

# **User Manual**



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# **Electronic Valve Controller**

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## **Electronic Valve Controller**

### **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: <u>www.cla-val.ch</u>.

: 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. <u>www.cla-val.ch</u>: Internet address.



f. **(**): Warning!





**Electronic Valve Controller** 

### 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 (Al1 to Al6)	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 $\Omega$ )		
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		

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### 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.

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### 2.2.1 JUNCTION BOARD INTERNAL CONNECTIONS





## **Electronic Valve Controller**

### 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")



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# **Electronic Valve Controller**



### 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).



## **Electronic Valve Controller**

### 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



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# **Electronic Valve Controller**



• With antenna and wall-mounting bracket







Cla-Box 10 (accessory box - U1 option)





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# **Electronic Valve Controller**

### 2.3.2 BOLT PATTERN



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### 2.4 HARDWARE INPUTS/OUTPUTS (I/O)



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

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### 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

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### 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

	1	DI	0	DII
	13	avj	3	ev
• •		DIZ	0	DI2
		84)	0	ev
		DE	0	D13
		84 <u>1</u>	0	ev
	8	<b>D14</b>	0	D14
	11	84 <sub>1</sub>	ŏ	> ev
	8	DE	9	D15
		<b>6</b> 5	0	ev
		DIE	õ	D16
		• 1	6	ev

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## **Electronic Valve Controller**

### 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.



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

### 2.7 OUTPUTS SOLENOIDS

S01+	() I≈
S01-	
S02+	
502-	
R01.1	319 0
R01.2	() I o/
R02.1	019
R02.2	() I o/

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### 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

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### 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



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

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- Short Click (less than 1 second)
- Ung 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 (1, 1), the cursor moves to the left
- When used as a  $\mathcal{W}$ , the cursor moves to the right









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### 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 Law 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 A 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 <sup>th</sup> on the **avigates to the "Inputs**" screen.

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







#### "RIGHT/OUTPUT" 3.3.3

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







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

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







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08/21/15 05:29 PM

4.0 bar

50.2 l/s

0.00 l/s



### 3.4 MENU LOCATIONS

3.4.1 INFORMATION SCREENS

		(Al2) (AO4) (Al3) (Al) (Al) (Al) (Al) (Al) (Al) (Al) (Al	
(412)	Inputs 08/21/15 05:28 PM	MOD (w) 08/21/15 05:27 PM	08/21/15 05:28 PM
CRD FB	4.0 bar		CRD cmd [bar]
[AI3]		CRD FB CRD cmd	
Q FB 4-20 mA	50.2 l/s	4.0 bar 4 bar	_
Q FB Pulses	0.00 l/s	Q FB 50.20 l/s	4
D22-test-labo	D22-POUT-DRV.01D.rdx	D22-test-labo D22-POUT-DRV.01D.rdx	D22-test-labo D22-POUT-DRV.01D.rdx
		1 Panel 08/21/15 05:28 PM [VAR] Flow Mode 4-20mA •	

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

	Inputs	08/21/15 05:28 PM
CRD FB	4.0 bar	
Q FB 4-20 mA	50.2 l/s	
(DI3_F) Q FB Pulses	0.00 l/s	
D22-test-labo	D22	-POUT-DRV.01D.rdx

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



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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™.

<b>n</b>	Panel	08/21/15 05:28 PM
Flow Mode	4-20mA	
D22-test-labo		D22-POUT-DRV.01D.rdx



### 3.4.2 CONFIGURATION MENUS











 $\overset{()}{\searrow}$  : The "Configuration" screens are accessed with a "long click"  $\overset{()}{\blacktriangleright}$  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.

<b>d</b>	Input AI2	08/21/15 05:29 PM			Configure Inputs	08/21/15 05:29 PM
Display Name	CRD FB					
Units	bar	<b>•</b>	5	[4]2]		
Decimal	0.0	-		CRD FB	7.90 mA	4.0 bar
Signal Type	4-20 mA	<b>•</b>				410 041
4mA =	2.1	bar		[AI3]		1
20mA =	10.0	bar		Q FB 4-20 mA	8.02 mA	50.2 l/s
Averaging time	1	sec (0 - 30)		[DI3_F]		
Lost Signal (< 3.6mA)	Do nothing	<b>•</b>		Q FB Pulses		0.00 l/s
Use as RSP/LSP						]
Display on home page						
D22-test-labo		D22-POUT-DRV.01D.rdx	D22	2-test-labo	D22	-POUT-DRV.01D.rdx

### Input Field Descriptions:

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

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- (bar) Bar [pressure]; 0
- (kPa) Kilopascals [pressure]; 0
- (Mhd) Mega Hectares per day [flow]; 0
- (psi) Pounds per square inch [pressure]; 0
- 0 (m) - Meters of water [pressure];
- (in) Inches of water [pressure]; 0
- (ft) Feet of water [pressure]; 0
- (%) Percentage [unit-less]; 0
- (h) Hours [time]; 0
- (min) Minutes [time]; 0
- 0 (s) - Seconds [time];
- (gal) Gallons [volume]; 0
- (mg) Mega gallons [volume]; 0
- (cf) Cubic feet [volume]; 0
- (I) Liters [volume]; 0
- (m3) Cubic meters [volume]; 0
- 0 (MI) - Mega liters [volume];
- (mA) Milliamps [electrical flow]; 0
- (Volt) Volts [electrical potential]; 0
- "Decimal": Select from available decimal places:
  - 0 0
  - 0.0 0
  - 0.00 0
- "Signal Type": Select from available signal types:
  - 4-20 mA 0
- "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 0 lost.
  - "Keep Value": This option allows the user to specify that the last input value received by the controller will be the 0 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. 0
- "Use as RSP/LSP": When this box is checked, the input is treated as an RSP/LSP Remote Set Point / Local Set Point.

Jhŋ 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

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A "short click" on "Right/output" from the "Configure Outputs" screen enters the configuration of the selected output. 9/15 18:33 03/09/15 18:34 [AO1] **Display Name** A01 A01 4.00 mA 4.00 mA cla-val@ Units mA no contractual illustrations. -Decimal 0.00 [AO2] Signal Type 4-20 mA -A02 4.00 mA 4.00 mA 4mA =4.00 mΑ [AO4] 20mA = 20.00 mA



## **Electronic Valve Controller**



- "Display Name": Use this field to choose a unique name for each output.
- "Type":

CI A-VAI

- "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:
  - o (gpm) Gallon per minute [flow];
  - o (mgd) Mega Gallons per day [flow];
  - o (cfm) Cubic Feet per minute [flow];
  - o (cfs) Cubic feet per second [flow];
  - o (I/min) Liter per minute [flow];
  - (I/s) Liter per second [flow];
  - o (m3/h) Cubic meters per hour [flow];
  - (MI/d) Mega liters per day [flow];
  - o (Imp gpm) Imperial Gallons per minute [flow];
  - o (bar) Bar [pressure];
  - o (kPa) Kilopascals [pressure];
  - o (Mhd) Mega Hectares per day [flow];
  - o (psi) Pounds per square inch [pressure];
  - o (m) Meters of water [pressure];
  - o (in) Inches of water [pressure];
  - (ft) Feet of water [pressure];
  - (%) Percentage [unit-less];
  - (h) Hours [time];
  - o (min) Minutes [time];
  - (s) Seconds [time];
  - o (gal) Gallons [volume];
  - o (mg) Mega gallons [volume];
  - o (cf) Cubic feet [volume];
  - (I) Liters [volume];
  - o (m3) Cubic meters [volume];
  - (MI) Mega liters [volume];



# **Electronic Valve Controller**

- o (mA) Milliamps [electrical flow];
- (Volt) Volts [electrical potential];
- "Decimal": Select from available decimal places:
  - o 0
  - o 0.0
  - o 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:





Control Curve



Retrans

Retransmission

### • "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!":

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## **Electronic Valve Controller**

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

		Configuration		1	10/02/15 08:4	
Flow	Reg Level	vs Flow	(( !Action	)) s! R	Retran Sig etrans	nal mission
D22-test-lai	0			D22-6	ES-CP	C.02D.rdx
		PID	1	1	0/02/1	5 08:56 AM
				1		
General	Input	Output	Adjustment	Zoni	ng	Back
General	Input D Description	Output	Adjustment	Zoni	ng	Back
General PI	D Description PID Type	Output Flow Res	Adjustment	Zoni	ng	Back
General PI PID C	D Description PID Type ycle every (s)	Flow Res Flow 20.00	Adjustment g Signal lo	Zoni ss No	ng 	Back
General PI PID C	Input D Description PID Type ycle every (s) PID Status	Flow Res Flow 20.00 Conditio	Adjustment g Signal lo onal	Zoni ss No	ng 	Back
General PI PID C	Input D Description PID Type ycle every (s) PID Status Active when	Output Flow Reg Flow 20.00 Conditio [VAR] Ma	Adjustment g Signal lo onal ode	Zoni	ng v action	Back
General PI PID C	Input D Description PID Type ycle every (s) PID Status Active when	Output Flow Reg Flow 20.00 Conditic [VAR] Me	Adjustment g Signal lo onal ode	Zoni ss No ▼<	action	Back

### A) "General" Tab

D22-test-labo	D22-RES-CPC.02D.rdy

### 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
  - o "Flow": Control using flow SetPoint and Feedback
  - **"Pressure":** Control using pressure SetPoint and Feedback
  - o "Level": Control using level SetPoint and Feedback
  - "%": Control using percentage open (position of the valve) SetPoint and Feedback
  - o "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:
  - o "No Action"
  - o "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:
  - o **"On**"
  - o **"Off**"



## **Electronic Valve Controller**

 "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:

PID Status	Conditional				
Active when	Always	-		Ŧ	

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 [Al2] is greater than 50.00 l/s.

PID Status	Conditional			•	
Active when	[AI2] Feedback	-	>	-	50.00

### B) "Input" Tab

		PI	01	10/02/2	15 08:59 AM	
General	Input	Output	Adjustment	Zoning	Back	
Setpoint	t	Source [	VAR] Target_F	ow		
Current Value 0 l/s			0	Override		
Ramping (l/s/min) OFF						
- Feedbac	:k					
Is Inle	t P.	Source [	AI3] Q		-	
	Currei	nt Value	l/s	0	verride	
D22-test-la	bo			D22-RES-C	PC.02D.rdx	

### **Input Field Description:**

### Setpoint Section:

- o "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 (I/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:

- o "Source": Designates which input is to be used as the feedback for the PID loop
- o "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



# **Electronic Valve Controller**



### C) "Output" Tab

		PID 1		10/02/15 09:06		
General	Input	Output	Adjustment	Zoning	Back	
Output Type		NO / NC				
Cycle	e Time (s)	120	Output	t Limit (%)	20.0	
Valve	Opening	[RO1] Watc	hDog		-	
Cycle	e Time (s)	120	Output	t Limit (%)	100.0	
D22-test-la	bo			D22-RES-0	PC.02D.rd	
Dell' cost la	TARSON .				. Crozbird	1

### 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)
  - o "NO/NC": Normally Open (Closing Sol) / Normally Closed (Opening Sol)
  - o "Linear 4-20mA": Will vary the Analog Output (4-20 mA) according to the PID loop
  - o "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



 $\neq$  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


### **Electronic Valve Controller**



 $\stackrel{<}{\checkmark}$  <u>Note</u>: Actual time to open will depend on the hydraulic conditions.

- "Deadband (I/s)": Designates where the controller will take no action because it is close to the SetPoint.
   <u>Example</u>: If the setpoint is 50 I/s and the deadband is set at 2 I/s, then the controller will take no action on the feedback value from 48 I/s to 52 I/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

	8	PI	01	05/16/	14 11:33 A
General	Input	Output	Adjustment	Zoning	Back
	Number	of of zor	nes: 1 🔻		
	Feed	back 0.00	0 - 1000.00	gpm	
	Zone 1:	0.00	to 1000.	.00	
				131-	-01-V0.1.r

### 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:

		PID	1	05/19/	14 03:39 PM
General	Input	Output	Adjustment	Zoning	Back
	Number Feed	of of zon back 0.00	es: 3 🔻	gpm	
	Zone 1:	0.00	to 333	.33	
	Zone 2:	333.33	to 666	67	
	Zone 3:	666.67	to 1000	.00	
				131-	01-V0.2.rdx

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.

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• Zone 3: designates the bottom range for zone 3 (top of the range is bounded by the high level of the feedback scale).

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



#### A) "General" Tab

	DP M	etering	05/20/	14 01:53 PM
General	Valve	Input	Output	Back
Metering	DP description	Flow		
	Units	US: psi,	gpm	-
			133-	01-V0.1.rdx

#### 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

	DP M	etering	05/2	0/14 02:10 PM
General	Valve	Input	Output	Back
	Size	1.5"	•	
	Body Style	100-01	-	
	Seat Type	Std	-	
	DP Config	Boss-Bos	s 🔹	

### Input Field Description:

- "Size": Designate the size valve that is being used. Options are:
  - 1.5" 0
  - 2" 0
  - 3" 0
  - 4" 0
  - 6" 0



## **Electronic Valve Controller**

o **8"** 

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- o 10"
- o **12"**
- o **14**"
- o **16"**
- o **18**"
- o 20"
- o 24"
- o **30**"
- o **36**"
- "Body Style": Designate the body style of the valve. Options are:
  - o 100-01 Full Port
  - o 100-20 Reduced Port
- "Seat Type": Designate the type of seat of the valve. Options are:
  - o 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:
  - o 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



## **Electronic Valve Controller**

### D) "Output" Tab

	D	P Meter	ing	0	5/20/1	4 03:09 PM
General	Valve	Inp	ut	Outpu	t	Back
	Physical O	utput	[AO]	] Flow F	late	•
	Prec	ision	0.00	•		
	Default	Value	0.00			
	Cu	rrent	nan g	Ipm		
	Maxi	imum	0.00	gpm		
					133-0	01-V0.3.rdx

### 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

	Configura	ation	10/02/15 09:39 AM
Flow Reg	Level vs Flow	(( Line (	Retrans Signal Retransmission
D22-test-labo		D	22-RES-CPC.02D.rdx

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
  - o "Calendar": The control curve is activated according to calendar rules, which are defined in the "Activation" tab

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- o "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)

Activation	In/Out Ad	justment	Back
			Dack
ek —			
Fuesday 📃 🛛 Wed	dnesday 🔲 The	ursday 📃 I	Friday 🗌
Sunday 🗌			
ear April	july [	Oct	ober 🗌
May 🗌	August	Noven	nber 🗌
	Fuesday _ Wee Sunday _ ear April _ May _	Fuesday _ Wednesday _ Thu Sunday _ ear April _ July _ May _ August	Fuesday Wednesday Thursday I Sunday ear April July Oct May August Noven

### 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

	Con	trol Curve 1	10/02/	15 05:01 PM
General	Activation	In/Out	Adjustment	Back
_ Input				
	Sourc	e [AI5] Reserv	voir Level	-
	Current Valu	e %		
Output —				
	Destinatio	n [VAR] Targe	t_Flow	
	Current Valu	e 0l/s	0	verride
				0
D22-test-labo			D22-RES-C	PC.02D.rdx

### 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





### **Electronic Valve Controller**

### D) "Adjustment" Tab

light).

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).

		Cont	rol Curve	1		10	/06/1	15 09	:07 A
General	Activat	ion	In/Out		Adjus	tme	nt	B	lack
2 bar									
8 Cmd									
T CK									
6									
5 5 T	/	0	0		1.175.000.00				•
tho 4	0								
						1			
0 15	30 45	60 75	90 105 Input [VAR] F	120 low	135	150	165	180	195 I/s (
22-test-labo	i				D22	-PO	UT-D	RV.0	DD.re

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.

 $\mathbb{M}$ : The light on the bottom right of the screen indicates whether the control curve is active (green light) or inactive (red

The control curve can be complete	ely customised by clicking	to enter in the "Adjustment" ta	ab.
Using and (standard), of currently selected point is filled in	or and and (rever red, while other points are r	ersed), navigate between each of th not filled.	e points on the screen. The
While on a point, click to an	rive at the following menu:	<ul><li>Edit this point</li><li>Split into two points</li></ul>	
		🔂 Add one point	
		Delete this point	
		Pressure Optimiser	
		info@ala val ao uk	



### **Electronic Valve Controller**

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

	Cont	trol Curve 1	10/15/2	15 08:32 AM			Con	ntrol Curve 1	10/15/1	5 08:34
General	Activation	In/Out	Adjustment	Back	Gen	eral	Activation	In/Out	Adjustment	Back
8			Sp	lit into two	points					
• - F					2 /					

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

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

		Control Curve 1	10/15/	15 08:32 AM			Co	ntrol Curve 1	10/15/	15 08:54 AM
Genera	al Activation	In/Out	Adjustment	Back		General	Activation	In/Out	Adjustment	Back
3 bar					4 t P	9				
Output [AO4] CRD c			(+	Add on	e point	6 5 4	, <del>O</del>			
	15 30 45 60	75 90 105 120 Input [VAR] Flow	0 135 150 165	180 195 32 l/s 🥥		0 15	30 45 60 7	5 90 105 120 Input [VAR] Flow	0 135 150 165	180 195 45 l/s 🕥
barga-po	ut-01		D22-POUT-D	RV.01D.rdx	bar	a-pout-01			D22-POUT-I	DRV.01D.rdx

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

• "Delete this point": Delete the currently selected point



• "Pressure optimiser":



It is function is only available in pressure control mode.

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### 3.4.2.7 Valve configuration - "Totalizer" Menu

<b>1</b>	Edit Totaliser 1	05/16/14 11:36 AM
Source	[VAR] SP	•
Output	[VAR] VOLUME	•
Active when	ALWAYS -	
Current Value Last reset	0 gal 05/09/14 02:37 PM	
	Reset	
		131-01-V0.1.rdx

### 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
  - o "Always": The totalizer will always be on
  - "[Al1]": Conditional based on input;
     <u>Example below</u>:

Active when	[AI1] Setpoint	-	>	-	10.00
-------------	----------------	---	---	---	-------

This totalizer is set to be active when the [Al1] 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.

		!Actions!	10/25	/15 06:02 PM
!A! 1	!A! 2	IA! 3	!A! 4	Back
Description	n			
Condition 1-				
Condition is	not configure	d		
Output				
Output is no	t configured			
barg			D22-POUT	-DRV.04A.rdx

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



### **Electronic Valve Controller**



### Input Field Description:

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- "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.

		!Actions!	10/25/	15 06:12 PM
!A! 1	IA! 2	IA! 3	!A! 4	Back
Description	on			
ON: [AI1] Pr OFF: [AI1] P	essure SP (@C ressure SP (@C	P) > 4.0 bar (P) <= 4.0 bar	×	7
Condition 2-				
Add Condition				
Output				*
Output is n	ot configured			
barq			D22-POUT-I	DRV.04A.rdx

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.

		!Actions!	10/25/1	5 07:56 PM
!A! 1	!A! 2	!A! 3	!A! 4	Back
Descriptio	on 🗌			
Condition 1-				
ON: [AI1] Pr OFF: [AI1] P	essure SP (@C ressure SP (@C	×	1	
Condition 2 – ON: [Al1] Pr OFF: [Al1] P	essure SP (@C ressure SP (@C	AN		
Output	ot configured			*
barg			D22-POUT-D	RV.04A.rdx

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The  $\checkmark$  icon is displayed when a condition is filled, and the imes when it is not filled.

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



		Action	10/25/15 09:19 PM
/alue to ap	ply		
Output	[RO1] RO1	•	
Value ON	1	Default 0	
			-
			•
			•

### 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



	Signal	Retransmissio	n 05/16/	14 11:41 AM				
Ret 1	Ret 2	Ret 3	Ret 4	Back				
	Retran	smission Dis	abled					
_ Input —								
	Source	[AI2] Fee	dback	•				
-Output-	Output							
D	estination	[A01] A0	1	•				
			131-	01-V0.1.rdx				

#### 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



#### **46 - LIN066UE** C 01/21 Reduce your waste - Sort your rubbish



"Identification" Tab A)

		Information	10/2	5/15 09:44 PM
Identification	Version	System Info	Libraries	
S/N (IMEI	) 3569170500	02422	Ľ	erene l
SIM (ICCID	) 8946204604	1000002309	F	
HostName	D22-35691	7050002422		CS 22
Contac	t			<u>97948</u>
Location	1			
Order I	<b>)</b>			
			USB EX	ort
barq			D22-POU	T-DRV.04A.rdx

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.

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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 select	ted, the following di	alog box appears:
	ValvApp Backup	10/28/15 07:09 PM
Create and save a ba	ackup of the current Val	vApp
	Backup Now	
X Automatically ba	ck up locally every day a	at 23:45
X Automatically back ValvApp has been	ck up to FTP server at 2: changed.	3:45 if the
NOTE: can genera	ite up to 250 KB per trai	isrer.
barq		D22-POUT-DRV.04A.rdx

- "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<sup>™</sup> stored to the configured FTP server. This back up will happen only if the ValvApps<sup>™</sup> has been modified.

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

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E 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.





### 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**"  $\stackrel{\frown}{=}$  icon is selected, the following screen appears to show the directory of the USB drive inserted into the D22.

	_





### **Electronic Valve Controller**

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 butto	n to enter a folder, and the button	to navigate to the parent directory.
Click the button to export the application selection:	o the current location. The following c	lialog box will appear to confirm the
	Qt	
	Export current .RDX to usb:/131-01-V0.1.rdx	
• Select "Yes" to export to the chosen .rdx file		
• Select "No" to cancel the export		
From the <b>"Export to USB</b> " screen, click the	outton to return to the previous menu. s to the main menu and cancel out of t	he 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.

	Import ValvApp	10/30/15 11:32 AM
/		Synchronise
🚺 USB 😪 My FTP		
barg		D22-POUT-DRV.04A.rdx

• **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.





			C	LA-VAL D22
GLA-VAL			Electror	nic Valve Controller
3.4.3.4 "Logging" Page		Log Options	07/03/01 11:02 AM	
		>		
	Connguration Exp	nr.	•	
A) "Configuration"	oma-res-01	D2	2-POUT-DRV.01A.rdx	
Select the icon to enter the lo	og configuration menu.			
	General	rver Configuration	10/29/15 11:29 PM	
	Logging enabled Log interval FTP Transfer interval Log format	1     min       60     min       V 1.0     •		
			•	

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

D22-PIN-SOL.03.rd

- "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.

D22-356917050016612

• "Log format": Designate which format to use for the log files.

- o "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



## **Electronic Valve Controller**

### B) "Export"

Select the *select the select the* 



Choose from one of the options & select to export.

Select to export log files **v** 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.





#### A) "GSM/GPRS" / Cellular Network

When the "GSM/GPRS"

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).

n is sele	cted, the following sc	reen app	ears:	
(1) 🗞 👘	GPRS/GSM Co	nnectivity	04	10/17 11:2
GPRS	GPRS Setup Monitor [ON]	GSM	Advanced	Operator
G	GPRS Status GPRS active IP address 100.71.238. PRS Gateway 192.168.202	e .202 2.0		~
	GPRS DNS 130.244.12	7.161		
				•
D22			D22-	LOG.00.rd)

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



• "GPRS Setup" Tab:

(y) 🗞 👘		GPRS/GSM Cor	nectivity	04	10/17 11:29
GPRS	GPRS Setup	Monitor [ON]	GSM	Advanced	Operator
	Setup	Cla-Val Clou	ıd	-	
				-	-
(v) Conr	nected: IP ad	dress 100.71.3	238.202	G	-
DZZ				D22-	LOG.00.rd

• "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:

(9) 🍕		SPRS/GSM Cor	nectivity	04	10/17 11:31
GPRS	GPRS Setup	Monitor [ON]	GSM	Advanced	Operator
	Setup	Custom		-	
	APN				
	User name				
	Password				
A	SMS Centre				
(v) Conr	nected: IP add	dress 100.71.	238.202	0	
D22				D22-	LOG.00.rdx



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

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

GPRS       GPRS Setup       Monitor [ON]       GSM       Advanced       Operator         Please wait, restarting       Resetting modem       Modem reset done       Connecting to GSM network       Connected to Swisscom, signal -51 dBm         Connecting to GPRS       Connecting to GPRS, waiting on activation       GPRS active	(y) 😪	c	PRS/GSM Co	nnectivity	04,	/10/17 11:41
Please wait, restarting Resetting modern Modem reset done Connecting to GSM network Connected to Swisscom, signal -51 dBm Connected to GPRS Connected to GPRS, waiting on activation GPRS active	GPRS	GPRS Setup	Monitor [ON]	GSM	Advanced	Operator
	Please wait, Resetting m Modem rese Connecting Connected Connected GPRS active	restarting nodem et done to GSM netw to Swisscom, to GPRS to GPRS, wait	ork signal -51 dB ing on activati	im ion		
D22 D22-LOG.00.rd	D22				D22-	-LOG.00.rdx

 "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:

- o "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

(y) %	(	nectivity	04/	10/17 11:44	
GPRS	GPRS Setup	Monitor [ON]	GSM	Advanced	Operator
Connecte	d to: Swissc	om		10	0%
RSSI: 29 Neighbou	ring cells: 3			Signal strengt <b>87 %</b>	th
					0%
D22				D22-	LOG.00.rdx

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

(v) 🐁 GPRS/GSM Connectivity					04/	10/17 11:46		
	GPRS	GPRS Setup	Monitor [ON]	GSI	м	Adva	nced	Operator
	LAC	BSIC	CI	Arfcn	R	LVI	Cl	C2
	0065	52	AFDE	109	-48	dbm	63	63
	0065	52	AFEO	114	-78	dbm	32	32
	0065	16	1F4A	71	-89	dbm	21	21
D2	2						D22-	LOG.00.rdx

"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:

<b>f</b>	1	P Configuration (eth0)	04/10/17 13:12
32	IP address	10.11.16.27	
	Subnet mask	255.255.255.0	
D	NS IP address	8.8.8.8	
Gat	teway address	10.11.16.1	
NOTE t DNS se param DNS se always	that these parar erver, concern tl eters are set au erver should NO s available.	neters, with the exception he wired LAN only. Wireless tomatically on connection. T be on your LAN unless thi	of the The is is
D22			D22-LOG.00.rd

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

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### 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).



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

		Publish	04/13/15	03:57 PM
Server	Subscribers			
	FTP server	ftp.l2v.ch		
Pu	blisher name	Reservoir		Test
Publis	hing enabled	5 seconds		-
				7
servoir			D22-RES-CP	C.02B.rd>

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 V "Server access status" confirms a successful

connection to the server, while a <sup>mage</sup> 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).

 $\sim$  : 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 🗮 icol

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

04/13	/15 03:27 P
n Timeout	Used
	C

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

Then import the right file with the

6. Click the form to check the connection to the FTP server. A V "Server access status" confirms a successful

connection to the server, while a **\*\*** indicates a failed connection.

(ARD)

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.

 $\frac{1}{2}$  : 15 minutes to 60 minutes is probably a good data transfer frequency for most of hydraulic applications.

 $\mathcal{L}$ : 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".

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

Long click O on the Then click

4/13/15 03:35 PI nout AI5 **Display Name Reservoir Level** Units m Decimal 0.0 -Signal Type 4-20 mA -4mA = 0.0 m 20mA = 20.0 m raging time sec (0 - 30) 1 Signal (< 3.6mA) Do nothing -Use as RSP/LSP



	Ren	note Recopy 0	4/13/15	03:35
Remote re	copy enabled			
	Publisher	Reservoir	-	
	Source value	[AI5] Reservoir Level	-	
				-

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).

	Modb	us Server	18/01/16 23:16
Modbus TCP/IP	Modbus RS485	Modbus RS232	
Modbus	TCP/IP enabled		
	IP Port No	0	
	Allowed Client	All	<b>-</b>
Alle	owed Interface	All	<b>•</b>
Override	e Timeout (sec)	OFF	
			-
D22-3569170500	16612		D22-RES-CPC.95A.rdx



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



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

VNC Remote Access	18/01/16 23:28
VNC enabled  IP Port No Password Allowed Client All	
Allowed Interface All	<b>•</b>
	•
D22-356917050016612	D22-RES-CPC.95A.rd



### **Electronic Valve Controller**

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*<sup>™</sup> from *Tight VNC*® (<u>http://www.tightvnc.com</u>).

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



• "Configure" Tab:

		FTP Serv	rer	19/01/16 00:00
Configure	Test	]		
	Setup	Cla-Val Link2Va	alves 🔻	
FTP Serve	er name	ftp.link2valves	com	
Registratio	n e-mail		Regi	iter
Sync interv	al (min)	720		-

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.



 $\mathbb{X}$ : If a connection to the CLA-VAL servers is desired, only a valid registration e-mail address is necessary.

	FTP Server	18/01/16 23:55
Configure Test		
Setup	Custom	
FTP Server name	ftp.l2v.ch	
User name		
Password		
Target Folder	D22-356917050016612	
Sync interval (min)	720	•
022 25601705001661	2	D22 RES CRC REA rdy

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• "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.

	Access Code				19/01/16 00:09
Password:	0 *	*	*	*	*
D22-356917050016612			D	22-R	ES-CPC.95A.rdx

### 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"

	Advan	ced	29/06/16 22:12			Update R-Engine	29/06/16 22:26
Ŵ	2				/ USB Wy FTP		
Engine Update	Diag -> USB	Factory Reset		П ОК			
			-				
Kernel Update							
D22-steeve		D22-	OUT-DRV.01G.rdx		D22-steeve		D22-POUT-DRV.01G.rdx

• USB: Click the F 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 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 **\***. 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.

	Advan	ced	29/06/16 22:45			Export Diagnostics	29/06/16 22:46
<b>Ø</b>	Ŀ				/ USB Y My FTP		
Engine Update	Diag -> USB	Factory Reset					
				ок	1		
			-				
Kernel Update							
D22-steeve		D22-P	OUT-DRV.01G.rdx		D22-steeve		D22-POUT-DRV.01G.rdx

- USB: Click the button to export the diagnostic file to a USB Flash drive. Navigate to the selected \*.tar file and OK 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.

Qt	×
Do you want to	load this library?
<u>Y</u> es	No

• 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.

Qt		×
Do you want to	load this libra	ry?
Yes	<u>N</u> o	

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

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05/13/14 12:48 PM

**Electronic Valve Controller** 

Display Name



### 3.5 IN-MENU NAVIGATION

### 3.5.1 KEYBOARD FUNCTIONALITY

Display Name	Input All 05/13/14 01:15 PM		Display Name	Closing Solenoid	
Units	apm -		1.7		
Decimal	0.00 -				
Signal Type	4-20 mA -		1 2 3 4	5 6 7 8 9	0 <
4mA =	0.00 gpm	n n			
20mA =	1000.00 gpm	ок	QWER		
Lost Signal (< 3.6mA)	Do nothing				
Use as RSP/LSP	×				
🔒 Override fr	om Display View with pwd 🛛 💙			C V B N M	
	131-01-V0.1.rdx		canc		RETURN
					131-01-V0.1.rdx
		-			
<ul> <li>Letter Sele</li> </ul>	ction - use arrow keys to	navigate to letters and th	en press 🖤 to	o select each letter	
Deleting tex	xt - navigate to 🖾 butte	on and press to de	lete letters.		
<b>•</b> • • • • •		CAPS			CAPS
<ul> <li>Capital Let</li> </ul>	ter (CAPS) Selection - se	lect 🔛 and press 🗨	. The CAPS but	itton will become re	ed - 💴 . Now al
of the text i	n the window will come in	n ALL CAPITAL LETTER	S.		
	_				
	RETUR				
<ul> <li>Accept text</li> </ul>	: - navigate to the <b>second</b>	🗾 button and press 🤜	to accept the f	text. Alternatelv. loi	ng hold (more tha
				····· <b>···</b>	5 (
2 seconds)	on 🍟 will also accept	t the text.			
,	·				
		canc	Â		
<ul> <li>Cancel text</li> </ul>	t changes - navigate to 🖳	button and pres	s 🔍 to cance	l text changes.	
00					

### 3.5.2 NUMERAL SELECTION

Use 🖌



• Press to enter the numeral selection field.

and V to increase and decrease the selected numeral.

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--------------------	-------------------	--------------------	--

### **Electronic Valve Controller**



	00.0		<b>→</b>	j i	.00	
	5.00	V	<b>→</b>	1	.00	
•	Use and to move the cursor to the	he left and	right, res	pectively.		
	4.00		<b>→</b>	4	.po	
	4.00	E	<b>→</b>	4	.po	
•	To add digits to the left of the current maxi	mum use tl	he Et	o move the cursor	to the left.	
	000.00 € →	<b>[]</b> 1	.000.	••	→ <b>₽</b>	000.00
•	To accept changes, select to return	to exit field				
3.5.3	DROP-DOWN MENU					
	Display Name Units Decimal Signal Type 4mA = 0.00 gpm 20mA = 1000.00 gpm Averaging time Lost Signal (< 3.6mA) Use as RSP/LSP x Override from Display View with pwd			Display Name Units Decimal Signal Type 4mA = 20mA = 20mA = Averaging time Lost Signal (< 3.6mA) Use as RSP/LSP	Input Al1 Setpoint gpm 0.00 4-20 mA 0.00 gpm 1000.00 gpm 1 sec (0 - 30 Do nothing v X	05/13/14 01:32 PM
	131-01-V0.1.rdx					131-01-V0.1.rdx

• Use A and V

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.

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### **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):

-	Configure Inputs	10/01/16 22:57		Activate Input	05/1
D *			Select an ir	nput to activate	
[AI1]	0.00		Input	Preconfig	ured Name
Remote CPC cma	0.90 MA	-19 %	AI3	AI3	
[AI2]			AI6	AI6	
CPC FB	0.91 mA	-19 %	DI1	DI1	
141			DI1_C	DI1_C	
	0.91 mA	0.91 mA	DI1_F	DI1_F	
	0.51	0.51	DI2	DI2	
15]			DI2_C	DI2_C	
eservoir Level	0.91 mA	20.00 m	DI2_F	DI2_F	
2-356917050017081		D22-RES-CPC.01C.rdx	D22-3569170	050017081	D22-RE

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:

ß	Input AI4			10/01/16 23:03
Display Name	AI4			
Units	mA		•	
Decimal	0.00		•	
Signal Type	4-20 mA		-	
4 mA = min	4.00	mA		1
20 mA = max	20.00	mA		8
Signal filter	70.00	%		
Lost Signal (< 3.6mA)	Do nothing		•	
Use as RSP/LSP		_		((m))
Display on home page	×	m		
			U	
D22-356917050017081			D2	2-RES-CPC.01C.rdx

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*<sup>™</sup> is not designed for it, without having to reconfigure the input.

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

	Configure Inputs	11/01/16 01:07		l	nput Recopy	11	/01/16 01:08
			Recopy 1	Recopy 2	Recopy 3	Recopy 4	Back
[AI1] Remote CPC cmd	0.91 mA	-19 %	Source	F	lecopy Disabled		
[AI2] CPC FB	0.91 mA	-19 %	[AI]	] Remote CP	C cmd		
[AI4] AI4	0.90 mA	0.90 mA	[A12	2] CPC FB			
[AI5] Reservoir Level	0.91 mA	20.00 m					
D22-356917050017081		D22-RES-CPC.01C.rdx	D22-356917050	017081		D22-RES-	CPC.01C.rdx

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

<b>.</b>	Input AI4		10/01/16 23:03	<b>1</b>	Custom Scaling	11/01/16 00:28
Display Name	AI4			AI4		
Units	mA					
Decimal	0.00		]			_
Signal Type	4-20 mA		]	20.00 mA	20.00 mA Acquire H	
4 mA = min	4.00	mA	100			
20 mA = max	20.00	mA	A 10		0.91 mA	
Signal filter	70.00	%				
Lost Signal (< 3.6mA)	Do nothing	I T	]	4.00 mA	4.00 mA Acquire LC	
Use as RSP/LSP			(((a)))			
Display on home page	×	— m				$\square$ $\square$ $\square$
						ш 🗸
D22-356917050017081			22-RES-CPC.01C.rdx	D22-356917050017	081	D22-RES-CPC.01C.rdx

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

	nput Al4				10/01/16 23	:03	
	Display Name	AI4					
	Units	mA			-		
	Decimal	0.00			-		
	Signal Type	4-20 mA	1		-		
	4 mA = min	4.00		mA		1	
	2 <mark>0 mA = max</mark>	20.00		mA		<i>6</i>	
	Signal filter	70.00		%			
	Lost Signal (< 3.6mA)	Do noth	ing	_	-		
	Use as RSP/LSP			_	-	(((a)))	
	Display on home page	×		— П	Π		
				u	n.		
	D22-356917050017081				D2	22-RES-CPC.01C.r	dx
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**Electronic Valve Controller** 

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 <u>user with Administrator rights</u> (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

(y) %		Cloud Storage	24/06/16 11:39
Configure	Test		
	Setup	Cla-Val Link2Valves	•
Ser	ver name	ftp.link2valves.com	
		1	
Registrati	on e-mail	ice.strevens@gmail.com	Register
Sync inter	rval (min)	720	
			· · · · · · · · · · · · · · · · · · ·
D22-356917	05002406	1	D22-FLO-CPC.92G.rdx

### 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.

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### **Electronic Valve Controller**



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

### 5 APPENDIX: MODBUS INTERFACE

### 5.1 MODBUS PROTOCOL

**GIA-VAI** 

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)





### **Electronic Valve Controller**

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 (Alx and Dlx\_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	Al1	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	Al6	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	Status/control word
40107	over time)	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


## **Electronic Valve Controller**

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	0	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	



### **Electronic Valve Controller**

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 <u>must</u> 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 <u>at least</u> 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.



### **Electronic Valve Controller**

#### 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 (Alx and Dlx\_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 Aln, 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.

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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. <u>Note</u>: 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	Al1	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



### **Electronic Valve Controller**

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	C	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 Al1. However, it is <u>NOT</u> 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.

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### **Electronic Valve Controller**

To override the value of Al1 initially requires two or three write operations:

- Write the desired value to registers 42001 and 42002 (using <u>either</u> two single-word writes <u>or</u> 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 (Alx and Dlx\_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 Aln, Dln\_C, Dln\_F, AOn, and 0xFFFF for channels Dln, 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.



### **Electronic Valve Controller**

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	Al1	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



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Analog Outputs			
44200	AO1	Status/control word	
44201		Output value	
44202		Read as zeros	
44203	AO2	Status/control word	
44204	C	Output value	
44205		Read as zeros	
44206	AO3	Status/control word	
44207	С	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 Al1 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

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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».



### **Electronic Valve Controller**

### 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+	А
2	0V	V-	В
3	GND	RS-485 GND	С
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"

		M	odbus	1	2/10/	18 10:07
0	TCP/IP	RS485	R5232	Variable Map	0	Quit
	Modbus F	RS485 enabled				
	Line	Speed (baud)	9600	•		
	IEEE Flo	oat word order	MSW:LS	w 🔹		
	Run as M	lodbus master	×			-
Test	Bristol			D22-RES	-CPC	.02E.rdx

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- 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

	Modb	Modbus					
	Device type	eDrive34	T				
	Interface	RS485	<b>v</b>				
	Device ID	1					
	Device Name	СРС					
	Poll interval (sec)	1					
		_					
TestBristol			D22-RES-CPC.02E.rdx				

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





### **Electronic Valve Controller**

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

- Inputs
  - o<name\_of\_device>.FB->Feedbacko<name\_of\_device>.HighAlarm->HighAlarmo<name\_of\_device>.LowAlarm->LowAlarm
- Output
  - o *<name\_of\_device*>.Cmd -> Command

	Configure Inputs	09/10/18 16:13		Configure Outputs	09/10/18 16:13
▲ [AI6]			CPC cmd	100 %	20.00 mA
AI6	-0.02 mA	-4.02 bar	[E34_1.Cmd]	0.0 m 0	
E34_1.FB		30.7 psi	E34_1.Cmd	0.0 mA	
E34_1.HighAlarm] E34_1.HighAlarm		0	WatchDog	1.0 %	
[E34_1.LowAlarm]—					
E34_1.LowAlarm		0			
TestBristol		D22-RES-CPC.02E.rdx	TestBristol		D22-RES-CPC.02E.rdx

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"

	Configura	tion	08/10/18 16:38		15)	e-Drive	34 Calibratio	on		
				0	Connection	Information	Display	Set Range	0	Quit
Flow Reg	Control Curves	LΣ Averagers	(()) !Actions!		Pleas	se select the M e-Drive	lodbus slave -34 to calibr	address of th ate	e	
Retrans Signal Retransmission	eDrive34		•		Set Mod	] C bus slave addi	onnected			
TestBristol		D2	2-RES-CPC.02E.rdx							

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Connection	Information	Display	Set Range	0	Quit	0	Connection	Information	Display	Set Range	0	Quit
Connection Total Averag	Information Serial Num Firmware Vers Last Modifica Number of st working time ( e working time °C/°F Deadband (	Display aber 1511150 sion 04.03 tion 25/09/20 arts 336 (s/h) 1665 e (s) 4 Max 44/111 mA) 0.32	Set Range 0026 018 09:51 °C/°F M	<b>O</b>	Quit /66	72 68 64 60 56 52 48 44 40 32 28 24 20 16	Connection	10 12.5 1	Display	Set Range Setpoin Inpu Outpu	t 12. t 12 t 12 d 0.3	Quit erride 00 mA .00 mA .00 mA .00 psi 2 mA
Connection	e-Drive	34 Calibratio Display	n Set Range	0	Quit	0	Information	e-Drive Display	34 Calibratio Set Range	n Configure	0	Quit
Table US Pilot CRD Range 20-105 Value at 4mA Value at 20mA Turns Change/turn	15.0 psi 75.0 psi 6.54 13.0 psi	Mode St Static Call Curre Turns	ibration ibration nt value s to low poin to high poin		psi - -		Rotation Spee On time Off time Deadband Lost signal mo Keep last po	d 0.0 0.3-30 0.0 0.7-30 0.32 0.1-20 ode esition	The rot time of for con 0 mA	ation speed affect the valve betwee ault setting is 0 s tinuous rotation. ure that the value system to minim ng	ts the re: en setpoi ec on, 0 is are ap ise the p	sponse nts. sec off propriate ossibility
	e-Drive	A Calibratio						o-Drive	34 Calibratio			
Set Range Input Calibratio 4.00 Low 20.00 High 0.9480:11 Calibrate Output Calibrate 4.00 Low 20.00 High 1.0000:0 Calibrate	Configure CPU cou Power-c CR Framin Overrui Buffer ov Buffer ov Brow Soo TOI CMA	Alarms Inters on reset 3 C errors 1 ng erors 3 nerrors rerflows 1 own-out atchdog 3 oft reset 3 P errors X errors	Maintenance Passwor Passwor SN SN SN SN CMAX (C Reset Cl	* * settin ISIII Iram I Iram C I Iurns PU co	Quit * * * 50026 5N 1000 MAX 6,000 unters	Da	Configure Date last over te last calibra Alarms config ionfiguration Counter r	Alarms ride: 08/10/20 stion: 27/09/20 ured: 27/09/20 date: 08/10/20 eset: 06/06/20	Maintenance 118 16:40:35 1 118 23:49:10 1 118 12:37:33 ( 118 08:22:11 1 118 18:08:10 (	History FestBristol FestBristol CEROM-H-DS FestBristol CEROM-H-LAR	<b>C</b> K16_ka	Quit

#### 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.



### **Electronic Valve Controller**

#### 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
. TD
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
```



 $\zeta$  : The "#" character is used to add comment into the 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

L: 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	MI/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	I	3
Volume	6	m3	4
Volume	6	MI	5
Volume	6	UK g	6
No Unit	7		
РН	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



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#### 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.
    - o 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"

		м	lodbus	1	7/10/	18 10:5
0	TCP/IP	RS485	RS232	Variable Map	0	Quit
	Modbus R	S485 enabled	×			
	Line	Speed (baud)	9600	-		
	_					
	IEEE Flo	pat word order	MSW:LS	w <b>-</b>		
	IEEE Flo Run as M	at word order odbus master	MSW:LST			•

- 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



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- 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

	Inputs	17/10/18 12:09
[AI2] CRD FB	6.0 bar	
[AI3] Q	7.0 l/s	
[D22_1.IN] D22_1.IN	7.0 %	
D22_1.0UT]	100.0 %	
D22-Training	D22-	POUT-DRV.01H.rd