ITVC Series

Intelligent Total Valve Controller

BASIC version

DVG AUTOMATION

GIVA GROUP

INSTALLATION
SET-UP
OPERATING
& SERVICE MANUAL

ITVC

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IOM-ITVC	AA	GR	05/09/2017	05

DVG AUTOMATION
GIVA GROUP

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

1 LEGEND

Protective Gloves Required

Protective Shoes Required

Protective Glasses Required

Prohibited to alter or remove the nameplate

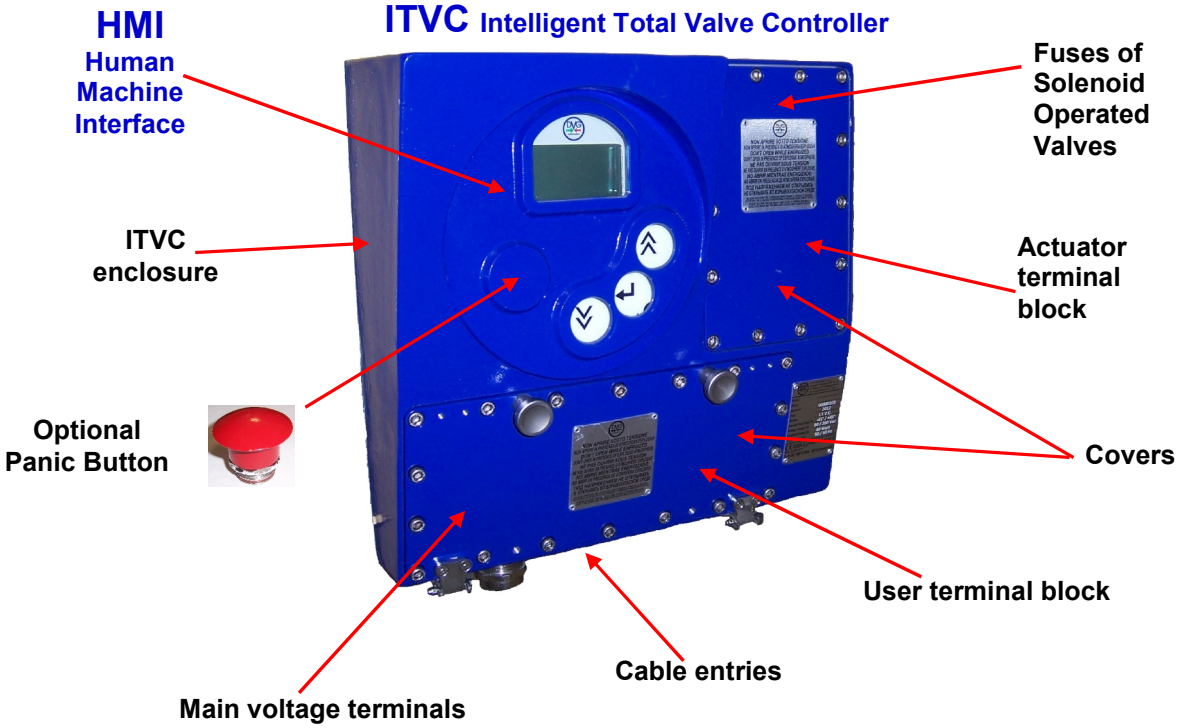
Work tools Necessary

Mechanical Operator

Operator

Advise

2 ITVC Intelligent Total Valve Controller



3 Introduction

This document, **IOM-ITVC-Basic**, is the Installation, Operation and Maintenance manual (**IOM**) of **ITVC**, **I**ntelligent **T**otal **V**alve **C**ontroller for pneumatic and hydraulic actuators. This manual includes only the instructions relevant to **BASIC version** of ITVC. The instructions of the **ITVC optional functions** (PST, Line Break, HPU control module, Modbus protocol, HIPPS, Battery, etc.) are in the documents **Annex A,…,I**, of the above IOM.
DVG Automation will activate only the functions requested by the user application and needed to correctly control the actuator.
This document does not contain the instructions relevant to the actuator controlled by the ITVC. The wiring and hydraulic diagrams present in the next pages should be considered only as examples of application of ITVC.
Refer to documentation supplied with the actuator to view the specific mechanical, electrical and hydraulic functional diagram and instructions.

This document is an integral part of the apparatus, which 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.**

4 General information

DVG Automation spa products are engineered, manufactured and tested in accordance with the quality control system complying with the international standard EN ISO 9001.

ITVC (Intelligent Total Valve Controller) is an electronic device designed to control pneumatic and hydraulic actuators.

DVG Automation will not be responsible for any possible damage or physical injury resulting from use in other than the designated applications or by lack of care during installation, operation, adjustment and maintenance of the machine. Such risks lie entirely with the user. Depending on the specific working conditions, additional precautions may be requested. Considering that DVG Automation has no direct control over particular applications, operation or maintenance conditions, it is operator's responsibility to comply with all applicable safety rules. Contact urgently DVG Automation in case of dangerous situations not considered in the manual. It is total responsibility of the operator to be according to the local health and safety regulations.

5 Storage

Receipt

On receipt of the ITVC, always check any damage. Never install a damaged unit and report the detected defect to the forwarding agent.

Packing

Ensure that adequate protections were secured during transport.

Handling and Storage

Ensure that principal holes on enclosure are occluded with a cap.

Storage temperature: -60°C ≤ T ≤ +85°C.

6 Applicable regulations

94/9/CE:	Directive on equipment and protective systems intended for use in potentially explosive atmospheres (ATEX)
2004/108/CE	EMC Directive (EMC)
EN 60079-0	Electrical apparatus for explosive gas atmospheres- Part 0: General requirements
EN 60079-1	Electrical apparatus for explosive gas atmospheres – Part 1: Flameproof enclosures "d"
EN 60079-31	Explosive atmospheres - Part 31: Equipment dust ignition protection by enclosure "t"
EN 61326-3-1	Electrical equipment for measurement, control and laboratory use. EMC requirements. Immunity requirements for safety-related systems and for equipment intended to perform safety-related functions (functional safety). General industrial applications
EN 61010-1	Safety requirements for electrical equipment for measurement, control, and laboratory use - Part 1: General requirements
2006 / 95 / CE	Low Voltage Directive (LVD)
EN 60529	Specification for degrees of protection provided by enclosures (IP code)
IEC 60068-2-6	Environmental testing – Part 2: Tests – Test Fc: Vibration (sinusoidal)
IEC 60068-2-27	Environmental testing - Part 2-27: Tests - Test Ea and guidance: Shock
IEC 61508	Functional safety of electrical/electronic/programmable electronic safety-related systems

7 Classification and Certification

EUM1 12 ATEX 0789 – ATEX 94/9/CE

II 2GD Ex db IIB+H_2 T5 Ex tb IIIC T88°C -60°C ≤ T_{amb} ≤ +85°C

II 2GD Ex db IIB+H_2 T5 Ex tb IIIC T88°C -45°C ≤ T_{amb} ≤ +85°C

II 2GD Ex db IIB+H_2 T5 Ex tb IIIC T88°C -20°C ≤ T_{amb} ≤ +85°C

IECEx EUT 14.0008
IP 68 – EN 60529
SIL 3 – IEC 61508
GOST – Certificate No. RU C-IT.ГБ08.B.00033
Resistance to Vibration – Certificate No. 223221TRFENV – IEC 60068-2-6
Seismic test – Certificate No. 223221TRFENV – IEC 60068-2-27

8 Warnings

WARNING!
Every notice in this manual, marked with the symbol shown to the left, concerns to the explosion risk and must be enforced by all operators working in potentially explosive areas. *Not abiding by these rules can lead to health dangers for people and damages for things.*

WARNING!
Do not open in explosive atmosphere and/or while energized. The area must be cleaned from explosive mixture since battery and residual capacitor charge could generate electrical spark and cause explosion

WARNING!
The equipment must not be mechanically connected to a separate heat source with temperature higher than 85°C.

WARNING!
Cable glands and/or plugs must be IEC Ex certified.

WARNING!
Installation of equipment must be in accordance with IEC 60079-14 (latest edition) or national standard.

WARNING!
Earthing and protective conductors *Minimum cross-sectional area of protective conductors (IEC 60079-0 Table 10)* *(S = cross sectional area of phase conductor [mm^2]; S_P = Minimum cross-sectional area of the corresponding protective conductor [mm^2])* *$S \leq 16$; $S_P = S$*

WARNING!
External earth connection *Equipment must be securely connected to an earth ground. An earthing connection is provided externally to the equipment. Connection must be secure so that the electrical conductors cannot be readily loosened or twisted and contact pressure on electrical connection can be maintained in all conditions. Care must be taken to protect the connection against corrosion.*

WARNING!	
	*Internal earth connection* *Earth conductor of cables must be electrically connected to ground. An earthing connection is provided internally to the equipment. Connection must be secure so that the electrical conductors cannot be readily loosened or twisted and contact pressure on electrical connection can be maintained in all conditions. Care must be taken to protect the connection against corrosion.*

WARNING!	
	*Paint procedures* *No.1 (standard): 70 ÷ 100µm TGIC-free polyester powder coating* *No.2 (optional): 840 ÷ 1050µm thermoplastic powder coating*

WARNING!	
	*<u>REPAIR</u> of equipment must be carried out according to IEC 60079-19 and only under control and authorization of DVG AUTOMATION S.p.A. or an authorized third-party.* *Nothing concerning the protection means can be modified.* *Violation of the above mentioned rules will cause loss of every feature of conformity to the certificate of the motor equipment.*

WARNING!	
	*Check periodically that maximum dust thickness on enclosure does never exceeds 5mm.*

WARNING!	
	*Perform electrical connections as per statutory requirements. In particular, check tightness and integrity of cable glands and/or plugs. If opening of any cover is necessary, before reassembling, check integrity of antideflagration joint/s and gasket/s, clean thoroughly and apply a small quantity of silicon grease on mating surfaces and gasket. Tighten hex socket head screws (M6 – tightening torque 8,0 Nm).*

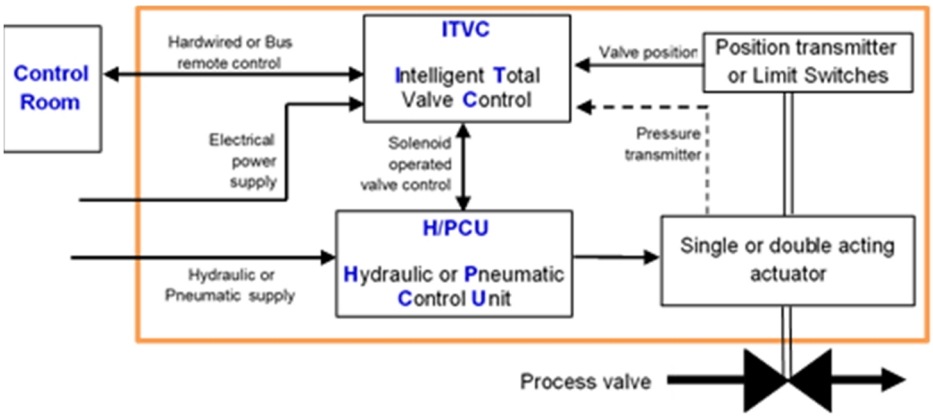
9 ITVC-features

9.1 Block diagram

The main features of the ITVC electronic unit are:

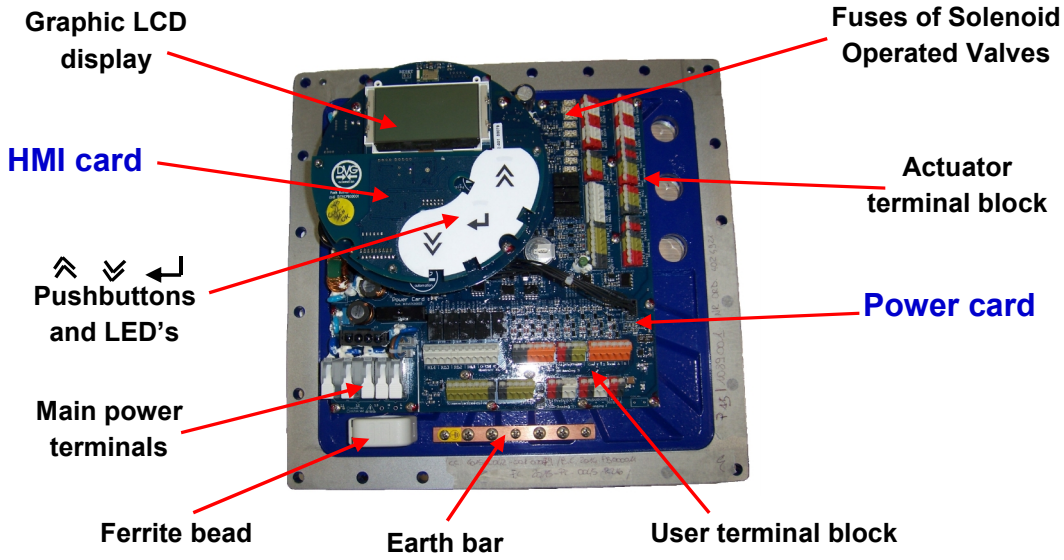
- To acquire the commands from control room
- To acquire the feedback from sensors of the actuator (position pressure, etc.) and ITVC hardware (temperature, current, etc.)
- To process the acquired data and send commands to the Solenoid Operated Valves to move the process valve
- To send status, alarms and warning signals of "ITVC-actuator- H/PCU" system to control room
- To log alarms, warning, events

Block diagram of **hydraulic** or **pneumatic actuator** with **ITVC**



H/PCU: Hydraulic or **Pneumatic Control Unit**
It is made of hydraulic / pneumatic components to control the hydraulic / pneumatic power and drive the actuator in opening and closing direction (Solenoid Operated Valves, Pneumatic and Hydraulic Operated Valves, filters, selectors, booster, flow regulated valves, etc.)

ITVC electronic cards



9.2 Main characteristics

Here below are listed the most important functions of the BASIC ITVC.

- Control and drive of DVG Automation pneumatic and hydraulic actuators, single acting spring return and double acting, on-off service
- Failsafe function
- **Redundant ESD E**mergency **S**hut-**D**own function (ESD1 and ESD2 channels with diagnostic each channel)
- Output to control **S**olenoid **O**perated **V**alves (**SOV**), fuse protection in each output
- Test of coils of **S**olenoid **O**perated **V**alves (**SOV**)
- Standard digital hardwired remote control
- Interlock controls
- Redundant Modbus RTU communication line
- Local actuator control
- **Human Machine Interface** (**HMI**) with graphic LCD display and non-intrusive, touch-sensitive, pushbuttons
- Multi-language menu, **icon** based
- **User friendly** navigation in the menu
- Local configuration
- Diagnostic functions
- **Two microcontrollers** working in parallel with cross comparison of operations and diagnostic
- Access to menu by password to protect against unauthorized change
- Bluetooth wireless communication
- Sensor of Temperature of Electronics
- Alarm, Warning, Event logger
- Real time clock and battery
- **SIL 3 compliance** for the SIF functions (ESD Emergency Shut-Down, Line Break and Panic Button)
- **1oo1, 1oo2, 2oo3 and 1oo3** configuration of analogue input channels with diagnostic
- Operating temperature and enclosure suitable for application in field, according to limits reported in the Classification/Certification paragraph
- Separated mounting option

Here below are listed the most important functions available and activated by DVG Automation according to the user request

- **PST** function (**P**artial **S**troke **T**est) (see Annex A: PST function)
- **Line Break** (**LB** and **LB-d**) function (see Annex B: Line Break function)
- **HPU** (**H**ydraulic **P**ower **U**nit) control module (see Annex C: HPU control module)
- **HIPPS** (**H**igh **I**ntegrity **P**ressure **P**rotection **S**ystem) function (see Annex D: HIPPS function)
- **Panic Button (PB)** (see Optional panic button paragraph)
- **Optional battery** (see Optional battery paragraph or Annex B)

Separated mounting option: it allows mounting the ITVC separately from actuator. It is especially useful when the actuator has to be mounted in a difficult access position, or highly vibrating valve or in excessive high/low temperature area. The maximum length of cable between ITVC and actuator is **50m**.

SIL features: the specific ITVC SIF functions "**ESD Emergency shutdown**", **Line Break** and **Panic Button** comply with **IEC61508,** application **"Low Demand mode".** The certificate 43SO00071 is available on request.

Optional battery: if required, ITVC can be equipped (only -20°÷+85°C ITVC version) with a rechargeable lithium-ion battery, which in case of power supply failure, keeps the ITVC functional, in monitoring mode. The battery is located on the top of the ITVC enclosure. See **Optional battery** paragraph or Annex **B: Line Break**

9.3 Input and Output of ITVC

This paragraph lists the inputs and outputs available in the ITVC electronics. These I/O's are collected in two terminal blocks, one terminal block is available to user, for connection of signals with the control room, the other one is available for connection of the actuator signals (Solenoid operated Valves, transmitters, etc.). The electrical features of the I/O's are described in the **INSTALLATION** chapter

I/O's available on **user** terminal block

- **Digital inputs:**
  - 2 configurable digital inputs (IN3, IN4) + Open and Close remote controls, optocoupled, 1 common.
  - 2 independent, separated ESD inputs (ESD1,ESD2), optocoupled,
  - 2 configurable digital inputs (IN1,IN2), optocoupled, 1 common
- **Outputs relays:**
  - 1 Monitor relay, single side stable, SPDT contact, voltage free (Monitor Relay)
  - 4 configurable, latched, SPST contact, voltage free (R1,R2, R3, R4)
- **Analogue input:**
  - 1 x 4-20mA channels, optocoupled isolated amplifier, factory configurable
- **Analogue output:**
  - 2 x 4-20mA channels, optocoupled isolated amplifier, active and passive current loop, factory configurable

I/O's available on the **actuator** terminal block

- **Digital inputs:**
  - 4 digital inputs , optocoupled, 1 common, factory configurable
- **Digital outputs:**
  - 8 x digital outputs , 1 common, fuse protected, to drive Solenoid Operated Valves, factory configurable
- **Outputs relays:**
  - 3 x latched, SPST contact, voltage free, factory configurable
- **Analogue input:**
  - 4 x 4-20mA channels, optocoupled isolated amplifier, factory configurable

9.4 Status signalling

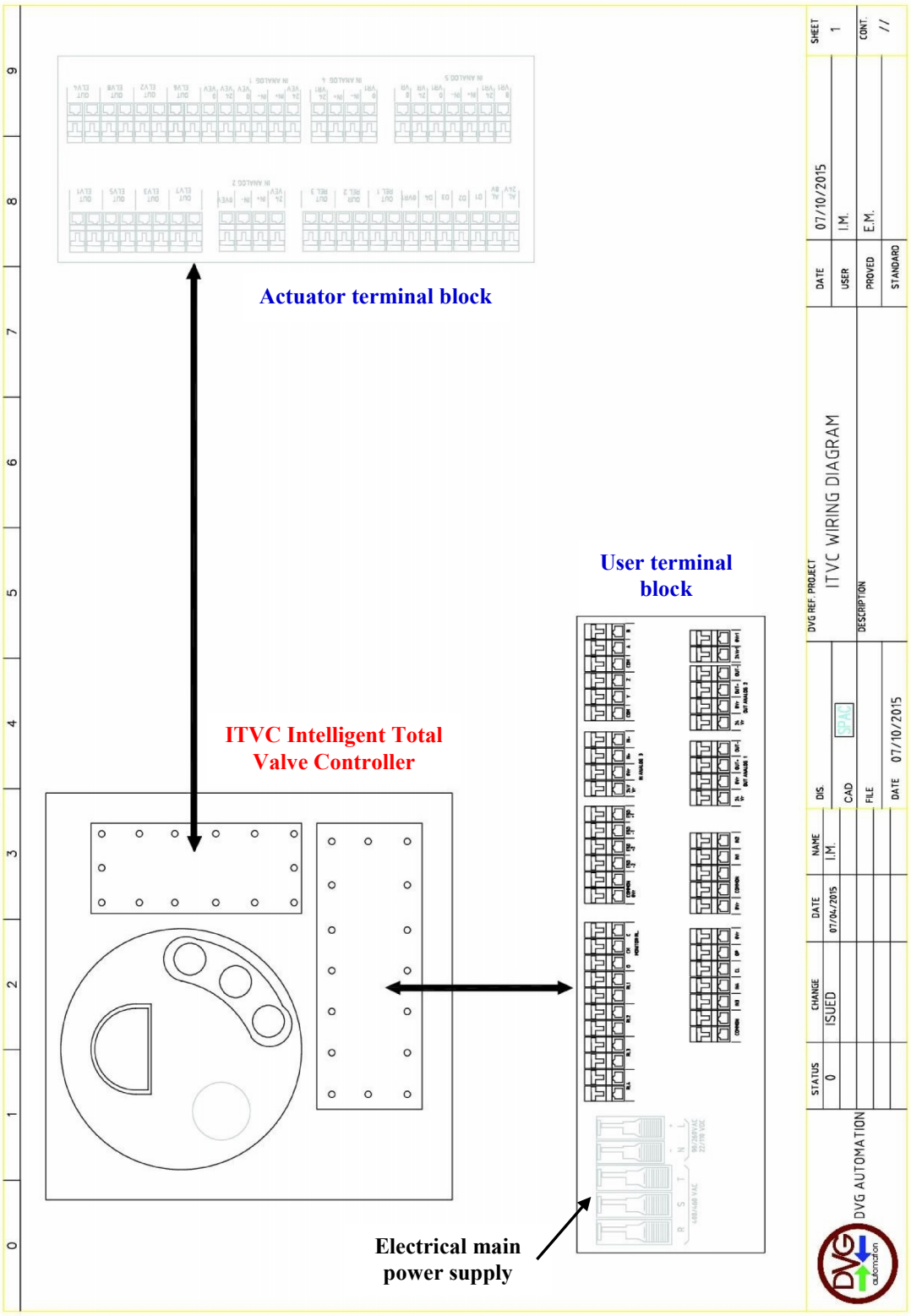
Output status of system ITVC-H/PCU-Actuator is available:

- Locally, by the HMI, Human Machine Interface, described in the chapter ITVC HMI
- remotely by
  - 1 Monitor relay: it summarizes the Alarm and MRT alarm status
  - 4 latched, output relays. The condition to switch of each relay can be set by the configuration options

9.5 BUS control

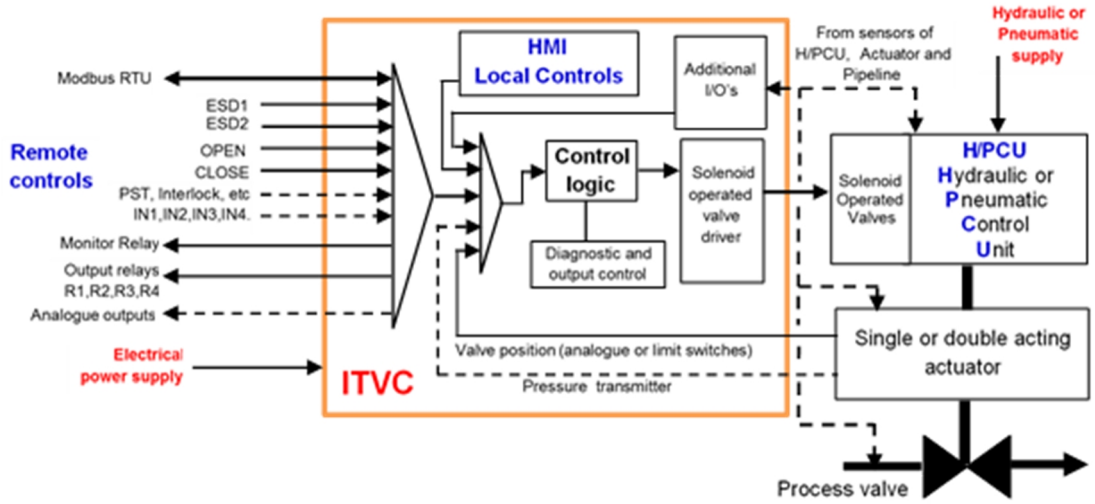
- 2 independent RS 485, Modbus RTU communication lines, are available to control the ITVC by a Modbus master station.

9.6 ITVC Terminal blocks



9.7 Operating principle

9.7.1 Actuator control



H/PCU: **Hydraulic** or **Pneumatic Control Unit:** made of Solenoid Operated Valves, hydraulic and pneumatic valves, filter, directional valves, etc. to drive the Actuator in open and close direction.

The ITVC collects the **commands** from control room and HMI, the **feedback sensors** signals from H/PCU, Actuator and Pipeline and **drives the Solenoid Operated Valves** of the **H/PCU** (Hydraulic or Pneumatic Control Unit) **to open and close the process valve** by means of the single or double acting **actuator**. Three actuator control mode are available: **LOCAL**, **REMOTE** and **OFF**. On request the **OFF** option can be removed.
In **LOCAL**, the actuator can be controlled by the local pushbuttons ⇈, ⇊ and ↵ of HMI. If the display is in the **Local Command page**, they work as **open**, **close** and **stop** actuator commands (see par. Actuator Control mode).
In **REMOTE**, the actuator is remotely controlled by the OPEN and CLOSE digital inputs. Further digital inputs (ESD, PST, etc.) are available to carry out special actions (safety valve positioning, command inhibit, etc.).
In **OFF** no command to move the actuator is available.
Both in **REMOTE** and **OFF** the local pushbuttons ⇈ , ⇊ , and ↵ are available to navigate in the HMI menu. In **LOCAL** they are available to menu operation only in HOME page. (see par. Actuator Control mode)
The **Control Logic** block handles the different source of inputs, drives the outputs, monitors the operation of the complete system "ITVC-H/PCU-Actuator" and in case of malfunction generates **Alarms**, **MRT Alarms**, and **Warnings** and carries out the configured actions. The condition of Alarm/MRT Alarm is remotely signalled by the Monitor Relay. Four additional relay are available to signal configurable status (end of travel, warnings, etc.). ITVC status is also locally signalled by the HMI. The minimum duration of each Local and Remote controls is **300ms**

In case of "**single acting spring return"** actuator, when the actuator reaches the electrical end of travel (by limit switch or analogue position transmitter), the coil of the Solenoid Operated Valve controlling the process valve is kept energized (or de-energized). In case of "**double acting**" actuator, when the actuator reaches the electrical end of travel (by limit switch or analogue position transmitter), the coil of the Solenoid Operated Valve controlling the valve is kept energized 5 sec and then it is released.

By the **ADMINISTRATOR** menu, in the **SETUP** chapter, the following control options can be set:

- Local control mode:
  - **Push to run**: the open and close commands is active for as long as the pushbutton ⇈ or ⇊ is pressed. When the pushbutton is released the action of command ends
  - **Auto-maintained**: by pressing the ⇈ or ⇊ pushbutton the command open or close is activated. Even if the pushbutton is released the command remains active. It is reset by the ↵ pushbutton or if the actuator reaches the end of travel.

- Remote control type
  - **Digital input**: the hardwired digital signals control the actuator
  - **Bus**: the commands by Modbus control the actuator
  - **Digital input and Bus**: digital inputs and bus can control the actuator. The Bus commands have the priority over the digital inputs.
  - **Function 2-Wires**: hardwired digital control by two wires
- Remote control mode:
  - **Push to run**: the open and close commands is active for as long as the input signal is present. When the signal disappears the action of command ends
  - **Auto-maintained**: the command open or close is activated by the signal on the digital inputs OPEN and CLOSE. Even if the signal is removed the command remains active. When the actuator reaches the end of travel the command is cleared. The commands can also be cleared by a digital input if configured as "**Remote STOP**".
- Remote stop:
  - **Enabled:** the remote STOP digital signal clears both remote and local open/close commands
  - **Disabled**: the remote STOP digital signal clears only the remote open/close commands

9.7.2 ESD Emergency Shutdown

The **ESD**, **E**mergency **S**hut**D**own, command overrides any existing command and allows the actuator executing the emergency action to reach the **safe position**. The reaction time is less than **600 ms**. The configuration options, in the ADMINISTRATOR menu, allows setting:

- ESD Safety position: close, open, inhibit all (stay in position)
- ESD control signal polarity: ESD active when the signal is present (active **HIGH** or **ETT**: **E**nergize-**T**o-**T**rip) or absent (active **LOW** or **DETT**: **D**e-**E**nergize-**T**o-**T**rip)
- ESD command type: push to run or self-maintained
- ESD command mode: active only in REMOTE or both in LOCAL and REMOTE control mode
- ESD latch: hold the ESD action until the signal is present or until a **manual RESET**, available in ADMINISTRATOR menu of HMI, is entered.
- ESD both active: two options are available: **inactive (1oo2)** and **active (2oo2)**

ESD signalling: While ITVC performs an ESD shutdown, it raises an alarm. This is signalled remotely, by the switch-over of monitor relay, and locally, by the LED ↵ red colour and the icon [A] in the **Home** page of display. In the detailed alarm list appear: **Performing ESD**, **Microprocessor 2 alarm** and **Safety action**.

ESD Redundancy:

The ITVC has 2 independent, separated, ESD1 and ESD2, input channels and carries out the emergency action according to the configuration options described below:

- **Active** and signal polarity **HIGH**: ESD starts if the signal is HIGH in both inputs
- **Active** and signal polarity **LOW**: ESD starts if the signal is LOW in both inputs
- **Active**, **any** signal polarity: if the signals are different, a warning appears, no action is done, the LED ↵ is colour fuchsia and icon ⚠ is in the **HOME** display
- **Inactive** and signal polarity **HIGH**: ESD starts if signal is HIGH at least in one input
- **Inactive** and signal polarity **LOW**: ESD starts if signal is LOW at least in one input

ESD is one of the ITVC safety functions (the other ones are Panic Button and Line Break). The **Diagnostics** function of the digital inputs can detect short circuit and open circuits in the ESD1/2 input channels. If the above failures occur in **2oo2** mode, the ITVC raises an "**MRT timer"** alarm (Fault opto ESD1 or ESD2) and switches to **1oo2** operation. When the MRT time expires and if the alarm is still present, the ITVC performs the safe action. If the above failures occur in **1oo2** mode, the ITVC raises an alarm and performs the safe action. See "Alarm, MRT alarm and Warning", "Visualization of Alarms and Warnings" and "Instantaneous measures sub-menu, MRT" paragraphs.

If one only input channel is used it is mandatory to put a jumper between the terminals ESD1 and ESD2.

ETT: in the **E**nergize-**T**o-**T**rip applications the optional battery must be present.

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9.7.3 Optional Panic Button

On demand, the ITVC can be equipped with an emergency **P**anic **B**utton (**PB**) (push or pull operation can be set and the procedure is described in the paragraph **Administrator** menu, **SETUP** chapter). When engaged, ITVC drives the valve-actuator to its predetermined **safe position**. The reaction time is less than **600ms**. The PB action is set by the parameter "**ESD safety position**". The PB action can be momentary or latched. In case of "latched", the PB action can be reset by a local command or by any local and remote command, according to the configuration of parameters "Op after PB action" and "Panic Button mode" in the Administration menu, SETUP chapter. **PB** is one of the ITVC safety functions (the other ones are ESD Emergency Shutdown and Line Break). The **Diagnostics** function of the digital input detects short circuit and open circuit on the **PB** input channels. If the above failures occur the ITVC drives the actuator in safe position. Option ETT (Energize-To-Trip) or DETT (De-Energize-To-Trip) are available. In case of ETT applications the optional battery must be present.

9.7.4 Failsafe function

The **Failsafe** function allows the actuator performing the configured action when a **Failsafe condition** occurs. The Failsafe action overrides any existing commands and works like an internally generated ESD command. It is activated by the ITVC **Diagnostics** function and its action is set by the parameter "**ESD safety position**". The procedure to set the "ESD safety position" is described in the paragraph ADMINISTRATOR menu (ESD shutdown), SETUP chapter.

9.7.5 Output signalling relays

The following output contacts of relays are available to signal the status of the system "ITVC-H/PCU-Actuator" to the user

- 1 Monitor relay, single side stable, voltage free SPDT contacts: it summarizes the status of **Alarm** and **MRT Alarm**.
- 4 relays, configurable, latched, voltage free SPST contacts (R1, R2, R3, and R4). The **action of contac**t and the **condition to switch** are configurable. The procedure to set the relays is described in the paragraph **ADMINISTRATOR** menu in the SETUP chapter.

Action of contact: the option "**make"** and "**break**" closes and opens the contact when the condition to trip occurs
Condition to trip: the **table of configurable conditions** to switch the R1, R2, R3, R4 relays is shown in the paragraph **ADMINISTRATOR** menu, in the **SETUP** chapter.

9.7.6 Configurable Remote controls

The ITVC has 4 configurable digital inputs, IN1, IN2, IN3, and IN4, available on the user terminal block. Each input can be individually associated to a control signal coming from control room. The configuration procedure is described in the **ADMINISTRATOR** menu, **Digital Inputs** paragraph, **SETUP** chapter. The following options are available.

- **No set**: not used
- **Interlock open**: input to inhibit the open command
- **Interlock close**: input to inhibit the close command
- **PST command**: input of PST command
- **Remote STOP**: input of STOP command
- **LB action**: remote command to inhibit the Line Break action once a pressure event has been detected (only if the Valve Control is enabled). Line Break alarm is cleared.
- **Pressure switch**: input available for an optional pressure switch or any digital signal. The signal can be repeated on the output relays (R1,…, R4). No ITVC function is associated to the input
- **Aut-Man**: automatic / manual
- **Open command**: additional open command, it work in parallel with the OPEN digital input
- **Close command**: additional close commnad, it work in parallel with the CLOSE digital input

9.7.7 Interlock function

The Interlock Open and Interlock Close are two digital signals used to inhibit the opening or closing of actuator. The function is activated by configuring 2 digital inputs, chosen from IN1,…, IN4, as Interlock Open and Interlock Close. The Interlock digital signals come from control room or from an on-off sensor (temperature, pressure, etc.) of actuator or pipeline. The existing open and close commands from remote digital inputs, are cleared.
The ESD command and the Failsafe function overrides the Interlock action. By the factory configuration options the Interlock signals can be set to be active when the signal is present or absent.

9.7.8 4-20 mA analogue output

The ITVC has 2 x 4-20mA analogue outputs available on the user terminal block. Each output can be individually associated to a different signal. The configuration of the outputs is done **in FACTORY**. According to the user request and to actuator type, DVG Automation sets the signal associated to each analogue output.
The following configuration options are available:

- Pressure L1 retransmission
- Pressure L2 retransmission
- Pressure S3 retransmission
- Oil level retransmission
- ITVC temperature retransmission
- Valve Position retransmission
- Position demand retransmission
- Pressure S4 retransmission
- Not used

The instructions in the paragraph **ADMINISTRATOR** menu, in the SETUP chapter, allows the user to re-calibrate the output.

9.7.9 Configuration parameters protection

Unauthorised changes of parameters is prevented by 2 alphanumeric passwords, OPERATOR and ADMINISTRATOR. One further password is reserved to DVG Automation, for factory configuration of ITVC. By the password OPERATOR, the user can view all parameters, but can change few of them. By the password ADMINISTRATOR, the user can view all parameters and can modify a lot of them. The ITVC shows the message “Type password” when it is requested to change a parameter. The ITVC is supplied with the default passwords “**1 0 0 0** “ (**Operator**) and “**00001**” (**Administrator**) . The paragraphs ADMINISTRATOR menu and OPERATOR menu, in the SETUP menu, describe the functions available with password OPERATOR and ADMINISTRATOR. The user can change the default passwords by the “**Change password**" routine in the SETUP menu. After entering the new password, the old one ceases to be valid, so it is important to record the password in a secure location for future retrieval. An option of the Administrator menu, “Reset config”, allows clearing the present configuration and restoring the factory one.

9.7.10 Display control

The function sets the LCD backlight mode and the display contrast. No password is required. The function can be set in the sub-menu with icon  of the SETUP menu  .
Backlight mode:

- Always on: the LCD backlight is always on. The display maintains the last page (the re-power on cycle restores the HOME page)
- Automatic: the LCD backlight switches off after 2 minutes of inactivity of local pushbuttons. The display shows the **HOME** page

Contrast: it can be set from 1 to 3

9.7.11 Alarm, MRT Alarm, Warning

The ITVC is provided with a powerful diagnostic program that monitors the hardware and the software execution and generates **Alarms**, **MRT alarm** and **Warning** in case of malfunction. The table of the **Alarms**, **MRT alarms** and **Warnings** is available in the paragraph **Troubleshooting**. The current Alarm / MRT alarm/ Warning can be locally viewed by the procedure described in the paragraph "**Visualization of Alarms and Warnings**"
The ITVC carries out the following actions when an Alarm, MRT alarm and Warning occurs:
Warning: the ITVC does not perform any action, it only raises the local signalling of warning by the icon ⚠ and by the fuchsia LED of pushbutton ↵. A remote signalling can be generated by the configuration options of the Output Relays.
Alarm: the alarm condition is locally signalled by the icon A and by the red LED of pushbutton ↵, and remotely by the tripping of the Monitor Relay. Depending on the type of malfunction the ITVC inhibits the commands to the actuator or drives the valve in the safe position or only signals the failure.
MRT alarm: the MRT alarm condition is locally signalled by the icon A and by the red LED of pushbutton ↵, and remotely by the tripping of the Monitor Relay. In the list of the alarm is present "**MRT timer**". The **safe action** due to the malfunction is performed only when the **MRT** (**M**aximum **T**ime to **R**epair) expires. Setting of **MRT time** is done by the option "MRT" in the ADMINISTRATOR menu, SETUP chapter. The option "MRT", described in the **Instantaneous measure sub-menu** paragraph, MEASUREMENT menu allows viewing the type of MRT alarm and the remaining time before than the safe action starts. This procedure allows also clearing the **MRT alarm**. The procedure resets the selected MRT alarm, but it is effective only if the malfunction is solved.
If the ITVC carries out the safe action in the alarm list appear the message "**Safety action**" and the issue that causes it (Performing ESD, Line break action, Panic Button, etc.).
When an Alarm/Warning ceases, the list is automatically updated. In case of Alarms and Warning present at the same time, only the Alarms can be viewed. The Warning can be viewed only after having removed the Alarms.
The **RESET** function, described in the paragraph "**Visualization of Alarms and Warnings**", allows clearing the selected alarm or warning. **Reset** will be effective only if the issue will be solved.
The above procedure does not reset the **MRT alarm**. They can be cleared only by the procedure described in the "**Instantaneous measure sub-menu, MRT"** paragraph, MEASUREMENT menu.

9.7.12 Instantaneous and Historical data and graphs

The ITVC acquires the variables connected to its input channels and visualizes them as: Instantaneous measures, 24 hours records, Alarm history, Temperature history, Event history. The zoom facility allows viewing the details relevant to one hour. The procedure to view the above data is described in the "**MEASUREMENT menu**" of **ITVC HMI** chapter.

- **Instantaneous measure:** the values are continuously updated.
- **24 hours records:** L1, L2, S3, S4 pressure history, Position history.
  - The records are available only if the acquisition of data was previously enabled in the **SETUP** menu.
  - Max memory capacity: 180 days/1 sensors, 120 days/2 sensors, 60 days/3 sensors
- **Event History**:
  - The records are available only if the acquisition of data was previously enabled in the **SETUP** menu. The following events are recorded: External ESD, PSLL/PSHH (if present), (PSWLL/PSWHH= Pressure switch low-low or high-high), PSL/PSH (if present) (PSL/PSH= Pressure level low or high), PB(if present) (PB=Panic Button)
- **Temperature history**: it records the minimum and maximum temperature of the Logic and Power electronic boards
- **Alarm history**: it records the last alarms and date (more than thousand), detected by the ITVC
- **PST, FST, Line Break, HPU, etc.**: they are described in the ANNEX A,B,.., etc.

9.7.13 Test of coils of Solenoid Operated Valves

This function allows setting the type of test of Solenoid Operated Valve coils. Two options are available: Automatic and Manual. In Automatic the test is performed every 8 hours, in Manual the test is performed immediately, by executing the procedure "**Coil test**" in the ADMINISTRATOR menu of SETUP chapter. The test compares the current of each coil with the values measured with the procedure "**Test coil absorption**" in the ADMINISTRATOR menu. If the comparison is OK the test is passed. If the test fails, the ITVC raises an Alarm that can be viewed in the Alarm list.

9.7.14 Measure of closing time

At the end of every valve closure, the closing time is compared with the reference "closing time" set by DVG Automation. If the comparison fails the ITVC raises an Alarm. The user can measure the closing time by the procedure described in the paragraph "Stroking time test", SETUP menu (it can be useful in the start-up phase to calibrate the pneumatic or hydraulic adjustable flow control valves).

9.7.15 Date and time

The function Date and Time is used to set the present date and time of ITVC. The function can be set by the sub-menu with icon 21-12-2012 of the SETUP menu . No password is requested to set it.

9.7.16 Digital input repetition

This function is used to retransmit the status of one digital input (chosen between IN1,…, IN4) by an output relay (chosen between R1,…, R4). See paragraphs "Configurable Remote controls" and "Output signalling relays". The configuration option to use is:

- Digital input = Pressure switch
- Output relay = Pressure switch

The setting procedures are described in the paragraphs "Digital inputs" and "Output relays" of the Administrator menu, SETUP chapter.

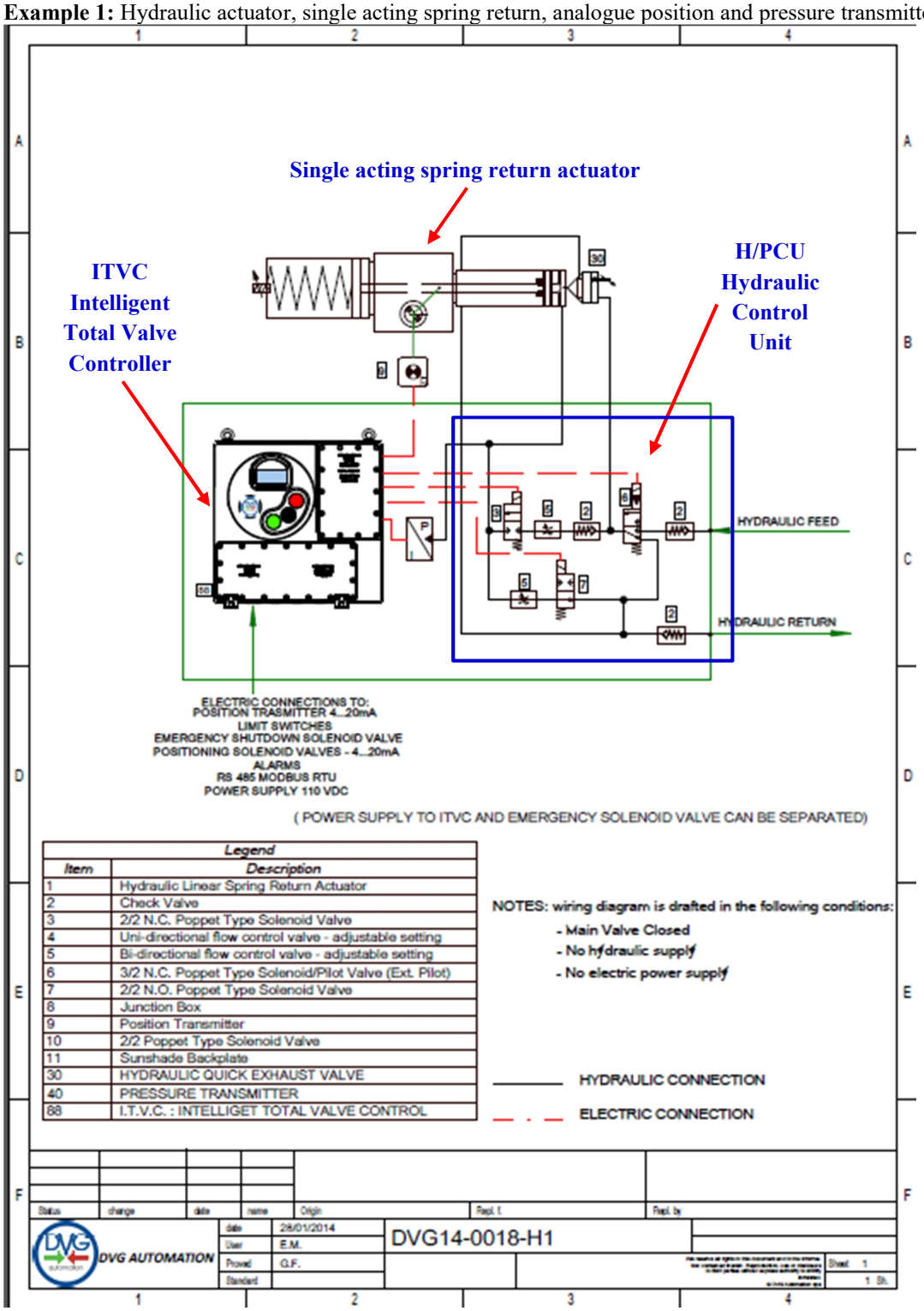
9.7.17 CPU's and Diagnostics

Safety functions (Emergency Shutdown, Panic Button and Line Break) are managed by two independent CPU's working in parallel. They manage input reading, logic processing, output enabling and fault detection and reaction

- **Logic block** and **Output block** are realised in **1oo2** redundant architecture
- **CPU Diagnostic**: Diagnostics processed by each CPU includes: Comparison between the two CPUs, Software flow diagnostics, Watchdog, System clock monitor etc. In case of fault an MRT alarm is generated. In case of faults not imputable to an identified channel, like Power supply, Temperature, etc., the system switches to failsafe state.
- **Digital input Diagnostics:** See Emergency Shutdown and Panic Button paragraphs
- **Analogue input diagnostics:** See Annex B: Line break function

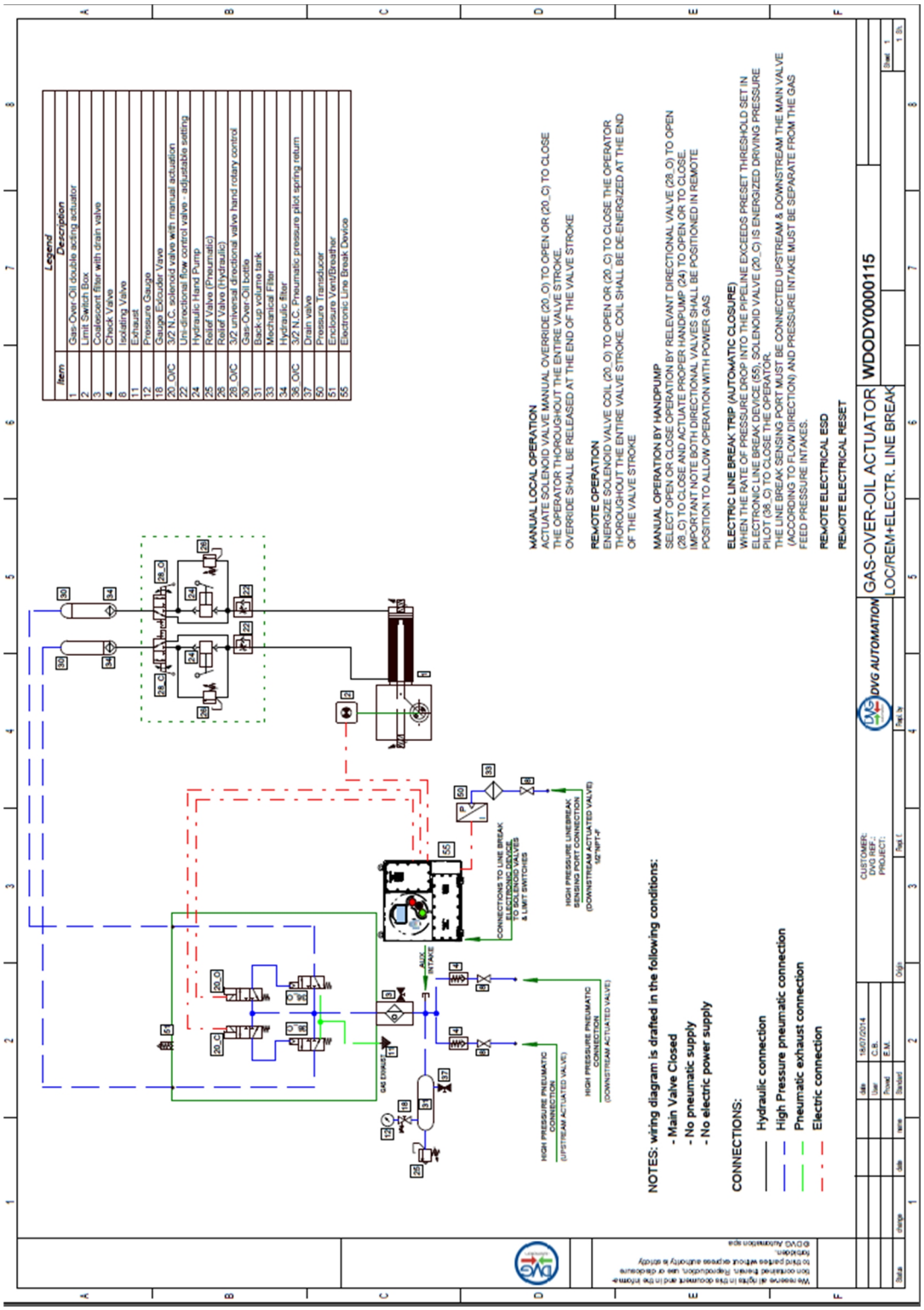
9.8 Examples of ITVC applications

Example 1: Hydraulic actuator, single acting spring return, analogue position and pressure transmitters



Legend	
Item	Description
1	Hydraulic Linear Spring Return Actuator
2	Check Valve
3	2/2 N.C. Poppet Type Solenoid Valve
4	Uni-directional flow control valve - adjustable setting
5	Bi-directional flow control valve - adjustable setting
6	3/2 N.C. Poppet Type Solenoid/Pilot Valve (Ext. Pilot)
7	2/2 N.O. Poppet Type Solenoid Valve
8	Junction Box
9	Position Transmitter
10	2/2 Poppet Type Solenoid Valve
11	Sunshade Backplate
30	HYDRAULIC QUICK EXHAUST VALVE
40	PRESSURE TRANSMITTER
88	I.T.V.C. : INTELLIGET TOTAL VALVE CONTROL

Example 2: Gas-over Oil actuator, double acting, remote electrical ESD



10 ITVC HMI (ITVC Human Machine Interface)

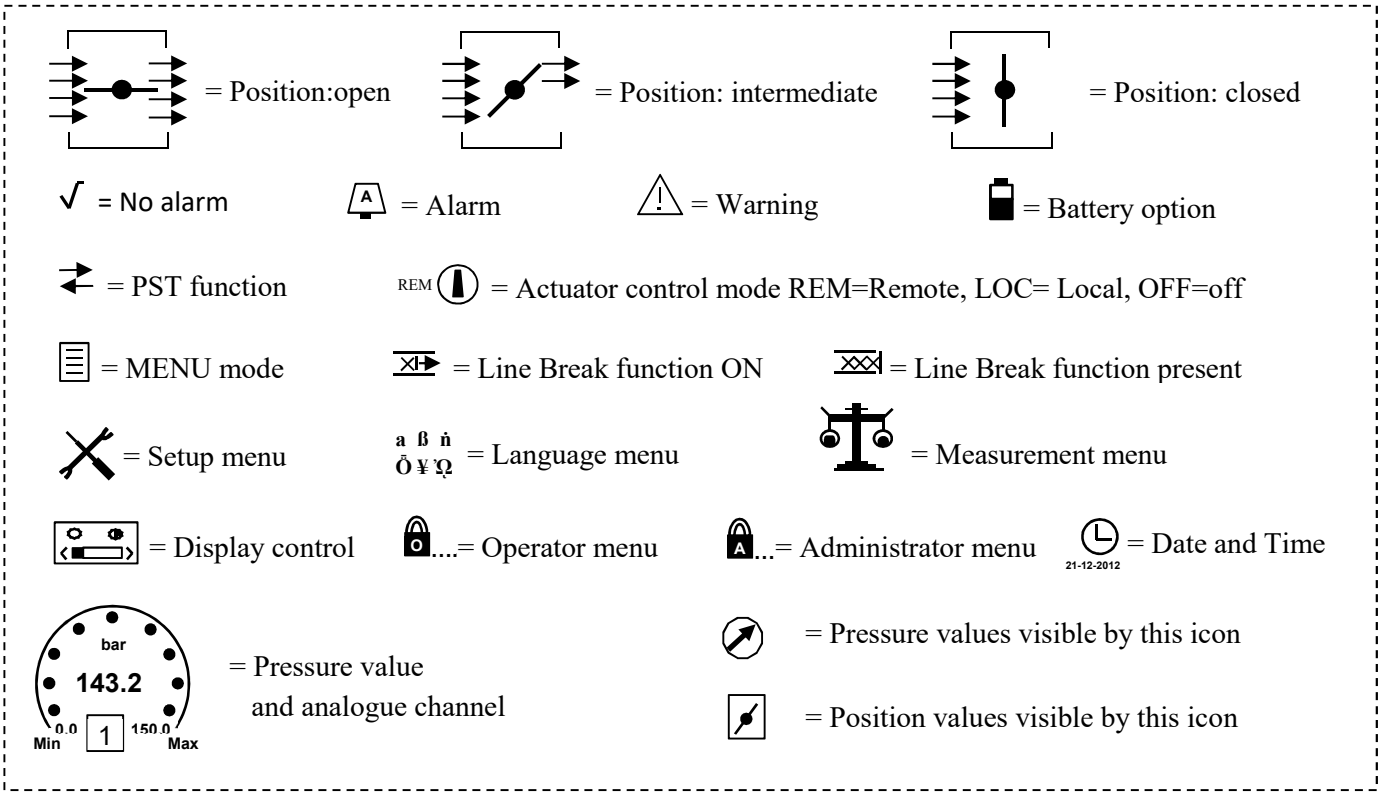
The **ITVC** is provided with a powerful **H**uman **M**achine **I**nterface (**HMI**). It allows the following operations:

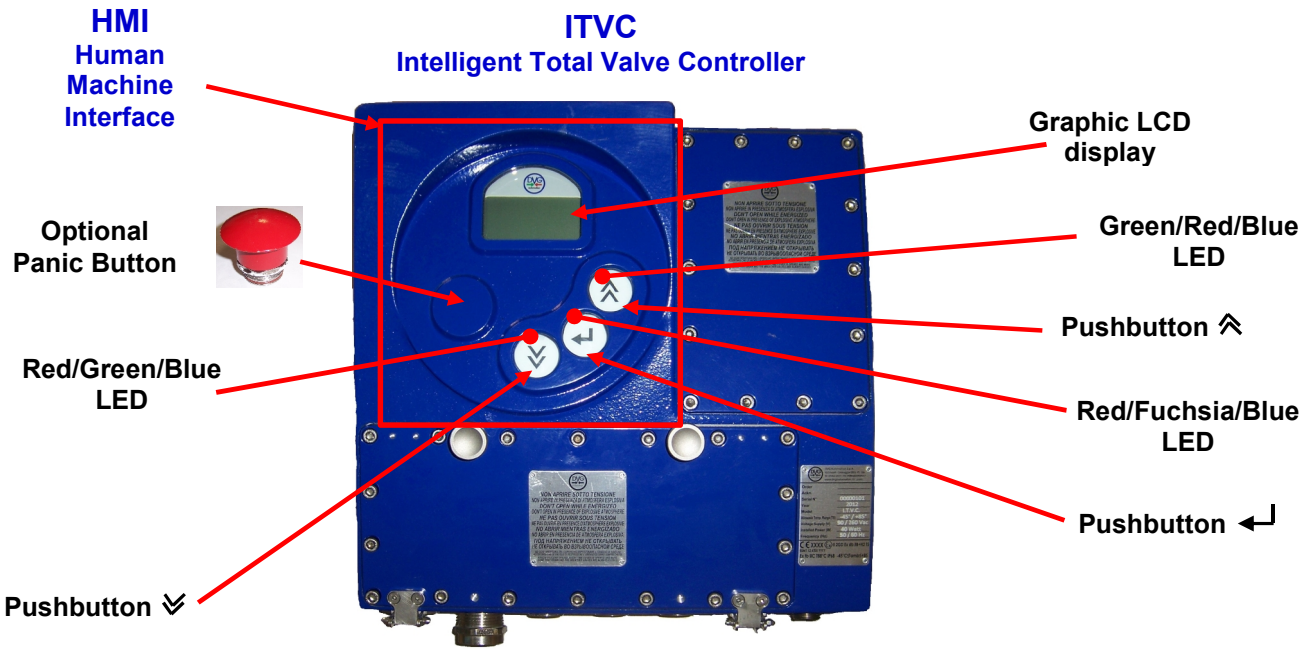
- **to set the actuator control mode** in
  - LOCAL: the ITVC electronics controls the actuator by means of the ITVC local pushbuttons
  - OFF: the ITVC electronics does not generates any electrical output to move the actuator
  - REMOTE: the ITVC electronics controls the actuator according to signals coming from control room
- **to drive the valve in opening or closing by means of local pushbuttons**
  - if the actuator control mode is LOCAL, the pushbuttons ⩓ and ⩔ drive the valve in opening and closing direction and ↵ stops the travel.
- **to navigate in the MENU** to
  - view and modify the working parameters
  - send commands to ITVC electronics, actuator, transmitters, etc. to execute calibration procedures and operations on data stored in the memory
  - view the value of the current variables (position, temperature, pressure, status, etc.)
  - view the "Alarm" and "Warning" list
  - clear the "Alarm" and "Warning" list
  - enter and modify the access password
  - view historical data (Alarms, Warnings, PST curves, etc.)

The ITVC **HMI** consists in:

- Two green/red LED's located near to pushbuttons ⩓ and ⩔. The green LED, near to pushbutton ⩓ , signals **valve open** (LED on) or **valve opening** (LED flashing). The red LED, near to pushbutton ⩔ , signals **valve closed** (LED on) or **valve closing** (LED flashing). If both LED's are off the valve is in **intermediate position**. If a LED is off and the pushbutton is pressed, it light up, blue colour. The LED's colour and function can be changed by the setting operation in the menu.
- One red/fuchsia LED located near to pushbutton ↵. It signals ALARM when it is red, WARNING when it is fuchsia, NO Alarm/Warning when it is off. If the LED is off and the pushbutton is pressed, it lights up, blue colour.
- One graphic LCD display, 64x128 dots. When the actuator is powered, the display shows the "**HOME**" page. It collects the most important data relevant to actuator (position, status, etc.) in one only view. The LCD backlight is normally off and switches on as a local pushbutton is pressed. **Icons** and **texts** give clear information to operator and make the menu user friendly**.** Different languages are available. The position of the display cursor is shown by a **flashing icon** or by the **symbol** " ► ".
- Three pushbuttons " ⩓ , ⩔ , ↵ " with the following functions:
  - in **REMOTE** and **OFF** actuator control mode: the pushbutton ⩓ **moves up** the cursor of the display or **increases** the value of the selected variable. The pushbutton ⩔ **moves down** the cursor of the display or **decreases** the value of the selected variable. The pushbutton ↵ **sets** the new value of the variable or **enters** in the sub-menu of the selected variable or icon.
  - in **LOCAL** actuator control mode: the pushbuttons ⩓ , ⩔ , ↵ work as open, close , stop commands

The below figure shows some **icons** of the display. When an **icon flashes**, the cursor is positioned on it. The following paragraphs shows the procedure to navigate in the ITVC menu.

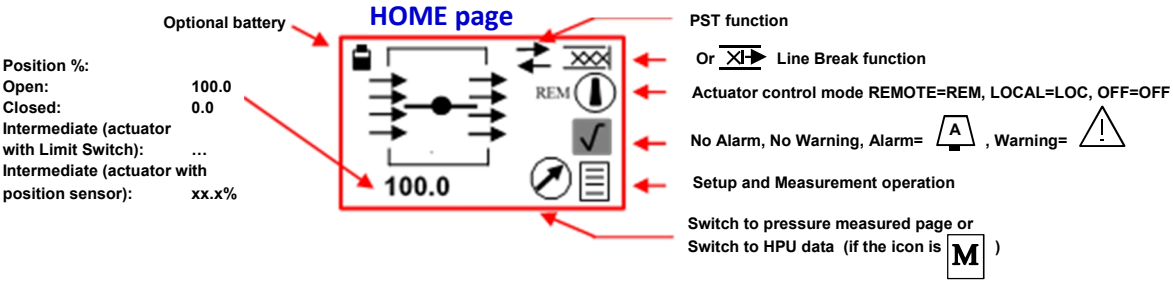




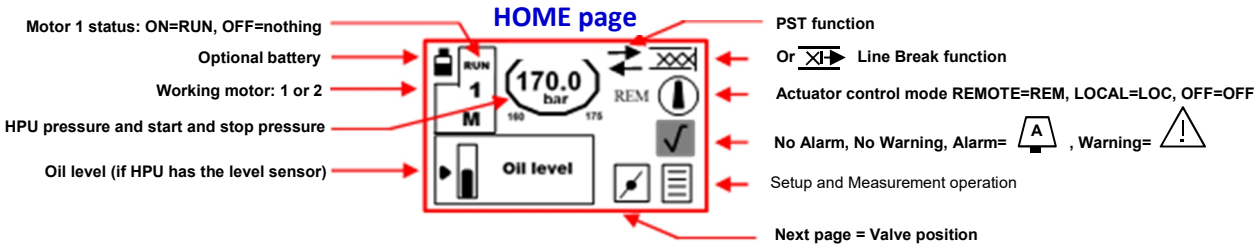
10.1 HOME page

In the normal operation the **HMI** display shows the **HOME page**. Depending on the ITVC configuration, three different HOME pages are available. The presence of the optional battery is shown by the icon , on the high, left corner of the display. The icon shows the battery charge level. The flashing icon shows the current position of cursor. The default position of the cursor is on the icon of **ITVC status**, √ or A or ⚠ .

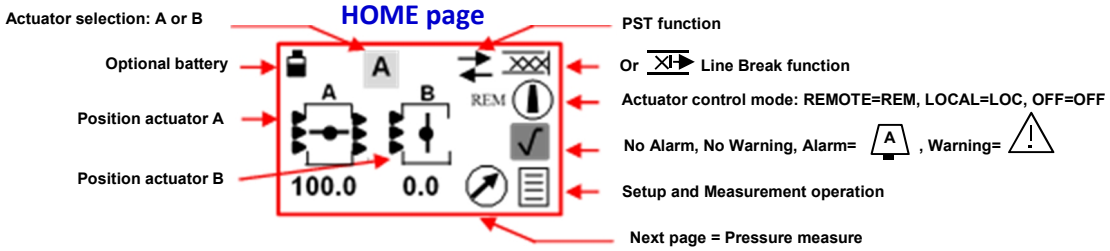
- **HOME page "Standard type"**: it shows the **icons** of the **actuator control mode** (Local, Off, Remote), **valve position** (open, close, intermediate), **ITCV status** (No Alarm and Warning, Alarm, Warning), **PST** function, **Line Break** function, **Optional battery, Setup and Measurement, Pressure measures**. The icons "Optional battery", "PST function", "Line Break function", "Pressure measures", are visible only if the relevant functions are active.



- **HOME page "HPU type"**: it shows the **icons** of the **actuator control mode** (Local, Off, Remote), **ITCV status** (No Alarm and Warning, Alarm, Warning), **HPU pressure**, **HPU oil level**, **HPU motor status**, **PST** function, **Line Break** function, **Optional battery, Setup and measurement, Valve Position**. The icons "PST function", "Line Break function" and "Optional Battery" are visible only if the relevant functions are active. See Annex C: HPU function



- **HOME page "HIPPS type"**: it used in HIPPS applications. The ITVC controls 2 actuators **A** and **B**. The display shows the **actuator control mode** (Local, Off, Remote) of selected A or B, **valve position** (open, close, intermediate) of both A and B, **ITCV status** (No Alarm and Warning, Alarm, Warning) of selected A or B, **PST** function, **Line Break** function, **Optional Battery**, **Setup and Measurement**, **Pressure measures**. The icons "Optional battery", "PST function", "Line Break function" and "Pressure measures" are visible only if the relevant functions are active. See Annex D: HIPPS function.



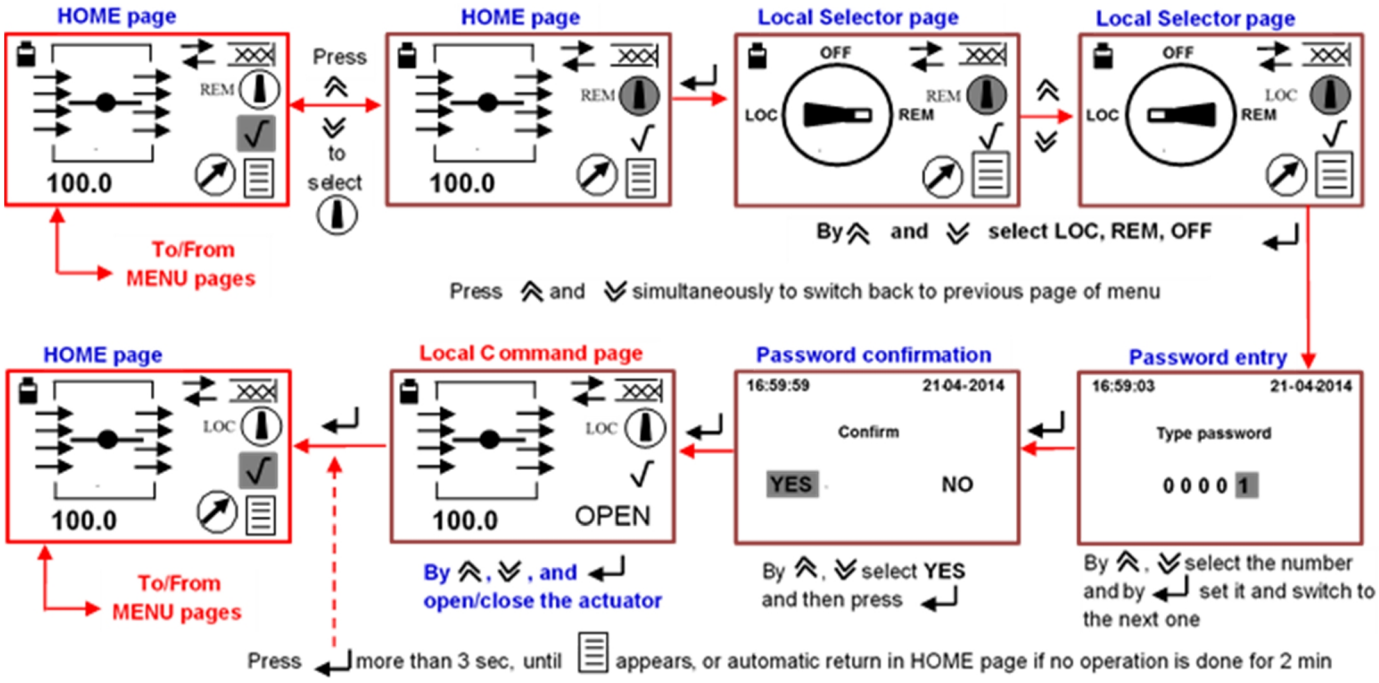
The actuator works according to the configured **actuator control mode, LOCAL, REMOTE, OFF**:

- in **LOCAL** and in **HOME** page, the pushbuttons ⇈⇊↵ are available for menu operations
- In **LOCAL** and in **Local Command** page, the pushbuttons ⇈⇊↵ work as local Open/Close/Stop actuator commands.
- in **REMOTE,** the actuator is remotely controlled.
- In **OFF,** any local or remote command to move the actuator is inhibited.
- In **REMOTE** and **OFF**, the pushbuttons ⇈⇊ and ↵ are available for menu operations.

On request **OFF** can be disabled, in this case only LOCAL and REMOTE are available.
On request the pushbutton ↵ can be configured to work as "Local STOP active even if actuator control mode is REMOTE".
The procedures and figures in the next paragraphs use the **HOME** page "**standard type**". In case of ITVC with HPU or HIPPS control, the HOME page should be replaced by the HOME page "**HPU type**" and "**HIPPS type**".

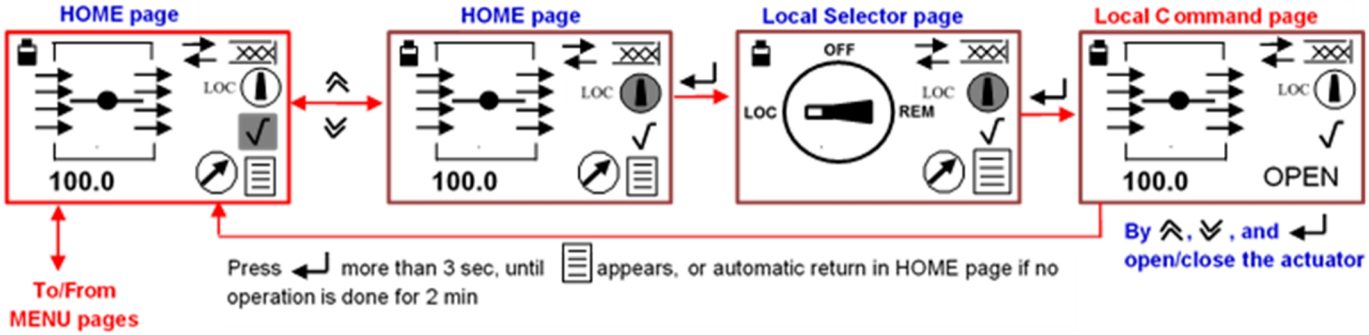
10.2 Actuator control mode

The following figure show the procedure to change the actuator control mode from **REMOTE** to **LOCA**L and to enter in the **Local Command** page to move in open and close the actuator by the pushbutttons ⇈⇊ and ↵ (see configuration options in the paragraph "Local and Remote controls", Administrator, SETUP menu). Password Administrator is required. The current actuator control mode is visible in the HOME page, REM=REMOTE, LOC=LOCAL, OFF=OFF.
Exit from **Local Command** page and return in **HOME** page is: **automatic** = no operation of pushbuttons is done in 2 min or **manual** = by pressing ↵ more than 3 sec, until the HOME page appears.

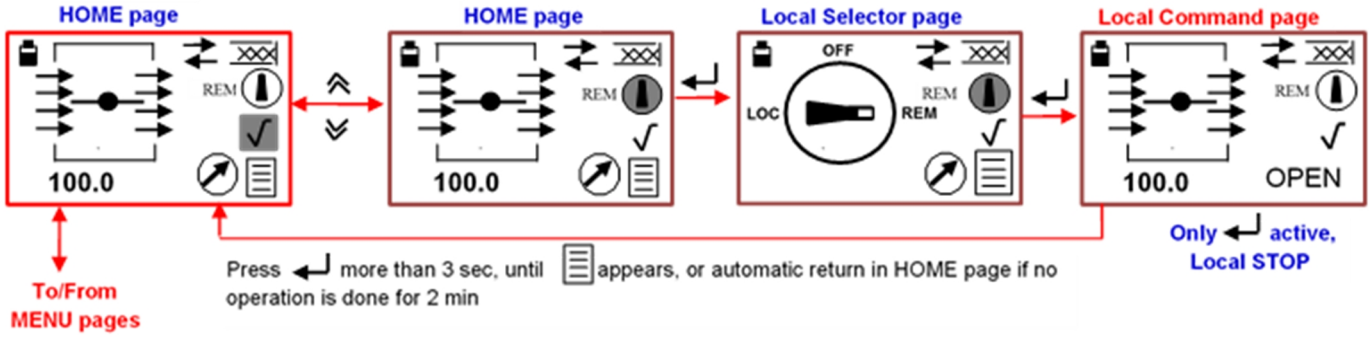


The same procedure can be used to switch from **LOCAL** or **OFF** to **REMOTE**. When the **Local Command** page appears, press ↵ more than 3 sec, until the HOME page is available.
If the procedure is used to switch from LOCAL or REMOTE to **OFF**, the **Local Command** page is not present and the display switches to HOME page from "Password confirmation" page.

The next figure shows the procedure to switch from **HOME** page to **Local Command** page without changing the actuator control mode. No password is required. This procedure enables the local actuator commands if the control mode is LOCAL.



If the actuator has the option "**Local STOP always active**" and the local control mode is **REMOTE**, the below procedure should be used to switch from **HOME** page to **Local Command** page to enable the STOP command This option is supplied only on request and allows using the local pushbutton ↵ to STOP the actuator even if the actuator control mode is REMOTE.



10.3 Navigation in the MENU

To **wake up** the display: press any pushbutton of HMI. The backlight switches on and menu operation are available

The **flashing icon** or **text** shows the position of the **cursor**. By the pushbuttons ⇈ and ⇊ move the cursor on the desired icon and then press ↵ to get in the selected sub-menu.
To **return** to previous page of menu:

a) Press simultaneously ⇈⇊ or
b) By ⇈ and ⇊ , move the cursor ▸ on ← and then press ↵

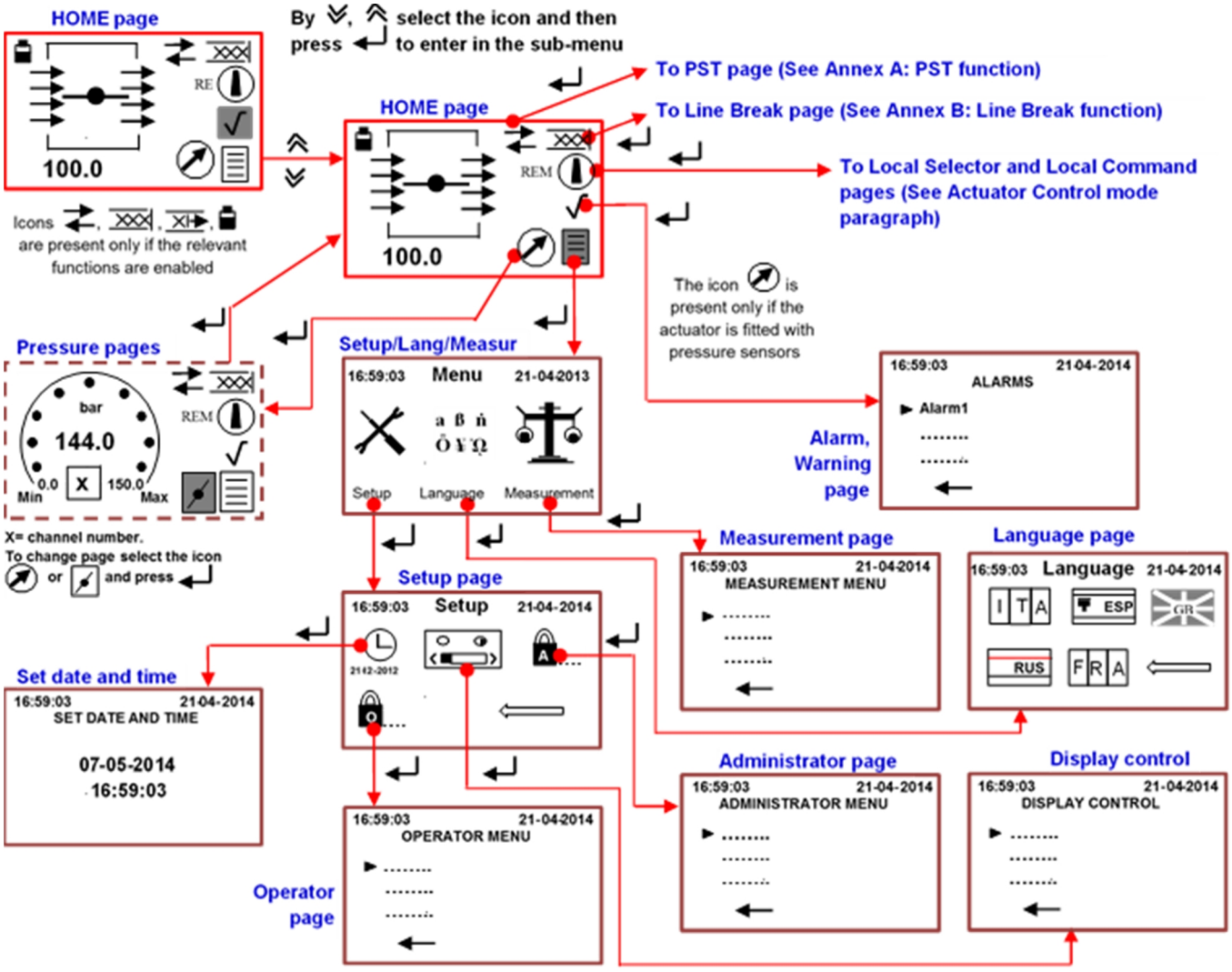
To **restore** the **HOME** page:

c) in any position of the menu, wait 2 min without any operation by pushbuttons
d) re-power the ITVC
e) in **Local Command** page (see Actuator Command paragraph) press ↵ more than 3 sec, until the **HOME** page appears
f) by the procedures described in a) and b), page by page switch back to **HOME** page

The icon ◔ is present only if the actuator is fitted with pressure sensors and allow viewing the **pressure pages**. The icon ◪ allows switching in the **position page**.
The icons ⇄ and ⌧ , ⌧▸ and ▮ , are present only if the PST, Line Break and Optional battery functions have been enabled by the manufacturer (See Annex A,B, etc. (PST, Line Break and Optional Battery functions).

10.3.1 MENU chart

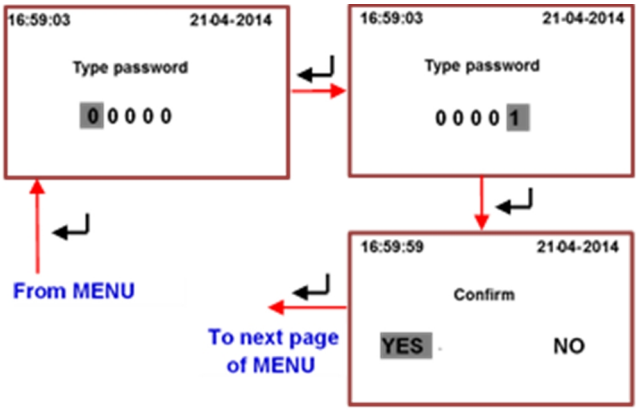
The following figure shows the flow chart of the ITVC menu. This IOM shows only the MENU chart with **HOME** and **MENU** pages "**Standard type"**. In case of HPU and HIPPS type, the **HOME** and **MENU** pages should be replaced with the corresponding "**HPU type"** and "**HIPPS type"** pages, the remaining parts of the chart do not change.



10.3.2 Password entry

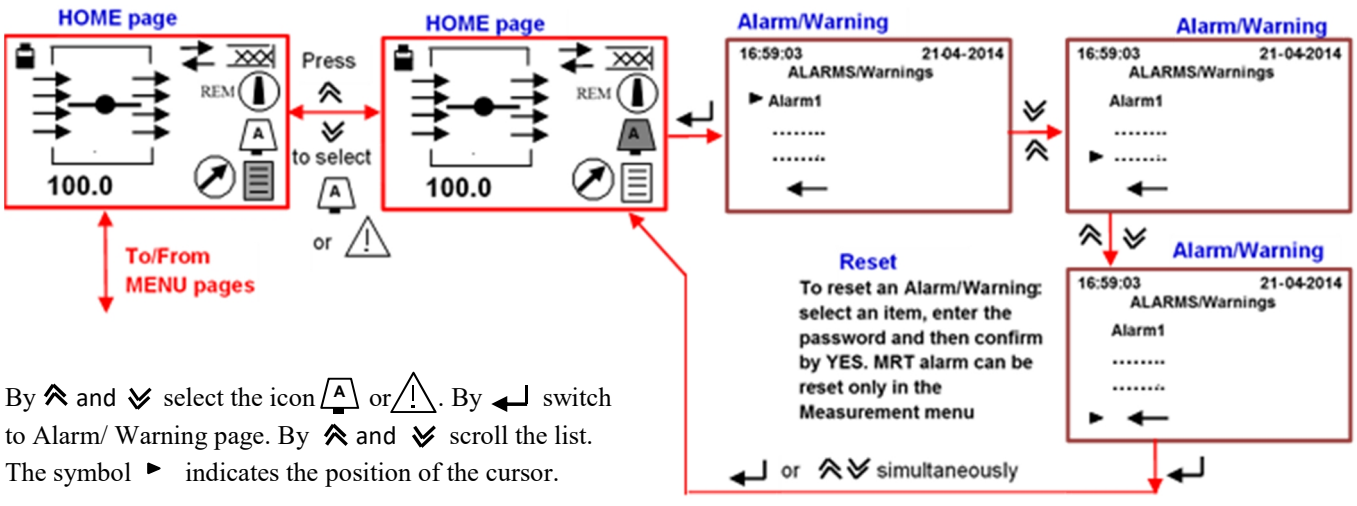
The ITVC working parameters are protected against unauthorized changes by passwords.
Two password levels are available, **O**perator ( ) and **A**dministrator ( ). The default value of the Operator password is "**1000**". It allows setting the LED colours of the ITVC HMI and viewing the most important parameters and the firmware version. The default value of the Administrator password is "**00001**". This password allows changing all control parameters of the ITVC.
The user can change the default passwords by the "**password change**" menu. As the new password is entered the old one is no longer valid.

The ITVC-HMI **automatically** shows the message "**Type password**" when the password is requested to proceed in the menu operation. The procedure to enter the password is the following: By ⩛ and ⩓ select the character, then by ↵ set it and switch to the next character. Enter for 4 characters for password **Operator** and 5 characters for password **Administrator**. After having entered the last character it is requested to confirm the password. By ⩛ move the cursor to **YES** and then press ↵ to confirm.



10.3.3 Visualization of Alarms and Warnings

If the there is an ALARM or a WARNING the icons A or ⚠ replace the icon √ in the **HOME** page. In case of Alarm the LED near to pushbutton ↵ is on, red colour, in case of Warning the same LED is still on but fuchsia colour.



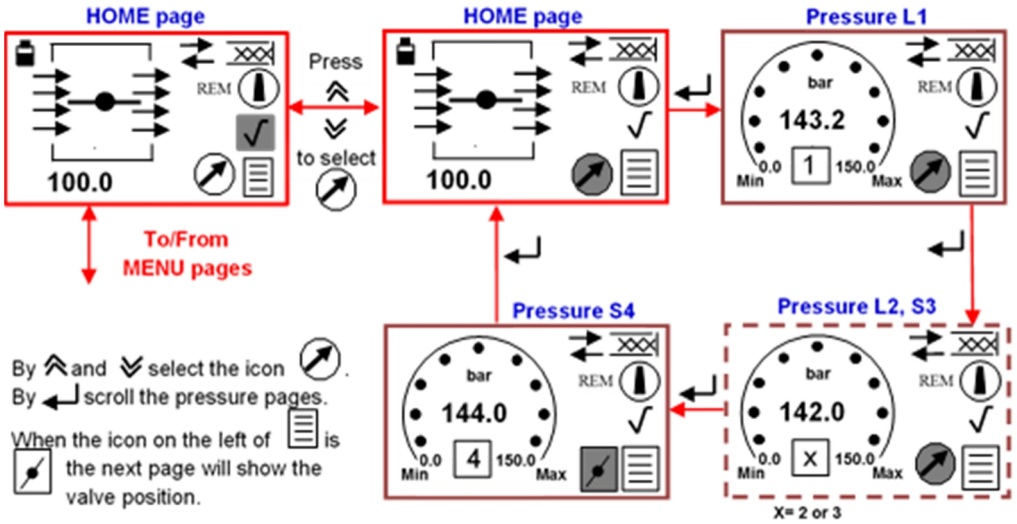
By ⩛ and ⩓ select the icon A or ⚠. By ↵ switch to Alarm/ Warning page. By ⩛ and ⩓ scroll the list. The symbol ► indicates the position of the cursor.

To return to **HOME** page, press simultaneously ⩛⩓ or move the cursor ► on ← and then press ↵

The above procedure allows viewing only the current Alarms, MRT alarms and Warnings. When an Alarm/Warning ceases, the list is automatically updated. In case of contemporary presence of Alarms and Warnings, only the Alarms can be viewed. The Warnings can be viewed only after having removed the Alarms. If the ITVC performs the safe action, in the list appears the message "**Safety action**" and the issue that caused it (Line Break action, Performing ESD, etc.).
To **RESET** an alarm or warning, by ⩔ and ⩒ select one item of the list and then press ↵ . Enter the password Administrator and then select YES and press ↵ to return to **HOME** page. (See Password entry paragraph). Reset will be effective only if the issue will be solved. In case of **MRT alarm,** the list contains the alarm "**MRT timer**". MRT alarms cannot be reset by the above procedure. They can be viewed and **cleared** by the procedure described in the paragraph "**Instantaneous measures sub-menu, MRT**", MEASUREMENT menu.
The chapter **Troubleshooting** shows the list of all possible ITVC Alarms, MRT alarms and Warnings with the indication of the potential cause and suggested action to solve the problem.
By the procedure described in the paragraph **Historical data**, in the MEASUREMENT menu, it is possible to see the list of the last Alarms, MRT alarms and Warning.

10.3.4 Visualization of Pressures

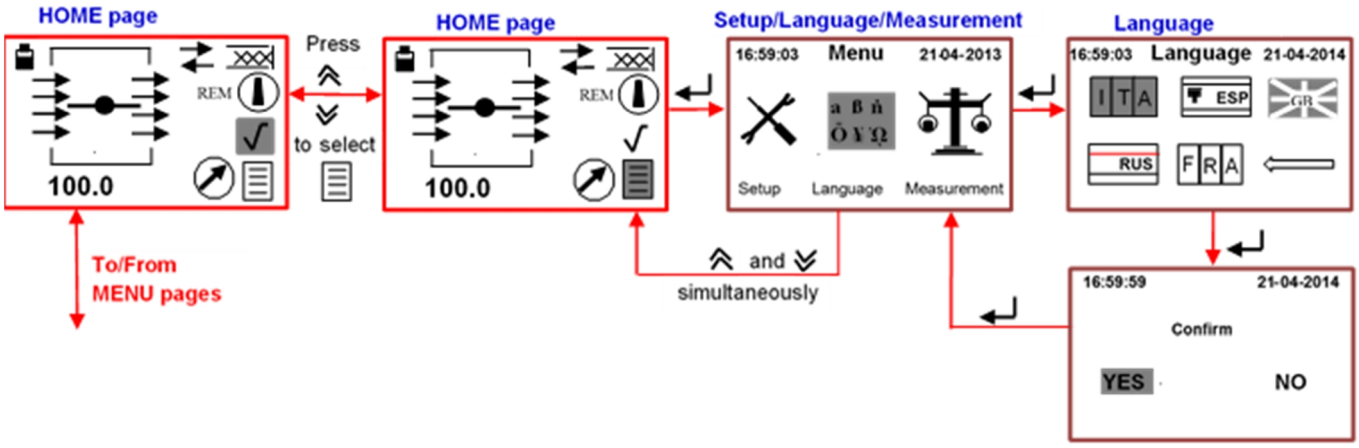
If the actuator is equipped with transmitters to measure the pressure in the cylinder or in the pipeline, the user can view the instantaneous pressure measures by the option "Pressure visualization". The presence of pressure pages is shown by the icon on the left of , in the **HOME** page. The pressure pages shows the value of the pressure and the analogue channel to which the transmitter is connected to. The icon in place of shows that the next page of menu is the "**Valve position**". The operator moves in the Pressure and Position pages by pressing the pushbutton ↵ .
If an analogue channel is not connected to a transmitter, the relevant pressure page is not present in the menu.



In case of ITVC with HPU control, the **HOME** page is **HPU type**. It shows the HPU data and the icon in place of . It means that the next page of the menu is the "Valve position". If present, the pressure data can be viewed in the next pages by pressing ↵ . See **Annex B and C: Line Break function** and **HPU control**.

10.3.5 LANGUAGE menu

The following procedure allows setting the menu language. No password is required to change the menu language

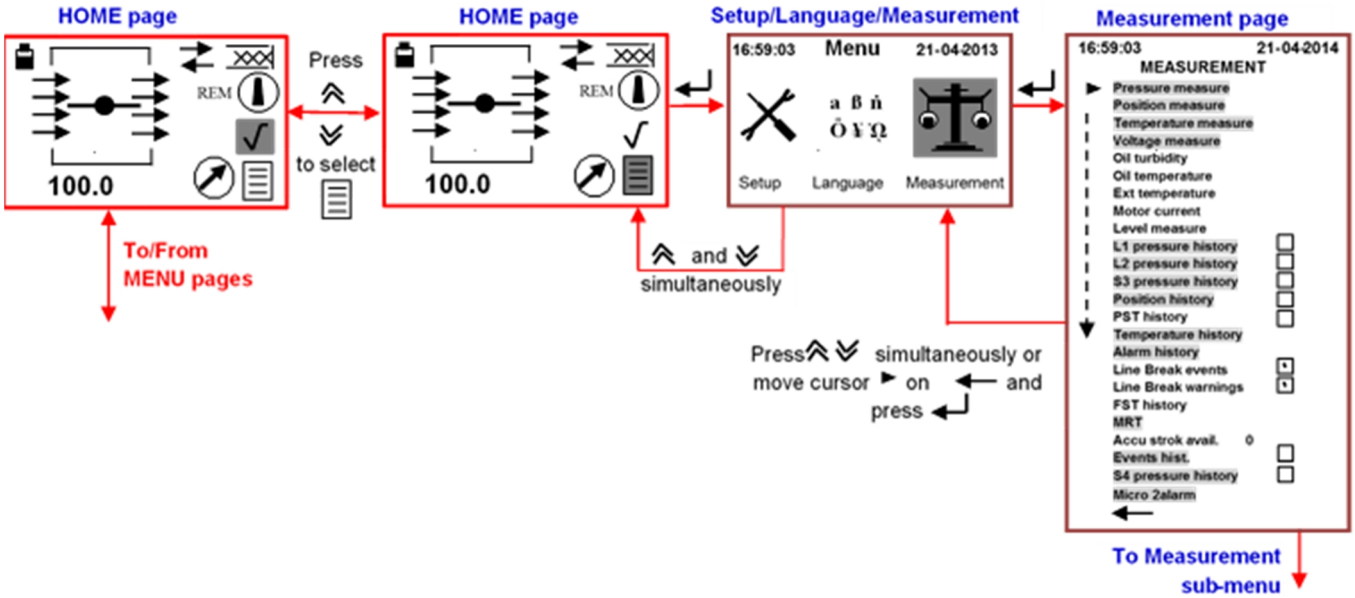


By ⩓ and ⩔ move the cursor on the icon ☰ .

Press ↵ to switch to **Setup/Language/Measurement** page. By ⩓ and ⩔ select the icon a ß ń Ō ¥ Ω .
Press ↵ to view the page of the available languages. By ⩓ and ⩔ select the language. Press ↵ to set the language. By ⩓ and ⩔ move the cursor on YES and then press ↵ to confirm and return to previous page of menu.
Press ⩓⩔ simultaneously to return to **HOME** page.

10.3.6 MEASUREMENT menu

This menu allows viewing the instantaneous and historical values and graphs of the variables managed by the ITVC.



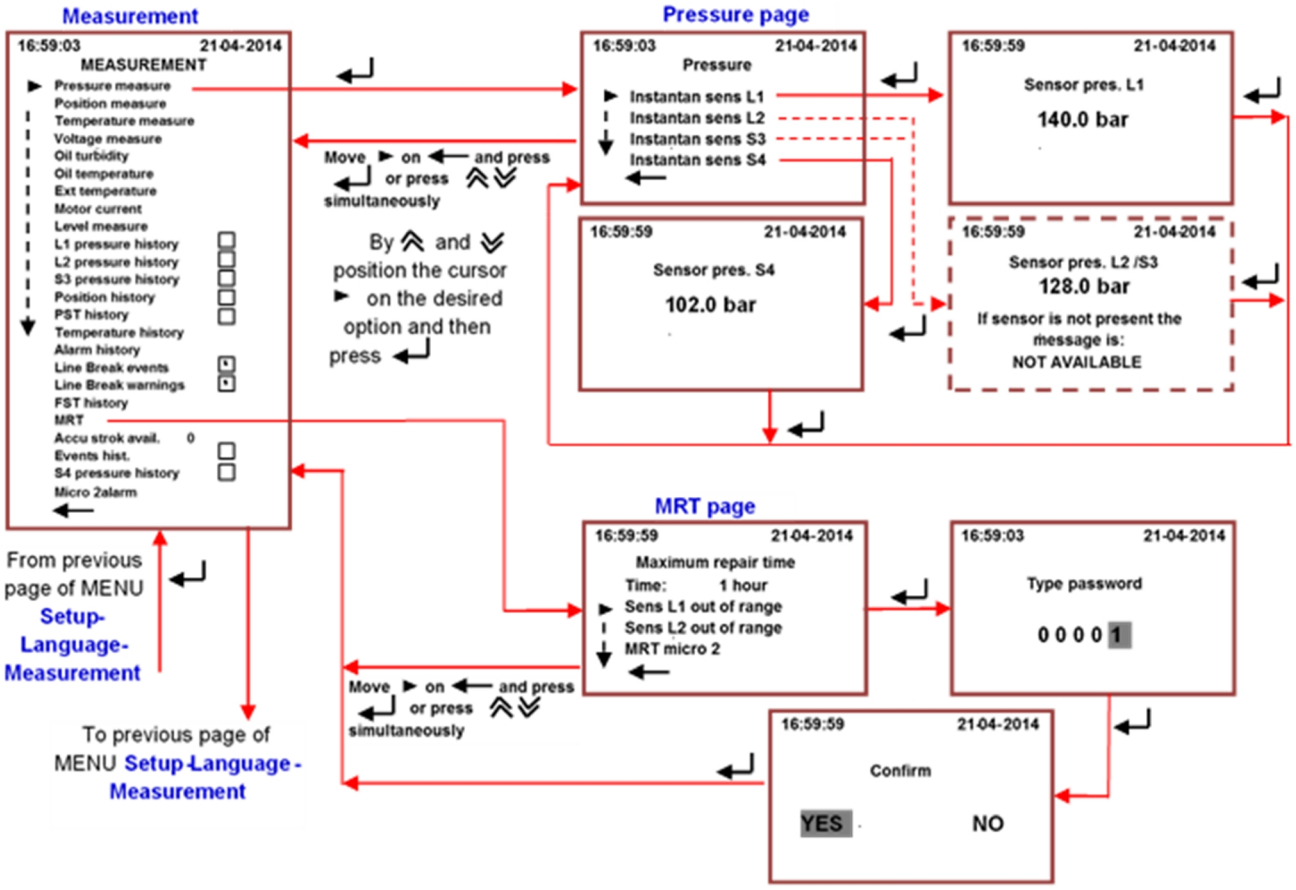
By ⩓ and ⩔ move the cursor on the icon ☰.

By ↵ switch to **Setup/Language/Measurement** page. By ⩓ and ⩔ select the icon ⚖.
Press ↵ to view the **MEASUREMENT** page. By ⩓ and ⩔ move the cursor ► on the desired option and then press ↵ to view the data. The symbol "⊡ " indicates if the option is available (not available "□")
To return to previous page of menu, **Setup/Language/Measurement**, move the cursor ► on ← or press ⩓⩔ simultaneously.
Press again ⩓⩔ simultaneously to return to **HOME** page.

The options in **grey** in the page "**MEASUREMENT**", are described in this document. The next figures describe only the procedures relevant to the above options. The remaining options of the "MEASUREMENT" page are described in the **ANNEX A,B,..** etc.

10.3.6.1 Instantaneous measures sub-menu

- **Pressure measure** and **MRT** (**M**aximum **R**epair **T**ime) sub-menu
  - **Pressure measure: the values are visible only if the relevant sensor are connected to ITVC**
  - **If the pressure sensor is configured "absent", the message of display is "NOT AVAILABLE"**
  - **MRT: the complete list of the MRT alarms is shown in the Alarm/Warning/MRT paragraph**



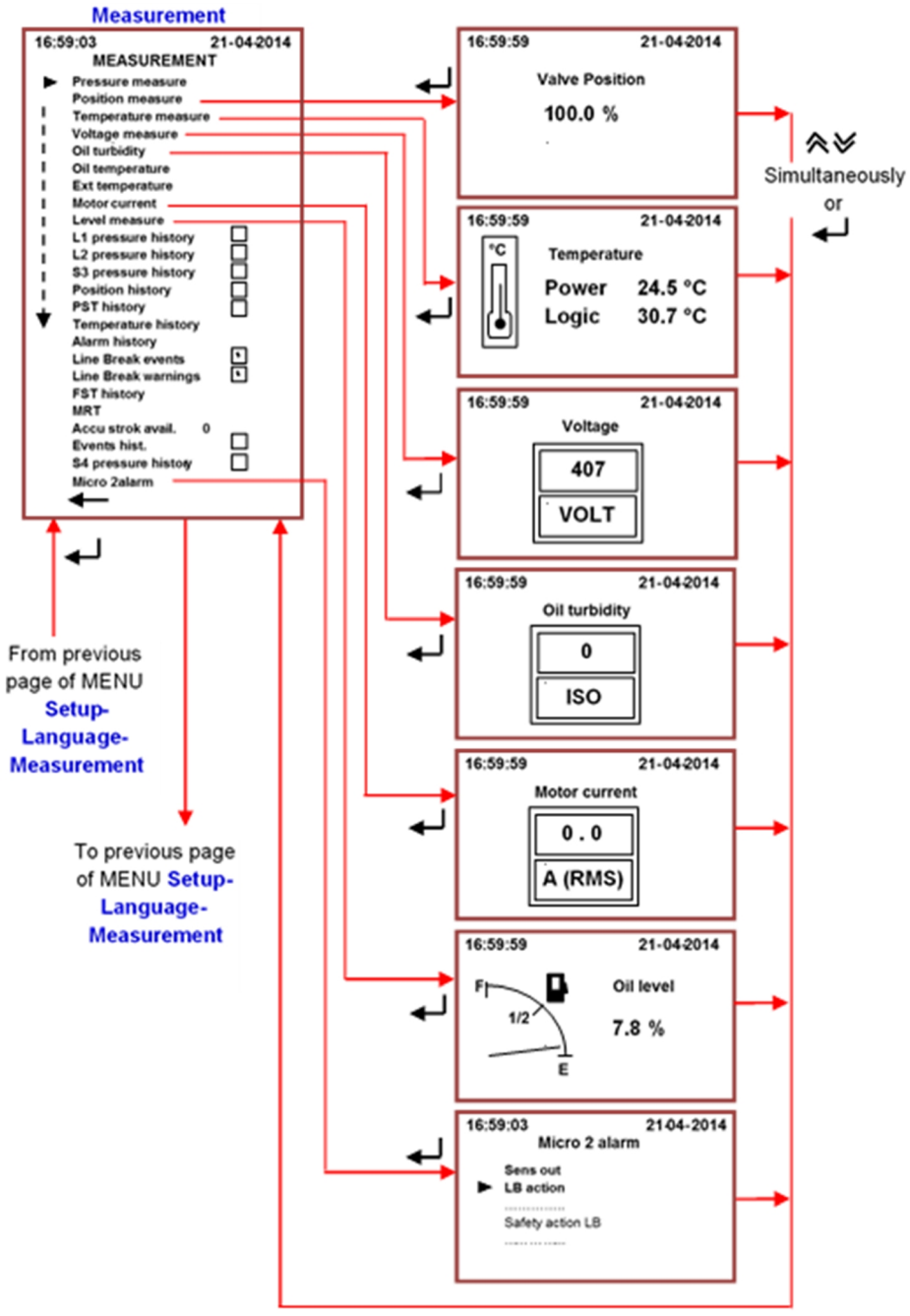
To switch back to previous page of menu press ⇈⇊ simultaneously or by ⇈ and ⇊ move the cursor ► on ◄ and then press ↵

The MRT page shows alternatively:

- **the remaining MRT time before than the configured safe action starts**
- **the current MRT Alarms**

The list of the MRT alarms is shown in the Alarm/Warning/MRT paragraph
To reset an MRT alarm: move the cursor ► on the alarm line. Press ↵. Enter the password administrator. Confirm by YES and press ↵ . Reset will be effective only if the issue will be solved.

- **Position-Temperature- Voltage-Oil turbidity-Motor current-Oil level-Accu strok, Micro 2 alarms**
- **If the measure is not done (since the sensor is not present or the ITVC does not manage the data) the message of display is "NOT AVAILABLE"**



Instantaneous value of valve position in percentage of opening. It is available only if the actuator is fitted with analogue position transmitter

Instantaneous values of temperature of Logic and Power boards in °C

Instantaneous value of main voltage supply in volt. It is available only in the ITVC with HPU (see Annex C: HPU control)

Instantaneous value of oil turbidity in ISO units. It is available only in the ITVC with HPU (see Annex C: HPU control)

Instantaneous value of current consumption from main supply, in ampere RMS. It is available only in the ITVC with HPU (see Annex C: HPU control)

Instantaneous value of oil level, in percentage of full scale of level sensor It is available only in the ITVC with HPU only if HPU has oil level transmitter (see Annex C: HPU control)

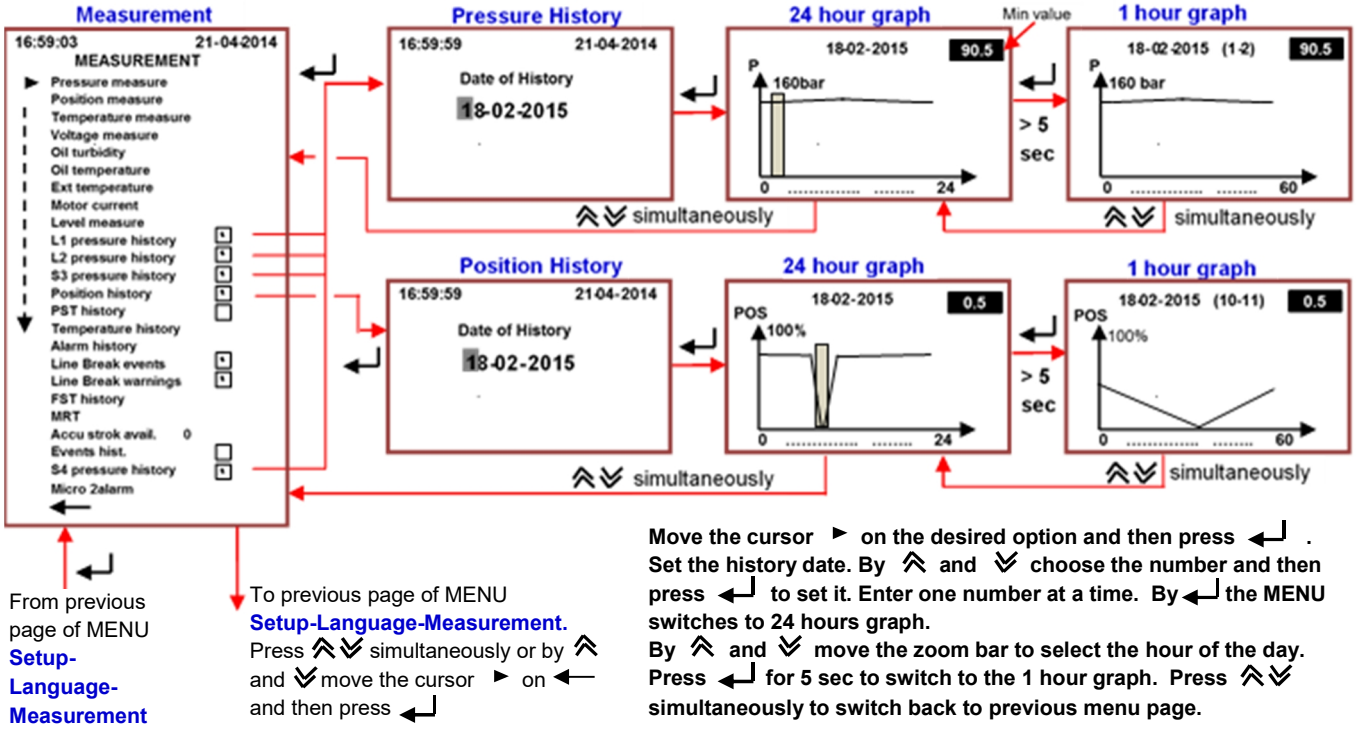
List of current microprocessor 2 alarms. The list is automatically updated

To switch back to previous page of menu press ⇈ simultaneously or by ⇈ and ⇊ move the cursor ► on ← and then press ↵

The option "**Accu Strok Avail**" reports the number of stroke that can be completed with the remaining pressurized hydraulic oil in the accumulator and it is available only in the ITVC with HPU (**see Annex C: HPU control).**

10.3.6.2 Historical data sub-menu

- **24 hours records:** L1, L2, S3, S4 pressure history, Position history.
  - The records are available only if the acquisition of data was previously enabled in the SETUP operation. This is shown by ☑ (enabled) and ☐ (disabled) in the MEASUREMENT page
  - If the graph is not present the display shows the message "Not present"

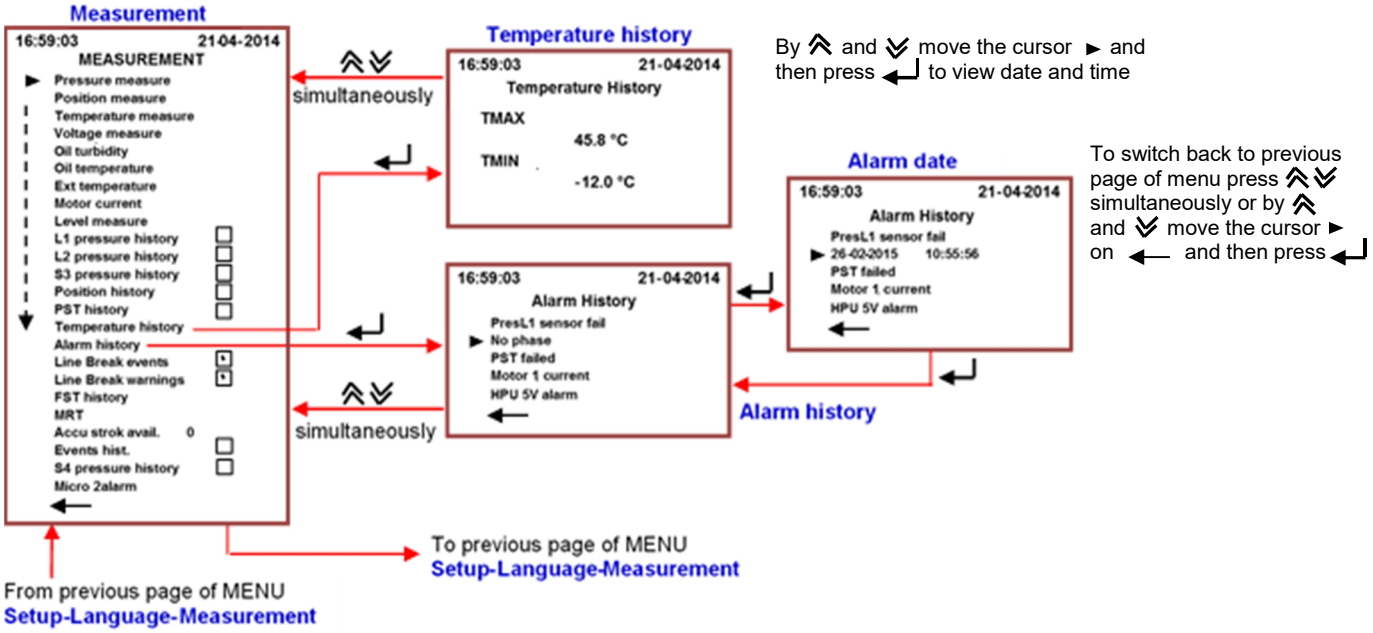


From previous page of MENU **Setup-Language-Measurement**

To previous page of MENU **Setup-Language-Measurement.** Press ⇈⇊ simultaneously or by ⇈ and ⇊ move the cursor ► on ← and then press ↵

Move the cursor ► on the desired option and then press ↵. Set the history date. By ⇈ and ⇊ choose the number and then press ↵ to set it. Enter one number at a time. By ↵ the MENU switches to 24 hours graph.
By ⇈ and ⇊ move the zoom bar to select the hour of the day. Press ↵ for 5 sec to switch to the 1 hour graph. Press ⇈⇊ simultaneously to switch back to previous menu page.

- **Temperature history:** it records the minimum and maximum temperature of the electronic boards
- **Alarm history:** it records the last alarms detected by the ITVC (more than 1000)



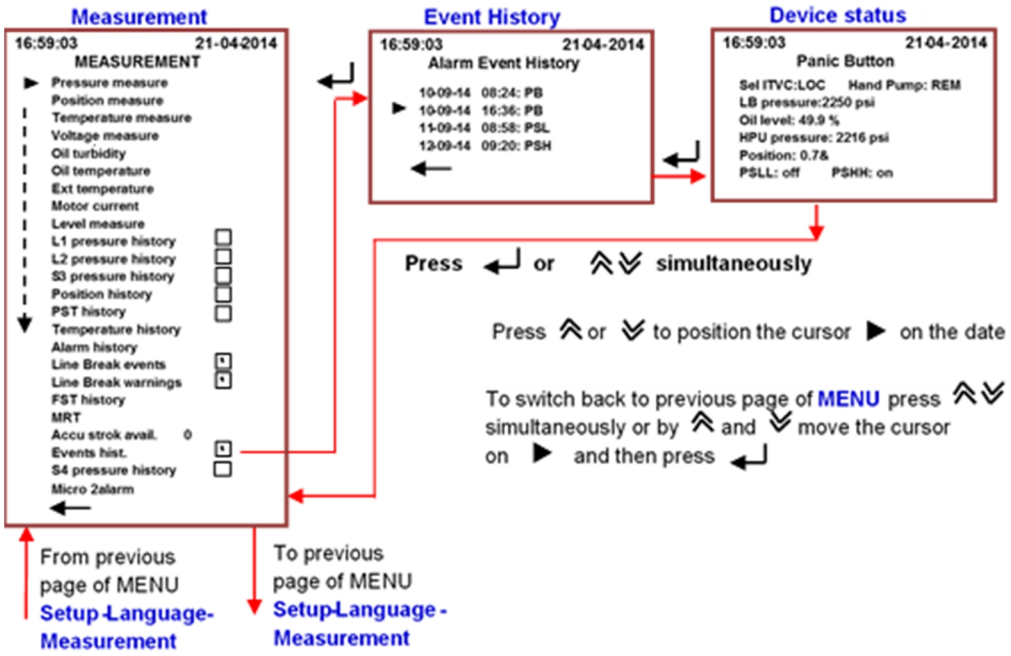
By ⇈ and ⇊ move the cursor ► and then press ↵ to view date and time

To switch back to previous page of menu press ⇈⇊ simultaneously or by ⇈ and ⇊ move the cursor ► on ← and then press ↵

From previous page of MENU **Setup-Language-Measurement**

To previous page of MENU **Setup-Language-Measurement**

- **Event History**:
  - The records are available only if the acquisition of data was previously enabled in the SETUP operation. This is shown by ☑ (enabled) and ☐ (disabled) in the MEASUREMENT page
  - The following events are recorded:
    - External ESD
    - PSLL/PSHH (if present) (PSWLL/PSWHH=Pressure switch low-low or high-high)
    - PSL/PSH (if present) (PSL/PSH=Pressure level low or high)
    - PB(if present) (PB=Panic Button)
    - For each event the ITVC records the most important processed data
- **Micro 2 alarm**: it shows the alarms detected by microprocessor 2

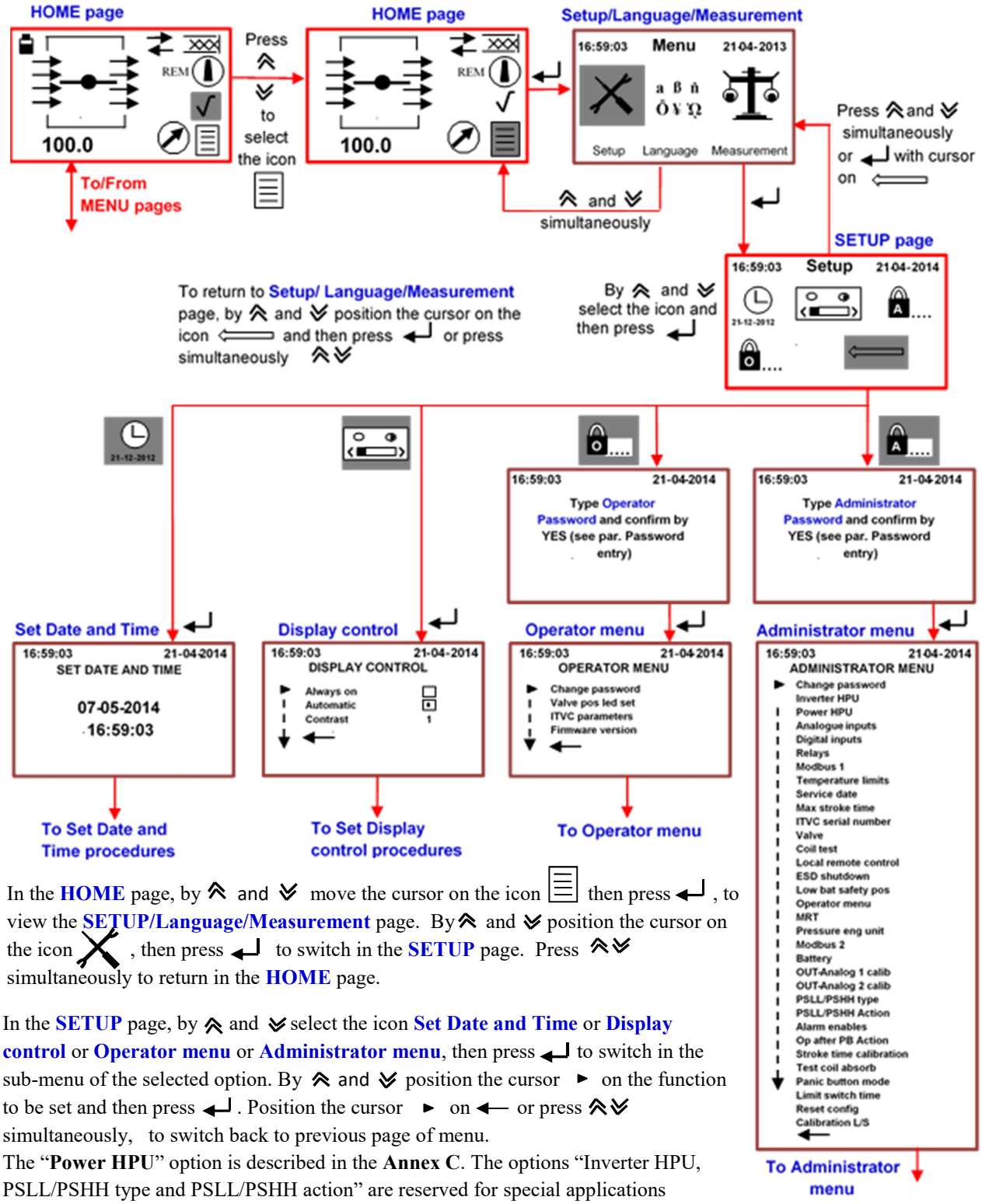


10.3.7 SETUP menu

The menu SETUP allows viewing and setting the parameters managed by the ITVC while it runs the functions needed to control the actuator. Four options are available

- Set Time and Date:  : the sub-menu allows setting Date and Time used by the ITVC to process the collected data
- Display control:  : the sub-menu allows setting the display operating mode and the LCD contrast
- Operator menu:  : the sub-menu allows viewing and setting the parameters with authorization level "**OPERATOR**". Password is requested to enter in the menu
- Administrator menu:  : the sub-menu allows viewing and setting the parameters with authorization level "**ADMINISTRATOR**". Password is requested to enter in the menu

SETUP flow chart

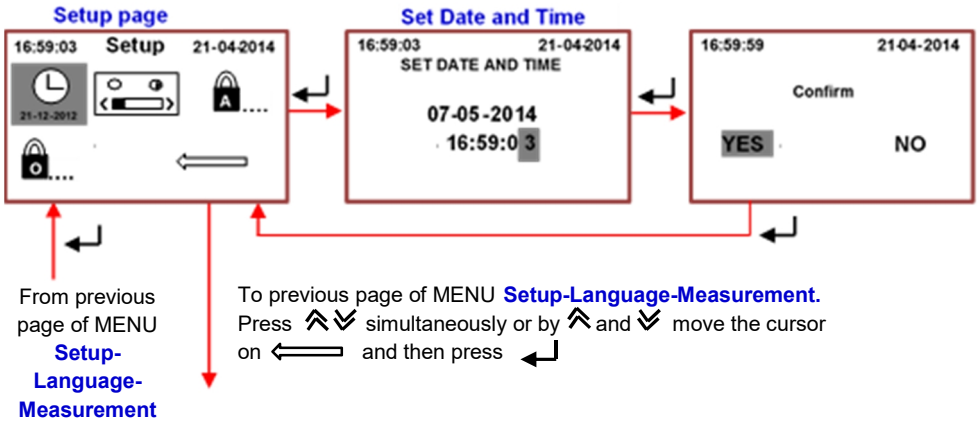


In the **HOME** page, by and move the cursor on the icon then press , to view the **SETUP/Language/Measurement** page. By and position the cursor on the icon , then press to switch in the **SETUP** page. Press simultaneously to return in the **HOME** page.

In the **SETUP** page, by and select the icon **Set Date and Time** or **Display control** or **Operator menu** or **Administrator menu**, then press to switch in the sub-menu of the selected option. By and position the cursor ► on the function to be set and then press . Position the cursor ► on ← or press simultaneously, to switch back to previous page of menu.
The "**Power HPU**" option is described in the **Annex C**. The options "Inverter HPU, PSLL/PSHH type and PSLL/PSHH action" are reserved for special applications

10.3.7.1 Set Time and Date

The function sets the current **date** and **time** of the ITVC. No password is required to set it.

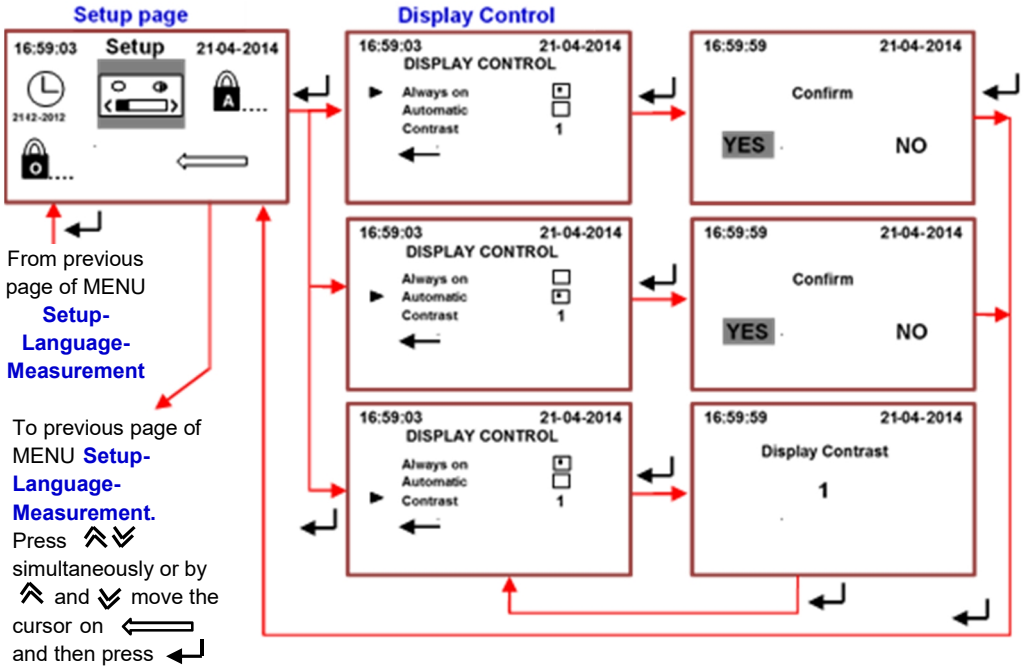


In the **SETUP** page, by and select the icon , then press to switch in the Set Date and Time sub-menu. Set day, month, year, hour, minute and second. Enter one number at a time, by and select the number, then press to set it. Confirm the entered date and time by YES. By return to **SETUP** page

10.3.7.2 Display Control

The function sets the LCD backlight mode and the display contrast. No password is required.

- **Backlight mode:**
  - Always on: the LCD backlight is always on. The display maintains the last page
  - Automatic: the LCD backlight switches off after 2 minutes of inactivity of local pushbuttons. The display shows the **HOME** page
- **Contrast:** it can be set from 1 to 3



By and move the cursor ► to select "Always on" or "Automatic". By and select YES and then confirm by .

By and move the cursor ► to select "Contrast". By and set the contrast (from 1 to 3) and then confirm by .

10.3.7.3 Operator menu

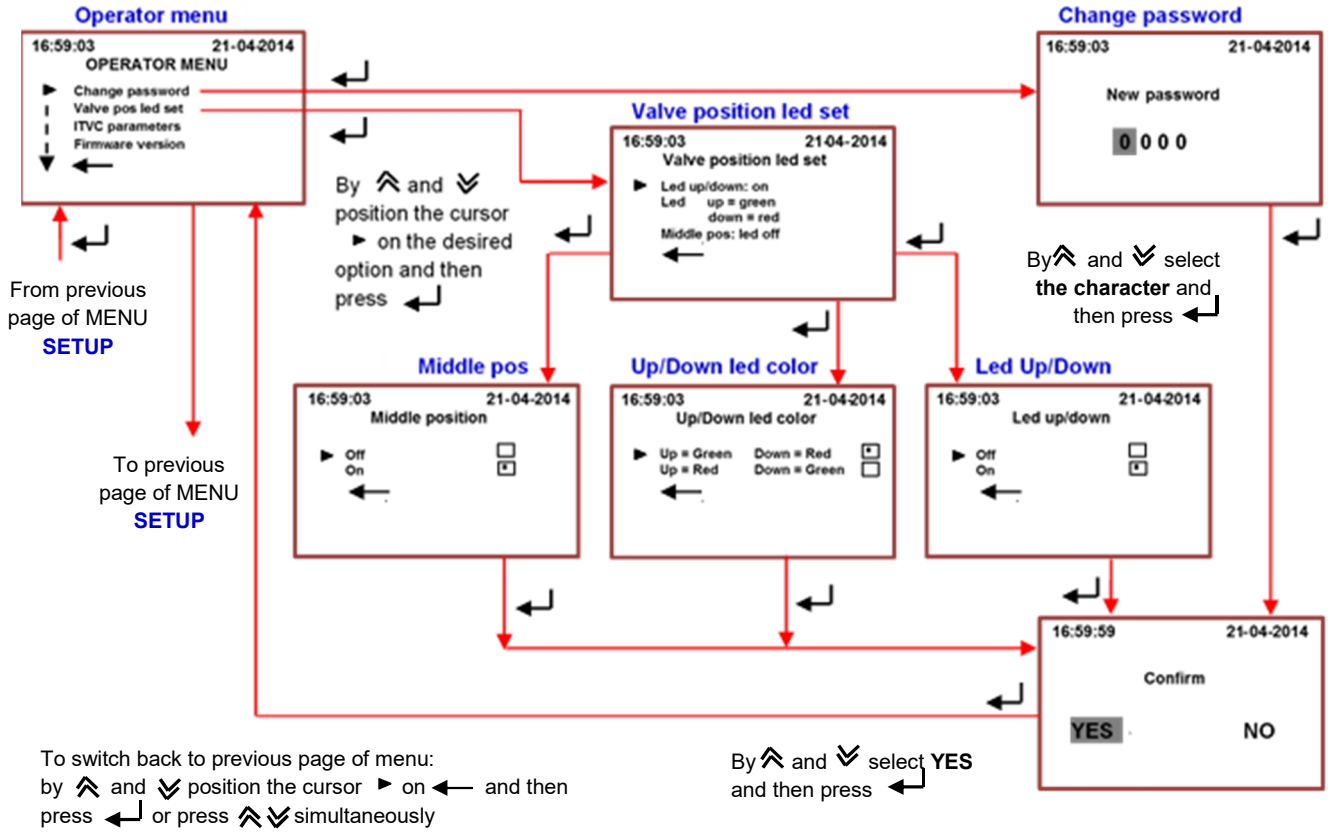
Four options are available: Change password, Valve position led set, Firmware version, ITVC parameters.

10.3.7.3.1 Change password

- The default Operator password is "1000". By the option "Change password" the Operator can enter its password. As the new password is entered the old one is no longer valid. Enter one character at a time, enter 4 characters. ITVC menu requires confirmation of setting by YES and ↵

10.3.7.3.2 Valve pos set

- The option allows setting colour and operation of the LED's placed near to pushbuttons ⩓ (Up) and (Down) ⩔. ITVC menu requires confirmation of setting by YES and ↵
  - The option "**Led up/down**" sets the operation of LED's: **ON**= LED Up⩓ =ON if the valve is open and LED Down ⩔ =ON if the valve is closed or **OFF**= "both LED's always OFF"
  - The option "**Led up=…, down=…**" set the LED's colour (red and green)
  - The option "**Middle pos**" sets the status of LED's if the valve is in intermediate position (both on or both off)

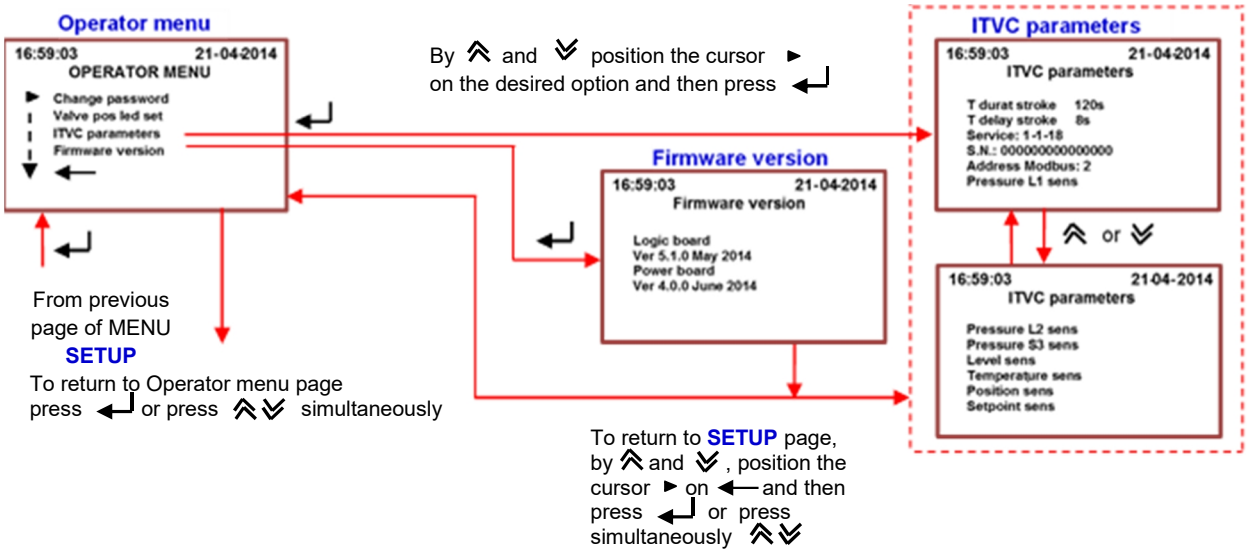


10.3.7.3.3 Firmware version

- Logic board: Ver 5.1.0 May 2014
- Power board: Ver 4.0.0 June 2014

10.3.7.3.4 ITVC parameter

- List of significant ITVC parameters: stroke duration, stroke delay, next service date, ITVC serial number, Modbus address, analogue channels, etc.



10.3.7.4 Administrator menu

The following options are available:

- Change password
- Inverter HPU
- Power HPU
- Analog inputs
- Digital inputs
- Relays
- Modbus 1
- Temperature limits
- Service date
- Max stroke time
- ITVC serial number
- Valve
- Coil test
- Local/Remote cntrl
- ESD shutdown
- Low bat safety pos
- Operator menu
- MRT
- Pressure eng unit
- Modbus 2
- Battery
- Out analog 1calib
- Out analog 2 calib
- PSLL/PSHH type
- PSLL/PSHH action
- Alarm enables
- OP after PB action
- Stroke time calibration
- Test coil absorp
- Panic button mode
- Limit switch time
- Reset config
- Calibration L/S

The options in **grey** are described in this manual IOM-ITVC-Basic. The options: “Power HPU is described in the ANNEX C, “Low bat safety pos” and “Battery” are described in the ANNEX B, “Limit switch time” is described in the ANNEX A.
The options “Alarm enables”, “Inverter HPU”,”PSLL/PSHH type” and “PSLL/PSHH action” are reserved for special application

10.3.7.4.1 Change password

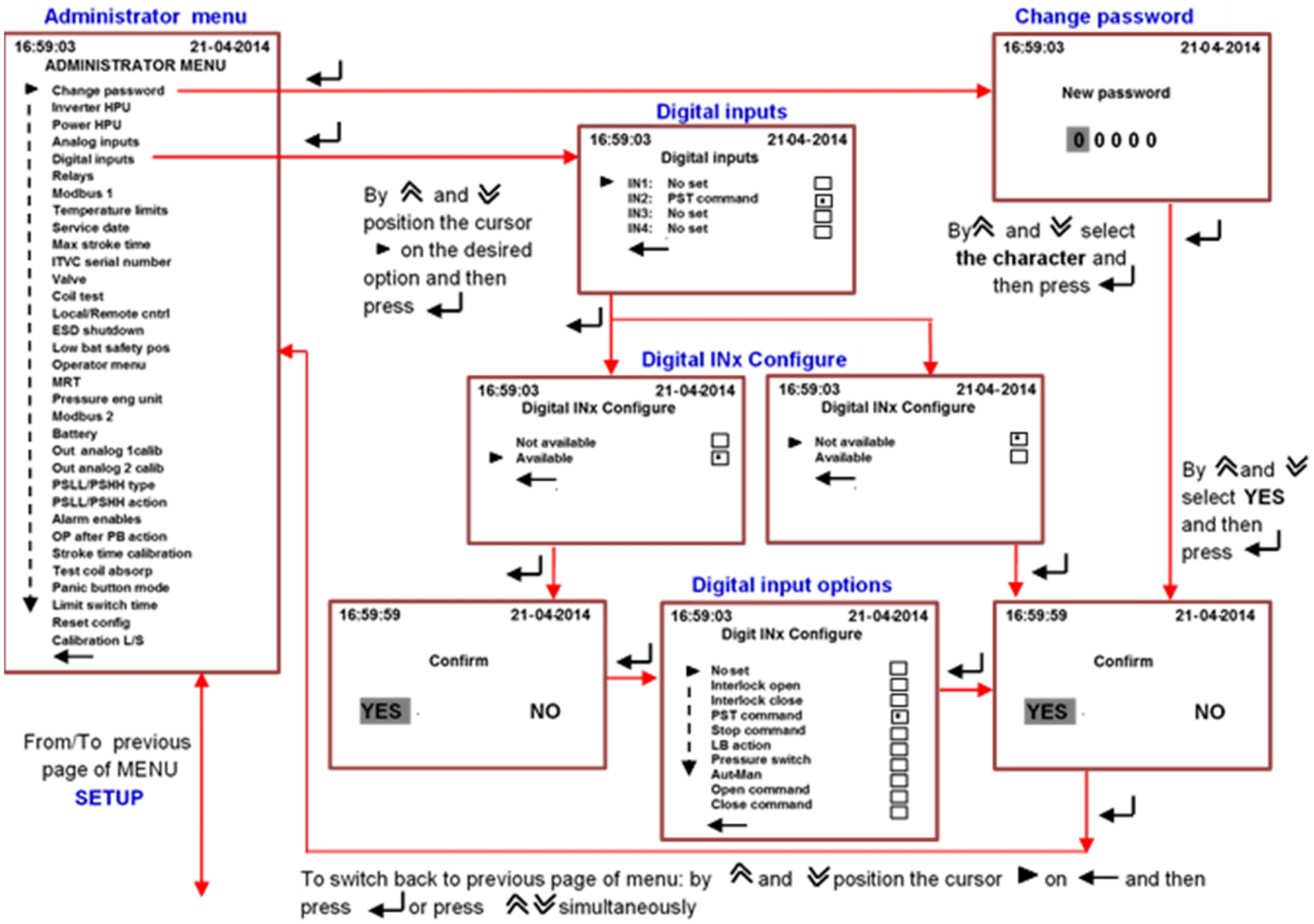
The default Administrator password is "**00001**". By the option "Change password" the Administrator can enter its password. As the new password is entered the old one is no longer valid. Enter one character at a time, enter 5 characters. ITVC menu requires confirmation of setting by YES and ↵

10.3.7.4.2 Digital inputs

The "Digital Inputs" option allows configuring the ITVC Configurable Remote Controls IN1, IN2, IN3 and IN4 with the type of signal to which it is connected, according to electrical wiring diagram (See paragraph Configurable Remote Controls). The available options are:

- **No set**: no signal to the input
- **Interlock open**: input to inhibit the open command
- **Interlock close**: input to inhibit the close command
- **PST command**: remote input of PST command
- **STOP command**: remote input of STOP command
- **LB action**: remote command to inhibit the Line Break action (if Valve Control is enabled)
- **Pressure switch**: input available for an optional pressure switch. The signal can be repeated on the output relay by the option "Pressure switch". No ITVC function is associated to the input. See par."**Output relays**".
- **Aut-Man**: automatic / manual
- **Open command**: additional open command, it work in parallel with the OPEN digital input
- **Close command**: additional close command, it work in parallel with the CLOSE digital input

ITVC menu requires confirmation of setting by YES and ↵ . The available inputs are 4. Each one can be individually configured, the procedure should be repeated for each channel. The figure below shows the configuration procedure of one channel only



10.3.7.4.3 Output relays

The ITVC has 4 latching SPST output relay R1, R2, R3, R4 (see paragraph Output Signalling Relays). For each relay can be configured:

- **Action of contact** when the "condition to trip" occurs: **make** (close the contact) or **break** (open the contact)
- **Condition to trip**: the available condition to switch are listed in the table below
- If the selected option is "**LS op**" or "**LS cl**" and the actuator is fitted with analogue position transmitter, a sub-menu of "Output relay" menu, allows setting the **actuator position** to which the relay switches (from 0.0 to 100.0)

Table of configurable conditions to switch the relays R1, R2, R3, R4

Display name	Description	ITVC type
No set	No condition to trip	Any ITVC type
Max pressure increase	Max pressure increase in Line Break operation	ITVC with Line Break
Max pressure drop	Max pressure drop in Line Break operation	ITVC with Line Break
Warning	Warning. See warning table	Any ITVC type
LB on	Line Break operation active. (LB or LB-d)	ITVC with Line Break
High LB pres	High pressure in Line Break operation	ITVC with Line Break
Low LB pres	Low pressure in Line Break operation	ITVC with Line Break
No voltage	Voltage failure	Any ITVC type
Pos no reach	Position not reached	Any ITVC type
Low bat	Low battery	ITVC with battery
Phase unbalance	Current absorbed from phases not balanced	ITVC with HPU
Selec REM	Local selector in REMOTE	Any ITVC type
Selec LOC	Local selector in LOCAL	Any ITVC type
Selec OFF	Local selector in OFF	Any ITVC type
LS op	Electrical Switch in opening	Any ITVC type
LS cl	Electrical Switch in closing	Any ITVC type
LS PST	Limit switch PST (option Limit Switch to set the PST travel)	ITVC with PST and LS
Max pres decr	Max pressure decrease	ITVC with Line Break
PST failed	PST failed	ITVC with PST
Low HPU pres	Low pressure of HPU	ITVC with HPU
High HPU pres	High pressure of HPU	ITVC with HPU
Low HPU volt	Low voltage of HPU main supply	ITVC with HPU
High HPU volt	High voltage of HPU main supply	ITVC with HPU
PSLL	Pressure Switch Low-Low	ITVC special
PSHH	Pressure Switch High-High	ITVC special
Pump fault	Pump failure	ITVC with HPU
Magnet HPU	Magnetothermal switch of HPU (not used)	ITVC with HPU
Unity door	Switch of device door on/off	ITVC with HPU
Magneto mot 1	Thermostat of motor 1	ITVC with HPU
Magneto mot 2	Termostat of motor 2	ITVC with HPU
Oil level	Oil level alarm	ITVC with HPU
Temperature	Temperature alarm (of electronics)	Any ITVC type
Pneum micro	Pneumatic micro-switch	ITVC special
Micro PST mech	Mechanical PST micro-switch	Any ITVC type
Selec LOC/MAN	Local selector LOCAL/AUTOMATIC of HPU	ITVC with HPU
Pressure switch	Pressure switch (repetition of digital input)	Any ITVC type
Performing PST	PST in execution	ITVC with PST
Min press acc	Low pressure in the accumulator	ITVC with HPU

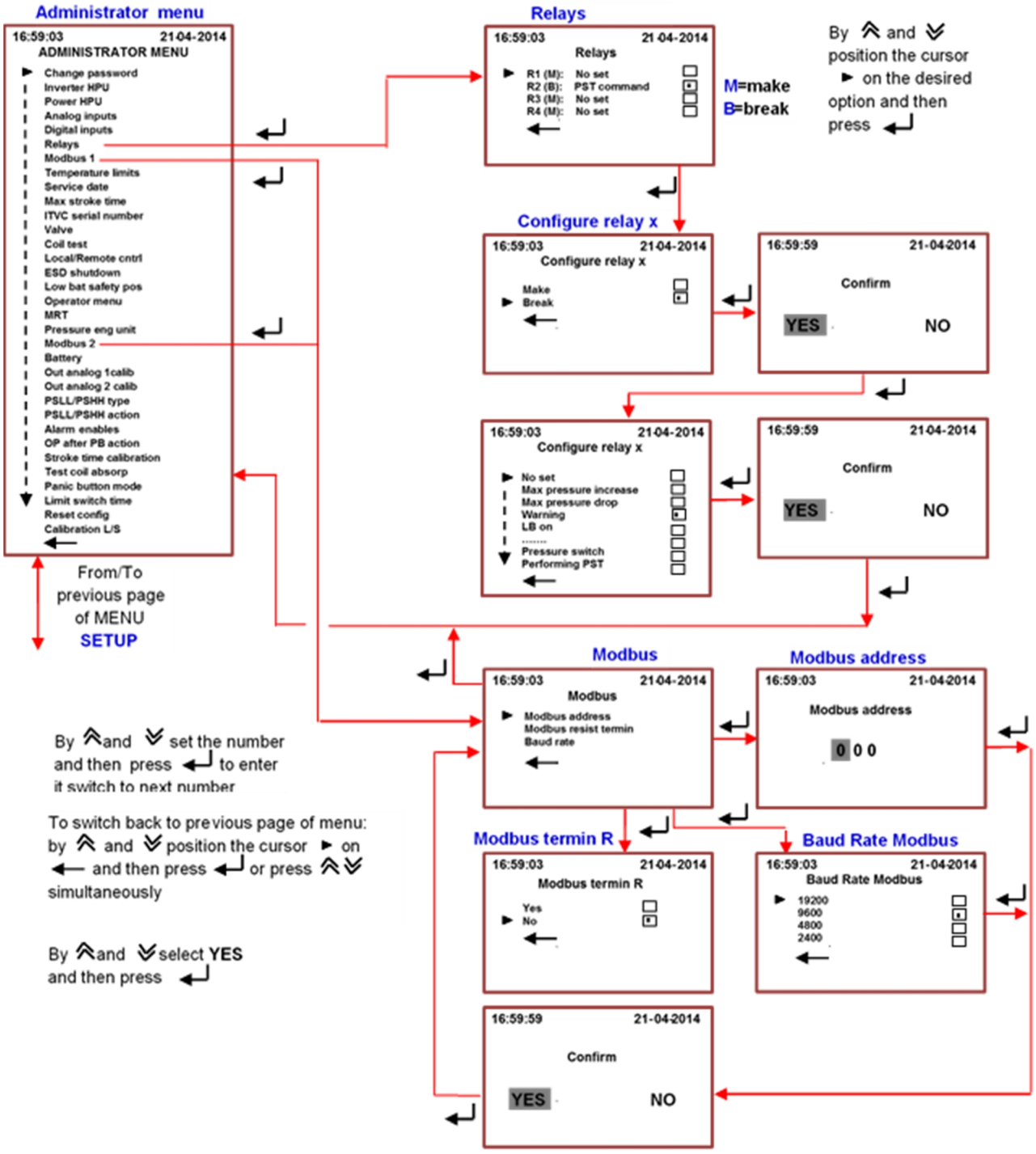
10.3.7.4.4 Modbus 1 and Modbus 2

The function allows setting the following parameters of the Modbus RTU communication line

- Modbus address: from 1 to 247
- Modbus termination resistance: present=yes, absent=no
- Modbus baud rate: 19200, 9600, 4800, 2400 bit/sec. The default baud rate is 9600.

The two lines are separated and the setting of each channel can be different.

The below figure shows the procedure to configure **one relay** and the **Modbus 1** and **2** parameters.



10.3.7.4.5 Temperature limits

When warning limits are exceeded (75°C) the ITVC raises a warning. When alarm limits are exceeded (maximum and minimum) the ITVC raises an alarm and drive the actuator according to the configured option (inhibit all or go to safe position)

10.3.7.4.6 Service date

The parameter sets the scheduled ITVC check by maintenance personnel. After this date the ITVC raises a **warning**

10.3.7.4.7 Maximum stroke time

The parameter can only be read. It is the maximum preset time to fully open or close the valve. It is used by the ITVC to de-energize the solenoids when neither limit switches nor position transmitter are provided on the actuator.

10.3.7.4.8 ITVC serial number

The parameter can only be read.

10.3.7.4.9 Valve

In this sub-menu the operator can enter the **valve manufacturer** and the **valve serial number**.

10.3.7.4.10 Coil test

This sub-menu allows setting the type of test of solenoid coils. Two options are available: Automatic and Manual. In Automatic the test is performed every 8 hours, in Manual the test is performed immediately, by pressing the pushbutton ↵ At the end of the test (Automatic or Manual) the display reports the list of solenoid valves and the result of test, failed= "X" or "√ "=passed. If the test fails the ITVC raises an Alarm that can be viewed in the Alarm list. Before running the test it is mandatoy that the "**Test coil absorption**" was done at least one time.

10.3.7.4.11 Local and remote controls

The sub-menu allows setting the ITVC local and remote control. The following options are available:

- Local control: push to run or self-maintained
- Remote control: push to run or self-maintained
- Remote control type: digital input, bus , digital input and bus
- Remote stop: enable or disable remote stop even if the actuator control mode is LOCAL

10.3.7.4.12 ESD shutdown

The sub-menu allows setting the ESD shutdown control. The following options are available:

- ESD safety position: close, open, inhibit all (stayput)
- ESD shutdown type: do not store (push to run), store (self-maintained), reset (if self-maintained)
- ESD command mode: push to run, self-maintained
- ESD control signal: active high, active low

By setting the "ESD safety position" also the "Failsafe position" is set.

10.3.7.4.13 Operator menu

By this sub-menu it is possible to gain access to OPERATOR menu (see OPERATOR menu paragraph)

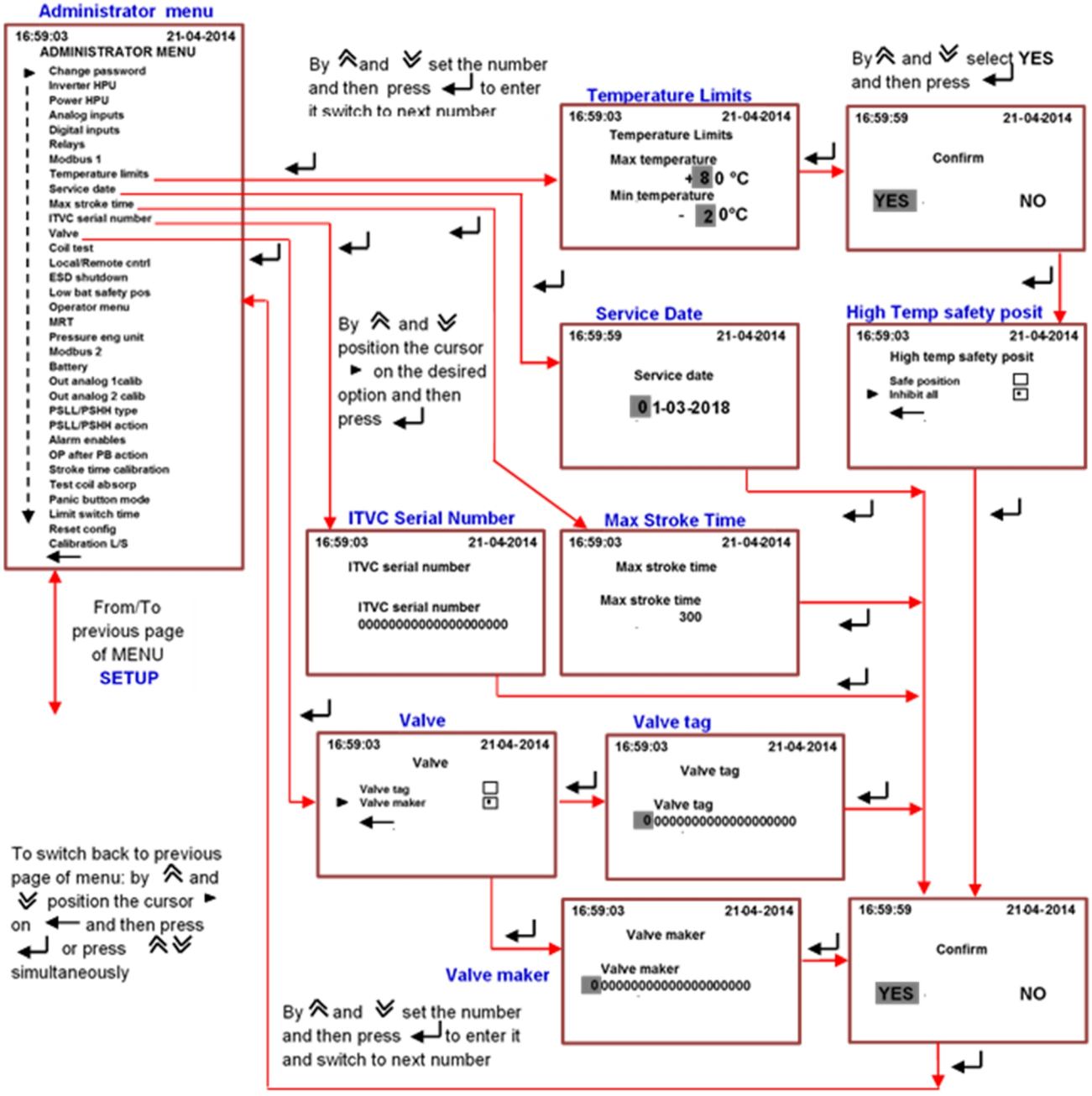
10.3.7.4.14 MRT Maximum Repair Time

The sub-menu allows setting the MRT, Maximum Repair Time. If the MRT time expires and the malfunction is still present, the ITVC performs the action depending on the type of alarm. See the list of MRT alarms.

10.3.7.4.15 Calibration L/S

The procedure works only if the actuator is equipped with 4-20 mA position transmitter and allows setting the electronic end of travel in opening and closing.

The below figure shows the procedure to configure the **Temperature limits**, the **Service date**, the **Valve tag**, the **valve maker** and to view the **ITVC serial number** and **Max stroke time**.

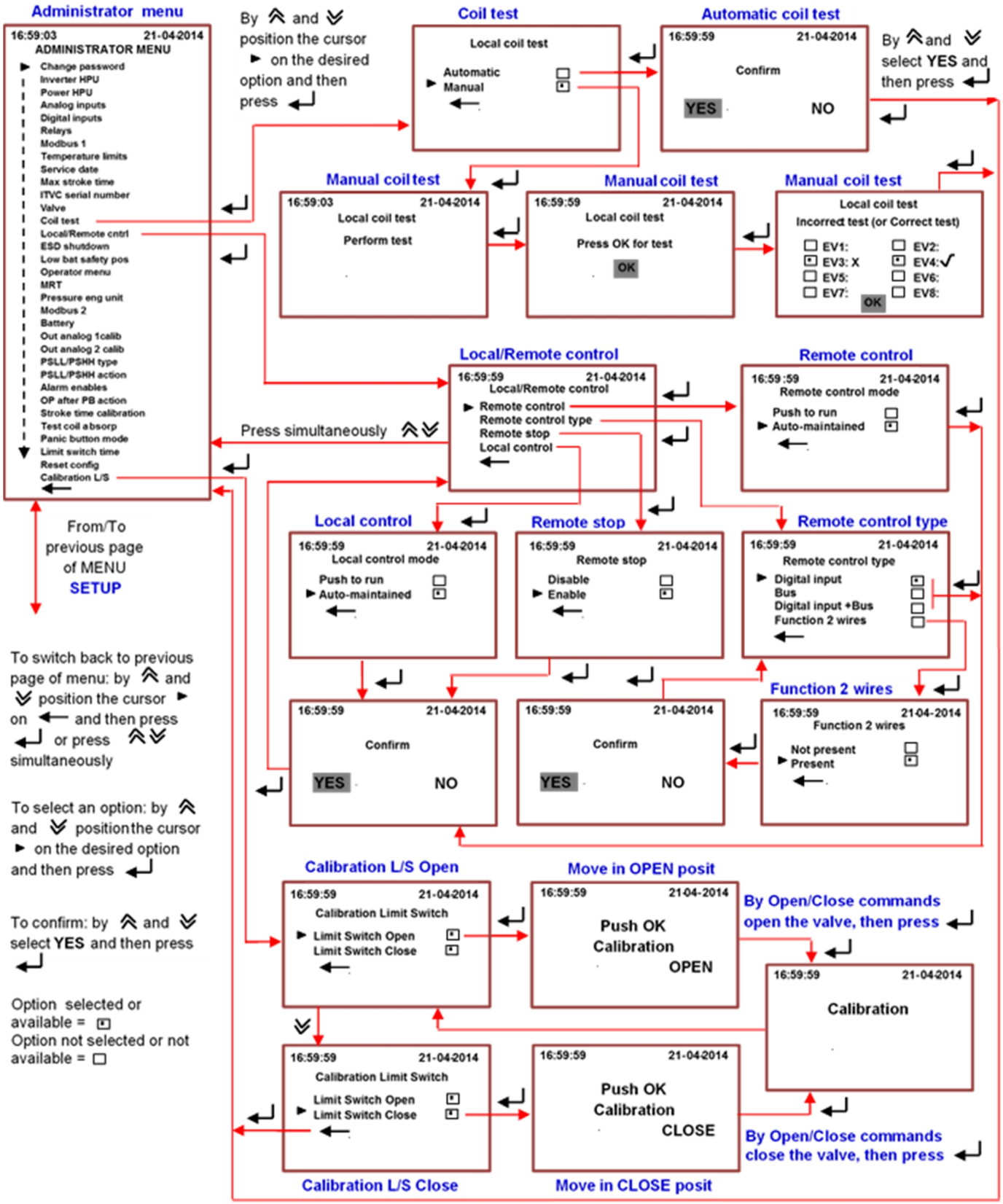


The following figure shows the procedures **Coil test**, **Local/Remote controls** and **L/S calibration**

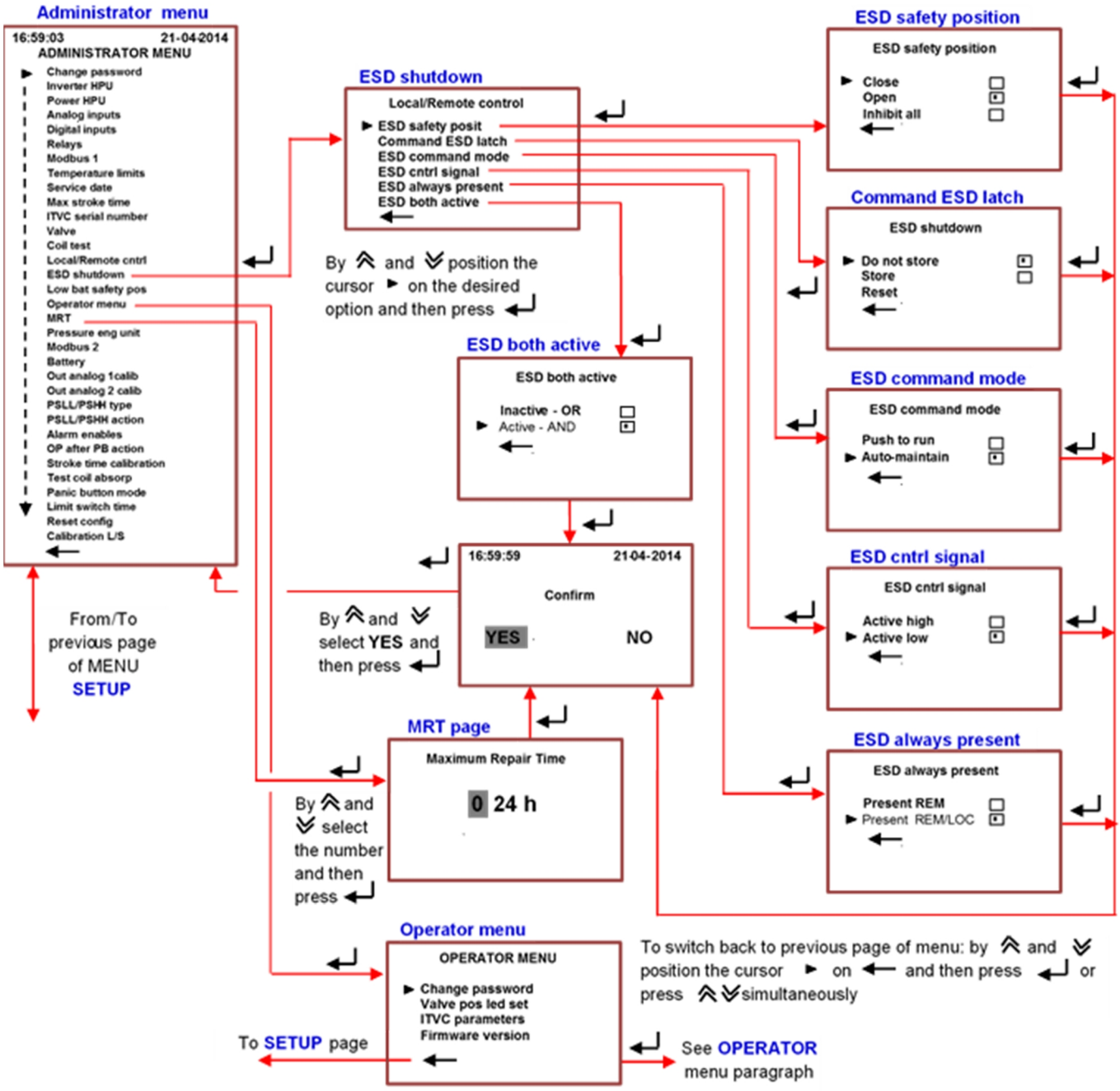
Calibration L/S: Set the Local Selector in "**LOCAL**" (see Actuator control mode paragraph), and return in **HOME** page. Then enter in **SETUP**, **Administrator** menu (see SETUP menu paragraph and SETUP flow chart to enter in the Administrator sub-menu). Select "**Calibration L/S**". Select **Limit Switch Open** to view the page "Push OK Calibration OPEN". By and move the valve in open position, then press to acquire the value of the position transmitter and return in "**Calibration L/S**" page. Select **Limit Switch Close** and repeat the procedure to set the close limit switch.

DVG AUTOMATION
GIVA GROUP

Coil test, Local/Remote control, Calibration L/S



The following figure shows the procedure to set **ESD shutdown**, **MRT** and **Operator** menu

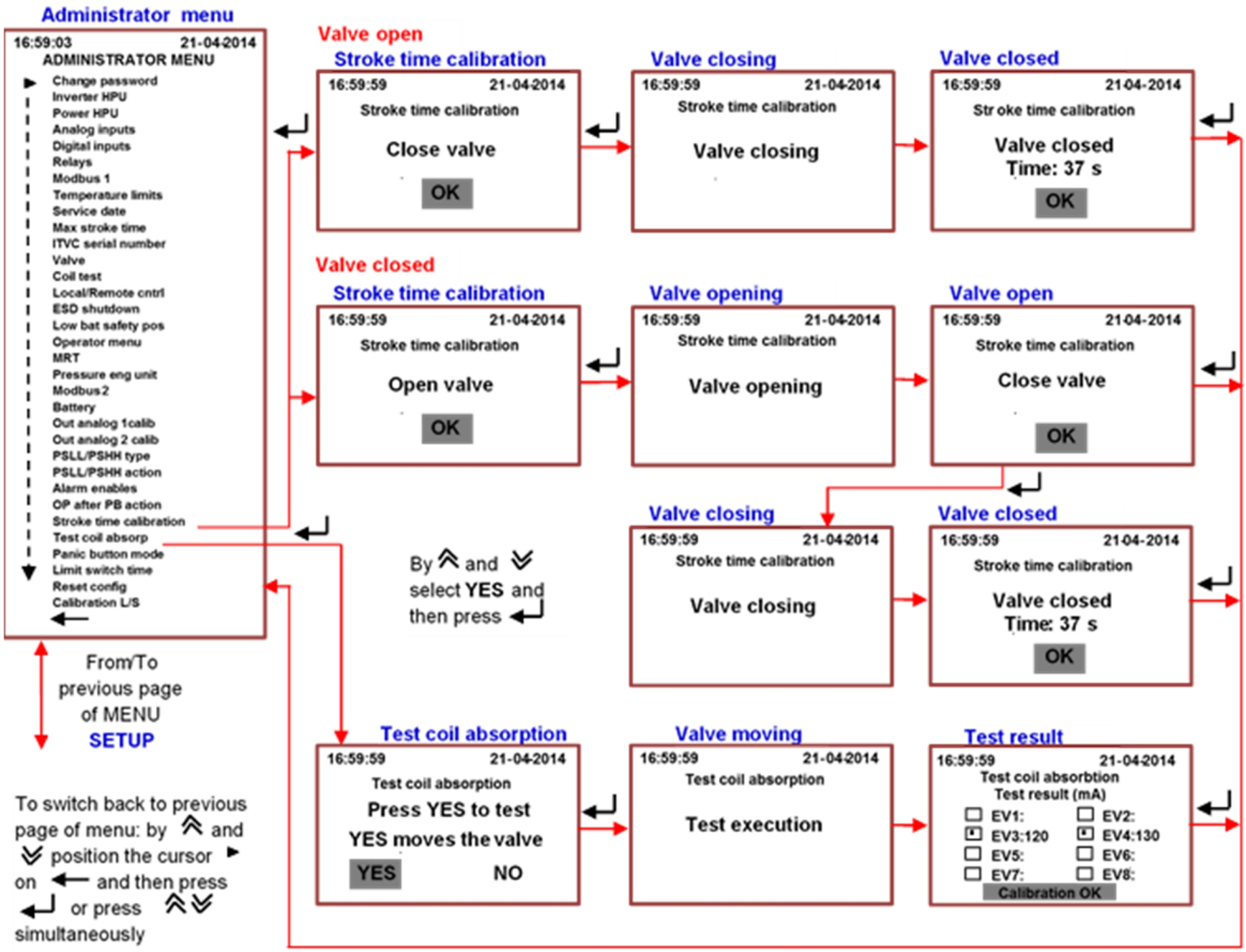


10.3.7.4.16 Stroke time calibration

The sub-menu starts the procedure that records the closing stroke time, by moving the valve. If the valve is open the ITVC closes the valve. If the valve is closed the ITVC open the valve and then closes it. The function is available only if the actuator control mode is "**LOCAL**" and the actuator is fitted with analogue position transmitter or limit switches

10.3.7.4.17 Test coil absorption

By this sub-menu the ITVC measures and records the current of each individual solenoid valve coil connected to the ITVC. The measured values are used as **reference** current to check the status of solenoid coils in the sub-menu "**Coil test**". The function is available only if the actuator control mode is "**LOCAL**".



10.3.7.4.18 Pressure eng unit

The sub-menu allows setting the engineering unit of the pressure. The available options are: MPag, psig, barg and kg/cm2

10.3.7.4.19 OP after PB action

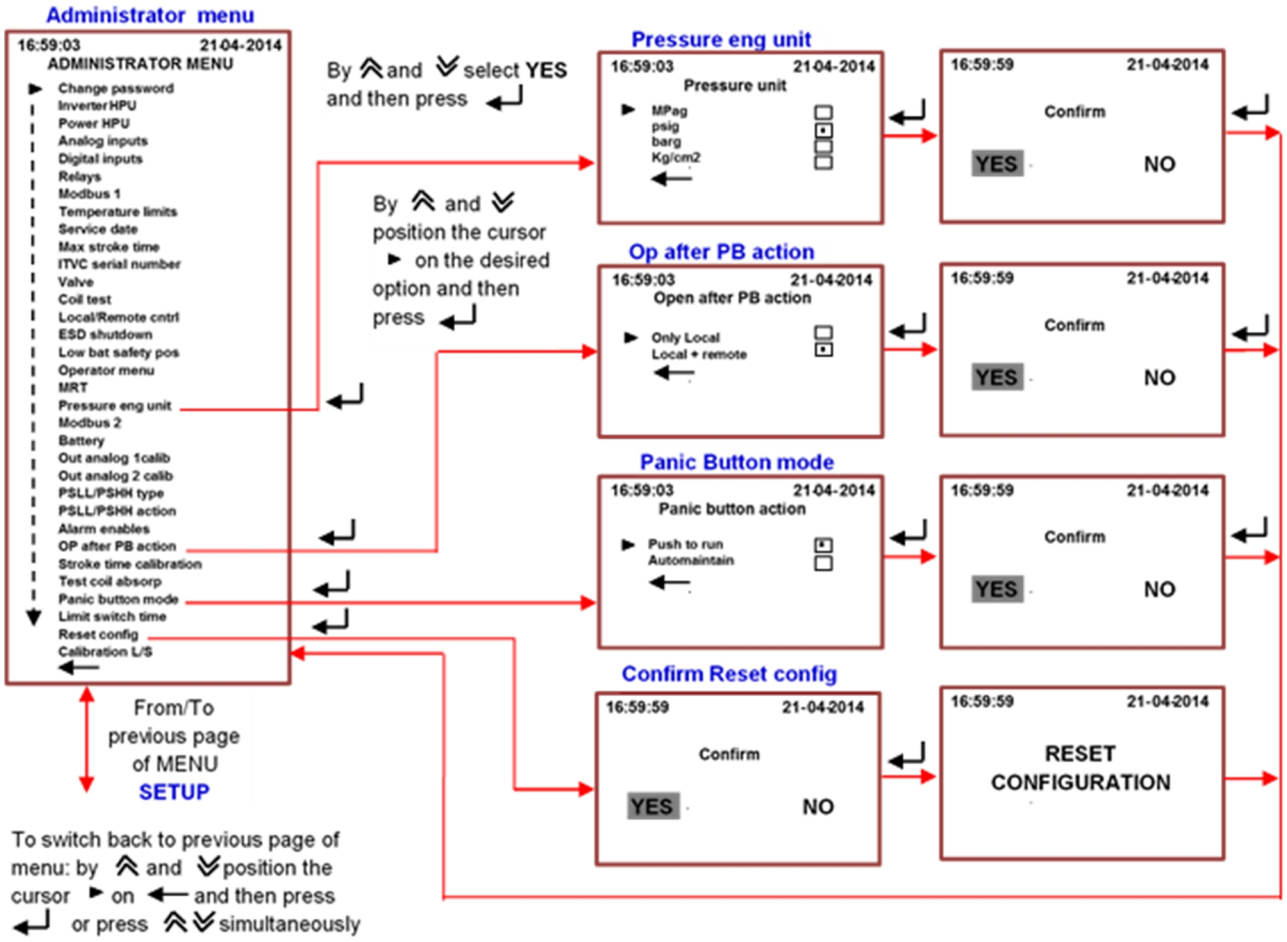
The sub-menu allows setting the reset mode of panic Button action if the Panic Button mode is latched (automaintained). The available options are: only by a local command or by “local or remote” command

10.3.7.4.20 Panic button mode

The sub-menu allows setting the Panic Button mode. The available options are: push to run= the action ends when the button is released or latched (automaintained)= the action continues even if the button is released. To reset the Panic Button action it needs a command according to the configuration of “OP after PB action”.

10.3.7.4.21 Reset config

The function clears the present settings and restore the factory ones. It is done in 3 steps: by ⩓ and ⩔ select “Reset config” and press ↵, by ⩓ and ⩔ select YES and press ↵. Now the ITVC works with the factory settings.



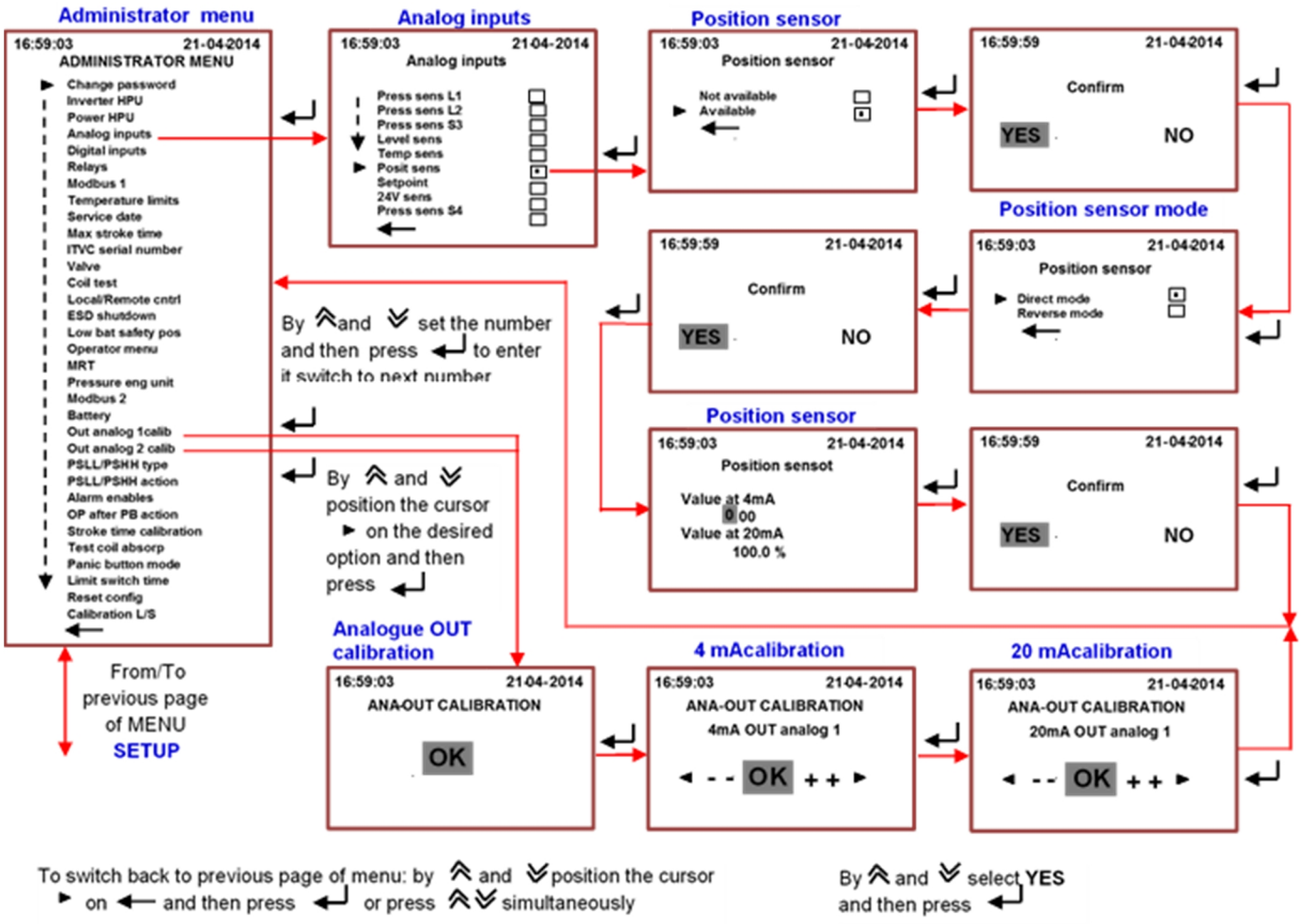
10.3.7.4.22 Analog inputs

The sub-menu allows setting the variable connected to the analogue input channels. The set of type of variable and hardware channel must be previously done by the ITVC manufacturer. This sub-menu allows setting the availability (Available/not Available), the mode (direct/reverse) and the mA to Engineering Unit relationship (4mA=xxxx EU, 20mA=xxxx EU)

10.3.7.4.23 Out analog 1-2 calib

The sub-menu allows setting the output channels 1 and 2 to adapt the 4-20mA output to the user instruments connected to it. The set of type of variable associated to the output channel must be previously done by the ITVC manufacturer. The ITVC "4-20mA outputs" are calibrated to supply an output signal with range 4-20mA, in factory. By a multimeter (or any indicator) connected to the output, the user can adjust the range by the procedure described below. Modify the variable associated to the output at the minimum (for instance in case of "Valve Position" close the valve) and set the minimum (4 mA calibration page). Now modify the variable at the maximum (for instance in case of "Valve Position" open the valve) and set the maximum (20 mA calibration page).

The below figures shows the procedure for one only channel. The procedure should be repeated for all channels. If any variable is connected to the analogue input or output the ITVC displays the message "NOT PRESENT".



11 Installation

WARNING!	
	*Always wear protective clothing, shoes, gloves and eyewear when performing any installation or maintenance procedures to avoid personal injury.* *Check with your process or safety engineer for any additional measures that need to be taken.*

WARNING!	
	*Always wear protective clothing, shoes, gloves and eyewear when performing any installation or maintenance procedures to avoid personal injury.* *Check with your process or safety engineer for any additional measures that need to be taken.*

NOTE	
	*Maximum main voltage: check value on the NAMEPLATES*

11.1 Safety Recommendation

Isolate before opening, do not open any ITVC cover without being sure that supply voltage has been switched off.

The ITVC MUST be connected to the voltage supply through a magneto-thermic switch with the following characteristics:

- Low voltage I.T.V.C.: 4A curve D
- High voltage I.T.V.C.: 2A curve D
- ITVC 24 VDC M.C.C. type: 25 A curve D (unless already included in M.C.C. by DVG)

DVG reserves the right to advise different sizes of circuit breakers based on the configuration of the systems to be controlled. This information will be recorded on the wiring diagrams supplied with the apparatus.

DO NOT OPEN the covers in hazardous area (i.e. in presence of explosive atmosphere).

The Isolation/Protection devices (magneto-thermal switches, fuses etc.) should be provided on the plant at Customer care. They should be

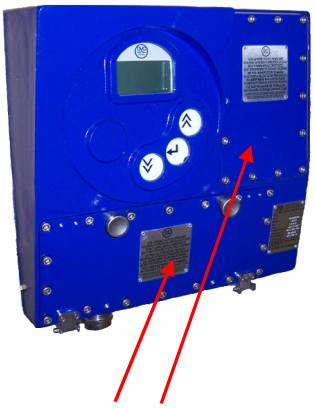
- In accordance with the Local National Standards and plant rules
- Suitable located and easy to reach
- Properly marked to identify the disconnecting device
- Not interrupt the protective earth connector

The output relays contacts R1,..R4, MR, in the “user terminal block”, are pure voltage free contacts. If these contacts are supplied by an external voltage (110-230Vac, etc.), it is at customer care to install fuses (or any voltage/current protections) in the marshalling cabinets of control room.

Any voltage should be **isolated** before opening any ITVC cover or enclosure.

11.2 Cable size

ITVC Power cables: max. 10mm²
Signal cables: max. 2,5mm² (Use of shielded cables is recommended, especially for analogue signals)
Earthing and protective conductors:
Minimum cross-sectional area of protective conductors (IEC 60079-0 Table 10)
(S = cross sectional area of phase conductor [mm²]; S_p = minimum cross-sectional area of the corresponding protective conductor [mm²]) **$S \leq 16$; $S_p = S$** **$16 < S \leq 35$; $S_p = 16$**



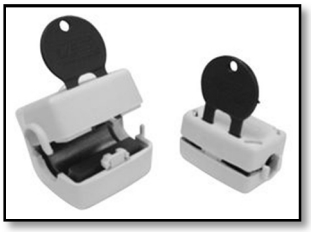
Remove the covers to connect the cables

Grounding must be done according to statutory requirements.

Connect the internal ground lead/s to the bus bar/s

Connect external ground lead to external ground connection

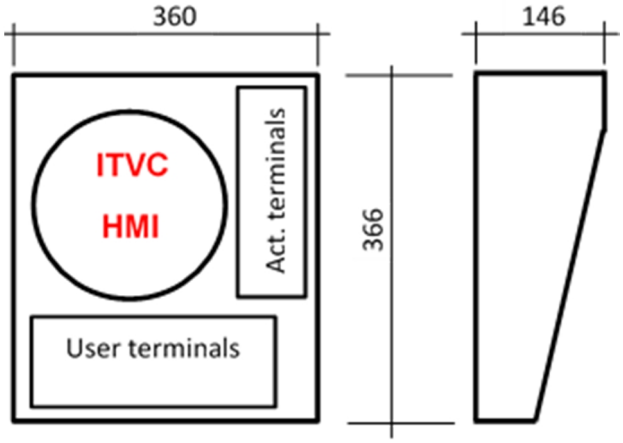
To avoid electromagnetic interference due to electrical cables coupling use separated cables for power and signals. Use shielded cables for analogue and data signals



Assemble the ferrite bead/s provided by DVG with documentation package, onto the digital control cable/s

Insert the connection cables into the electrical enclosures through the cable glands (or conduits) and connect the electrical supply and the control signals to the ITVC terminal blocks, according to the Wiring Diagram. Screw the cable glands (or the conduits) tightly into the threaded entries, in order to guarantee the weatherproof and explosion-proof protection (when applicable). Thread sealant is necessary for explosion proof capability. Replace the plastic plugs of the **unused** enclosure entries by metal ones, to guarantee perfect weatherproof tightness and to comply with the explosion-proof protection codes (where applicable).

11.3 Weights and Measurements



Total weight of the ITVC, aluminium alloy enclosure, without battery is 17 Kg / with battery 19 Kg.

Total weight of the ITVC,
SS 316L (cast CF3M) enclosure, without battery is 46.5 Kg / with battery 50 Kg.

See Annex C and E for weight and measurement of ITVC with optional battery and HPU control

11.4 Solenoid Operated Valves fuses

Fuses for 8 Solenoid Operated Valves are located under the upper right cover.

DO NOT OPEN the covers in hazardous area (i.e. in presence of explosive atmosphere).

FUSES MUST BE REPLACED IN A SAFE AREA AND USING ONLY DVG ORIGINAL PARTS.

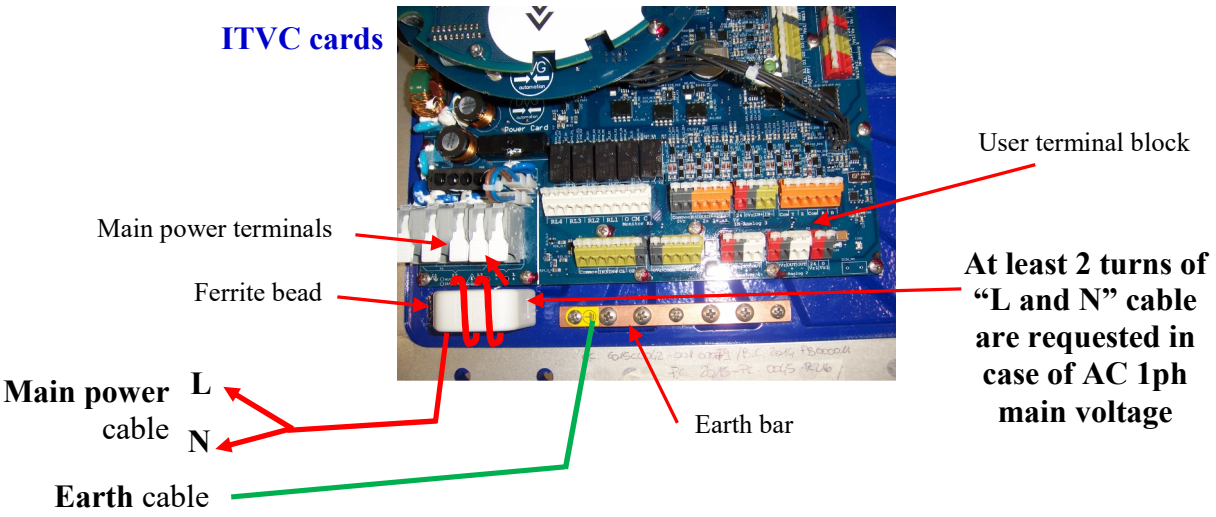
Fuse P/N: CEDFUS01000

Remove the cover
to change the fuses

11.5 Power supply

- Low voltage version: 22 – 60 Vdc
- High voltage version: 90 – 260 Vac 50 / 60 Hz
- Installed Power from 5 to 45W max, (based on the configuration)

11.5.1 Power supply connection



11.6 Input/output electrical characteristics

This paragraph describes the characteristics of the input and output channels available in the ITVC electronics in the customer and actuator terminal blocks.

Customer terminal block:

- **Digital inputs:**
  - 4 digital inputs, optocoupled, 1 common, max voltage 130Vdc/Vac, min voltage 22Vdc/Vac, max current 5mA, logical-0 < 10V, logical-1 > 18V, surge arresters 175V
  - 2 separated digital ESD inputs, optocoupled, max voltage 130Vdc/Vac, min voltage 22Vdc/Vac, max current 5mA, logical-0 < 10V, logical-1 > 18V, surge arresters 175V
  - 2 digital inputs, optocoupled, 1 common, max voltage 130Vdc/Vac, min voltage 22Vdc/Vac, max current 5mA, logical-0 < 10V, logical-1 > 18V, surge arresters 175V
- **Outputs relays:**
  - 1 Monitor relay, single side stable, voltage free SPDT contact, max 24Vdc/230Vac/5A
  - 4 configurable, latched, voltage free SPST contact, max 24Vdc/230Vac/5A
- **Analogue input:**
  - 4-20mA, optocoupled insulating amplifier, max voltage drop at 20mA= 6V
- **Analogue output:**
  - 2 x 4-20mA, optocoupled insulating amplifier, active and passive current loop, max resistive load 750 ohm, max voltage 24Vdc
- **Output voltages** to supply the customer inputs and outputs:
  - Output voltage Vr = 0-24Vdc / max 100mA
  - Output voltage Vr1= 0-24Vdc / max 100mA

Actuator terminal block:

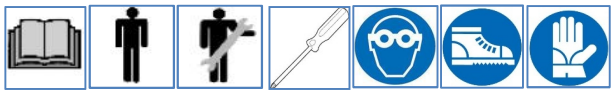
- **Digital inputs:**
  - 4 digital inputs, optocoupled, 1 common, max voltage 30V, max current 5mA, logical-0 < 15V logical-1 > 18V, surge arresters 30V
- **Digital outputs:**
  - 8 digital outputs, 24Vdc/ 0.7 A, fuse protected, to supply the Solenoid Operated Valves EV1,…,EV8
- **Output relays:**
  - 3 x latched, voltage free SPST contact, max 24Vdc/230Vac/5A
- **Analogue inputs:**
  - 4 x 4-20mA, optocoupled isolated amplifier, max voltage drop at 20mA= 6V
- **Output voltages** to supply the customer inputs and outputs:
  - Output voltage Vr = 0-24Vdc / max 100mA
  - Output voltage Vr1= 0-24Vdc / max 100mA
  - Output voltage Vev= 0-24Vdc / max 1.5A

Minimum command time 300 ms

12 Maintenance and cleaning

The ITVC is an electronic device enclosed in a weatherproof and explosion-proof housing, and does not require any particular maintenance. Also, there are not any special requirements regarding cleaning.

13 Troubleshooting



ITVC has a powerful diagnostic program to monitor the operation of system "ITVC-Actuator-Pneumatic/Hydraulic" control unit. In case of ITVC malfunction and depending on the type of malfunction the ITVC raises an Alarm, a MRT alarm, a Warning. ITVC signals the presence of Alarm and MRT alarm remotely by the **Monitor relay** and locally by the icon A in the **HOME** page. The presence of Warning is locally signalled by the icon ⚠. The LED of pushbutton ↵ lights up red, in case of Alarm and fuchsia, in case of warning. The paragraph "**Alarm, MRT alarm, and Warning**" describes the difference between the malfunctions. The procedure described in the paragraph "**Visualization of Alarms and Warnings**" allows viewing the list of current Alarms, MRT alarms and Warnings. Here below are the tables of all possible Alarms, MRT alarms and Warnings. They includes also the potential cause and the suggested action to solve the problem. In general Alarms and Warning (except MRT Alarm), disappear automatically from the list when the malfunction is solved. However it is also available the **reset** procedure to manually clear the Alarm/Warning, one at a time. Reset will be effective only if the issue will be solved. Only the Alarms and Warnings corresponding to the active ITVC functions can be detected (i.e. if the function "Line Break" is off, the relevant Alarm/MRT alarm and Warning cannot be generated). If ITVC performs the safe action, in the alarm list appears the message "**Safety action**".

MRT alarm: if in the alarm list (visible by the icon A), there is the alarm "**MRT timer**", an MRT alarm is present and the safe action will be done when the MRT time will expire and if the alarm will be still present. In the paragraph "Instantaneous measures sub-menu, MRT", chapter MEASUREMENT, is described the procedure to view the list of current MRT alarms and the remaining time. If the failure is not repaired before than the time expires, the ITVC drives the actuator in safe position. In the above paragraph is also described the procedure to reset the MRT alarms, one at a time. Reset will be effective only if the issue will be solved. MRT alarms cannot be reset by the procedure described in the paragraph "**Visualization of Alarms and Warnings**".

ALARM TABLE

Alarm displayed	Potential cause	Action
NO VOLTAGE	Power supply failure	Check power supply Reset alarm. If alarm persists, replace ITVC
24V FAIL	Power card failure	Reset alarm. If alarm persists, replace power card
24V REG FAIL	Power card failure	Reset alarm. If alarm persists, replace power card
24V SOV FAIL	Probable short-circuit on SOVs	Disconnect SOVs. Check which one is short circuited and act accordingly
24VEXT1 FAIL	Probable short-circuit on EXT1 circuit	Disconnect EXT1. Check short circuit and act accordingly
24VEXT2 FAIL	Probable short-circuit on EXT2 circuit	Disconnect EXT2. Check short circuit and act accordingly
24V TO TERMINAL FAIL	- Probable short-circuit on SOVs - Power card failure	- Disconnect SOVs. Check which one is short circuited and act accordingly. - Reset alarm. If alarm persists, replace power card
NO 5VA	ITVC failure	Reset alarm. If alarm persists, replace ITVC

Alarm displayed	Potential cause	Action
NO 5VAP	ITVC failure	Reset alarm. If alarm persists, replace ITVC
OVER TEMPERATURE	Internal ITVC max temp. exceeded	Solve cause of overheating and restore ITVC
CRC ERROR	ITVC failure	Reset alarm. If alarm persists, replace ITVC
NO POSITION LS	Limit switch failure	Check limit switch and connections
PRES L1 SENSOR FAIL	Pressure sensor L1 failure	Check sensor L1 and connections
PRES L2 SENSOR FAIL	Pressure sensor L2 failure	Check sensor L2 and connections
PRES S3 SENSOR FAIL	Pressure sensor S3 failure	Check sensor S3 and connections
PRES S4 SENSOR FAIL	Pressure sensor S4 failure	Check sensor S4 and connections
POS SENSOR FAIL	Position transmitter failure	Check position transmitter and connections
STROKE TIME TOO LONG	Valve movement is too slow	Check valve/position transmitter/limit switches
WRONG ROTATION	Valve moves in wrong direction	Check position transmitter/switches and wiring
DSP1 POWER FAIL	ITVC failure	Reset alarm. If alarm persists, replace ITVC
DSP2 POWER FAIL	ITVC failure	Reset alarm. If alarm persists, replace ITVC
PANIC BUTTON ACTION	Panic Button pressed	Solve emergency and restore ITVC
ELV**n** TEST FAILED (**n= 1÷8**)	Open-circuit of SOV No. **n**	Check SOV No. **n**
HI ELV**n** PWR CONSUMPT (**n= 1÷8**)	High power consumption of SOV No. **n**	Check SOV No. **n**
OPERATION NOT ALLOWED	Valve moves without ITVC command	Check power fluid supply, valve/position transmitter/limit switches
BLOCKED VALVE	No valve movement after open/close command	Check power fluid supply, valve/position transmitter/limit switches
SOFTWARE ERROR	ITVC failure	Reset alarm. If alarm persists, replace ITVC
OPTO ESD 1 FAULT	ITVC failure	Reset alarm. If alarm persists, replace ITVC
OPTO ESD 2 FAULT	ITVC failure	Reset alarm. If alarm persists, replace ITVC
CROSS COMPAR ERR	ITVC failure	Reset alarm. If alarm persists, replace ITVC
MICRO RESET	ITVC failure	Reset alarm. If alarm persists, replace ITVC
CRC RAM ERROR	ITVC failure	Reset alarm. If alarm persists, replace ITVC
MRT TIMER	Maximum repair time countdown active	Solve emergency and restore ITVC
WB RAM ERR	ITVC failure	Reset alarm. If alarm persists, replace ITVC

Alarm displayed		Potential cause	Action
CTO-CTO ELV **n** (**n= 1÷8**)		Short circuit of SOV No. **n**	Check SOVs, coils and connections
MICRO 2 ALARM		ITVC failure	Reset alarm. If alarm persists, replace ITVC
MEMORY COMPARISON		ITVC failure	Reset alarm. If alarm persists, replace ITVC
MRT EXPIRED		Maximum Repair Time expired	Solve emergency and restore ITVC
CLOCK ERROR		ITVC failure	Reset alarm. If alarm persists, replace ITVC
R175		ITVC failure. Shunt 24Velv failure	Reset alarm. If alarm persists, replace ITVC
F20		ITVC failure. Fuse F20 Vreg interrupted. Probable damage to SOV's	Check SOV/s Reset alarm. If alarm persists, replace ITVC
PERFORMING ESD		Electric ESD in progress	Solve emergency and restore ITVC
SAFETY ACTION		Safety action in progress	Solve emergency and restore ITVC
Battery (only if optional battery is present)	LOW BATTERY	Low battery voltage	Check power supply. Restore power supply and after 2 hours check again alarm. If necessary, replace battery
	NO BATTERY	Low battery voltage or battery disconnected	Check if battery is activated in Administrator menu. Check power supply. Restore power supply and after 2 hours check again alarm. If necessary, check battery connections and/or replace battery

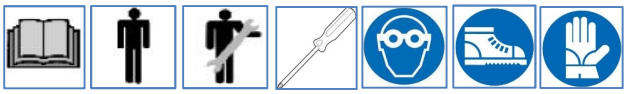
WARNING TABLE

Warning displayed	Potential cause	Action
SERVICE REQUEST	Set service time expired	Perform service/maintenance
HIGH TEMPERATURE	Max temperature set value exceeded **(75 °C)**	Solve emergency and restore ITVC
ONLY ESD 1 ACTIVE	ESD1 and ESD2 signals different	Check wiring and ITVC ESD2 channel
ONLY ESD 2 ACTIVE	ESD1 and ESD2 signals different	Check wiring and ITVC ESD1 channel

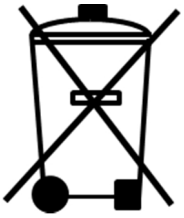
MRT ALARM TABLE

MRT displayed	Potential cause	Action
CRC FLASH ERR	ITVC failure	Reset alarm. If alarm persists, replace ITVC
SENS **n** OUT OF RANGE (**n= 1÷3**)	Sensor No. **n** reading is out of range	Check sensor **n**. If necessary, replace it.
SENS **n** OUT COMP (**n= 1÷3**)	Sensor No. **n** reading is out of comparison and voting process	Check sensor **n**. If necessary, replace it.
FAUTL OPTO ESD1	ITVC failure	Reset alarm. If alarm persists, replace ITVC
FAULT OPTO ESD2	ITVC failure	Reset alarm. If alarm persists, replace ITVC
FLASH ERROR	ITVC failure	Reset alarm. If alarm persists, replace ITVC
RAM ERROR	ITVC failure	Reset alarm. If alarm persists, replace ITVC
SW ERROR	ITVC failure	Reset alarm. If alarm persists, replace ITVC
WATCHDOG	ITVC failure	Reset alarm. If alarm persists, replace ITVC
SOV **n** FAULT (**n= 1÷8**)	Fault on SOV No. **n**	Check SOV No. **n**. If necessary, replace it.
CLOCK ERROR	ITVC failure	Reset alarm. If alarm persists, replace ITVC
RAM CRC ERR	ITVC failure	Reset alarm. If alarm persists, replace ITVC
MRT MICRO 2	ITVC failure	Reset alarm. If alarm persists, replace ITVC

14 Decommissioning



Disposal and recycling



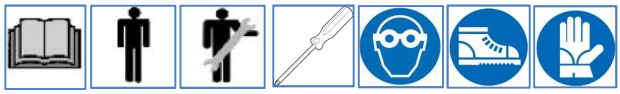
At the end of the life the ITVC must be disassembled.

WARNING!	
	Do not dump non-biodegradable products, lubricants and non-ferrous (rubber, resins, PVC, etc.) into the environment. Dispose of all such materials as indicated in the below table

Subject	Hazardous	Recyclable	Disposal
Electrical and electronic equipment	Yes	Yes	Use specialist recyclers
Glass	No	Yes	Use specialist recyclers
Metals	No	Yes	Use licensed recyclers
Plastics	No	Yes	Use specialist recyclers
Rubber (seals and o-rings)	Yes	No	May require special treatment before disposal, use specialist waste disposal companies
Battery	Yes	No	May require special treatment before disposal, use specialist waste disposal companies

WARNING!	
	• Do not re-use parts or components which appear to be in good condition after they have been checked or replaced by qualified personnel and declared unsuitable for use • In all cases check local authority regulation before disposal

15 Start-up procedure



15.1 General checks

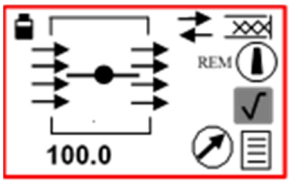
Before powering the ITVC the following check should be done:

- Temperature: it should be correct for the installation and according to the value indicated in the label on the ITVC enclosure
- Main supply voltage: it should be correct for the installation and according to the attached electrical diagram and the label on the ITVC enclosure.
- Wiring and electrical connections: they should be according to the electrical diagram.
- Actuator: the mechanical stop of the actuator should be already set and the actuator should be in its safe position. Pneumatic/hydraulic connection. Use the IOM's of the actuator to perform this checks.
- Pneumatic / Hydraulic power: it should be available and according to the actuator and plant specification

Once the above checks are completed, switch on the electrical power of ITVC.

The ITVC display shows the **HOME** page.

Example of **HOME** page



By the procedure described in the paragraph "**Actuator control mode**" set **LOCAL** control mode.
In case of Alarm or Warning (icons A or ⚠ in place of √), **reset** Alarms and Warnings by the procedure described in the paragraph "**Visualization of Alarm and Warning**". If Alarms and Warnings persist, try to solve the problem with the instruction in **Troubleshooting** chapter.

The ITVC is supplied with a **configuration** of its internal parameters (temperature limits, local and remote control mode, ESD shutdown parameters, MRT time, PST parameters, output relay, etc.) in accordance with the wiring diagram and user request. By the instruction of this IOM, the user can modify the parameters, but in general it is not necessary. Here below are described only the test needed to check the correct operation of complete system "ITVC-Actuator-Pneumatic/Hydraulic Control Unit".

15.2 End of travel setting

- Actuator with electrical limit switches

If the actuator is closed, set the electrical limit switch in closure. Set it to trip slightly before than the actuator reaches the mechanical stop. The display should indicate position 0.0. By the local pushbutton ⏫ open the actuator until it reaches the mechanical stop in opening. Set the electrical limit switch in opening. Set it to trip slightly before than the actuator reaches the mechanical stop. The display should indicate position 100.0. Repeat the close and open strokes few times to verify the repeatability of the setting.
The same procedure should be done if the actuator is open. Set the open limit switch, then close the actuator and set the close limit switch.

- Actuator with 4-20mA position transmitter

The "zero" and "span" of the position transmitter are set by the customer to cover the maximum available travel of the actuator (from mechanical stop open to mechanical stop close). The operator should only acquire the electronic end of travel by the procedure described in "**Calibration L/S**", **SETUP**, **Administrator** menu. The ITVC will consider the read values as "stroke limit switches" The procedure allows setting both open and close travel limits.

15.3 Test of absorption of coil of Solenoid Operated Valves

This test should be done only if the ITVC is supplied without actuator and pneumatic / hydraulic control unit.
The test measures and records the current of each coil of Solenoid Operated Valves controlled by the ITVC.
The procedure is described in the paragraph "**Test coil absorption**", in the **Administrator menu**, **SETUP** chapter
The measured current of each coil is used as **reference current** to check the status of coils when the ITVC carries out the procedure "**Coil test**".
The above test is not necessary if the ITVC is supplied together with the actuator and pneumatic / hydraulic control unit assembled in DVG Automation facility. In this case the test is done in factory, in the test operations.

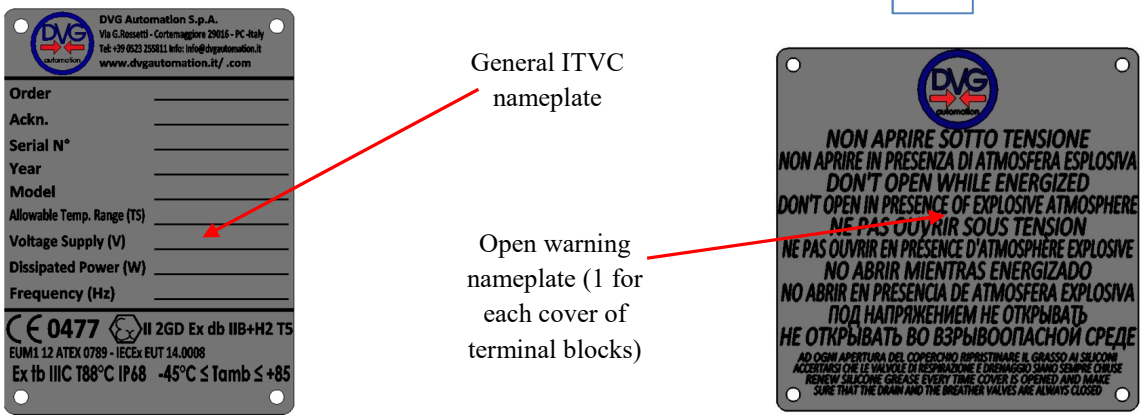
15.4 Test of Stroke time

The test measures the closing time by moving the valve. If the valve is open, the ITVC closes the valve. If the valve is closed, the ITVC before opens and then closes the valve.
The procedure is described in the paragraph "**Stroke time calibration**", in the **Administrator** menu, **SETUP** chapter

15.5 Set of coil test option

It allows setting the type of test of solenoid coils. Two options are available: Automatic and Manual. In Automatic the test is performed every 8 hours, in Manual the test is performed immediately, by pressing the pushbutton ↵
At the end of the test (Automatic or Manual) the display reports the list of solenoid valves and the result of test, failed= "X" or "√"=passed. If the test fails the ITVC raises an Alarm that can be viewed in the Alarm list. Before running the test it is mandatoy that the "**Test coil absorption**" was previously done, at least one time.
The procedure to set the coil test option is described in in the paragraph "**Coil test**", in the **Administrator** menu, **SETUP** chapter.

16 Nameplates



WARNING!	
	Prohibited to alter or remove the nameplate/s

17 Battery option

If required, ITVC can be equipped (only -20°÷+85°C ITVC version) with a rechargeable lithium-ion battery, which in case of power supply failure, keeps the ITVC functioning even if the main electrical power fails. Battery option is available for all types of ITVC controller but in general is requested in the versions with Line Break.

PLEASE NOTE THAT IN CASE OF "ENERGIZE-TO-TRIP" ESD ACTION, BATTERY IS MANDATORY

MINIMUM BATTERY OPERATING TIME IN MONITORING MODE

(ITVC disconnected from power supply; No. 3 sensors + No. 1 position sensors connected)

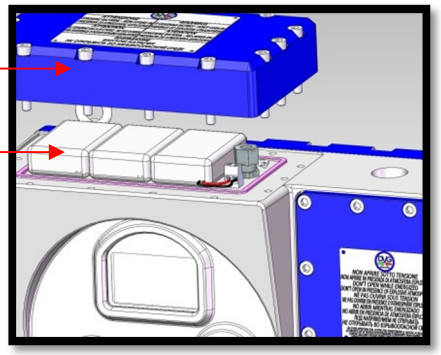
STANDARD BATTERY: 12 hours (battery capacity 53Wh) - **DVG P/N: CBAEOZZ0001**

EXTENDED BATTERY: 36 hours (battery capacity 160Wh) - **DVG P/N: CBAEOZZ0002**

In case of power supply failure, battery recharge cycle will start automatically when power supply is restored. The recharge time is max 9 hours (standard pack) and 27 hours (extended pack), charge current 500mA.

- The battery is located on top of the ITVC, in the battery compartment.
- Electrical connection between battery and the ITVC module is according to ATEX.
- The ITVC is shipped with the battery **connected** and **disabled**. After installation and start-up of ITVC, **enable the battery** from the **ADMINISTRATOR menu.**

REPLACE BATTERY IN A SAFE AREA AND USING ONLY DVG ORIGINAL PARTS.



WARNING!	
	*Use only genuine DVG AUTOMATION parts.* *Use of components not manufactured by DVG AUTOMATION will void your warranty, might adversely affect the performance of the instrument, and could cause personal injury and property damage.*

Local signalling: If the battery is enabled the **HOME** page of the ITVC HMI shows the icon . The icon shows also the charge level of battery. If the battery is **discharged** or **unconnected** the ITVC raises an **alarm** and the icon is . The LED of pushbutton lights-up, red colour, the Open and Close actuator commands are available and work. The alarm should be reset by the procedure described in the paragraph "Visualization of alarms and warning" of the IOM-ITVC-Basic.

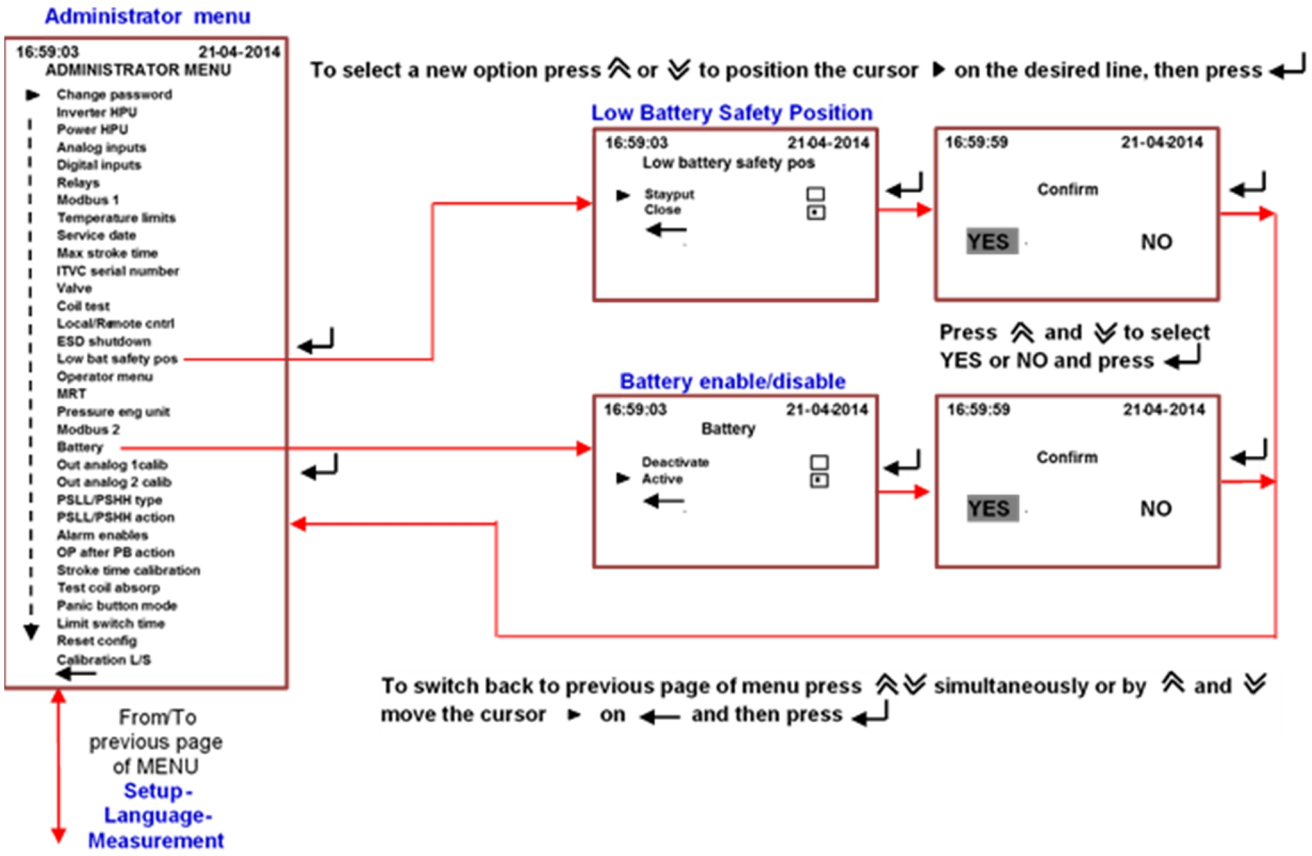
Remote signalling: in case of battery alarm the **Monitor relay** switches-over. The auxiliary output relays R1,…,R4 can be individually set to signal "**Low battery**". The paragraphs "Output signalling relays" and "Output relays" in the IOM-ITVC-Basic give the procedure to set the above relays.

Configuration options: in the SETUP, ADMINISTRATOR menu are available two configuration options

- Battery: the option "Deactivate" disables the battery, the option "Active" enables the battery
- Low bat safety pos: it sets the action in case of battery alarm, stayput or close.

17.1 Setting options in the ADMINISTRATOR menu

The figure below shows the procedure to enable/disable the battery and to set the action in case of battery alarm



See the manual **IOM-ITVC-Basic**, chapter SETUP, ADMINISTRATOR to find more instruction relevant to navigation and setting of parameters

WARRANTY

DVG Automation S.p.a. products are warranted to be free from defects in materials and workmanship for a period of eighteen months from the date of delivery (unless otherwise agreed when ordering) if they are used according to DVG Automation S.p.a. recommended usages. DVG Automation S.p.a.'s liability is limited to the repair, purchase price refund, or replacement in kind, at DVG Automation S.p.a.'s sole option, of any products proved defective. DVG Automation S.p.a. reserves the right to discontinue manufacture of any products or change products materials, designs or specifications without notice.

Note: DVG Automation S.p.a. does not assume responsibility for the selection, use and/or maintenance of any product. Responsibility for proper selection, use and maintenance of any DVG Automation S.p.a. product remains solely with the purchaser and end user.

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