ITVC Series

Intelligent Total Valve Controller

Annex A: Partial Stroke Test (PST)

DVG AUTOMATION

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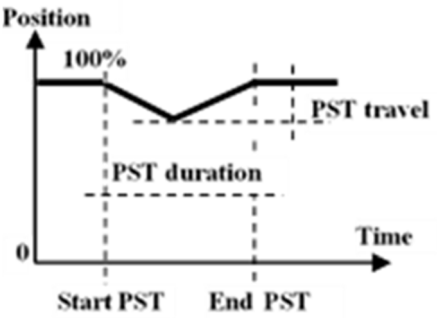

PST cycle

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IOM-ITVC-PST	AA	GR	16/02/2016	03

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DVG *ITVC Series – "Intelligent Total Valve Controller"*

ANNEX A: Partial Stroke Test (PST)

1 Introduction

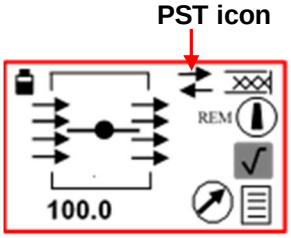
This document, **ITVC Annex A: PST function**, contains the information to set and use of the **PST function** (**P**artial **S**troke **T**est) of the **ITVC** **I**ntelligent **T**otal **v**alve **C**ontroller. It is supplied to the user together with the manual **IOM-ITVC-Basic** only if the **ITVC** has the option "**PST function**".

The "Annex A: PST function" should be considered an integral part of the document IOM-ITVC-Basic for actuator with PST function.
Refer to document "IOM-ITVC-Basic" for the complete Installation, Operation and Maintenance instructions of the ITVC
The "Annex A: PST function", together with the "IOM-ITVC-Basic" is an integral part of the apparatus and must be carefully read, understood and consulted before use and must be retained for future reference

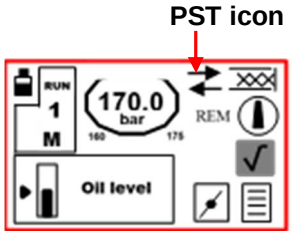
WARNING!	
⚠	**Do not install, operate, or maintain an ITVC without first being fully trained and qualified in valve, actuator and accessory installation, operation and maintenance, and carefully reading and understanding the contents of this manual, including all safety cautions and warnings. For any questions regarding these instructions, contact the factory before proceeding.**

With reference to the manual **IOM-ITVC-Basic**, chapter ITVC HMI, paragraph **HOME** page, the PST function is available only if the ITVC display shows the **icon** ⇄ .
The PST options in the **PST MENU** allow setting, initiating and checking the PST operation.

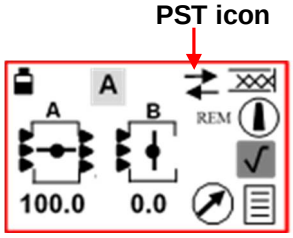
The below figures show the **HOME** page, **standard, HPU** and **HIPPS types** of the ITVC HMI. Refer to IOM-ITVC-Basic, ITVC HMI chapter, to view the HOME pages features. Refer to the above IOM to find the instructions relevant to **MENU chart** and **menu operations.**



HOME page **standard type**



HOME page **HPU type**



HOME page, **HIPPS type**

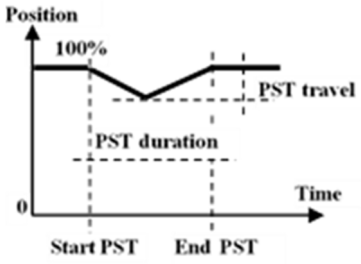
The procedures described in this document use **HOME** page **standard type**.
The procedures to navigate in the menu are the same if the **HOME** page is **HPU** and **HIPPS type**. Only the **HOME** page changes.

2 PST (Partial Stroke Test)

The function **PST** (**P**artial **S**troke **T**est) is used to check the actuator and valve operation **on-line**, while they are **in service** in the pipeline. The test consists in driving the actuator to perform a small travel near to fully open (or closed) position and then to compare the collected data with a reference **signature** previously memorized. If comparison is OK the test is passed. The minimum time between 2 subsequent PST is 1 min. The start position (100% or 0% open) can be configured by the parameter "**Action**" in the PST menu.

The condition to perform the PST are the following:

- The function was enabled by the ITVC manufacturer
- The icon is present in the **HOME** page of the display
- The valve is OPEN and the parameter "**Action**" = **close**
- The valve is CLOSED and the parameter "**Action**" = **open**
- The actuator control mode is LOCAL or REMOTE



Actuator travel in case of "**Action** = close". A specular travel with start position 0% is done if "**Action** = open"

The PST can be initiated by

- local command of ITVC HMI
- remote digital input signal
  - only if one out of 4 digital inputs (IN1,IN2,IN3,IN4) is configured as "**PST command**" (see paragraph "Configurable remote controls" of IOM-ITVC-Basic)
- remote Modbus command
- automatically, at the end of a configured period of time

It is performed as follows:

- to energize (or de-energize according to ITVC settings) the Solenoid Operated Valve to move the actuator in closure (or opening). The valve travel duration depends on the configured option in the "**PST type**" sub-menu (analogue, digital or time). The parameter "**Action**" sets the direction to move (close or open)
- to open (or close) the valve and restore the initial position (100% open or 0% open)
- to memorize the curves "**Position versus time**" and "**Pressure versus time**". The curve "**Position versus time**" is present only if the actuator is fitted with analogue position transmitter. The curve "**Pressure versus time**" is present only if the actuator is fitted with transmitter of cylinder pressure. No curve is done if the actuator is without analogue position and pressure sensors
- to compare the above curves with the **signature curve** previously done. If the actuator has no analogue position transmitter, the comparison is done only between the duration times of the signature and of the last PST.

If the test is completed and the comparison is **ok**, the test is **passed**, vice-versa the ITVC raises an **alarm**.

2.1 Local signalling:

In case of PST alarms the icon appears in the **HOME** page of the display and the LED near to pushbutton lights-up red colour. The actuator commands are still actives and the alarm is cleared by an **alarm reset** command or a **new PST** command. The following PST alarms are detected:

- **PST failed**: PST cannot find position partial position.
- **PST not performed**: PST not performed because system is in alarm mode.

The procedure to view the alarms is described in the paragraph "Visualization of Alarms and Warnings" of document **IOM-ITVC-Basic**.

2.2 Remote signalling:

In case of alarm the Monitor Relays changes-over.
The following options can be set to switch the output relays R1, R2, R3 and R4:

- PST failed: PST not passed
- Performing PST: PST in execution
- LS PST: available only if the actuator is fitted with limit switch to set the portion of travel in closure during PST execution

The procedure to set the output relay R1,…R4 is described in the paragraph "Output relays", Administrator menu, SETUP chapter of document **IOM-ITVC-Basic**.

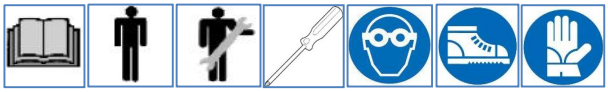
2.3 Full Stroke Test (FST):

The **FST test** (**F**ull **S**troke **T**est) is used to check the correct operation of the system "ITVC-SOV's-Actuator-Valve" in complete travel cycle (close to 0% and then open to 100% if "Action = close" or open to 100% and then close to 0% if "Action = open). In general the test is done only in **maintenance operation** since the complete valve closure and opening is not allowed when the process is working.

WARNING!	
	**In general, the permit from process authority should be obtained before performing a FST (Full Stroke Test)**

WARNING!	
	**Before performing the PST be sure that:** • **the PST parameters have been set according to electrical wiring and type of actuator** • **At least one PST signature was previously done and is present in the ITVC memory (check by the procedure Calibration, option SHOW, in the Perform PST paragraph)** **If the signature is not present perform it, by the procedure Calibration, option NEW SIGNATURE, described in the "Perform PST" paragraph.** **If a PST parameters should be changed, it is mandatory to repeat the "Calibration" procedure to generate a new signature.**

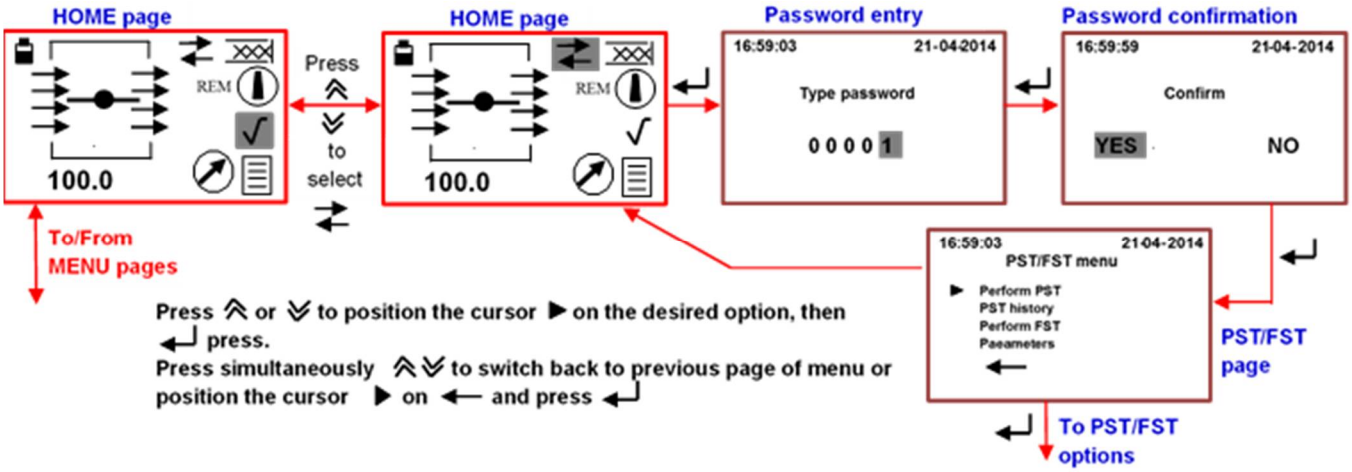
3 PST menu



The procedures to view the instantaneous values of pressure transmitters (if present), the historical data and the alarms are described in the paragraphs "**Visualization of pressures**", "**Instantaneous measures sub-menu**", "**Historical data sub-menu**" and "**Visualization of Alarms and Warnings**" of the document "**IOM-ITVC-Basic**". Refer to **ITVC HMI** chapter of the above IOM to find the instructions relevant to **HOME** page, **MENU operation** and **MENU chart**.

Here below are described only the procedures to set the PST parameters, to initiate the PST, to view the PST reports and graphs, to perform the **signature** and the FST. Access to PST menu is allowed only by password "**ADMINISTRATOR**".

In the **HOME** page, by ⇈ and ⇊ position the cursor on the icon ⇄ and press ↵ . Enter the password **Administrator**. By ⇈ and ⇊ select the number and then press ↵ to set it and switch to the next one. Enter 5 characters. By ⇈ and ⇊ select **YES** and then press ↵. The PST/FST menu page appears on the display.



The above figure refers to the "**Standard type**" of **HOME** page (see IOM-ITVC-BASIC, paragraph HOME page). The procedure to navigate in the PST menu is the same in case of **HOME** pages "**HPU type**" and "**HIPPS type**".

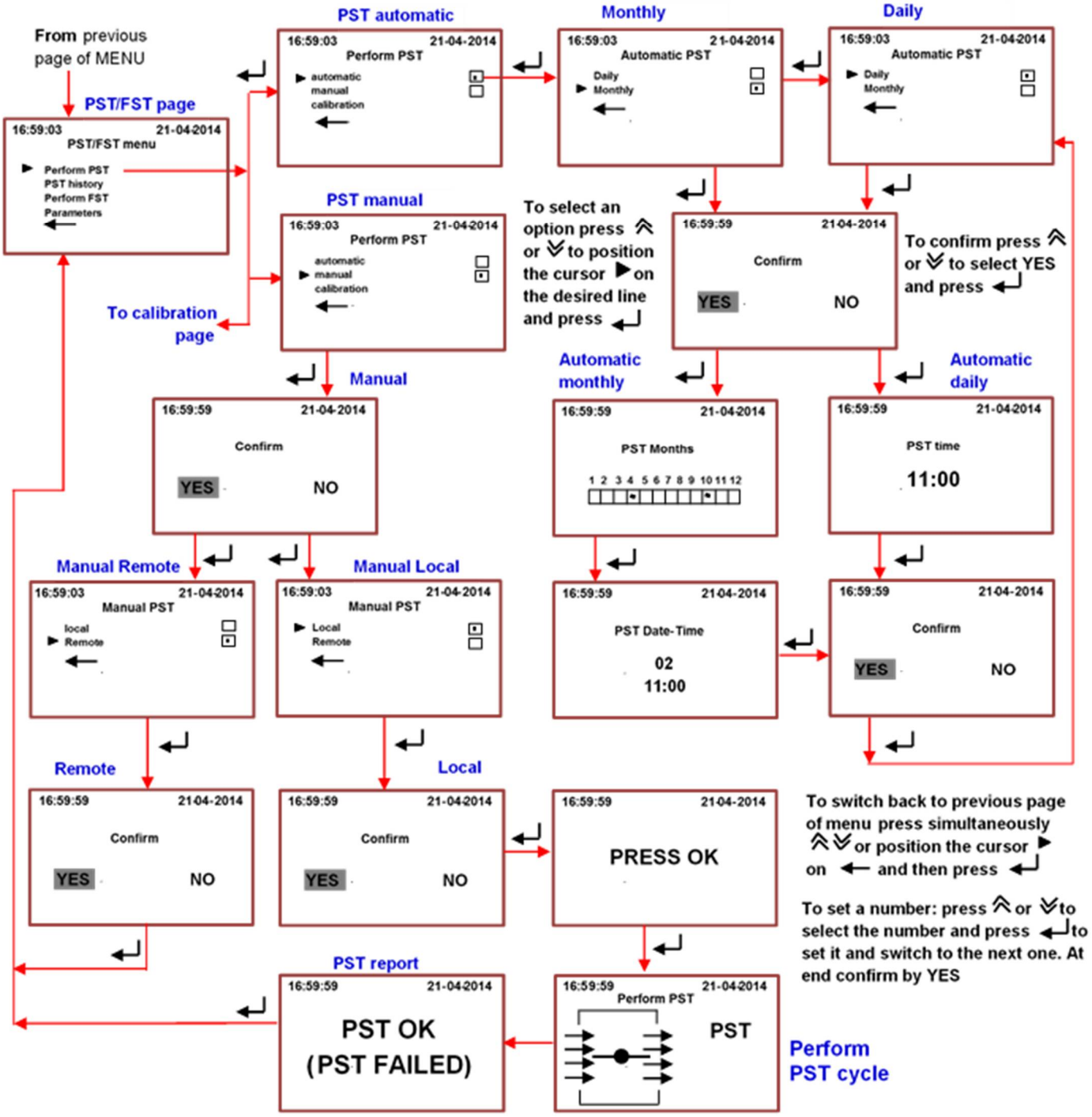
The PST menu has the following options: Perform PST, PST history, Perform FST, Parameters. Below is the description of each PST option.

3.1 Perform PST

Perform PST sub-menu: it sets the PST start mode. 3 options are available:

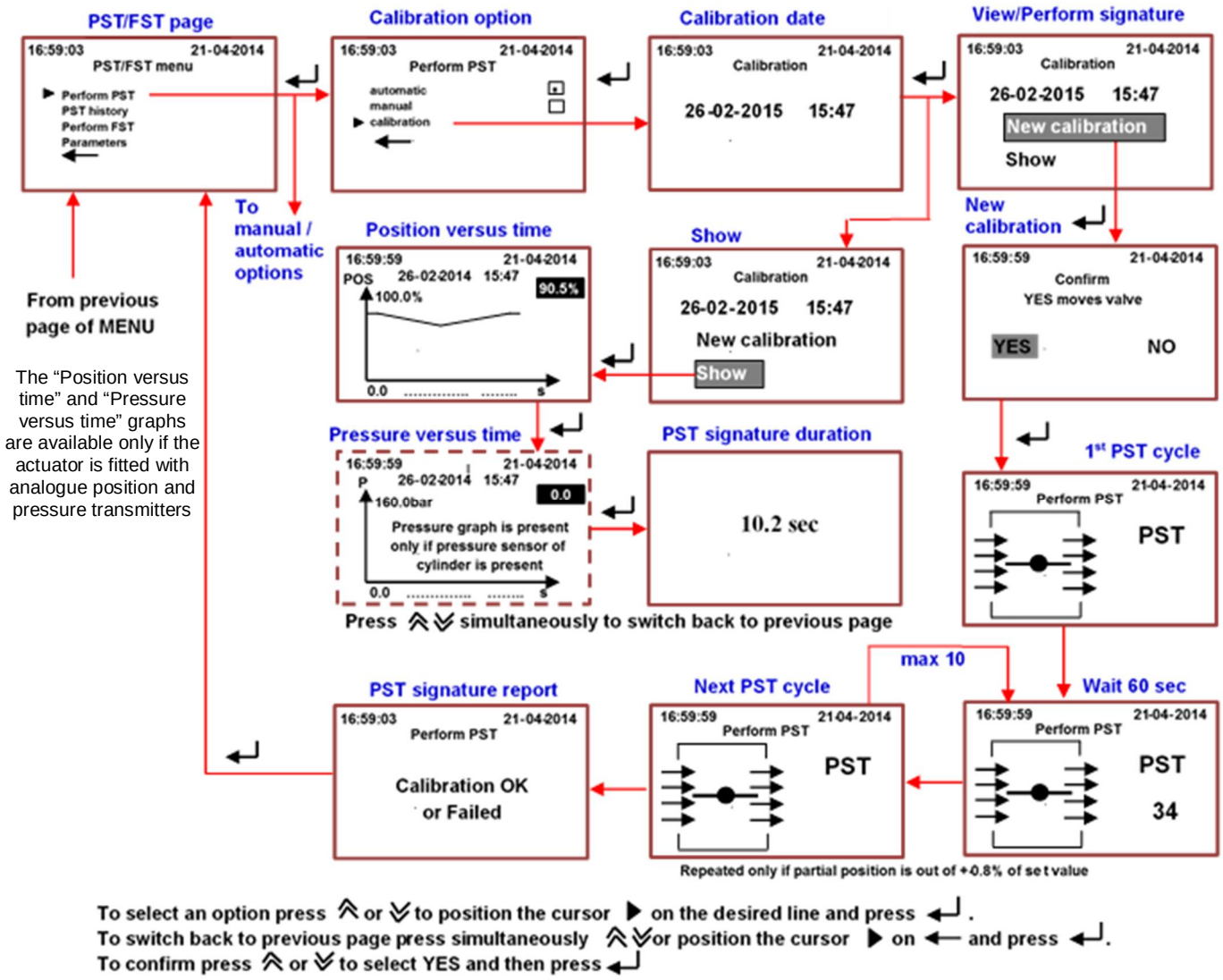
- **Automatic**: the PST cycle initiates at a configurable time of day and at the end of a period of time
- **Manual**: the PST cycle initiates on receiving of local or remote command
- **Calibration**: it allows performing and viewing the **signature**

3.1.1 Automatic and Manual procedure



3.1.2 Calibration procedure

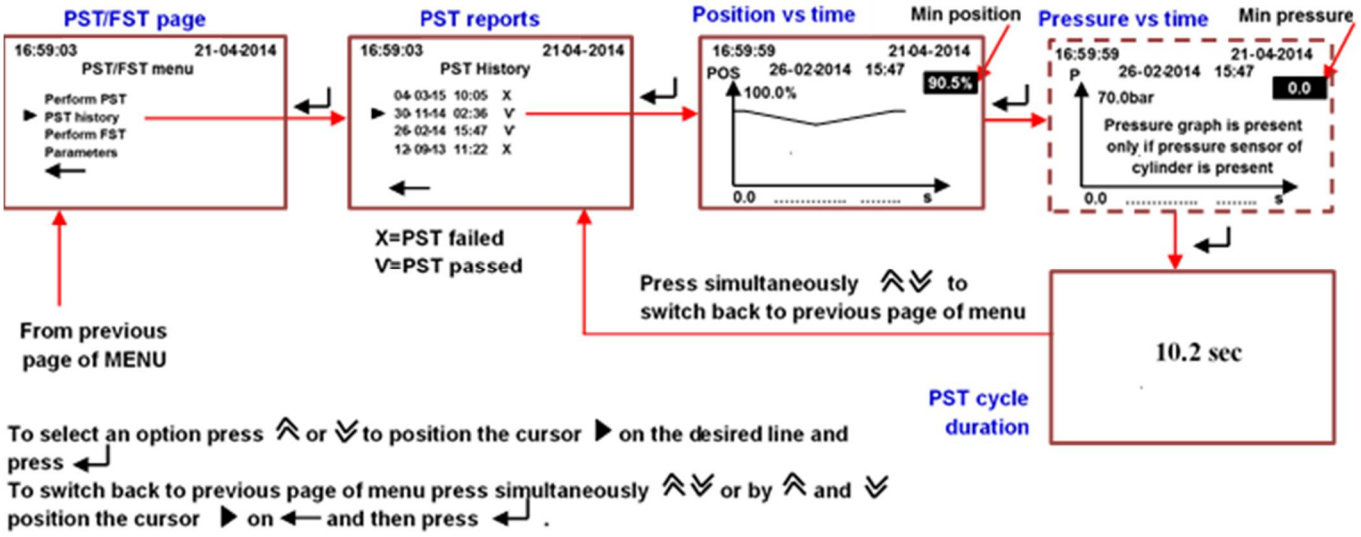
The following diagram shows the menu chart of the **Calibration option**. It allows viewing the **date** of the **signature** obtained in the last calibration procedure. The next display page has two options, "**New calibration**" and "**Show**". The option "**Show"** allows viewing the "PST duration" of **signature**. The "Position versus time" and "Pressure versus time" graphs are available only if the actuator is fitted with analogue position and pressure transmitters. The option "**New calibration**" allows generating a **new signature**. The old signature is lost when a new one is produced. The procedure consists in few steps (max 10). In the 1st PST cycle the ITVC measures the time needed to complete the PST. In the 2nd PST cycle the ITVC collects the data of position and pressure (if present), to make the graphs. If the reached position in closure, is within +-0.8% of set of partial position, the calibration procedure ends and the message "**Calibration OK**" appears. If the reached position is out of the +-0.8% of set of partial position, the PST cycle is repeated and the check on the reached partial position is done again. The procedure continues until the result of the above test is OK. At each PST cycle, the ITVC anticipates the release of the Solenoid Operated Valve in closure. After 10 PST cycles, if the result is still wrong, the calibration procedure ends and the message "**Calibration failed**" appears. A wait cycle of 60 sec between the PST cycles allows restoring the pressure before initiating a new PST.



If the **PST type** is "**time**" or "**digital**" and pressure transmitter is not present, the signature contains only the "**PST duration**" page

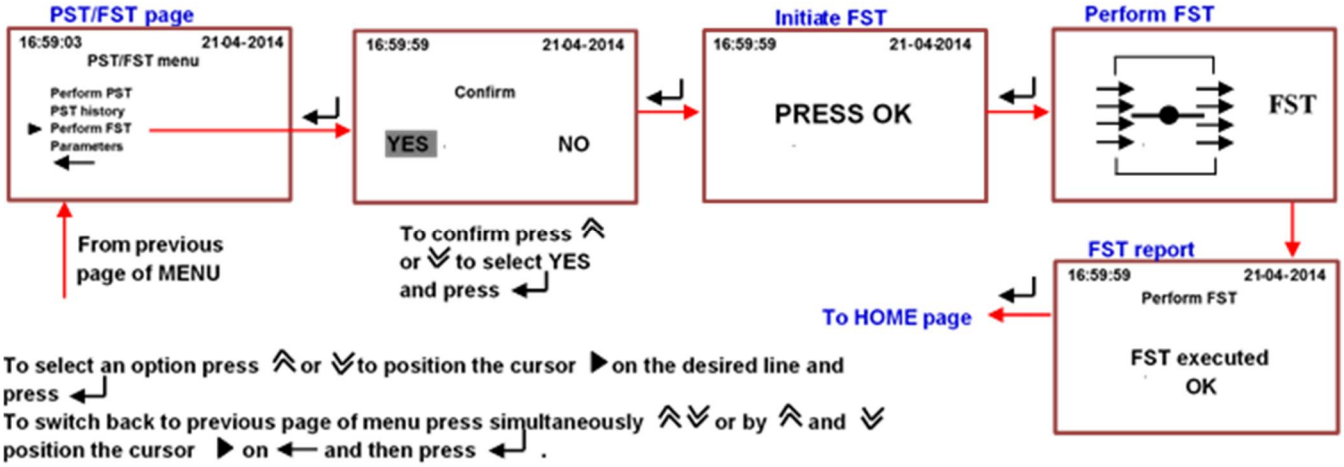
3.2 PST history

PST History sub-menu: it allows viewing the PST history with date, time, result (passed, failed). The next pages of the menu show the duration of PST cycle. The "Position versus time" graph is available only if the actuator is fitted with analogue position transmitter. The "Pressure versus time" curve is available only if the relevant pressure sensor is present on the actuator.



3.3 Perform FST

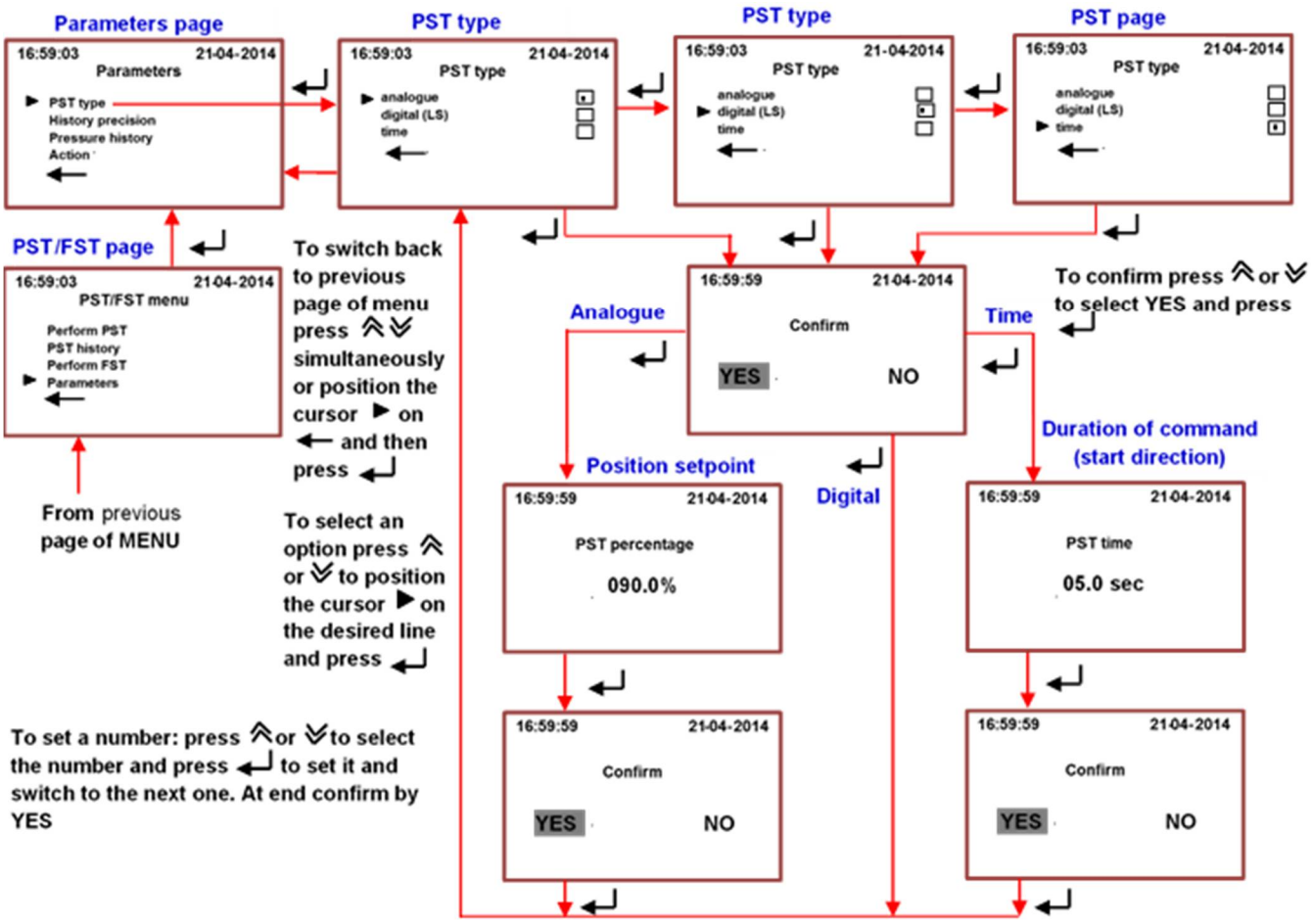
Perform FST (Full **S**troke **T**est**)** sub-menu: the function performs a **complete travel cycle** (from 100 to 0% and then from 0 to 100% if "Action = close", or from 0 to 100% and then from 100 to 0% if "Action = open"). The test is used only in **maintenance operation**, it cannot be used while the actuator is in service and process is running. Before launching the test it is mandatory to obtain permission from the authority that manages the process.



3.4 PST type

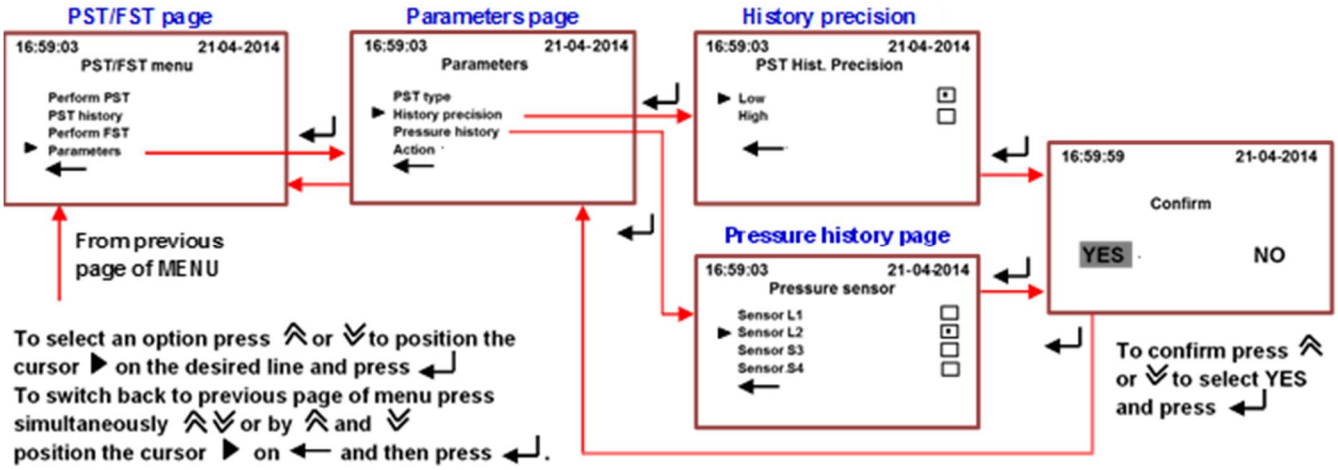
PST type sub-menu: it allows setting the portion of stroke to cover from position "**fully open**" or "**fully closed**" . 3 options are available:

- **Analogue**: the actuator is equipped with position transmitter and the ITVC clears the close or open command when the configured position is reached (>50% if "action" is close, <50% if "action" is open. (View the below PST type chart, "PST percentage" page)
- **Digital**: the actuator is equipped with PST position switch and the ITVC clears the close command when the digital switch is triggered. The user should set the position of the electrical switch.
- **Time**: the actuator has neither position transmitter nor position switch, the ITVC clears the close command when the configured time has passed (View the below PST type chart, "Duration of command in the close phase" page).



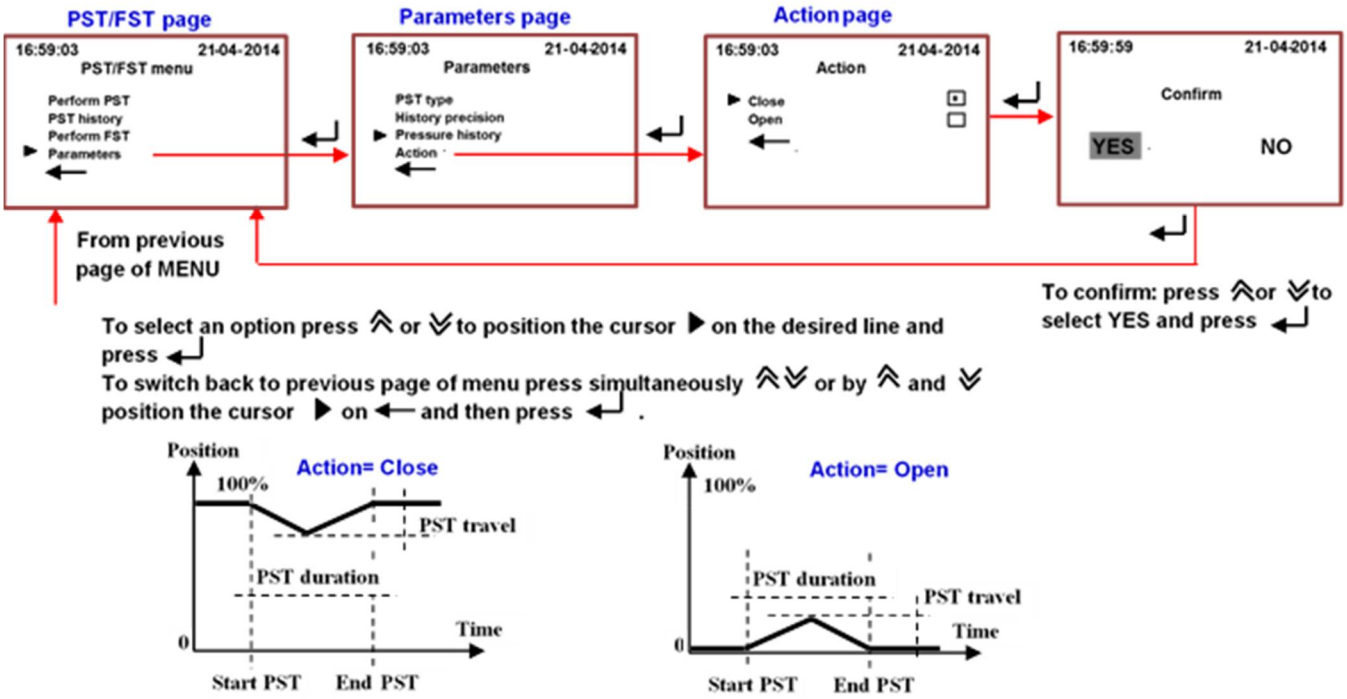
3.5 History precision and Pressure history

History precision sub-menu: it allows setting the accuracy of the saved curves. The option **Low** saves 1000 samples, the option **High** saves 2000 samples, for each curve. The formula to calculate the time between each sample is "PST signature duration divided 1000 or 2000". In High resolution the maximum number of curves is 150.
Pressure history sub-menu: it allows setting which sensor measures the cylinder pressure. Setting is possible only if the sensor is present and its analogue channel was previously configured by the ITVC manufacturer. If the sensor is absent the "Pressure versus time" curve is not saved.

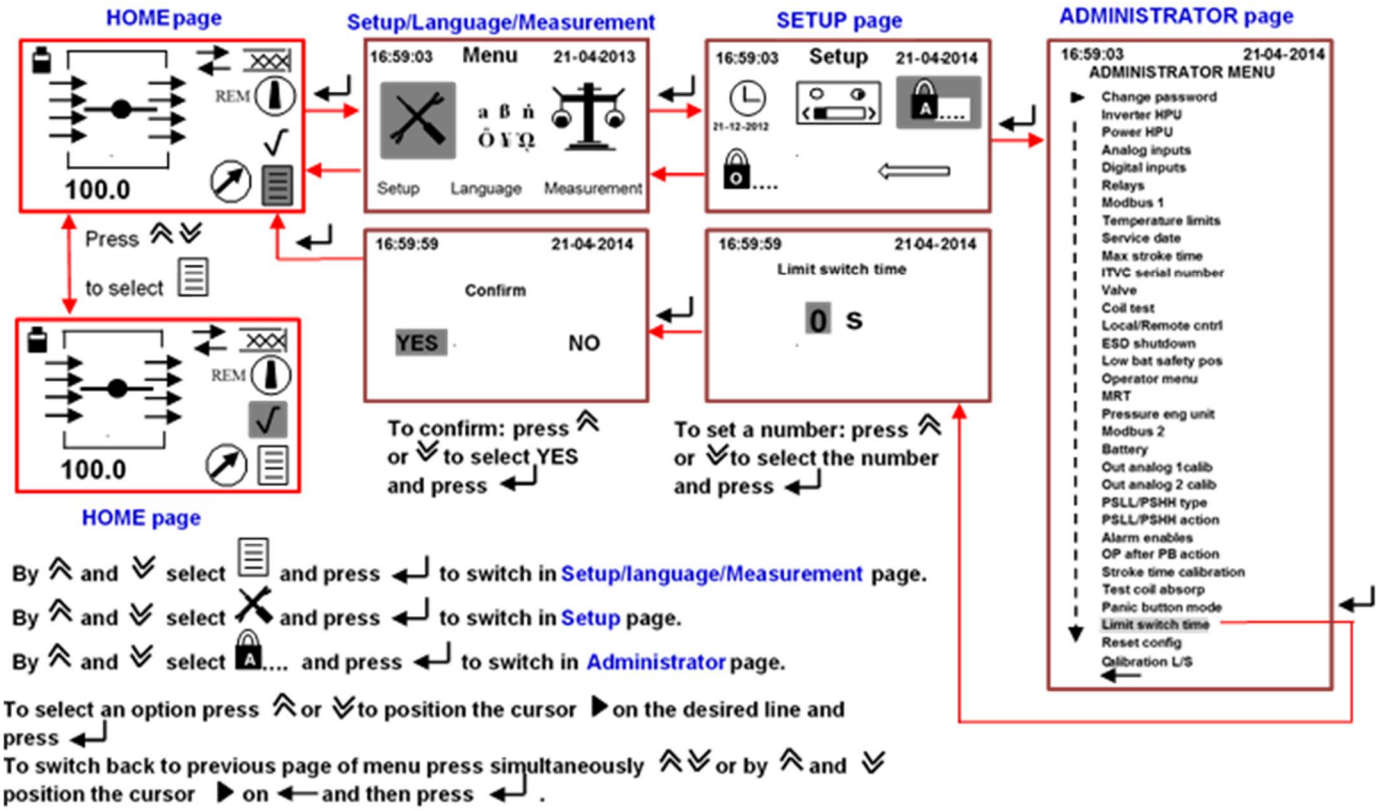


3.6 Action

Pressure sensor sub-menu: it allows setting the position to initiate the PST cycle. If setting is "**Close**" the PST cycle can initiate only from position 100% open and the first movement of the valve is in closure. If setting is "Open" the PST cycle can initiate only from position 0% open= closed and the first movement of the valve is in opening direction.



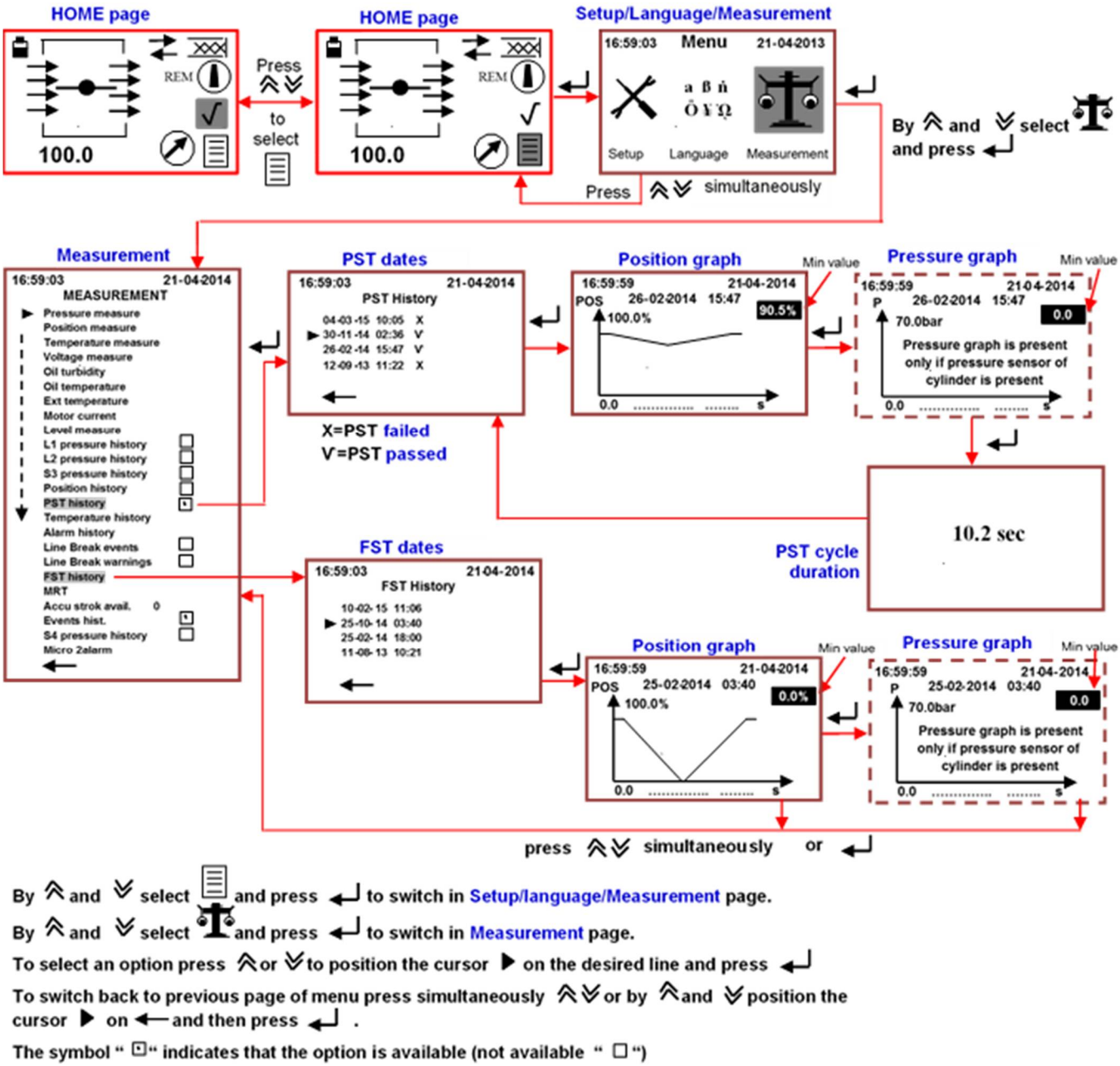
3.7 PST option in the SETUP, Administrator menu



3.8 PST options in the MEASUREMENT menu

The **MEASUREMENT** menu allows viewing the instantaneous and historical values and graphs of the variables managed by the ITVC.
The next figure shows the procedure to view the options "**PST history**" and "**FST history**". The other options of **Measurement** page are described in the IOM-ITVC-Basic and Annex B,C, etc.
PST history is visible also in the **HOME** page, PST menu (icon ⇄)

- The "Pressure versus time" graphs are present only if the actuator is fitted with sensor of cylinder pressure
- The "Position versus time" graphs are present only if the actuator is fitted with analogue position transmitter
- If no analogue sensor is present, only the "**PST duration**" page is present. In the FST history only the "**FST dates**" page is present.



4 PST Troubleshooting

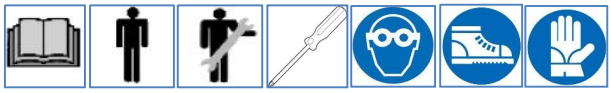
In addition to the alarms listed in the paragraph TROUBLESHOOTING of manual **IOM-ITVC-Basic**, two further alarms can be generated by the execution of the PST function: "**PST failed**" and "**PST not performed**".

ITVC signals the presence of an Alarm remotely by the **Monitor relay** and locally by the icon A in the **HOME** page. The LED of pushbutton ↵ lights up red colour. Use the procedure described in the paragraph "**Visualization of Alarms and Warnings**" of document "**IOM-ITVC-Basic**" to view the type of alarm.

The table below shows the potential causes of the alarms and the action to do to solve the problem.

Alarm displayed	Potential cause	Action
PST FAILED	PST cannot find the position to reach	Check valve position/limit switches
PST NOT PERFORMED	PST not performed because system in alarm mode	Solve alarms and restore ITVC

5 PST start-up



The following checks should be added to the procedures described in the chapter START-UP of the document **IOM-ITVC-Basic**.

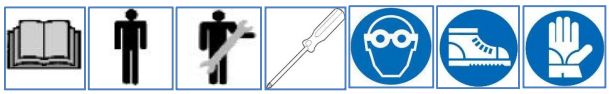
- the remote digital input "PST command" (if configured present) should be according to the wiring diagram
- the setting of the PST parameters should be according to the wiring diagram, type of actuator and user request
- At least one signature was previously done (by the option **SHOW**, described in the "Calibration procedure, Perform PST" paragraph).

If the **signature** is not present, perform it by the option **NEW SIGNATURE**, described in the procedure "Calibration", in the paragraph "Perform PST".

Redo the procedure to generate a new PST signature if a PST parameter should be changed, or if the actuator working conditions are not the same of the existing signature.

Perform the PST and check the report and the historical data with the procedures described in the previous paragraphs.

6 Installation and Maintenance



Refer to document **IOM-ITVC-Basic**. No additional instruction are requested for PST.

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