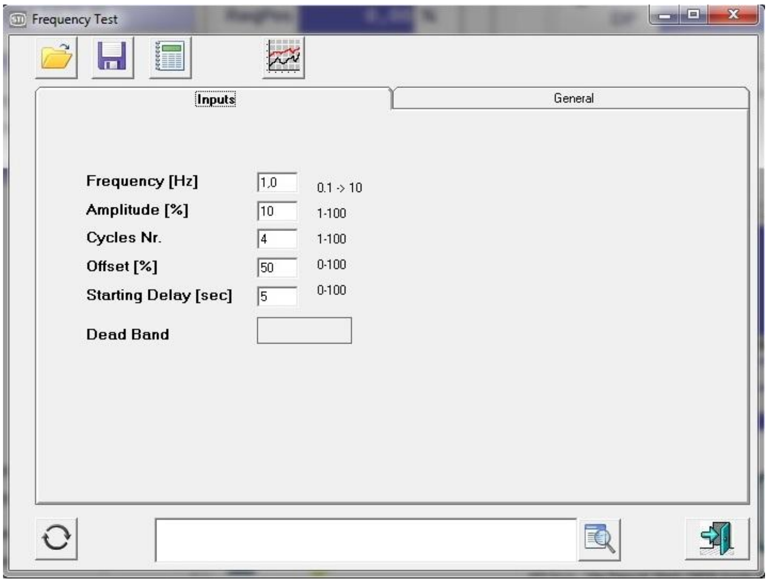
DANGER

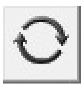
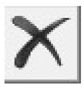
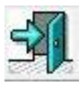
The Signal generator moves the valve regardless the 4-20mA setpoint.
This action can be dangerous for peoples or for the process.
Before to start a Signal Generator doublecheck that all the safety requirements are satisfied.



In order to start the SignaGenerator press the button in the main page :

The SignalGenerator configuration window appears :



	Open a saved 'Frequency' test.		Save the actual 'Frequency test' results
	Create a report with the results		See in a graphical way the collected data (also when the test is running)
	START		STOP a running test
			Exit

Frequency [Hz] : 0,1-10
Specify the frequency of the sinusoid that must be generated from 0,1 to 10Hz

Amplitude [%]: 1-100
Amplitude of the sinusoid

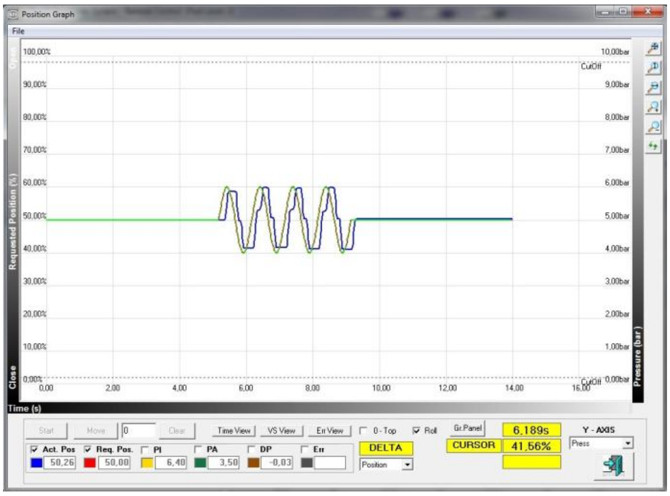
Cycles Nr.:1-100
Number of sinusoid cycles

Offset [%] :0-100
Offset value of the sinusoid

Starting Delay [sec] : [0-100]
The actuator is moved at the Offset position, the delay is applied at this moment before to start with the sinusoid

Press the 'Start' button to initiate the test.

Pressing the 'Graph' button it is possible to see the test in the while it is running.



Signal Generator result analysis :
The main parameters are :
- The phase shift (absolute value).
- The gain amplification/attenuation.

Using the right button of the mouse it is possible to measure the results of the test.
The feature allows to select any two points on the graph.
- The difference on x axis of the two chosen points is the time between the points and it is used to calculate the phase shift compared to period of input signal. The phase shift is shown on x label [deg] unit.
- The difference on y axis of the two chosen points is the Ao value and it is used to calculate the gain compared to signal amplitude (Ai). The gain is shown on y label [db] unit. (see pag. 48).

Phase shift :
With the right button draw a segment between the starting point of the setpoint and the equivalent starting point of the actual position. The system know the frequency of the setpoint and it is able to evaluate the phase delay, shown on the hatched line.

In the picture is showed the phase lag 95,2° between setpoint (at 50%) and actual position (at 50%), calculated using the frequency = 1 sec^{-1} and delay = 2,2644 sec

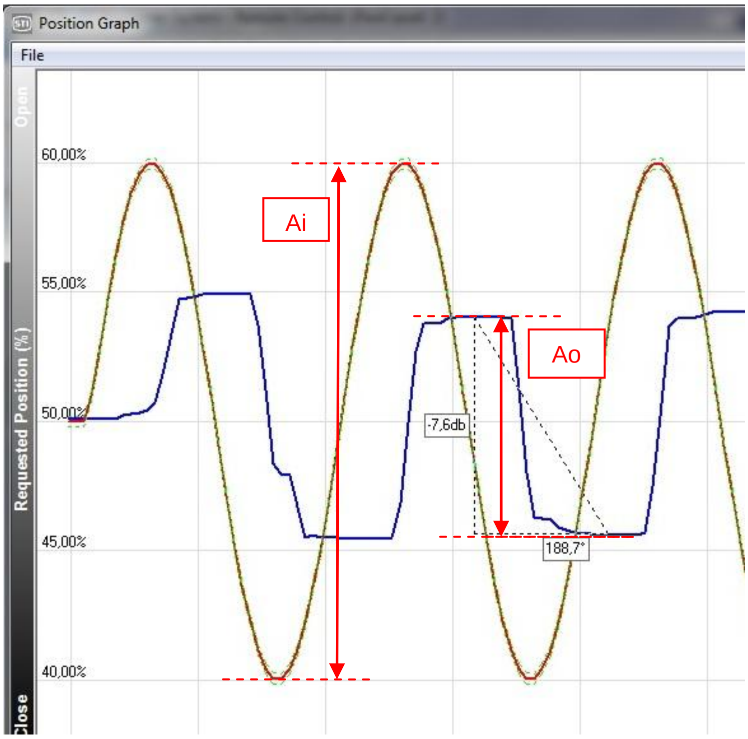
The formula is:
phase lag = 360/1·0,2644 = 95,2°

Gain :

With the right button draw a segment between the two peaks of the actual position (Ao). The software measure its value and using the amplitude of the setpoint (Ai) is able to calculate the gain, shown on the the vertical side of the hatched triangle.

In the picture is showed the gain -7,6 db, calculated using Ao = 8,32 and Ai = 20. The other value of 188,7° shown on the horizontal side of the hatched triangle is not relevant (It is the phase shift between the two measurement).

The formula is:
gain = 20log (Ao/Ai) = 20log (8,32/20) = -7,6 db



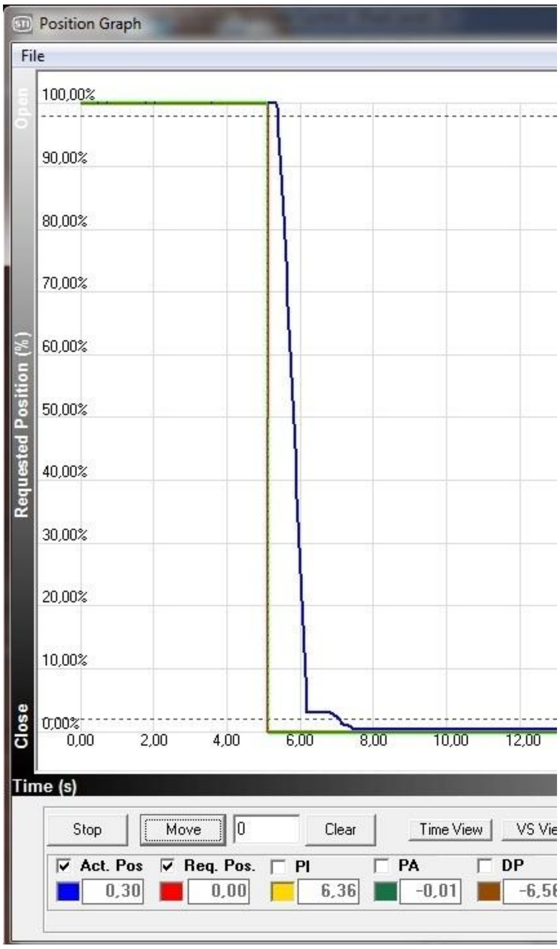
Soft Approach to seat

This option allows to set a CUTOFF with a reduced risk to hit the seat with the full energy accumulated. Even if valve is moved at the maximum speed and the plug is heavy the control algorithm works to reduce the speed in the last part of the movement reducing (or avoiding) the impact on the seat.

This option can be turned on in the 'travel control' window selecting 'Soft CutOff' and defining the cutoff threshold.

The result of this option is that the positioner moves the valve in the CutOff direction with the maximum speed until the threshold is reached, the last part of the movement happens with a limited speed. At the end the full pressure is applied in order to grant the cutoff feature (full thrust on seat)

The picture shows what happens with a softcutoff set at 2%.

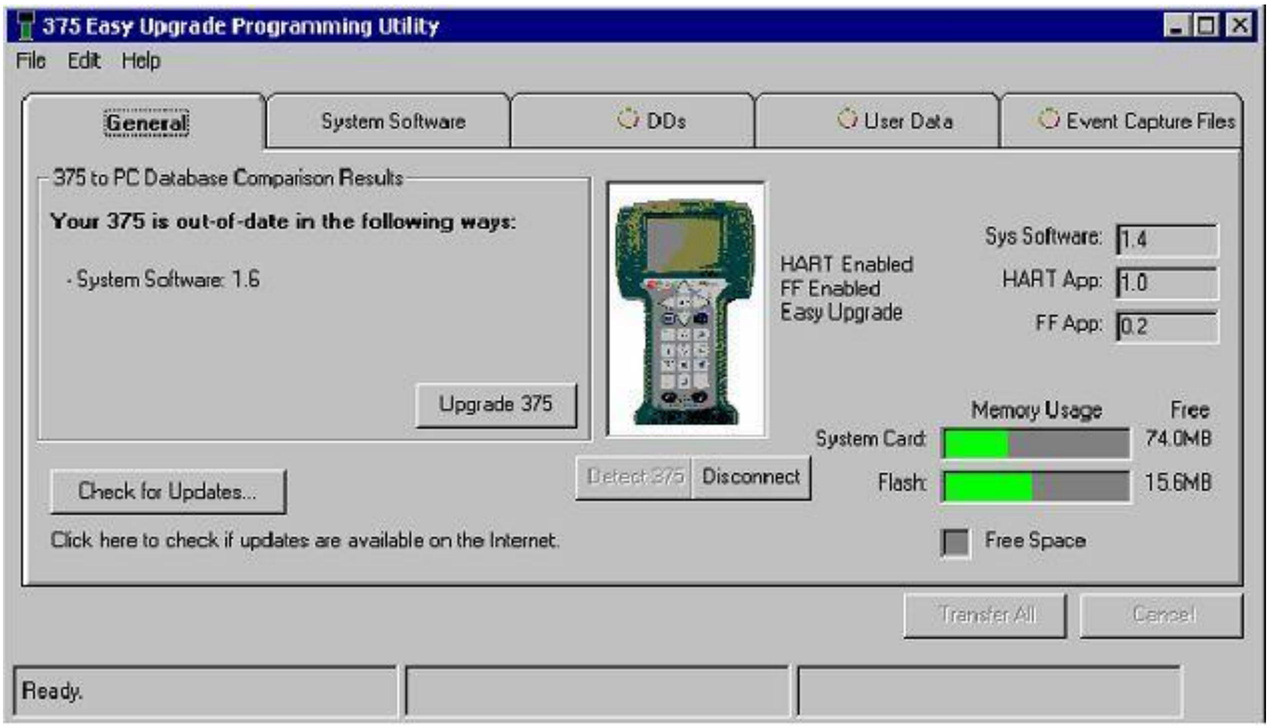


375 HandHeld & DD file

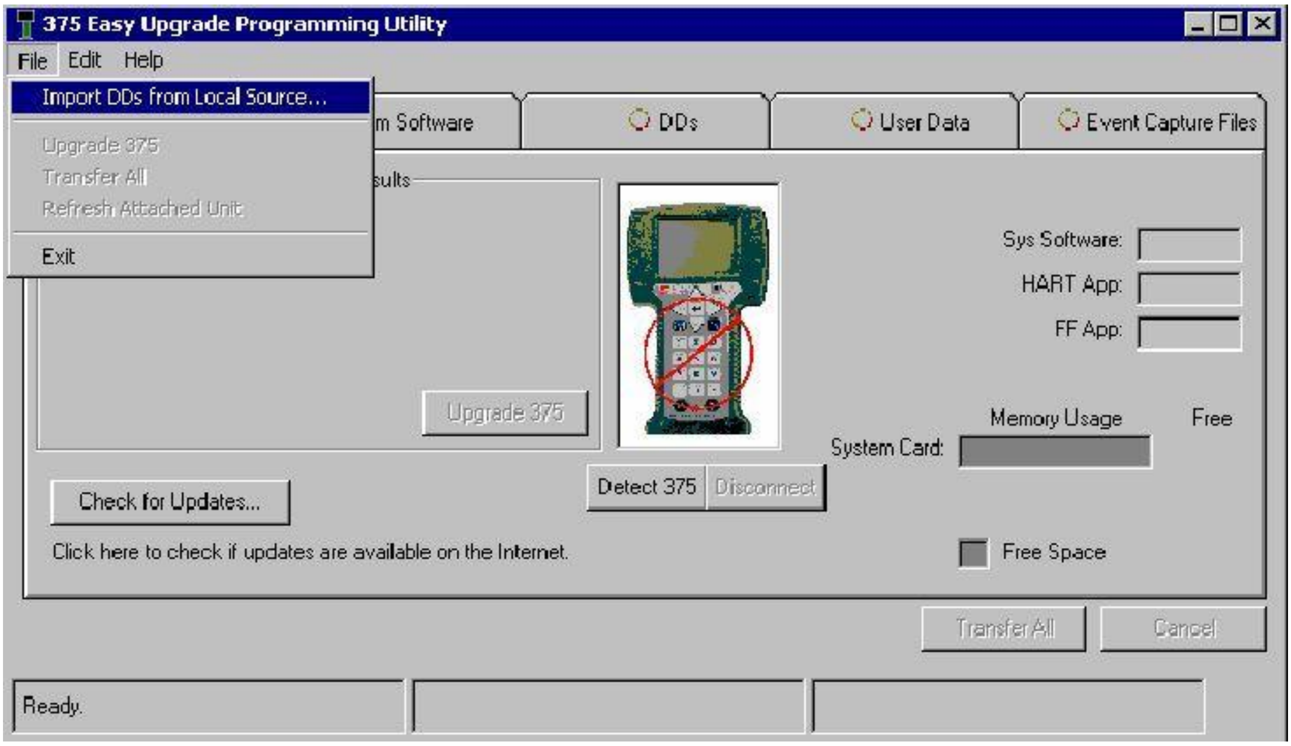
INSTALLATION

375 Easy Upgrade Programming Utility is required to upload and download files to the 375 Field Communicator. The Programming Utility communicates with the Field Communicator and permits file movement between a PC and a 375.
- Start the Programming Utility
- Verify that the 375 is up-to-date, checking and updating the HART Application for 375 if it's necessary.

Refer to the 375 Field Communicator User's Manual for reference.



- Select File/Import DDs from Local Source



- In the Select Path to DD Files dialog, browse to the location of the DDP (directory \375 on the FT installation CD).
- Each DDP (Device Driver Package) consists of two files. A DD binary has an .hdd file extension, and a corresponding binary header has an .hhd file extension.
- Select OK after the desired DDP(s) have been found. The Programming Utility adds the selected DDP(s) into its database.

CONNECTION

- Connect the FT device to the 375 (refer to the 375 Field Communicator User's Manual if you need instructions).
- Turn on the 375 Field Communicator. The 375 Main Menu is displayed with HART as the default application.
- Double HART application to run the HART application.

On startup, the HART application will automatically poll for devices.
If a live HART device is connected to the 375 Field Communicator, the HART Application main menu will be displayed automatically with key parameters from the connected device.

MENU

1 Main Vars
2 System Status
3 System Setup
4 Manual Mode
5 Position Sensor
6 Calibration
7 Communication

1 Main Vars

1 ActPos	100.00%
2 ReqPos	0.99%
3 Input	4.00mA
4 PI	6.00bar
5 PA	6.00bar
6 DP	6.00bar
7 TE	13.70 °C

2 System Status

1 Set operation mode	
2 Operation Mode	In Service
2 Status	
3 Calib.progr./err.	
4 Progr./err. Details	
5 Data source	

2.1 Set Operation

1 In Service
2 Out Service - Manual

3 System

1 Travel Control
2 Tuning

3.1 Travel Control

1 Open cutoff/limit	95%
2 Open mode	CutOff
3 Close cutoff/limit	5%
4 Close mode	CutOff

3.2 Tuning

1 Kp opening	1.0
2 Kp closing	1.0
3 Ti opening	0 msec
4 Ti closing	0 msec
5 Td opening	0 msec
6 Td closing	0 msec
7 Dead band	.20%
8 Open velocity limit	10.00s/100%
9 Open vel.lim.funct.	Disabled
10 Close velocity limit	10.00s/100%
11 Close vel.lim	Disabled
12 Damping open	0
13 Damping close	0
14 Switched ctrl err	25%
15 Sweep pressure	10.0bar
16 Switched ctrl funct.	Enabled

4 Manual mode

1 ActPos	
2 ReqPos	
3 Manual Setpoint	0.00%

5 Position

1 Sens. pos. reading	451
2 Sens. pos. lower lim	
3 Sens. pos. upper lim.	4095

6 Calibration

1 System Calibration	
2 0%/fail signal pos.	Close
3 Actuator Volume	don't know
4 Actuator type	Double
5 Booster or QE	Yes
6 PI	7.00 bar
7 Norm.supply press.	6.50 bar
8 Status	
9 Calib.progr./err.	
10 Progr./err. Details	

7 Communication

1 Manufacturer
2 Model
3 Dev id
4 Write protect
5 Tag
6 Descriptor
7 Message
8 Date
9 Hart revision
10 Fld dev rev
11 Software version
12 Poll addr
13 Num req preamms

Setup Wizard

Setup Wizard starts from :
6 Calibration ->
6.1 System Calibration

Welcome to the setup wizard. This step by step sequence will help you to setup your positioner.

Select 0% signal/signal fail valve position

- Close
- Open

Select Actuator Volume
1- SMALL
2- SMALL
3- SMALL
4-MEDIUM
''''

Select Actuator Type
1- Single
2- Double
3- Double with spring

Boosters or Quick Exhaust.

- NO
- YES

Select calibration.

- System Calibration
- Only hard lim. calibr.

Are you sure you want to start self-tune ?
Valve will move!

Calibration in progress ... step 140

Self Tune completed

Return INSERVICE.

- NO
- YES

Refresh parameters ... 1

AMS sw interface :

AMS Software is the configuration, calibration, and diagnostic tool. It allows maintenance and operations personnel to monitor control valve health and performance on-line and improve reliability by spotting problems before they affect the process.

INSTALLATION

Close AMS if it is running. Disconnect any devices from the system running AMS.
- Select START > Programs > AMS > Add Device Type Manually to open the device installation program.
- Follow the directions on the screen to install the device.
- Once the installation is complete, you're ready to connect your device.

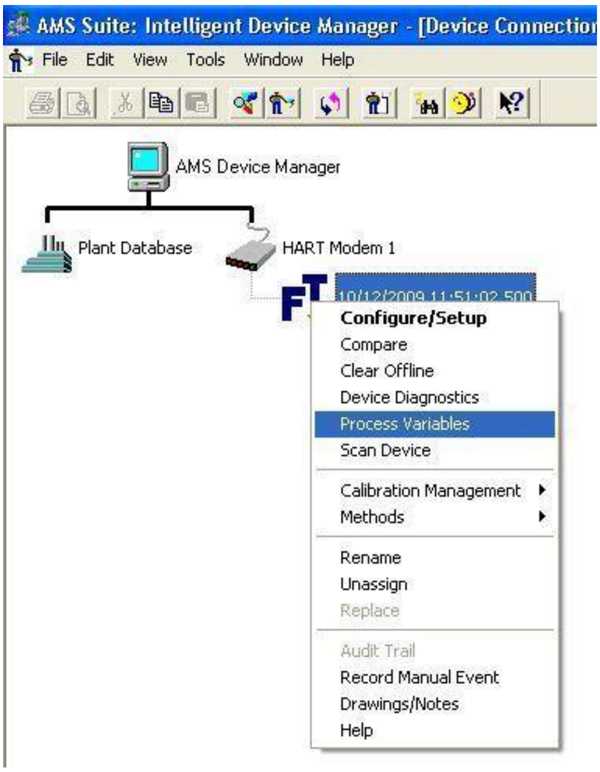
CONNECTION

- Once your device has been connected (refer to AMS Installation Guide for information on how to connect a device to AMS) start AMS (refer to the AMS User's Guide if you need instructions).
- Open the Device Connection view, if it is not already open (View > Device Connection View).

After a short delay, you should see the FT device attached to the modem.

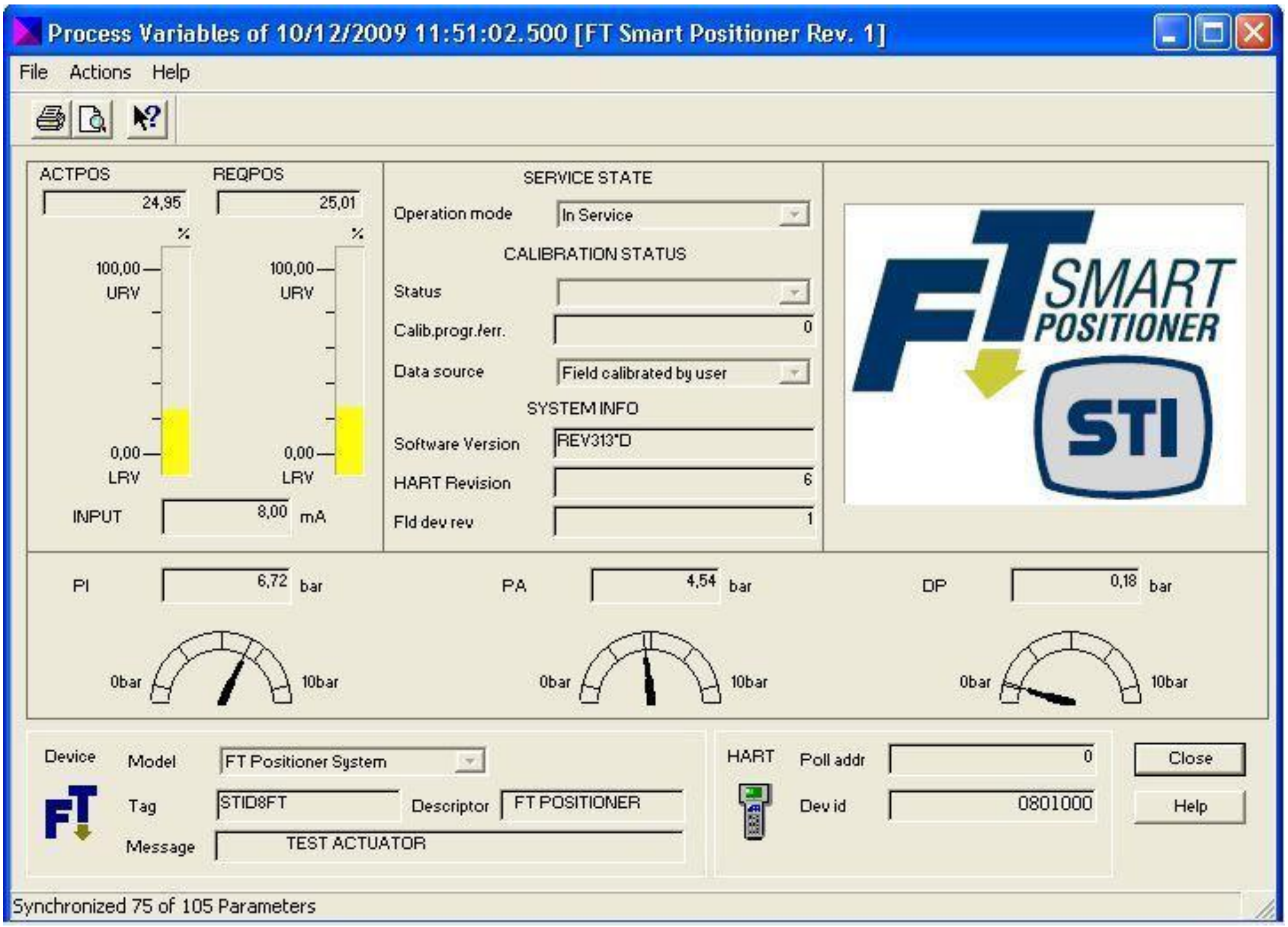
DEVICE CONTEXT MENU

The device context menu appears when you click the right mouse button on the device in either the AMS Device Connection View or the AMS Explorer.



PROCESS VARIABLES

Selecting Process Variables… from the device's context menu displays the device's Process Variables screen, i.e., the faceplate. The faceplate reports summary information for the FT device (primary variables, system status, errors,…).
You can also double-click the FT device icon from the Device Connection view to open the FT faceplate and display the process variables.



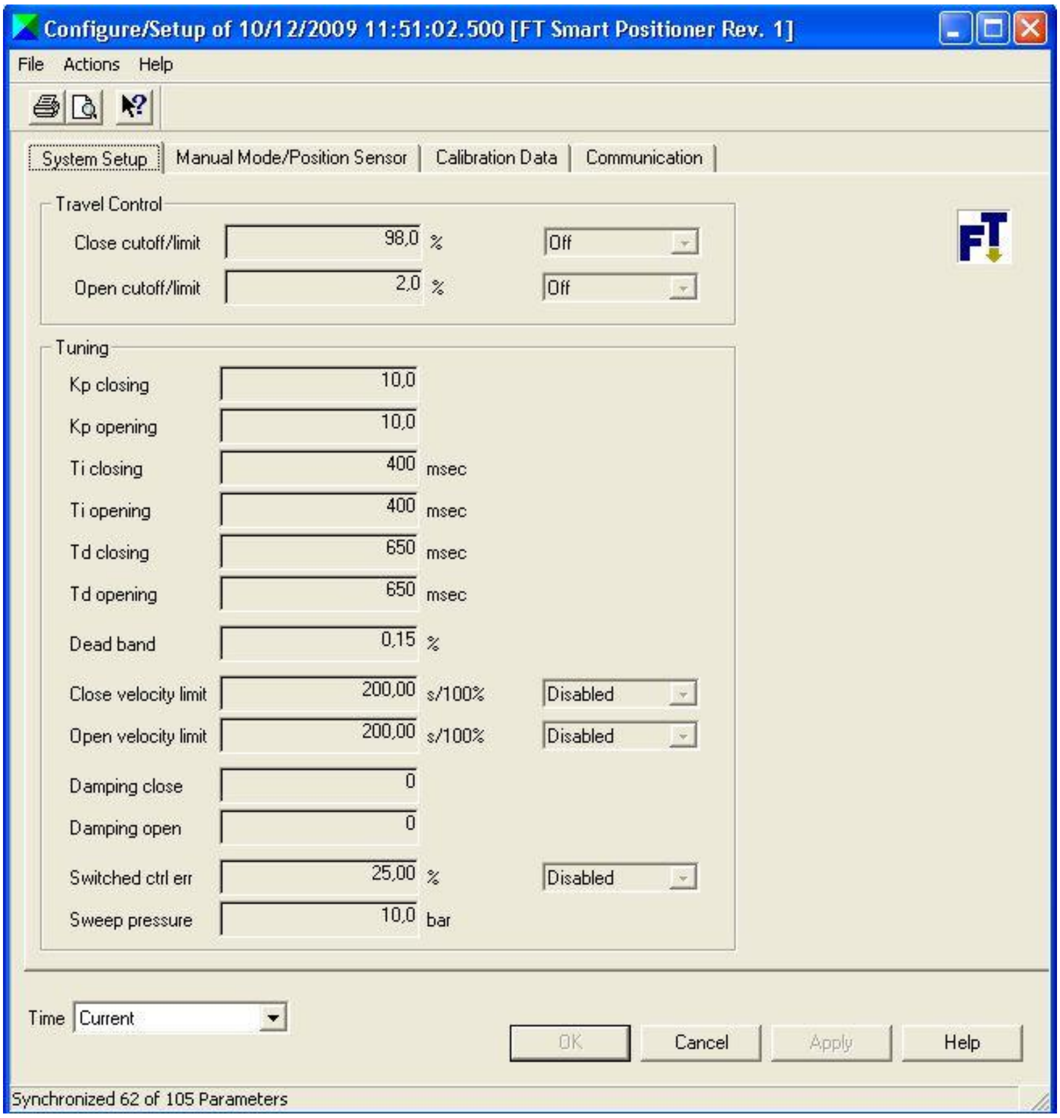
CONFIGURE/SETUP

Selecting Configure/Setup from the device’s context menu, displays the Configuration Properties screen.

System Setup

This window shows the tuning parameters that are part of ‘Tuning’ & standard ‘System setup’ area of the standard RemoteControl interface (refer to the FT IOM for explanation of the parameters).

In order to change the parameters the FT must not be in ‘INSERVICE’ mode (see ‘change the Operation Mode’).



Manual Mode/ Position Sensor

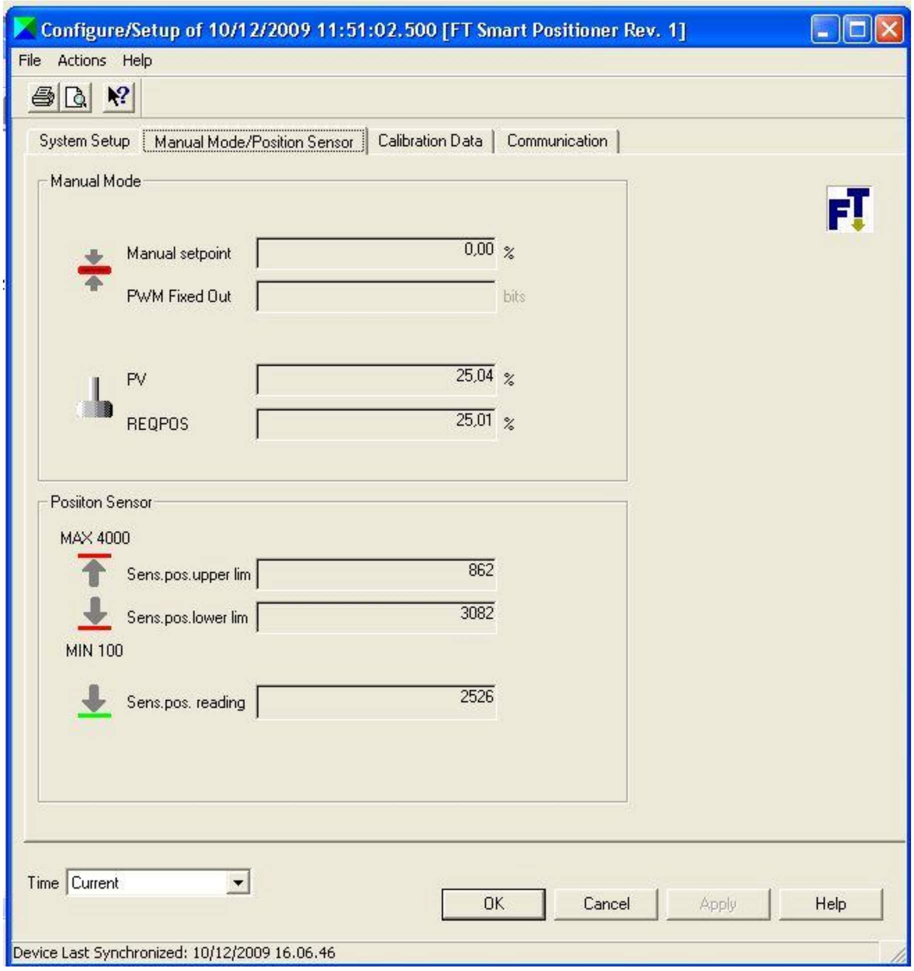
This window is designed to :

Allow to move the actuator in manual mode inserting the target position

If the Operation Mode is 'Out of service : manual' it is possible to specify the target position in the 'Manual setpoint' field. Clicking on the 'Apply' button the positioner move the actuator to the specified position.

Check the position sensor alignement

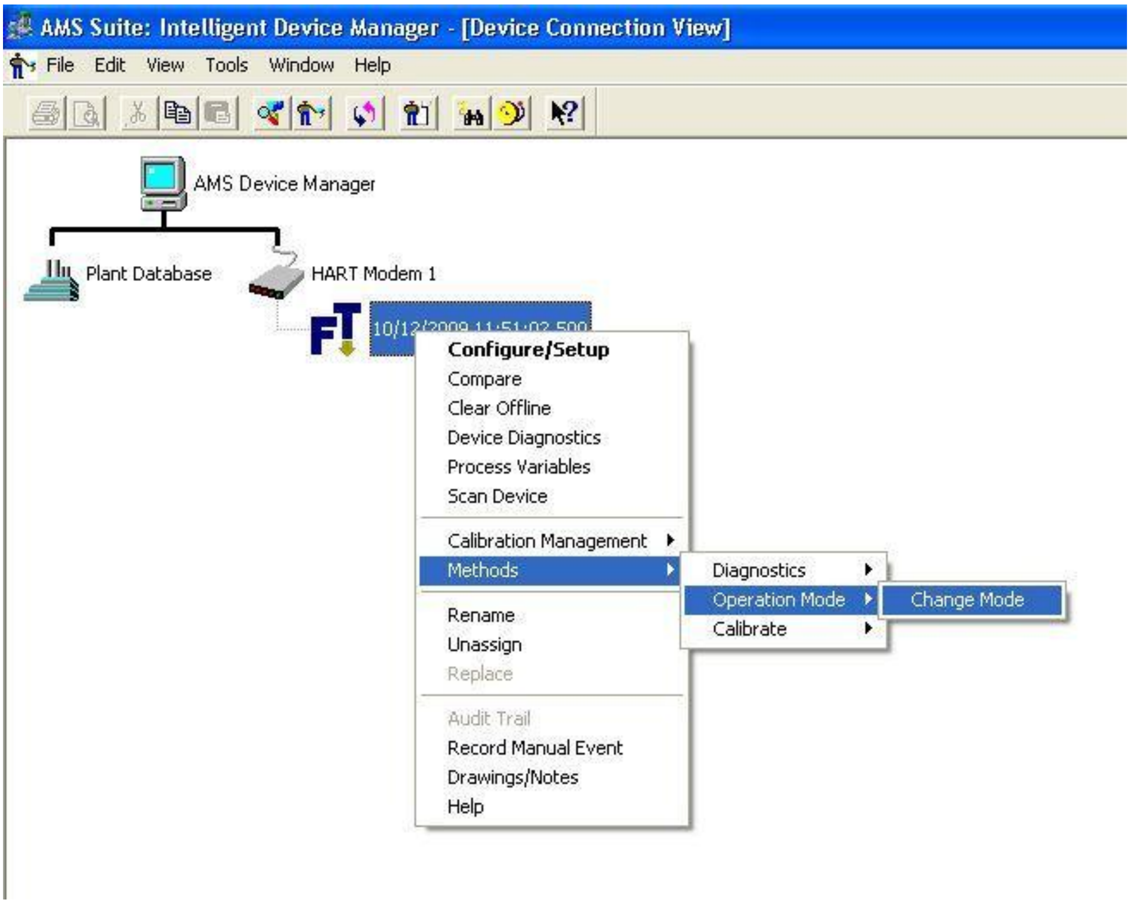
Refer to the MECHANICAL FEEDBACK LINKAGE MOUNTING paragraph in the FT IOM



CHANGE THE OPERATION MODE

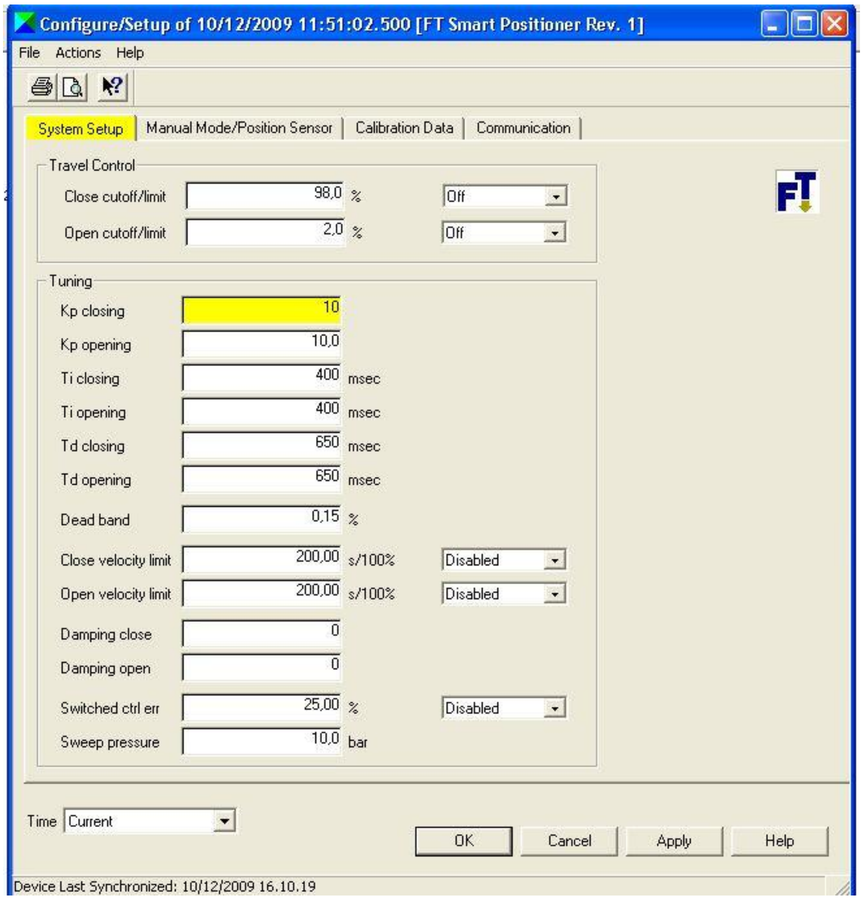
From the Device Context Menù it is possible change the operation mode selecting from

- ‘INSERVICE’ : the Request Position come from the 4-20mA input
- ‘Out of Service : Manual’ : the Request Position can be assigned manually, it is possible to change the parameters and configure the positioner.



EDIT A CONFIGURATION PARAMETER

In order to change the setting of the FT positioner is possible to change the value of one of the field showed in the window.

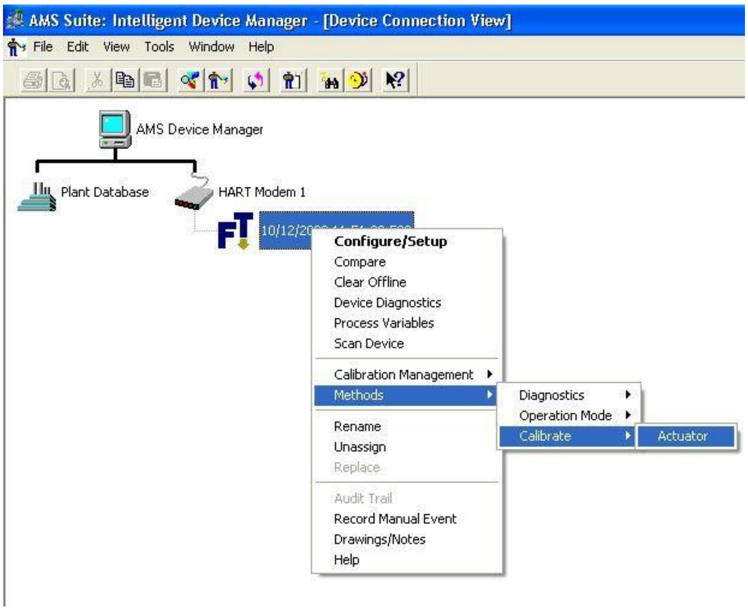


To send the new value to the positioner click on the 'Apply' button .

A confirmation window appear, click on YES to apply the changes.

START THE CALIBRATION

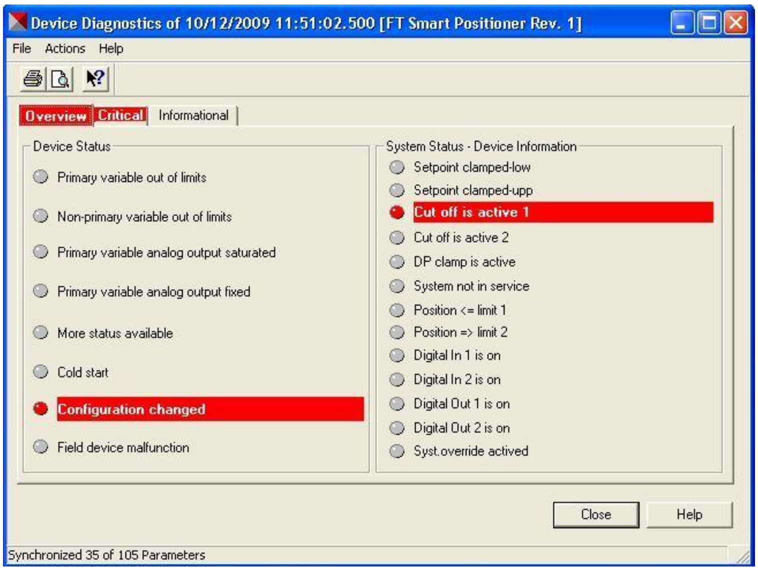
From the device context menu select Methods➔Calibrate➔Actuator in order to start the SelfTuning Wizard.

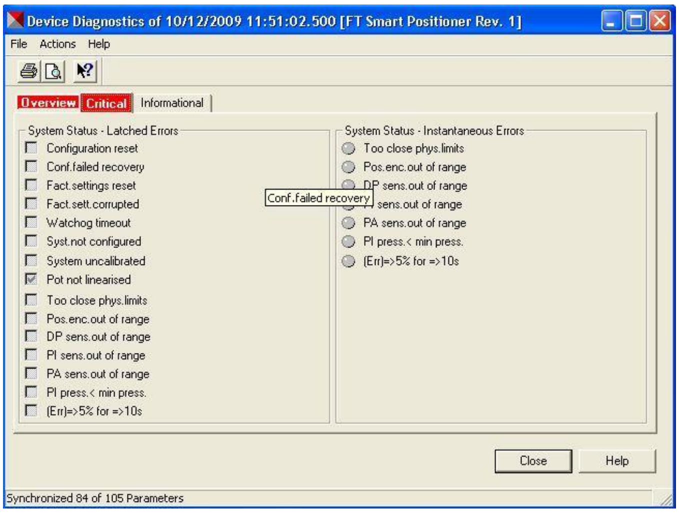


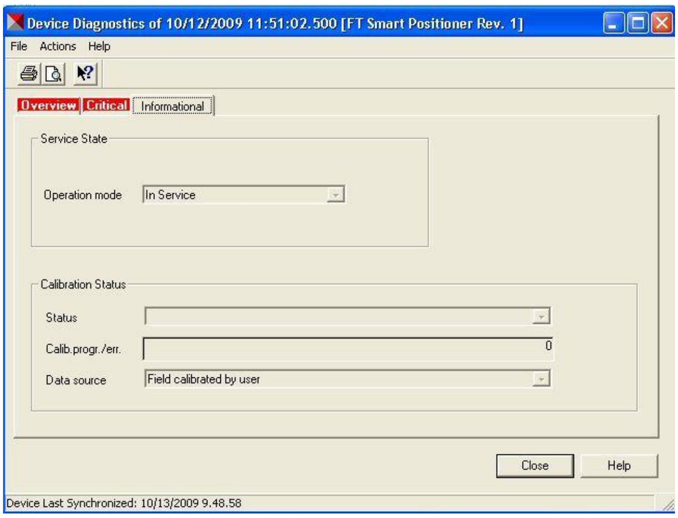
DIAGNOSTIC

From the device context menu it is possible to have access to the diagnostic information panel.

Three window (Overview, critical, Informational) are available with different flags that show the status of the positioner.







Error/Diagnostic bits in HART protocol

With HART protocol is possible to get different information about error and diagnostic. The HART protocol uses different ways to provide this information.

Device Status

This byte is part of any answer.

Bit [0]= Primary variable Out of limits	Not implemented
Bit [1]= Non Primary variable Out of limits	Not implemented
Bit [2]= Loop Current saturated	Not implemented
Bit [3]= Loop Current Fixed	
Bit [4]= More status available	Implemented starting from rel. 1.4.2
Bit [5]= Cold Start	
Bit [6]= Configuration changed	
Bit [7]= Device Malfunction	

Common practice command CMD48 : Read additional device status

It is a special command that provide and 'extended status'
[0]= Response command
[1]=Device status
[2]=Extended status byte0
[3]=Extended status byte1
[4]=Extended status byte2
[5]=Extended status byte3_(bits 8..15)

[6]=Extended status byte3_(bits 0..7)
…..

Extended status byte 0 :

[0] "Configuration reset", Error [latched] - user configuration has been reset
[1] "Conf.failed recovery", "Error [latched] - user configuration data failed recovery"}, // (bad)
[2] "Fact.settings reset", "Error [latched] - factory settings have been reset"}, // (bad)
[3] "Fact.sett.corrupted", "Error [latched] - factory settings were corrupt at power on"}, // (bad)
[4] "Watchog timeout", "Error [latched] - a watchog timeout caused the last system reset"}, // (bad)
[5] "Syst.not configured", "Error [latched] - system has not been configured (perhaps first power on?)"}, //
[6] "System uncalibrated", "Error [latched] - system is uncalibrated"}, // (bad)
[7] "Pot not linearised", "Error [latched] - the pot has not been linearised"} // [latched]
Bits 0,1,2,3,4,5,6 change the 'More status available' bit

Extended status byte 1 :

[0] "Too close phys.limits", "Error [instantaneous] - too close physical limits"},
[1] "Pos.enc.out of range", "Error [instantaneous] - position encoder out of range"},
[2] "DP sens.out of range", "Error [instantaneous] - DP sensor out of range"},
[3] "PI sens.out of range", "Error [instantaneous] - supply pres sensor out of range"},
[4] "PA sens.out of range", "Error [instantaneous] - portA sensor out of range"},
[5] "PI press.< min press.", "Error [instantaneous] - supply pressure < min pressure" },
[6] "(Err)=>5% for =>10s", "Error [instantaneous] - (error)=>5% for =>10seconds"}
Bit 1 change the 'More status available' bit

Extended status byte 2 :

[0] "Too close phys.limits", "Error [latched] - too close physical limits"},
[1] "Pos.enc.out of range", "Error [latched] - position encoder out of range"},
[2] "DP sens.out of range", "Error [latched] - DP sensor out of range"},
[3] "PI sens.out of range", "Error [latched] - supply pres sensor out of range"},

[4] "PA sens.out of range", "Error [latched] - portA sensor out of range"},
[5] "PI press.< min press.", "Error [latched] - supply pressure < min pressure" },
[6] "(Err)=>5% for =>10s", "Error [latched] - (error)=>5% for =>10seconds"}

Extended status byte 3 :

[0] "Setpoint clamped-low", "Status - setpoint is being clamped (lower clamp)"},
[1] "Setpoint clamped-upp", "Status - setpoint is being clamped (upper clamp)"},
[2] "Cut off is active 1", "Status - cut off is active"},
[3] "Cut off is active 2", "Status - cut off is active"},
[4] "DP clamp is active", "Status - the DP clamp is active"},
[5] "System not in service", "Status - system not in service"},
[6] "Position <= limit 1", "Status - position <= limit 1"},
[7] "Position => limit 2", "Status - position => limit 2"},
[8] "Digital In 1 is on", "Status - Digital In 1 is on"},
[9] "Digital In 2 is on", "Status - Digital In 2 is on"},
[10] "Digital Out 1 is on", "Status - Digital Out 1 is on"},
[11] "Digital Out 2 is on", "Status - Digital Out 2 is on"},
[12] "Syst.override actived", "Status - digital input has activated system override"}
Bits 10 and 11 change the ‘More status available’ bit

Selftune phases :

110	Finding valve limits...	The system is in fixed DP mode in the 'up' direction, and is waiting for the actuator to start moving.
120		The system has begun moving in the up direction in fixed DP mode, and is waiting for the actuator to stop moving.
130		The system has stopped moving in the up direction, and is now applying full +DP for a set 'dwell time' at the end stop.
140		The system is in fixed DP mode in the down direction, and self tune is waiting for the position to start moving.
150		The actuator has started moving in the down direction, in fixed DP mode.
160		The actuator has stopped moving, and is assumed to be at the end stop. Self tune is waiting for a pre-set dwell time, with full -DP.
170	Finished finding actuator limits.	The result of the mechanical limits search is being processed and assigned to storage variables. This is really just a dummy state which is exited after one cycle.
176	Calibrating the system..	The system is in open loop fixed DP mode, moving up, and self tune is waiting for the position to cross a high threshold.
178		The system is in open loop fixed DP mode, and is approaching the end stop, waiting for the position to stop moving.
180		The system has applied a PWM setting to the output port and is waiting for the DP to either come close to a threshold (first loop) or cross a threshold (subsequent loops).
182		The system has applied a fixed DP value and is waiting for the actuator to cross a low threshold.
184		The actuator has crossed the required low threshold, and the system is now waiting for the actuator to stop moving
186		The system has applied a PWM value, and is waiting a fixed period of time for the pressure to settle before continuing. The length of time of between each change is different depending on whether this is the first change.
210	Measuring the stroke time...	The system has applied a +10bar DP, and is waiting for the actuator to cross a high position threshold
220		The system is calculating the rise time and waiting for the actuator to stop moving at the high end stop.
230		The system has applied a -10bar DP, and is waiting for the actuator to cross a low position threshold.
240	Finished measuring stroke time.	The system is calculating the fall time, and waiting for the actuator to stop moving at the low end stop.
310	Characterizing actuator...	The temporary friction/DP offset maps have been cleared, and the system has been put into closed loop velocity mode, with a slow upward velocity. The system will slow down (i.e. reduce the target velocity) just before each 10% marker, and measure the DP at each point. Self tune continues like this until the position crosses 95%.
320		The same procedure as in the previous step, except the target velocity is in the down direction. Self tune continues until the actuator reaches 5%.
330	Measuring friction...	To check the previous friction reading, self tune is measuring the friction at the valve midpoint. P only control is used, and the target position is set to 50%. Waiting for the actuator to start moving.
340		The actuator has started moving, self tune is now waiting for it to settle at a point.
350		The actuator has stopped moving, self tune is now waiting for a pre-set time before incrementing/decrementing the setpoint towards the target. After each change of the setpoint, self tune watches to see when the position crosses the target (50%).
360		The threshold has been crossed in one direction. Self tune is now

		adjusting the setpoint in the other direction
370	Finished characterizing actuator.	The measurements have finished, and calculations are being performed on the results. This is a state which should be immediately exited.
375	Detailed characterization...	This state is only used during transition. It is the start of the DP/friction mapping phase 3, using break-away pressures at 10% intervals along the stroke.
380	Detailed characterization....	The system is trying to move the actuator to a start position, and is waiting for the actuator to start moving.
385		The system is trying to move the actuator to a start position, and is waiting for the actuator to stop moving.
390		The system is gradually changing the setpoint and waiting for the actuator to cross a threshold
395		The actuator has now crossed a threshold, and the system is waiting for the actuator to cross another threshold a short distance away. It continues increasing the setpoint to achieve this.
396		The first crossing has been done, and the system is going back to measure the crossing in the other direction, or it has done both directions, and is now calculating the results. When the very last crossing has been done in both directions, this state is also the place where the full DP offset map is calculated.
410	Tuning test...	The system has set up the PID with default tuning parameters, put the system into closed loop control mode, and is now waiting for the actuator to stop moving at a target start point.
415		The actuator has now slowed down, and the system is waiting for the actuator to stop moving completely.
420		The system is now making micro adjustments to the setpoint to get the actuator into a known start position for a step test.
425		The system has now been put into fixed DP mode, and a drive DP has been applied. The reaction rate of the system will be used to tune the PID. In this state, we are waiting for the actuator to move
430		The system is now waiting for the actuator to cross 60%.
440	Tuning test complete.	The system is now calculating the PID tuning parameters besed on the ZeiglerNichols reaction rate method.
1000	Self tune complete!	The self tune completed successfully with no errors

Error codes :

111	Position sensor out of range.	The position sensor is not within its measurable range. Please check the alignment of the position sensor to the actuator travel. Other possible reasons: • The position encoder is electrically disconnected. • The position encoder is faulty.
121	Movement took too long.	The actuator did not move quickly enough in the positive direction Possible reasons: • The actuator is too big for the positioner to control directly. • When trying to find the actuator limits, the actuator exceeded the maximum allowed up-step time. This usually happens when the actuator doesn't move at all.
131	Movement timed out	The actuator did not move away from it's positive end stop. Possible reasons: • The position sensor is mechanically disconnected. • The position sensor is electrically disconnected. • The air supply failed during the test. • A fault occurred with the positioner. • While trying to find the actuator limits, the actuator reached. • the upper end stop, but then didn't move away from the upper end stop.
141	Movement took too long.	The actuator did not move quickly enough in the negative direction Possible reasons: • The air supply failed during the test. • An external force is causing abnormal movement of the actuator.
151	Position sensor out of range!	The position sensor went out of range during the self tuning. Possible reasons: • The position sensor is not correctly aligned for the actuator and linkage. The sensor must be within its active range for the full stroke of the actuator, and this means the start point must be set to allow the full travel to be sensed. Please turn off the air supply and adjust the potentiometer rotation. • The position sensor became electrically disconnected during the • test. Please check the electrical connections before continuing.
152	Position sensor stroke range too small!	The position stroke range was too small. For correct functioning of the positioner, the system requires good resolution on the position sensor, which requires a minimum difference between the min and max travel points, of at least 15 degrees. Please adjust or change the linkage to give more rotation of the sensor, and aim for use 90 degrees or more for best results.
174	The pneumatic system is unstable on this actuator.	With the factory configuration, the pneumatic system can oscillate on small actuators, or setups with narrow bore pipes. To solve this problem, turn the PCB trimmer labeled 'SEN.', one turn

		clockwise. This reduces the sensitivity of the pneumatic system. Turn an additional revolution if the problem persists. You can reset to factory settings by turning the 'SEN.' trimmer multiple turns anticlockwise, the total range is 11 full revolutions, and there is no hard stop at the end of the range. Never adjust the potentiometer marked 'SPL NULL'. This problem can also occur if there if there is a power supply fault, e.g. voltage supply instead of current supply. If we get here, the DP oscillation detection was triggered during the self tune. We need to give the user practical advice on what to do.
176	Actuator movement took too long.	The actuator did not move quickly enough in the positive direction, or stopped before it had reached its end stop. Possible reasons: • The actuator air supply failed during the test. • The actuator is single acting, and but the single/double acting selector plate on the circuit board is in double acting mode.
178	Actuator did not stop at end stop.	The actuator came close to reaching the travel limit but did not stop. Possible reasons: • There is too much noise in the system. • The air supply is unstable. • An external force is moving the actuator.
180	Internal calibration failed.	The self calibration of the system failed. Please contact your customer support contact to arrange for the unit to be returned. If we get to here, then it means that the pilot has either drifted too far out of calibration, or it is broken/intermittent. In both cases, we want the unit back in the lab to investigate.
182	Actuator movement took too long.	The actuator did not move quickly enough in the negative direction, or stopped before it had reached its end stop. Possible reasons: • The actuator air supply failed during the test.
184	Actuator did not stop at end stop.	The actuator came close to reaching the travel limit but did not stop. Possible reasons: • There is too much noise in the system. • The air supply is unstable." • An external force is moving the actuator.
186	Internal calibration failed.	The self calibration of the system failed. Please contact your customer support contact to arrange for the unit to be returned. If we get to here, then it means that the pilot has either drifted too far out of calibration, or it is broken/intermittent. In both cases, we want the unit back in the lab to investigate.
206	Actuator took too long or did not move.	The actuator did not return to 0% within in the required time. Possible reasons: • The actuator volume is too large for the system to control "directly." • The position sensor linkage is faulty or has become disconnected. • There is a fault with the position sensor. The state here is just to allow the actuator to move back to the start of its travel, if the previous self tune step left the actuator in a strange place. We wait the full stroke time allowance,

		before timing out.
211	Actuator took too long or did not move.	The actuator did not reach the required threshold in the required time Possible reasons:" • The actuator is single acting, but the system is configured as "double acting." • The actuator volume is too large for the system to control "directly."
221	Error calculating rise-time	An error occurred while calculating the rise time of the actuator. Please retry. If this error repeats, please contact your technical support representative.
222	Actuator did not settle.	The actuator did not stop moving after an up step. Possible reasons: • There is a fault with the position sensor. • An external force is moving the actuator.
231	Actuator took too long or did not move.	The actuator did not reach the required threshold in the required time Possible reasons: • The actuator is single acting, but the system is configured as double acting. • The actuator volume is too large for the system to control directly
241	Error calculating fall-time	An error occurred while calculating the fall time of the actuator. Please retry. If this error repeats, please contact your technical support representative.
242	Actuator did not settle.	The actuator did not stop moving after a down step. Possible reasons: • There is a fault with the position sensor. • An external force is moving the actuator.
311	Actuator movement took too long.	The actuator took too long to move when doing a controlled sweep of the actuator travel in the positive direction. Possible reasons: • The position sensor linkage is faulty or has become disconnected. • There is a fault with the position sensor. • An external force is moving the actuator.
312	Unstable movement during self tune.	The actuator did not move correctly with automatically assigned parameters Possible reasons: • Supply pressure is inconsistent during the test" • This type of actuator is not supported by the self tune, please record details of the actuator type, supply pressure and pneumatic configuration, this error code, and contact your technical support representative.
321	Actuator movement took too long.	The actuator took too long to move when doing a controlled sweep of the actuator travel in the negative direction. Possible reasons: • The position sensor linkage is faulty or has become disconnected. • There is a fault with the position sensor. • An external force is moving the actuator.
331	Actuator failed to move.	The actuator failed to move during a critical point of the self tuning. Possible reasons:

		• The position sensor linkage is faulty or has become disconnected. • There is a fault with the position sensor.
341	The actuator did not settle correctly.	The actuator did not settle at when trying to move to a fixed point. Possible reasons: • The actuator is too small for the system to control." • The inner loop gain is too high. Contact your technical support representative.
351	Could not move actuator.	The actuator could not be moved while trying to measure the actuator friction. Possible reasons: • The position sensor linkage is faulty or has become disconnected. • The friction of the actuator is too great for automatic tuning. • An external force is jamming the actuator. • The air supply failed during the test.
361	Could not move actuator.	The actuator could not be moved while trying to measure the actuator friction. Possible reasons: • The position sensor linkage is faulty or has become disconnected. • The friction of the actuator is too great for automatic tuning. • An external force is jamming the actuator. • The air supply failed during the test.
381	Actuator did not move	The actuator did not move correctly to the start of a characterization test. Possible reasons: • The position sensor linkage is faulty or has become disconnected. • The air supply failed during the test.
386	Actuator did not settle.	The actuator did not settle while moving to the start of a characterization test. Possible reasons: • The actuator is too small for the system to control. • The air supply is unstable.
391	Could not move actuator.	The actuator could not be moved while trying to measure the actuator friction. Possible reasons: • The position sensor linkage is faulty or has become disconnected. • The friction of the actuator is too great for automatic tuning. • An external force is jamming the actuator. • The air supply failed during the test.
396	Could not move actuator.	The actuator could not be moved while trying to measure the actuator friction. Possible reasons: The position sensor linkage is faulty or has become disconnected. The friction of the actuator is too great for automatic tuning. An external force is jamming the actuator. The air supply failed during the test.
411	Actuator did not settle.	The actuator did not settle correctly at the start of a tuning test. Possible reasons: • The actuator is too small for the system to control. • The air supply is unstable.

416	Actuator did not settle.	The actuator did not settle correctly at the start of a tuning test. Possible reasons: • The actuator is too small for the system to control. • The air supply is unstable.
422	Could not move actuator.	The actuator could not be moved close enough to the start point of a tuning test. Possible reasons: • The actuator is too small for automatic tuning (tune manually). • The air supply failed during the test.
426	Actuator failed to move.	The actuator did not move during a tuning test. Possible reasons: • The actuator is too large/slow for automatic tuning. • The position sensor linkage is faulty or has become disconnected. • The air supply failed during the test.
431	Actuator did not settle.	The actuator did not settle during a tuning test. Possible reasons: • The actuator is too large/slow for automatic tuning. • The position sensor linkage is faulty or has become disconnected. • The actuator is too small for the system to control. • The air supply is unstable.
432	Insufficient actuator movement.	The actuator did not move enough during a tuning test. Possible reasons: • The actuator is single acting, but the system is configured for double acting actuators. • The actuator is too large/slow for automatic tuning. • The air supply failed during the test. • An external force is jamming the actuator.
441	Error calculating PID parameters.	An error occurred while calculating the PID parameters. Please retry and if the problem repeats, contact your technical support representative. As an interim solution, please manually choose appropriate PID tuning parameters.
995	Unexpected software error.	An unexpected software error occurred, please record the following and pass them to your customer support representative: • What type of actuator you are using. • Whether you have any boosters fitted in the supply lines. • The progress indicator value • Any other details about the application An un-trapped software error has occurred, and the system has reached an unexpected state. This probably indicates a software bug, so we need to get as much information about the application and fault as possible.
996	Unexpected software error	An unexpected software error occurred, please record the following and pass them to your customer support representative: • What type of actuator you are using. • Whether you have any boosters fitted in the supply lines. • The progress indicator value • Any other details about the application An un-trapped software error has occurred, and the system has reached an unexpected state. This probably indicates a software bug, so we need to get as much information about the application and fault as possible.

997	Digital input triggered abort.	The self tune procedure was aborted because a digital input was previously configured to put the valve into a safe state, and this digital input triggered during the sequence. Please check the equipment connected to the digital inputs, to ensure that it will not fire during the self tuning, or alternatively, disable the digital input override setting in the control interface.
998	Self tune aborted by user.	The self tune was aborted at the request of the user. Please restart the self tune when ready.
999	Feature not implemented	The self tuning procedure was attempted on a setup that the system is not currently capable of handling automatically. Please perform limits only tuning, and then tune the parameters manually.