USER MANUAL

EPP2000 - Intelligent Positioner Control Unit

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1 General

Software revision level at the time, when this document was printed:

Ver. 2.05

Hardware revision level at the time, when this document was printed:

Rev. 6

1.1 Safety instructions

For a safe installation of a positioner, the following must be observed. The module must only be installed by qualified personnel who are familiar with the national and international laws, directives and standards that apply to this product as well as all instructions in this manual.

The information in this user manual is subject to changes without notice.

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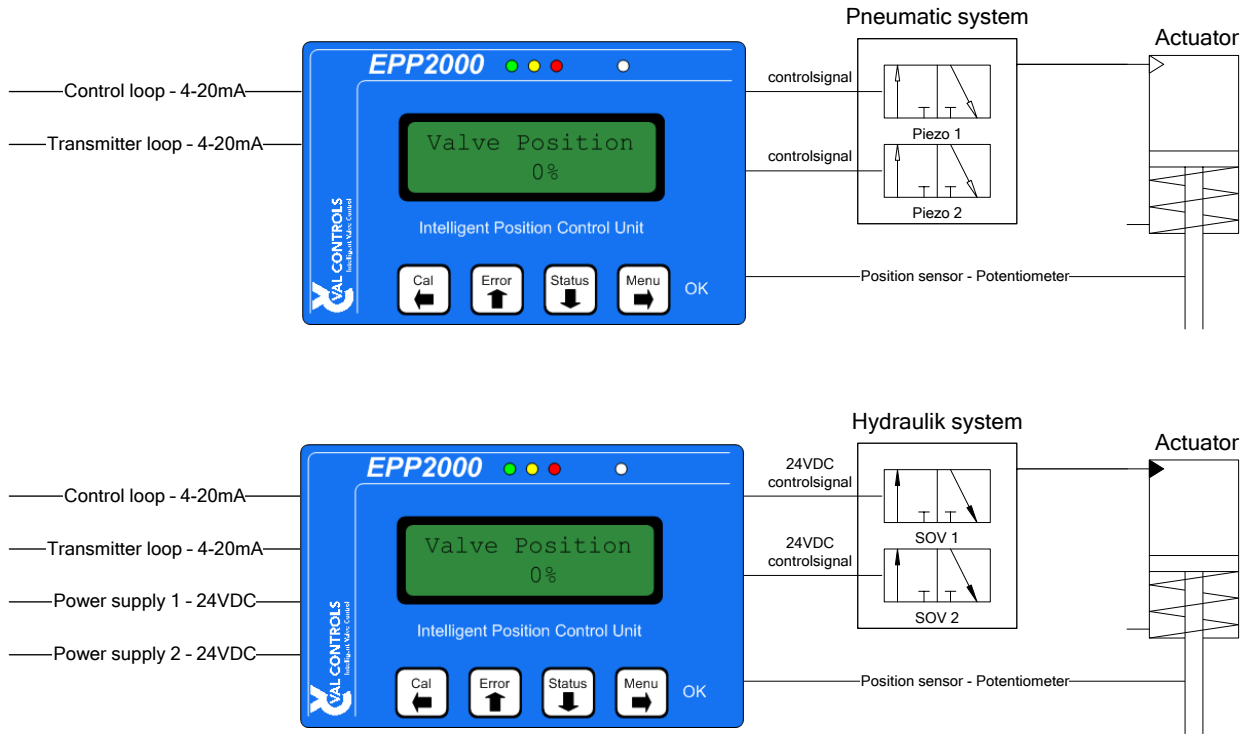
2 Application

Val Controls intelligent hydraulic positioner controls almost all hydraulic and pneumatic, linear, rotary, single-return (SR) and double-acting (DA) actuators on the market.
Its compact design, with few moving parts, makes it very reliable. The flexible software calibrates automatically, it contains intern safety surveillance together with several standard flow curves. A special flow curve is defined very simple, and the positioner's set point and deadband can be adjusted from the user menu.

The positioner works by comparing the control loop signal with the position feedback, it then uses control valve signals to operate the actuator/valve to the desired position. The control loop and the transmitter loop signal is a 4-20mA signal.

The EPP2000 can control either two piezo valves or two 24VDC IS solenoid valves depending on the attached driver module.



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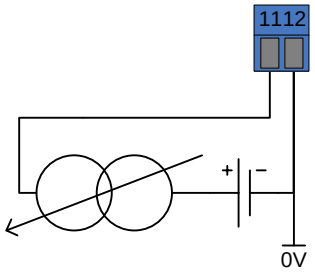
3 Electrical specifications and terminals

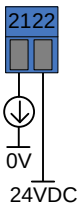
3.1 Control loop

The positioner needs a 4-20mA signal from the control room.



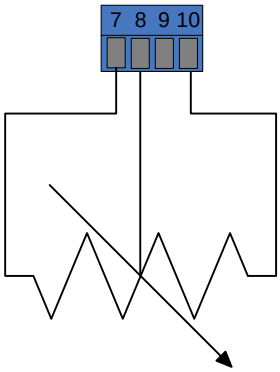
3.2 Transmitter

The positioner can send a 4-20mA transmitter signal to the control room. This signal is a repeated signal of the position sensor.



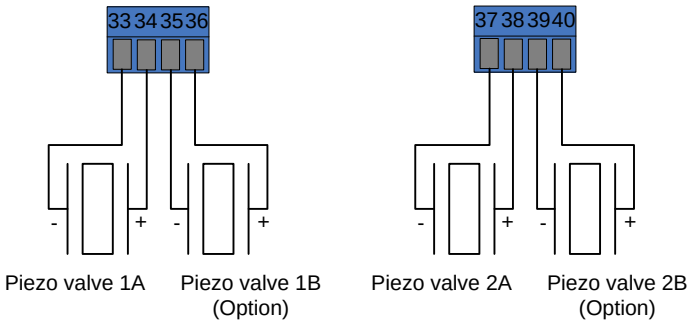
3.3 Position sensor

The position feedback can be delivered from a 3-wire potentiometer.



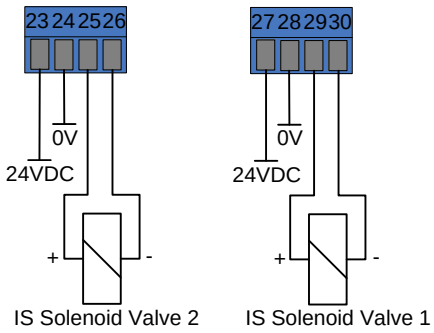
3.4 Piezo Valve 1-2 (Configuration 8)

The positioner has 2 output to control 2 piezo valves, 1A and 2A. As an option has the positioner outputs with the inverse signal of port 1A and 2A these are port 1B and 2B.



3.5 Solenoid Valve 1-2 (Configuration 3)

The positioner has 2 output to control 2 solenoid valves.



3.6 Terminals

See the chart below to see how to connect to the terminals on the positioner.

Control loop	**Piezo Valve 1 (Configuration 8)**
11. Control loop (+) 12. Control loop (-)	33. Valve 1A (-) 34. Valve 1A (+) 35. Valve 1B (-) 36. Valve 1B (+)
Transmitter	**Piezo Valve 2 (Configuration 8)**
22. Transmitter loop (-) 23. Transmitter loop (+)	37. Valve 2A (-) 38. Valve 2A (+) 39. Valve 2B (-) 40. Valve 2B (+)
Position sensor	**Solenoid Valve 2 (Configuration 3)**
7. Position sensor – High 8. Position sensor – Wiper 9. Not Used 10. Position sensor – Low	23. Supply 24 VDC 24. Supply 0 VDC 25. Valve 2 (+) 26. Valve 2 (-)
	Solenoid Valve 1 (Configuration 3)
	27. Supply 24 VDC 28. Supply 0 VDC 29. Valve 1 (+) 30. Valve 1 (-)

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3.7 Electrical specifications

Control loop	
Power supply	11.5 – 30VDC
Resistance	< 550 ohm @20mA and 11VDC
Linearity	< 0.1%
Transmitter loop	
Power supply	5 – 30VDC
Resistance	< 250 ohm @20mA and 5VDC
Linearity	< 0.1%
Galvanic isolated	
Position sensor	
Potentiometer size	4.5 Kohm to 100 Kohm
Cable length	1.5 meters
Linearity	Depends on potentiometer
Piezo Valve 1-2 (Configuration 8)	
Valve	2 piezo valves
IS Solenoid Valve 1-2 (Configuration 3)	
Max input voltage	25V
Typical output voltage	24V
Max current	Depends on selected ATEX safety barrier

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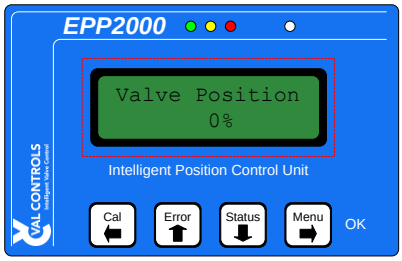
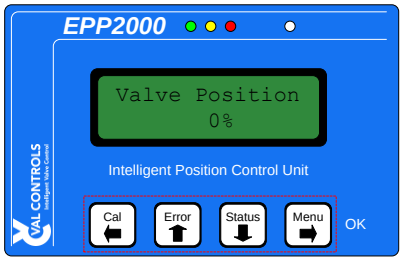
4 User interface

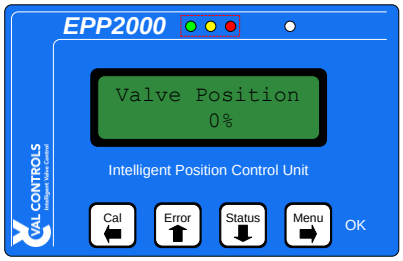
To control and monitor the positioner, it is fitted with a display, four buttons and three indicators.



Display



Keyboard



Indicator

4.1.1 Display

The display is a two lined display.

4.1.2 Keyboard

The keyboard has four buttons, which has the following functions.

Button	Menu	Menu navigation	Confirmation
←	Calibrate	Back	
↑	Error	Up	
↓	Status	Down	
→	Menu	Forward	OK

4.1.3 Indicator

The indicator lights will work as follow:

- Red indicator: Flashes when an error has occurred in the positioner
- Yellow indicator: Flashes when positioner is saving to memory

5 Menus

The positioner has four menus. All menus can be directly activated by pressing one of the four buttons.

- Calibrate ←, you will enter the calibrate menu
- Error ↑, you will enter the error menu
- Status ↓, you will enter the status menu
- Menu →, you will enter the main menu

5.1 Calibrate

The positioner can be calibrated using two calibration menus.

Calibrate	Description
1 Automatic	Start the sequence to automatic calibration
2 Manual	Start the sequence to manual calibration

5.1.1 Automatic

The automatic calibration is an automated calibration that will find the necessary information to optimize the performance of the system. The calibration can take from 90 sec. up to 1000 sec. The minimum requirement for the travel time of the actuator is 10 sec.

The calibration consists of the following eight steps.

	Description
Step 1	Measure noise
Step 2	Finding 1st end
Step 3	Finding 2nd end
Step 4	Hold test
Step 5	Find break distance and time near 100%
Step 6	Find pulse ON time near 100%
Step 7	Find break distance and time near 0%
Step 8	Find pulse ON time near 0%

5.1.2 Manual

In the manual calibration you can manually set the end points of the travel. After manually setting the end points, the positioner will ask if it has to find more information regarding your system to optimize the performance - this is recommended.

5.2 Error

The valve positioner will write an error message in the display when an error occurs. The positioner will despite the error message continue to regulate according to the control signal given. To see a chart over the error messages please see section 6.

Error	Description
Error explanation	Detalied explanation of the current highest priority

5.3 Status

If the user want to get a live status on the control parameters or a general view over the chosen configuration parameters, it is possible by pressing the "↓" key while the positioner is in regulation mode. The regulation of the valve will not be influenced.

Status	Description
1 Live status	Show updated values
SP - Flow	% value of the control loop - Flow
PV - Flow	% value of the position loop/sensor - Flow
TM - Flow	% value of the transmitter loop - Flow
SP - Travel	% value of the control loop - Travel
PV - Travel	% value of the position loop/sensor - Travel
SP - mA	mA value of the control loop from control room
TM - mA	mA value of the transmitter loop to control room
CntV1	Puls counter for valve 1
CntV2	Puls counter for valve 2
2 Identification	Values to identify the product
Manu	Manufacture
SW ver.	Software version
Type	Product type
PCB	Printed circuit board unique number
3 Basic Parameters	Show values in the basic menu
Deadband	The value of the deadband
Flowcurve	Which flow curve in use
Valve action	Valve action
TM action	Transmitter action
TM alarm pos	Which alarm position the transmitter will go to
Hold at open - Status	Whether function is on or off
Hold at open - Time	Time to wait while at open
Hold at close - Status	Whether function is on or off
Hold at close - Time	Time to wait while at close
Position	The direction of the position shown on the front page
4 Advanced Parameters	Show values in the advanced menu
Hysteresis	The value of the hysteresis
Pulse Open	The distance before the SP where IPCU starts pulsing
Pulse Close	The distance before the SP where IPCU starts pulsing
Open on-time	Regulating open on-time
Open off-time	Regulating open off-time
Close on-time	Regulating close on-time
Close off-time	Regulating close off-time
Valve - Open	Valve configuration for open position
Valve - Close	Valve configuration for close position
Valve - Stay-put	Valve configuration for stay-put position
Linear Correction	Status of the linear correction function
Noise	The noise meassured on the pot
Sensor 1st end	The ADC value of the potentiometer at the 1st end
Sensor 2nd end	The ADC value of the potentiometer at the 2nd end

5.4 Menu

In the menu you can choose two submenus, basic and advanced. In the basic menu you can change some basic control parameters. These changes can be made will the positioner is still in service. In the advanced menu you can change some more advanced parameters. These changes will change how the positioner is working and the positioner will stop regulating while changing settings in this menu.

All changes in both menus will not have effect before the user leaves the menu and confirms the changes.

Menu	Description
1. Basic	Basic control settings
2. Advanced	Advanced control settings

5.4.1 Basic menu

Basic menu structure.

Basic	Default	Values	Reset	Description
1 Deadband	1.0	0.5 - 10.0	X	Acceptable deviation from setpoint in percentage
2 Flow curve				Choice of flow curve
1 Linear	√		X	Linear flow curve
2 Equal pct. 50:1				Equal percentage 50:1 flow curve
3 Custom				Custom flow curve
3 Valve action				Valve action
1 Direct	√		X	Valve opens with increasing set point value
2 Reverse				Valve closes with increasing set point value
4 Regulator functions				Special function on how the positioner works
1 End settings				Settings when the set point signal is 0% or 100%
1 Hold at open				Function at 100%
1 Status	Off	On/off	X	Timer starts at 100%
2 Time	5	0 - 30	X	Time before positioner goes to stay-put
2 Hold at close				Function at 0%
1 Status	Off	On/off	X	Timer starts at 0%
2 Time	5	0 - 30	X	Time before positioner goes to stay-put
5 Transmitter				Transmitter settings
1 Transmitter action				Transmitter action
1 Direct	√		X	0% flow = 4mA
2 Reverse				0% flow = 20mA
2 Transmitter alarm position				Transmitter alarm
1 3.5 mA	√		X	In case of alarm the transmitter will be 3,5mA
2 21.5 mA				In case of alarm the transmitter will be 21,5mA
6 Display				Settings for the display and readout of values
1 Position				The valve position shown on the frontpage
1 Direct	√		X	Direct position
2 Reverse				Reverse position

Deadband

The deadband can be manual altered from the user menu. The standard adjustment is 1% but this value can be changed from 0.5 to 10 %.
Note: The deadband is on the position of the valve - not the flow!

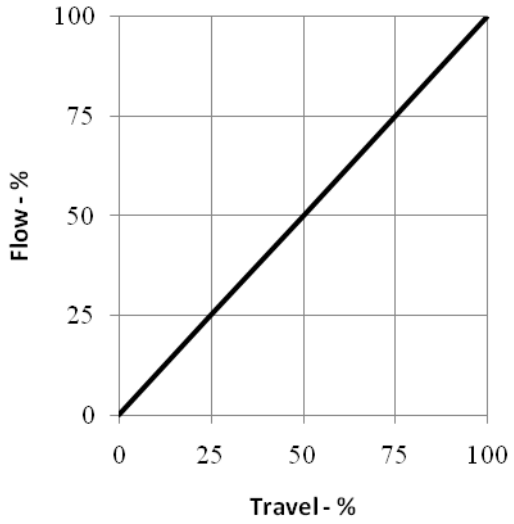
If the deadband is set to e.g. 5% the valve positioner will regulate in on a set point with an accuracy of +/- 5 % and stay there until the position feedback is bigger than 5 %.

Flow curve

The valve characteristic expresses the flow percent through a valve at different opening angles. To obtain an accurate regulation of the flow media it is important to choose a valve characteristic that is identical with the one for the valve used.

Linear valve characteristic

The flow through the valve is proportional with the travel of the valve. The linear valve-characteristic can be chosen from the users menu.



Equal Percentage 50:1

The flow through the valve rises in the last part of the curve. The equal percentage valve characteristic can be chosen from the users menu.

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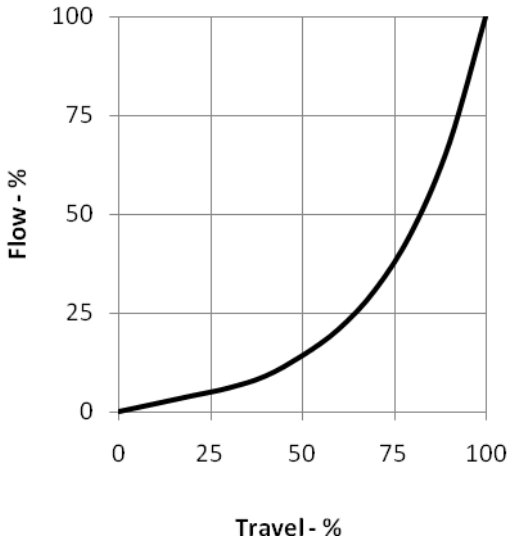

Custom curve

The positioner offers the user to define his own valve characteristic from the keyboard. This option makes it possible to use a wide range of valves and still be able to obtain an accurate regulation. The positioner needs 11 reference points to linearize an arbitrary valve characteristic. Point 0 and point 10 can not be entered as they must be (0%,0%) and (100%,100%).

Point	Travel %	Flow %
0	0	0
1	66	0
2	72	16
3	78	33
4	83	50
5	89	66
6	94	83
7	100	100
8	100	100
9	100	100
10	100	100

When the points describing the flow curve are keyed in, the valve positioner will linearize the flow curve.

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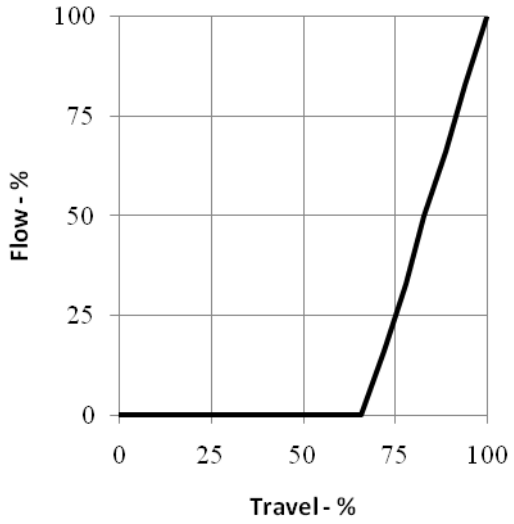


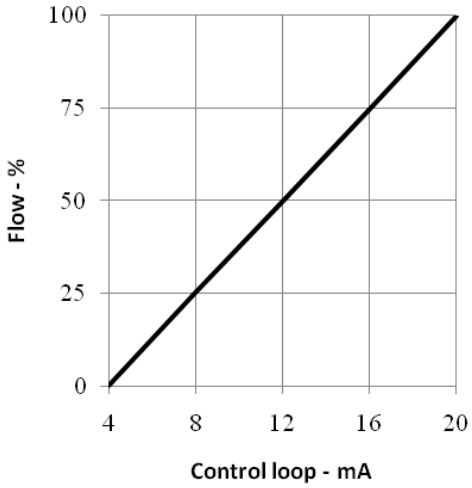
Valve action

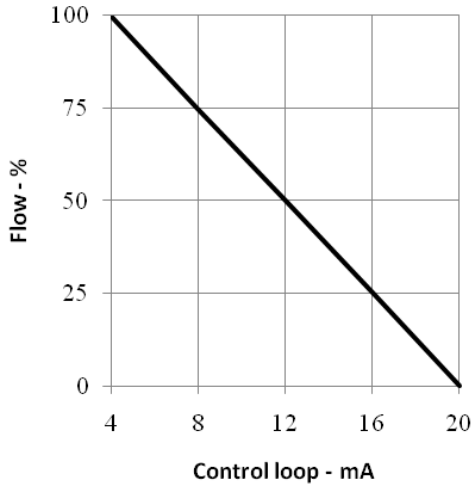
Menu to select the Control Loop to be Direct or Reverse.

- Direct : Valve opens with increasing set point value
- Reverse : Valve closes with increasing set point value

Display

Set the direction of the position shown on the front page.





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Regulator

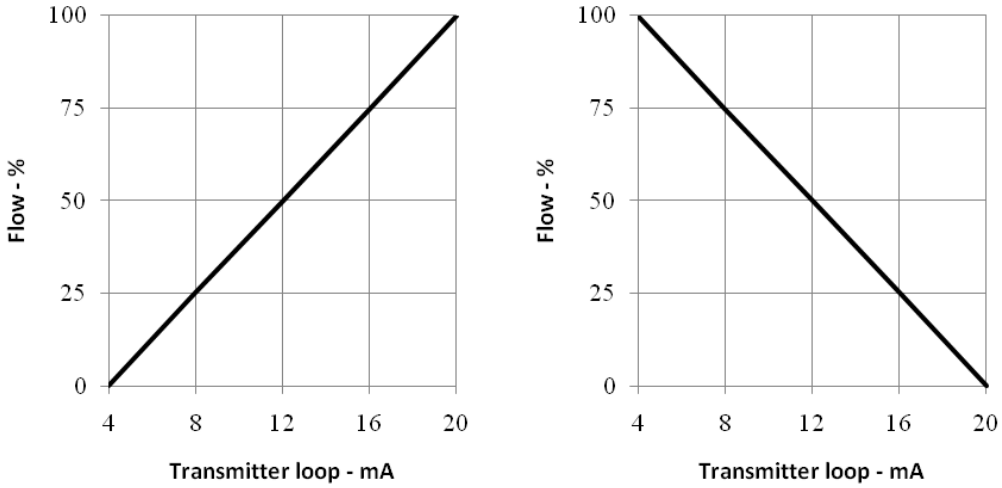
Menu to set whether the regulator should keep opening or closing at 0% and 100% End settings

- Hold at Open:
  - Status:
    - Off: Never hold
    - On: Hold after the number of seconds specified in the next menu
  - Time: 0-30 sec. Do not have any effect if Status is Off
- Hold at Close:
  - Status:
    - Off: Never hold
    - On: Hold after the number of seconds specified in the next menu
  - Time: 0-30 sec. Do not have any effect if Status is Off

Transmitter

Menu to select the Transmitter Loop to be Direct or Reverse.

- Direct : 0% flow = 4mA
- Reverse : 0% flow = 20mA



The transmitter will go into an error position when regulator is not active, e.g. during calibration and manual control. It is possible to choose the two positions:

- 3.5mA +/- 0.2mA
- 21.5mA +/- 0.2mA

Display

Menu to set the settings regarding the display.

Position

The readout of the valve position on the front page can be reversed, that is 0% → 100% and 100% → 0%

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5.4.2 Advanced menu

Advanced menu	Default	Value	Reset	Description
1 Manual Control				Manual control of positioner.
1 Control valves				Manual control of individual control valves
2 Setpoint				Manual control of set point
3 Actuator				Manual control of control valve
4 Actuator pulse				Manual control of control valve using pulse only
2 Signal Calibration				Calibration of signals to control room
1 Control loop				Calibration of 4-20 mA control signal
2 Transmitter loop				Calibration of 4-20 mA transmitter signal
3 Configuration				Configuration of in- and outputs
1 Valve function				Configuration of valve control
1 Open				Menu to select valve position to open actuator
2 Close				Menu to select valve position to close actuator
3 Stay-put				Menu to select valve position to keep current actuator position
2 Linear Correction				Configuration and calibration of the linear correction
1 Status			X	Turn the linear correction on and off
2 Calibration			X	Calibrate at 25%, 50% and 75%
4 Control Parameters				Control parameters for the regulator
1 Close on-time	100	5 - 1500	X	
2 Close off-time	100	5 - 1500	X	
3 Open on-time	100	5 - 1500	X	
4 Open off-time	100	5 - 1500	X	
5 Hysteresis	0.5%	0.3 - 10.0	X	
6 Pulse Close	2%	0.0 - 10.0	X	
7 Pulse Open	2%	0.0 - 10.0	X	
8 Position ADC 1st end		0 - 1023	X	
9 Position ADC 2nd end		0 - 1023	X	
5 Reset				Resetting of positioner
1 Factory reset				Resets all marked with X

Manual control

In manual control it is possible to control the positioner manually. It is possible to control the valves individually, control the set point manually and control the actuator with open and close.

Signal calibration

In this menu you can calibrate the control loop and the transmitter loop.

Configuration

In configuration the user can change how the valves operate during open, close and stay-put. It is also possible to choose the desired position feedback.

Linear Correction: Linear correction will allow you to calibrate the positions of the actuator at 25%, 50% and 75% to remove the deviation which may occur due to the use of a linear actuator. Use the up and down arrows to move the actuator.

Make sure that the linear correction is calibrated when setting the status to On.

Control parameters

This menu shall only be used by Val Controls certified personal. For more information please contact Val Controls

Reset

In this menu it is possible to reset the positioner back to standard setting.

Factory reset: Reset the parameters marked with X.

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6 Error no.

6.1 Mounting and settings

No. 101	**Solenoids/Piezo are not configured**
Description	The solenoids/piezo has not been configured in the menu
Trouble shooting	Configure the solenoid/piezo in the advanced menu (3.1)

No. 102	**Potentiometer is not connected**
Description	The potentiometer has been selected as the position feedback signal, but there is not connected a potentiometer to the positioner.
Trouble shooting	Connect a potentiometer to the positioner

No. 105	**Control loop is not calibrated**
Description	The control loop is not calibrated
Trouble shooting	Calibrate the control loop from the advanced menu (2.1)

No. 106	**Transmitter loop is not calibrated**
Description	The transmitter loop is not calibrated
Trouble shooting	Calibrate the transmitter loop from the advanced menu (2.2)

No. 107	**Linear Correction, wrong order**
Description	The order of the calibration points was wrong.
Trouble shooting	Do the Linear correction calibration over again and this time switch the positions of 25% and 75%

6.2 Calibration

No. 201	Not Calibrated!
Description	The positioner is not calibrated
Trouble shooting	Calibrate the positioner

No. 202	Calibrated w. error. Using old values!
Description	The last calibration failed and the positioner is using the parameters from the previous calibration.
Trouble shooting	Investigate the Error log to find the reason to why the calibration failed.

No. 203	Too few ADC points
Description	The measured travel is not large enough
Trouble shooting	Increase the travel. Notice that the allowed operation-angle is between 50-60 degrees for a linear actuator.

No. 204	No movement or too large actuator
Description	The positioner has not detected any movement
Trouble shooting	Movement is confirmed visually: • The actuator is very slow moving. Use manual calibration without auto tuning • Check that the position feedback is connected correct No movement: • Check that the solenoids are configured correct • Check the hydraulic system

No. 205	Travel time too long. Actuator is too big
Description	The travel time is larger than 120 sec
Trouble shooting	Use manual calibration

No. 206	Sensor signal is too noisy
Description	The sensor signal is too noisy, even if the deadband has been set to 10%
Trouble shooting	• Improve signal quality • Increase the travel. Notice that the allowed operation-angle is between 50-60 degrees for a linear actuator.

No. 207	Calibration timeout
Description	A timeout occurred during the calibration
Trouble shooting	The travel time is too short.

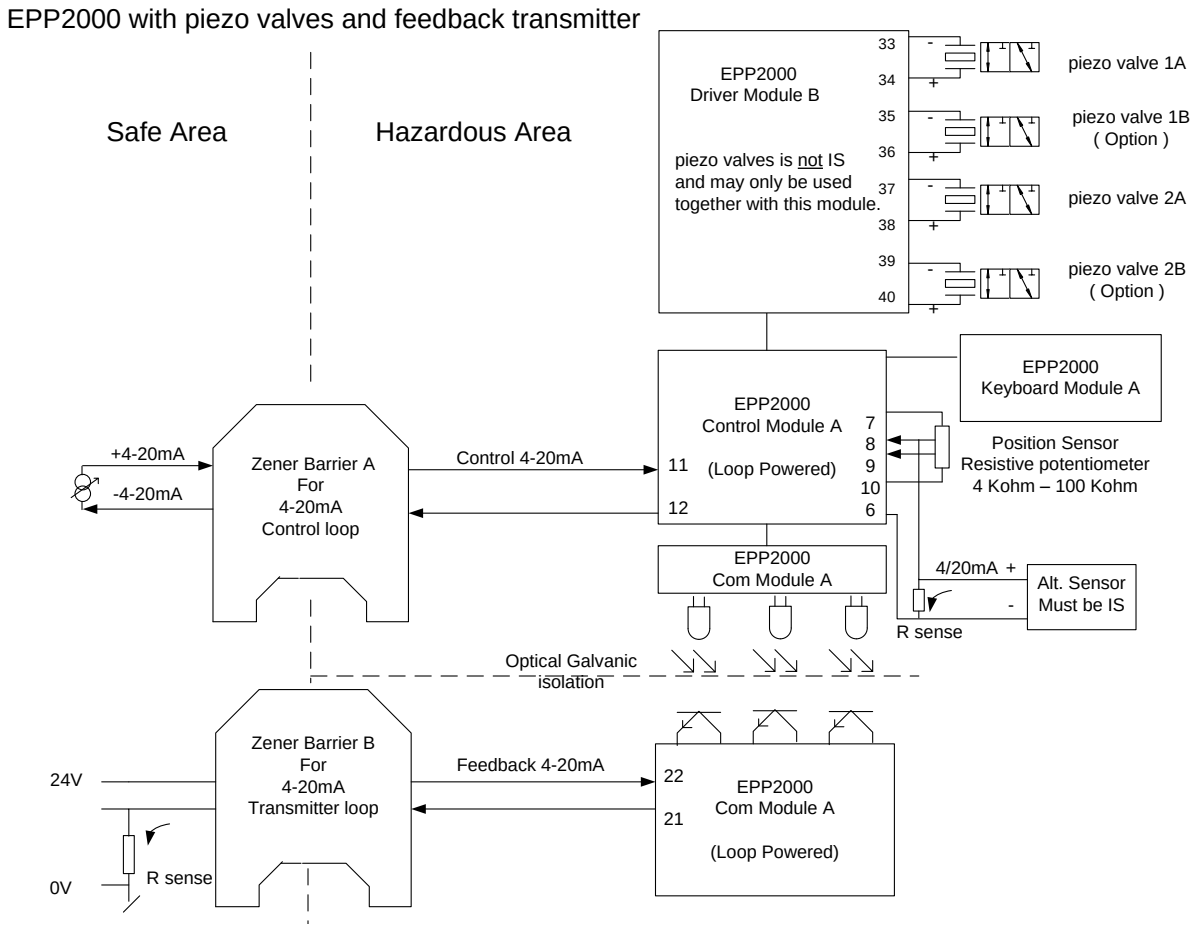
No. 208	Hold test failed
Description	The positioner is not able to hold the actuator at a 50%
Trouble shooting	• Check solenoid settings • Check for leakages in the hydraulic system

6.3 Internal errors

No. 9xx	Internal Error contact support
Description	An internal error has occurred
Trouble shooting	Contact Val Controls A/S and give the following information: • Product type • Software version • Error number • How did the error occur

7 Basic circuit diagram (Configuration 8)

The following block diagram shows the EPP2000 positioner configuration 8.



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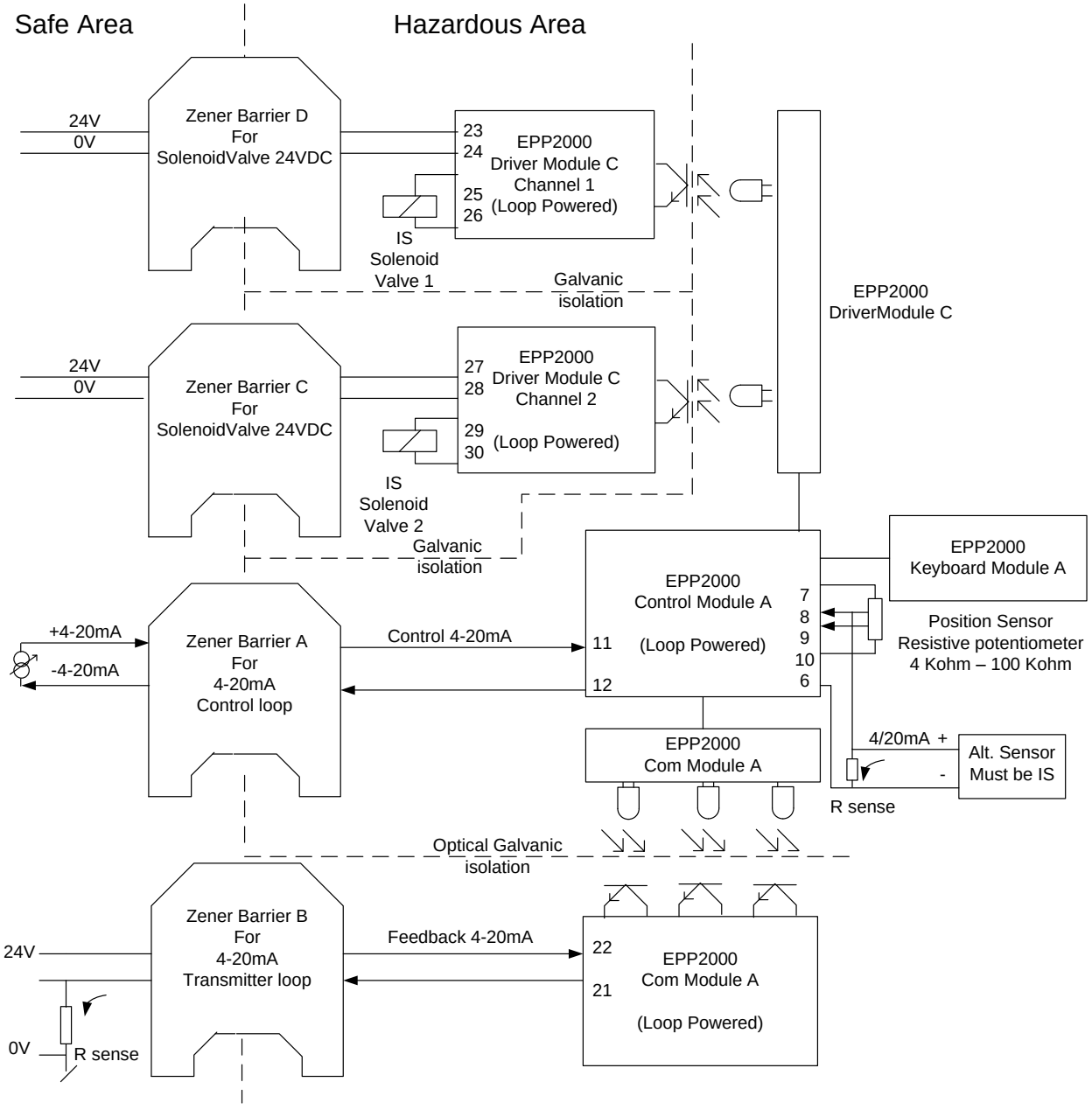
8 Basic circuit diagram (Configuration 3)

The following block diagram shows the EPP2000 positioner configuration 3.

EPP2000 with IS solenoid valves and feedback transmitter



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