

# FTC – FasTrak Compact

## INSTRUCTION MANUAL (SOFTWARE) 4050



*Engineering  
GREAT Solutions*

10/10/2019	00	Issue	N. Zenoni	F. Tondolo
Date	Revision	Description	Compiled	Approved

*STI S.r.l. has taken every care in collecting and verifying the documentation contained in this Instruction Manual. The information here in contained are reserved property of STI S.r.l.*

## INDEX

<b>1</b>	<b>GENERAL INFORMATION .....</b>	<b>1</b>
1.1	GENERAL WARNINGS.....	1
1.2	GENERALITIES.....	1
1.3	MANUFACTURER.....	1
1.4	TERMS AND CONDITIONS .....	1
1.5	MANUFACTURER’S LIABILITY.....	1
1.6	APPLICABLE STANDARDS AND DIRECTIVES .....	2
1.7	SYMBOLOLOGY USED.....	2
<b>2</b>	<b>INSTALLATION .....</b>	<b>3</b>
2.1	SOFTWARE INSTALLATION .....	3
2.2	CONNECTIONS.....	3
2.3	STARTING THE SOFTWARE .....	4
<b>3</b>	<b>REMOTE CONTROL .....</b>	<b>5</b>
3.1	REMOTE CONTROL – MAIN FEATURES .....	5
3.1.1	<i>Quick Buttons</i> .....	5
3.1.2	<i>‘Tuning’ &amp; standard ‘System setup’ area</i> .....	6
3.1.3	<i>Main vars and system status</i> .....	7
3.2	REMOTE CONTROL – CFG PAGE .....	10
3.2.1	<i>Position sensor</i> .....	10
3.2.2	<i>System Calibration</i> .....	11
3.2.3	<i>4-20mA Calibration</i> .....	11
3.2.4	<i>Warning limits Cfg</i> .....	12
3.2.5	<i>Split range input</i> .....	12
3.2.6	<i>Input char</i> .....	12
3.2.7	<i>Analog Output</i> .....	13
3.3	REMOTE CONTROL – HART PAGE.....	14
3.3.1	<i>HART PARAMETERS</i> .....	14
3.3.2	<i>HART Protocol</i> .....	14
3.3.3	<i>HART Communication</i> .....	14
3.4	REMOTE CONTROL – ADVANCED PAGE (ONLY FOR ADVANCED USERS) .....	15
3.4.1	<i>CUTOFF Pressures</i> .....	15
3.4.2	<i>Analog output DAC calibration</i> .....	15
3.4.2.1	<i>4mA calibration</i> .....	15
3.4.2.2	<i>20mA calibration</i> .....	16
3.4.3	<i>0-100% position (4mA action inversion)</i> .....	16
3.5	THE GRAPH WINDOW .....	18
3.5.1	<i>The Menu</i> .....	19
	<i>Menu : File</i> .....	19
	<i>Menu : Device</i> .....	19
	<i>Menu : Password</i> .....	19
3.6	SYSTEM CALIBRATION: SELF TUNE .....	20
3.6.1	<i>Starting page</i> .....	20
3.6.2	<i>Position sensor alignment</i> .....	21
3.6.3	<i>Actuator volume</i> .....	22
3.6.4	<i>Booster type</i> .....	23
3.6.5	<i>‘Only stroke’ or ‘Fully calibration’</i> .....	23
3.7	OPTION PACK 1 : DIAGNOSTIC FOR CRITICAL SEVERE SERVICE VALVES .....	24
3.7.1	<i>Valve Signature</i> .....	24
3.7.2	<i>Step Response</i> .....	27
<b>4</b>	<b>DISPLAY: SELF-TUNING GUIDE .....</b>	<b>30</b>
<b>5</b>	<b>375 HANDHELD &amp; DD FILES .....</b>	<b>32</b>
5.1	INSTALLATION.....	32

5.2	CONNECTION .....	33
5.3	MENU .....	33
<b>6</b>	<b>AMS SW INTERFACE .....</b>	<b>36</b>
6.1	INSTALLATION .....	36
6.2	CONNECTION .....	36
6.3	DEVICE CONTEXT MENU .....	36
6.4	PROCESS VARIABLES .....	37
6.5	CONFIGURE/SETUP .....	38
6.5.1	<i>System Setup 1 &amp; 2</i> .....	38
6.5.1.1	Operation mode .....	38
6.5.1.2	Travel Control .....	38
6.5.1.3	Tuning .....	39
6.5.1.4	Cutoff Pressures .....	39
6.5.1.5	0 - 100% Position .....	39
6.5.1.6	Reset Setting .....	40
6.5.1.7	Analog Output .....	40
6.5.1.8	Position Sensor .....	41
6.5.1.9	Split Range Input .....	41
6.5.1.10	Manual Mode .....	42
6.5.1.11	Input Char .....	42
6.6	EDIT A CONFIGURATION PARAMETER .....	43
6.7	START THE CALIBRATION .....	44
6.7.1	<i>Calibration</i> .....	44
6.7.2	<i>Device Calibration</i> .....	44
6.7.3	<i>DP Calibration Data</i> .....	45
6.8	ADVANCED TESTS .....	45
6.8.1	<i>Step Response</i> .....	45
6.8.2	<i>Valve Signature</i> .....	46
6.9	HART COMMUNICATION .....	47
6.10	DIAGNOSTICS .....	47
6.10.1	<i>Device Status</i> .....	47
6.10.2	<i>System Status</i> .....	48
6.10.3	<i>Latched Errors</i> .....	49
6.10.4	<i>Instant Errors</i> .....	49
6.10.5	<i>Diagnostics</i> .....	50
6.11	DEVICE INFO .....	50
<b>7</b>	<b>ERROR/DIAGNOSTIC BITS IN HART PROTOCOL .....</b>	<b>51</b>
7.1	DEVICE STATUS .....	51
7.2	COMMON PRACTICE COMMAND CMD48: READ ADDITIONAL DEVICE STATUS .....	51
7.3	EXTENDED STATUS BYTE 0: .....	51
7.4	EXTENDED STATUS BYTE 2: .....	51
7.5	EXTENDED STATUS BYTE 3: .....	51
<b>8</b>	<b>SELF-TUNE PHASES .....</b>	<b>53</b>
<b>9</b>	<b>ERROR CODES .....</b>	<b>55</b>

# 1 GENERAL INFORMATION

## 1.1 General Warnings

<b>Important</b> 	<b>This Instruction Manual is an integral part of the machine, it should be carefully read before carrying out any operation and it should be kept for future references. The operators shall adopt the safety precautions required by the country where the product is installed. This Instruction Manual is realized in accordance with the Directive 2006/42/CE.</b>
---	---

## 1.2 Generalities

STI S.r.l. products are conceived, manufactured and controlled according to the Quality management System in compliance with EN ISO 9001 International Standard.

## 1.3 Manufacturer

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

STI S.r.l. Via Dei Caravaggi 15  
24040 Levate (BG) Italy  
Tel. +39 035 2928.2  
Fax +39 035 2928.247  
[imisti.sales@imi-critical.com](mailto:imisti.sales@imi-critical.com)

## 1.4 Terms and conditions

STI S.r.l. guarantees each single product to be free from defects and to conform to current goods specifications. The warranty period is one year from the date of installation by the first user, or eighteen months from the date of shipment to the first user, whichever occurs first.

The warranty does not cover special products or components not covered by warranty in their turn by subcontractors. No warranty is given for products which have been subject to improper storage, improper installation, misuse, corrosion, or which have been modified or repaired by unauthorised personnel: it is not advisable that customer or end users modify the device characteristics.

## 1.5 Manufacturer's liability

STI S.r.l. declines all liability in the event of:

- use of the device in contravention of local safety at work legislation;
- incorrect installation, incorrect maintenance, disregard or incorrect application of the instructions provided on the FTC nameplate and in this manual;
- modifications or repairs without STI S.r.l. authorisation;
- work done on the unit by unqualified or unsuitable operators.

It is operators' responsibility to comply with all applicable safety rules and to ensure that the local health and safety regulations are adhered to. Depending on the specific working conditions, additional precautions may be requested.

Please inform STI S.r.l. urgently if you face unsafe situations not described in this Instruction Manual.

## 1.6 Applicable Standards and Directives

- EN ISO 12100:2010 Safety of machinery - General principles for design - Risk assessment and risk reduction
- 2006/42/EC Machinery Directive
- 2014/68/UE Pressure Equipment Directive (PED)
- 2006/95/EC Directive for Low Voltage Equipment (LV)
- 2004/108/EC Directive relating to the Electromagnetic Compatibility (EMC)
- 2014/34/CE Equipment used in potentially explosive atmospheres (ATEX)

## 1.7 Symbology used

<b>Important</b> 	<p><b>Be careful where these symbols are shown, they indicate a potentially hazardous situation and they warn that if the steps are not properly performed, may result causing serious injury, death or long-term risks to the health of exposed persons</b></p>
--	--



GENERAL DANGER



DANGER POWER SUPPLY



CRUSHING HAZARD

<b>Important</b> 	<p><b>The operators shall adopt the safety precautions required by the country where the product is installed.</b></p> <p><b>The operators shall also adopt the following precautions.</b></p>
---	--



Must wear protective clothing.



Must wear protective gloves.



Must wear protective footwear.



Must wear protective helmet.



Must wear protective glasses



Must wear earplugs

## 2 Installation

### 2.1 Software installation

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

### 2.2 Connections

Connect your HART interface to the same connectors as the 4-20mA input signal (XT1/L+ and L-).

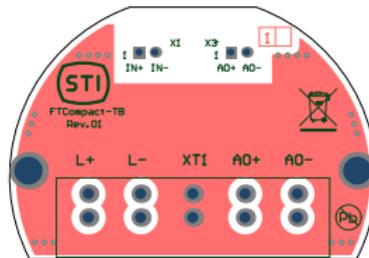


Figure 1: FTC electrical connection

<p><b>Warning</b></p> 	<p>If the 4-20mA signal generator is not HART-compliant, then communication problems may occur.</p>
---	---

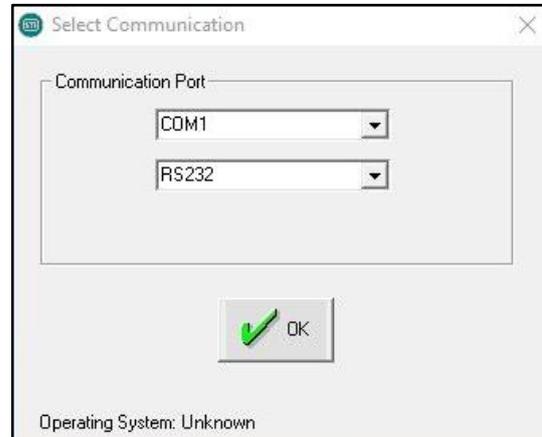
Connect the 'FTx positioner connection cable' to positioner connector X4.

<p><b>Warning</b></p> 	<p>X4 connection facilities can only be used in a non-hazardous area provided that:</p> <ul style="list-style-type: none"> <li>- Only the special 'FTx positioner connection cable' is used;</li> <li>- The laptop is battery-powered or is powered by a power supply unit complying with IEC 60950-1 with Maximum Output Voltage (<math>U_m</math>) <math>\leq</math> 30V.</li> </ul>
---	--

## 2.3 Starting the Software

Run the software starting from the desktop icon or from the Windows Start menu. The 'Select Communication' page is displayed:

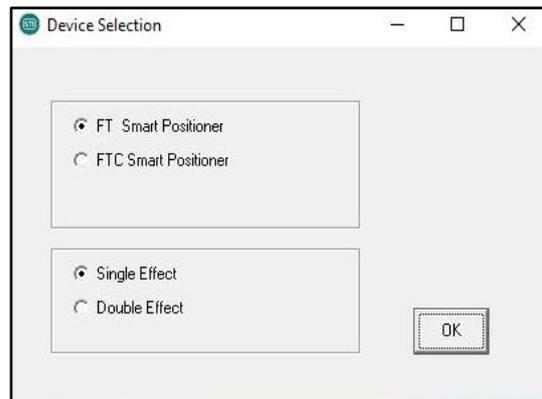
- Select the right communication port (only the available communication ports are displayed in the combo box);
- Select the Communication mode (RS232 or HART MODEM);
- Click on 'OK' button.



**Figure 2:** Select Communication Page

Then, the 'Device Selection' page appears:

- Select the correct positioner installed (FT or FTC Smart Positioner);
- Select the type of actuator (Single or Double Effect);
- Click on 'OK' button.



**Figure 3:** Device Selection Page

### 3 Remote Control

#### 3.1 Remote Control – Main features

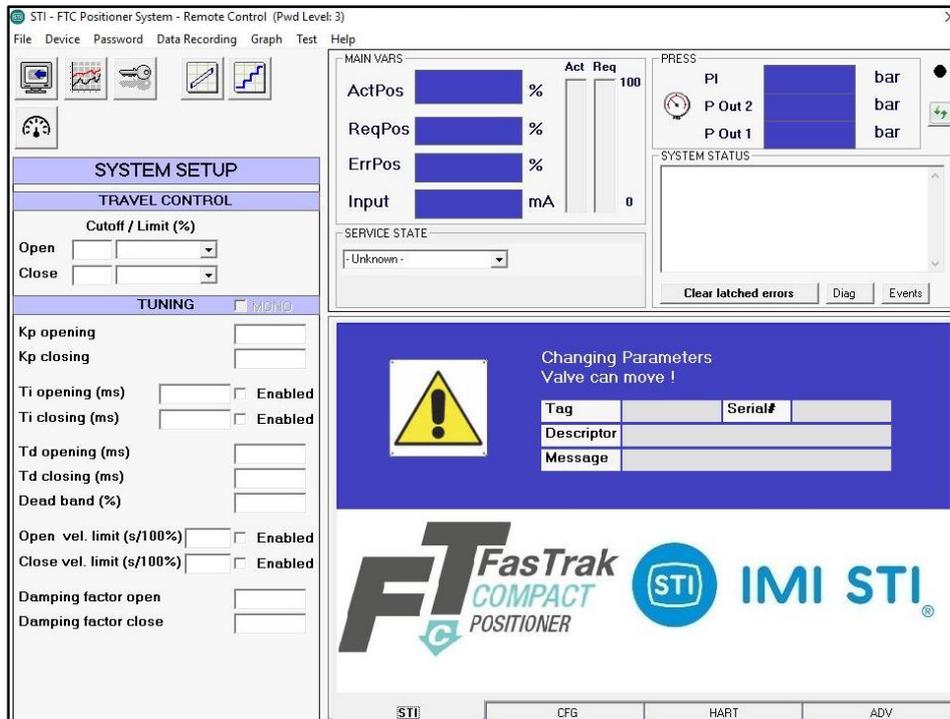


Figure 4: Main features

##### 3.1.1 Quick Buttons

- Download button: downloads all the parameters from the FTC positioner. At the end of the download the displayed values are the same as the positioner;
- Graph button: opens the Graph window;
- Password button: opens the Login window. In order to change the parameters or to access configuration windows, a login is required. The default standard password is: 12345.



Figure 5: Download button, Graph button, Password button

### 3.1.2 System Setup area: Travel Control and Tuning Setup

General definitions:

- Limit: when a limit is configured, the Requested position is limited to this value (example: if the Limit is set at 95%, even if the signal input is 20mA, thus the Requested position would be 100%, the Requested position can't exceed the 95%);
- Cutoff: when a cutoff is configured, if the Requested position fall inside the Cutoff area, then the Request position is fixed at the min (or max) value (example: Set the cutoff at 5%; when both the Requested position and the Actual position are less than 5%, a fixed pressure is applied in order to set the actual position to 0%);
- Cutoff (open/close) pressure: it defines the applied pressure when a cutoff is active (Advanced parameter);
- Open/Close: information related to 'Signal Fail Action' configuration.

<p><b>Important</b></p> 	<p>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 configurable through software.</p>
---	--

<p><b>Important</b></p> 	<p>With some type of valves, it is mandatory to enable the cutoff to ensure the full trust on seat.</p>
--	---

<p><b>Important</b></p> 	<p>Many 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 then the first value of each parameter is automatically copied into the second one.</p>
---	---

Travel control:

- Open Limit [50 ... 100 %]: specify if a Limit or a Cutoff is configured in the open direction;
- Close Limit [0 ... 50 %]: specify if a Limit or a Cutoff is configured in the close direction.

Tuning:

- Kp [0,1 ... 25]: the proportional gain is the multiplier of the error (difference between the set-point and the actuator position - it is expressed in percentage) and it is active only if the error exceeds the dead band value. A different gain for each movement direction can be selected;
- Ti [10 ... 100000 ms]: the integral term helps to reach the set-point quicker and eliminates the residual steady-state error that occurs with a proportional-only controller. However, since the integral term depends on the accumulated errors from the past, it can cause the setpoint overshoot. The smaller the integral term value, the more aggressive the integral effect. A different integral factor for each movement direction can be selected;
- Td [0 ... 1000]: the derivative term slows the rate of change of the controller output. Setting Td equal to 0 disables the derivative factor. Increasing its value makes the derivative action more effective;
- Dead Band [0 ... 10]: in a steady-state condition, dead band can be used to reduce continuous cycling ("hunting") around the target position. Increasing its value reduces the accuracy, but it can improve stability;
- Velocity Limit [0 ... 655 s]: velocity limit is the maximum speed value (expressed in number of seconds to travel the whole stroke) the actuator can travel. A different velocity limit for each movement direction can be selected;

- Damping Factor [0 ... 255]: applies a damping effect to the set-point rate of change. Increasing the damping factor smoothens the set-point.

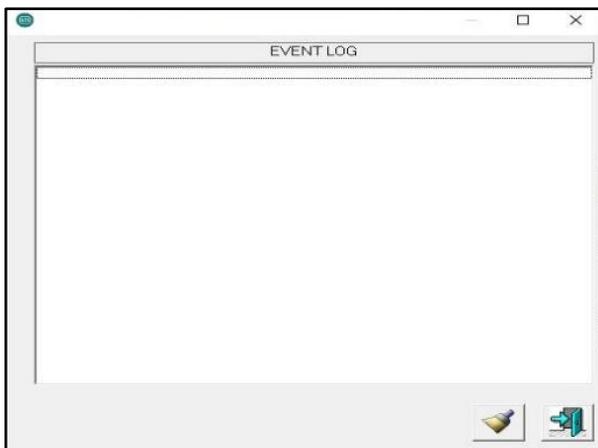
### 3.1.3 Main Vars, Service State, Press and System Status area

This window reports information about the positioner:

- The LED in the top-right position informs the user about the communication status (YELLOW LED blinking: communication ok - RED LED: communication problem);
- ActPos [%]: actual position measured by the positioner;
- ReqPos [%]: input signal or request position. The source of the requested position depends on the 'service state'. If the system is put 'in service' mode, the requested position depends on the 4-20mA input signal and the split range setting. If the system is put in 'out of service' mode, the requested position is equal to the setpoint setting by remote control;
- ErrPos [%]: equal to the difference between ReqPos and ActPos;
- Input [mA]: current read by the 4-20mA loop current input channel;
- PI [bar]: line pressure;
- P Out 1 [bar]: pressure measured at port 1 of the positioner;
- P Out 2 [bar]: pressure measured at port 2 of the positioner;
- System Status window: displays the status of the device (the same information is also available with CMD48 of the HART protocol). Following the error list ([latched] means that the error condition occurred before, but it is not present now; [instantaneous] means that the error condition is currently present):
  - "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] - system has not been configured (perhaps first power on?)"
  - "Error [latched] - system is uncalibrated"
  - "Error [latched] - the pot has not been linearized"
  - "Error [instantaneous] - too close physical limits"
  - "Error [instantaneous] - position encoder out of range"
  - "Error [instantaneous] - DP sensor out of range"
  - "Error [instantaneous] - supply pressure sensor out of range"
  - "Error [instantaneous] - port A 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] - DP sensor out of range"
  - "Error [latched] - supply pressure sensor out of range"
  - "Error [latched] - port A 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 - system not in service"
  - "Status - position <= limit 1"
  - "Status - position => limit 2"
  - "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"
- "PI Press.Sens.0bar calib.completed"
- "PI Press.Sens.0bar calib.in progress"
- "PI Press.Sens.0bar calib.failed"
- "PI Press.Sens.3bar calib.completed"
- "PI Press.Sens.3bar calib.in progress"
- "PI Press.Sens.3bar 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 " ... ")"
- Clear latched errors (button): clears all the latched errors;
- Diag (button): shows a window with all the communication errors that have occurred. When the button is displayed with a red LED on it, this means that at least an error has occurred. Press 'Clear' button to erase the content of the Event Log window, 'Exit' button to close it:



**Figure 7:** Diag button



**Figure 6:** 'Clear' and 'Exit' button

- Service State area allows to select the Service State:
  - In Service: Requested Position depends on the 4-20mA input signal;
  - Out Of Service (Manual): the Requested Position comes from the 'Setpoint' input box from remote control. When the Service State is set to 'Out Of Service (Manual)', the first manual setpoint is equal to the last 'Actual position' in order to have a bump less transition;
  - Out Of Service: special mode that gets automatically selected when the system is not calibrated.

<p><b>Warning</b></p> 	<p>Changing from 'Out of Service' to 'In Service' can cause the actuator to move. When the positioner is turned on it automatically starts in 'In Service' or 'Out of Service' according to the calibration status.</p>
---	---

### 3.2 Remote Control – CFG page

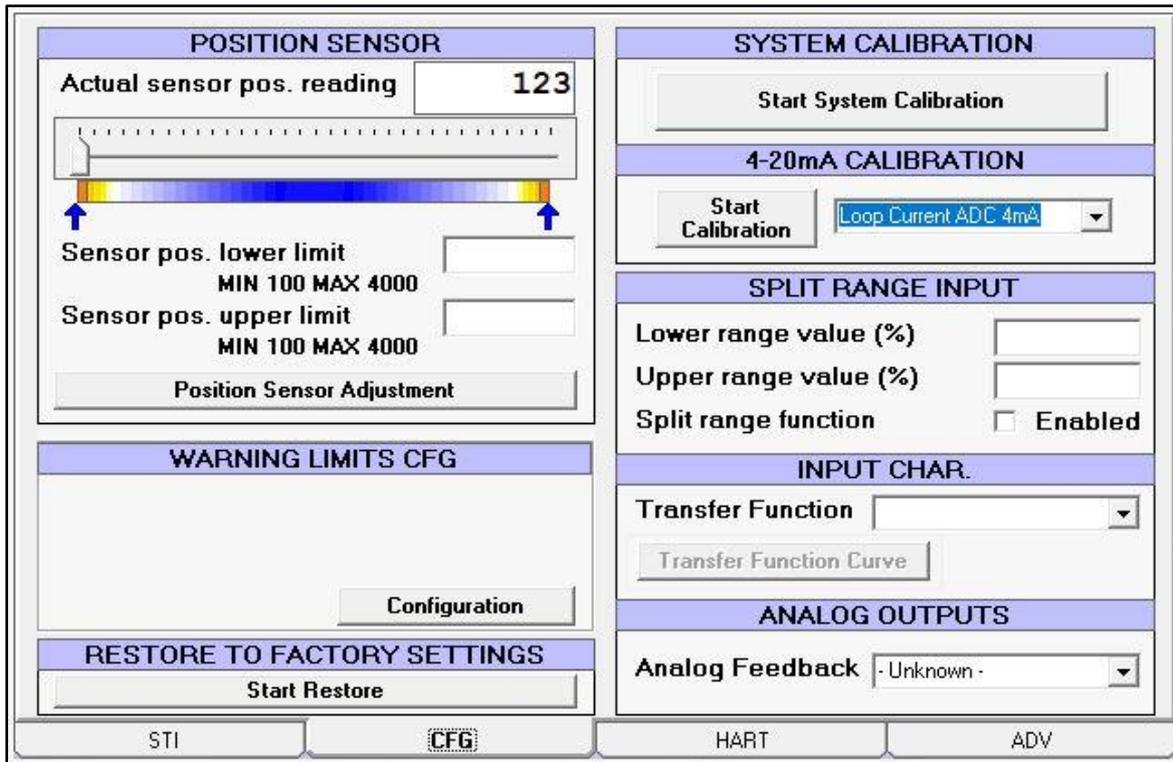


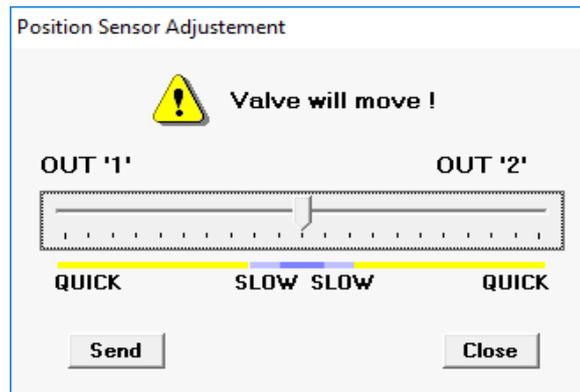
Figure 8: CFG Page

#### 3.2.1 Position sensor

The “Actual sensor pos. reading” (or “Pos. raw ADC reading”) reports the value read from the position sensor (bits). 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 linkage alignment: the 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) and when the 0% and 100% mechanical limit stay in blue/white area.

<p><b>Important</b></p> 	<p>In order to limit the travel of actuator, it is necessary to find the raw ADC value in correspondence of the hard limit and to manually set the raw ADC desired value. For example, suppose that for the lower hard limit the raw ADC reading is 1000 and for the upper hard limit the raw ADC reading is 3000. If the actuator travel must be reduced by 5% on lower limit and 10% on upper limit, the raw ADC values to set are 1100 for lower limit and 2800 for upper limit. Then check the actual positions on end stroke and adjust if necessary.</p>
---	--

The “Position sensor adjustment button” opens a window to help the user 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 away from the mid position



**Figure 9:** Position Sensor Adjustment

<b>Warning</b> 	<p>When the 'Send' button is pressed the actuator will move.</p>
---	--

### 3.2.2 System Calibration

Starts the calibration and the self-tuning procedure. The 'Only stroke' option allows the calibration of the hard limits without performing the full self-tuning procedure.

<b>Warning</b> 	<p>When the 'Start' button is pressed the actuator will move.</p>
---	---

### 3.2.3 4-20mA Calibration

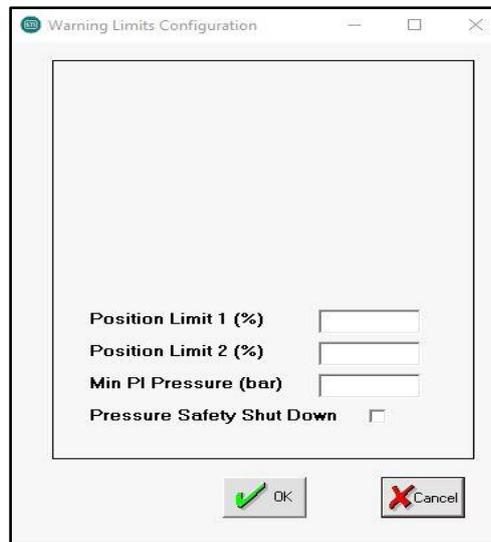
<b>Important</b> 	<p>Make sure that the positioner is supplied with a stable, accurate 4mA and 20 mA reference.</p>
---	---

Start the calibration of the selected option:

- Loop Current ADC 4mA: reads the actual value of the input current and calibrates 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.

### 3.2.4 Warning limits Cfg

Select 'Configuration' button to insert position limits and the minimum supply pressure.



**Figure 10:** Warning limits configuration

### 3.2.5 Split range input

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. The result of the split range is then evaluated by the 'Transfer Function Curve'.

(example 1: if the Low range value is equal to 0% and Upper range value is equal to 100%, thus the resulting Requested positions are 0% for 4mA and 100% for 20mA).

(example 2: if the Low range value is equal to 0% and Upper range value is equal to 50%, thus the resulting Requested positions are 0% for 4mA and 100% for 12mA).

### 3.2.6 Input char

Specifies the relationship between the Input signal and the Requested Position. The 'Transfer Function Curve' shows the effect of Split Range Function in a graphical way. Selects one of the following functions:

- Linear
- Standard 1-50: equipcentage 1:50
- Standard 50-1: inverse equal percentage 1:50
- User: user defined
- Standard 1-25: equipcentage 1:25
- Standard 25-1: inverse equal percentage 1:25
- Standard 1-30: equipcentage 1:30
- Standard 30-1: inverse equal percentage 1:30
- Feedback Linearization

Opens the Transfer Function Curve window using the 'Transfer Function Curve' button:

- The 'Close' and 'Open' labels on the 'Requested position' axis show the effect of the 'Signal Fail Action' selection;
- The '4.0mA' and '20.0mA' on the 'Signal Position' axis show the effect of the 'Split Range' setup;
- The effect of 'Limit' and 'Cutoff' are shown on the graph;
- Only the 'User Curve' can be modified, the other curves are fixed. In order to generate a user curve starting from a standard curve proceed as follows:
  - 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, only the Requested position values can be changed;
- A value can be changed either in the table or by clicking & dragging the corresponding dot in the graph;
- If the shift key is held down when clicking on two dots, the system will automatically perform a linear interpolation between these two points.

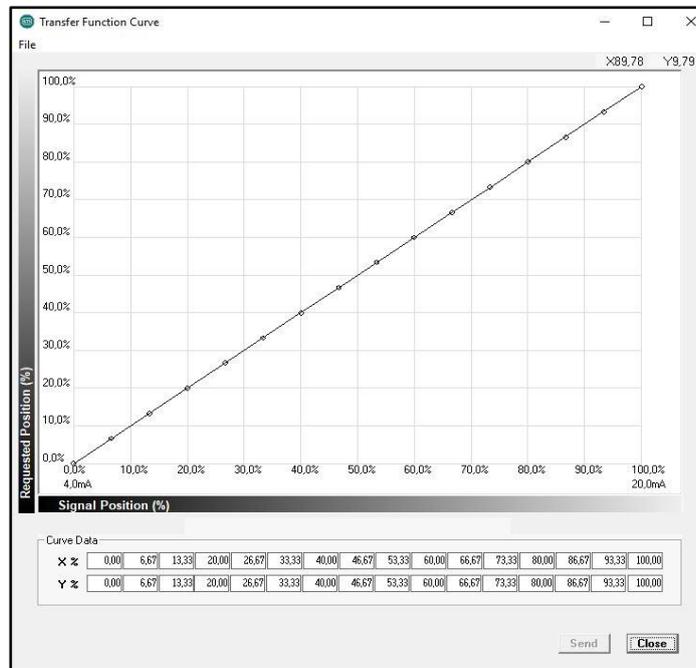


Figure 11: Example of the Linear Transfer Function Curve

### 3.2.7 Analog Output

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

### 3.3 Remote Control – HART page

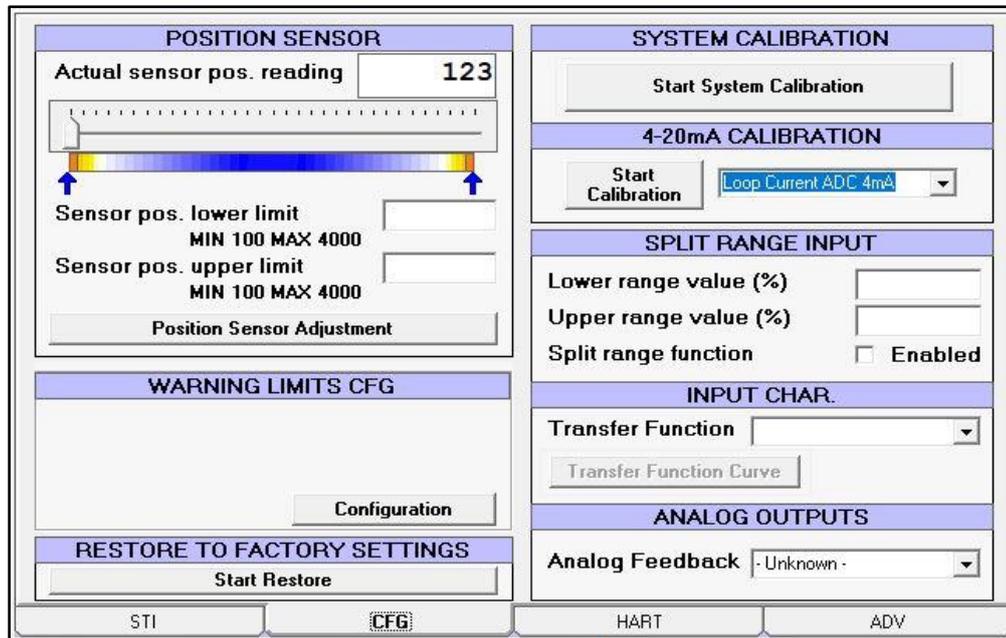


Figure 12: CFG Page

#### 3.3.1 HART PARAMETERS

- Tag: Tag is an 8-character label assigned by the user that is based on the location and the use of the field device. It is coded as an 8-character Packed ASCII string (6 bytes) and it is used to identify the field device. The term originated when physical tags were attached to instruments for this purpose;
- Date: Date is coded by means of three 8-bit binary unsigned integers that represent, respectively, the current day, month and year (minus 1900). It is used by the Master for record keeping (e.g. last or next calibration date);
- Descriptor: Descriptor is a 16-character Packed ASCII string (12 bytes) that is used by the Master for record keeping. The default value is a blank string;
- Message: Message is a 32-character Packed ASCII string (24 bytes) used by the Master for record keeping. The default value is a blank string;
- 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 the serial number (see page 7).

#### 3.3.2 HART Protocol

Shows some communication parameters which may be useful for debugging communication problem.

#### 3.3.3 HART Communication

'Time management' and 'Time management (performance)' are two different ways to manage the Hart modem. In case of communication problems, a possible solution is to change this option.

### 3.4 Remote Control – Advanced page (only for advanced users)

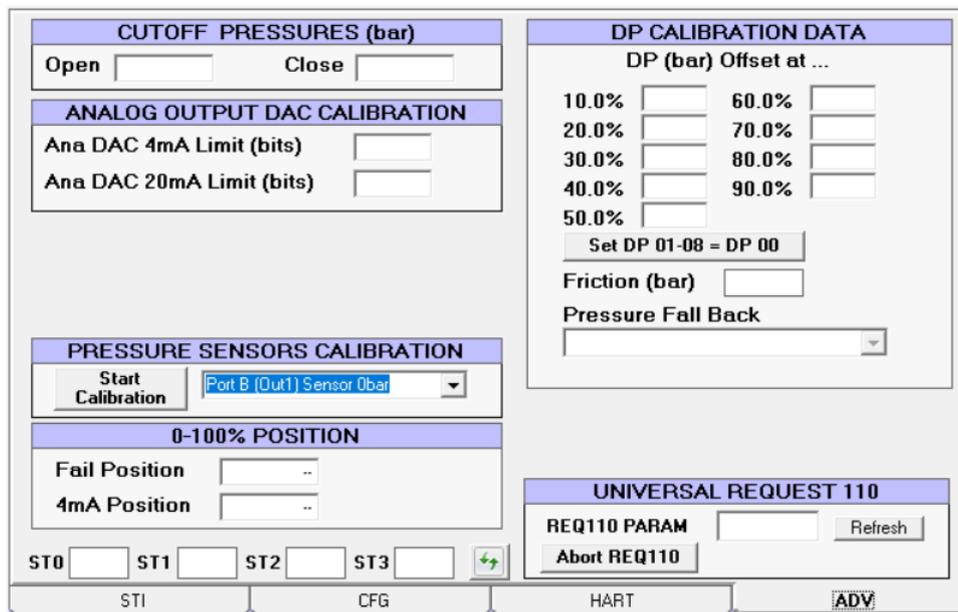


Figure 13: CFG Page

#### 3.4.1 Cutoff pressures (bar)

It is the pressure used at the fully close (open) position when the Cutoff is enabled. The default value is 10bar. In order to speed up the movement of the valve during the opening (closing) phase and from the fully close (open) position, it may be useful to reduce the pressure set.

<b>Warning</b> 	<p>If the cutoff pressures is too low, the valve could be not fully closed, thus leakage occurs. In some applications, the valve can be damaged.</p>
---	--

<b>Warning</b> 	<p>The pressure limitation is valid only when the positioner is on. When the power supply (4-20mA loop) is removed, the output pressure from the positioner is equal to the line pressure, so actuator and valve must be able to withstand the full pressure.</p>
---	---

#### 3.4.2 Analog output DAC calibration

The analog output (4-20mA passive loop) is calibrated during the production phase but any adjustment can be done in this window. In order to 'reverse' the output, a specific function is provided in the 'CFG' window (see 'Analog Feedback'): the analog output calibration must not be used for this purpose.

##### 3.4.2.1 4mA calibration

Move the actuator in the 4mA position, then 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 if the measured output is less than 4mA or decrease the value if it is greater. When finished press the 'Start Calibration 4mA' button.

### 3.4.2.2 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 if the measured output is less than 20mA or decrease the value if it is greater. When finished press the 'Start Calibration 20mA' button.

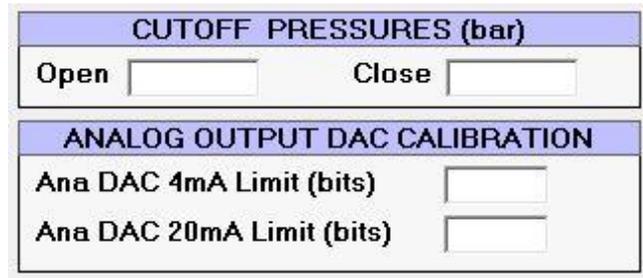


Figure 14: Calibration

### 3.4.3 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').

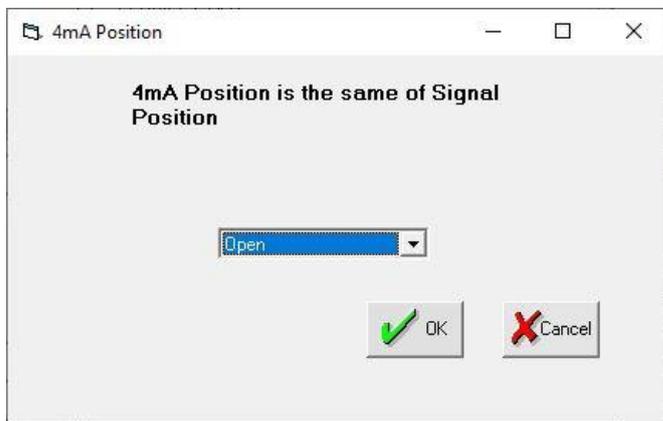


Figure 15: 4mA Position

By design, when the power is removed (4-20mA signal), the FasTrak Compact positioner has:

- Port 'A' connected to the atmosphere
- Port 'B' fully pressurized

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

(an exception to the above rule is when the 'Fail Freeze' option device is used, in this case – by means of a special electronic device and 3-way valves – the position

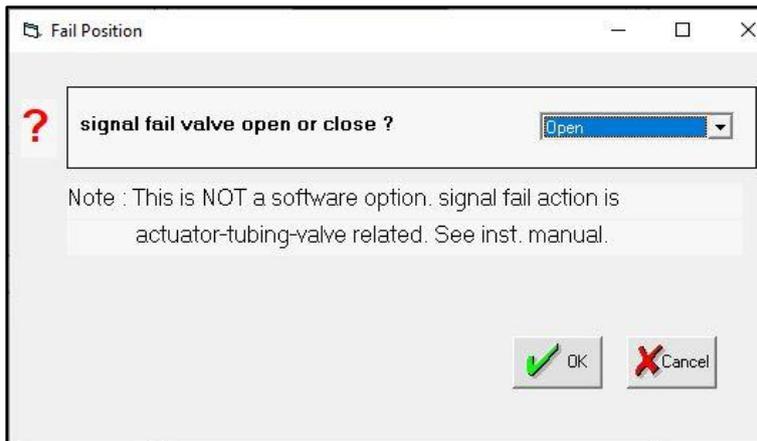
when the power is removed is the last valid one).

By default the '4mA position' is the same as the power fail position.

During the 'SelfTune' procedure it has to be specified 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 it depends on the pneumatic connection.

The 'Fail Position' field shows what was selected during the 'Selftune' procedure. If necessary it can be changed.

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



**Figure 16: Fail Position**

<p><b>Warning</b></p> 	<p>Setting '4mA Position' different from 'Fail position' can be dangerous: if for example with 4mA the valve is fully open, when the input signal goes below the minimum threshold then the valve moves to the fully close position. If the input signal is unstable and close to the minimum value, it may happen that the valve continuously moves between the close and the open positions.</p>
---	--

### 3.5 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 analyse the acquired waveforms. This feature is only available on the “RCFTC” program with an RS232 connection.

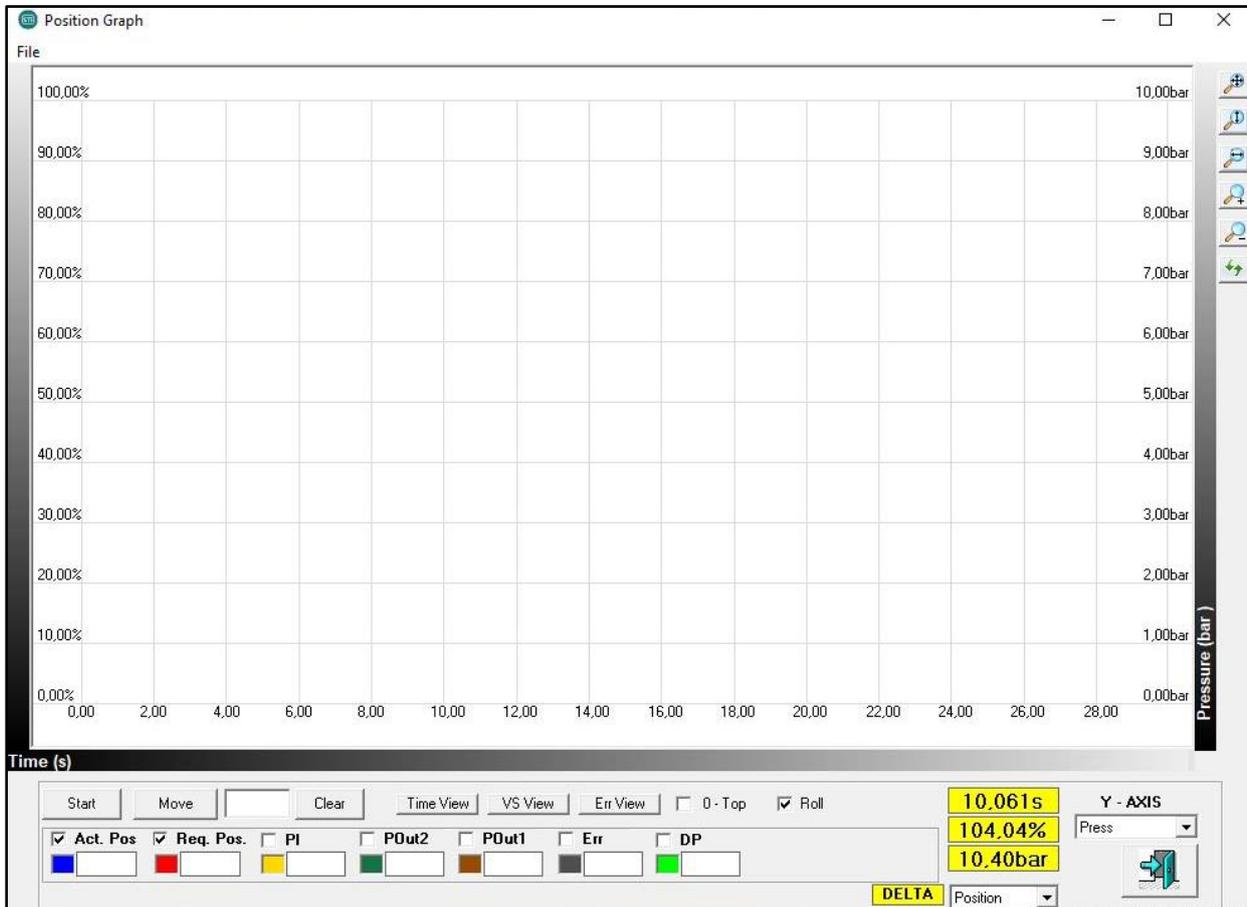


Figure 17: Graph Window

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



Figure 18: Graph Window Menu

- File-> Save Image:** The graph is saved as a bitmap picture
- File-> Save Graph:** The graph is saved as a ‘collection of data’. It can be useful in order to reload it again.
- File-> Load Graph:** Loads a graph that was previously saved with ‘Save Graph’.
- File-> Graph Compare:** Loads another graph to compare it with the present one. In order to ‘align’ the two graphs, keep the ‘SHIFT’ key and the mouse ‘right button’ pressed, then move in the graph area (to the left or to the right).

### 3.5.1 *The Menu*

#### **Menu : File**

- **Load:**  
Loads into RCFTC a previously saved set of parameters.
- **Save:**  
Saves the current set of parameters in a .qtp file.
- **Report:**  
Creates a document in .rtf format with the actual parameters (like the Save command but the file format is compatible with text editing software).
- **Exit:**  
Closes 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**  
Same as the Upload Param command but it additionally sends calibration information

#### **Menu : Password**

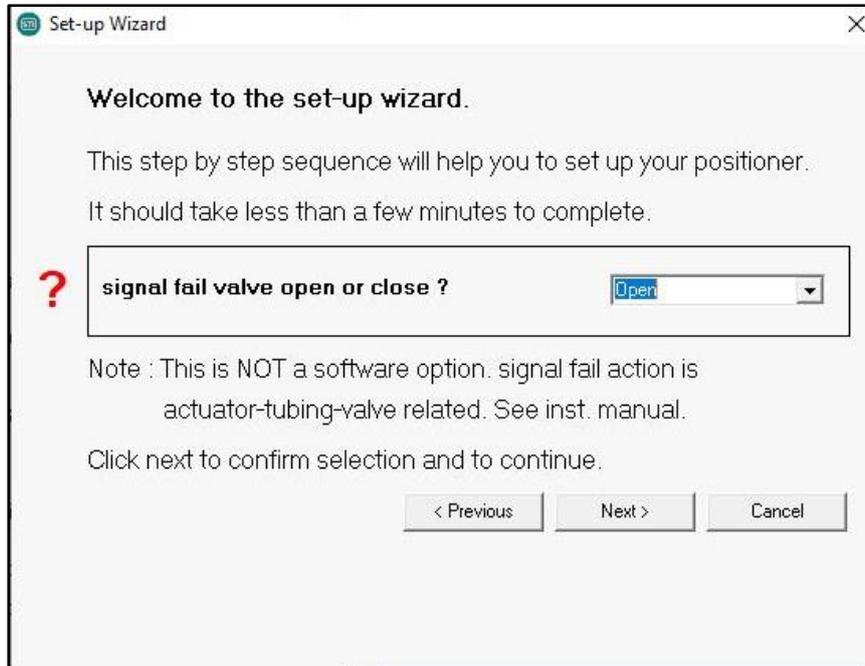
- **Login**  
Performs the same function as the quick button
- **Change**  
Changes the password

### 3.6 System Calibration: Self Tune

The 'self-tune' wizard can be started by pressing the 'Start System Calibration' button.

**More information about this procedure can be found in the specific 'Installation Instruction Manual'.**

#### 3.6.1 Starting page

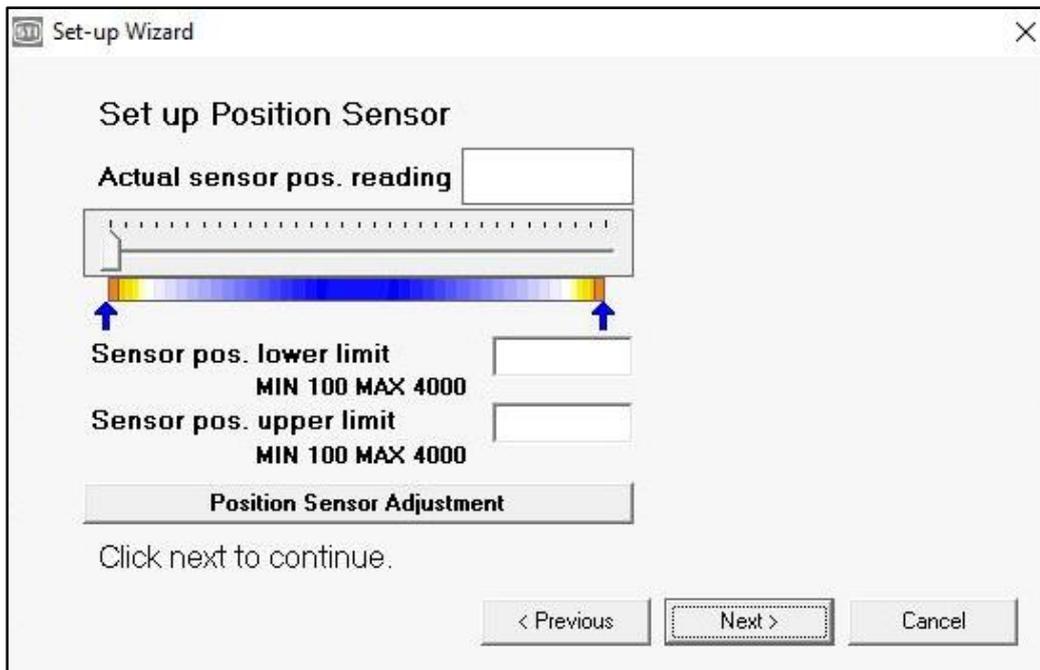


You must specify what happens when the 4-20mA signal is removed (with the air present). Based on the pneumatic connection the actuator moves in one direction or in the other (when the 4-20mA signal is removed, portB is fully pressurized).

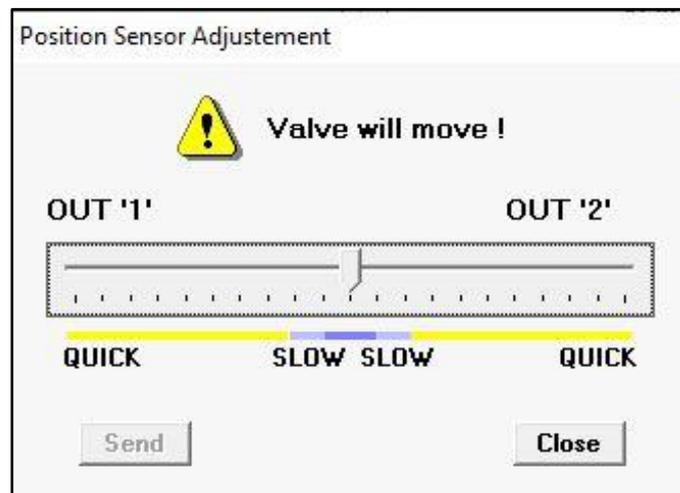
<p><b>Warning</b></p> 	<p>This panel is to inform the positioner about the action and not to specify the user-desired behaviour (as the positioner cannot change the mechanical default piston).</p>
---	---

### 3.6.2 Position sensor alignment

The following page helps you to align the position sensor.

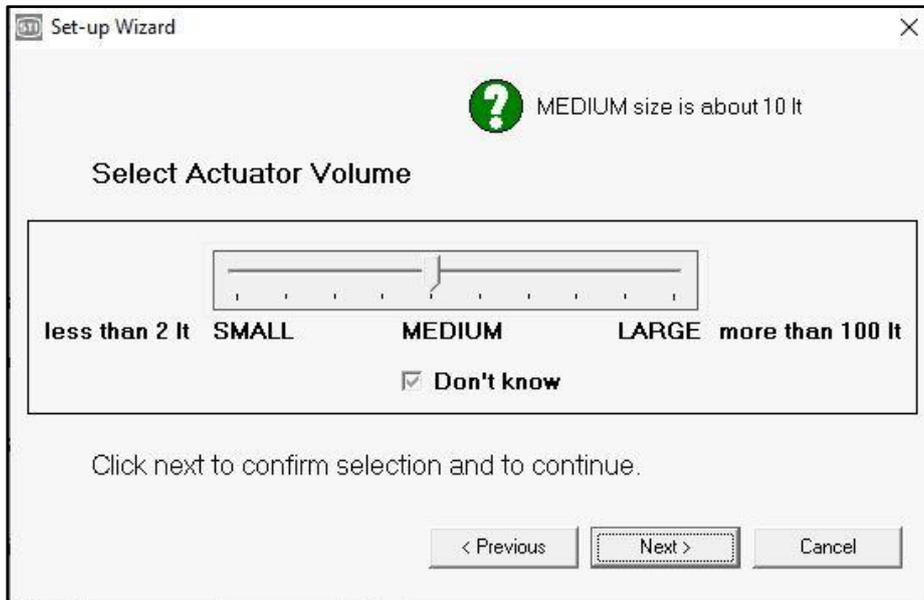


The 'Position sensor adjustment' button opens a window with a tool to move the valve.

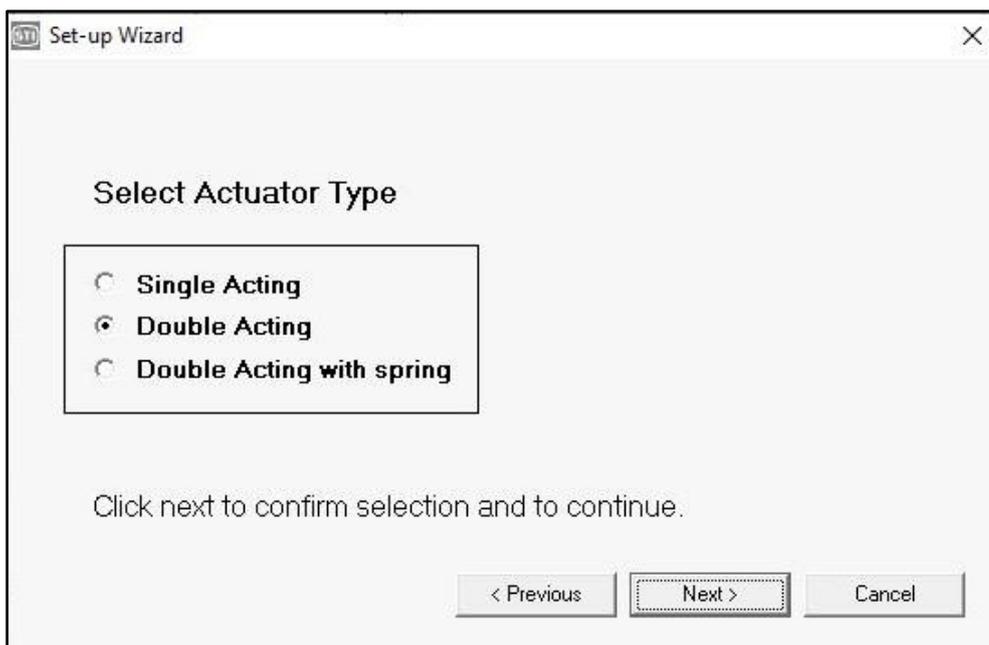


### 3.6.3 Actuator volume

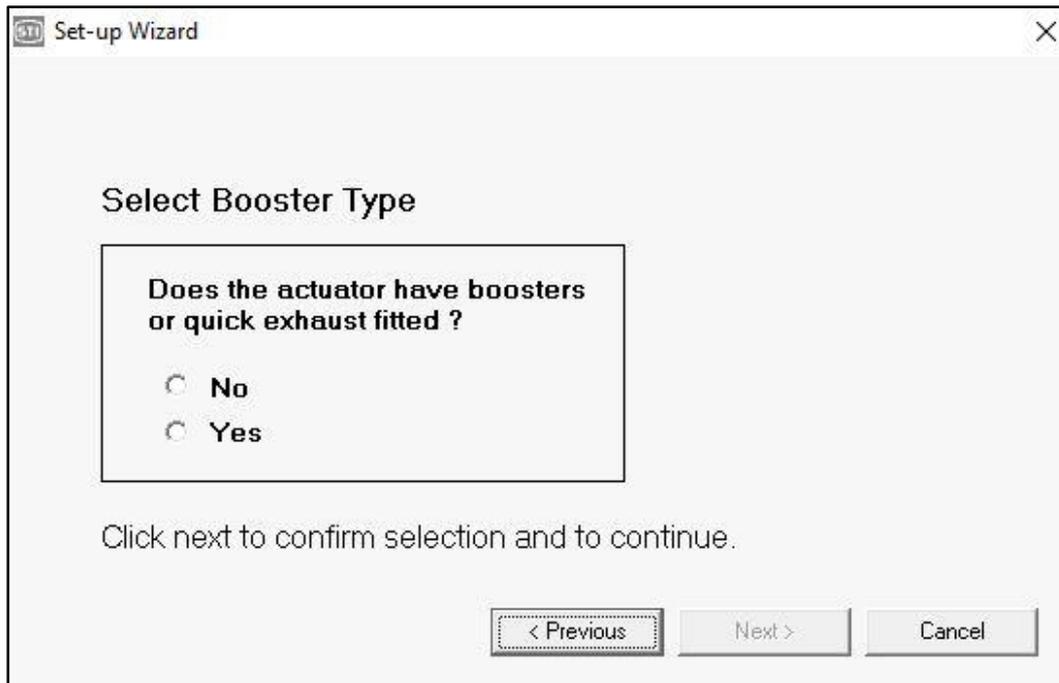
Specify the size of the actuator:



Select the type of the actuator:



### 3.6.4 **Booster type**



### 3.6.5 **'Only stroke' or 'Fully calibration'**

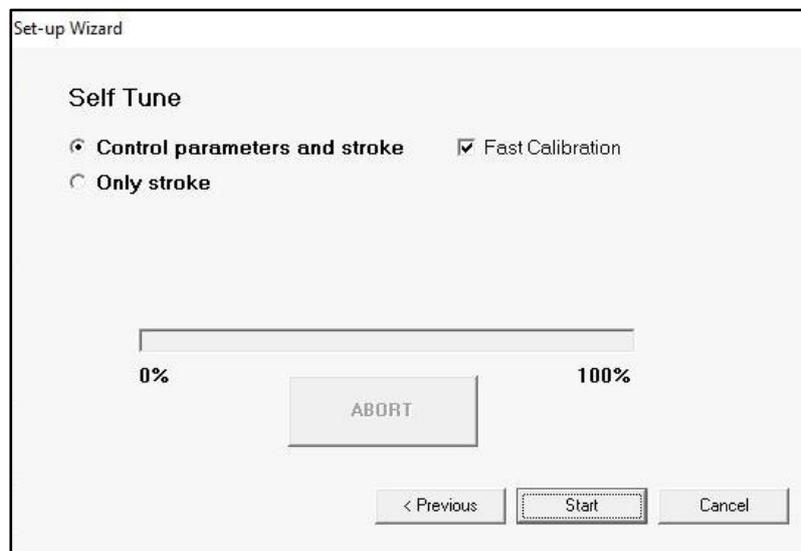
Select *'Control parameters and stroke'* to perform a full SelfTune procedure.

If *'Fast Calibration'* is checked, a faster SelfTune procedure starts.

Select *'Only stroke'* to just update the hard limits of the valve.

Press *'Start'* to perform the SelfTune

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



### 3.7 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

#### 3.7.1 Valve Signature

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

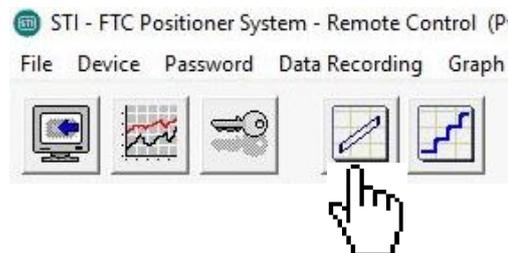
The valve is moved in a configurable stroke range, data are collected and the report shows the delta pressure (trust) vs position.



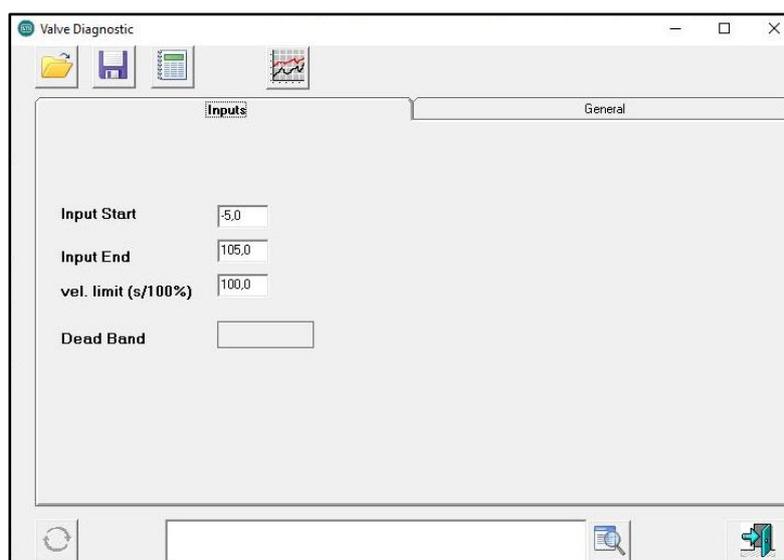
Figure 19: Valve signature

 <p><b>Warning</b></p>	<p>The ValveSignature procedure moves the valve regardless the 4-20mA setpoint. This action can be dangerous for people or for the process. Before starting the ValveSignature procedure double-check that all the safety requirements are met.</p>
---	---

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



The ValveSignature configuration window appears:



- **Input Start:**

- Specifies the starting point for the test.
- **Input End:**  
Specifies the final point for the test.
- **Velocity Limit:**  
Specifies 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 Compact must be in 'Manual' mode. If it is in 'In Service' mode the SW

	Opens a saved 'ValveSignature' test		Saves the actual 'ValveSignature' results
	Creates a report with the results		Shows in a graphical way the collected data (as well as the test is running)
	STARTS the ValveSignature procedure		STOPS a running ValveSignature procedure
	Shows the details about the 'ValveSignature' process status		Exits

can, with the user consent, automatically change the status to 'Manual'.

As the ValveSignature procedure is running it is possible to see what is going on (actual position, DeltaP).

In this phase the Graph shows data (i.e. position & DeltaP) versus time.



Figure 20: Time View Figure

When the ValveSignature procedure is completed the Graph shows DeltaP versus position.

It is possible to switch from one visualization to another by means of the buttons 'Time view' and 'VS view'.

In addition, it is possible to load another ValveSignature graph to make a comparison with the current one.



Figure 21: VS View Figure

The button 'Err view' shows the dynamic error vs position:

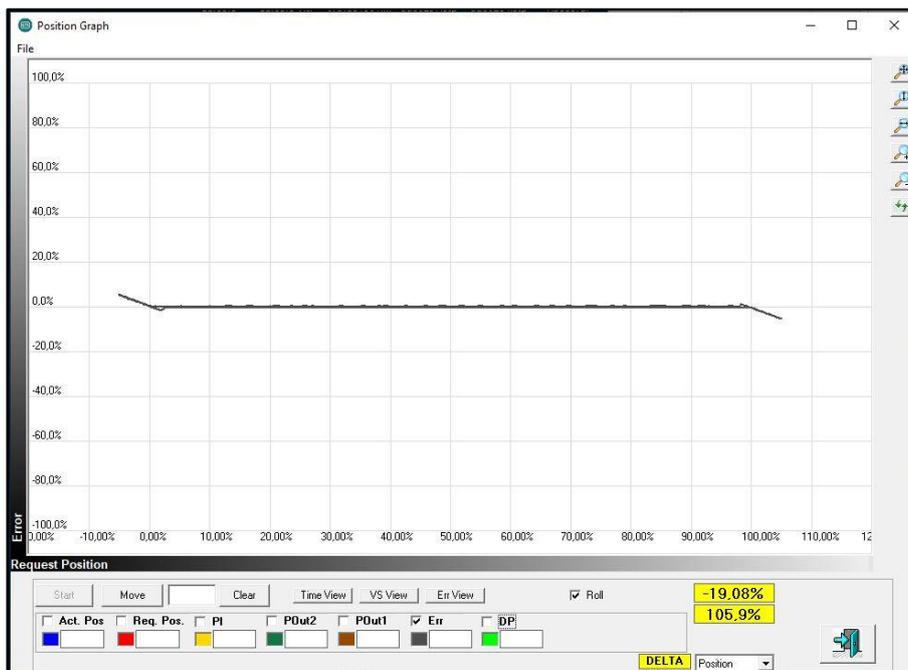
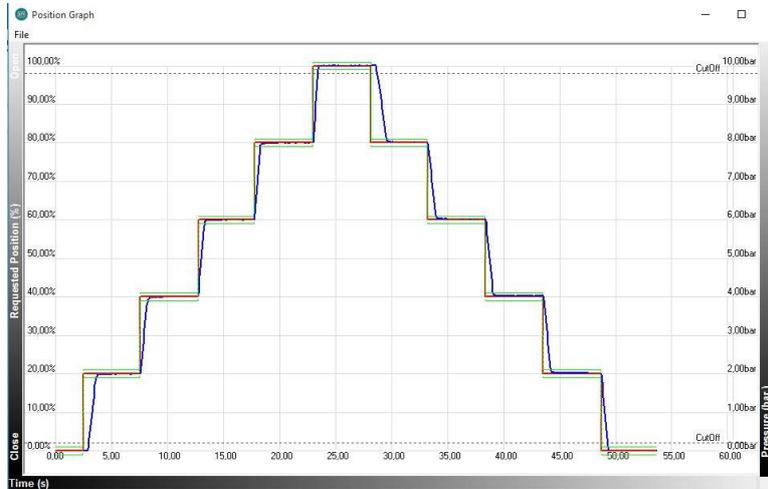


Figure 22: Err View Figure

### 3.7.2 Step Response

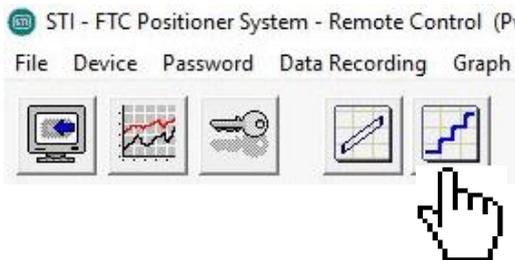
The Step Response option allows to move the valve to different positions based on a list of endpoints.



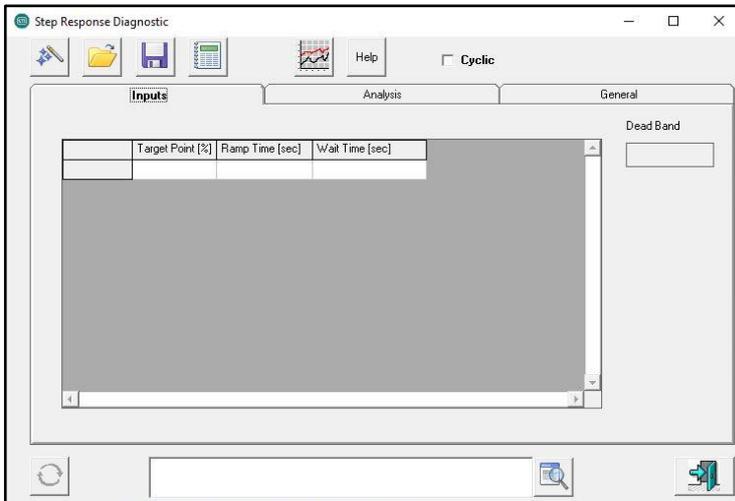
**Figure 23: Step Response Test**

	<p><b>Warning</b></p> <p>The Step Response moves the valve regardless the 4-20mA setpoint. This action can be dangerous for peoples or for the process. Before starting the Step Response procedure double-check that all the safety requirements are met.</p>
--	--

In order to start the Step Response procedure, press the button on the main page:



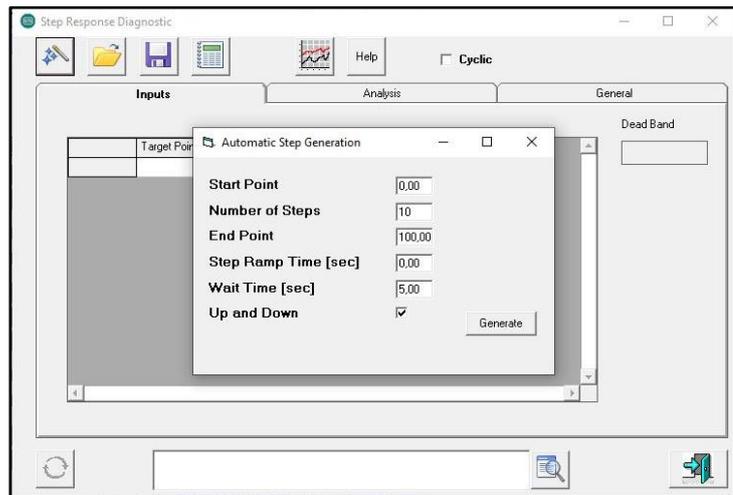
The Step Response configuration window appears:



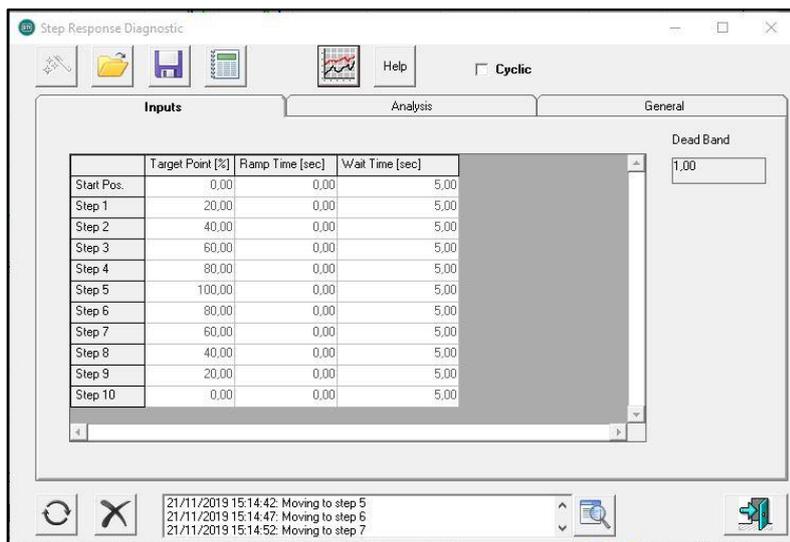
**Figure 24: Step Response Wizard**

Pressing the 'Step Response Wizard' button the 'Automatic Step Generation' window appears:

- **Start Point:**  
First Position for the test.
- **Number of Steps:**  
Number of points in the table
- **End Point:**  
Final position for the test.
- **Step Ramp Time [sec]:**  
Stroke time applied to each step.
- **Collection Time [sec]:**  
Delay after the execution of each step.
- **Up and Down flag:**  
When this option is selected, the table has 2 x 'Number of Steps' and the table has steps both in the UP direction and in the DOWN direction.



The 'Generate' button creates 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 (with the mouse pointer on the table, press the right button and a specific menu appears).

*In order to start the test, the FasTrak Compact must be in 'Manual' mode. If it is in 'In Service' mode the SW can, with the user consent, automatically change the status to 'Manual'*

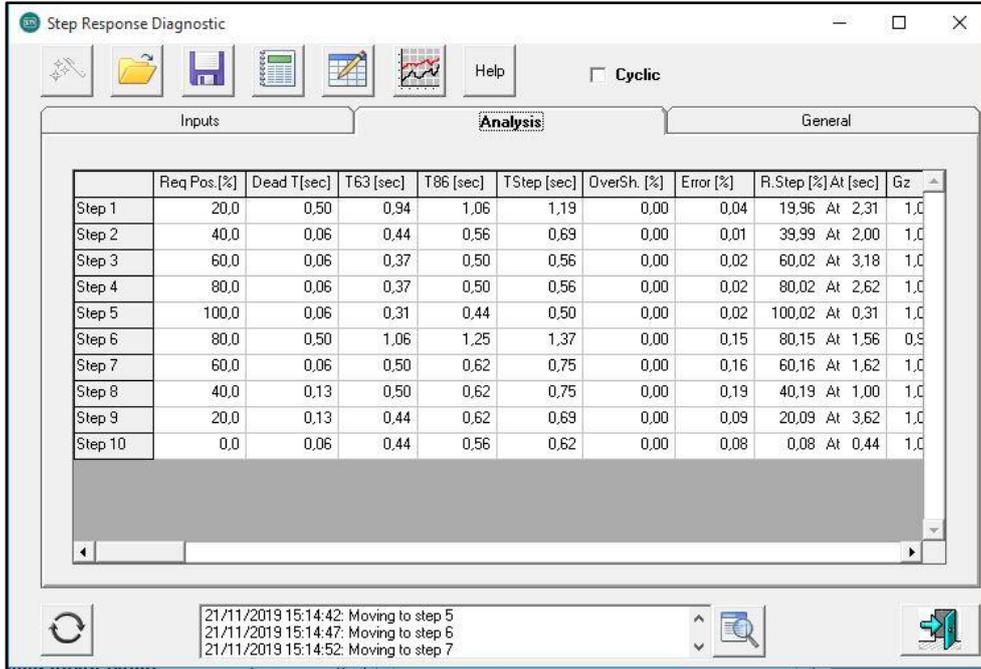
Press the 'Start' button to initiate the test.



**Figure 25:** Start Button

As the Step Response procedure is running it is possible to see what is going on in the Graph Window.

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 the percentage of the overshoot related to each step).



	Req Pos. [%]	Dead T [sec]	T63 [sec]	T86 [sec]	TStep [sec]	OverSh. [%]	Error [%]	R.Step [%] At [sec]	Gz
Step 1	20,0	0,50	0,94	1,06	1,19	0,00	0,04	19,96 At 2,31	1,0
Step 2	40,0	0,06	0,44	0,56	0,69	0,00	0,01	39,99 At 2,00	1,0
Step 3	60,0	0,06	0,37	0,50	0,56	0,00	0,02	60,02 At 3,18	1,0
Step 4	80,0	0,06	0,37	0,50	0,56	0,00	0,02	80,02 At 2,62	1,0
Step 5	100,0	0,06	0,31	0,44	0,50	0,00	0,02	100,02 At 0,31	1,0
Step 6	80,0	0,50	1,06	1,25	1,37	0,00	0,15	80,15 At 1,56	0,9
Step 7	60,0	0,06	0,50	0,62	0,75	0,00	0,16	60,16 At 1,62	1,0
Step 8	40,0	0,13	0,50	0,62	0,75	0,00	0,19	40,19 At 1,00	1,0
Step 9	20,0	0,13	0,44	0,62	0,69	0,00	0,09	20,09 At 3,62	1,0
Step 10	0,0	0,06	0,44	0,56	0,62	0,00	0,08	0,08 At 0,44	1,0

Pressing the 'Create Report' button a detailed test report is generated.



**Figure 26:**  
Create Report

**Disclaimer:**

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

## 4 Display: self-tuning guide

<p><b>Warning</b></p> 	<p><b>The actuator will move during the self-tuning.</b></p>
---	--

Follow these steps using the display buttons (ENT, DOWN, UP, ESC):

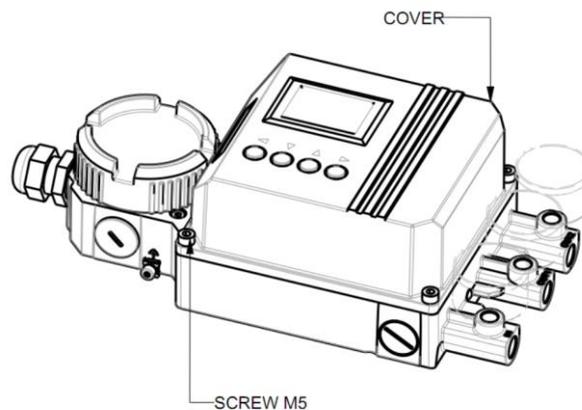
- turn on the FTC smart positioner;
- push any button and then enter the password (ENT-UP-DOWN-UP-DOWN);
- select set-up from main menu;
- select operating mode menu from set-up menu;
- select “Out svc” in the operating mode menu;
- come back to set-up menu;
- select actuator menu from set-up menu;
- chose the actuator type;
- come back to main menu;
- select calibration menu from main menu;
- select full self-tuning menu from calibration menu;
- start the self-tuning.

See Fig.7 for more details.

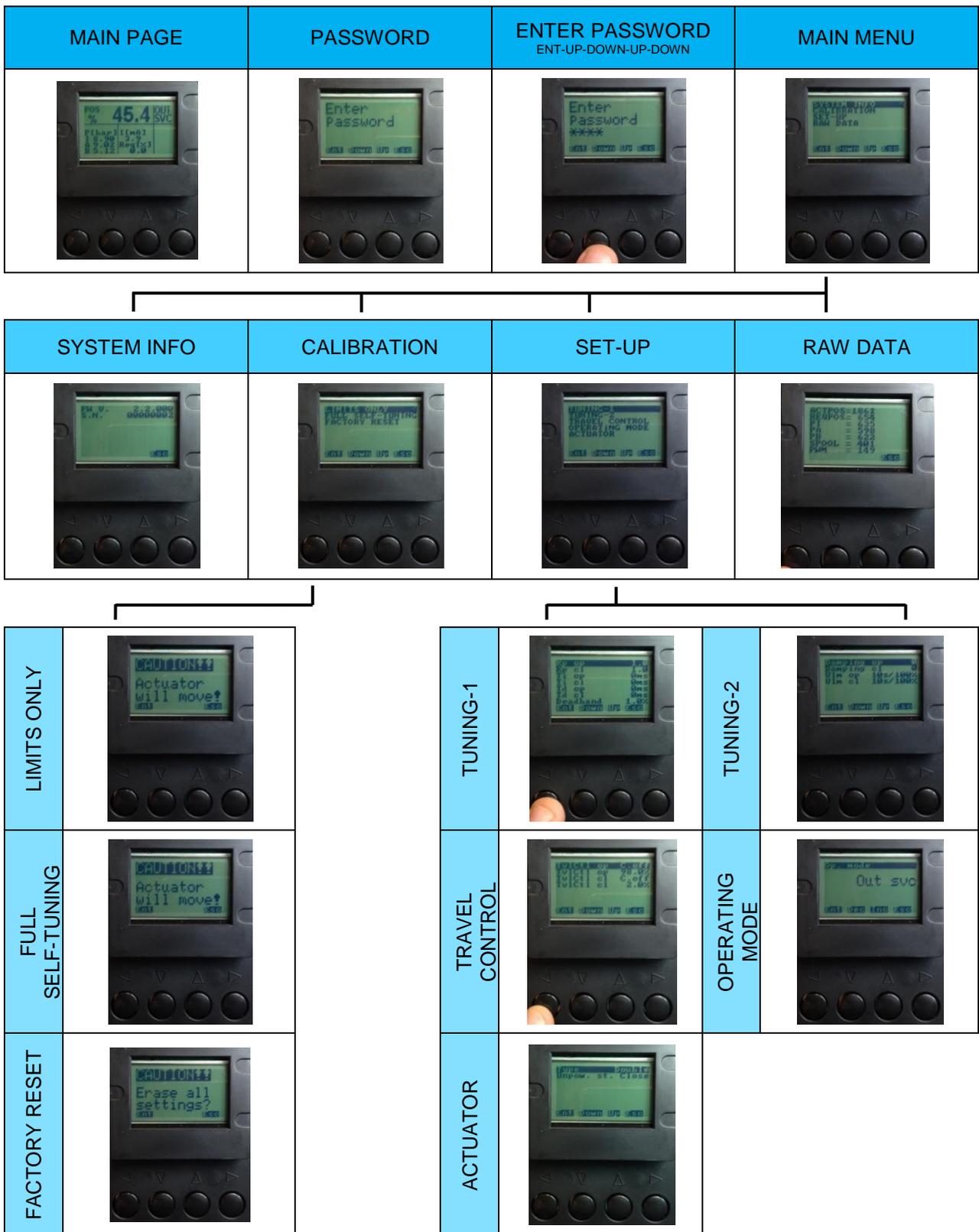
It is also possible to have the benefit of high-speed connection on the electronic board (restricted to use in a non-hazardous area) following the indications below:

- remove the cover by removing the #4 M5 screws;
- only the STI “FTx positioner connection cable” can be used to connect the FTC to the laptop;
- the laptop used must be powered from battery or by a power supply unit in compliance with IEC 60950-1, with Maximum Output Voltage ( $U_m$ )  $\leq$  30V;
- see Instruction Manual 4050 for more details about the FTC remote control;
- when the High-speed connection is not required, remove the “FTx positioner connection cable” and mount the FTC cover by #4 M5 screws (tightening torque = 4Nm).

For Intrinsically Safe design details (FTC-I), see related Safety Manual 9031.



**Figure 27:** FTC cover



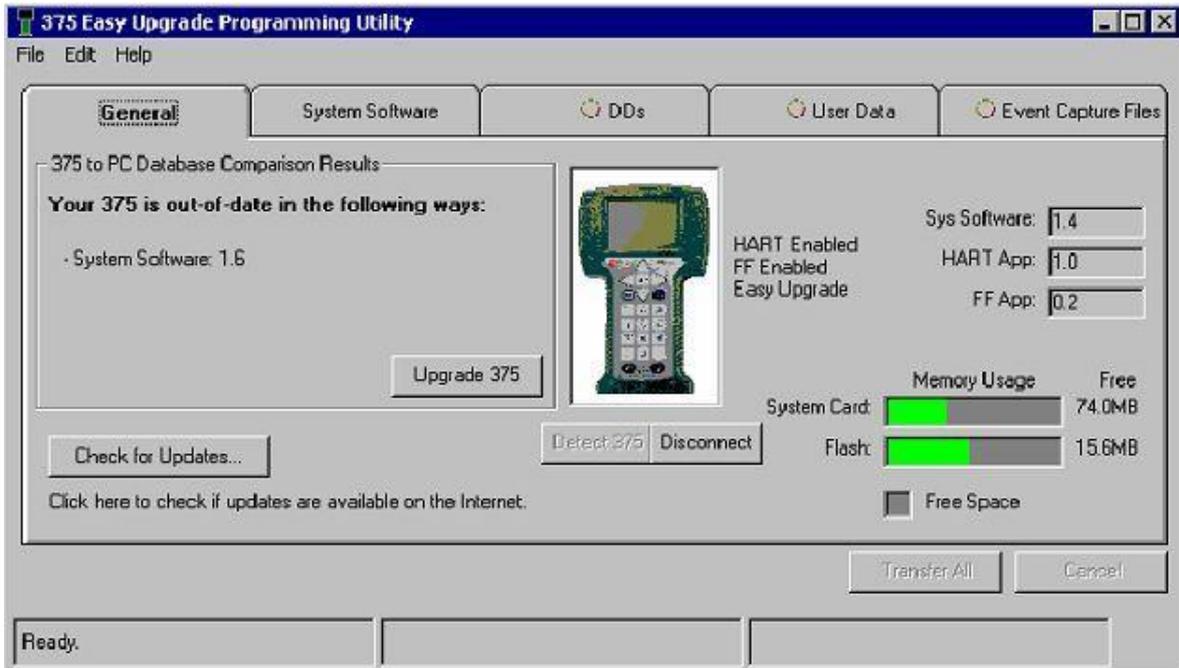
## 5 375 HandHeld & DD files

### 5.1 INSTALLATION

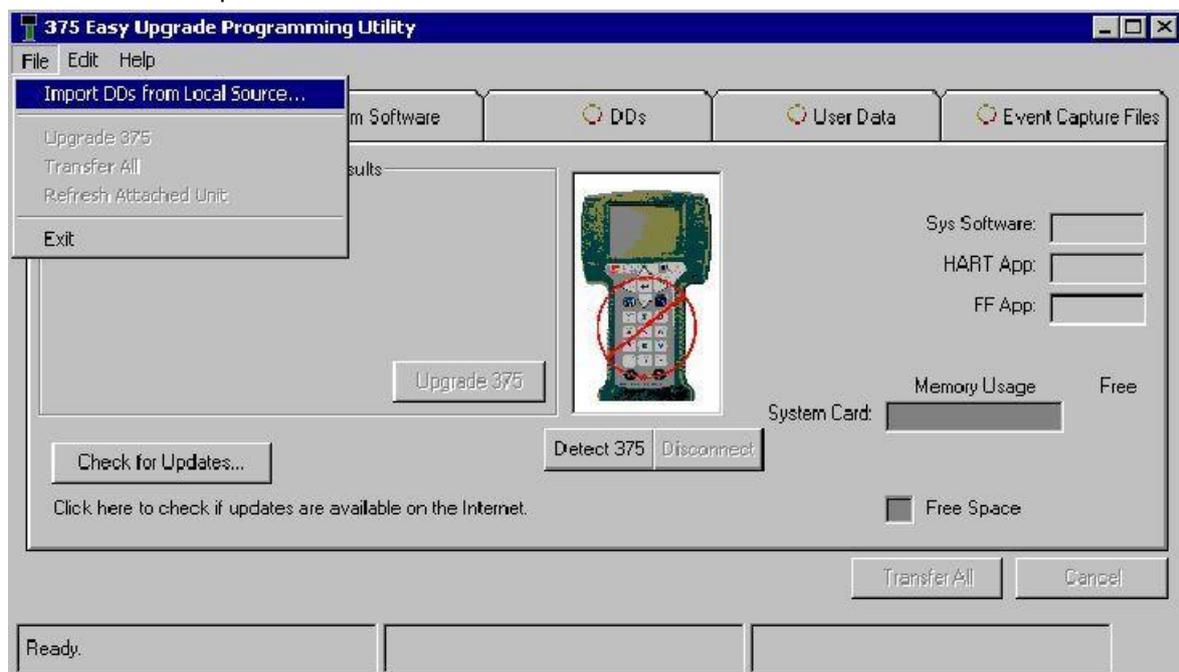
375 Easy Upgrade Programming Utility is required to upload/download files to/from the 375 Field Communicator.

- Start the Programming Utility.
- Verify that the 375 is up-to-date, checking and updating the HART Application for 375 if it is 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 FTC 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.

## 5.2 CONNECTION

- Connect the FTC 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.

## 5.3 MENU

(\*) → Method (i.e. wizard)

(\*\*) → Graphical element (e.g. gauge, graph, chart, etc.)

STI Menu	
1	Process Variables
2	System Setup 1/2
3	System Setup 2/2
4	Calibration
5	Advanced Tests
6	HART Communication
7	Diagnostics
8	Device Info

1 Process Variables	
1 - ActPos	51,59%
2 - ReqPos	51,55%
3 - Input	12,23 mA
4 - PI	4,64 bar
5 - POUT2	2,67 bar
6 - POUT1	2,8 bar

2 System Setup 1/2	
1	Operation Mode
2	Travel Control
3	Tuning
4	Cutoff Pressures
5	0 100% Position
6	Reset Settings

2.1 Operation Mode	
1 - Operation mode	Out Of Service

2.2 Travel Control	
1 - Open cutoff/limit	98%
2 - Open mode	Cut Off
3 - Close cutoff/limit	2%
4 - Close mode	Cut Off

2.3 Tuning	
1	PID
2	Velocity
3	Dampening

2.3.1 PID	
1 - Kp opening	5
2 - Kp closing	3,5
3 - Ti opening	11986 ms
4 - Ti closing	12812 ms
5 - Td opening	0 ms
6 - Td closing	0 ms
7 - Dead band	0,50%

2.3.2 Velocity	
1 - Open velocity limit	10 s/100%
2 - Open vel. lim. func.	Disabled
3 - Close velocity limit	10 s/100%
4 - Close vel. lim. func.	Disabled

2.3.3 Dampening	
1 - Dampening open	0
2 - Dampening close	0

2.4 Cutoff Pressures	
1 - Tight open press.	10 bar
2 - Tight close press.	10 bar

2.5 0-100% Position	
1 - Fail signal pos.	Close
2 - Reverse setpoint	Off

2.6 Reset Settings	
1 - Factory Settings	

3 System Setup 2/2
1 - Analog Output
2 - Position Sensor
3 - Split Range Input
4 - Manual Mode
5 - Input Char

3.1 Analog Output	
1 - Analog feedback	Actuator position
2 - DAC 4mA limit	165 bit
3 - DAC 20 mA limit	832 bit

3.2 Position Sensor	
1 - Pos. sens. Reading	2126
2 - Pos. sens. min	702
3 - Pos. sens. max	3462

3.3 Split Range Input	
1 - Lower range value	0%
2 - Upper range value	100%
3 - Split range func.	Enabled

3.4 Manual Mode	
1 - ActPos	51,59%
2 - ReqPos	51,55%
3 - Manual setpoint	51,55%

3.5 Input Char	
1 - Transfer function	Linear
2 - User curve Y1	0%
3 - User curve Y2	7%
...	
17 - User curve Y16	100%
User curve	(**)

4 Calibration	
1 - Fail signal pos.	Close
2 - Actuator volume	Don't know
3 - Actuator type	Double
4 - Boosters or QE	No
5 - Status	
6 - Calib. progr./err.	0
7 - Calib. data source	Factory calibration settings
8 - Device calibration	
9 - DP calibration data	

5 Advanced tests	
1 - Step Response	
2 - Valve Signature	

6 HART Communication	
1 - Tag	STID8FT
2 - Date	01/01/2000
3 - Descriptor	
4 - Message	
5 - Poll addr	0
6 - Dev id	9900001

7 Diagnostics	
1 - Device status	
2 - System status	
3 - Latched errors	
4 - Instant errors	
5 - Progr./Err. Details	(*)
6 - Clear latched err.	(*)

4.8 Device calibration	
1 - System Calibration	(*)
2 - Loop Current ADC Calibration	(*)
3 - Pressures Sensors Calibration	(*)

4.9 DP calibration data	
1 - DP offset at 10 %	0,00 bar
2 - DP offset at 20 %	0,00 bar
...	
9 - DP offset at 90 %	0,00 bar

5.1 Step Response	
1 - Step response wizard	(*)
2 - Step response	(**)

5.2 Valve Signature	
1 - Valve signature wizard	(*)
2 - Valve signature 1	(**)
3 - Valve signature 2	(**)

7.1 Device status	
1 - Device status	0x40

7.2 System status	
1 - System status	0x00000000

7.3 Latched errors	
1 - Latched errors 1	0x000000a0
2 - Latched errors 2	0x000000a0

7.4 Instant errors	
1 - Instant errors	0x00000000

## 6 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.

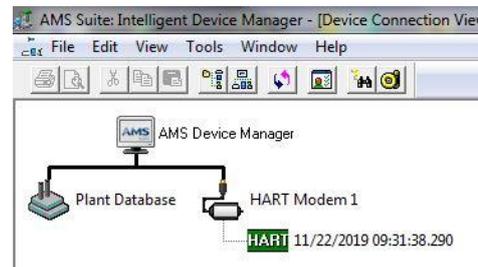
### 6.1 INSTALLATION

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.

### 6.2 CONNECTION

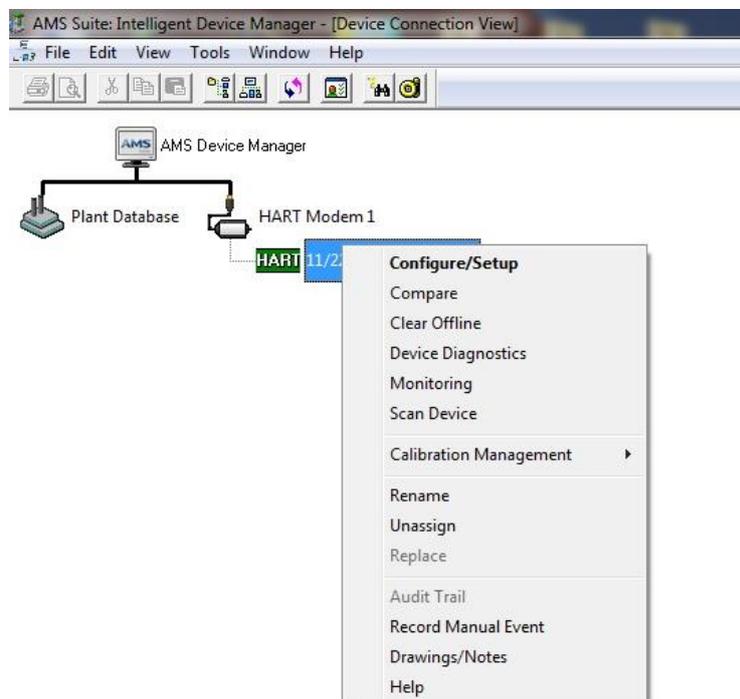
- Once your device has been connected (refer to AMS Installation Guide for information on how to connect a device to AMS) start AMS (refer to the AMS User's Guide if you need instructions).
- Open the Device Connection view, if it is not already open (View > Device Connection View).



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

### 6.3 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.



## 6.4 PROCESS VARIABLES

Selecting Monitoring... from the device's context menu displays the device's Process Variables screen, i.e., the faceplate. The faceplate reports summary information for the FTC device (primary variables, system status, errors...).

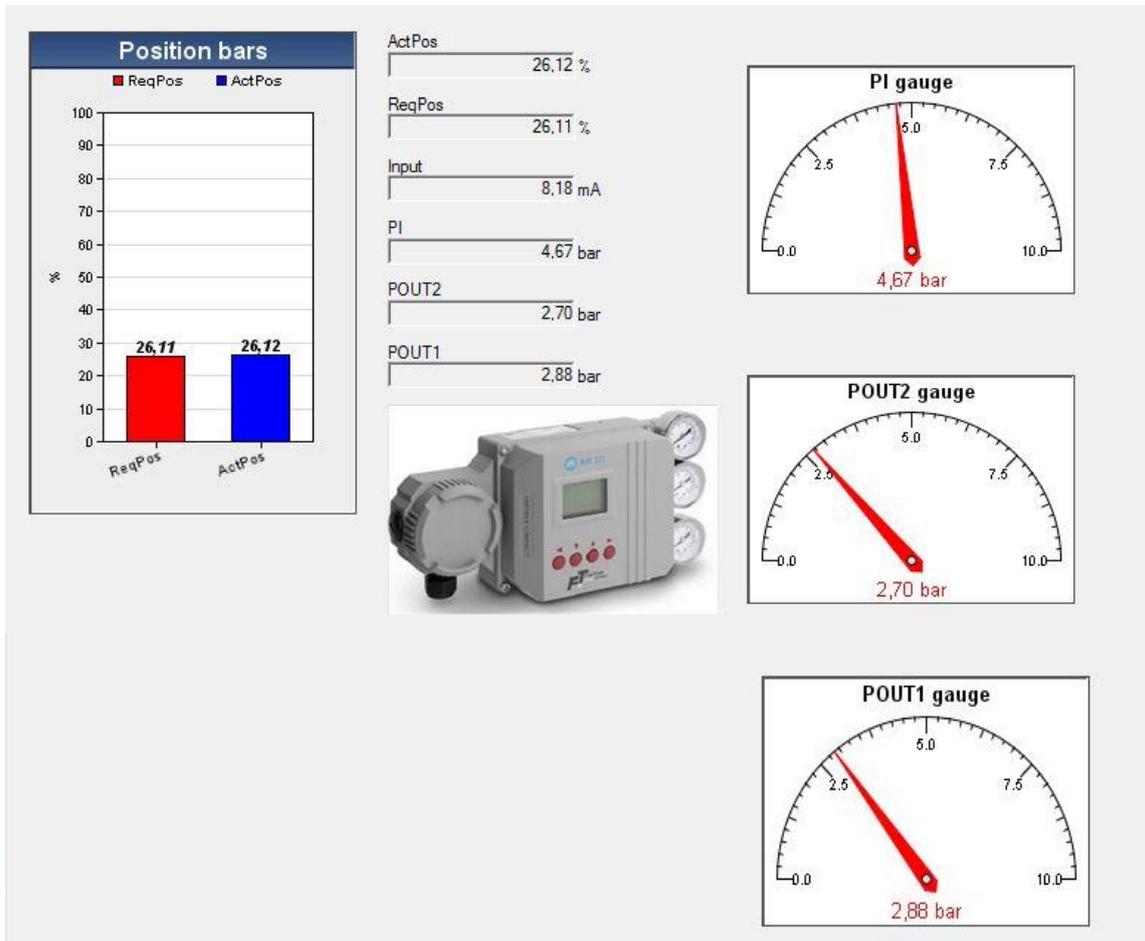


Figure 28: AMS Main Page



You can also double-click the FTC device icon from the Device Connection view to open the FTC faceplate and display the process variables.

## 6.5 CONFIGURE/SETUP

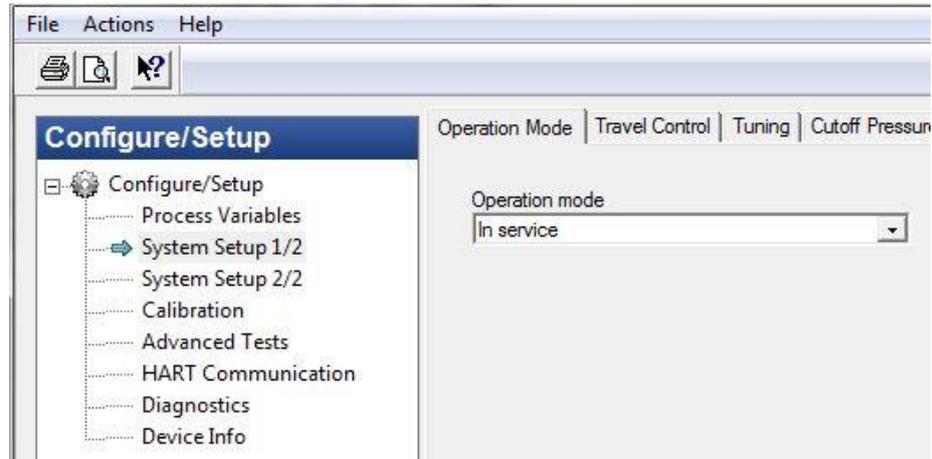
Selecting Configure/Setup from the device's context menu, displays the Configuration Properties screen.

### 6.5.1 System Setup 1 & 2

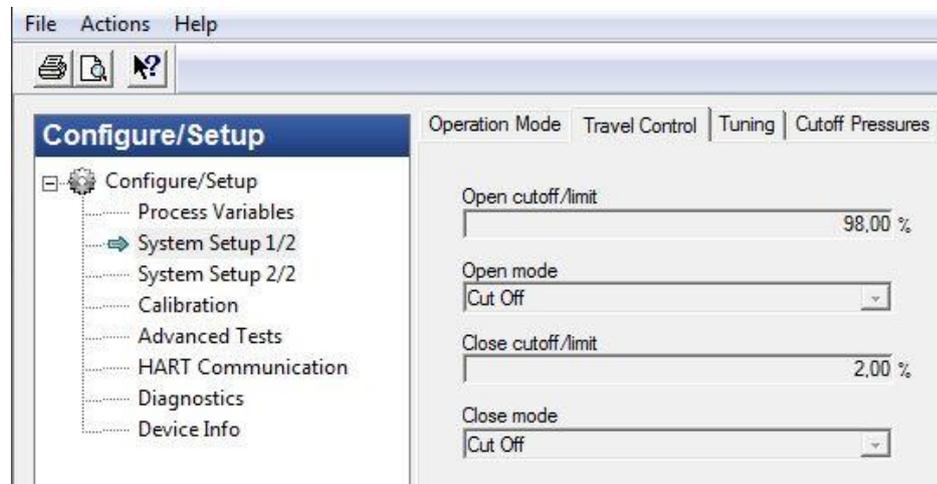
These windows show the tuning parameters that are part of 'Tuning' & standard 'System setup' area of the standard RemoteControl interface (refer to the FT IOM for explanation of the parameters).

In order to change parameters, the FTC must not be in 'In service' mode.

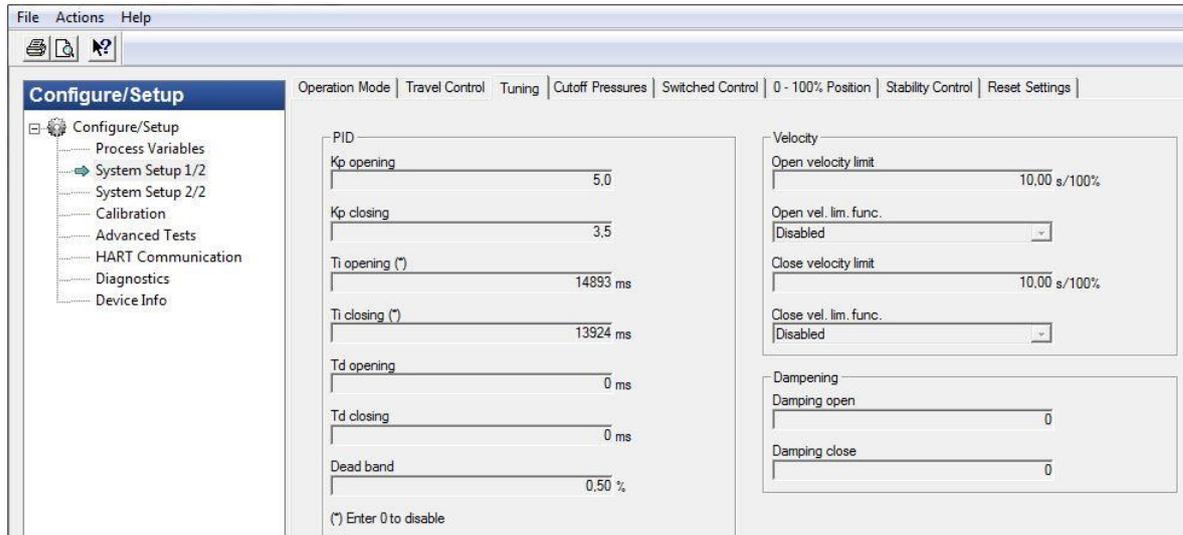
#### 6.5.1.1 Operation mode



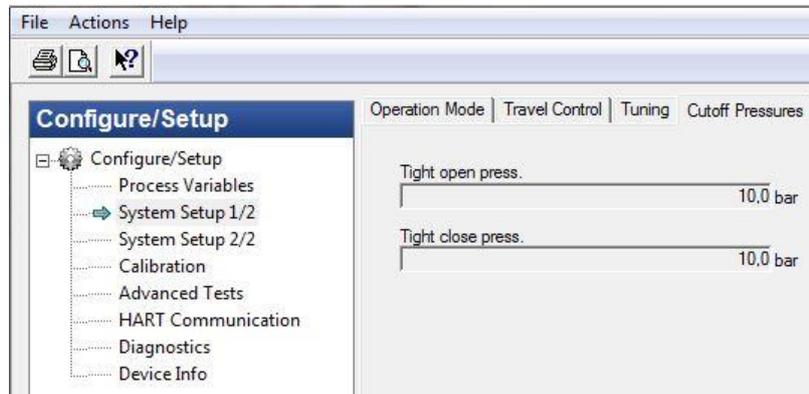
#### 6.5.1.2 Travel Control



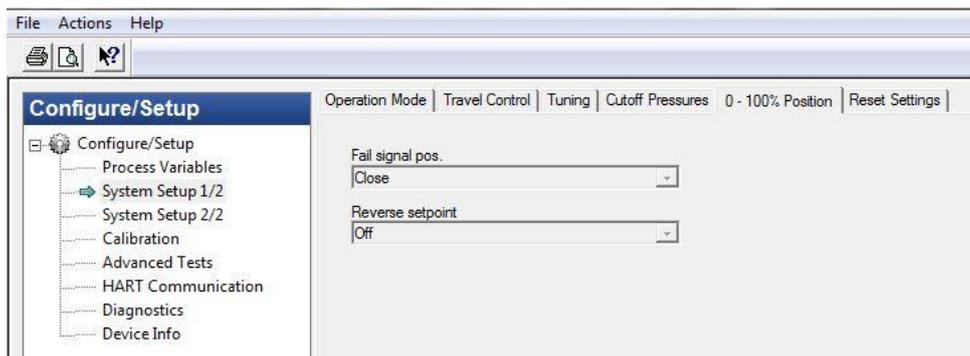
### 6.5.1.3 Tuning



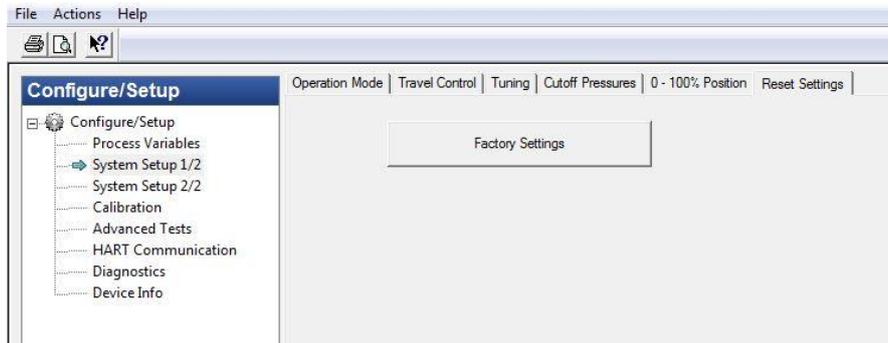
### 6.5.1.4 Cutoff Pressures



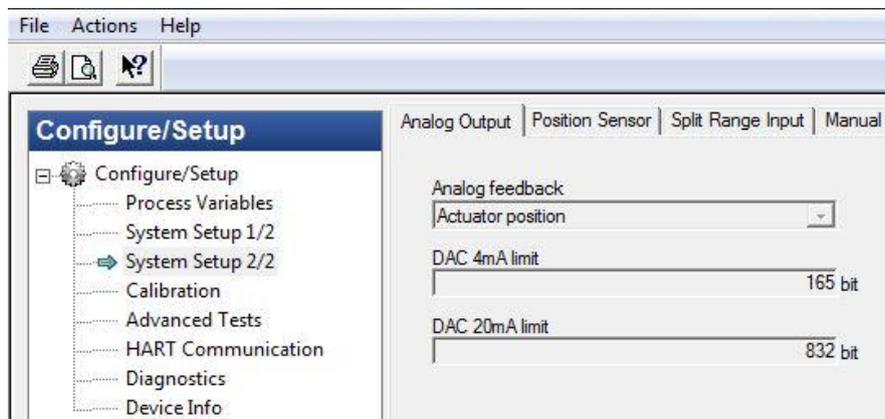
### 6.5.1.5 0 - 100% Position



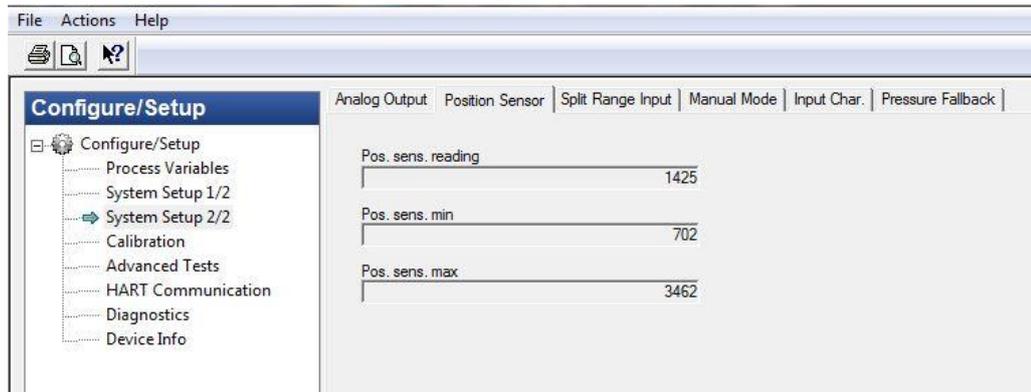
### 6.5.1.6 Reset Setting



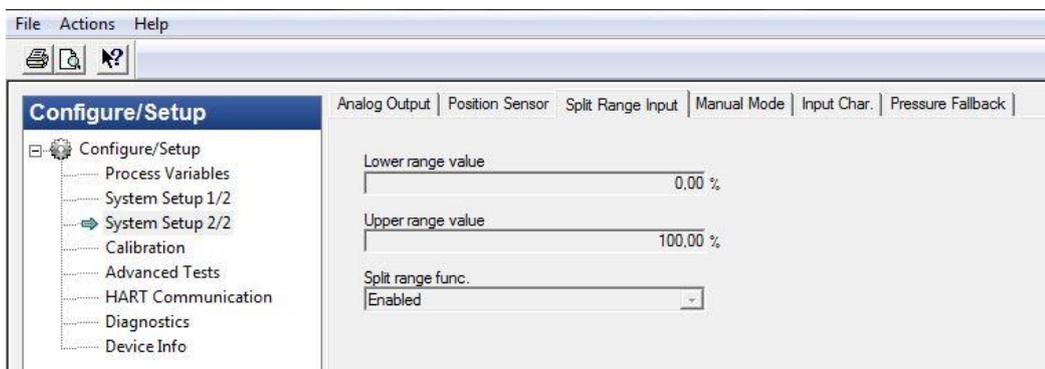
### 6.5.1.7 Analog Output



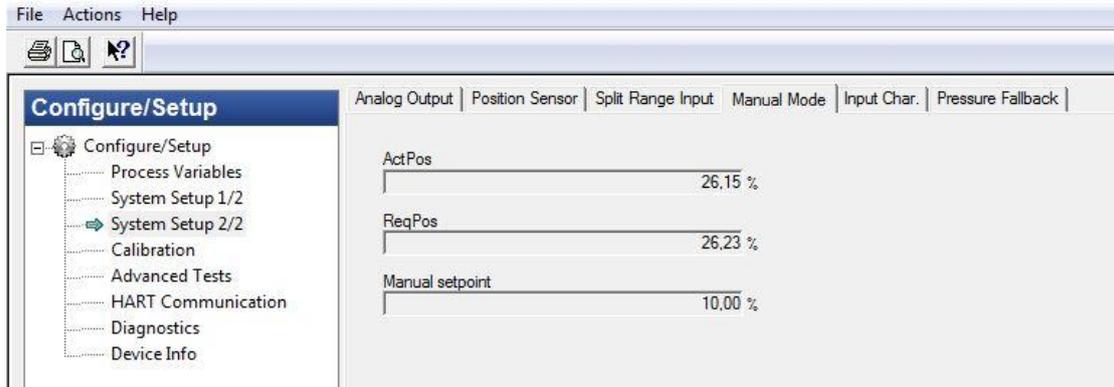
### 6.5.1.8 Position Sensor



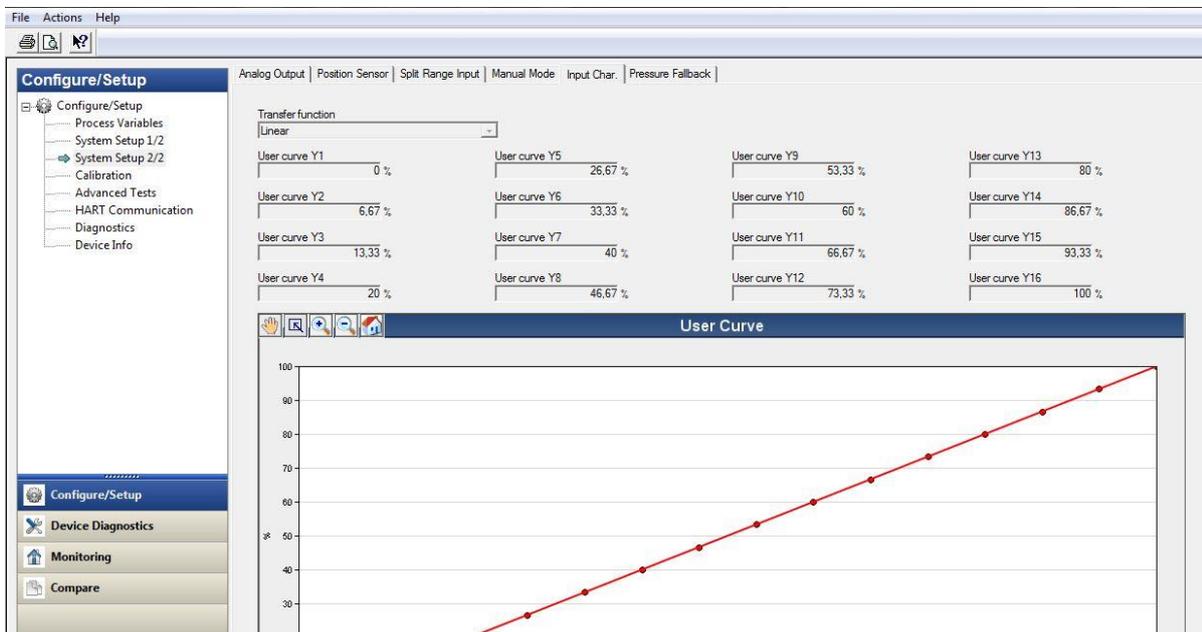
### 6.5.1.9 Split Range Input



### 6.5.1.10 Manual Mode

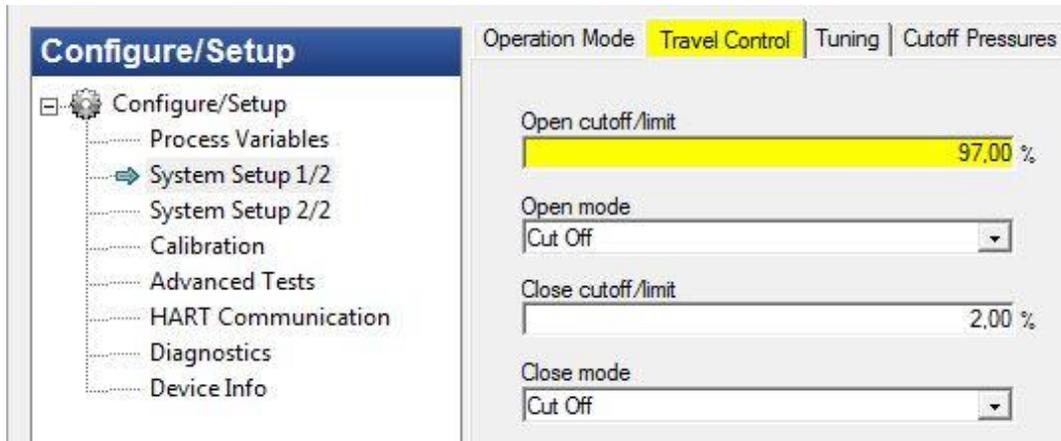


### 6.5.1.11 Input Char.



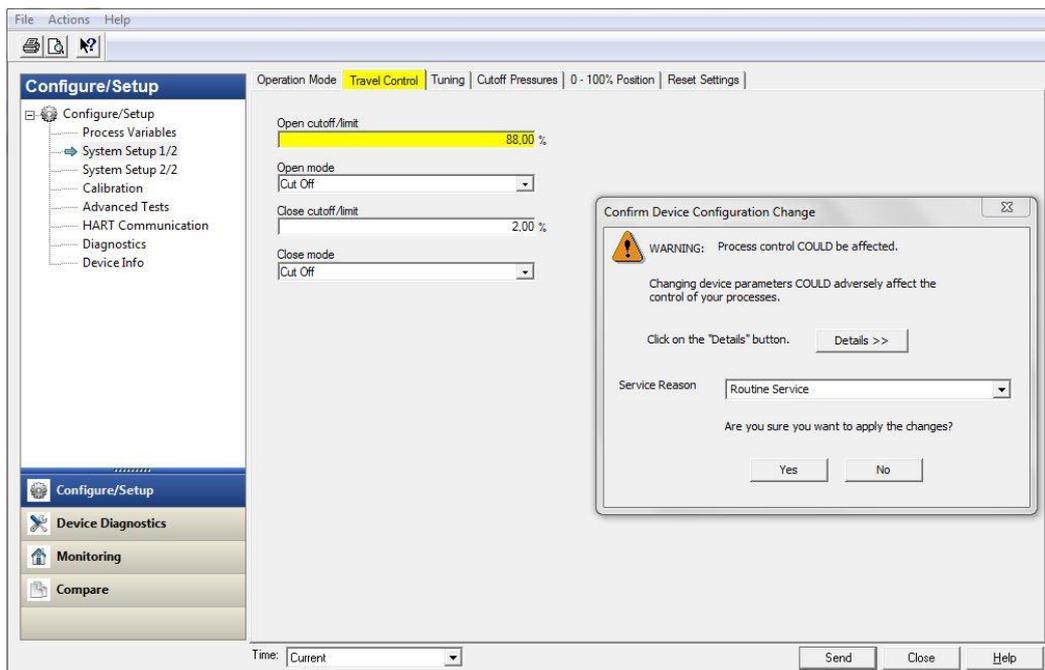
## 6.6 EDIT A CONFIGURATION PARAMETER

In order to change the setting of the FTC positioner is possible to change the value of one of the fields shown in the window.



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

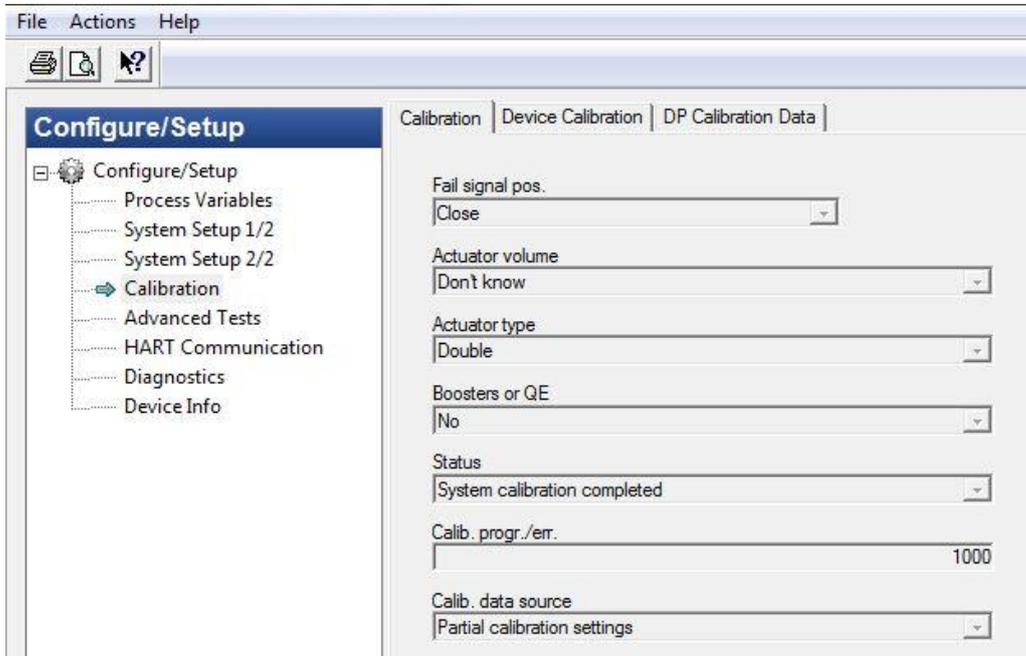
A confirmation window appears, click on Yes to apply the changes.



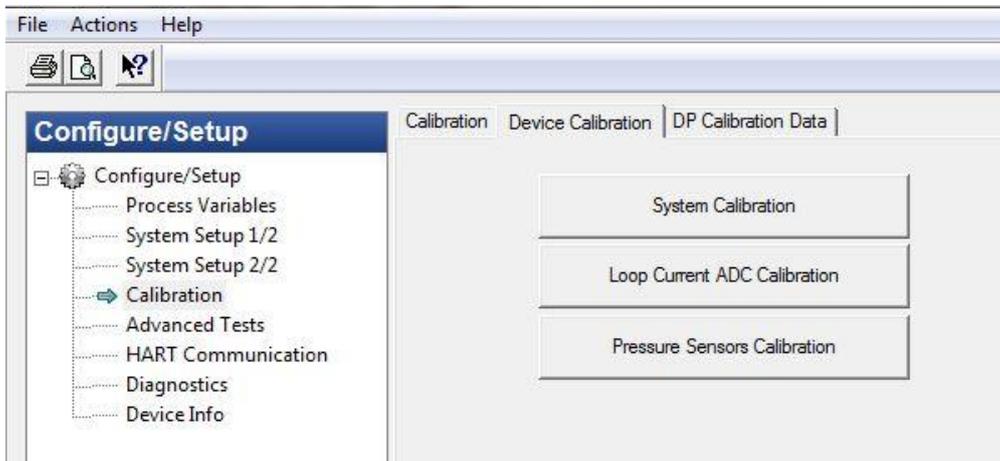
## 6.7 START THE CALIBRATION

In Configure/Setup click on Calibration to access the Calibration menus and wizards.

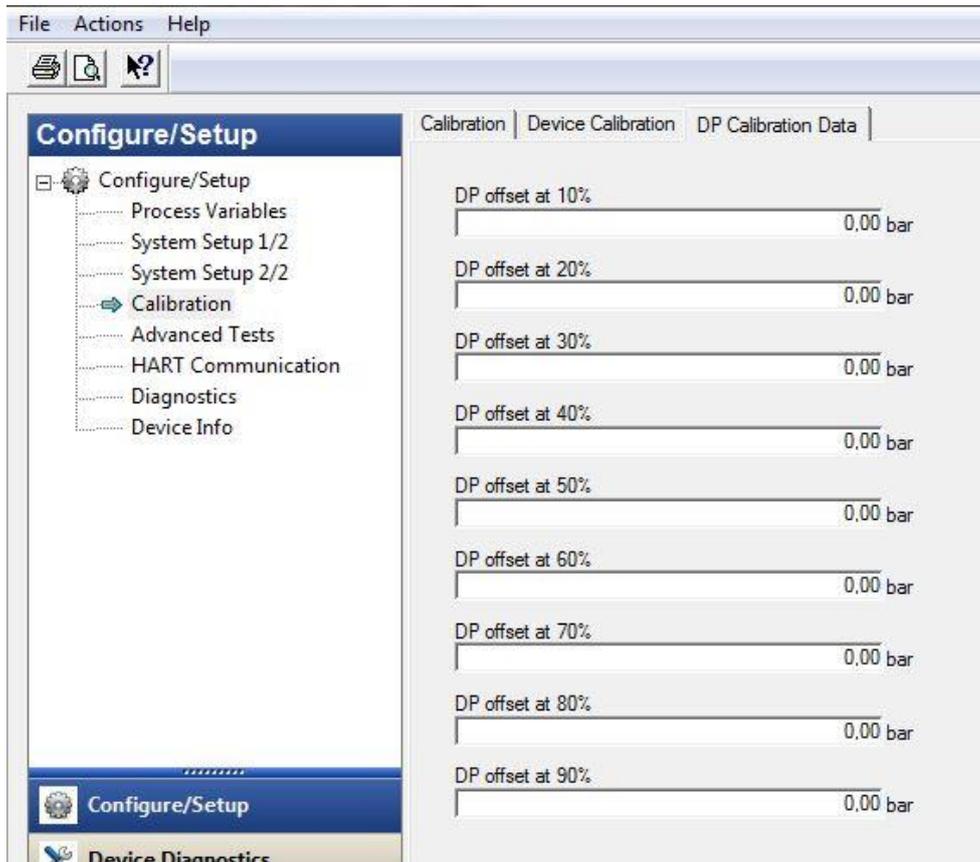
### 6.7.1 Calibration



### 6.7.2 Device Calibration



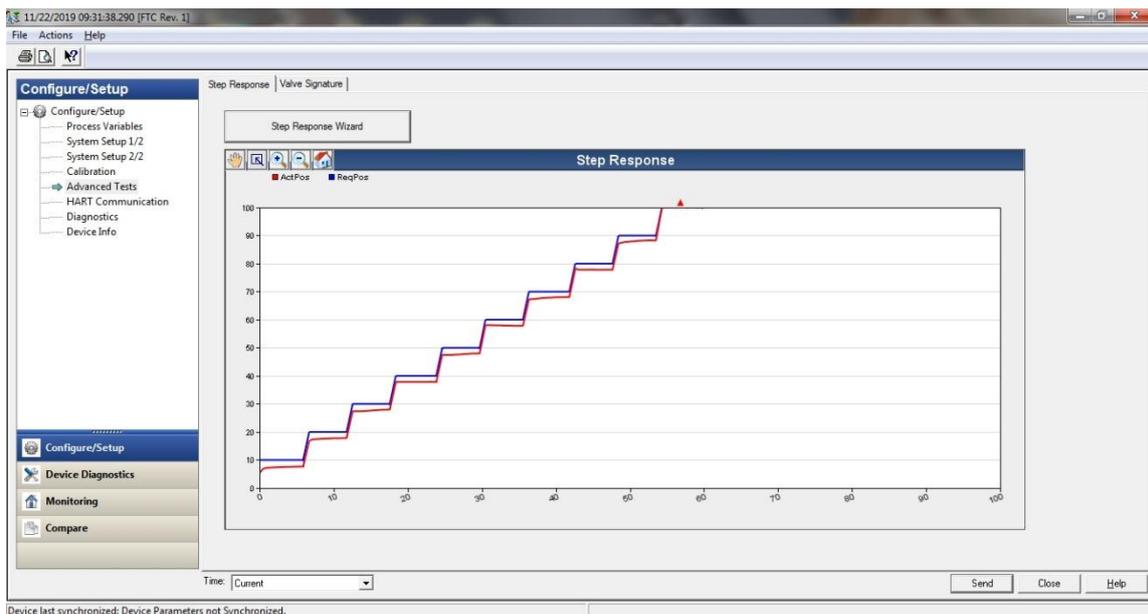
### 6.7.3 DP Calibration Data



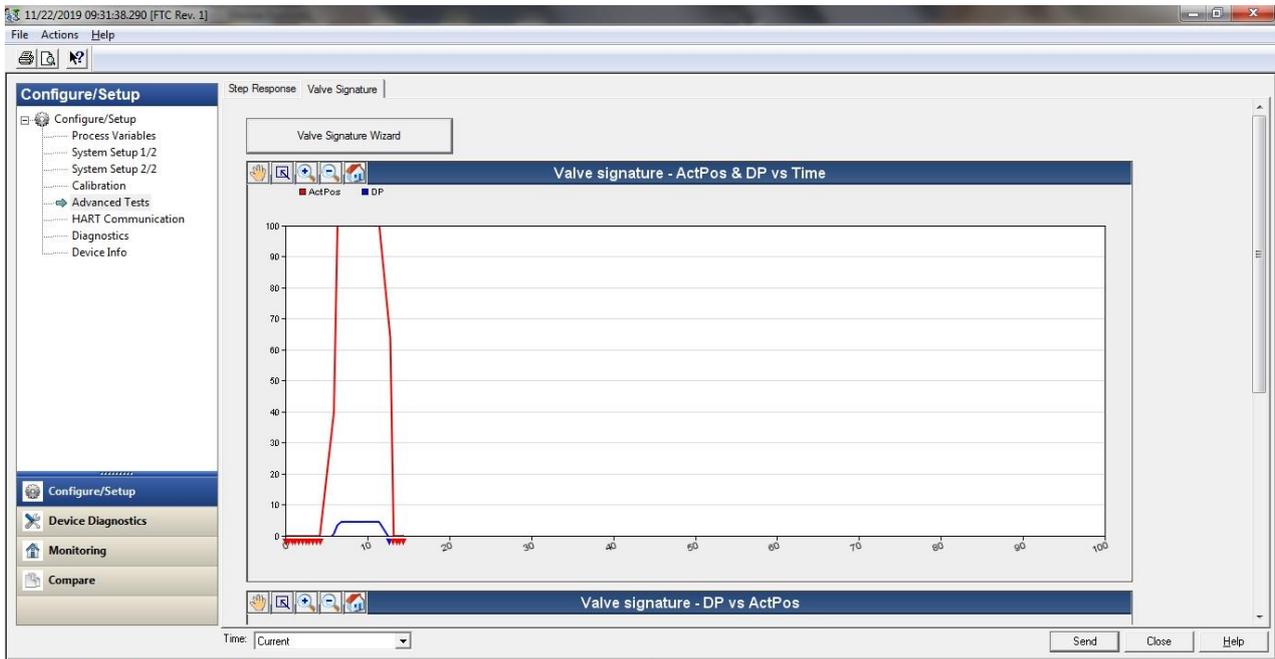
## 6.8 ADVANCED TESTS

In Configure/Setup click on Advanced Tests to access the advanced tests wizards.

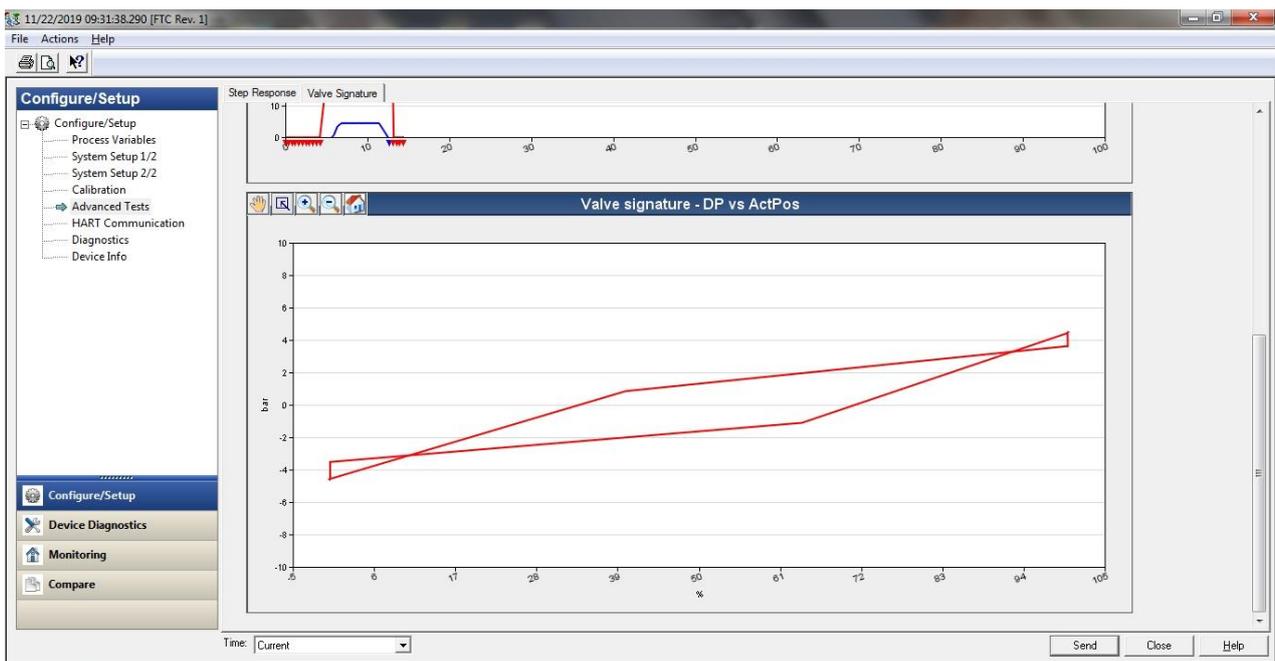
### 6.8.1 Step Response



## 6.8.2 Valve Signature



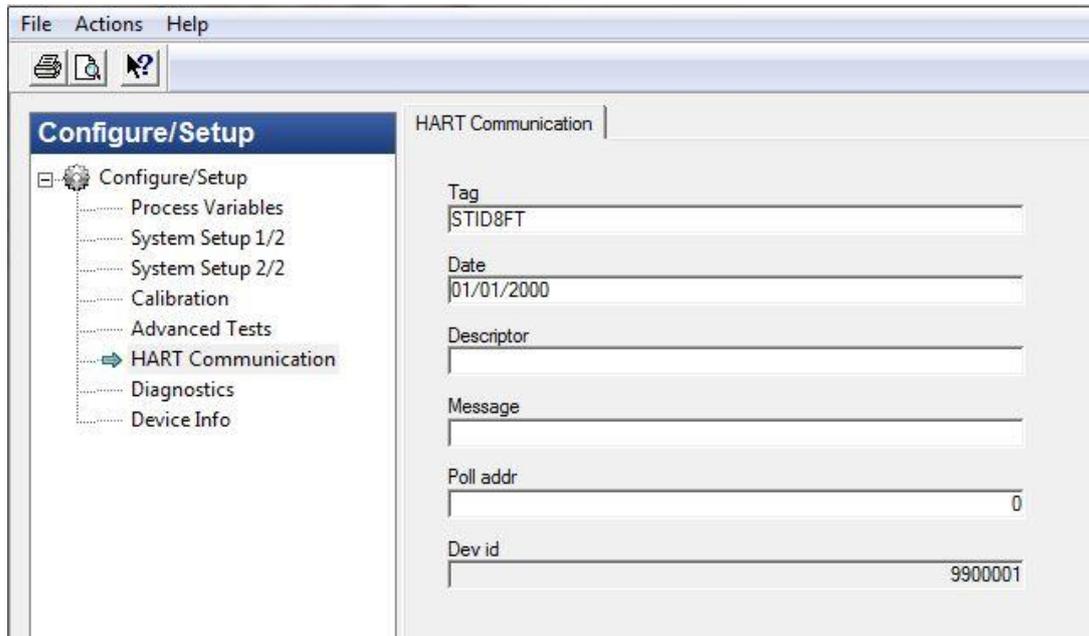
Device last synchronized: Device Parameters not Synchronized.



Device last synchronized: Device Parameters not Synchronized.

## 6.9 HART COMMUNICATION

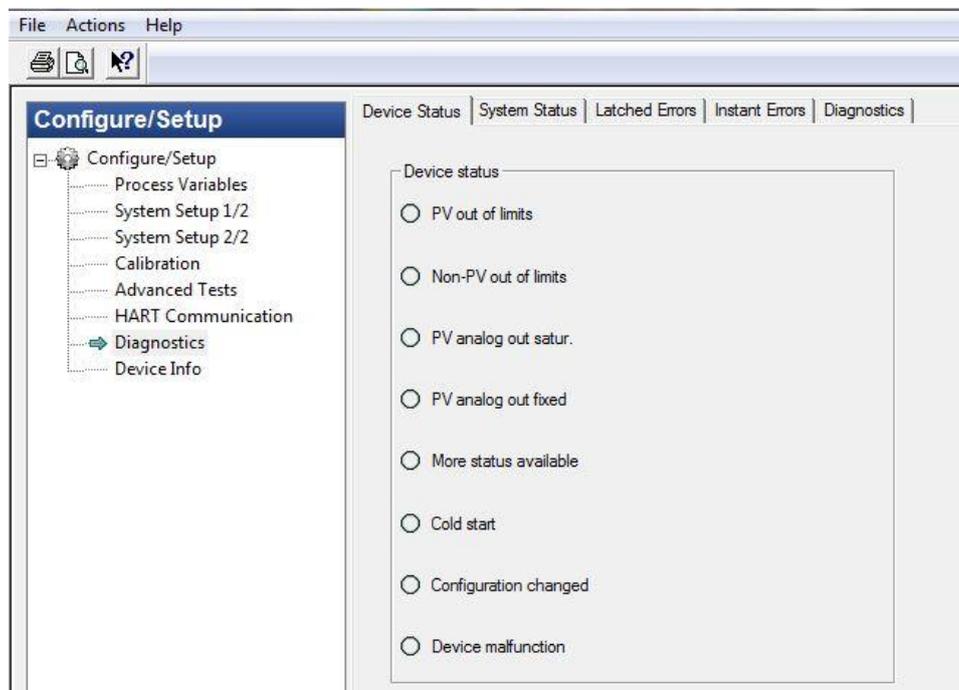
In Configure/Setup click on HART Communication to view information regarding HART protocol.



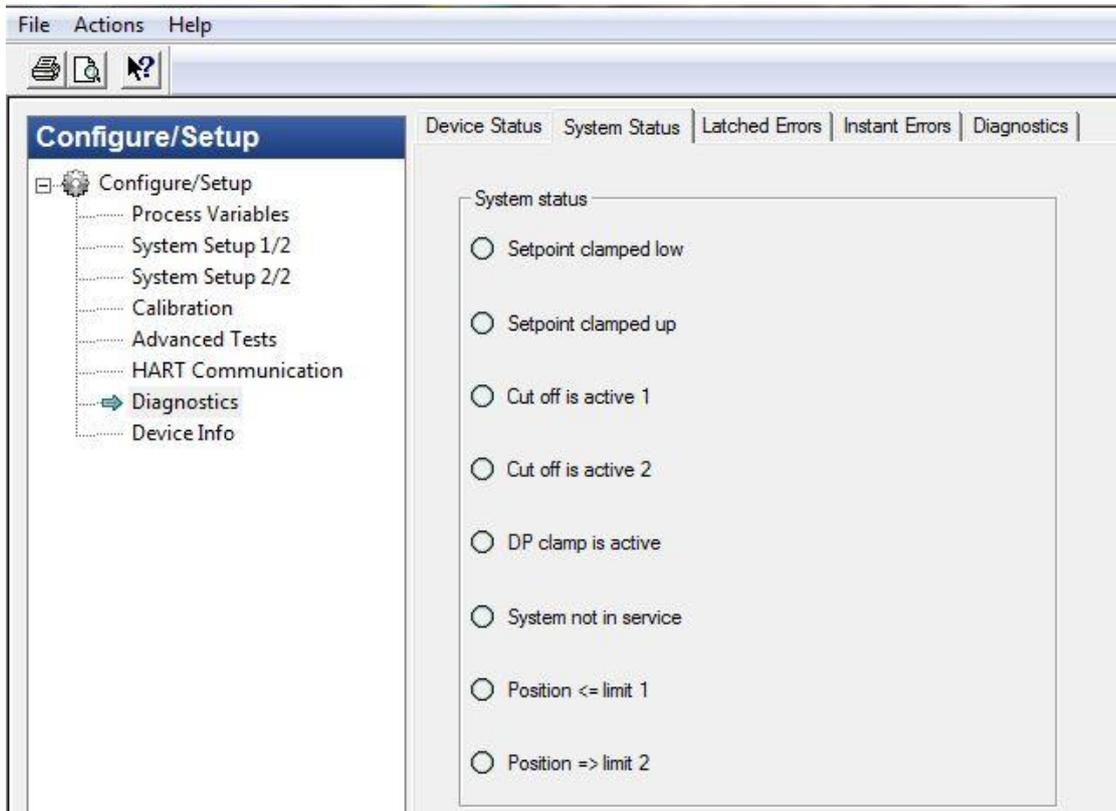
## 6.10 DIAGNOSTICS

In Configure/Setup click on Diagnostics to access the Diagnostics menus and wizards.

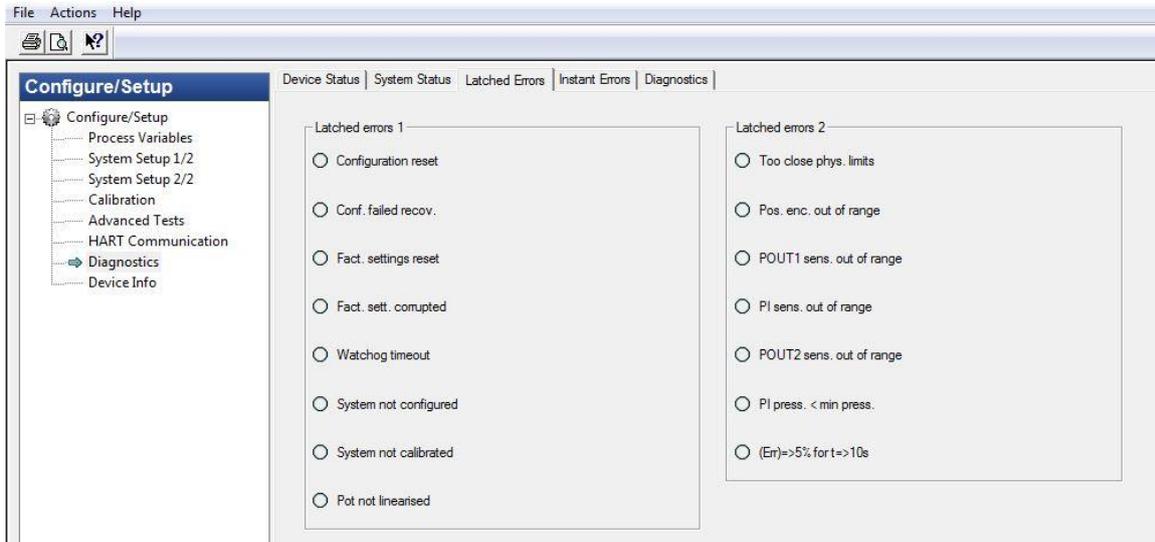
### 6.10.1 Device Status



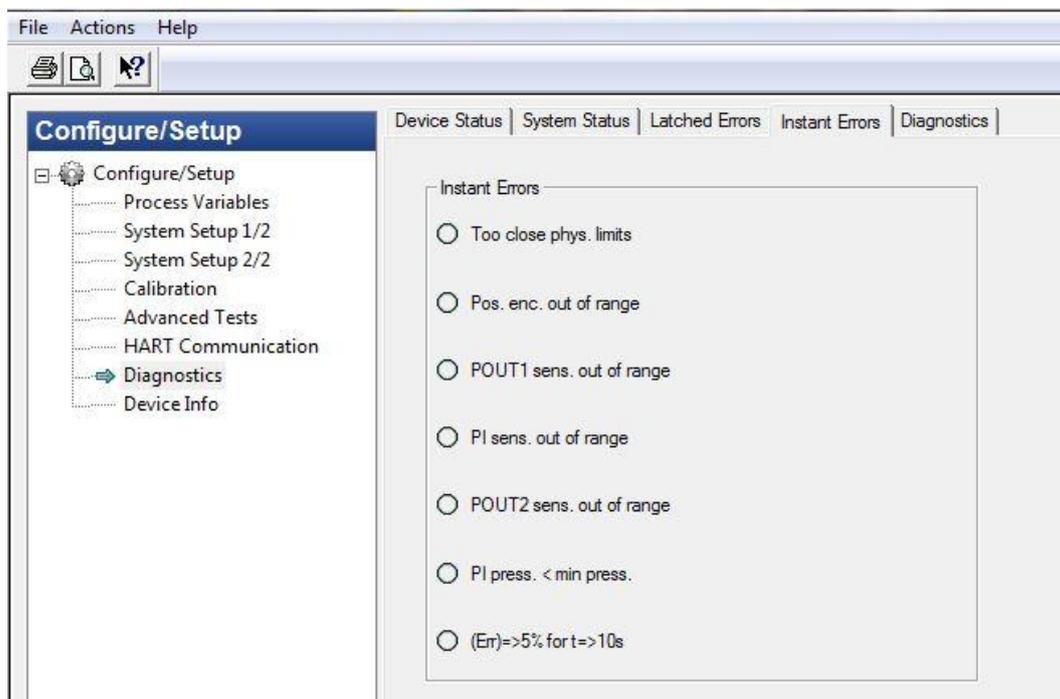
## 6.10.2 System Status



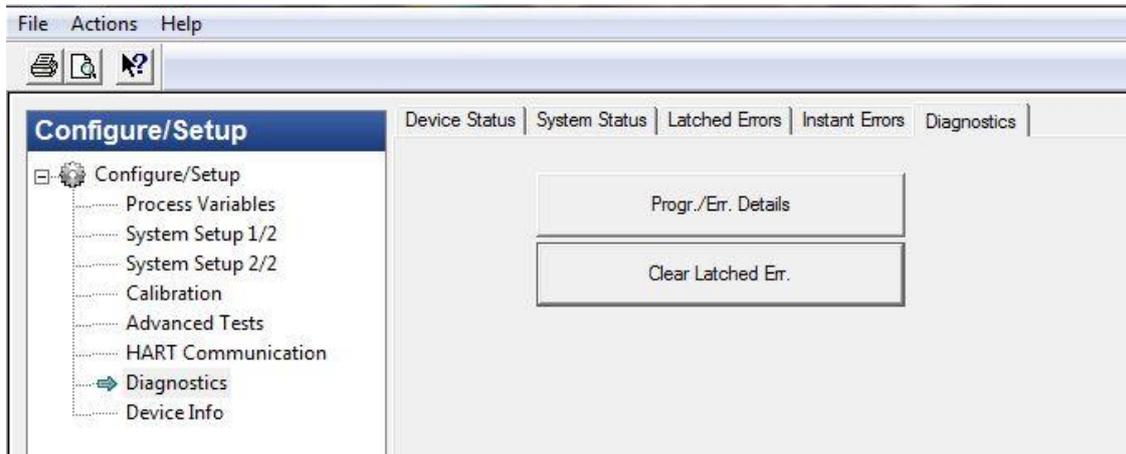
### 6.10.3 Latched Errors



### 6.10.4 Instant Errors

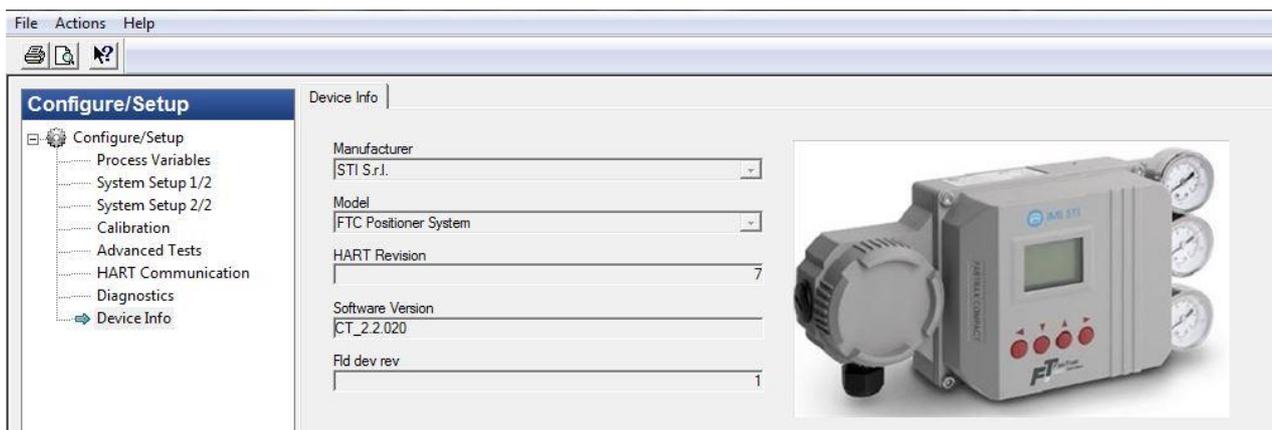


## 6.10.5 Diagnostics



## 6.11 DEVICE INFO

In Configure/Setup click on Device Info to view information about FTC.



## 7 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.

### 7.1 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	

### 7.2 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)
- ....

### 7.3 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] "Watchdog timeout", "Error [latched] - a watchdog 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

### 7.4 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"

### 7.5 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 activated", "Status - digital input has activated system override"}
Bits 10 and 11 change the 'More status available' bit
```

## 8 Self-tune 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...
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...
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.	
1000	Self tune complete!	The self tune completed successfully with no errors

## 9 Error codes

111	Position sensor out of range.	<p>The position sensor is not within its measurable range. Please check the alignment of the position sensor to the actuator travel.</p> <p>Other possible reasons:</p> <ul style="list-style-type: none"> <li>• The position encoder is electrically disconnected.</li> <li>• The position encoder is faulty.</li> </ul>
121	Movement took too long.	<p>The actuator did not move quickly enough in the positive direction</p> <p>Possible reasons:</p> <ul style="list-style-type: none"> <li>• The actuator is too big for the positioner to control directly.</li> <li>• 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.</li> </ul>
131	Movement timed out	<p>The actuator did not move away from its positive end stop.</p> <p>Possible reasons:</p> <ul style="list-style-type: none"> <li>• The position sensor is mechanically disconnected.</li> <li>• The position sensor is electrically disconnected.</li> <li>• The air supply failed during the test.</li> <li>• A fault occurred with the positioner.</li> <li>• While trying to find the actuator limits, the actuator reached.</li> <li>• the upper end stop, but then didn't move away from the upper end stop.</li> </ul>
141	Movement took too long.	<p>The actuator did not move quickly enough in the negative direction</p> <p>Possible reasons:</p> <ul style="list-style-type: none"> <li>• The air supply failed during the test.</li> <li>• An external force is causing abnormal movement of the actuator.</li> </ul>
151	Position sensor out of range!	<p>The position sensor went out of range during the self tuning.</p> <p>Possible reasons:</p> <ul style="list-style-type: none"> <li>• 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.</li> <li>• The position sensor became electrically disconnected during the</li> <li>• test. Please check the electrical connections before continuing.</li> </ul>
152	Position sensor stroke range too small!	<p>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.</p>
174	The pneumatic system is unstable on this actuator.	<p>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.</p>

		<p>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 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.</p>
176	Actuator movement took too long.	<p>The actuator did not move quickly enough in the positive direction or stopped before it had reached its end stop. Possible reasons:</p> <ul style="list-style-type: none"> <li>• The actuator air supply failed during the test.</li> <li>• The actuator is single acting, and but the single/double acting selector plate on the circuit board is in double acting mode.</li> </ul>
178	Actuator did not stop at end stop.	<p>The actuator came close to reaching the travel limit but did not stop. Possible reasons:</p> <ul style="list-style-type: none"> <li>• There is too much noise in the system.</li> <li>• The air supply is unstable.</li> <li>• An external force is moving the actuator.</li> </ul>
180	Internal calibration failed.	<p>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.</p>
182	Actuator movement took too long.	<p>The actuator did not move quickly enough in the negative direction or stopped before it had reached its end stop. Possible reasons:</p> <ul style="list-style-type: none"> <li>• The actuator air supply failed during the test.</li> </ul>
184	Actuator did not stop at end stop.	<p>The actuator came close to reaching the travel limit but did not stop. Possible reasons:</p> <ul style="list-style-type: none"> <li>• There is too much noise in the system.</li> <li>• The air supply is unstable."</li> <li>• An external force is moving the actuator.</li> </ul>
186	Internal calibration failed.	<p>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.</p>
206	Actuator took too long or did not move.	<p>The actuator did not return to 0% within in the required time. Possible reasons:</p> <ul style="list-style-type: none"> <li>• The actuator volume is too large for the system to control "directly."</li> <li>• The position sensor linkage is faulty or has become disconnected.</li> <li>• There is a fault with the position sensor.</li> </ul> <p>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.</p>

211	Actuator took too long or did not move.	The actuator did not reach the required threshold in the required time. Possible reasons: <ul style="list-style-type: none"> <li>• The actuator is single acting, but the system is configured as "double acting."</li> <li>• The actuator volume is too large for the system to control "directly."</li> </ul>
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: <ul style="list-style-type: none"> <li>• There is a fault with the position sensor.</li> <li>• An external force is moving the actuator.</li> </ul>
231	Actuator took too long or did not move.	The actuator did not reach the required threshold in the required time Possible reasons: <ul style="list-style-type: none"> <li>• The actuator is single acting, but the system is configured as double acting.</li> <li>• The actuator volume is too large for the system to control directly</li> </ul>
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: <ul style="list-style-type: none"> <li>• There is a fault with the position sensor.</li> <li>• An external force is moving the actuator.</li> </ul>
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: <ul style="list-style-type: none"> <li>• The position sensor linkage is faulty or has become disconnected.</li> <li>• There is a fault with the position sensor.</li> <li>• An external force is moving the actuator.</li> </ul>
312	Unstable movement during self tune.	The actuator did not move correctly with automatically assigned parameters Possible reasons: <ul style="list-style-type: none"> <li>• Supply pressure is inconsistent during the test"</li> <li>• 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.</li> </ul>
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: <ul style="list-style-type: none"> <li>• The position sensor linkage is faulty or has become disconnected.</li> <li>• There is a fault with the position sensor.</li> <li>• An external force is moving the actuator.</li> </ul>
331	Actuator failed to move.	The actuator failed to move during a critical point of the self tuning. Possible reasons:

		<ul style="list-style-type: none"> <li>• The position sensor linkage is faulty or has become disconnected.</li> <li>• There is a fault with the position sensor.</li> </ul>
341	The actuator did not settle correctly.	<p>The actuator did not settle at when trying to move to a fixed point.</p> <p>Possible reasons:</p> <ul style="list-style-type: none"> <li>• The actuator is too small for the system to control."</li> <li>• The inner loop gain is too high. Contact your technical support representative.</li> </ul>
351	Could not move actuator.	<p>The actuator could not be moved while trying to measure the actuator friction.</p> <p>Possible reasons:</p> <ul style="list-style-type: none"> <li>• The position sensor linkage is faulty or has become disconnected.</li> <li>• The friction of the actuator is too great for automatic tuning.</li> <li>• An external force is jamming the actuator.</li> <li>• The air supply failed during the test.</li> </ul>
361	Could not move actuator.	<p>The actuator could not be moved while trying to measure the actuator friction.</p> <p>Possible reasons:</p> <ul style="list-style-type: none"> <li>• The position sensor linkage is faulty or has become disconnected.</li> <li>• The friction of the actuator is too great for automatic tuning.</li> <li>• An external force is jamming the actuator.</li> <li>• The air supply failed during the test.</li> </ul>
381	Actuator did not move	<p>The actuator did not move correctly to the start of a characterization test.</p> <p>Possible reasons:</p> <ul style="list-style-type: none"> <li>• The position sensor linkage is faulty or has become disconnected.</li> <li>• The air supply failed during the test.</li> </ul>
386	Actuator did not settle.	<p>The actuator did not settle while moving to the start of a characterization test.</p> <p>Possible reasons:</p> <ul style="list-style-type: none"> <li>• The actuator is too small for the system to control.</li> <li>• The air supply is unstable.</li> </ul>
391	Could not move actuator.	<p>The actuator could not be moved while trying to measure the actuator friction.</p> <p>Possible reasons:</p> <ul style="list-style-type: none"> <li>• The position sensor linkage is faulty or has become disconnected.</li> <li>• The friction of the actuator is too great for automatic tuning.</li> <li>• An external force is jamming the actuator.</li> <li>• The air supply failed during the test.</li> </ul>
396	Could not move actuator.	<p>The actuator could not be moved while trying to measure the actuator friction.</p> <p>Possible reasons:</p> <ul style="list-style-type: none"> <li>• The position sensor linkage is faulty or has become disconnected.</li> <li>• The friction of the actuator is too great for automatic tuning.</li> <li>• An external force is jamming the actuator.</li> <li>• The air supply failed during the test.</li> </ul>

411	Actuator did not settle.	The actuator did not settle correctly at the start of a tuning test. Possible reasons: <ul style="list-style-type: none"> <li>• The actuator is too small for the system to control.</li> <li>• The air supply is unstable.</li> </ul>
416	Actuator did not settle.	The actuator did not settle correctly at the start of a tuning test. Possible reasons: <ul style="list-style-type: none"> <li>• The actuator is too small for the system to control.</li> <li>• The air supply is unstable.</li> </ul>
422	Could not move actuator.	The actuator could not be moved close enough to the start point of a tuning test. Possible reasons: <ul style="list-style-type: none"> <li>• The actuator is too small for automatic tuning (tune manually).</li> <li>• The air supply failed during the test.</li> </ul>
426	Actuator failed to move.	The actuator did not move during a tuning test. Possible reasons: <ul style="list-style-type: none"> <li>• The actuator is too large/slow for automatic tuning.</li> <li>• The position sensor linkage is faulty or has become disconnected.</li> <li>• The air supply failed during the test.</li> </ul>
431	Actuator did not settle.	The actuator did not settle during a tuning test. Possible reasons: <ul style="list-style-type: none"> <li>• The actuator is too large/slow for automatic tuning.</li> <li>• The position sensor linkage is faulty or has become disconnected.</li> <li>• The actuator is too small for the system to control.</li> <li>• The air supply is unstable.</li> </ul>
432	Insufficient actuator movement.	The actuator did not move enough during a tuning test. Possible reasons: <ul style="list-style-type: none"> <li>• The actuator is single acting but the system is configured for double acting actuators.</li> <li>• The actuator is too large/slow for automatic tuning.</li> <li>• The air supply failed during the test.</li> <li>• An external force is jamming the actuator.</li> </ul>
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: <ul style="list-style-type: none"> <li>• What type of actuator you are using.</li> <li>• Whether you have any boosters fitted in the supply lines.</li> <li>• The progress indicator value</li> <li>• Any other details about the application</li> </ul> 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: <ul style="list-style-type: none"> <li>• What type of actuator you are using.</li> </ul>

		<ul style="list-style-type: none"> <li>• Whether you have any boosters fitted in the supply lines.</li> <li>• The progress indicator value</li> <li>• Any other details about the application</li> </ul> <p>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.</p>
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.

**IMI STI - Headquarters**

Via Dei Caravaggi 15  
24040 Levate (BG)  
Italy

Tel. +39 035 2928.2  
Fax +39 035 2928.247

**IMI STI – Sales Office**

Via San Francesco 18  
29017 Fiorenzuola d'Arda (PC)  
Italy

Tel. +39 035 2928.2  
Fax +39 0523 1715.295

**IMI Critical Engineering**

Lakeside, Solihull Parkway  
Birmingham Business Park  
Birmingham B37 7XZ  
United Kingdom

Tel. +44 (0)121 717 3700  
Fax +44 (0)121 717 3701

[www.imi-critical.com](http://www.imi-critical.com)  
[imisti.sales@imi-critical.com](mailto:imisti.sales@imi-critical.com)