ETB
Sensortechnik GmbH

EPC – 24

Proportional Valve PI – Controller

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1. Introduction

Figure 1: Front view of the EPC – 24 control unit

The EPC – 24 control unit consists of a PI – controller with pulse width modulated (PWM) power amplifier. It has been realised using microcontroller technology and provides an appropriate tool for controlling of open- and closed-loop control systems containing i.e. proportional valves. The plastic housing allows a straightforward installation onto mounting rails of type DIN 46277/1 and DIN 462277/3. Furthermore, an efficient wiring is possible by the clamps arranged at the side walls of the housing. The power supply voltage V_s lies between V_s = 12 - 36 VDC and the maximal output current I_{max} is I_{max} = 3.5 A. In addition, the unit operates in the open or closed loop mode. The operating mode is indicated by a bicolour LED mounted in the front panel. Moreover, using the internal 10 VDC reference in order to generate the set-point signal, an open or closed loop control system can be realised with only a few additional electrical components. Due to the PWM – power amplifier the heat dissipation of the unit is kept very low, which allows an unproblematic installation of the unit into a closed housing. The parameters can be adjusted by potentiometers accessible through destined holes, which are laced in the front cover. Finally, a monitoring of the actual value allows an immediate shutdown of the output current in case of its absence.
A complete block diagram of the control unit is displayed below in figure 4.

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2. Electrical and Mechanical Data

Electrical Data and Terminal Assignment

Table 1: Electrical Data

Description	Value
Supply Voltage V_s	12 – 36 VDC
Reference Voltage V_{ref}	+ 10 V
Analogue inputs [1]	0 – 10 VDC [2]
	0 – 20 mA
	4 -20 mA
Output current I_{out}	≤ 3.5 A
Digital inputs	U_c < 0.8 V → off
	U_c > 1.5 V → on
PWM-frequency υ	70 – 500 Hz

1) The actual value inputs are available in the indicated configurations.
2) Differential input

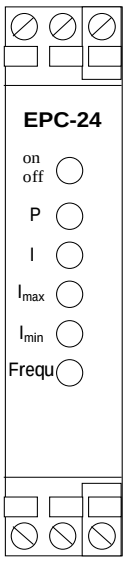
Table 2: Terminal Assignment

Description	Terminal
+ V_S	D
GND (power)	F
V_{ref}	K
GND (signal)	M
Amplifier on	B
Controller on	E
+ Set-up value	H
- Set-up value	G
+ Actual value	J
- Actual value	L
+ Current output	C
- Current output	A

A schematic drawing of the terminal assignment is shown in figure 4.

Front cover

The aluminium front cover is provided with an oil-resistant silk screen printing. The potentiometers for parameter adjustments are accessible from the front cover and can be tuned using a suitable screw-driver. Figure 2 shows a schematic front view of the unit.



LED red /green
Amplification P
Integration I
Maximal current I_{max}
Minimal current I_{min}
PWM – frequency υ

Figure 2: Schematic front view of the EPC-24 unit.

Parameters

Minimal and maximal output current can be tuned in the range of 0-30 % and 50-100 % with respect to the nominal coil current, respectively. The following 5 parameters can be adjusted:

- Amplification p
- Maximal current I_{max}
- PWM - frequency ν
- Integration I
- Minimal current I_{min}

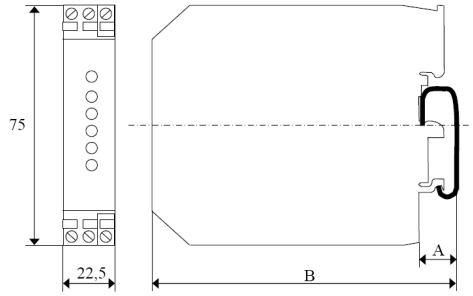
Operating mode

Selecting the corresponding inputs the power amplifier can be switch on and off. A bicolour LED indicates the actual status of the unit (Table 3).

Table 3: LED – Status display

LED	Enable (B)	Closed Loop (E)	Status
Red	off	Off	No error / amplifier off
Red alternating	X	X	Error
Green	on	Off	Amplifier on / open loop
Green alternating	on	on	Amplifier on / closed loop

Mechanical Dimensions



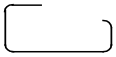
Type	TS1	TS3	TS4/5
A	15	10	17.5
B	107	102	109,5
			

Figure 3: Mechanical Dimensions. The module can be directly mounted onto mounting rails corresponding to DIN 46277/1 and DIN 462277/3.

3. Block-diagram

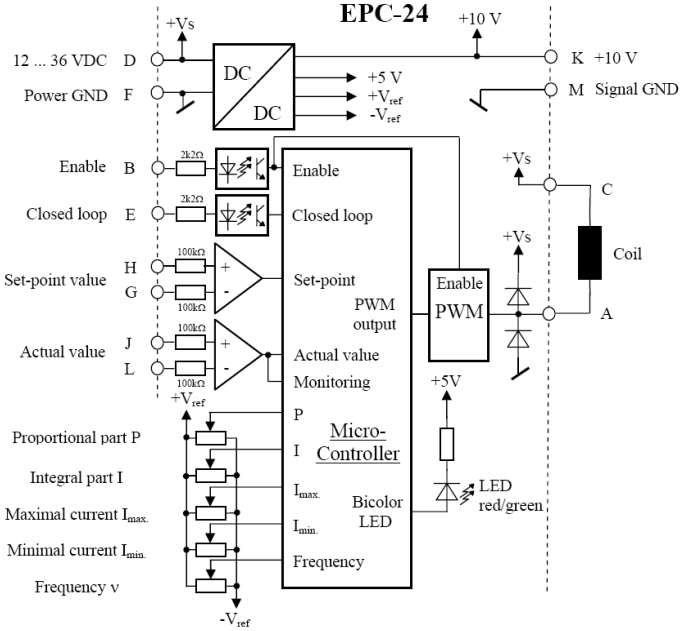


Figure 4: Block-diagram of the EPC-24 unit.

4. Adjustment Guidance

1. Activate enable and desactivate closed loop: The unit operates in open loop mode.
2. Set set-point voltage to U_c = 0V: The minimal current I_{min} can be adjusted.
3. Set set-point voltage to U_c = 10V: The maximal current I_{max} can be adjusted.
4. Set set-point voltage to a value of approximately $U_c \approx 5V$ and turn the potentiometer Frequ to its maximal value: Reduce the frequency ν, if the system starts to oscillate turn the potentiometer back by half of a turn.
5. Turn potentiometers P and I counterclockwise to its minimal values and activate closed loop: Turn potentiometer p clockwise until the system becomes instable. Subsequently turn it back by a half of a turn. If the transient response lies in the desired range the adjustments are terminated, otherwise continue with point 6.
6. Turn the potentiometer I clockwise until the transient response behaves optimal. Continue with point 5.

5. Typical Applications

a) Using internal 10 V reference voltage:

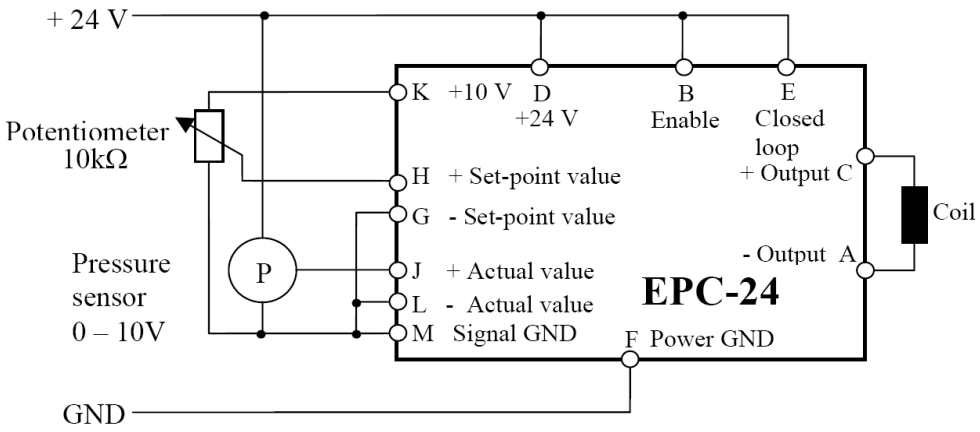


Figure 5: Example using internal reference voltage.

b) Using programmable logic controller (PLC):

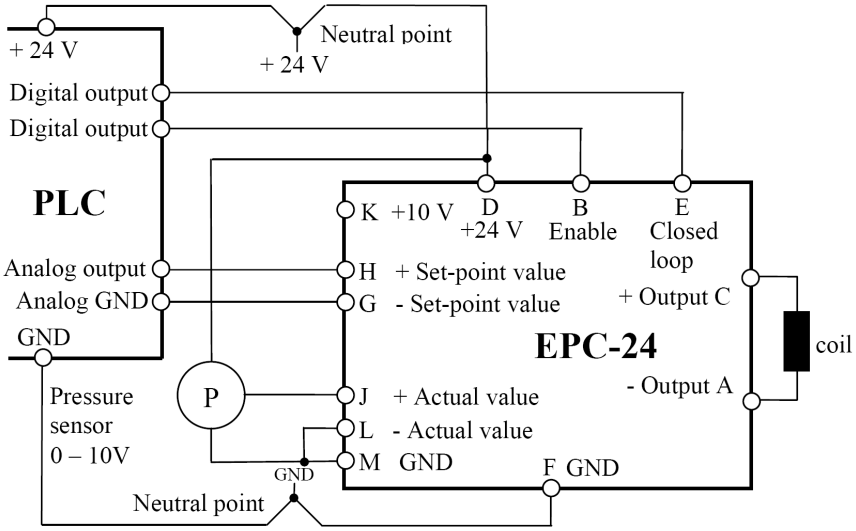


Figure 6: Example using PLC