CLA-VAL **D22**

Electronic Valve Controller

User Manual

Reduce your waste - Sort your rubbish

3.2 Basic Button Functionality....23
3.2.1 Button Descriptions....23
3.2.2 Short Click - Less than 1 Seconds....24
3.2.3 Extended Click - More than 3 Seconds ("Home/Ok" Button Only)....25
3.3 Button Destinations....26
3.3.1 "Up/Valve Configuration"....26
3.3.2 "Left/Input"....26
3.3.3 "Right/Output"....27
3.4 Menu Locations....28
3.4.1 Information Screens....28
3.4.2 Configuration Menus....30
3.4.2.1 "**Configure Inputs**" Menu....30
3.4.2.2 "**Configure Outputs**" Menu....31
3.4.2.3 "**Valve Configuration**" Menu....33
3.4.2.4 Valve configuration - "**PID**" Menu....34
3.4.2.5 Valve configuration - "**DP Metering**" Menu....38
3.4.2.6 Valve configuration - "**Control Curve**" Menu....40
3.4.2.7 Valve configuration - "**Totalizer**" Menu....44
3.4.2.8 Valve configuration - "**Actions**" Menu....44
3.4.2.9 Valve configuration - "**Signal Retransmission**" Menu....46
3.4.3 "Settings" Menu....46
3.4.3.1 "**Information**" Page....47
3.4.3.2 "**Application Management**" Page....48
3.4.3.3 "**Date & /Time**" Page....51
3.4.3.4 "**Logging**" Page....52
3.4.3.5 "**Display**" Page....53
3.4.3.6 "**Connectivity**" Page....53
3.4.3.7 "**Security**" Page....61
3.4.3.8 "**Reboot**"....61
3.4.3.9 "**Advanced**" Pages....62
3.5 In-Menu Navigation....65
3.5.1 Keyboard Functionality....65
3.5.2 Numeral Selection....65
3.5.3 Drop-Down Menu....66
4 Specific Features....67
4.1 Add Inputs On-The-Fly....67
4.2 Input Remap (Input Type Selection)....68
4.3 Custom Scaling....68

3.2 Basic Button Functionality....23
3.2.1 Button Descriptions....23
3.2.2 Short Click - Less than 1 Seconds....24
3.2.3 Extended Click - More than 3 Seconds ("Home/Ok" Button Only)....25
3.3 Button Destinations....26
3.3.1 "Up/Valve Configuration"....26
3.3.2 "Left/Input"....26
3.3.3 "Right/Output"....27
3.4 Menu Locations....28
3.4.1 Information Screens....28
3.4.2 Configuration Menus....30
3.4.2.1 "**Configure Inputs**" Menu....30
3.4.2.2 "**Configure Outputs**" Menu....31
3.4.2.3 "**Valve Configuration**" Menu....33
3.4.2.4 Valve configuration - "**PID**" Menu....34
3.4.2.5 Valve configuration - "**DP Metering**" Menu....38
3.4.2.6 Valve configuration - "**Control Curve**" Menu....40
3.4.2.7 Valve configuration - "**Totalizer**" Menu....44
3.4.2.8 Valve configuration - "**Actions**" Menu....44
3.4.2.9 Valve configuration - "**Signal Retransmission**" Menu....46
3.4.3 "Settings" Menu....46
3.4.3.1 "**Information**" Page....47
3.4.3.2 "**Application Management**" Page....48
3.4.3.3 "**Date & /Time**" Page....51
3.4.3.4 "**Logging**" Page....52
3.4.3.5 "**Display**" Page....53
3.4.3.6 "**Connectivity**" Page....53
3.4.3.7 "**Security**" Page....61
3.4.3.8 "Reboot"....61
3.4.3.9 "**Advanced**" Pages....62
3.5 In-Menu Navigation....65
3.5.1 Keyboard Functionality....65
3.5.2 Numeral Selection....65
3.5.3 Drop-Down Menu....66
4 Specific Features....67
4.1 Add Inputs On-The-Fly....67
4.2 Input Remap (Input Type Selection)....68
4.3 Custom Scaling....68

4.4 Input Filtering 68
4.5 Remote Configuration 69
4.5.1 Register the Electronic Controller on Link2Valves 69
4.5.2 Connect to Link2Valves 69
5 Appendix: Modbus Interface 70
5.1 Modbus Protocol 70
5.2 Standard Modbus interface 70
5.3 Modbus-TOPKAPI 75
5.4 Integer Modbus-TOPKAPI 79
6 Appendix: Modbus Interface for various slave sensors 84
6.1 Cla-Val e-Drive-34 Actuator 84
6.1.1 Interfacing an e-Drive-34 actuator to the Electronic Valve Controller 84
6.1.2 Calibrate an e-Drive-34 actuator from the Electronic Valve Controller 86
6.2 Sensor interface definition file 88
6.2.1 .ID section 89
6.2.2 .Channels section 89
6.2.3 Readrequest section 90
6.2.4 .Writerequest section 90
6.3 Adding sensor into the Electronic Valve Controller 90

1 INTRODUCTION

1.1 PRECAUTIONS BEFORE STARTING

: Before usage, make sure that the latest software version is installed on your device. You can download the latest software from: www.cla-val.ch.

: This equipment must be handled with precaution. CLA-VAL electronic products are robust and designed to work under field environmental conditions, but high shocks and strong mechanical constraints can damage the equipment and/or alter its functionality.

1.2 TROUBLESHOOTING

1.2.1 NOTHING ON THE DISPLAY

A) Check that there is a proper power supply applied to the Electronic Valve Controller. A clean 12 VDC to 24 VDC continuous voltage must be provided to one of the "**V+**" connections in the junction terminal (grounded to the "**V-**")

B) Check that the screen is not in standby mode by clicking on one of the five navigation buttons. If the screen switches on, you can unlock the screen by clicking two seconds on the "**Home/Ok**" button .

1.2.2 AN INPUT OR VARIABLE IS DISPLAYED IN RED, ORANGE OR BLUE

See the colour coding convention used on the Electronic Valve Controller for the inputs, outputs and variables in chapter 3.1.

1.2.3 ISSUE WITH THE BEHAVIOUR OF THE VALVAPPS™

Refer to the technical datasheet related to your ***ValvApps™***, and especially the block diagram and the logic scheme explaining its behaviour.

For any remaining issue, please contact CLA-VAL.

1.3 GENERAL DISCLAIMER

In accordance with our policy of continuous development and improvement, CLA-VAL reserves the right to modify or improve its products at any time without prior notice. CLA-VAL assumes no liability or responsibility for any errors or omissions in the content of this document.

1.4 ENVIRONMENTAL PROTECTION

Help to preserve and protect the environment. Recycle used equipment and accessories.

1.5 TYPOGRAPHY

Throughout this manual, the following typographical conventions and symbols have been adopted to help readability:

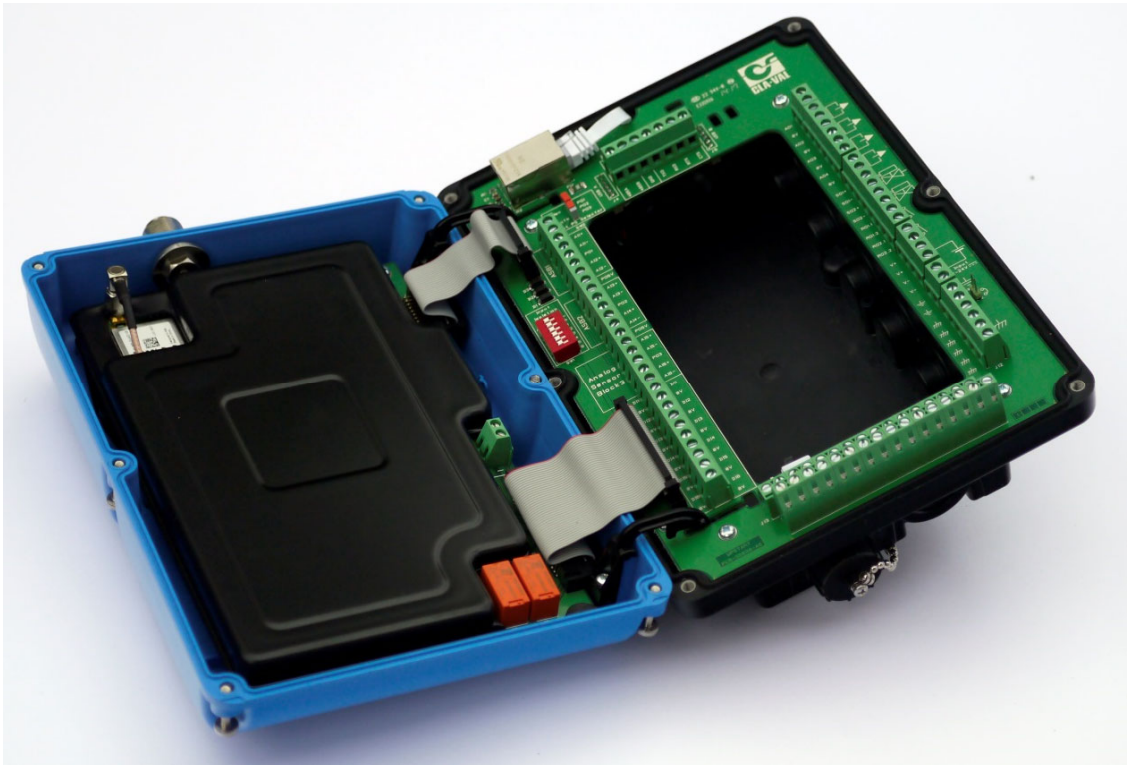
a. "**Bold":** Menu, command, tab and button.
b. ***BOLD ITALIC***: Important information.
c. (1): Number of the reference marks on image.
d. **www.cla-val.ch:** Internet address.
e.  : Some tips.
f. : Warning!

2 ELECTRICAL & MECHANICAL DETAILS

2.1 TECHNICAL CHARACTERISTICS

Enclosure	
Material	Flame retardant PC/ABS plastic
Connections	M16/M20 IP-68 Cable Glands IP-68 USB Type A IP-68 RJ45 Ethernet Port
Dimensions	227 mm (8.94") H x 160 mm (6.3") W x 95 mm (3.74") D
Protection	IP68 (1 month under 2 meters)
Mounting Bracket	Stainless steel
Power Requirements	
Voltage Input	12 VDC to 24 VDC
Power Consumption	1.9 W in stand-by, 3 W nominal when regulating (up to 30 W peak consumptions)
Protection	32 VDC over-voltage protection Reverse voltage protection
Inputs (Screw Connection I/O terminal)	
Analog (AI1 to AI6)	6 (six) 4-20 mA inputs (max. voltage = 32 VDC)
Digital (DI1 to DI6)	6 (six) dry contacts inputs (max. voltage = 5 VDC @ 0.1 A, max. frequency = 100 Hz)
Units	Configurable
Decimal point	1 (“0”) to 4 (“0.000”) significant digits
Signal filter	Cumulative filter configurable 1% to 99%, or disabled
Totalizer	Configurable input and units
Outputs (Screw Connection I/O terminal)	
Analog (AO1 to AO4)	4 (four) 4-20 mA outputs (10-bit resolution, impedance = 500 Ω)
Solenoid (SO1 and SO2)	2 (tow) solid state relay (24 VDC @ 0.5 A - binary or proportional)
Relay (RO1 and RO2)	2 (two) mechanical relay (max. voltage 24 VDC or 240 VAC, max. current 2 A)
PID Control Parameters	
Proportional Band	0% to 100% (adjustable in 1% increments - independently for opening and closing)
Dead Band	Adjustable from 0 to full-scale of set-point signal
Cycle Time	0 s to 60 s (adjustable in increments of 1 s)
Integral Band	0 s to 60 s (adjustable in increments of 1 s)
Derivative Band	0 s to 60 s (adjustable in increments of 1 s)
Loop Zoning	Up to 4 zones
PID Loops	Up to 4
Display & Navigation	
Display	4.3" color display (272 x 480, 24-bit)
Navigation	5 (five) mechanical push buttons
Communication	
Interfaces	Ethernet, 2G / 3G / 4G (GPRS, LTE-M, NB-IoT), RS-232 & RS-485, USB
Protocols	Modbus RTU, Modbus TCP, VNC, FTP
Logging	
Process	Manual and Automatic
Memory	Internal memory, SD card (4 GB default), Export to USB, Export to FTP server
Logging speed	1 minute
Format	CSV file (proprietary format)
Temperature Range	
Working Temperature	-10°C to +70°C
Storage Temperature	-30°C to +85°C

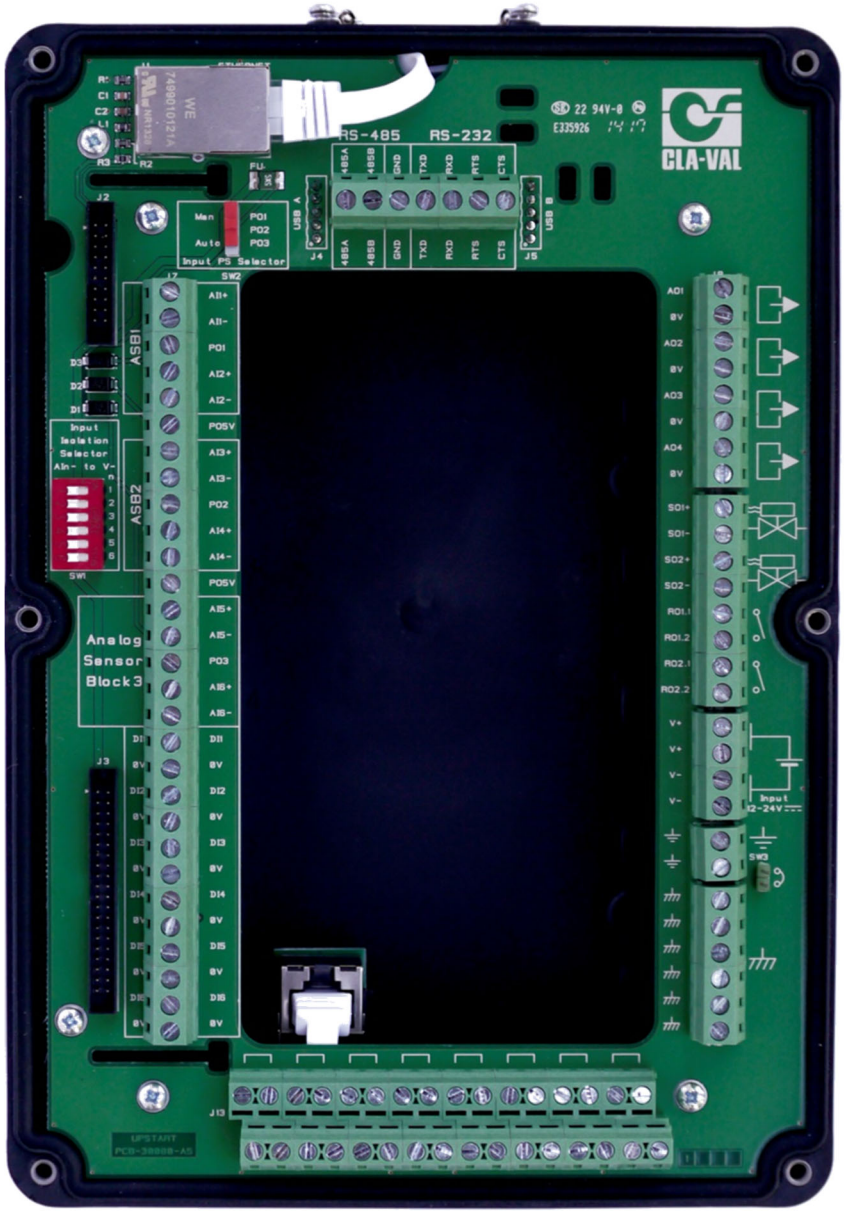
2.2 MECHANICAL DETAILS



The product is composed of two separable sub-parts:

- **Cover:** this part contains the main board implementing all the control electronics of the Electronic Valve Controller.
- **Junction board:** this part contains the connection blocks for power supply, inputs and outputs.

2.2.1 JUNCTION BOARD INTERNAL CONNECTIONS

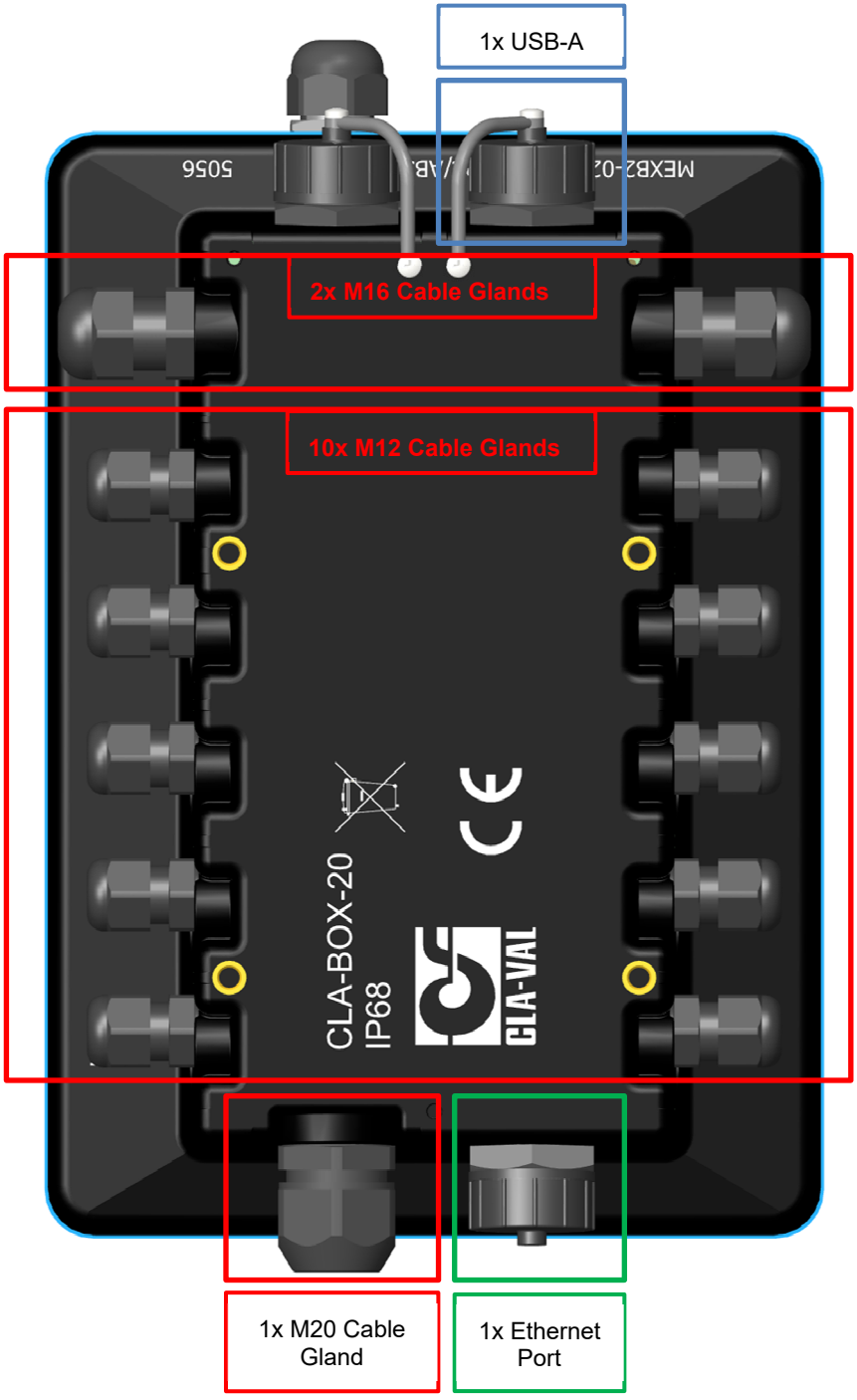


2.2.2 JUNCTION BOX CABLE GLANDS / SIZES / LOCATIONS

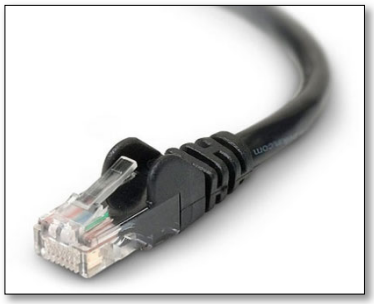
To ensure IP68 protection, the junction box is interfaced via cable glands (optionally Souriau™ connectors).

A) Multi-Conductor Cable Size / Wire Gauge. **Note:** To preserve IP68, the following must be respected

- M12 Multi-Conductor Cable Size Range: 3 mm - 6 mm (0.12" - 0.26")
- M16 Multi-Conductor Cable Size Range: 5 mm - 10 mm (0.20" - 0.39")
- M20 Multi-Conductor Cable Size Range: 6 mm - 12 mm (0.24" - 0.47")



B) Ethernet



The Ethernet port 100 Base-T (right) accepts standard RJ-45 Ethernet cables (left).

C) USB-A

The USB-A slot (left) accepts standard USB Flash Drives (right).

2.2.3 COVER PART

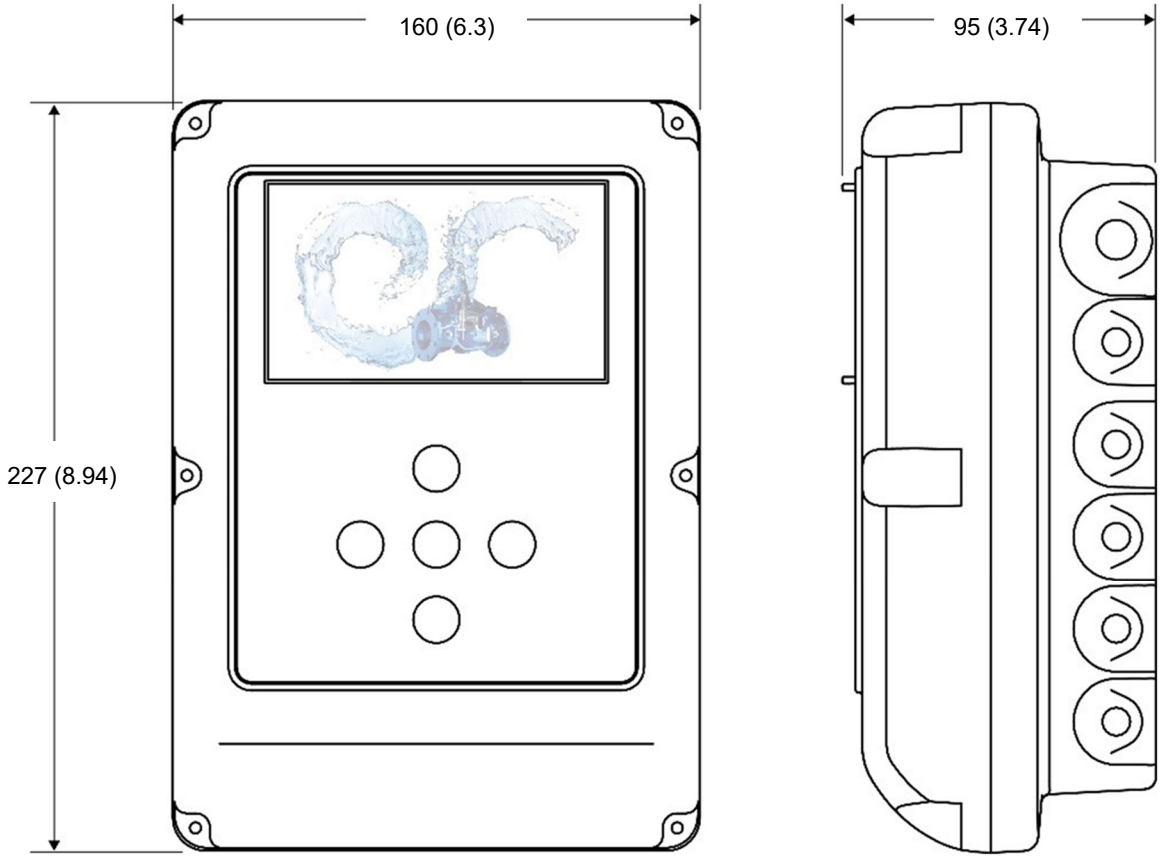
The cover part is physically separable from the junction board. This part of the product contains all the control electronics of the Electronic Valve Controller. Except to access the SIM card and/or the external memory SD card, the cover should not be opened and is not intended to be accessed by the user, except for memory or SIM card access.

2.3 PHYSICAL MOUNTING

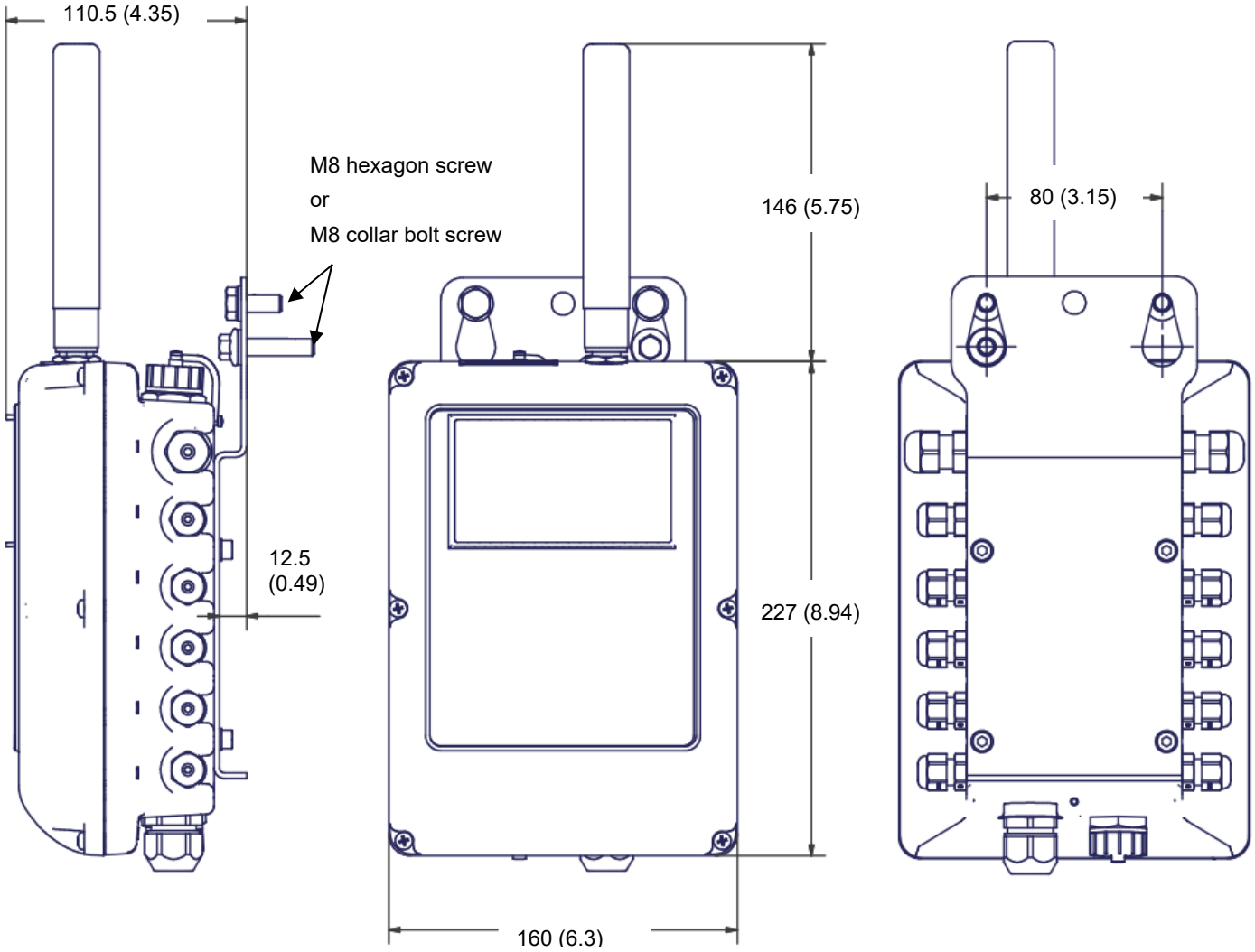
2.3.1 OVERALL DIMENSIONS

For all drawings below, units are in millimeters (inches).

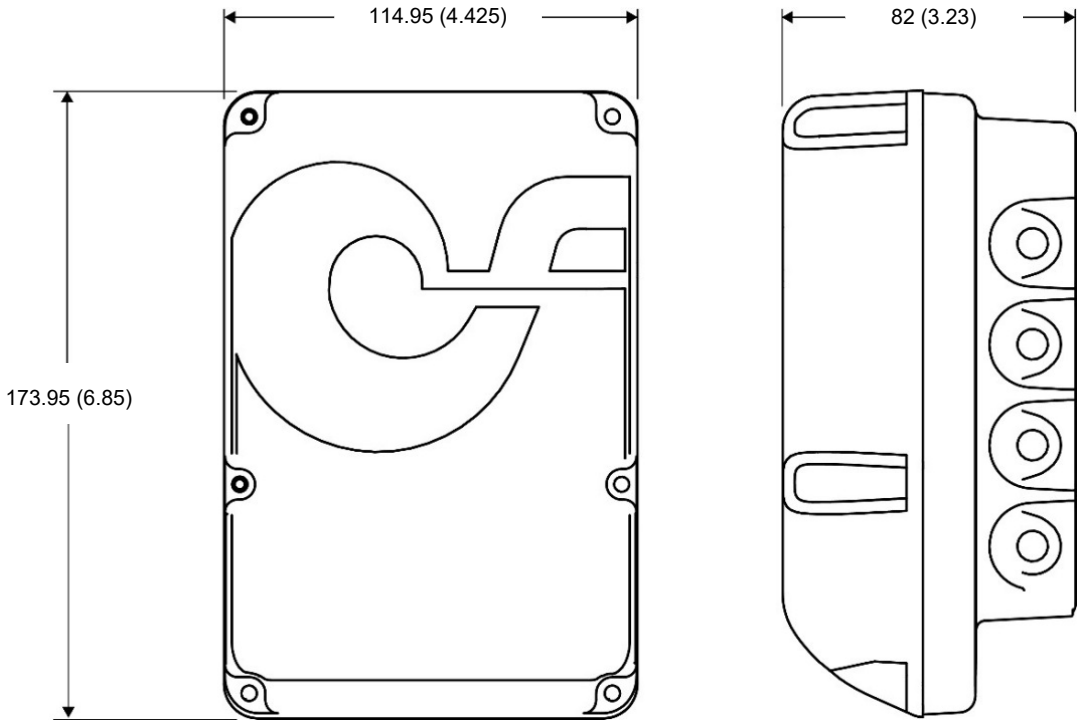
- Control Box



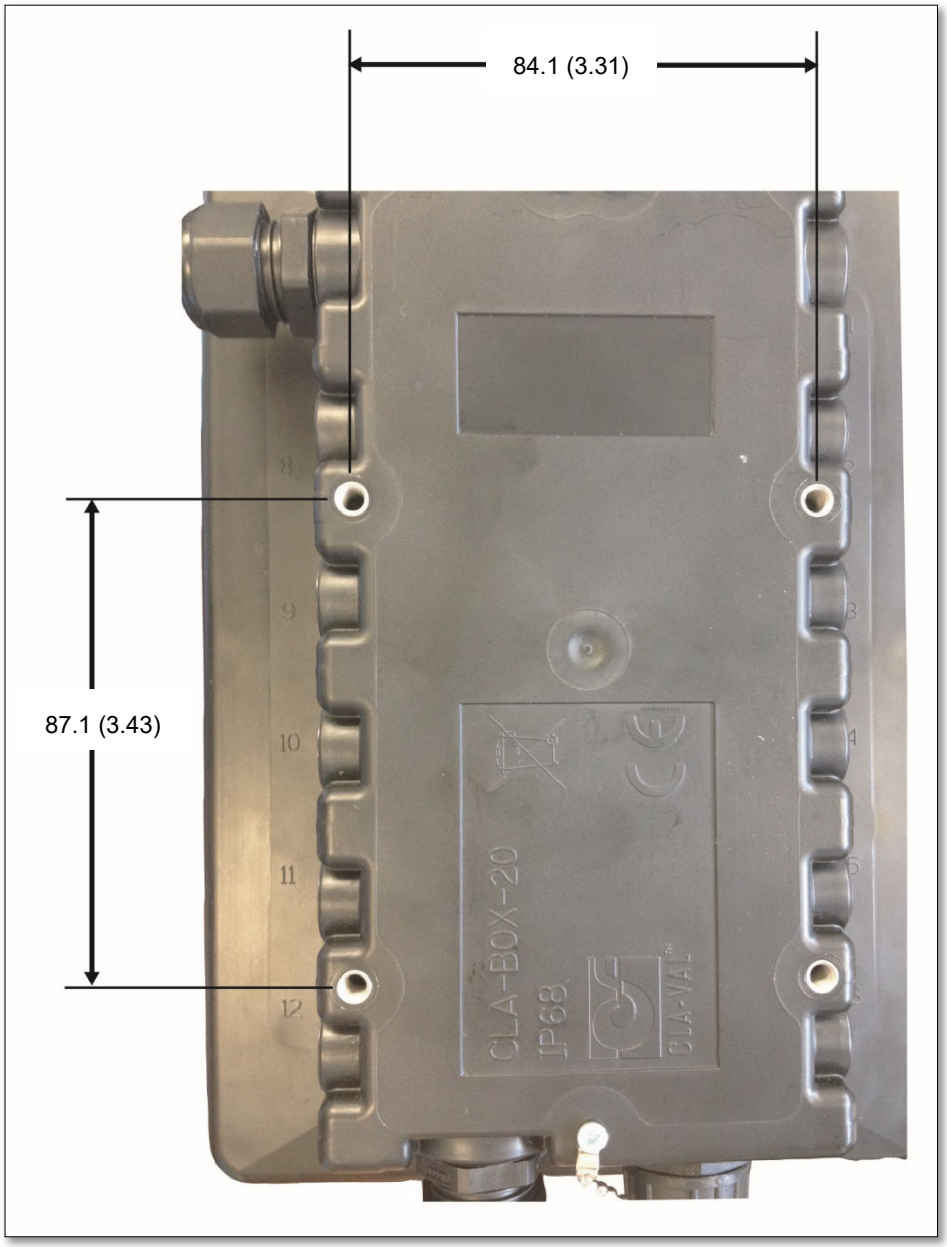
- With antenna and wall-mounting bracket



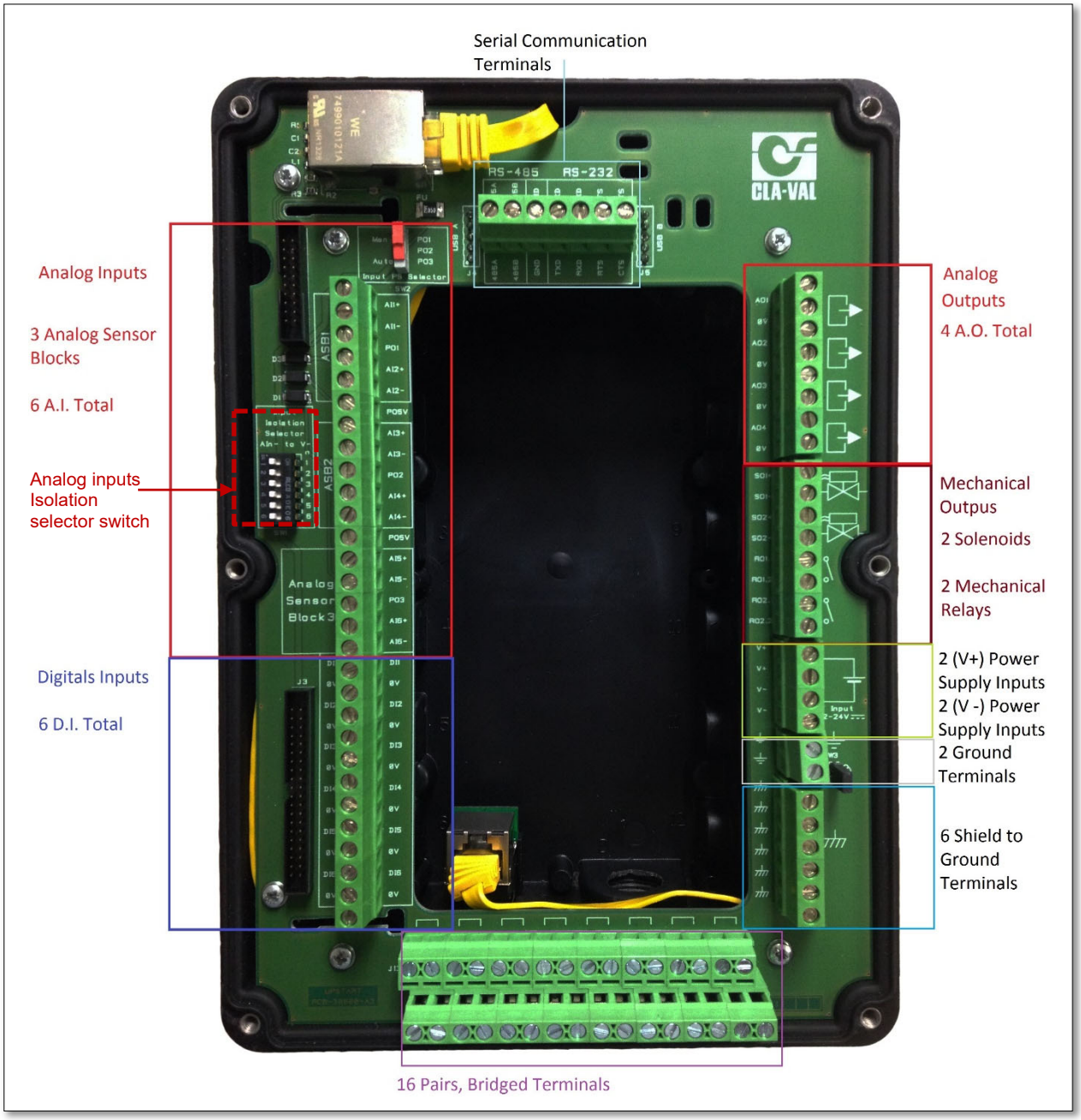
- Cla-Box 10 (accessory box - U1 option)



2.3.2 BOLT PATTERN

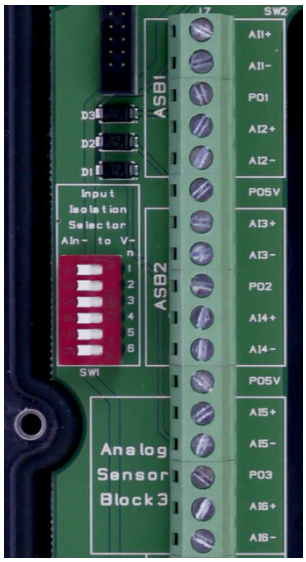


2.4 HARDWARE INPUTS/OUTPUTS (I/O)



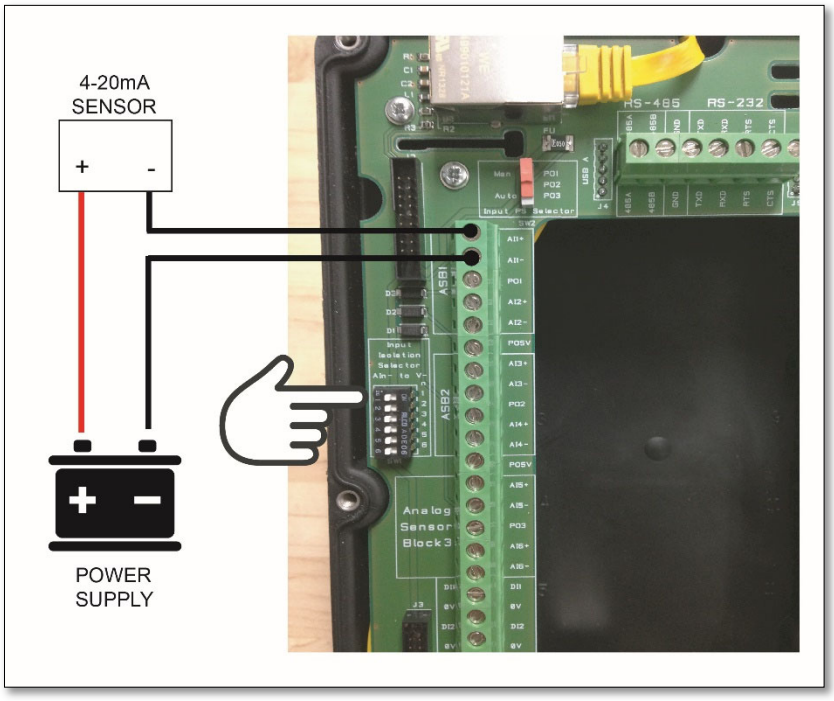
- Inputs
  - Six Analog Inputs (AI)
  - Six Digital Inputs (DI)
- Outputs
  - Four Analog Outputs (AO)
  - Four Mechanical Outputs: 2x Solenoid Outputs, 2x Contact Closures (mechanical relays)

2.5 WIRING ANALOG INPUTS FOR 4-20 MA SENSORS



2.5.1 2-WIRE 4-20 MA SENSOR (LOOP POWER)

2.5.1.1 2-wire (Externally Powered)

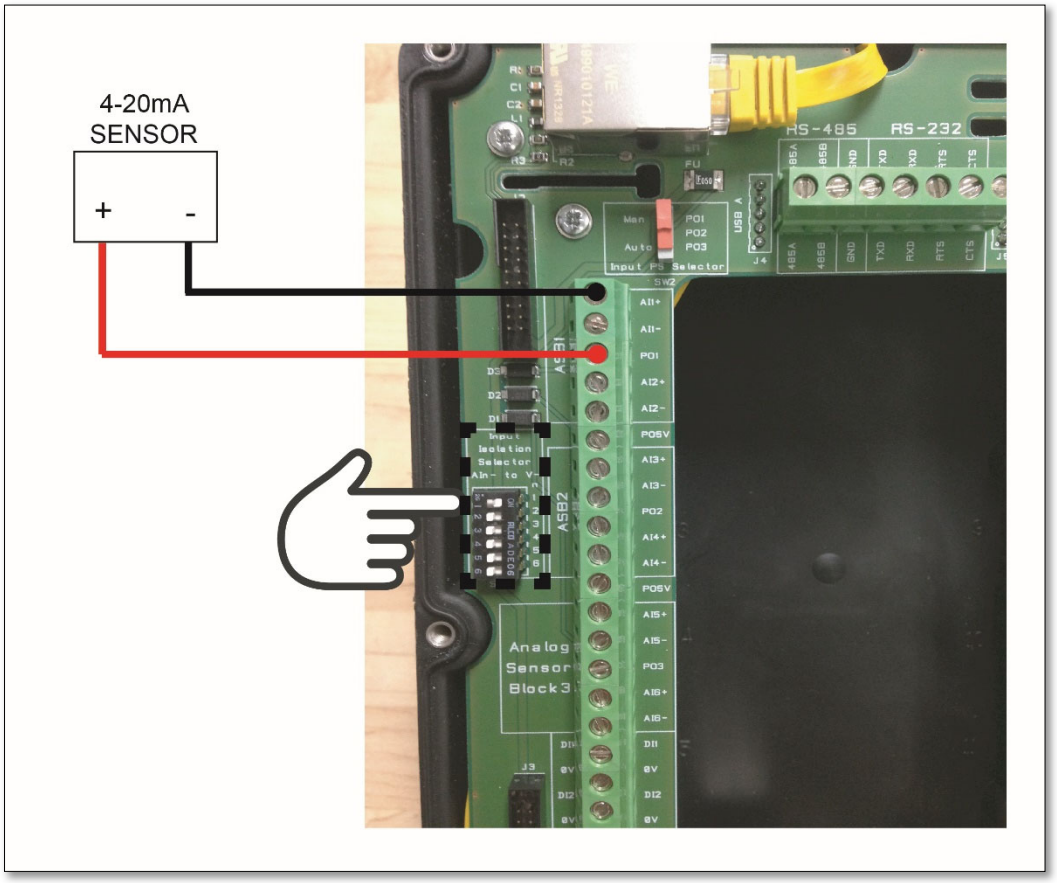


For isolated 2-wire signals, the power supply, sensor and Electronic Valve Controller make a continuous loop, allowing the current to be measured by the Electronic Valve Controller.

⚠ For isolated signals, ensure that the "Isolation Selector Switch" is set to the ***LEFT*** or "***OFF***".

Examples: Mag Meter

2.5.1.2 2-wire (Internally Powered)



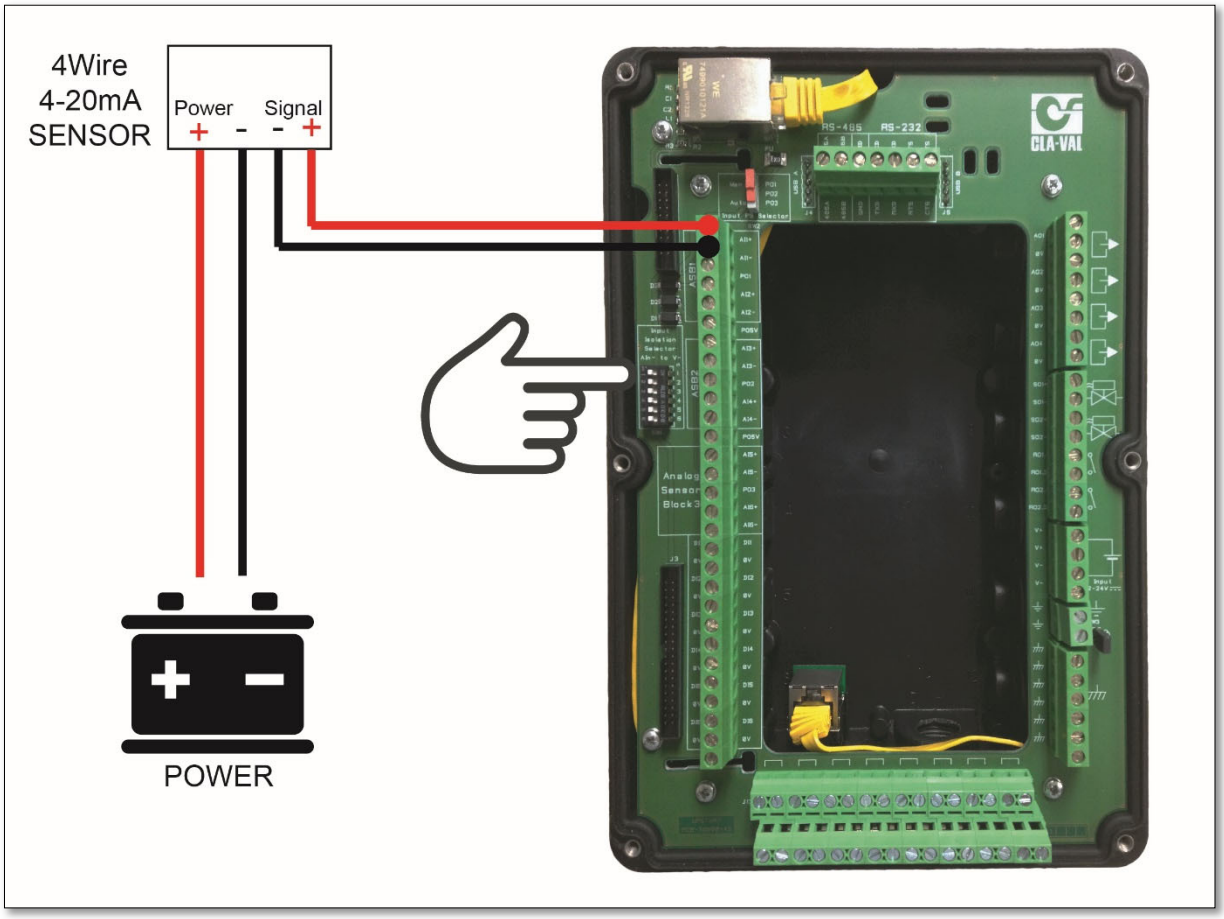
For non-isolated signals, the Electronic Valve Controller provides the power for the sensor and makes a continuous loop, allowing the current to energize the sensor and then be measured by the Electronic Valve Controller.

⚠ For non-isolated signals, ensure that the "Isolation Selector Switch" is set to the ***RIGHT*** or "***ON***".

Examples: e-FlowMeter, pressure transducer.

2.5.2 4-WIRE 4-20 mA SENSOR

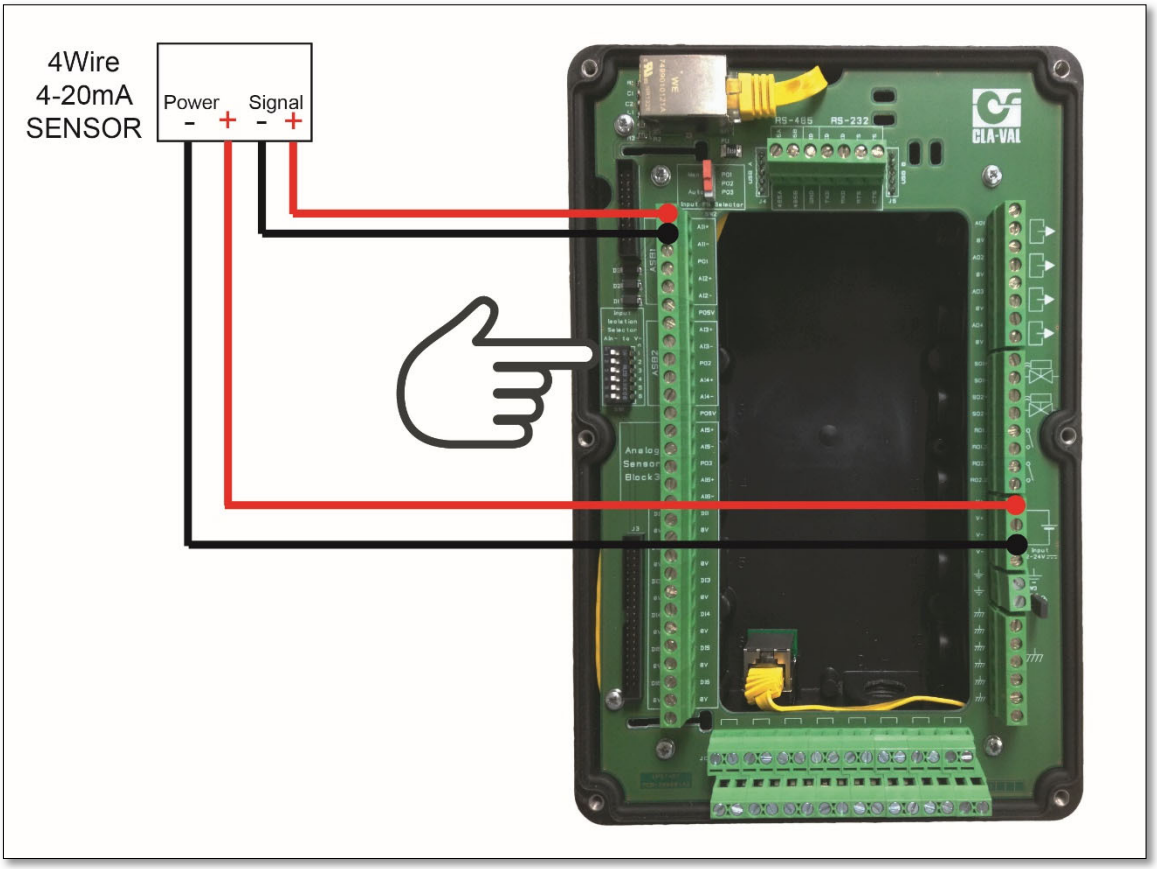
2.5.2.1 4-wire (Externally Powered)



For 4-wire signals, the Sensor is externally powered usually using 2 wires. The two signal wires coming from the sensor are then measured by the Electronic Valve Controller in the Analog Input section of the terminal board.

⚠ For 4-wire signals, ensure that the "Isolation Selector Switch" is set to the ***LEFT*** or "***OFF***".

2.5.2.2 4-wire (Internally Powered)



For 4-wire internally powered signals, the sensor is powered directly from the main Electronic Valve Controller power supply terminals. The two signal wires coming from the sensor are then measured by the Electronic Valve Controller in the Analog Input section of the terminal board.

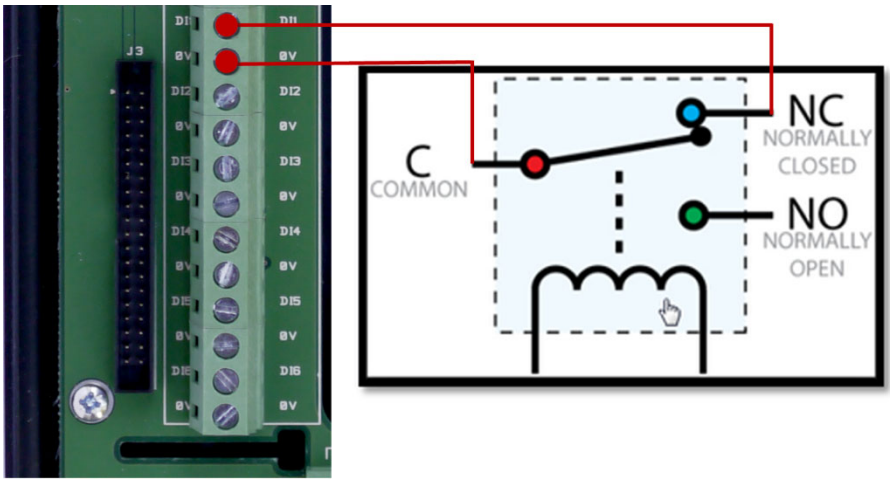
⚠ For isolated signals, ensure that the "Isolation Selector Switch" is set to the ***LEFT*** or "***OFF***".

2.6 WIRING DIGITAL INPUTS

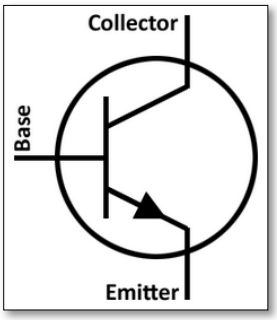
2.6.1 MECHANICAL RELAY

A mechanical relay can be used as a digital input because the state is either open (1) or closed (0). Depending on how the input is configured, action can be taken when this mechanical switch closes or opens.

Typical application: position/limit/proximity/level switch.



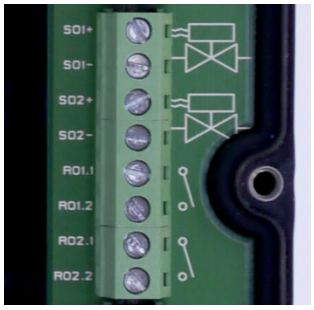
2.6.2 NPN TRANSISTOR



An NPN transistor can be used as a digital input because the state is either open (V+) or closed (V-). Depending on how the input is configured, action can be taken when this NPN transistor switches state.

Typical applications: digital pulse output from flow meter or register counter.

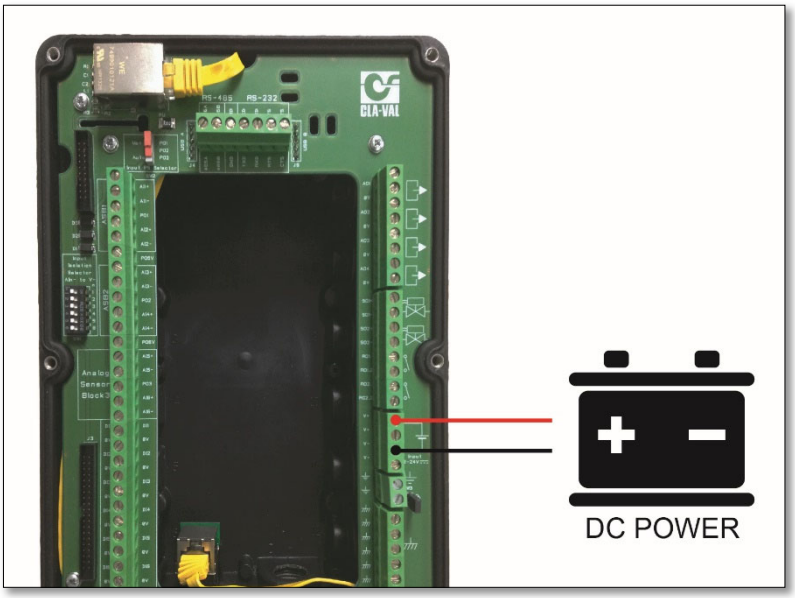
2.7 OUTPUTS SOLENOIDS



2.8 POWER SUPPLY

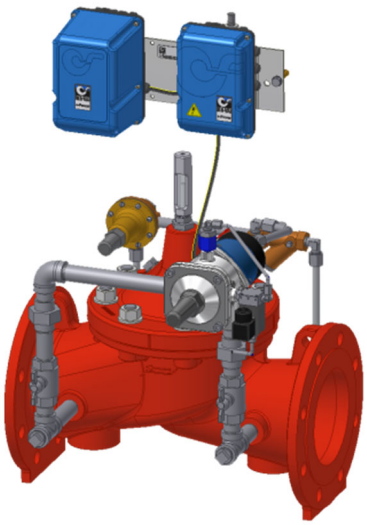
2.8.1 DC INPUT POWER

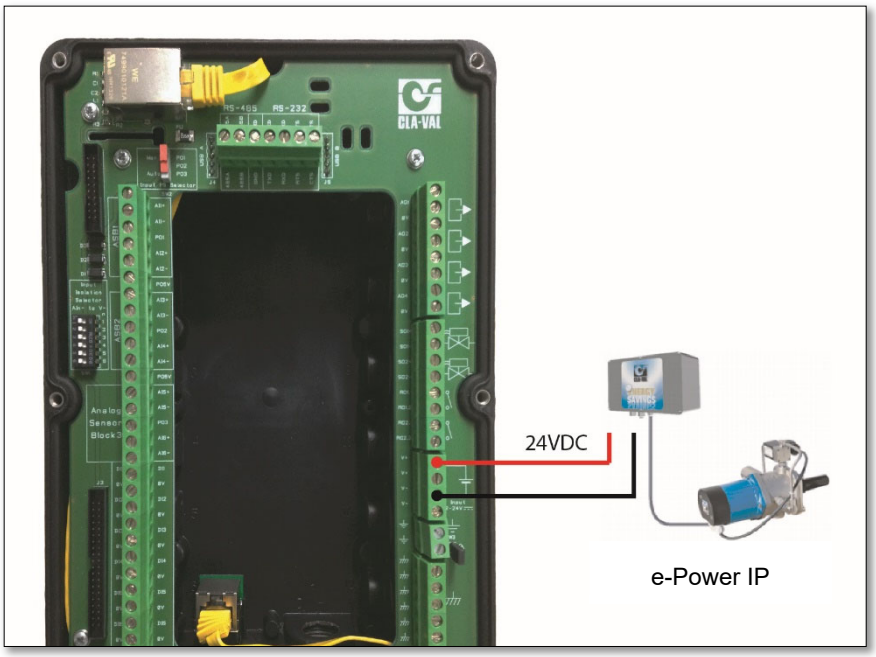
The Electronic Valve Controller requires a continuous voltage of 12-24 VDC. The Electronic Valve Controller consumes typically 0.9 W in standby mode and 3 W in usage; its peak power consumption can go up to 30 W.



2.8.2 AUTONOMOUS POWER SUPPLY

The **CLA-VAL e-Power IP** power supply is the ideal compact power generator for the Electronic Valve Controller to get a completely autonomous valve.





2.8.3 ALTERNATIVE POWER SUPPLIES

2.8.3.1 Solar Panel

2.9 WIRING TROUBLESHOOTING

Check the wiring connections first. The large majority of electronics problems arise from mistakes in the wiring.

Use the continuity function of the meter to check and make sure that A connects to B.

If mistakes are made during the wiring, for example AI2 was wired in place of AI1, their positions can be rearranged using the Input configuration menus instead of re-wiring all of the inputs.

3 NAVIGATION

3.1 COLOR CONVENTION

Values are usually displayed in black; however input values can sometimes be displayed in different colors, depending on the status of the associated input:

- **Black:** normal status. The value displayed is what is measured on the input
- **Red:** loss of signal. The associated input has no signal arriving
- **Orange:** loss of signal, and the system overrides the value
- **Blue:** local override. The value has been manually overridden locally and the signal at the input is not taken into account
- **Grey:** remote signal

3.2 BASIC BUTTON FUNCTIONALITY

3.2.1 BUTTON DESCRIPTIONS

-  - Home/Ok
-  - Left/Input
-  - Right/Output
-  - Up/Valve Configuration

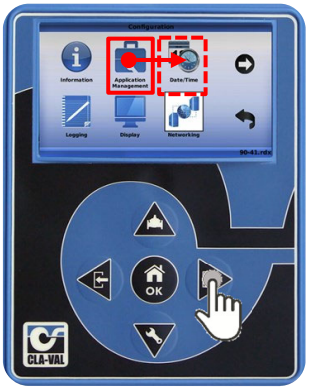
-  - Down/Settings

Other Icons in this manual

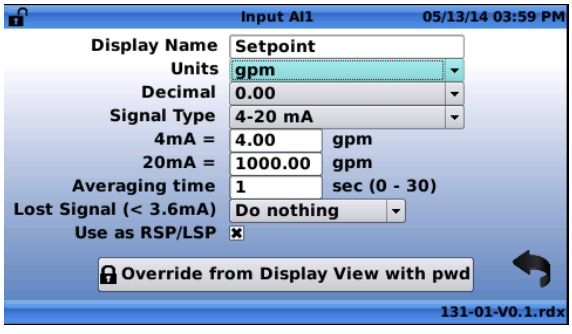
-  - Short Click (less than 1 second)
-  - Long Click (more than 1 second)

3.2.2 SHORT CLICK - LESS THAN 1 SECONDS

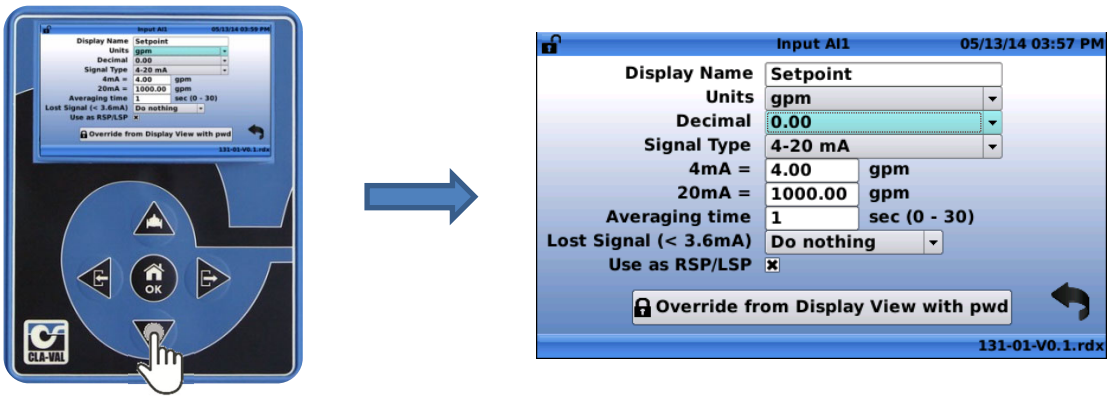
-  Is "**Ok**" or "**Select**" when used as a  (short click)
-  - When used as a  , the cursor moves to the left
-  - When used as a  , the cursor moves to the right



-  - When used as a  , the cursor moves up

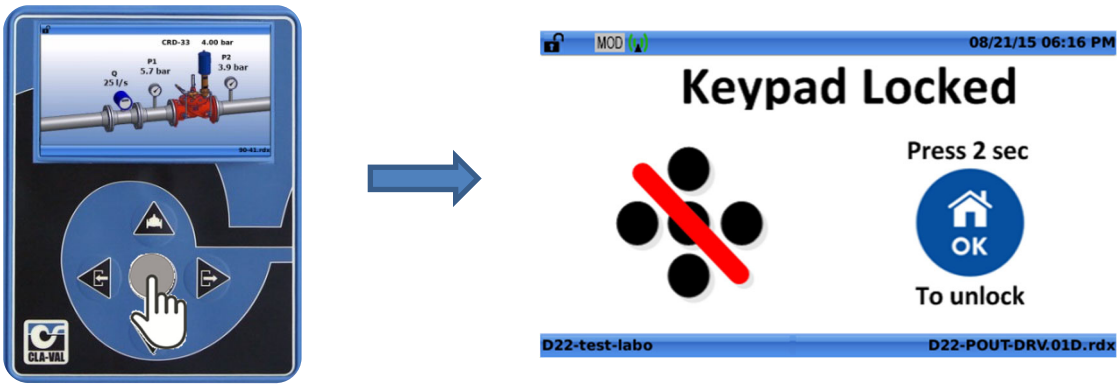


-  - When used as a  , the cursor moves down

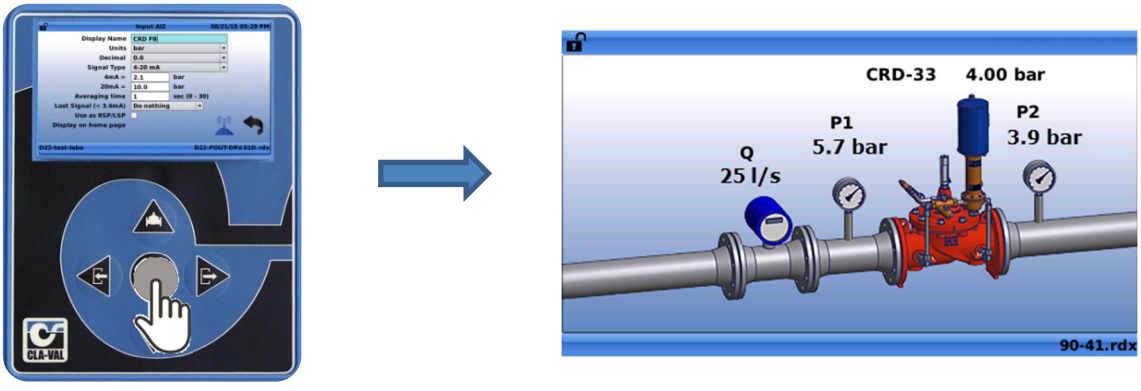


3.2.3 EXTENDED CLICK - MORE THAN 3 SECONDS ("HOME/OK" BUTTON ONLY)

From the home screen, and extended click on "**Home/Ok**" will put the Electronic Valve Controller into sleep mode.



From any other location, a long click on the "**Home/Ok**" button returns to the "**Home Screen**".

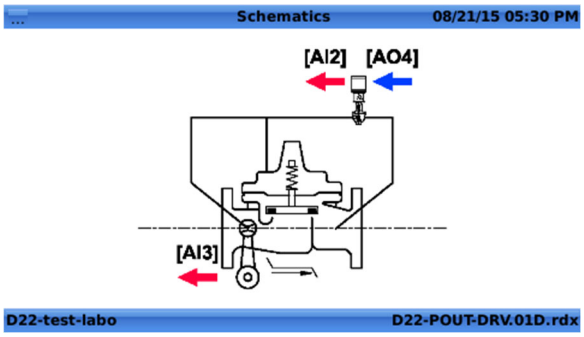


3.3 BUTTON DESTINATIONS

3.3.1 "UP/VALVE CONFIGURATION"

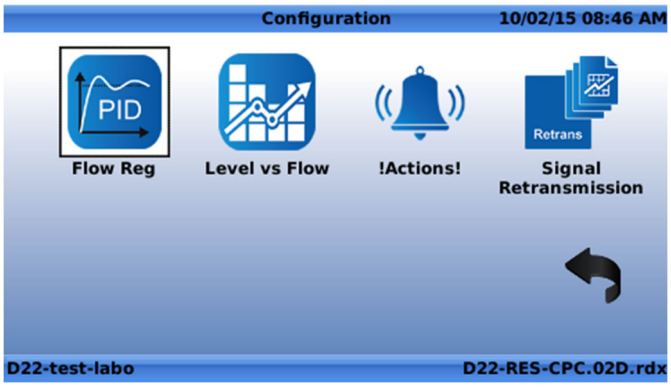
A) "**Short Click**": View Valve Information (from Home Screen).

From the "**Home Screen**",  on the  button navigates to the "**Valve Information**" screen.



B) "**Long Click**": Enter Valve Configuration Menu (from Home Screen).

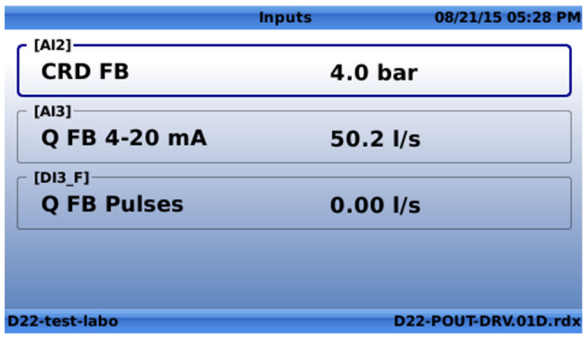
From the "**Home Screen**", a  (long click) on the  navigates to the "**Valve Configuration**" screen.



3.3.2 "LEFT/INPUT"

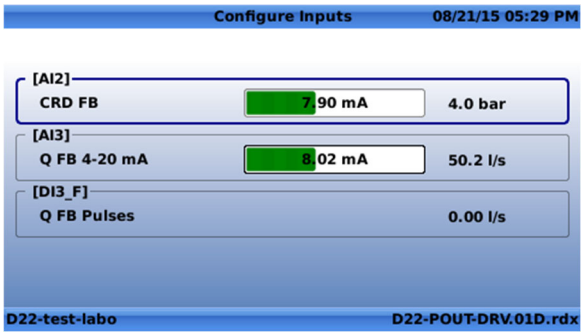
A) "**Short Click**": View Input Information (from Home Screen).

From the "**Home Screen**", a  on the  navigates to the "**Inputs**" screen.



B) **"Long Click"** - Enter Input Configuration Menu (from Home Screen).

From the "**Home Screen**", a  on the  navigates to the "**Configure Inputs**" screen.



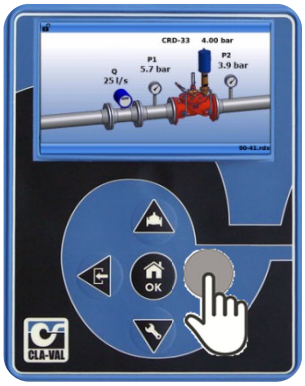
3.3.3 "RIGHT/OUTPUT"

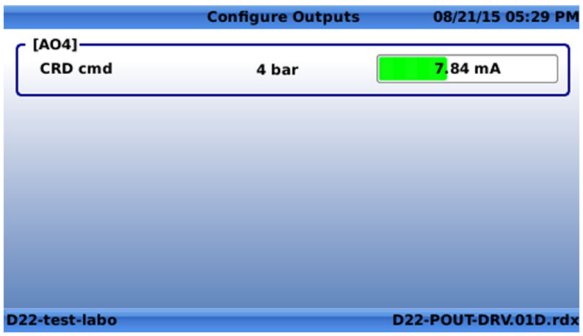
A) "**Short Click**": View Output Information (from Home Screen).

From the "**Home Screen**", a  on the  navigates to the "**Outputs**" screen.

B) "**Long Click**": Enter Output Configuration Menu (from Home Screen).

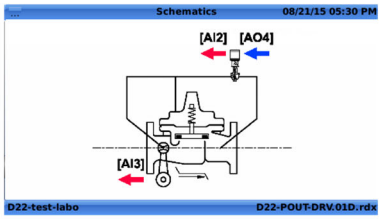
From the "**Home Screen**", a  on the  navigates to the "**Configure Outputs**" screen.

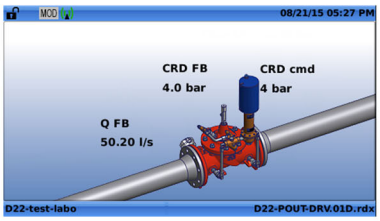


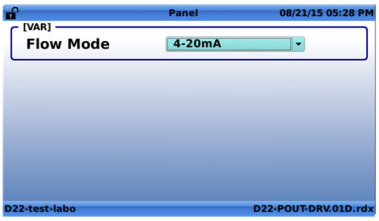


3.4 MENU LOCATIONS

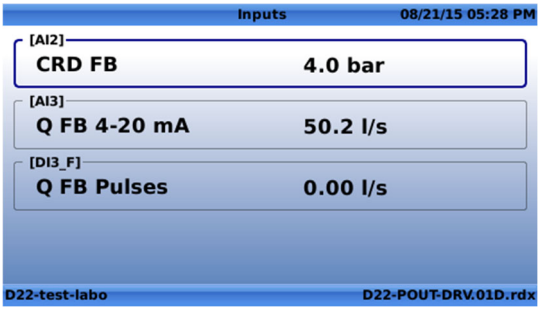
3.4.1 INFORMATION SCREENS





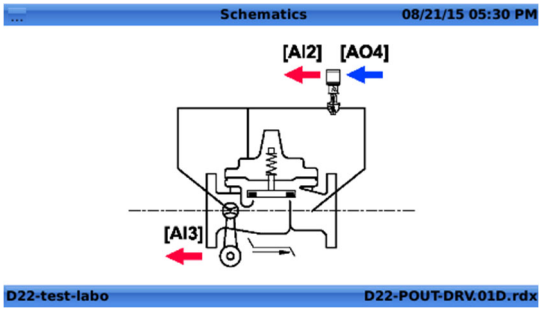


A) **"Inputs":** The Inputs menu displays all of the activated inputs in current use by the selected ***ValveApps***™.

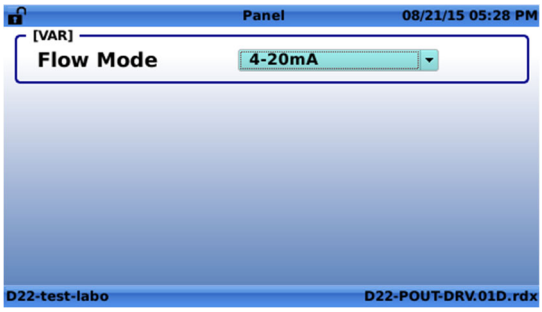


B) **"Outputs":** The outputs menu displays all of the activated inputs in current use by the selected ***ValveApps***™.

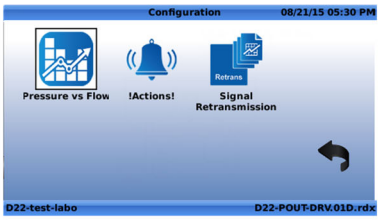
C) **"Schematics":** The Schematics menu displays the simplified valve schematics for a given ***ValveApps™*** and the connected inputs and outputs.

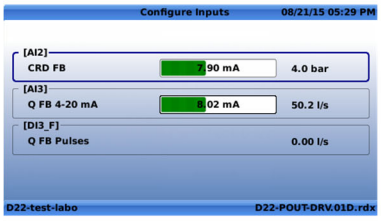


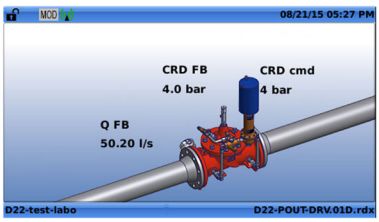
D) **"Display Panel":** The Display Panel displays all of the activated variables in current use by the selected ***ValveApps™***.

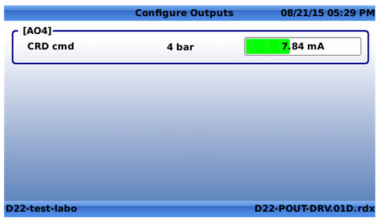


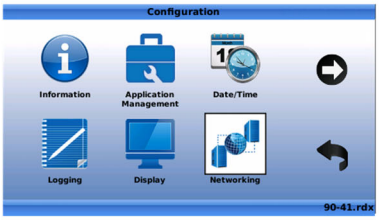
3.4.2 CONFIGURATION MENUS







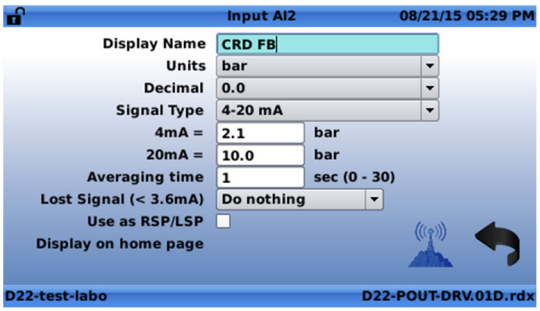


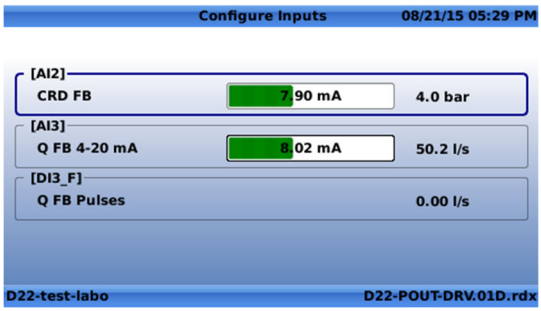


: The "**Configuration**" screens are accessed with a "**long click**" from the "**Home Screen**".

3.4.2.1 "**Configure Inputs**" Menu

A "**short click**" on "**Left/Input**" from the "**Configure Inputs**" screen enters the configuration of the selected input.





Input Field Descriptions:

- "**Display Name**": Use this field to choose a unique name for each input.
- "**Units**": Choose from the available units of:
  - (gpm) - Gallon per minute [flow];
  - (mgd) - Mega Gallons per day [flow];
  - (cfm) - Cubic Feet per minute [flow];
  - (cfs) - Cubic feet per second [flow];
  - (l/min) - Liter per minute [flow];
  - (l/s) - Liter per second [flow];
  - (m3/h) - Cubic meters per hour [flow];
  - (Ml/d) - Mega liters per day [flow];
  - (Imp gpm) - Imperial Gallons per minute [flow];

- (bar) - Bar [pressure];
- (kPa) - Kilopascals [pressure];
- (Mhd) - Mega Hectares per day [flow];
- (psi) - Pounds per square inch [pressure];
- (m) - Meters of water [pressure];
- (in) - Inches of water [pressure];
- (ft) - Feet of water [pressure];
- (%) - Percentage [unit-less];
- (h) - Hours [time];
- (min) - Minutes [time];
- (s) - Seconds [time];
- (gal) - Gallons [volume];
- (mg) - Mega gallons [volume];
- (cf) - Cubic feet [volume];
- (l) - Liters [volume];
- (m3) - Cubic meters [volume];
- (Ml) - Mega liters [volume];
- (mA) - Milliamps [electrical flow];
- (Volt) - Volts [electrical potential];

- "**Decimal":** Select from available decimal places:
  - 0
  - 0.0
  - 0.00
- "**Signal Type":** Select from available signal types:
  - 4-20 mA
- "**4mA =":** Set the value of the input at 4 mA; usually this will correspond to a value of 0.
- "**20mA =":** Set the value of the input at 20 mA; this should correspond to the maximum measured value.
- "**Signal Filter":** Select a filter length between 1% and 99%. This is a cumulative filter, where the value corresponds to the weight of the previous sample. The higher the value, the higher the filtering effect. A 0% value will inactivate the filter.
- "**Lost Signal (< 3.6 mA)":** This menu designates which action the controller will take in the event that a signal falls below 3.6 mA, usually when there is a power outage or when the 4-20 mA loop has been broken.
  - "**Default Value**": This option allows the user to input a value to be inserted when the 4-20mA input signal has been lost.
  - "**Keep Value**": This option allows the user to specify that the last input value received by the controller will be the value that is used once the signal is lost.
  - "**Do nothing**" This option will specify that no action is taken by the controller when an input signal is lost.
- "**Use as RSP/LSP":** When this box is checked, the input is treated as an RSP/LSP - Remote Set Point / Local Set Point.

  This allows the input to be seen in the Display Panel (short click down -  + ) and allows Actions to be taken when the Remote Set Point is changed or overridden.

3.4.2.2 "**Configure Outputs**" Menu

A "**short click**" on "**Right/output**"  from the "**Configure Outputs**" screen enters the configuration of the selected output.

Solenoid Output (SO) Field Descriptions:

- "**Display Name**": Use this field to choose a unique name for each output.
- "**Type**":
  - "**PWM**": (Pulse Width Modulation): this is the industry trade name for the management of pulses sent to the opening/closing solenoids.
  - "**Digital 1/0**": Specifies that the output is either open or closed for the time specified in the boxes below.
- "**Cycle Time**": The amount of time for one complete cycle of action for the opening/closing solenoid.
- "**Default Value**": The default active time of the solenoid during the cycle.

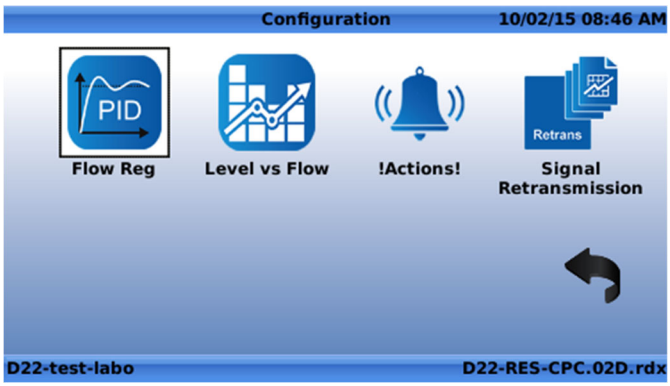
Analog Output (AO) Field Descriptions:

- "**Display Name**": Use this field to choose a unique name for each input.
- "**Units**": Choose from the available units of:
  - (gpm) - Gallon per minute [flow];
  - (mgd) - Mega Gallons per day [flow];
  - (cfm) - Cubic Feet per minute [flow];
  - (cfs) - Cubic feet per second [flow];
  - (l/min) - Liter per minute [flow];
  - (l/s) - Liter per second [flow];
  - (m3/h) - Cubic meters per hour [flow];
  - (Ml/d) - Mega liters per day [flow];
  - (Imp gpm) - Imperial Gallons per minute [flow];
  - (bar) - Bar [pressure];
  - (kPa) - Kilopascals [pressure];
  - (Mhd) - Mega Hectares per day [flow];
  - (psi) - Pounds per square inch [pressure];
  - (m) - Meters of water [pressure];
  - (in) - Inches of water [pressure];
  - (ft) - Feet of water [pressure];
  - (%) - Percentage [unit-less];
  - (h) - Hours [time];
  - (min) - Minutes [time];
  - (s) - Seconds [time];
  - (gal) - Gallons [volume];
  - (mg) - Mega gallons [volume];
  - (cf) - Cubic feet [volume];
  - (l) - Liters [volume];
  - (m3) - Cubic meters [volume];
  - (Ml) - Mega liters [volume];

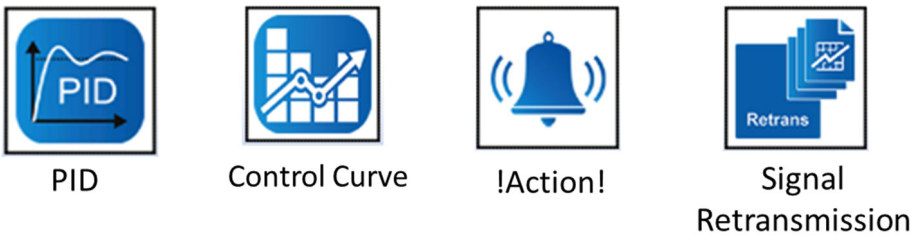
- (mA) - Milliamps [electrical flow];
- (Volt) - Volts [electrical potential];

- "**Decimal":** Select from available decimal places:
  - 0
  - 0.0
  - 0.00
- "**Signal Type":** Select from available signal types (to be updated to include more signal types in the future):
  - 4-20 mA
- "**4mA =":** Set the value of the input at 4 mA; usually this will correspond to a value of 0.
- "**20mA =":** Set the value of the input at 20 mA; this should correspond to the maximum measured value.
- "**Default Value":** When the 4-20 mA loop is broken, this is the value that is used.
- "**Ramping":** Ramping speed to reach the value.

3.4.2.3 "**Valve Configuration**" Menu



The "**Valve Configuration**" screen includes the regulation blocks related to the loaded ***ValvApps™***. Regulation blocks can be of the following types:



- "**PID" (Proportional-Integral-Derivative):**

  The "**PID**" regulation maintains the valve at a configured set-point. Up to four (4) "**PID**" regulation loops can be programmed, each of them offering local or remote set-point capability. Real-time chart view helps to visualize valve response and fine tune the Electronic Valve Controller accordingly. Perfect valve control is achieved by CLA-VAL features such as programmable set-point ramping to prevent hydraulic shocks.

- "**Control Curve":**

  The "**Control Curve**" offers an easy way to create a relationship between 2 system variables. Using graphical functions the user draws the "**Control Curve**" relationship linking pressure, flow, level and/or time directly on the Electronic Valve Controller screen. Up to four (4) "**Control Curves**" can be profiled allowing specific adaptation such as seasonal adjustment.

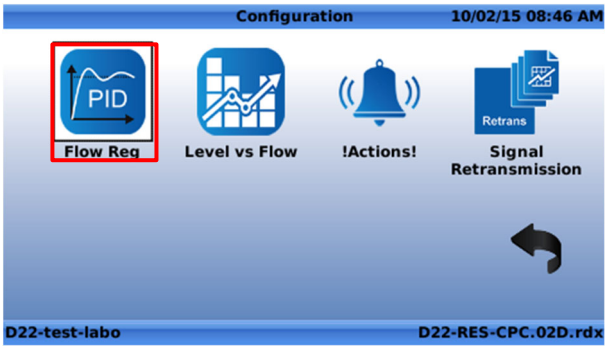
- "**!ACTION!":**

Used to take action (or alarms) when a programmable condition is met by forcing an output (relay, solenoid, 4-20 mA). The closing relay can be used to send an alarm to a supervision system. Up to four (4) "**!Actions!**" can be programmed including appropriate hysteresis or dead band configuration.

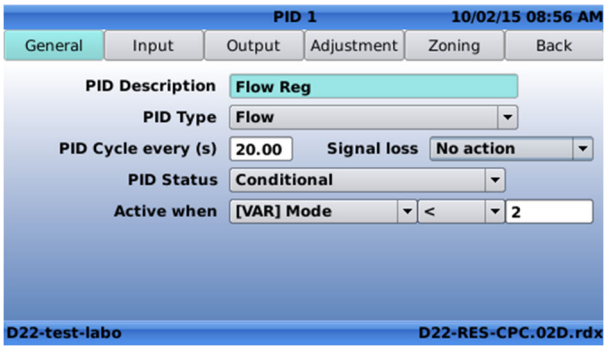
- "**Signal Retransmission**":

  Used to retransmit any input signal, variable, or calculation to a supervision system. Up to four (4) input signals, such as pressure, flow, or level can be redirected through the 4-20 mA outputs. Pulses received from a flow meter are converted into a 4-20 mA signal and retransmitted.

3.4.2.4 Valve configuration - "**PID**" Menu



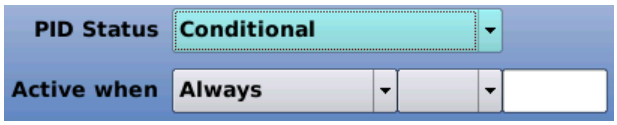
A) "**General**" Tab



Input Field Description:

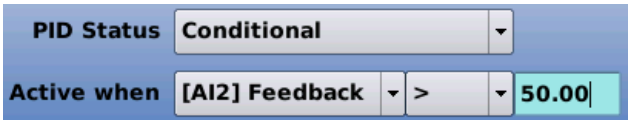
- "**PID Description**": Use this field to choose a unique name for each PID loop
- "**PID Type**": Designate what type of control is being used
  - "**Flow**": Control using flow SetPoint and Feedback
  - "**Pressure**": Control using pressure SetPoint and Feedback
  - "**Level**": Control using level SetPoint and Feedback
  - "**%**": Control using percentage open (position of the valve) SetPoint and Feedback
  - "**Analog**": Control using flow SetPoint and Feedback
- "**PID Cycle every (s)**": This field designates how often the calculation will be done to determine the appropriate action to be taken with the output
- "**Signal loss**": This field designates what action the controller will take when there is a loss of signal on the Remote Set Point (RSP). The options are:
  - "**No Action**"
  - "**Open 100%**": Open valve 100%
  - "**Close 100%**": Close valve 100%
  - "**Lock Position**": Maintain valve in current position
- "**PID Status**": The user may configure a PID loop, but not activate it until the appropriate time. The choices are:
  - "**On**"
  - "**Off**"

- **"Conditional":** When the **"Conditional"** option is chosen, an additional field appears and prompts the user to specify when the PID should be active. The following field is shown:

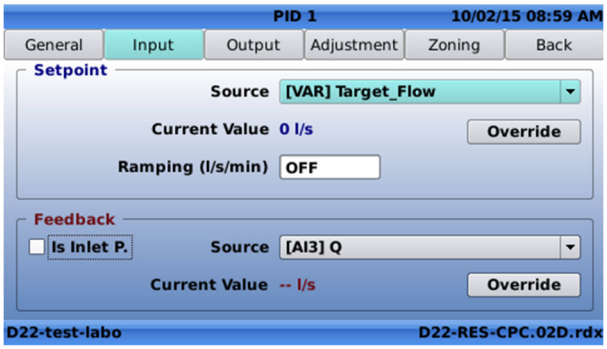


The PID loop can be configured to be active - Always, or when one of the inputs meets a certain condition. In this case, use the pull down menu that is defaulted to "Always" to select the appropriate input, then use the pull down menu to the right to select an operator, such as the **"Greater than"** sign (>), then specify a value.

Example: The following PID loop has been set to be conditional active, only when the Feedback [AI2] is greater than 50.00 l/s.



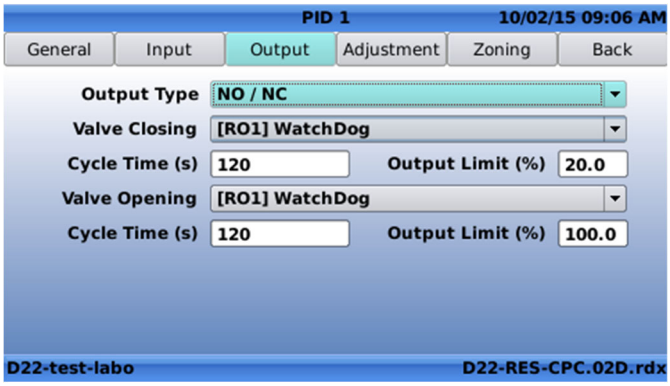
B) **"Input"** Tab



Input Field Description:

- **Setpoint Section:**
  - **"Source":** Designates which compatible input or variable is to be used as the SetPoint for the PID loop
  - **"Current Value":** Shows the *live* current value of that input
  - **"Override":** Allows the user to input an override value from this menu rather than having to go back to the input information or input configuration screens - this can be helpful when commissioning a system for the first time
  - **"Ramping (l/s/min)":** Gradually variating the value when the set point changes rapidly [either by **"Remote Set Point"** Changes or **"Local Set Point"** (override) changes]
- **Feedback Section:**
  - **"Source":** Designates which input is to be used as the feedback for the PID loop
  - **"Current Value":** Shows the *live* current value of that input
  - **"Override":** Allows the user to input an override value from this menu rather than having to go back to the input information or input configuration screens - this can be helpful when commissioning a system for the first time

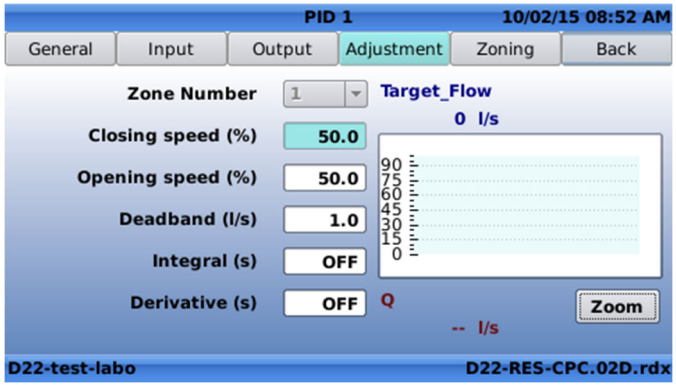
C) "**Output**" Tab



Input Field Description:

- "**Output**": Designates what type of output is used. Pick in the dropdown menu from the following:
  - "**NC/NC**": NC = Normally Closed (Closing Sol / Opening Sol)
  - "**NO/NO**": NO = Normally Open (Closing Sol / Opening Sol)
  - "**NO/NC**": Normally Open (Closing Sol) / Normally Closed (Opening Sol)
  - "**Linear 4-20mA**": Will vary the Analog Output (4-20 mA) according to the PID loop
  - "**Linear -> VAR**": Will vary the internal variable according to the PID loop
- "**Valve Closing**": Designates which of the solenoid outputs [SO1] or [SO2] will be used to close the valve
- "**Cycle Time (s)**": Designates the total cycle of action for the "**Valve Closing**" solenoid
  - "**Output limit (%)**": Designates valve closing limit
- "**Valve Opening**": Designates which of the solenoid outputs [SO1] or [SO2] will be used to open the valve
  - "**Output limit (%)**": Designates valve opening limit
- "**Cycle Time (s)**": Designates the total cycle of action for the "**Valve Closing**" solenoid

D) "**Adjustment**" Tab



Input Field Description:

- "**Zone Number**": Designates which PID loop is being adjusted; at any time, up to 4 PID loops may be used
- "**Closing Speed (%)**": Designates how quickly the valve will be able to close. 1% is the slowest possible, 99% is the fastest possible

Note: Actual time to close will depend on the hydraulic conditions.

- "**Opening Speed (%)**": Designates how quickly the valve will be able to open. 1% is the slowest possible, 99% is the fastest possible

Note: Actual time to open will depend on the hydraulic conditions.

- "**Deadband (l/s)":** Designates where the controller will take no action because it is close to the SetPoint.

  Example: If the setpoint is 50 l/s and the deadband is set at 2 l/s, then the controller will take no action on the feedback value from 48 l/s to 52 l/s

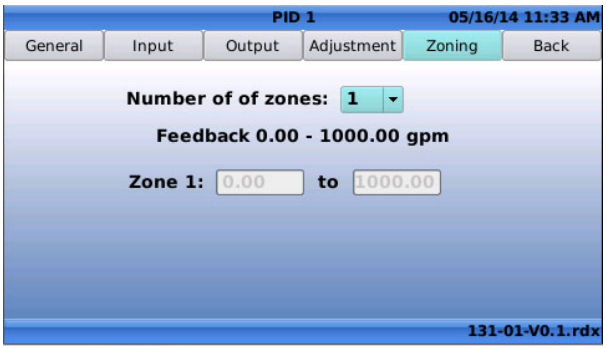
- "**Integral (s)":** This value is used for fine tuning of very sensitive systems

  It is not recommended that this be used without contacting CLA-VAL Technical Support!

- "**Derivative (s)":** This value is used for fine tuning of very sensitive systems

  It is not recommended that this be used without contacting CLA-VAL Technical Support!

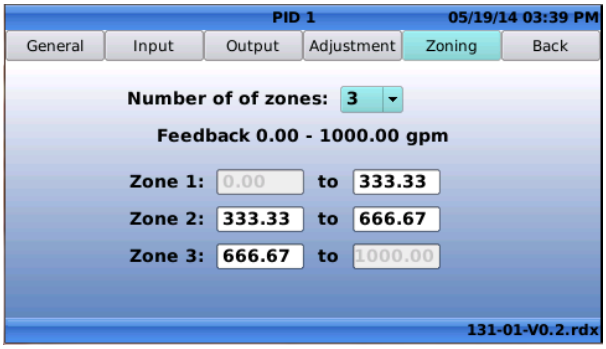
E) "**Zoning**" Tab



Input Field Description:

- "**Number of zones":** Designates how many PID zones are to be created

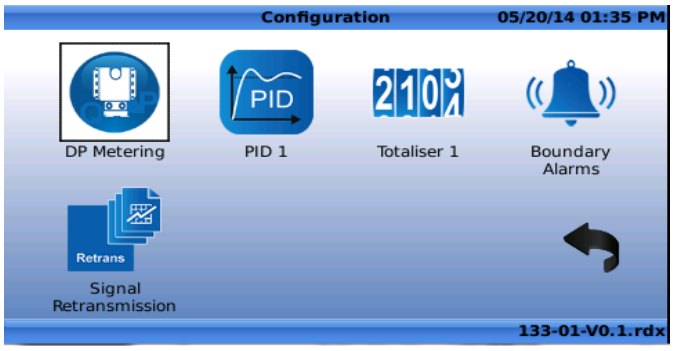
Note: When multiple PID loops are created, the active region for each is designated by an equal division of the total feedback range, see example below:



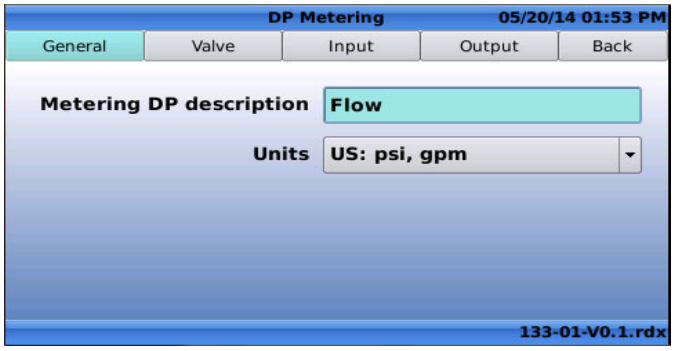
The active region for zones 1, 2 and 3 are each one third of the total feedback range. These values can be specified by changing the values in each zone, according to the needs of the user.

- Zone 1: designates the top of the range for zone 1 (bottom range is bounded by the low level of the feedback scale).
- Zone 2: designates the bottom and top range for zone 2.
- Zone 3: designates the bottom range for zone 3 (top of the range is bounded by the high level of the feedback scale).

3.4.2.5 Valve configuration - "**DP Metering**" Menu



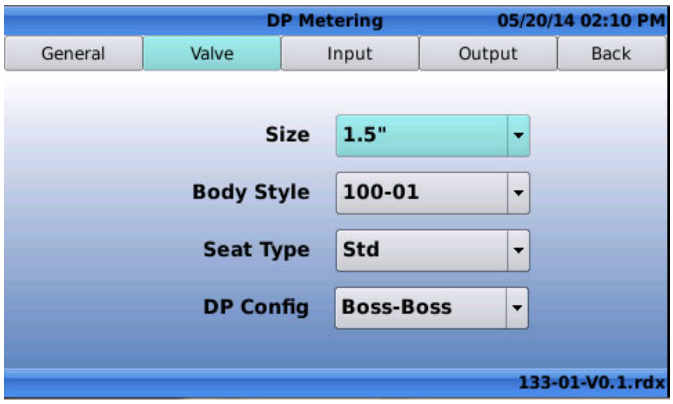
A) "**General**" Tab



Input Field Description:

- "**Metering DP description**": Designate the name of the Metering function
- "**Units**": Designate what units set you would like to use

B) "**Valve**" Tab



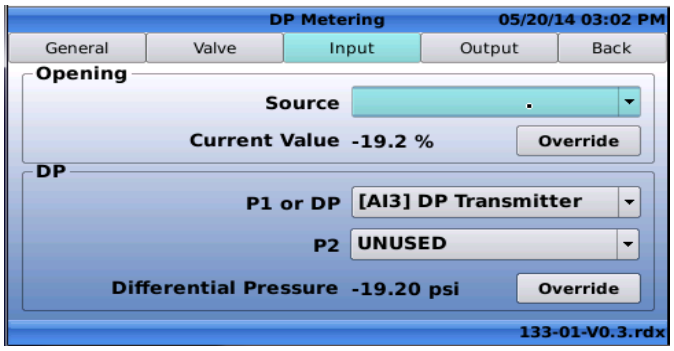
Input Field Description:

- "**Size**": Designate the size valve that is being used. Options are:
  - 1.5"
  - 2"
  - 3"
  - 4"
  - 6"

- 8"
- 10"
- 12"
- 14"
- 16"
- 18"
- 20"
- 24"
- 30"
- 36"

- "**Body Style":** Designate the body style of the valve. Options are:
  - 100-01 - Full Port
  - 100-20 - Reduced Port
- "**Seat Type":** Designate the type of seat of the valve. Options are:
  - Std - Standard Seat
  - KO - Anti-Cavitation Trim
  - KOL - Anti-Cavitation Lite Trim
  - LFS - Low Flow Trim
- "**DP Config":** Designate the location of the pressure transducers. Options are:
  - Boss-Boss - Pressure transducers located on the valve
  - Pipe-Pipe - Pressure transducers located on the pipe

C) "**Input**" Tab



Input Field Description:

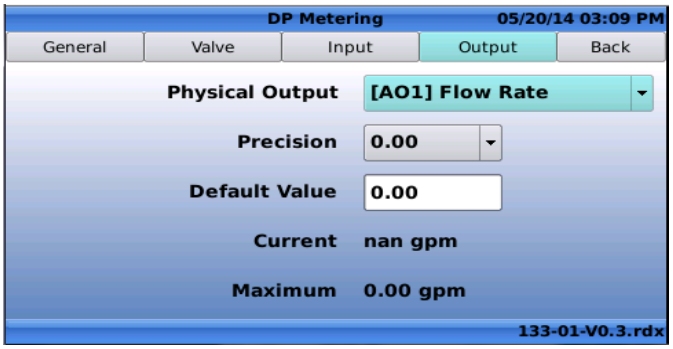
"***Opening*" *Section:***

- "**Source":** Designate the appropriate AI for the position transmitter

"***DP*" *Section:***

- "**P1 or DP":** Designate if the DP signal comes from P1-P2 or from a DP transmitter. Select appropriate AI for either the P1 or the DP transducer
- "**P2":** If using P1-P2 for DP signal, designate AI for P2

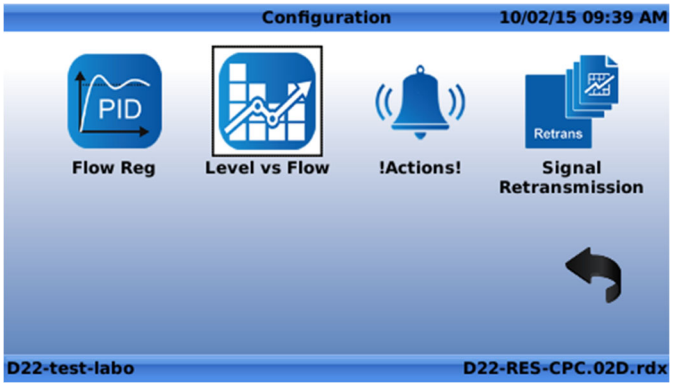
D) "**Output**" Tab



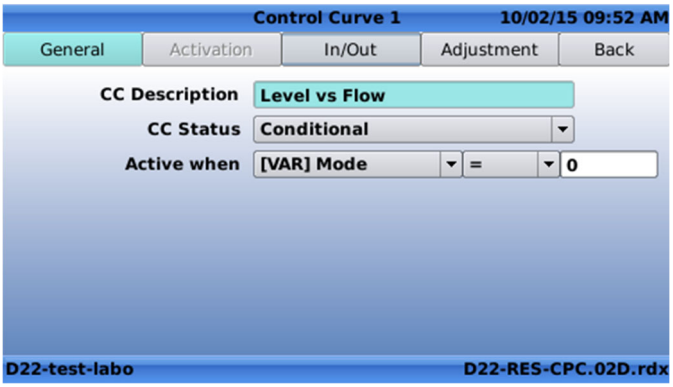
Input Field Description:

- "**Physical Output**": Designate which output should be used for the calculated flow signal
- "**Precision**": Designate how many decimal places should be used for the calculated flow rate - Default: "0.00".
- "**Default Value**": Designate the default value - Default: "0.00".

3.4.2.6 Valve configuration - "**Control Curve**" Menu



A) "**General**" Tab



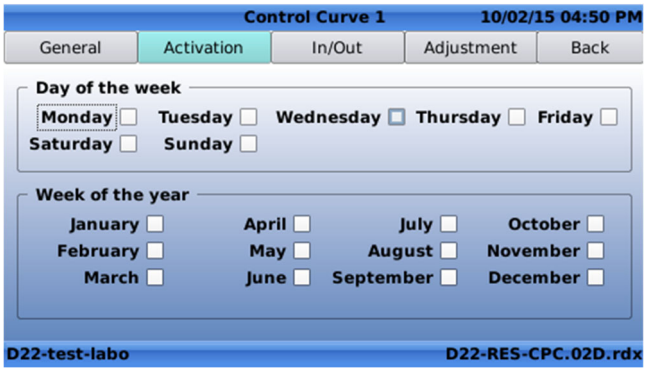
Input Field Description:

- "**CC Description**": Designate a name for the custom control curve
- "**CC Status**": Designate whether the control curve is active
  - "**On**": The control curve is active
  - "**Off**": The control curve is inactive
  - "**Calendar**": The control curve is activated according to calendar rules, which are defined in the "**Activation**" tab

- "**Conditional**": Condition based on an input or variable, as defined in the "**Active when**" field

- "**Active when**": Designate the rule for the conditional activation

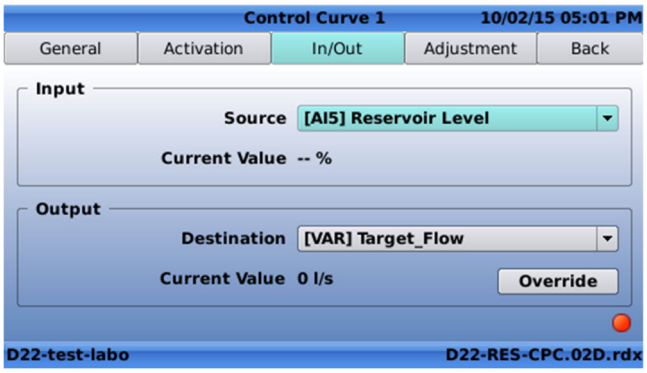
B) "**Activation**" Tab (only for calendar activation)



Input Field Description:

- "**Day of the week**": Designate which day(s) of the week the custom control curve is active
- "**Week of the year**": Designate for which months the days selected are considered

C) "**In/Out**" Tab



Input Field Description:

"***Input*" *Section:***

- "**Source**": Designate the input flow signal location

"***Output*" *Section:***

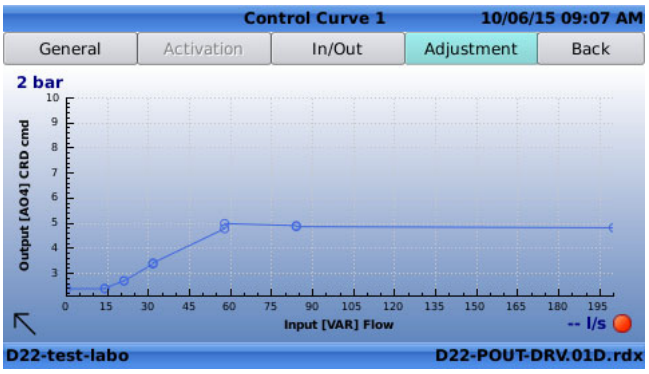
- "**Destination**": Designate the analog output location for the motorized control
- "**Override**": Override the output in "**Designation**" with a custom value

D) "Adjustment" Tab

This screen describes the relationship between 2 system variables affected to the X and Y axis.

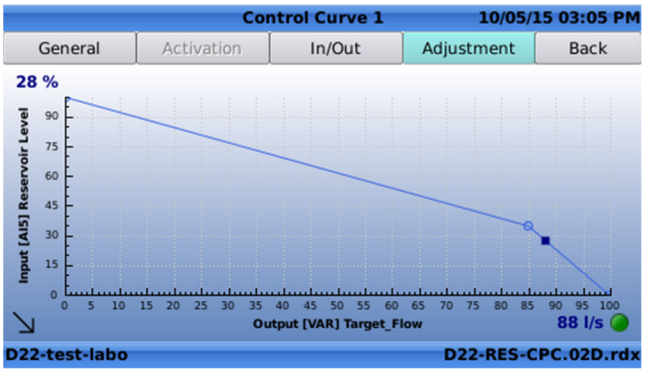
The arrow located at the bottom-left corner shows the user in which way to read the graph:

1. Standard: the input is on the X-axis (in this case, flow) and the output on the Y-axis (in this case, actuated pilot command for a targeted downstream pressure).



This screen describes that as the flow increases, the motorized control will increase the output pressure up according to the graph.

2. Reverse: the input is on the Y-axis (in this case, Reservoir/Tank Level) and the output on the X-axis (in this case, Target Flow)



This screen describes that as the reservoir level decreases, the targeted flow (to fill the reservoir) increases, and the motorized control will act accordingly.

 : The light on the bottom right of the screen indicates whether the control curve is active (green light) or inactive (red light).

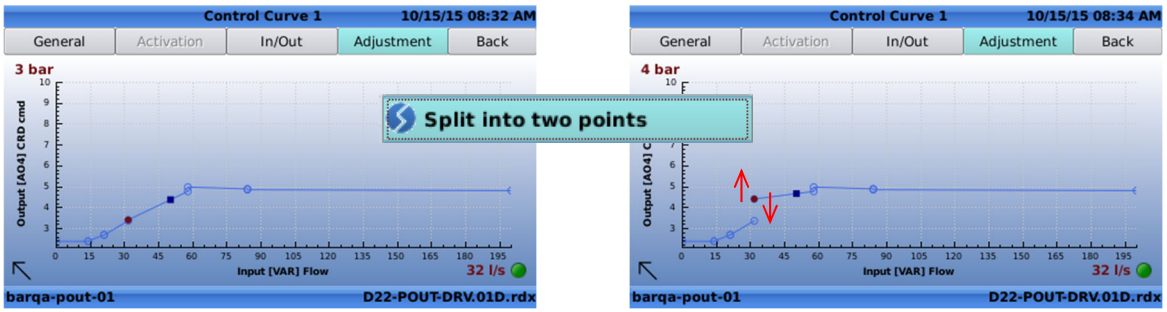
The control curve can be completely customised by clicking OK to enter in the "**Adjustment**" tab.

Using and (standard), or and (reversed), navigate between each of the points on the screen. The currently selected point is filled in red, while other points are not filled.

While on a point, click OK to arrive at the following menu:

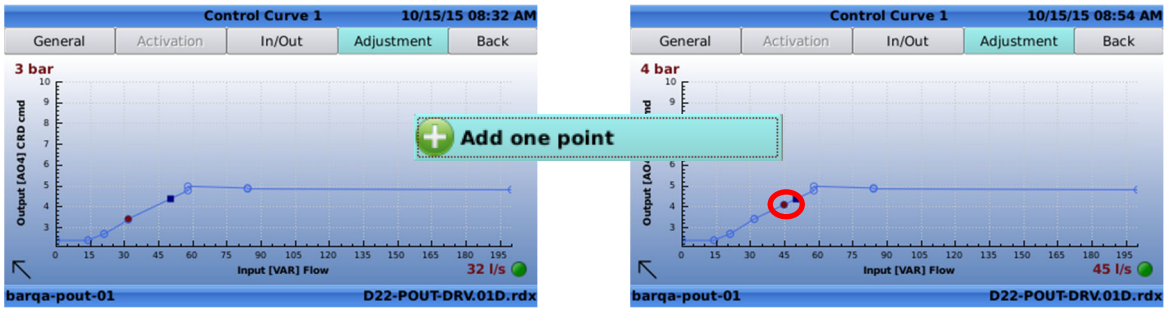
Using the functionality of these tools, many shapes and custom curves can be created to tailor each specific application to the user's unique needs. See below for a detailed explanation of how to use each of the tools to make changes to the standard curve.

- "**Edit this point":** Edit the currently selected point. After it is in edit mode, it can be moved from left to right using the  and  keys, and up and down using the  and  keys.
- "**Split into two points":** Split a point, as shown below:



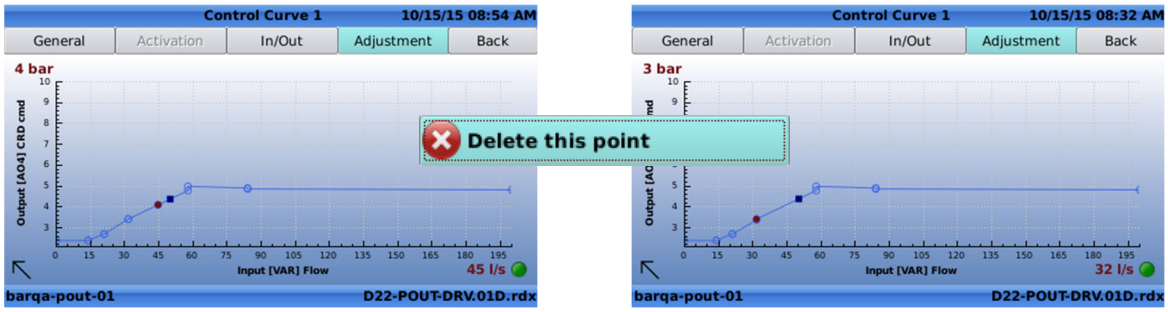
After the point is split, it can be moved up or down using the  and  buttons.

- "**Add one point":** Add a point on the control curve to the immediate right of the selected point



Use the "**Edit this point**" function to change the position of this point.

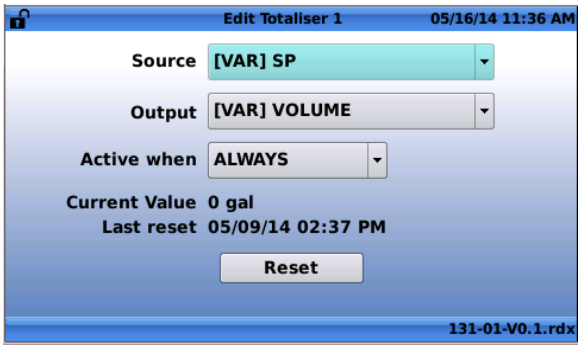
- "**Delete this point":** Delete the currently selected point



- "**Pressure optimiser**":

This function is only available in pressure control mode.

3.4.2.7 Valve configuration - "**Totalizer**" Menu



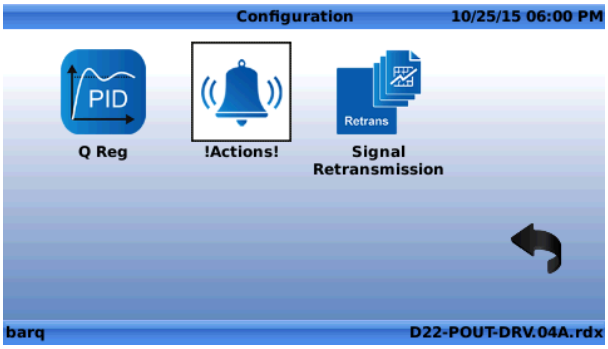
Input Field Description:

- "**Source":** Designates which input should be used as the source for the totalizer count
- "**Output":** Designates where the total should be sent after it is calculated
- "**Active when":** Designates when the totalizer should be active
  - "**Always":** The totalizer will always be on
  - "**[AI1]":** Conditional based on input;

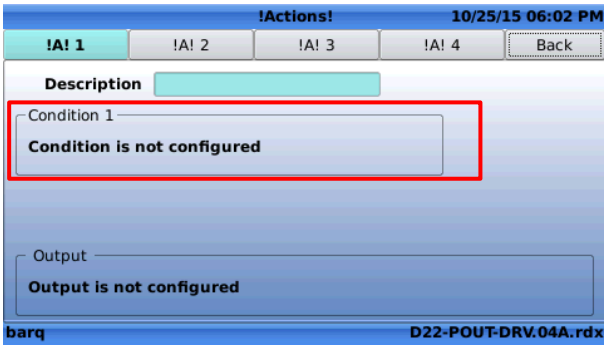
    Example below:

    This totalizer is set to be active when the [AI1] Setpoint is greater than 10.00
- "**Reset":** This toggle button resets the totalizer to zero.

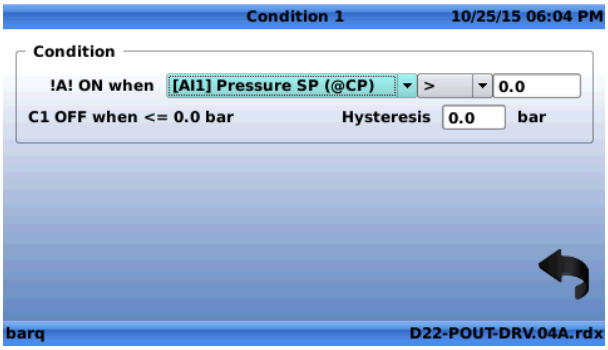
3.4.2.8 Valve configuration - "**Actions**" Menu



Click  on the "**Condition**" to configure the condition.

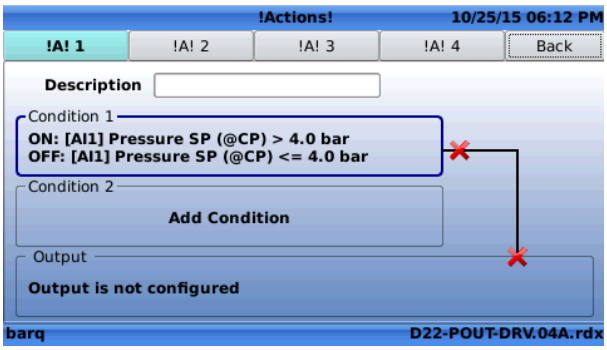


In the condition menu, configure the condition to apply the action.

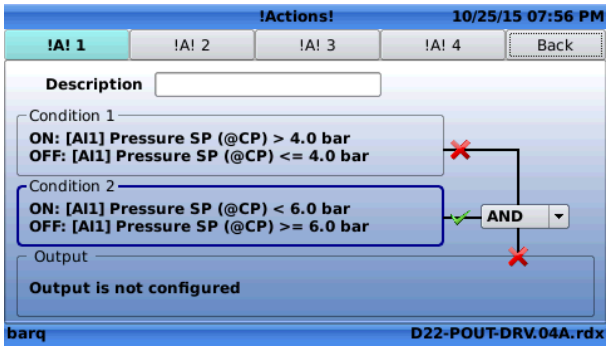


Input Field Description:

- "**Description":** Use this field to choose a unique name for each input.
- "**!A! Enabled":** Designates that this action is enabled or disabled.
- "**!A! ON when":** Conditional field that designates when this action is active, according to the value and operator used.
- "**Hysteresis":** Set up an hysteresis.

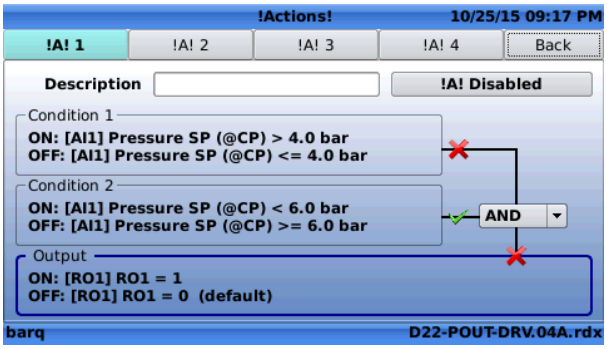


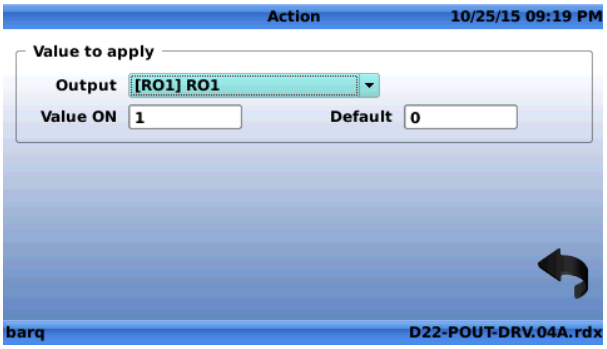
Up to two conditions can be set for an action, and the user can configure a condition "AND" or "OR" on the two conditions to apply an action, as per the following example.



The ✔ icon is displayed when a condition is filled, and the ✖ when it is not filled.

Once the conditions are configured, the user shall designate which output to take the action on

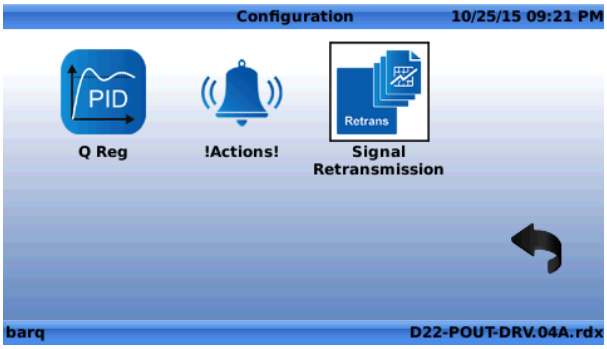


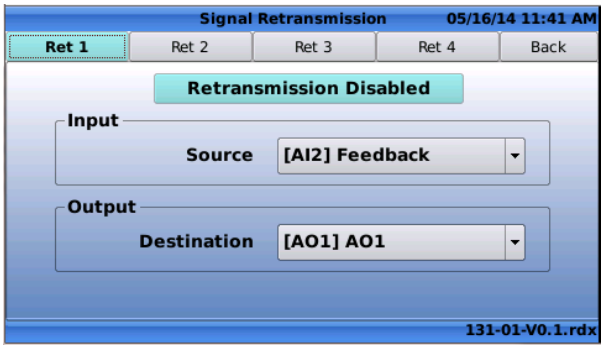


Input Field Description:

- "**Output**": Designates which of the outputs to take action on.
- "**Value ON**": Designates the value to apply to the selected output.
- "**Default**": Designates the default value of that action - which will be applied while the action is in the "OFF" state.

3.4.2.9 Valve configuration - "**Signal Retransmission**" Menu

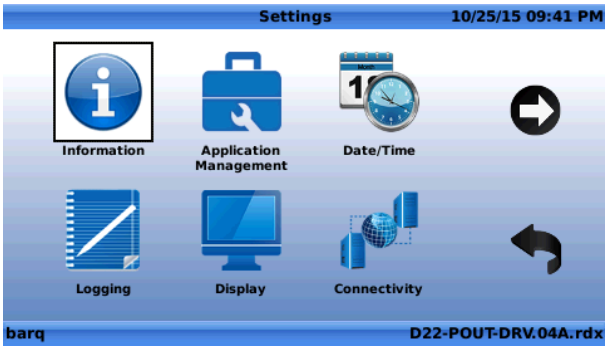




Input Field Description:

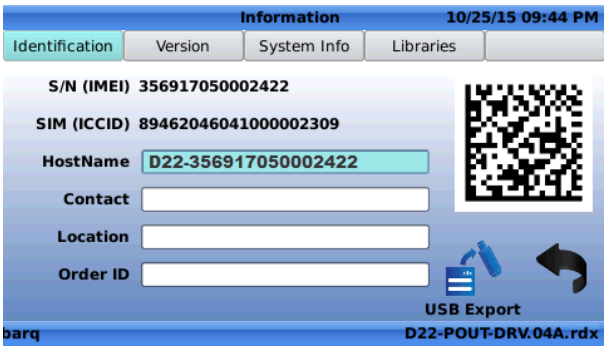
- "**Retransmission Enabled**" (resp. "**Retransmission Disabled**"): Designates that this retransmission is enabled (resp. disabled)
- "**Source**": Designates which of the analogue inputs are to be copied
- "**Destination**": Designates which of the analogue outputs are to be used to retransmit the selected input

3.4.3 "SETTINGS" MENU



3.4.3.1 "**Information**" Page

A) "**Identification**" Tab

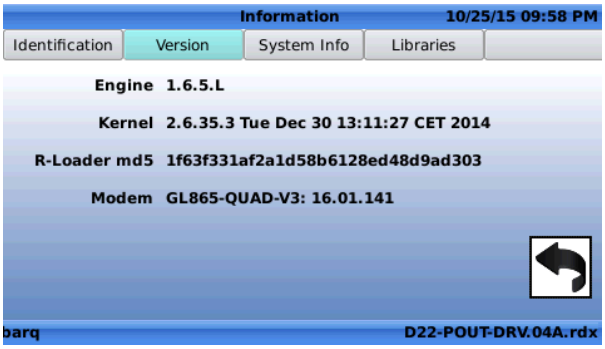


Device identification information with "**S/N (IMEI)**" the serial number of the device, and "**SIM (ICCID)**" the SIM card identification number.

Input Field Description:

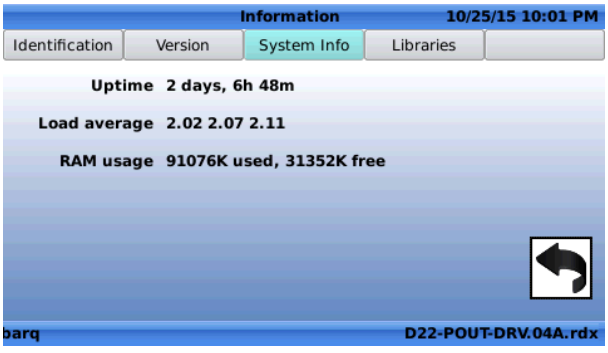
- "**HostName**": Use this field to assign a host name to the device. The default host name of the device is of the form *D22-serial number*
- "**Contact**": Use this field to enter an email valid email address for the use of the ***Link2Valves***™ data visualisation web interface
- "**Location**": Use this field to enter the location of the device
- "**Order ID**": Use this field to enter the Order ID

B) "**Version**" Tab



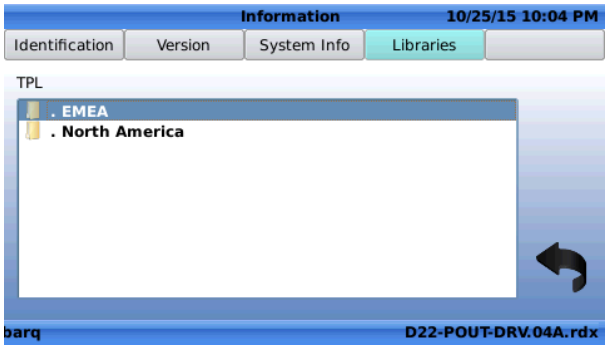
This page shows information regarding the low-level software loaded in the Electronic Controller.

C) "**System Info**" Tab



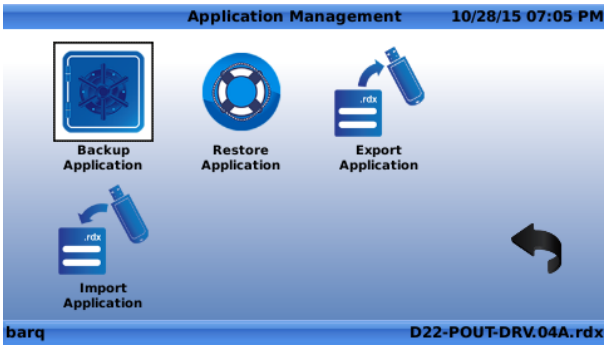
This page shows information concerning various system settings, such as Uptime or RAM usage.

D) "Libraries" Tab



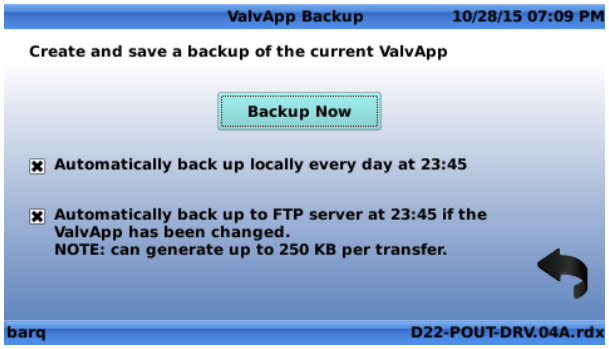
From this page, the user can access the libraries of standard ***ValvApps***™.

3.4.3.2 "Application Management" Page



A) "Backup Application"

When the "**Backup Application**" icon is selected, the following dialog box appears:

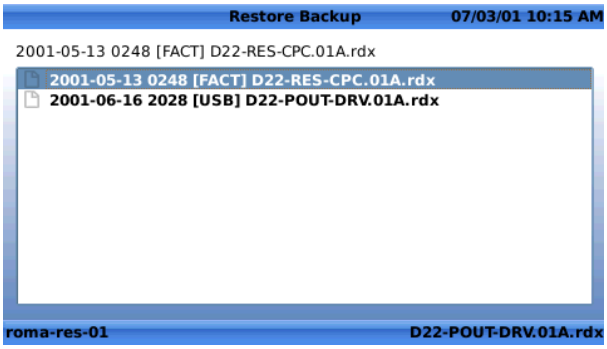


- "**Backup Now":** Click on this button to manually back up the application
- "**Automatically back up locally every day at 23:45":** Check (resp. un-check) the box to activate (resp. deactivate) an automatic backup of the current ***ValvApps***™ stored locally in the machine daily
- "**Automatically back up to FTP server at 23:45 if the ValvApps has been changed":** Check (resp. un-check) the box to activate (resp. deactivate) an automatic backup of the current ***ValvApps***™ stored to the configured FTP server. This back up will happen only if the ***ValvApps***™ has been modified.

⚠ This function can generate important data transfer (up to 250 kB) depending on the application.

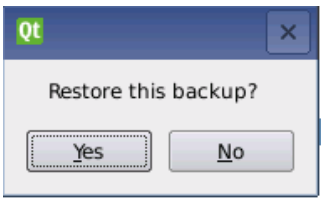
B) "Restore Application"

When the "**Restore Application**"  icon is selected, the following screen appears, showing the available backup files that can be restored:



 : In the directory screen, click the  button to enter a folder, and the  button to navigate to the parent directory.

Select the appropriate file to restore, then click  . The following dialog box will appear to confirm your choice:



Select "**Yes**" to restore to the chosen backup file. Select "**No**" to cancel the backup.

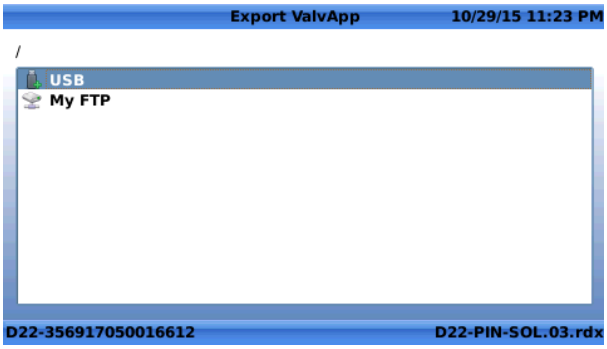
From the "**Restore Backup**" Screen, click the  button to return to the previous menu.

 : A Long click  on the  button returns to the main menu and cancel out of the menu.

C) "Export Application"

 In order to use the functionality of the "**Export Application**" function, ensure that either a USB flash drive is inserted into the USB-A Slot of the D22 Electronic Controller, and/or an FTP server is setup in the device.

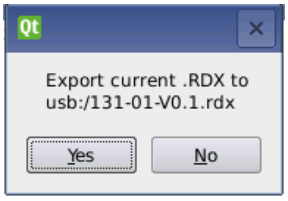
When the "**Export Application**"  icon is selected, the following screen appears to show the directory of the USB drive inserted into the D22.



When export ing the application to the server, the *.*rdx* file will be pushed to the FTP server configured in the Electronic Controller in the "***SYNC\UP***" folder.

: In the directory screen, click the button to enter a folder, and the button to navigate to the parent directory.

Click the button to export the application to the current location. The following dialog box will appear to confirm the selection:



- Select "**Yes**" to export to the chosen .rdx file
- Select "**No**" to cancel the export

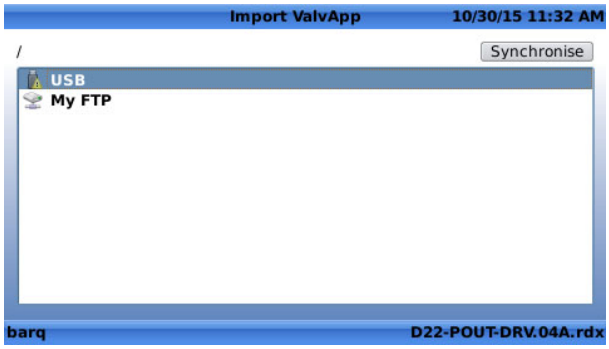
From the "**Export to USB**" screen, click the button to return to the previous menu.

: A Long click on the button returns to the main menu and cancel out of the menu.

D) "Import Application"

In order to use the functionality of the "**Import Application**" function, ensure that a USB Flash drive or is inserted into the USB-A slot of the Electronic Controller, and/or an FTP server is setup in the device.

When the "**Import Application**" icon is selected, the following screen appears to show the directory of the USB drive inserted into the Electronic Controller.



- **Remote update**: The pplication can be updated remotely via the FTP server configured in the device. To use this functionality, the *.*rdx* file needs to be put on the server "***SYNC\DOWN***" folder.

: In the directory screen, click the button to enter a folder, and the button to navigate to the parent directory.

Click the  button to load the selected file. The following dialog box will appear to confirm the selection:

- Select "**Yes**" to import the chosen **.rdx* file
- Select "**No**" to cancel the import

From the Import from USB screen, click the  button to return to the previous menu.

 : A Long click  on the  button returns to the main menu and cancel out of the menu.

3.4.3.3 "**Date & /Time**"  Page

 "**Set Date":** select to set the date

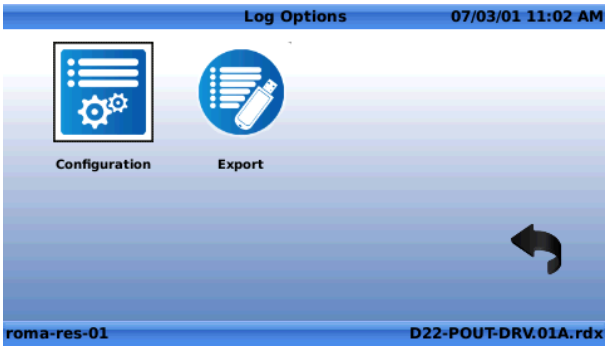
 "**Set Time":** select to set the time

 "**Time Zone":** select to set the time zone

 "**NTP Server":** select to set the NTP Server address (if applicable)

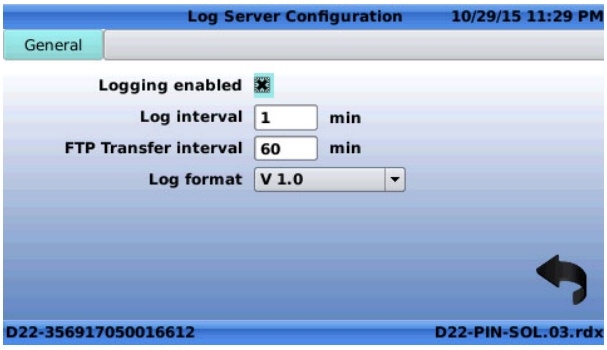
 "**Format":** select to set the language and date/time format

3.4.3.4 "Logging" Page



A) "Configuration"

Select the icon to enter the log configuration menu.



It is recommended to not change the logging parameters without assistance of an official CLA-VAL representative.

- **"Logging enabled":** Check (resp. un-check) the box to activate (resp. deactivate) the logging of data
- **"Log interval":** Defines the frequency at which data are saved in the internal memory of the device

  Interval of less than a minute can result to a rapidly overload of the memory.

- **"FTP Transfer interval":** Defines the frequency at which saved data are transferred to the FTP server that has been configured in the device.

  : Enter the value **"0"** to disable the transfer to the FTP server.

- **"Log format":** Designate which format to use for the log files.
  - **"V1.0":** Complete log format for devices with an R-Engine software version 1.7 or higher
  - **"Legacy":** Allows to generate log files compatible with log files of devices with R-Engine software version lower than 1.7

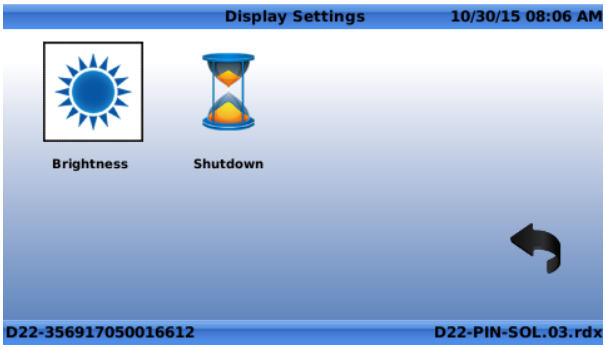
B) "Export"

Select the  icon to export log files to a USB drive or FTP server.

Choose from one of the options & select to export.

Select to export log files  and navigate to the place where to export the files.

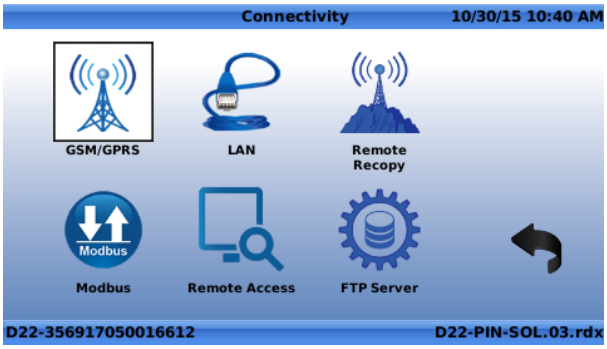
3.4.3.5 "**Display**" Page



 "**Brightness":** Select to set the screen brightness %. 100% is maximum, 1% is minimum.

 "**Shutdown":** Select to set the shutdown time. 0 is the default value and will keep the system on all the time.

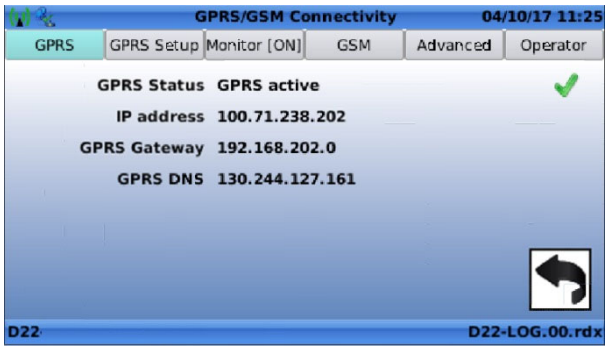
3.4.3.6 "**Connectivity**"  Page



A) "GSM/GPRS" / Cellular Network

⚠ In order to use the cellular network functionality, ensure that a valid SIM card is inserted in the cover part of the Electronic Controller (see section §2.2.3 of this manual).

When the "**GSM/GPRS**" icon is selected, the following screen appears:



- "**GPRS**" **Tab:** Provides general information about the cellular network connectivity

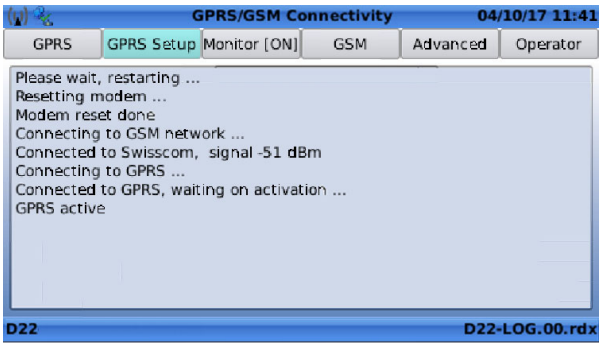
 : The ✓ icon is displayed if the product is connected, and the icon ✗ when there is no cellular connection.

- "**GPRS Setup**" **Tab:**

  - "**Setup**": Allows the user to choose between the CLA-VAL cloud servers (default) or a custom FTP server When the "**Custom**" field is chosen, the following screen appears:

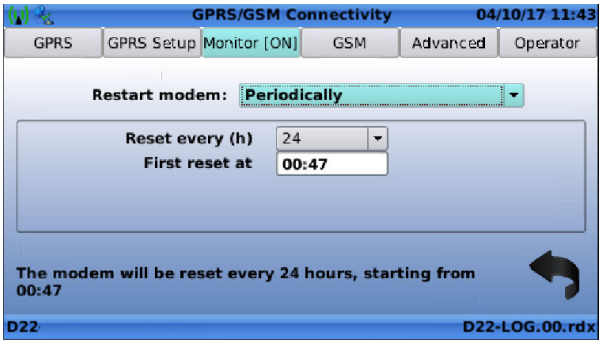
The fields must be filled to set up the connection to the custom FTP server.

- When the "**Refresh**" is hit, the following screen appears:



 : A Long click  on the  button returns to the main menuIP and cancel out the operation.

- "**Monitor [ON]" Tab:** In this tab, the user can chose a method to test if the network connection is valid and restart the communication modem



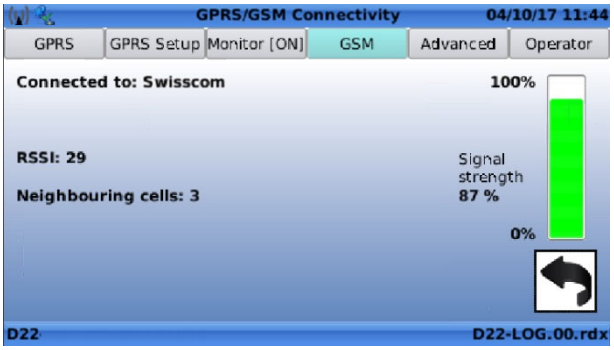
The choices are:

- "**Never":** The modem will not restart
- "**Connection to target lost":** Designate a known IP address "**Ping Target**" to target for the modem to check at a regular interval defined in "**Interval (min.)**" if the communication failed. After a number of unsuccessful tries defined in "**Retry Count**", the communication is considered lost, and the modem restarts

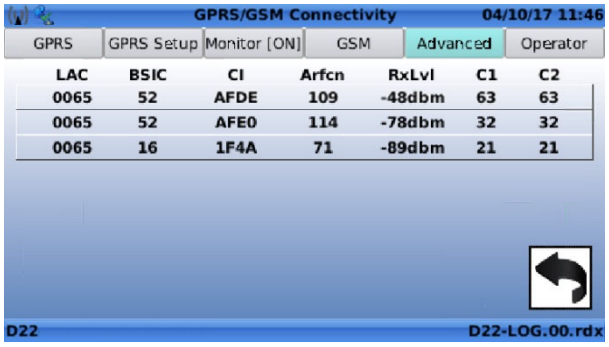
⚠ Make sure that the target is a valid IP address that is constantly active. Use the "**Test**" button to test if the connection to the target can be made.

- "**Periodically":** Reboot the communication modem periodically as defined in "**Reset every (h)**" starting at the time set in "**First reset at**"

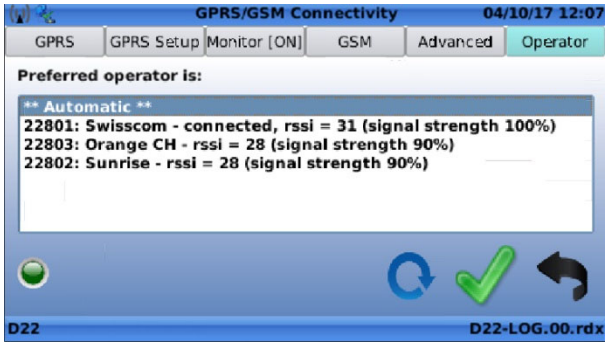
- "**GSM":** This screen provides information regarding the network signal quality



- "**Advanced**": This screen provides advance information regarding the cellular network connectivity

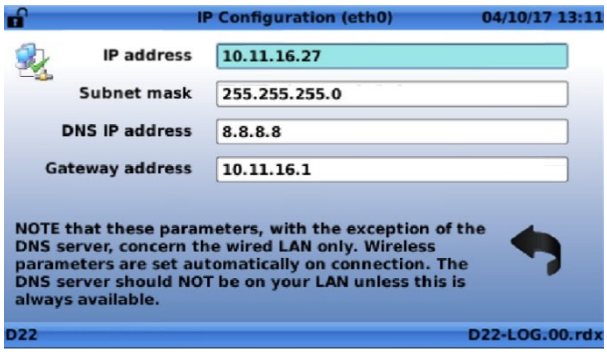


- "**Operator**": This screen provides list of operator available on this area. You can stay in automatic mode mean best operator selected by default or select the one preferred.



B) "LAN"

When the "**LAN**"  icon is selected, the following screen appears:

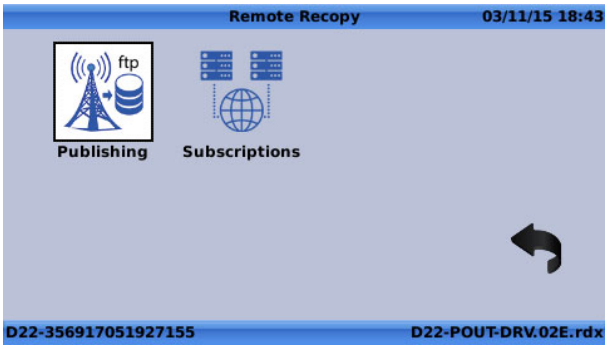


Enter address information for a LAN (Land Area Network) connection.

C) "Remote Recopy"

The remote recopy screens allow setting up a *Peering* functionality, for multiple Electronic Controllers to communicate together remotely (remote access to inputs, outputs and internal variables).

When the "**Remote Recopy**"  icon is selected, the following screen appears:



1. Click on the "**Publishing**" icon, and enable the "**Publishing enable**" to setup the publisher device settings.

The FTP server setting is then automatically filled with the FTP server set in the device. The FTP server access settings can be changed by pressing the  icon.

2. Click the  icon to check the connection to the FTP server. A  "Server access status" confirms a successful connection to the server, while a  indicates a failed connection.

    In this case, please check the FTP server parameter settings and connectivity.

3. Enter the publishing frequency in the "**Publish every**" field (minimum 5 seconds).

    : 15 minutes to 60 minutes is probably a good data transfer frequency for most of hydraulic applications.

    Attention: care the amount of transfers if the device is connected via GPRS.

4. Once the publishing is set and validated, export the configuration on a USB stick by clicking the  icon.

5. For each of the devices that need to access the publishing device inputs, outputs or remote variables, click the "**Remote Recopy**" > "**Subscriptions**"  icon.

Click on the  icon to add a subscriber, and Insert the USB stick with the publishing device configuration (see step iv.).

Then import the right file with the  icon.

6. Click the 

icon to check the connection to the FTP server. A  "Server access status" confirms a successful connection to the server, while a  indicates a failed connection.
7. Enter the connection frequency in the "**Refresh time**" field (minimum 5 seconds), and the time to disable tentative connections in case of a connection failure in the "**Timeout**" field.

 : 15 minutes to 60 minutes is probably a good data transfer frequency for most of hydraulic applications.

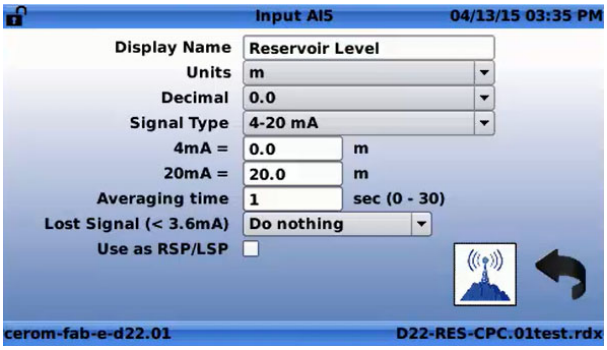
 : The connection frequency of the subscribers should be smaller or equal to the publishing frequency of the publisher.

 Attention: care the amount of transfers if the device is connected via the cellular network.

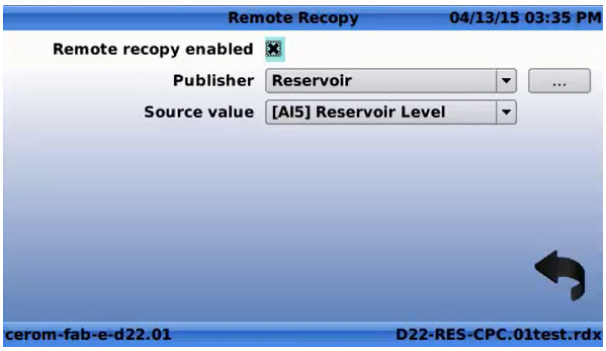
8. Go in the input configuration screen to affect a remote value of the "**Publisher**" to one of the inputs of the "**Subscriber**".

Long click  on the  from the home screen, and select the input to be affected to a remote value.

Then click  .



9. Click on the  icon and enable the "**Remote recopy enable**" check box.

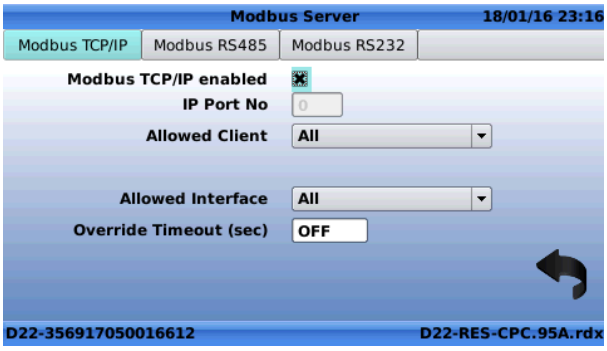


Choose the "**Publisher**" and the "**Source value**" to be peered to.

 : Only compatible signals of the "**Pulisher**" will be shown in the "**Source value**".

D) "Modbus" 

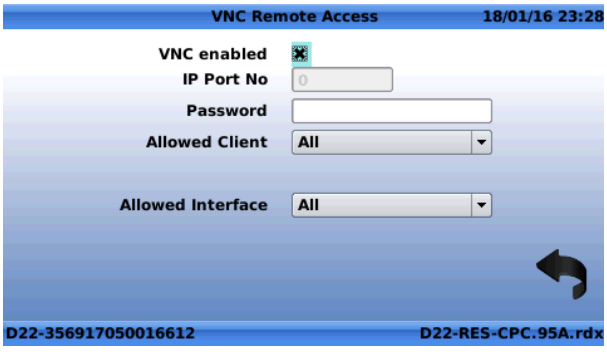
Activate Modbus by checking the check box of the desired Modbus interface (TCP/IP, RS-485, RS-232).



 : See Chapter 5 «Appendix: Modbus Interface» for more details on how to interface to the Electronic Valve Controller via Modbus.

E) "Remote Access" 

Enable the remote access to the device via VNC by checking the "**VNC enabled**" check box:



The user can then set a password and restrictions in the desired fields.

Required software: the recommended software to access Electronic Controller Remote display is ***VNC Viewer***™ from ***Tight VNC***® (http://www.tightvnc.com).

To set a connection via ***VNC Viewer***™, follow the steps hereunder:

1. Set the IP address on the computer to 10.11.16.1, netmask 255.255.255.0 of the interface.

: In a ***Windows***® environment, for a wired LAN this is usually accessed via the *Control Panel* > *Network and Internet* > *Network connections* > *Local Area Connections* > *Local Area Connection.*

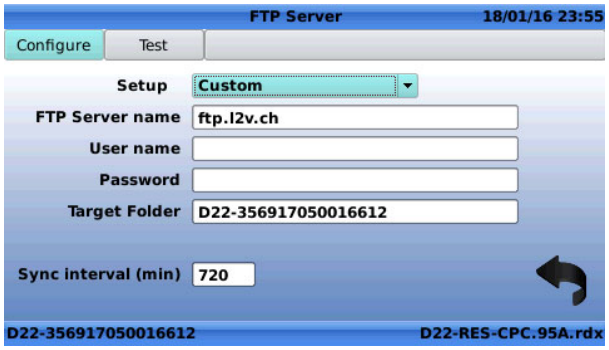
2. Get the IP address of the Electronic Controller (see section 3.3.3.6 section B of this manual) **From the Home Screen, go to device configuration (Long click down) > Next screen > Reboot**

F) "FTP Server"

- **"Configure" Tab:**

Select whether to connect to a private FTP server (**"Custom"**), to the CLA-VAL servers (**"CLA-VAL Link2Valves"**) or switch off. Then configure all the setting necessary to access an FTP server.

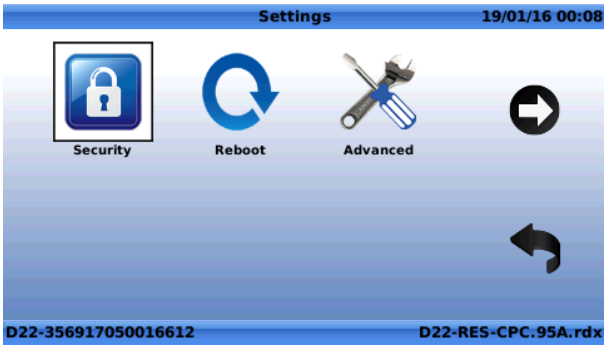
: If a connection to the CLA-VAL servers is desired, only a valid registration e-mail address is necessary.



- **"Test" Tab:**

Go to the "**Test**" tab to check the connection to the FTP server set up. Click on the  icon to run the test again.

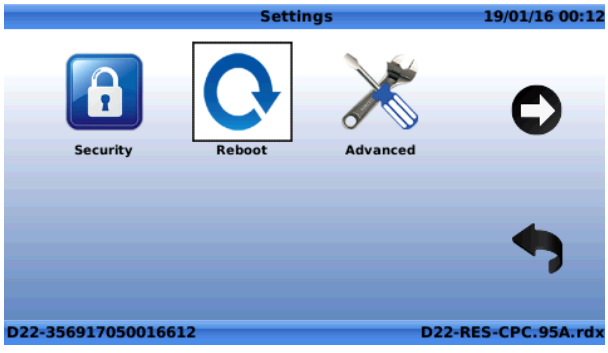
3.4.3.7 "**Security**" Page



This page allows to setup a password to access the Electronic Controller.

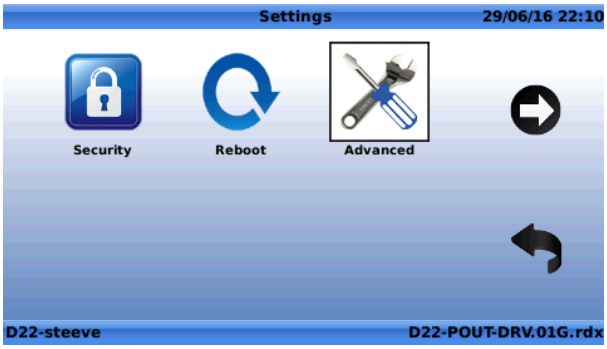
3.4.3.8 "Reboot"

Use this button to reboot the Electronic Controller whenever necessary.

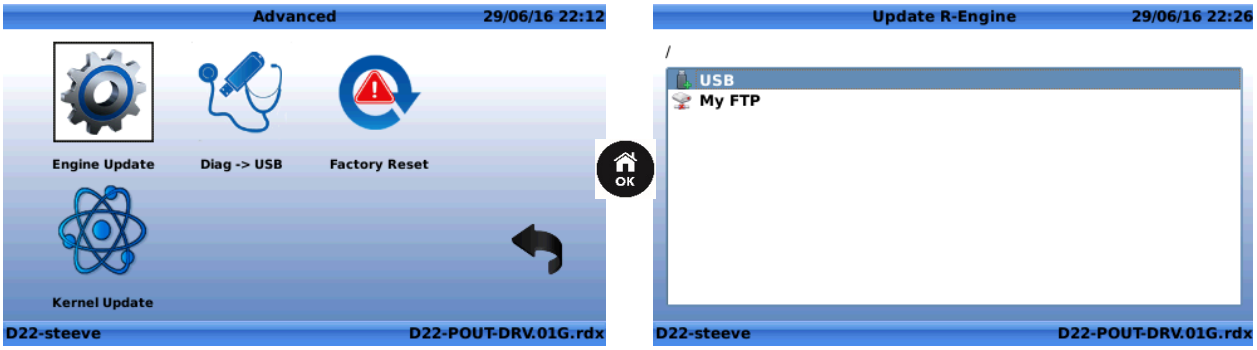


Once the system reboots, it will take approximately 45-120 seconds to restart.

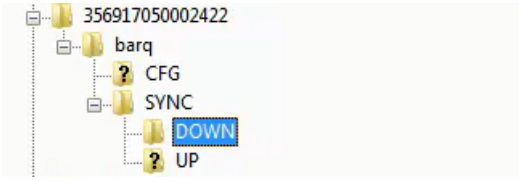
3.4.3.9 "**Advanced**" Pages



A) "Engine Update"



- USB: Click the button to update from a USB Flash drive. If a USB Flash drive is inserted into the USB slot, then the Electronic Controller will show the contents of that drive. Navigate to the selected **.tar* file and click OK.
  My FTP: If a server has been setup for connectivity, the update can be made from that server. Navigate to the selected **.tar* file and click OK.
  The Engine needs to be located on the FTP server configured in the Electronic Controller in the "***SYNC\DOWN***" folder

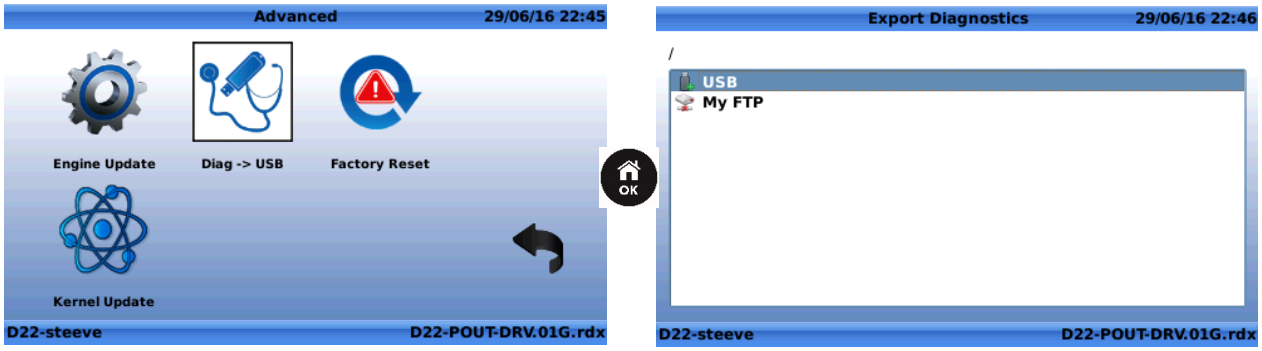


: En Engine update requires a **.tar* file.

When navigating, click the button to return to the previous level.

B) "Diag -> USB"

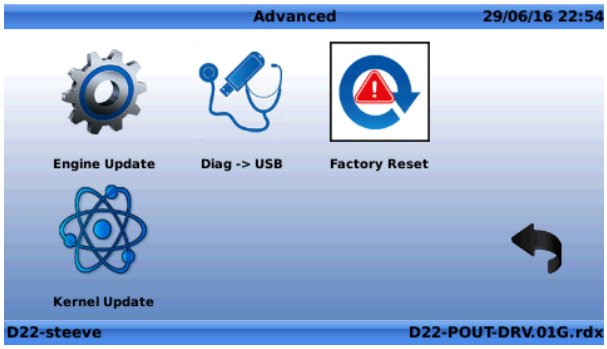
This allows to export the diagnostic file of the Electronic Controller. The diagnostic file cannot be used directly by the user, and is usually requested by CLA-VAL for support purposes.



- USB: Click the button to export the diagnostic file to a USB Flash drive. Navigate to the selected **.tar* file and click .
- My FTP: If a server has been setup for connectivity, the file can be exported to that server.

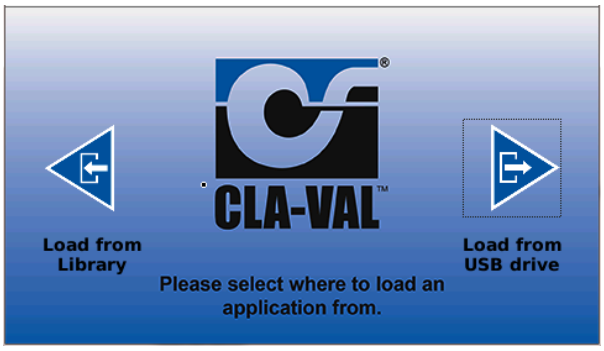
When navigating, click the button to return to the previous level.

C) "Factory Reset"



When clicking on the icon, the following dialog box will appear to confirm or cancel the factory reset:

- After the factory reset has taken place, the following screen will appear to prompt the next choice:



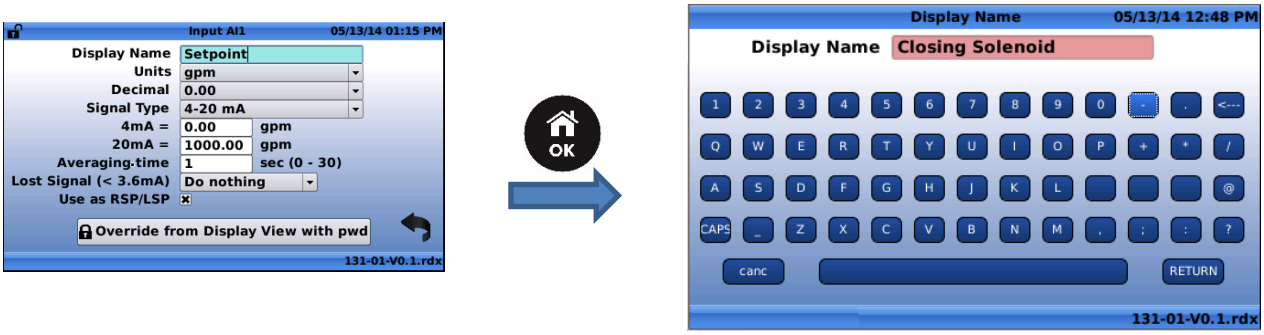
- Click the  button to load from the internal library. When the proper file has been selected, the following screen will appear to confirm the choice.

- Click the  button to load from an attached USB Flash Drive. When the proper file has been selected, the following screen will appear to confirm the choice.

The Electronic Controller will restart and the application will be loaded upon startup of the system.

3.5 IN-MENU NAVIGATION

3.5.1 KEYBOARD FUNCTIONALITY



- Letter Selection - use arrow keys to navigate to letters and then press 

to select each letter.
- Deleting text - navigate to 
button and press 

to delete letters.
- Capital Letter (CAPS) Selection - select 

and press 

. The CAPS button will become red - 

. Now all of the text in the window will come in ALL CAPITAL LETTERS.
- Accept text - navigate to the 

button and press 

to accept the text. Alternately, long hold (more than 2 seconds) on 

will also accept the text.
- Cancel text changes - navigate to 

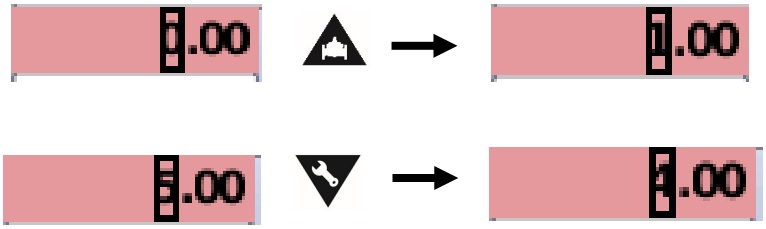
button and press 

to cancel text changes.

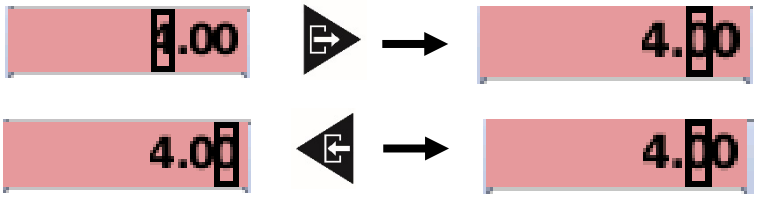
3.5.2 NUMERAL SELECTION

- Press 

to enter the numeral selection field.
- Use 
and 
to increase and decrease the selected numeral.



- Use and to move the cursor to the left and right, respectively.



- To add digits to the left of the current maximum use the to move the cursor to the left.

- To accept changes, select to return to exit field.

3.5.3 DROP-DOWN MENU

- Use and to navigate up and down the options in the drop down menu.

etc…

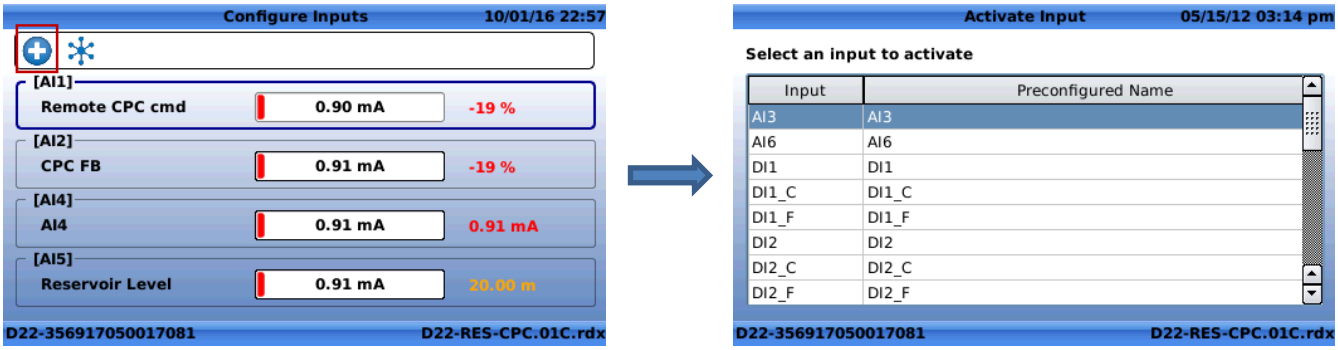
- Short click to accept the selection.
- Long click will escape to Home Screen and cancel any selections.

4 SPECIFIC FEATURES

4.1 ADD INPUTS ON-THE-FLY

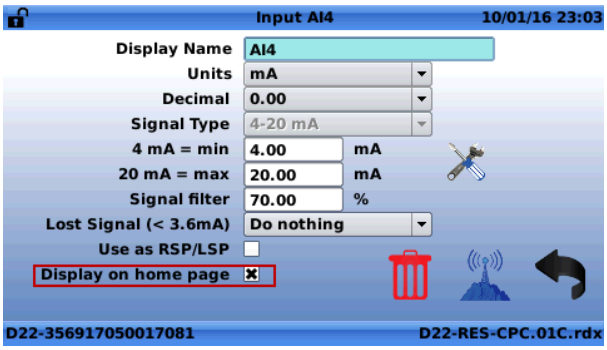
It is possible to add inputs on-the-fly in the Electronic Controller, even if these inputs are not originally included in the loaded ***ValvApps***™, which is helpful if you have to add a sensor to the system for instance.

To add an input on-the-fly, you must go to the Inputs Configuration screen (long click left):



By clicking the "**+**" button, the input to be activated can be chosen from the list. The input added will then show up in the list of input of the configuration screen.

To display the added input in the home screen, go in the configuration of the added input:

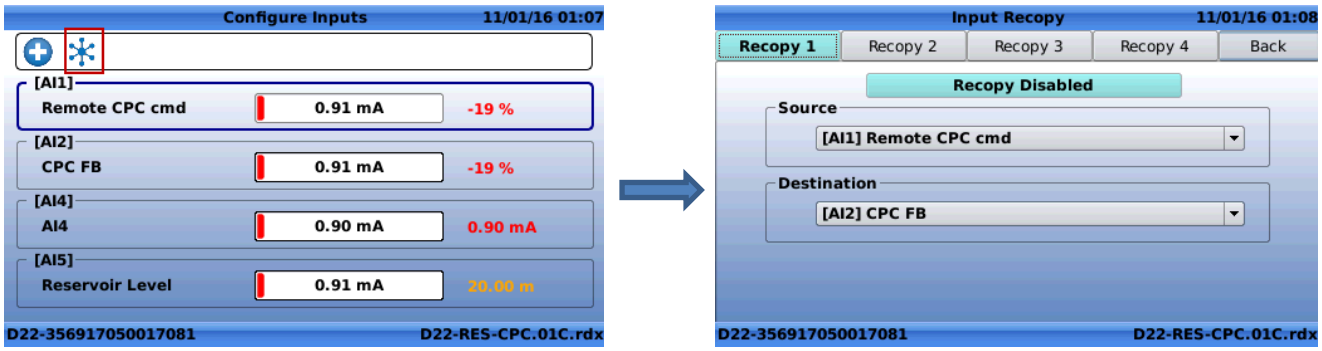


An added input can be deleted by clicking on the trash icon of the same screen.

4.2 INPUT REMAP (INPUT TYPE SELECTION)

This feature remaps an input to another, allowing for instance to add a pulse flowmeter even if the ***ValvApps***™ is not designed for it, without having to reconfigure the input.

This feature is available from the Inputs Configuration screen (long click left):



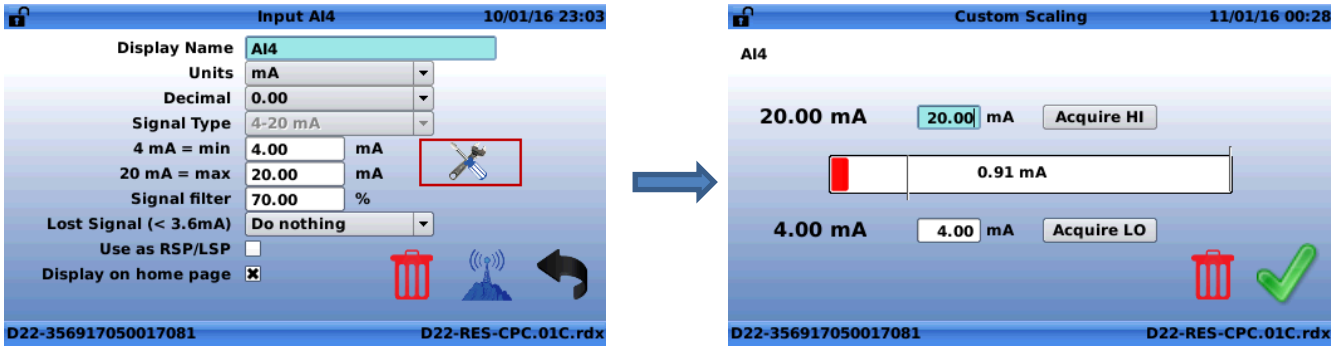
Note that only compatible inputs can be remapped, so the "*Destination*" will only show compatible inputs with the "*Source*".

4.3 CUSTOM SCALING

This feature is useful to re-scale signals of 4-20 mA sensors when the practical application range is reduced (say for instance 6-16 mA).

To custom scale an input, go to the Inputs Configuration screen:

Long click left > *Left* on input to be custom scaled

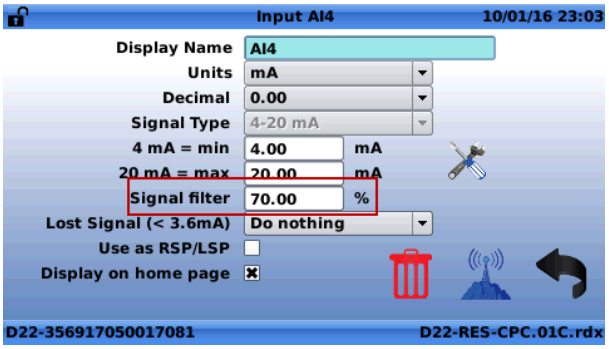


Push "***Acquire Lo***" to set the minimum value and "***Acquire HI***" to set the maximum value, and validate with the check mark. Note that the sensor can also have a reversed range, i.e. minimum physical value for 20 mA and maximum physical value for 4 mA.

4.4 INPUT FILTERING

Signal filtering has been added to the analogue inputs of the Electronic Controller in order to attenuate noise coming from the sensors, and stabilize the signal. The filter ratio can be set in the Inputs Configuration screen:

Long click left > *Left* on the selected input



The value can be set from 1% (light) to 99% (strong) or disabled. The default value is set at 70%, which is usually a good filtering for most of the application.

Unless required and understood, this value should not be changed.

4.5 REMOTE CONFIGURATION

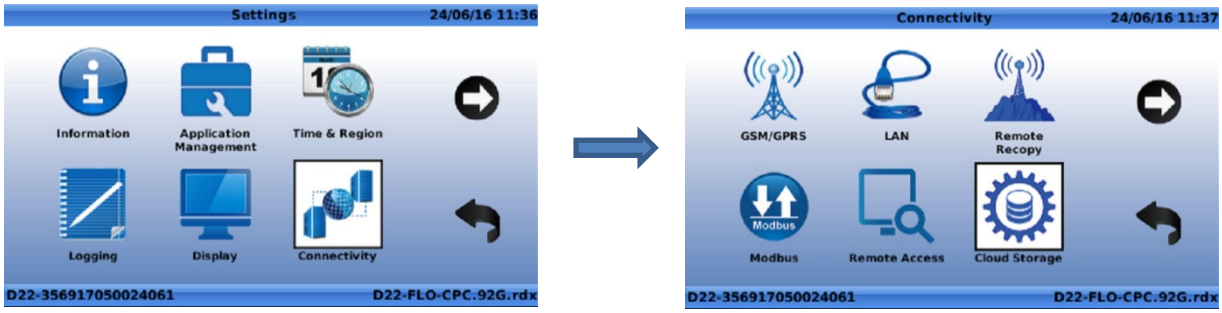
It is possible to edit and change remotely control curves, set-points, and values of the configuration screen (short click down) via the CLA-VAL ***Link2Valves*** web platform. This feature brings a high value when needing to change the mode of operation or characteristics of the regulation profile, without having to send a technician in the field.

For instance, the mode of operation can be changed from a fixed pressure regulation to an automatic pressure vs. flow regulation profile, and/or could slowly and slightly drop off the PRV outlet pressure set-point until the optimal point of the network is reached.

To use this functionality, the Electronic Controller needs to be connected to the internet (either via the cellular network or via Ethernet), and registered in the CLA-VAL ***Link2Valves*** platform for a user with Administrator rights (contact CLA-VAL for more details).

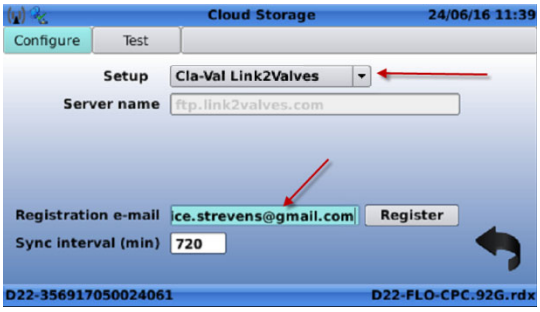
4.5.1 REGISTER THE ELECTRONIC CONTROLLER ON LINK2VALVES

Long click down > "**Connectivity**" > "**Cloud Storage**"



Make sure that the communication is set to "**Cla-Val Cloud**" (requires a CLA-VAL SIM card) in *Long click down* > "***Connectivity***" > "***GPRS/GSM***" > "***GPRS Setup***"

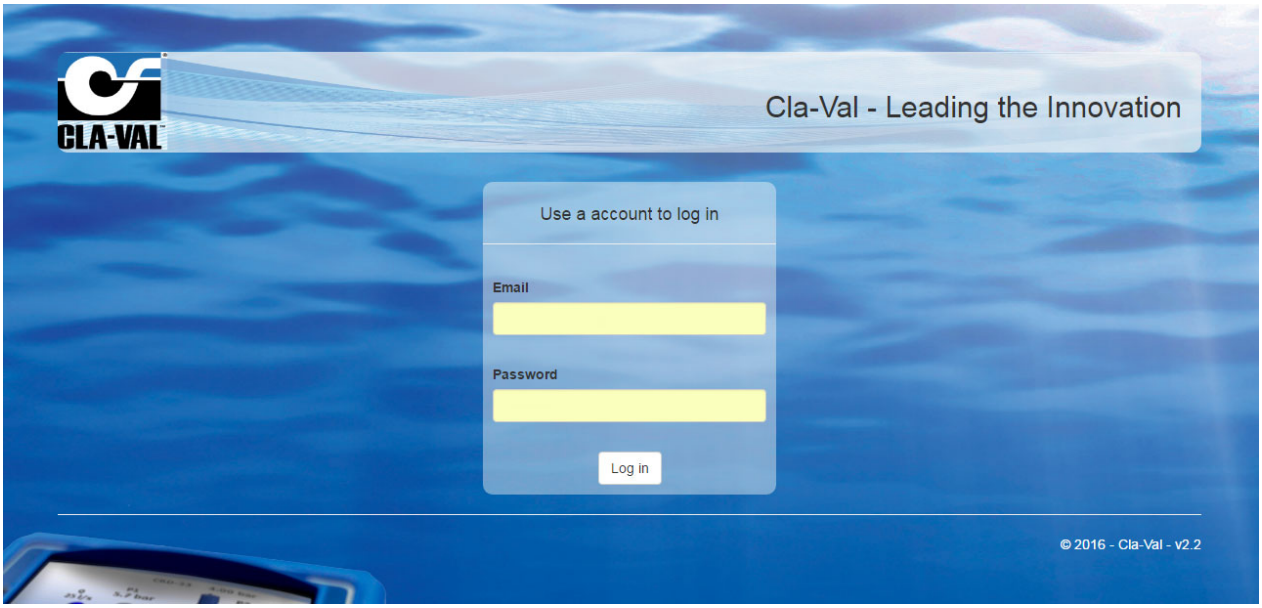
a) Enter "**Cla-Val Link2Valves**" in "**Setup**"
b) Enter email address in "**Registration e-mail**"
c) Click on "**Register**" and wait for process to complete



4.5.2 CONNECT TO LINK2VALVES

If already registered in ***Link2Valves***, connect to www.link2valves.com and log in.

If not registered, click on the automatic email received from *no-reply@link2valves.com* (check your spam box if not in your inbox) and enter a password in the website. Ask CLA-VAL to get administrator rights.



See the Link2Valves User Guide for more details on how to use the functionality of Link2Valves.

5 APPENDIX: MODBUS INTERFACE

5.1 MODBUS PROTOCOL

Supports Modbus TCP/IP and Modbus RTU simultaneously, as a server (slave) only.

Modbus RTU: requires UID (Modbus address, 1-255) and baudrate

Modbus TCP/IP: requires allowed client IP address range (for access control) and IP port number (default 502)

5.2 STANDARD MODBUS INTERFACE

All data accessible with Modbus requests is mapped into the Holding Register address space (40000 to 65535). The commands supported are

- 03 - read multiple holding registers
- 16 - write multiple holding registers

Initially, only the physical inputs and outputs are available to a client. All share a common format, in which an input or output is accessible as three consecutive 16-bit words. (Remember that Modbus word data is transmitted in Motorola format ie high-order byte:low-order byte).

Each input/output is represented as follows:

- status/control word
- input/output value (IEEE 32-bit float, high-order word:low-order word)

The status of the status/control word is common to all, but certain bits may never be set if they are not applicable. Unused bits are read as zeros.

b0 signal lost/out of range (AIx and DIx_F only) **read-only**

b1 local override applied **read-only**

b2 alarm active (AOx, DOx only) **read-only**

b3 recopy active (AOx, DOx only) **read-only**

b14 clear Modbus override **write-only**, always reads as 0

b15 Modbus override active/set Modbus override **read/write**

Input/output values are expressed as natural units, so that if a 4-20 mA analog input is configured as flow, where 4 mA = 10 l/s and 20 mA = 200 l/s, for an input value of 12 mA the client will read 105.

Space is reserved for 32 each of the analog inputs, digital inputs, analog outputs and digital outputs. Reading an input/output which does not, physically, exist will return all zeros: writing has no effect.

Note that input values are supplied after any filtering, scaling and special handling. So reading the value of an 4-20 mA input which has no signal (defined as input < 3.6 mA) may return:

- an out-of-range value
- the last-known good value
- a default value

Depending on the configuration of the input. An input/output with a local override applied will return the override value, ***not*** the current physical value.

Address mapping is as follows:

Analog Inputs		
40000	AI1	Status/control word
40001		Input value, high-order word
40002		Input value, low-order word
40003	AI2	Status/control word
40004		Input value, high-order word
40005		Input value, low-order word
40006 . .	AI3 . .	
40015	AI6	Status/control word
40016		Input value, high-order word
40017		Input value, low-order word
40018 - 40099		Read as zeros

Digital Inputs		
40100	DI1 (digital state 1/0)	Status/control word
40101		Input value, high-order word
40102		Input value, low-order word
40103	DI1_C (counter value)	Status/control word
40104		Input value, high-order word
40105		Input value, low-order word
40106	DI1_F (flow value ie counter value over time)	Status/control word
40107		Input value, high-order word
40108		Input value, low-order word
40109 . .	DI2 . .	
40145 - 40147	DI6	
40148 - 40150	DI6_C	
40151 - 40153	DI6_F	
40154 - 40199		Read as zeros

Analog Outputs		
40200	AO1	Status/control word
40201		Output value, high-order word
40202		Output value, low-order word
40203	AO2	Status/control word
40204		Output value, high-order word
40205		Output value, low-order word
40206 . .	AO3 . .	
40209	AO4	Status/control word
40210		Output value, high-order word
40211		Output value, low-order word
40212 - 40299		Read as zeros

Digital Outputs		
40300	DO1	Status/control word
40301		Output value, high-order word
40302		Output value, low-order word
40303	DO2	Status/control word
40304		Output value, high-order word
40305		Output value, low-order word
40306 . .	DO3 . .	
40309	DO4	Status/control word
40310		Output value, high-order word
40311		Output value, low-order word
40312 - 40399		Read as zeros

To override an input/output value, the client must perform a single write operation to all three words of the input(s)/output(s) concerned. Any number of inputs/outputs may be overridden in the same write operation, but the above condition must be respected.

To override a value the client must write

- status/control word, with b15 set to 1 (other bits will NOT be changed)
- high-order word of the new value
- low-order word of the new value

To clear an override the client must write at least the status/control word for the input/output concerned, with b14 set to 1. In this case, should the client write to the value registers this is ignored.

This means that with a single 18-word (6 x 3) write operation the client can override the values of selected analog inputs (by setting b15 of the status/control word to 1), clear an override on others (set b14 to 1), and leave the state of the rest unchanged (b14, b15 = 0).

Note: that an override will have no effect if:

- The write operation is incomplete (writing only 5 words to address 40200, for example, may override AO1 but will have no effect on AO2)
- The supplied value is outside the permitted range
- A local override, an alarm, or a recopy is active
- If an override is applied and subsequently a local override, an alarm or a recopy become active, the override is removed.

Note also: That the values read may not reflect those used in, for example, a PID block. If, for example, AO1 is used as the setpoint for a PID the user may override it locally: alternatively he may choose to override the setpoint value in the PID parameters. In this latter case the value of AO1 no longer reflects the setpoint value.

5.3 MODBUS-TOPKAPI

The inputs and outputs of a D22 are also mapped into a second table, starting at address 42000. The Modbus commands supported for this table are

- 03 - read multiple holding registers
- 06 - write single register
- 16 - write multiple registers (register count of 1 or 2, see note below)

An external system may read from or write to any word in this table, in any order.

Each input/output is represented by the following elements:

- status/control word
- input/output value

The format of the status/control word is common to all channels, but certain bits may never be set if they are not applicable. Unused bits are read as zeros.

b0 Modbus override active **read/write**

b1 signal lost/out of range (AIx and DIx_F only) **read-only**

b2 local override applied **read-only**

b3 alarm active (AOx, DOx only) **read-only**

b4 recopy active (AOx, DOx only) **read-only**

A read from this table will always return the current value of the corresponding channel. Writing to this table places the values written into a set of holding registers, from where they may be applied to the corresponding I/O channels under the following conditions:

- Writing 1 to b0 of the status/control word of a channel will override the physical value for the channel with the value in the associated holding register(s) for that channel (if valid, ie within min/max values for that channel). ***IF*** the value in the holding register(s) for the channel is ***NOT*** valid, the current value will be used as the override value.
- Writing 0 to b0 of the status/control word of a channel will remove the override (if active) and will reset the holding register(s) for that channel to an invalid value (NaN - not-a-number - for channels AIn, DIn_C, DIn_F, AOn, and 0xFFFF for channels DIn, SOn and ROn).
- If a Modbus override is already active, writing to the low-order holding register for a channel will apply the value in the holding register(s) as an override. If this value is not valid, the current value will be kept.

For **analog inputs, the digital counter and frequency inputs, and the analog outputs**, the input/output values are represented as IEEE 32-bit floats, high-order word:low-order word.

For the **digital inputs** the values are represented as a single 16-bit word, either 0 or 1.

For the **digital outputs** the values are represented as a single 16-bit word. If an output is configured as purely digital it will read as 0 or 1: writing 0 will force it to 0, and writing a value other than 0 will force it to 1. If an output is configured as a PWM it will read and may be written as a value from 0 - 100, representing the PWM activation percentage.

Input/output values are expressed as natural units, so that if a 4-20 mA analog input is configured as flow, where 4 mA = 10 l/s and 20 mA = 200 l/s, for an input value of 12 mA the client will read 105.

Note that input values are supplied after any filtering, scaling and special handling. So reading the value of an 4-20 mA input which has no signal (defined as input < 3.6 mA) may return

- an out-of-range value
- the last-known good value
- a default value

Depending on the configuration of the input.

Reading an input/output which has a local override applied will return the override value, ***not*** the current physical value. **Note:** That a local override, a recopy, or an alarm (!Action!) output will take precedence over a Modbus override.

Address mapping is as follows:

Analog Inputs		
42000	AI1	Status/control word
42001		Input value, high-order word
42002		Input value, low-order word
42003	AI2	Status/control word
42004		Input value, high-order word
42005		Input value, low-order word
42006 . .	AI3 . .	
42015 - 42017	AI6	
42018 - 42099		**Read as zeros**

Digital Inputs		
42100	DI1 (digital state 1/0)	Status/control word
42101		Input value, 0/1
42102	DI2	Status/control word
42103		Input value, 0/1
42104 . .	DI3 . .	
42110 - 42111	DI6	
42112 - 42119		**Read as zeros**
42120	DI1_C (counter value)	Status/control word
42121		Input value, high-order word
42122		Input value, low-order word
42123	DI2_C	Status/control word
42124		Input value, high-order word
42125		Input value, low-order word
42126 . .	DI3_C . .	
42135 - 42137	DI6_C	
42138 - 42139		**Read as zeros**
42140	DI1_F (frequency value)	Status/control word
42141		Input value, high-order word
42142		Input value, low-order word
42143	DI2_F	Status/control word
42144		Input value, high-order word
42145		Input value, low-order word
42146 . .	DI3_F . .	
42155 - 42157	DI6_F	
42158 - 42199		**Read as zeros**

Analog Outputs		
42200	AO1	Status/control word
42201		Output value, high-order word
42202		Output value, low-order word
42203	AO2	Status/control word
42204		Output value, high-order word
42205		Output value, low-order word
42206	AO3	Status/control word
42207		Output value, high-order word
42208		Output value, low-order word
42209	AO4	Status/control word
42210		Output value, high-order word
42211		Output value, low-order word
42212 - 42299		**Read as zeros**

Digital Outputs		
42300	SO1	Status/control word
42301		Output value
42302	SO2	Status/control word
42303		Output value
42304	RO3	Status/control word
42305		Output value
42306	RO4	Status/control word
42307		Output value
42308 - 42399		**Read as zeros**

Multiple-register writes:

Modbus function 16 may be used to write two word values to a pair of holding registers which represent a single float value. Consequently, it is possible two use function 16 to write two words in a single operation to registers 42001 and 42002, representing the float value of AI1. However, it is *NOT* possible to perform a multi-word write at address 42000, for example.

Examples:

To override the value of DI5 to 1 initially requires two write operations:

- Write the desired value to address 42109 to set the holding register
- Write 1 to address 42108 to apply the value in the holding register

Once the override is in place, the override value may be changed simply by writing the new value to address 42109.

To remove the override it is sufficient to write 0 to address 42108.

To override the value of AI1 initially requires two or three write operations:

- Write the desired value to registers 42001 and 42002 (using either two single-word writes or a single 2-word write operation)
- Write 1 to address 42000 to apply the value in the holding register

Once the override is in place the override value may be changed by writing to registers 42001 and 42002: as above, this may be done as two single-word operations or as a single 2-word operation.

Note:

- That in the first case, it is the write to the low-order holding register at address 42002 which triggers the application of the new value.

- When the override value is set from '1' to '0', this is mandatory to perform both writes operations explains before to force a new value on the register «holding register».

5.4 INTEGER MODBUS-TOPKAPI

The inputs and outputs of a D22 are also mapped into a third table, starting at address 44000. The Modbus commands supported for this table are

- 03 - read multiple holding registers
- 06 - write single register
- 16 - write multiple registers (register count of 1, see note below)

An external system may read from or write to any word in this table, in any order.

Each input/output is represented by the following elements:

- status/control word
- input/output value

The format of the status/control word is common to all channels, but certain bits may never be set if they are not applicable. Unused bits are read as zeros.

b0 Modbus override active **read/write**

b1 signal lost/out of range (AIx and DIx_F only) **read-only**

b2 local override applied **read-only**

b3 alarm active (AOx, DOx only) **read-only**

b4 recopy active (AOx, DOx only) **read-only**

A read from this table will always return the current value of the corresponding channel. Writing to this table places the values written into a set of holding registers, from where they may be applied to the corresponding I/O channels under the following conditions:

- Writing 1 to b0 of the status/control word of a channel will override the physical value for the channel with the value in the associated holding register for that channel (if valid, ie within min/max values for that channel). ***IF*** the value in the holding register(s) for the channel is ***NOT*** valid, the current value will be used as the override value.
- Writing 0 to b0 of the status/control word of a channel will remove the override (if active) and will reset the holding register for that channel to an invalid value (NaN - not-a-number - for channels AIn, DIn_C, DIn_F, AOn, and 0xFFFF for channels DIn, SOn and ROn).
- If a Modbus override is already active, writing to the holding register for a channel will apply the value in the holding register as an override. If this value is not valid, the current value will be kept.

For **analog inputs, the digital counter and frequency inputs, and the analog outputs**, the input/output values are represented as IEEE 16-bit integer word.

Note:

To keep most possible precision, the I/O values are multiplied by the decimal parameter set into the I/O configuration.

Example:

I/O	Value displays on D22	Decimal parameter	Read with Modbus
AI1 (Q Set Point)	582	0	582
AI1 (Q Set Point)	582.3	0.0	5823
AI1 (Q Set Point)	582.31	0.00	58231

For the **digital inputs** the values are represented as a single 16-bit word, either 0 or 1.

For the **digital outputs** the values are represented as a single 16-bit word. If an output is configured as purely digital it will read as 0 or 1: writing 0 will force it to 0, and writing a value other than 0 will force it to 1. If an output is configured as a PWM it will read and may be written as a value from 0 - 100, representing the PWM activation percentage.

Input/output values are expressed as natural units, so that if a 4-20 mA analog input is configured as flow, where 4 mA = 10 l/s and 20 mA = 200 l/s, for an input value of 12 mA the client will read 105.

Note that input values are supplied after any filtering, scaling and special handling. So reading the value of an 4-20 mA input which has no signal (defined as input < 3.6 mA) may return

- an out-of-range value
- the last-known good value
- a default value

Depending on the configuration of the input.

Reading an input/output which has a local override applied will return the override value, **not** the current physical value. **NOTE** that a local override, a recopy, or an alarm (!Action!) output will take precedence over a Modbus override.

Address mapping is as follows:

Analog Inputs		
44000	AI1	Status/control word
44001		Input value
44002		Read as zeros
44003	AI2	Status/control word
44004		Input value
44005		Read as zeros
44006 . .	AI3 . .	
44015 - 44017	AI6	
44018 - 44099		**Read as zeros**

Digital Inputs		
44100	DI1 (digital state 1/0)	Status/control word
44101		Input value, 0/1
44102	DI2	Status/control word
44103		Input value, 0/1
44104 . .	DI3 . .	
44110 - 44111	DI6	
44112 - 44119		**Read as zeros**
44120	DI1_C (counter value)	Status/control word
44121		Input value
44122		Read as zeros
44123	DI2_C	Status/control word
44124		Input value
44125		Read as zeros
44126 . .	DI3_C . .	
44135 - 44137	DI6_C	
44138 - 44139		**Read as zeros**
44140	DI1_F (frequency value)	Status/control word
44141		Input value, high-order word
44142		Read as zeros
44143	DI2_F	Status/control word
44144		Input value
44145		Read as zeros
44146 . .	DI3_F . .	
44155 - 44157	DI6_F	
44158 - 44199		**Read as zeros**

Analog Outputs		
44200	AO1	Status/control word
44201		Output value
44202		Read as zeros
44203	AO2	Status/control word
44204		Output value
44205		Read as zeros
44206	AO3	Status/control word
44207		Output value
44208		Read as zeros
44209	AO4	Status/control word
44210		Output value
44211		Read as zeros
44212 - 44299		**Read as zeros**

Digital Outputs		
44300	SO1	Status/control word
44301		Output value
44302	SO2	Status/control word
44303		Output value
44304	RO3	Status/control word
44305		Output value
44306	RO4	Status/control word
44307		Output value
44308 - 44399		**Read as zeros**

Writes Examples:

To override the value of DI5 to 1 initially requires two write operations:

- Write the desired value to address 44109 to set the holding register
- Write 1 to address 44108 to apply the value in the holding register

Once the override is in place, the override value may be changed simply by writing the new value to address 44109.
To remove the override it is sufficient to write 0 to address 44108.

To override the value of AI1 initially requires two write operations:

- Write the desired value to registers 44001
- Write 1 to address 44000 to apply the value in the holding register

Once the override is in place the override value may be changed by writing to registers 44001.

Note:

- That in the first case, it is the write to the holding register at address 44001 which triggers the application of the new value.

- When the override value is set from '1' to '0', this is mandatory to perform both writes operations explains before to force a new value on the register «holding register».

6 APPENDIX: MODBUS INTERFACE FOR VARIOUS SLAVE SENSORS

6.1 CLA-VAL E-DRIVE-34 ACTUATOR

The e-Drive-34 actuator is fully interfaced to the Electronic Valve Controller via its Modbus RS-485 interface, connected to the e-Drive-34 SOURIAU circular connector.

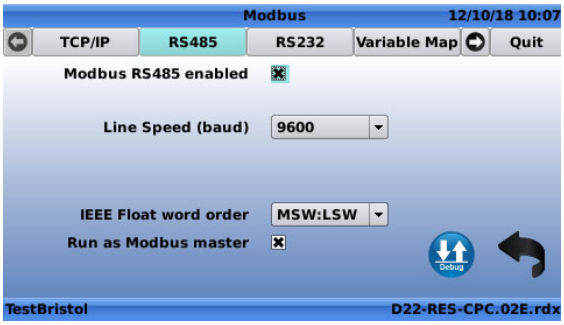
⚠ ***IMPORTANT: this feature requires the e-Drive-34 actuator to be loaded with firmware version 4.03 or higher!***

6.1.1 INTERFACING AN E-DRIVE-34 ACTUATOR TO THE ELECTRONIC VALVE CONTROLLER

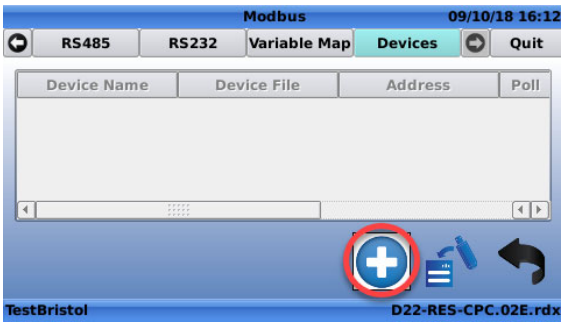
1. Turn off the Electronic Valve Controller
2. Connect the circular plug cable on the e-Drive-34 and the Electronic Valve Controller
    a. According this wiring table

Circular plug cable	Designation	D22	e-Drive-34
1	24V	V+	A
2	0V	V-	B
3	GND	RS-485 GND	C
4	485A	RS-485 485A	D
5	485B	RS-485 485B	E
6	Libre	-	F

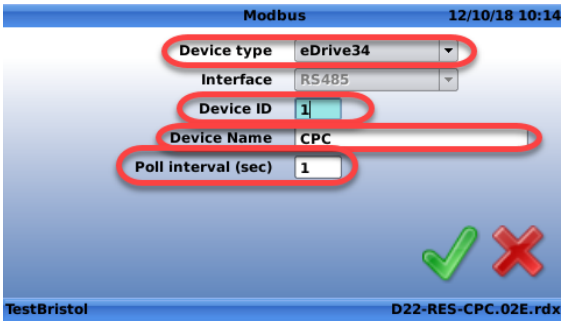
3. Turn on the Electronic Valve Controller
4. Go into "**Settings**" (long click down) > "**Connectivity**" > "**Modbus**"
5. In the "**RS-485**" tab
    a. Enable the checkbox to allow **Modbus RS-485** connection
    b. Set "**Line Speed**" at "**9600**" baud
    c. Set "**IEEE float word order**" to "**MSW:LSW**"
    d. Check the checkbox to "**run as Modbus master**"



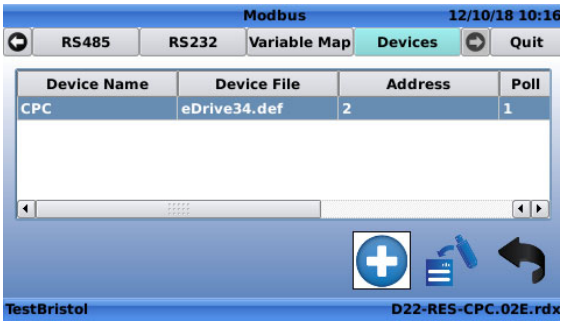
6. In the "**Devices**" tab (right click to reach the tab)
    a. Click on the "**+**" button



7. Create the Modbus device
    a. Set "**Device type**" to "**eDrive34**"
    b. "**Device ID**" to the slave address of the e-Drive-34 (default: 1)
    c. Give a name to the device
    d. Set the "**Poll interval**" (default: 1 second)
    e. Click on the "**green checkmark**" to add/create the device

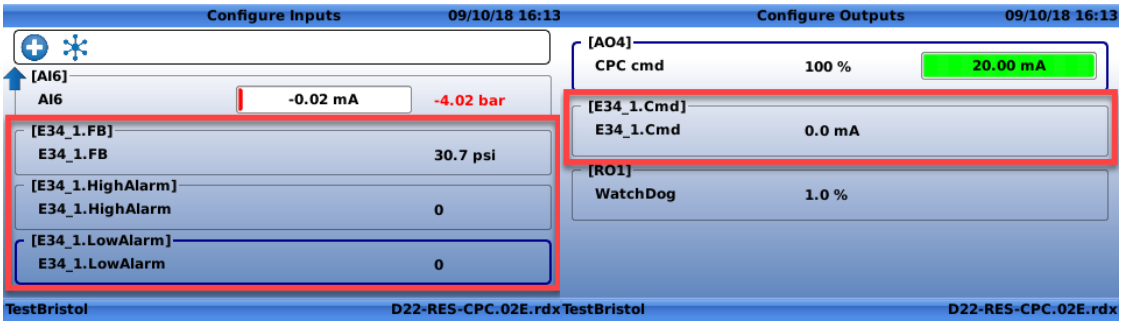


    f. The e-Drive-34 is created and now controllable via Modbus.



Once the actuator is interfaced to the Electronic Valve Controller advanced controller, the following e-Drive-34 signals are available:

- Inputs
  - <*name_of_device*>.FB -> Feedback
  - <*name_of_device*>.HighAlarm -> HighAlarm
  - <*name_of_device*>.LowAlarm -> LowAlarm
- Output
  - <*name_of_device*>.Cmd -> Command

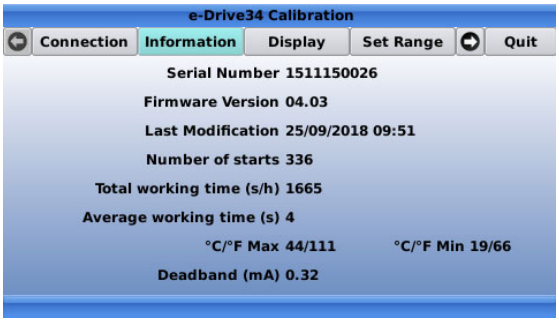


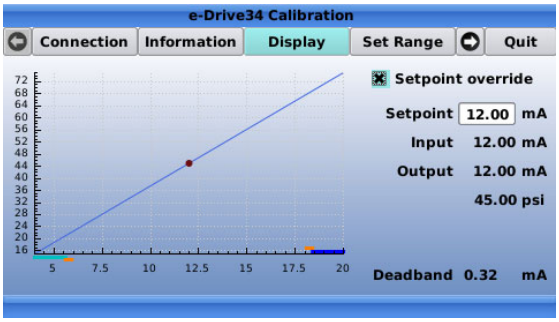
All the inputs/outputs can be used into followings Electronic Valve Controller regulation blocks:

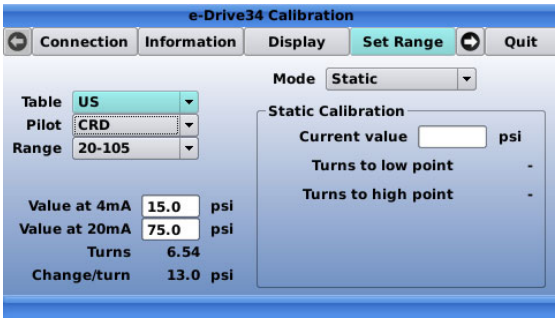
- PID
- Control Curve
- Input recopy
- Signal retransmission
- Actions

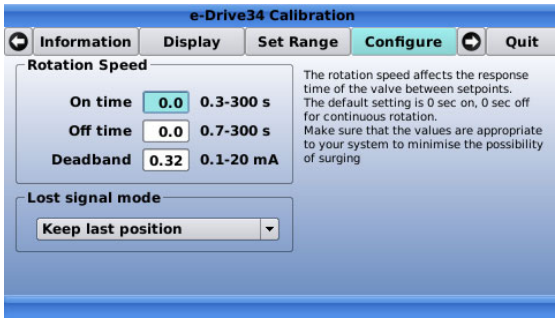
6.1.2 CALIBRATE AN E-DRIVE-34 ACTUATOR FROM THE ELECTRONIC VALVE CONTROLLER

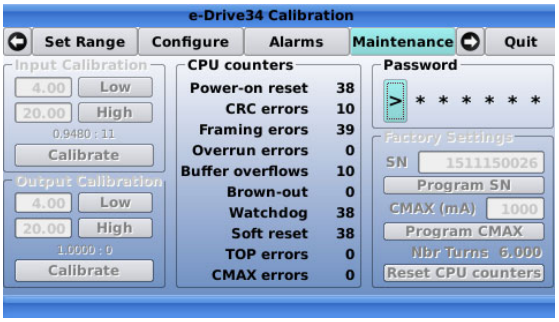
It is also possible to calibrate the e-Drive-34 with a D22 controller (via its Modbus RS-485 interface), preventing the need of a computer in the field. The Electronic Valve Controller graphical interface replicates the e-Drive-34 PC software information/commands, with an improved user experience (context-sensitive assistance). To navigate to the e-Drive-34 user interface:
(Long click up) "**Configuration**" > "**eDrive34**"

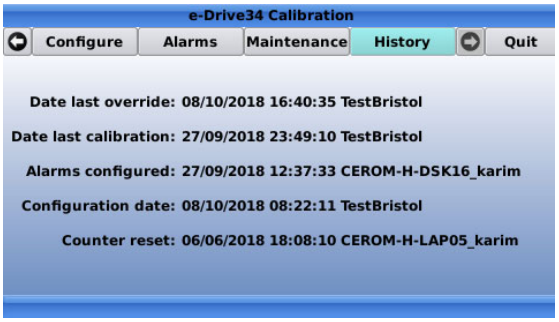












How to access the menu

Once the e-Drive-34 is interfaced (see paragraph 6.1.1), click on the "**eDrive34**" icon into "**Configuration**" menu (Long click up)

1. By default, the "**Modbus slave address**" of an e-Drive-34 actuator is set to 1
2. It is possible to connect up to five e-Drive-34 to a Electronic Valve Controller, by setting a different Modbus slave address for each actuator, before connecting them at the same time.
3. When changing settings, the button "**Write calibration**" appears. Click on this button to save changes.
4. The "**Maintenance**" tab is protected by password, providing access only to advanced users, and avoiding unwanted misusage. Please contact your CLA-VAL representative if the password is requested.

6.2 SENSOR INTERFACE DEFINITION FILE

The sensor interface definition file is used to describe a sensor and its values. The file contains a description for the values available from the sensor (Modbus address, unit, range of the value, etc.). This chapter explains how to create a description file for a specific sensor.

All the values described in the sensor interface definition file can be used into the followings Electronic Valve Controller regulation blocks:

- PID
- Control Curve
- Input recopy
- Signal retransmission
- Actions

The sensor interface definition file (.def) is composed of the following section:

1. .ID — This section defines a sensor type.
2. .Channels — This section defines the channels provided by the sensor.
3. .ReadRequest X — This section(s) defines Modbus read request(s). X is the id of the request.
4. .WriteRequest X — This section(s) defines Modbus write request(s).

This is an example of the definition file (edrive34.def) for the CLA-VAL e-Drive-34:

```
# EDrive34 difinition file
.ID
Equipment=eDrive34,E34,rs485
.Channels
Cmd=2
FB=0,4,0,0,100
LowAlarm=1
HighAlarm=1
.ReadRequest 1
registers=4,23,5
Cmd=0,int16,moto,raw,40,200
FB=2,int16,moto,raw,40,200
LowAlarm=3,int16,moto,cooked
HighAlarm=4,int16,moto,cooked
.WriteRequest 1
registers=16,23,2
Cmd=0,int16,moto,raw,40,200
```


: The "#" character is used to add comment into the file.

: No empty line are accepted in the .def file.

6.2.1 .ID SECTION

This .ID section defines the sensor type. The section contains only one line beginning with "Equipment", followed by the sensor type name, the base name, and the interface to use.

```
Equipment=<equipment type name>,<base name>,<interface>
```

- <equipment type name> is informational
- <base name> indicates the base name affected to object and channels
- <interface> = rs485/tcpip/both

 : tcpip & both are not yet implemented in version 2.3.1

6.2.2 .CHANNELS SECTION

This .Channels section defines the channels of the sensor. The section contains one line for each channel beginning with the channel base name, followed by the channel type, unit type, unit code, minimum value, and maximum value.

```
<channel name>=<type>,<unittype>,<unitcode>,<min>,<max>
```

- <type> = Code of the channel type
- <unittype> = Code of the unit type (optional)
- <unitcode> = Code of the unit (optional)
- <min> = Minimum acceptable value, natural units (optional)
- <max> = Maximum acceptable value, natural units (optional)

The following tables describe the various codes:

Channel Type	Code
Analog Input	0
Digital Input	1
Analog Output	2
Digital Output	3

Unit Type	Unit Type Code	Unit	Unit Code
Analog	0	mA	0
Analog	0	V	1
Flow	1	gpm	0
Flow	1	mgd	1
Flow	1	cfm	2
Flow	1	cfs	3
Flow	1	l/m	4
Flow	1	l/s	5
Flow	1	m3/h	6
Flow	1	Ml/d	7
Flow	1	UK gpm	8
Pressure	2	bar	0
Pressure	2	kPa	1
Pressure	2	Mhd	2
Pressure	2	psi	3
Height	3	m	0
Height	3	in	1
Height	3	ft	2
Height	3	%	3

Unit Type	Unit Type Code	Unit	Unit Code
Percent	4		
Time	5		
Volume	6	g	0
Volume	6	mg	1
Volume	6	cf	2
Volume	6	l	3
Volume	6	m3	4
Volume	6	Ml	5
Volume	6	UK g	6
No Unit	7		
PH	8	PH	0
Free Rad	9	Cl	0
Temperature	10	deg C	0
Temperature	10	deg F	1
Turbidity	11	FNU	0
Turbidity	11	NTU	1
Turbidity	11	FAU	2

6.2.3 READREQUEST SECTION

This .ReadRequest section defines the Modbus read request of the sensor. The section contains one line for registers to read, and one line for each channel to assign to the register(s). It is possible to have several .ReadRequest; e.g.: .ReadRequest 1, .ReadRequest 2, etc.

```
registers=<function code>,<register address>,<read count>
```

- <function code> = Modbus function code to use
- <register address> = Address of 1st register to read
- <read count> = Number of 16-bit registers to read

```
<channel name>=<offset>,<type>,<format>,<state>{[,<scale>]}|{,<min>,<max>}
```

- <offset> = Register offset in reply
- <type> = int16/int32/float
- <format> = moto/intel (applies only to int32 and float)
  - Moto: Big-endian, most significant bit/word.
  - Intel: Little-endian, least significant bit/word.
- <state> = cooked/raw
  - cooked: There is an optional scaling factor <scale>. For instance, if vbatt is provided as mV * 10, there is a scaling factor of 0.01 to get the value in volts. If not supplied, <scale> is 1
  - raw: Then min/max for the raw data values must be supplied so that the Electronic Valve Controller can calculate gain+offset to get from the raw value to the physical min/max defined for the channel

6.2.4 .WRITEREQUEST SECTION

This .WriteRequest section defines the Modbus write request of the sensor. The section contains one line for registers to read, and one line for each channel to assign it to a register. It's possible to have several .WriteRequest; e.g.: .WriteRequest 1, .WriteRequest 2, etc.

The description of a .WriteRequest is exactly the same than the .ReadRequest.

6.3 ADDING SENSOR INTO THE ELECTRONIC VALVE CONTROLLER

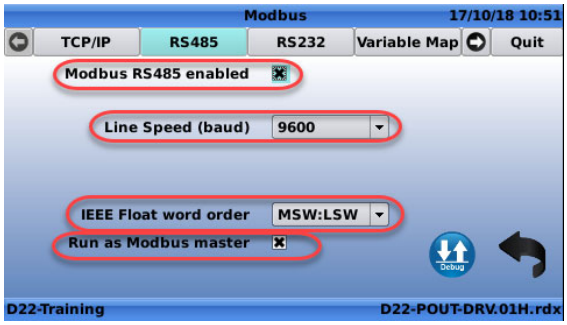
This chapter explains how to add a custom sensor, described by a sensor interface definition file (.def), into a Electronic Valve Controller.

1. Create a sensor interface definition file, according the process describes in chapter 6.2
   a. For this example we'll use a D22 like a sensor and read two values: AI1 (IN) and AO1 (OUT) as input channel type, this is the description file:

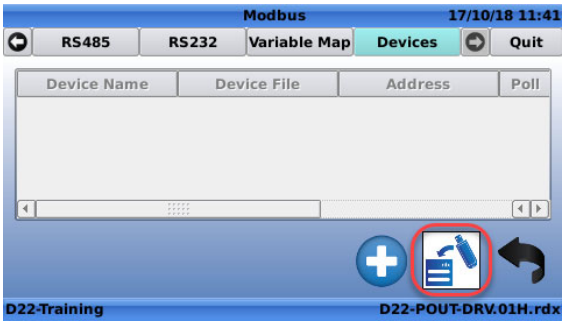
```
.ID
Equipment=D22,D22,rs485
.Channels
IN=0,4,0,0,100
OUT=0,4,0,0,100
.ReadRequest 1
registers=3,42001,2
IN=0,float,moto,cooked
.ReadRequest 2
registers=3,42201,2
OUT=0,float,moto,cooked
```

2. Save this file with the .def extension, ex: D22_test.def
3. Copy this file into a USB key

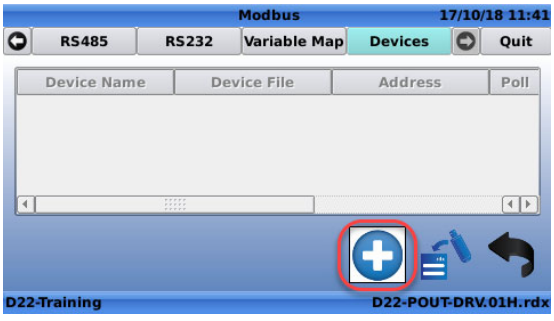
4. Plug the USB key into the Electronic Valve Controller
5. On Electronic Valve Controller, go into "**Settings**" (long click down) > "**Connectivity**" > "**Modbus**"
    a. On the "**RS485**" tab
        i. Check the checkbox "**Modbus RS485**"
        ii. Set "**Line Speed**", ***is mandatory to set the same value on the Modbus Master and Modbus slave***
        iii. Set "**IEEE Float word order**", MSW:LSW for D22
        iv. Check the checkbox "**Run as Modbus master**"



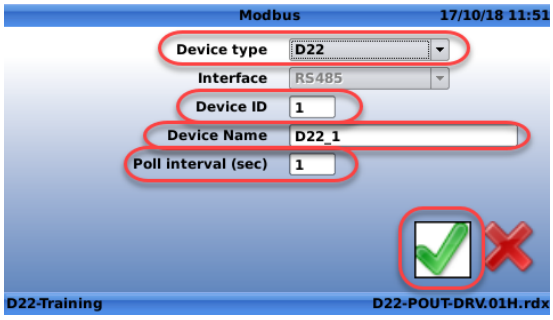
    b. On the "**Devices**" tab, on the far right
        i. Click on the button to import file



        ii. Browser into USB key to reach the definition file and click "**Ok**"
        iii. Click on the "**+**" button to add the new sensor



iv. Select the "**Device type**" sensor, defined into the sensor interface definition file.
v. Set the "**Device sensor ID**"
vi. Set the Device sensor Name
vii. Set the "**Poll Interval**"
viii. Click on the "**green mark**" to validate the addition of the device sensor



ix. The sensor is correctly added

6. Go back to "**Main screen**" with long click ok
7. Go into "**Inputs**" menu with short click left
8. The two read values have been added