CLA-VAL **e-Drive-34**

Motorised Pilots

User Manual

Table of Contents

1 MISCELLANEOUS INFORMATION

1.1 PRECAUTIONS BEFORE STARTING

⚠ Before use, please connect to our webside www.cla-val.ch to:

- Download and install the USB driver on your PC [Refer to the driver USB installation manual (LIN006UE)]
- Download and install the latest version of the product software on your PC

Check that the product has the latest firmware version

1.2 TROUBLESHOOTING

1.2.1 Diagnostic for the LED

At start-up, the LED remains red for 5 seconds, then switches to blinking green.

- **Solid Green**
  - Status OK, USB cable connected on the maintenance port.
- **Blinking Green**
  - Status OK.
- **No light**
  - Check power supply.
- **Red**
  - Firmware update wait for the end of the update.
  - Motor overload (higher than 32 VDC) or detection of too high torque on the driver. Remove the blockage and cut the power supply then restore it. If the problem persists, contact CLA-VAL.
  - Supply voltage lower than 10 VDC, cut power supply and adjust the voltage between 11 and 32 VDC. If the problem persists, contact CLA-VAL.
- **Blinking Red/Green**
  - Calibration was not completed correctly - recalibrate.

1.2.2 Changing a set-point without a command signal *with* an e-Drive - USB cable connected

1- Calibrate your range.
2- Select "**Last position**" in loss of signal mode.
3- Go to "**Display**" tab, select your milliamp value and tick the check box to activate.

1.2.3 Changing a set-point without a command signal *without* an e-Drive - USB cable

- To increase or decrease the actuator, refer to wiring diagram in the user manual.
- To increase actuator connect the purple wire with the pink.
- To decrease actuator connect the turquoise wire with the pink.

Note: If it returns to 4 mA or 20 mA, then the loss of signal mode was not in "**Last position mode**".

1.3 GENERAL DISCLAIMER

In accordance with our policy of continuous development and improvement, CLA-VAL Europe reserves the right to modify or improve these products at any time without prior notice. CLA-VAL Europe 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 batteries and accessories.

1.5 TYPOGRAPHY

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

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

INTRODUCTION

Thank you for purchasing a CLA-VAL e-Drive. We are confident that it will give you complete satisfaction in the use of your valve. With proper maintenance, this e-Drive will allow you to control your valve accurately and reliably for many years to come. The e-Drive incorporates the latest electronic technology and high quality components to provide you with maximum service.

The e-Drive motor for motorised pilots is designed for a setpoint change of 500 actions/day (average of 1 action every 3 minutes) and tested on complete motor/pilot cycles.

The e-Drive motor can be assembled with various CLA-VAL standard hydraulic pilots, giving motorised pilots as follows :

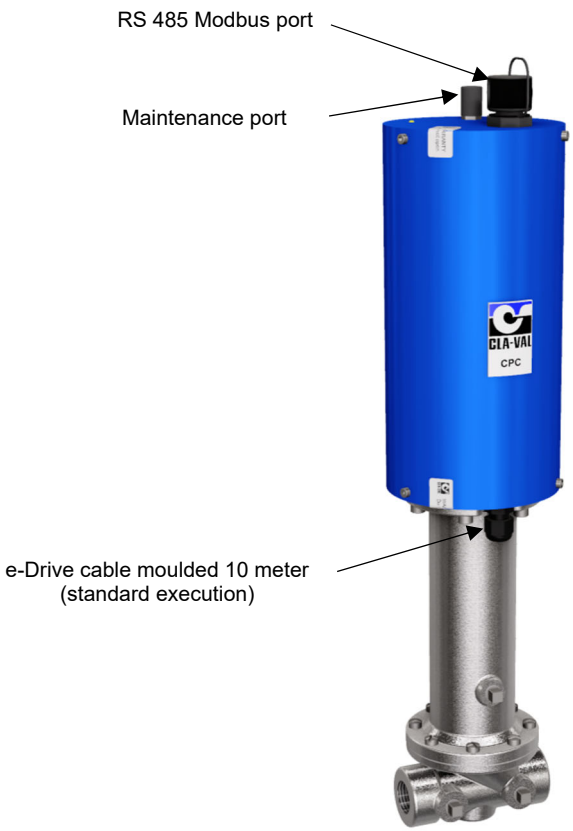
- CRD-34: Downstream Pressure Control Motorised Pilot
- CRL-34: Motorised pilot for upstream pressure control
- CPC-34: Motorisation for positioning valve
- CDHS-34: Motorised pilot for flow control

This document is a manual for the motorised part of each of these drivers.

2 E-DRIVE CHARACTERISTICS

The e-Drive is a 4-20 mA standalone actuated controller which is PC calibrated and able to remotely control any CLA-VAL valve. The pilot setting can be adjusted with a standard 4-20 mA signal and a 4-20 mA position feedback signal is available to cross check if the requested position is reached.

e-Drive with pilot



Câble de maintenance

3 HOW TO USE THE E-DRIVE?

3.1 WIRING CONNECTIONS

Cable		
Code	Function	Colour
0 V	Connect with ground principal	black
+24 VDC	Power supply	red
+4-20 mA	Position Feedback	green
Common -	For position feedback & push button	pink
+4-20 mA-	Set point +	yellow
-4-20 mA	Set point -	grey
Alarm 1	Input low contact relay	brown
Alarm 1	Output low contact relay	blue
Alarm 2	Input high contact relay	orange
Alarm 2	Output high contact relay	white
Manual 1	Decrease position by push button	turquoise
Manual 2	Increase position by push button	purple

3.2 MODBUS CONNECTIONS

Cable		
Code	Function	Wire N°
+24 VDC	Power supply	1
0 V	Connect with ground principal	2
GND	Ground for Modbus controller	3
485A	485A Terminal Modbus controller	4
485B-	485B Terminal Modbus controller	5
Free	Not used, do not connect	6

3.3 E-DRIVE TECHNICAL DATA

	Electrical Specifications
Electrical Power:	• 10 VDC to 30 VDC • 16 rpm nominal speed @ 24 VDC • 8 rpm nominal speed @ 12 VDC 500 mA max. (actuating mode) @ 16 bar 800 mA max. (actuating mode) @ 21 bar 350 mA average nominal 30 mA stand-by (un-actuating mode) CLA-VAL recommended power supply is the e-Power-IP turbine for a completely autonomous system
Power Protection:	Max. 32 VDC overvoltage Max. 1 A couple limitation Polarity inversion & short circuit Automatic shut-down at 80°C internal
Operating diagnostic:	Through diagnostic LED as referenced in the user manual (Green / Red / Blinking)
Electrical connection:	1x 10 meter shielded cable (12 wire) Wire section: 0.22 mm^2 Cable diameter: 6.9 mm 1x 6-pin Souriau connector for Modbus communication 1x 3-pin Lumberg connector for computer connection / maintenance
Control inputs:	• 4-20 mA (2 wires) • 2x dry contact (manual operation) • Modbus RTU 485 Souriau 6-pin connector
4-20 mA input protection:	Max. 32 VDC over voltage Insolation (2 wires) Optocoupler isolation CMR 1000 V (CMR: common mode rejection)
Position feedback:	• 4-20 mA (load impedance ≤ 500 Ω) • 2x programmable alarm position 10-32 VDC / 110-240 VAC at max 1 A
4-20 mA output protection:	Max. 32 VDC over voltage (dry contact input and 4-20 mA output at the same voltage, un isolated to each other)
	Other Specifications
Pressure range:	0 - 10 bar / 16 bar / 25 bar (depending on the associated pilot)
Operating temperature:	-10°C to +80°C (Electronics only)
Environmental Protection:	IP68, validated 1 month at 0.2 bar
Interface:	Plug & Play Modbus RS 485 Optionally CLA-VAL D22 Electronic Valve Controller Graphical software interface compatible with Win 7 (32 & 64 bit)
	Default mode
Control signal loss:	Choice of: Hold last position, or return 4 mA or 20 mA

3.4 INSTALLATION INSTRUCTIONS

1- All installation, adjustment and maintenance should be carried out by a competent electrician.

2- Do not exceed the maximum ratings given in the specifications and printed on the label.

3- The electrical connections should be made as described in the user's manual.

4- Before any maintenance operation the main power should be turned off.

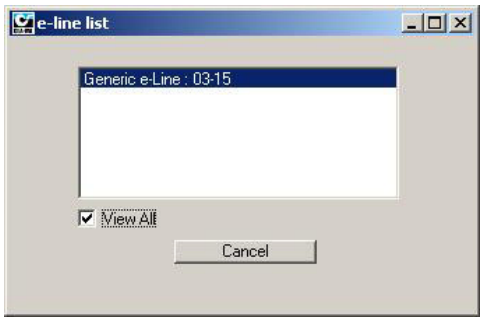
⚠: ***DO NOT ATTEMPT TO OPEN THE PRODUCT AS THIS WILL INVALIDATE THE WARRANTY!***

3.5 CONNEXION PC / E-DRIVE

When launching the e-Drive / CPC Software, if no e-Drive is connected to your PC, the list allowing e-Line product multi-connection is empty (see image below), select "**Cancel**".

If you are connected to one or more e-Drive or other e-Line products, click on "**View All**" and select the product line you wish to connect to.

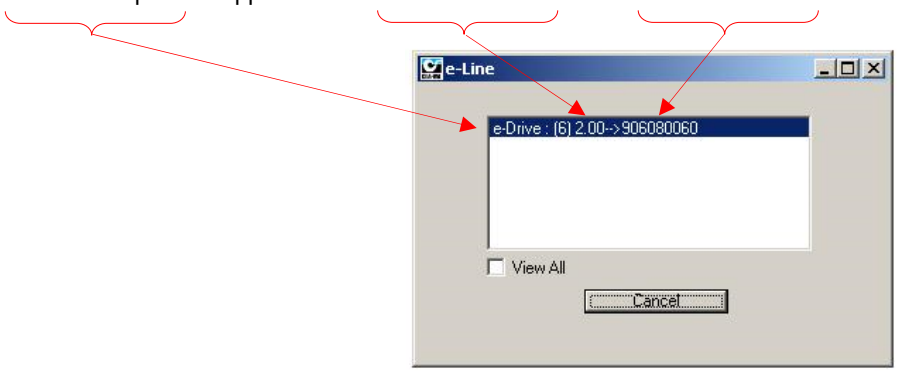
If your e-Line product is not up to date on the multi-connection, the e-Line product list remains empty. Click on "**View All**". The e-Line product is visible under "**Generic e-Line**" (see image below). Select the line to communicate with the e-Line product.
In order to display the name and serial number of the e-Line product in the e-Line List, a firmware update is required (see Chapter 3.6 "Firmware Update [Internal Software]").



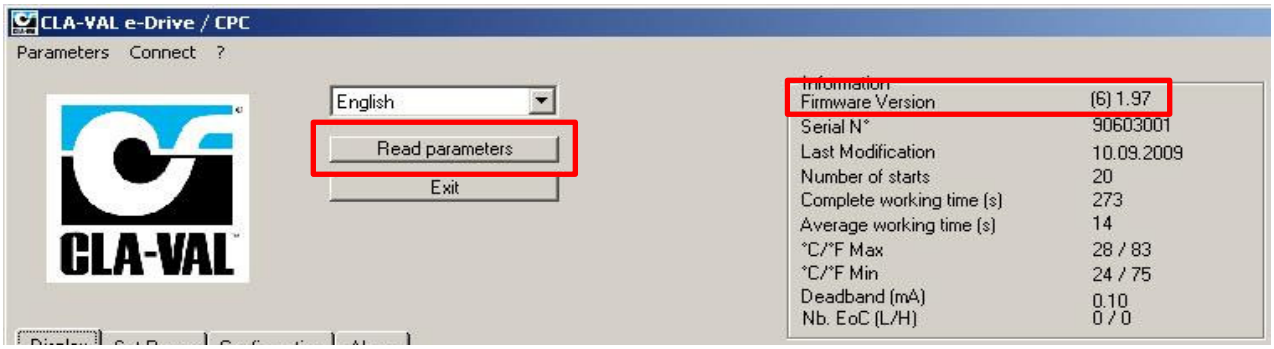
3.6 FIRMWARE UPDATE (INTERNAL SOFTWARE)

1- The e-Drive must be powered.
2- Connect the connection cable to the USB port of your computer.
3- Connect the e-Drive to the connection cable.
4- Open the e-Drive software (latest version).
5- A selection window appears:

The name of the product appears with its Firmware version and serial number.



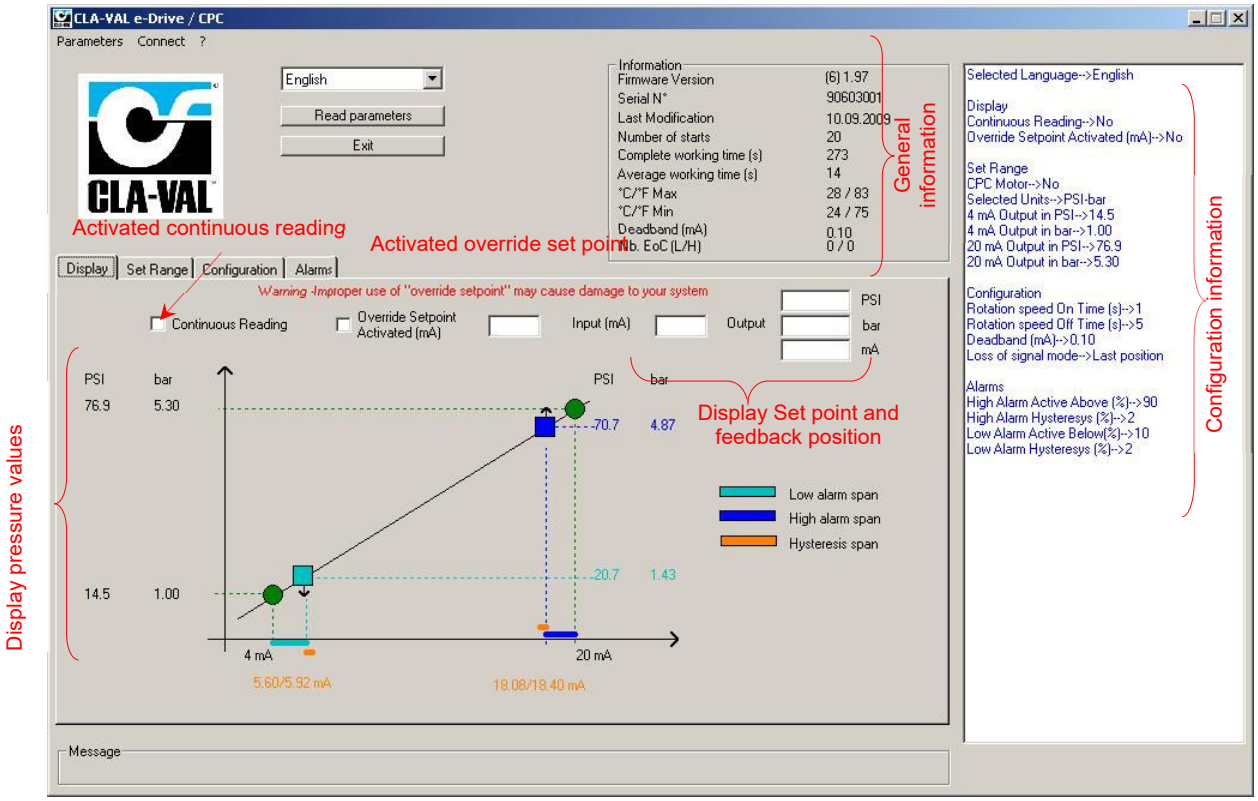
6- Click on the e-Drive line, the software opens.
7- Click on "**Read parameters**": retrieve information about the device and set the output parameters.
8- Check that the e-Drive has the latest firmware version available via our website www.cla-val.ch.



9- If yes, go directly to the next chapter.
10- If no, select "**e-Drive / CPC firmware update**" in the "**Parameters**" tab.
11- Open the corresponding "hex" file, previously downloaded from our website www.cla-val.ch.
12- Then click on "**Read parameters**" in order to view the firmware version update.

4 HOW TO CALIBRATE THE E-DRIVE?

4.1 DISPLAY



Connect your PC to the e-Drive with the USB cable.

1- Start the e-Drive / CPC CLA-VAL software.

2- Selected the e-Drive in the e-Line list.

3- Selected your language and click "**Read parameters**".

4- On the right side the configuration information is displayed. On the top, General Information displays: the date of the latest calibration, the average & total working time since the first power up, number of starts, serial number, Firmware version and the maximum and minimum recorded temperature.

5- Click on continuous reading if you would like to see the position of e-Drive, set point (mA) and feedback position (mA and units).

6- If you would like to manually change the setting, write your setting and click on "**Override Setpoint Activated (mA)**".

⚠ Improper use of "**Override Setpoint Activated (mA)**" may cause damage to your system.

:

a- Display configuration text colour is blue by default. If you amend any parameters, the text colour will change to black. To restore text to blue, select "**Read parameters**".

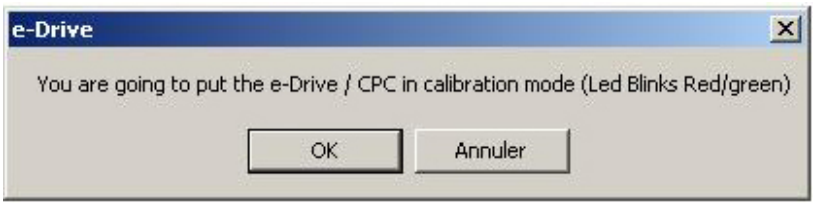
4.2 STATIC CALIBRATION MODE

During this process, ***SYSTEM PRESSURES WILL NOT CHANGE*** (or change slightly depending on the rounded number entered) when entering set-point values in order to complete the process. If you prefer to change the system pressures, use "**Dynamic Calibration**" mode.

The 'Set Range' tab allows either 'Static' or 'Dynamic' calibration.

When you click on "**Set Range**", you will see the message below.

If you would like to continue with calibration, click "**OK**", if not click "**Cancel**".



Determine the pilot spring range. (Check nameplate label on pilot).

Calculate the pressure change per turn of pilot from the spring chart.

Calculate the number of turns between the reference pressure and desired low and high pressures.

1- Select "**Static Calibration**" Mode.

2- Select units.

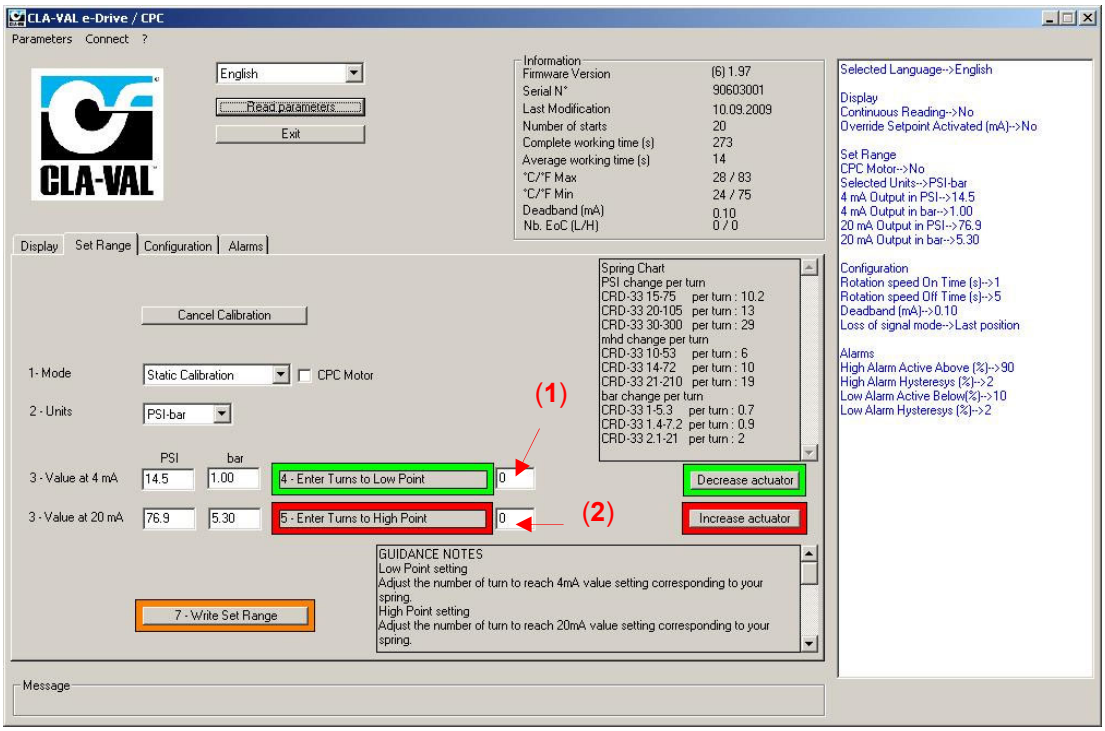
3- Enter these numbers into "**Value at 4 mA**" and to "**Value at 20 mA**" windows. Numbers must be positive and can have up to 2 decimal places.

4- From the values current pressure/flow, enter the number of turns to reach Low pressure/flow set-point (**1**).

5- From the values current pressure/flow, enter the number of turns to reach High pressure/flow set-point (**2**).

6- Click "**Write Set Range**" button to complete actuator setup.

Your e-Drive is calibrated.



Example program:

- Valve is in control operating at 45 psi (3 bar).
- The pressure at 4 mA is 30 psi (2 bar).
- The pressure at 20 mA is 60 psi (4 bar).
- From the spring chart, the pressure per turn is 9.1 psi (0.6 bar).

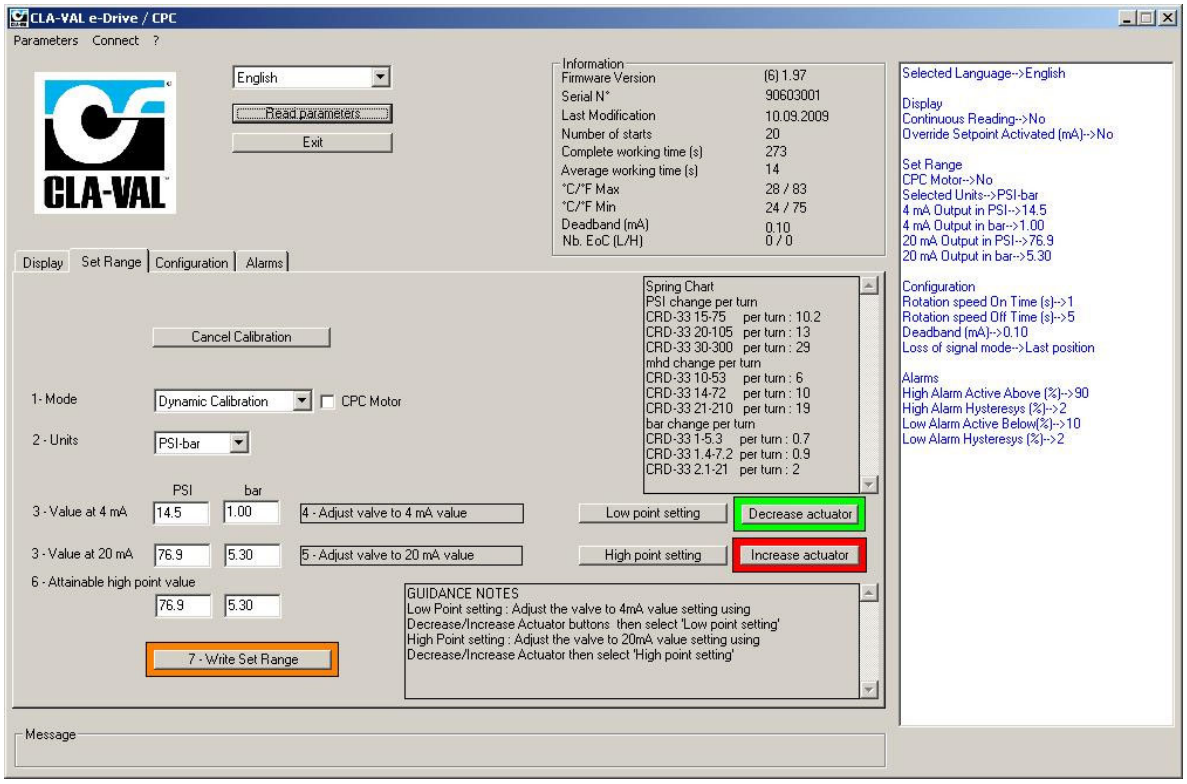
The number of turns to **Low set point** is equal to 45 psi (3 bar) minus 30 psi (2 bar) Divided by 9.1 psi (0.6 bar) = 1.65 turns.

The number of turns to **High set point** is equal to 60 psi (4 bar) minus 45 psi (3 bar) Divided by 9.1 psi (0.6 bar) = 1.65 turns.

4.3 DYNAMIC CALIBRATION MODE

During this process, ***SYSTEM PRESSURES WILL BE CHANGED*** from the minimum to maximum set-point values in order to complete the process. If it is not possible to change system pressures, use "**Static Calibration**" mode.

Now you are in the calibration, please follow the setting:



1- Select "**Dynamic Calibration**" mode.

2- Select Units.

3- Enter the required setting Value at 4 mA point and Value at 20 mA point.

4- "**Low point setting**": Look at the pressure/flow on the gauge/display and use the "**Increase actuator / Decrease actuator**" button to decrease the pressure/flow until it reaches the low pressure/flow point. When the low pressure/flow point is reached, then click on the button "**Low point setting**".

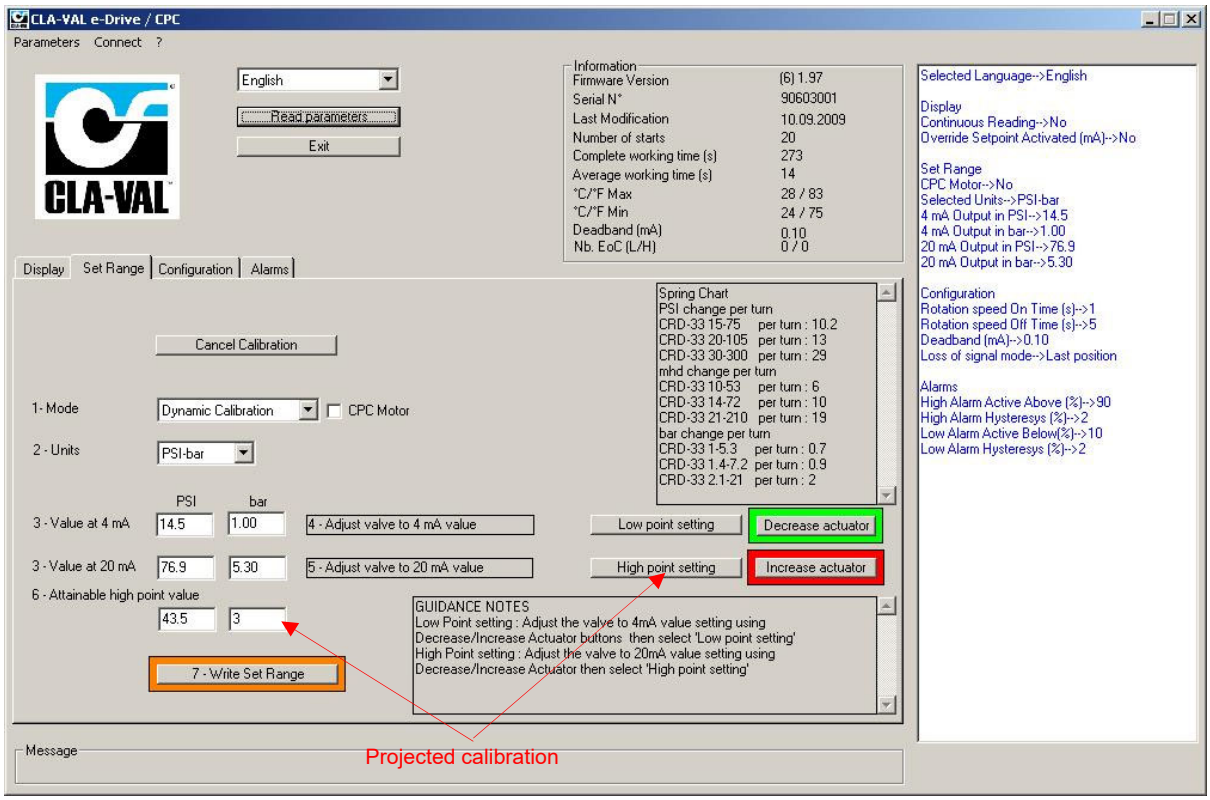
5- "**High point setting**": Look at the pressure/flow on the gauge/display and use the "**Increase actuator / Decrease actuator**" button to increase the pressure/flow until it reaches the high pressure/flow point. When the high pressure/flow point is reached, then click on the button "**High point setting**".

6- When all values have been entered, click on "**Write Set Range**".

Dynamic calibration is done.

4.4 EXTENDED DYNAMIC CALIBRATION MODE: HIGH POINT VALUE

During this process, ***SYSTEM PRESSURES WILL BE CHANGED*** from the minimum to the chosen maximum set-point values in order to complete the process. If it is not possible to change system pressures, use "**Static Calibration**" Mode.



If you cannot physically reach the requested High pressure point, in this situation you have to follow the extended dynamic calibration mode:

1- Select "**Dynamic Calibration**" mode.

2- Select Units.

3- Enter the required setting Value at 4 mA point and Value at 20 mA point.

4- "**Low point setting**". Look at the pressure/flow on the gauge/display and use the "**Increase actuator / Decrease actuator**" button to decrease the pressure/flow until it reaches the low pressure/flow point. When the low pressure/flow point is reached, then click on the button "**Low point setting**".

5- Look at the pressure/flow on the gauge/display and use the "**Increase actuator / Decrease actuator**" button, in order to increase the pressure/flow until it reaches the high pressure/flow point. When the pressure does not increase any more then stop the actuator. Decrease the pressure/flow by a small amount, as soon as you see the gauge/flow changing stop again.

6- "**High point setting**". Enter the indicated value in the projected calibration window "**Attainable high point value**" as described over, then click on "**High point setting**".

7- When all values have been entered, click on "**Write Set Range**".

Extended calibration is done.

4.5 CONFIGURATION

The configuration tab sets the ***rotation speed*** and the ***deadband***.

- **Rotation speed** affects the response time of the valve between set-points. The default condition is 1 second on-time, 5 seconds off-time achieving at rotation speed of 2 rpm.

⚠ Make sure that the values entered are appropriate to your system to minimise potential for surge.

Entering a '0' (zero) ON-TIME and '0' (zero) OFF -TIME will achieve a continuous rotation speed of 16 rpm at 24 VDC (The maximum speed).

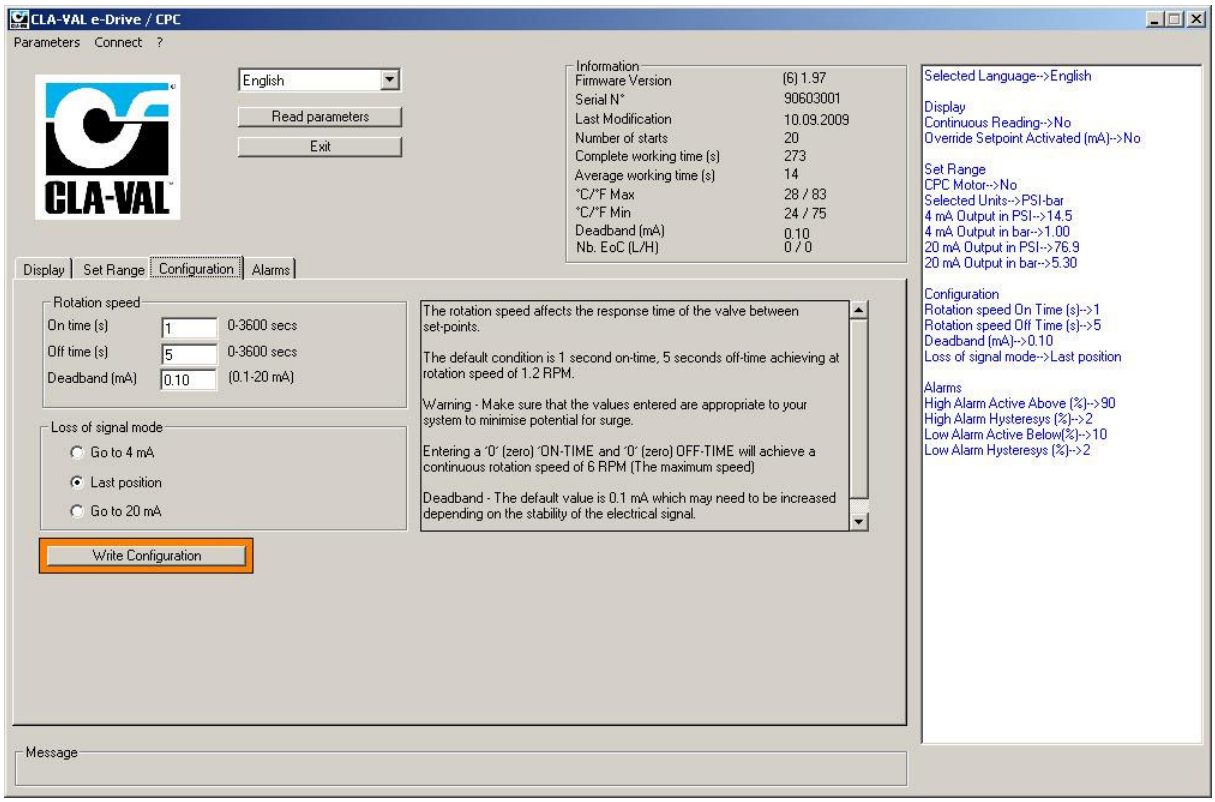
- **Deadband:** The default value is 0.2 mA which may need to be increased depending on the stability of the electrical signal.

Choose the loss of signal mode:

- **Go to 4 mA:** e-Drive will default to the 4 mA position (low set point).
- **Last position:** e-Drive will maintain the last position.
- **Go to 20 mA:** e-Drive will default to the 20 mA position (high set point).

Note: Loss of signal can occur on the SCADA system which generates the 4-20 mA command but at the same time the e-Drive can stay powered, so it is important to select the right option.

When you have finished your configuration, click on "**Write Configuration**".
Your e-Drive is configured.



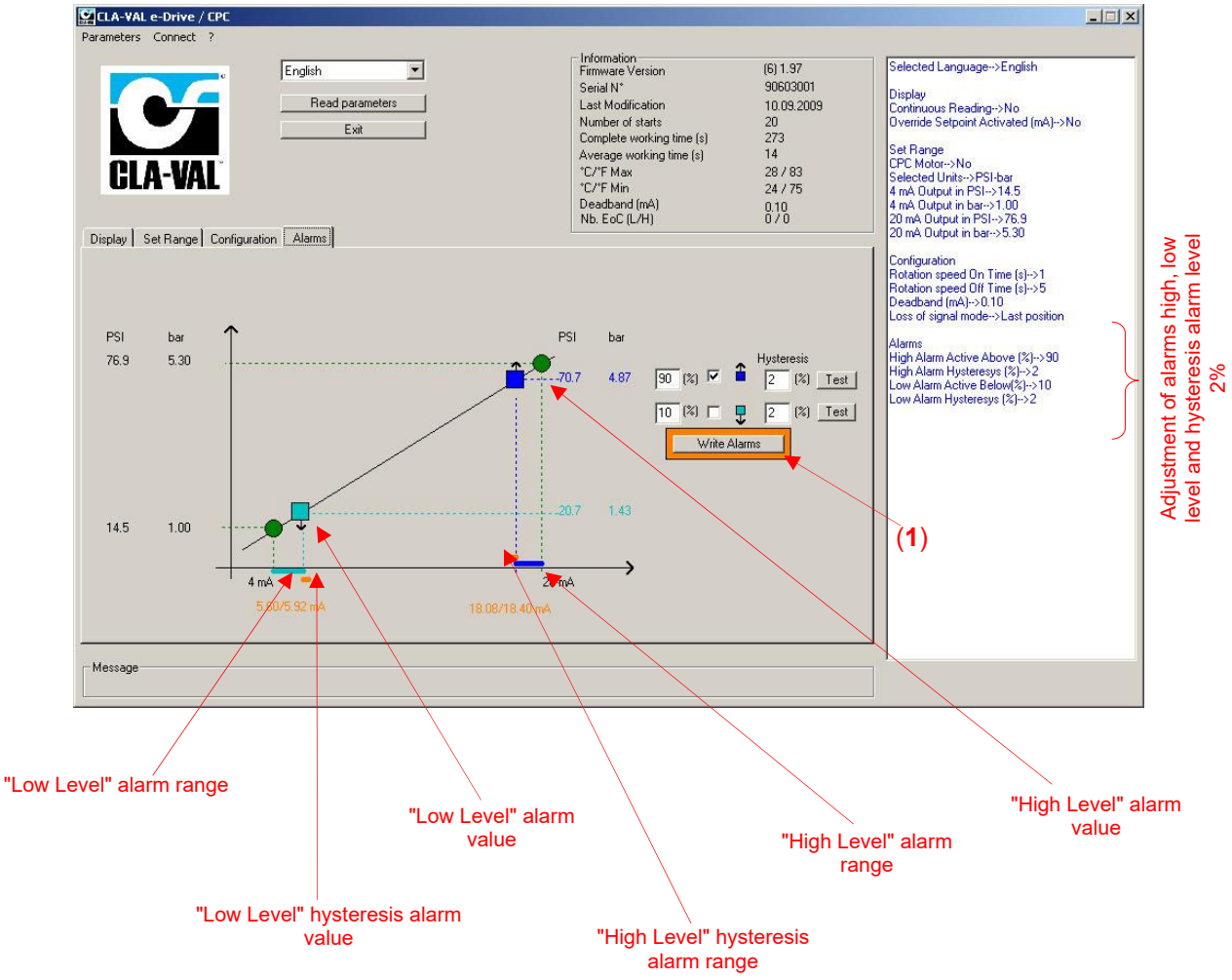
4.6 ALARMS

The e-Drive incorporates a ***LOW*** and ***HIGH*** Alarm with an adjustable hysteresis.
Note: The ***LOW*** and ***HIGH*** alarm levels are activated within the range:

- **Example:**
  - 10% low alarm = 4 + (10% x 16) = 5.6 mA
  - 90% High alarm = 4 + (90% x 16) = 18.4 mA

- **Hysteresis:**
  - The calculation is: 4 + (2% x 16) = 0.32 mA
  - Low alarm hysteresis in this example = 5.6 mA + 0.32 mA = 5.92 mA
  - High alarm hysteresis in this example = 18.4 mA - 0.32 mA = 18.08 mA

1- Enter the requested percentage, for the alarms and hysteresis.
2- Click on "**Test**" to close or open your contact relay.
3- Click on "**Write Alarms**" (**1**) once your alarm settings are correct.



5 APPENDIX : MODBUS INTERFACE

5.1 MODBUS PROTOCOL

The e-Drive supports Modbus RS-485 protocol only in slave mode.

The Modbus RS-485 protocol requires the unit identification UID (Modbus address, 1-255) and baudrate.

Connection parameters: 9600 baud, 8 bits, no parity, 1 bit stop.

5.2 STANDARD MODBUS INTERFACE

All data accessible via Modbus requests are mapped into the “Holding Register” address space (40000 to 40030). The supported commands are:

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

These registers contain 16-bit signed integers (one register) with the exception of registers [10 / 11], [12 / 13], [14 / 15] which are 32-bit signed integers (2 registers), the most significant number being the first address.

For example, for the number of starts information, located in registers [10/11], the most significant number is in [10], and the least significant number is in [11].

The values of the registers can be multiplied by given factor, according to the required precision. See the detail for each register in the register table (see chapter 5.3 «Register Table»).

For example, the 4-20 mA input (register [23]) is expressed in mA*10, and a value of ***4 mA*** will be read ***40*** in Modbus.

Overriding the input (register [23]) is carried out according to the following sequence:

- Write in [23] of the desired value
- Write in [24] of a value equal to 1

The input override is inactive as soon as the value 0 is written in [24].

5.3 REGISTER TABLE

Registers 10/11, 12/13, 14/15 (highlighted blue in the table) are 32-bit signed integers, with the first register as most significant number.

	REGISTER VARS LIST	
REGISTER ADDRESS (40000)	CONTENT	Mode
0	Version/build	Read
1	Product Name	Read
2	Product Type	Read
3	Serial Number	Read
4	Serial Number	Read
5	Last Modification Day	Read
6	Last Modification Month	Read
7	Last Modification Year	Read
8	Last Modification Hours	Read
9	Last Modification Minutes	Read
10	Numbers of starts msb	Read
11	Numbers of starts lsb	Read
12	Complete working time (**s**) msb	Read
13	Complete working time (**s**) lsb	Read
14	Average working time (**s**) msb	Read
15	Average working time (**s**) lsb	Read
16	Temperature min (°**C*10**)	Read
17	Temperature max (°**C*10**)	Read
18	Temperature min (°**F*10**)	Read
19	Temperature max (°**F*10**)	Read
20	Deadband (**mA*100**)	Read / Write
21	Voltage Level (**V*100**)	Read
22	Instant. Consumption current Motor (**mA*100**)	Read
23	Input (**mA*10**)	Read / Write
24	Override Input (**0/1**)	Read / Write
25	Output (**mA*10**)	Read
26	Relay Low Alarm (**0/1**)	Read / Write
27	Relay High Alarm (**0/1**)	Read / Write
28	Open cmd (**0/1**)	Read
29	Close cmd (**0/1**)	Read

6 SOME TIPS

a. After calibration if you want to change the pilot position, use the "**Override setpoint**" option.

b. To generate a calibration report, select "**Parameters**" and then "**Report**".

- Enter a reference number.
- Click on "**Report**".

The Software will automatically generate a TXT report file (C:\Program Files\CLA-VAL\e-Drive Setup) including all the calibration settings.