

# ***Proportional valve amplifier with position feedback AMP08F***

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

AMP08F is amplifier for control of hydraulic proportional valves with one solenoid and with electrical feedback for the position of valve spool. By using of microprocessor the position is adjusted proportional to the input reference. The main features of AMP08F are:

- ☞ **switching power supply with a wide input voltage range**
- ☞ **bright 3-digit 7-segment LED display**
- ☞ **trimmers for adjustment of the offset, gain and ramps**
- ☞ **digital input for enable of the amplifier**
- ☞ **PID algorithm for control of the valve spool position**
- ☞ **PI algorithm for control of the solenoid current**
- ☞ **alarm output**
- ☞ **test analog output**
- ☞ **protection against reverse connection of the power supply**
- ☞ **protection against overvoltage in the power supply**
- ☞ **protection against overload and short circuit in the output**
- ☞ **protection against short-circuit or break in cable to position transducer**
- ☞ **internal replaceable fuse**

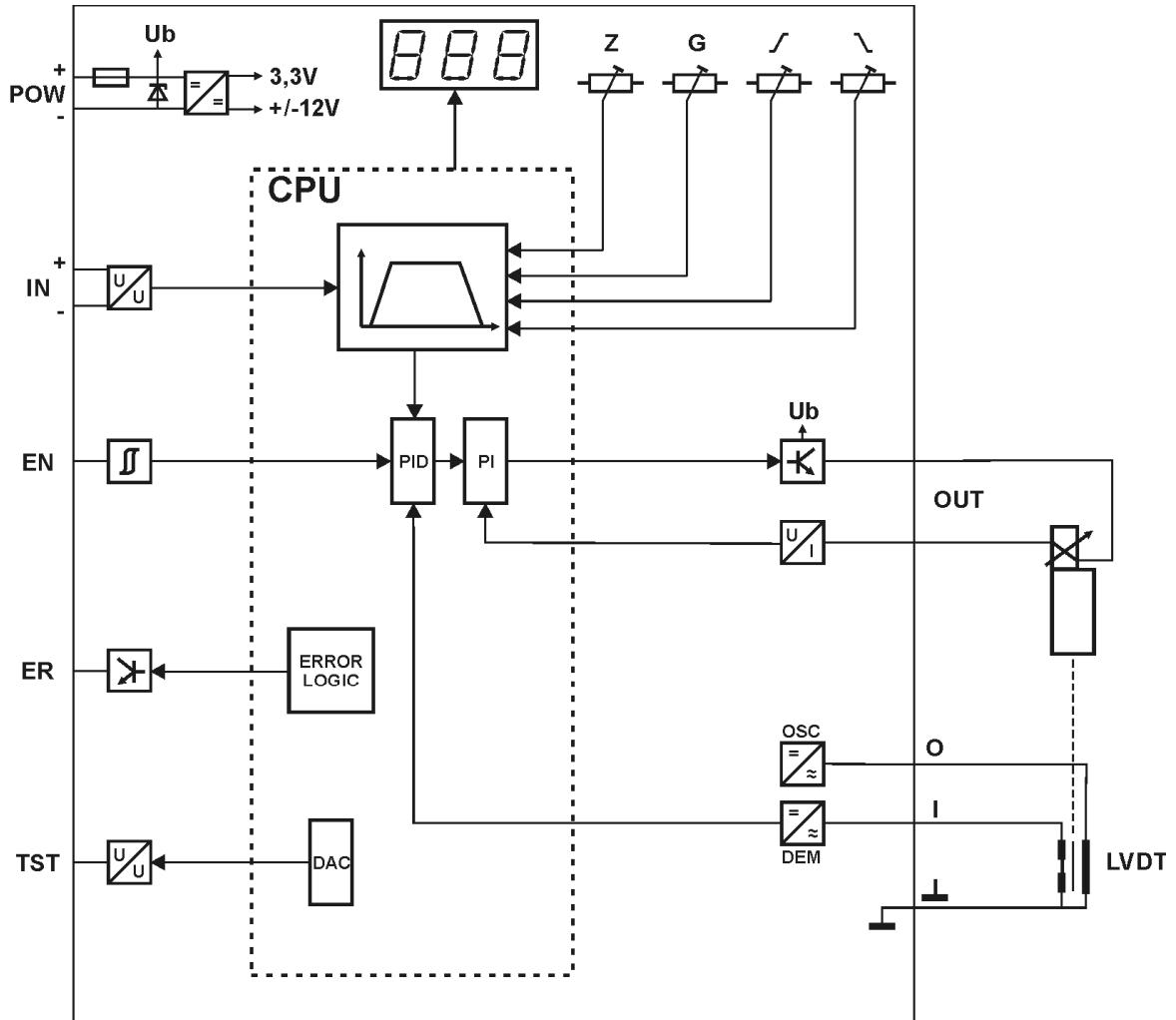
The amplifier is suitable for control of pressure valves for machines with hydraulic drive system such as injectors, hydraulic machines and positioners and more.

## Technical specifications

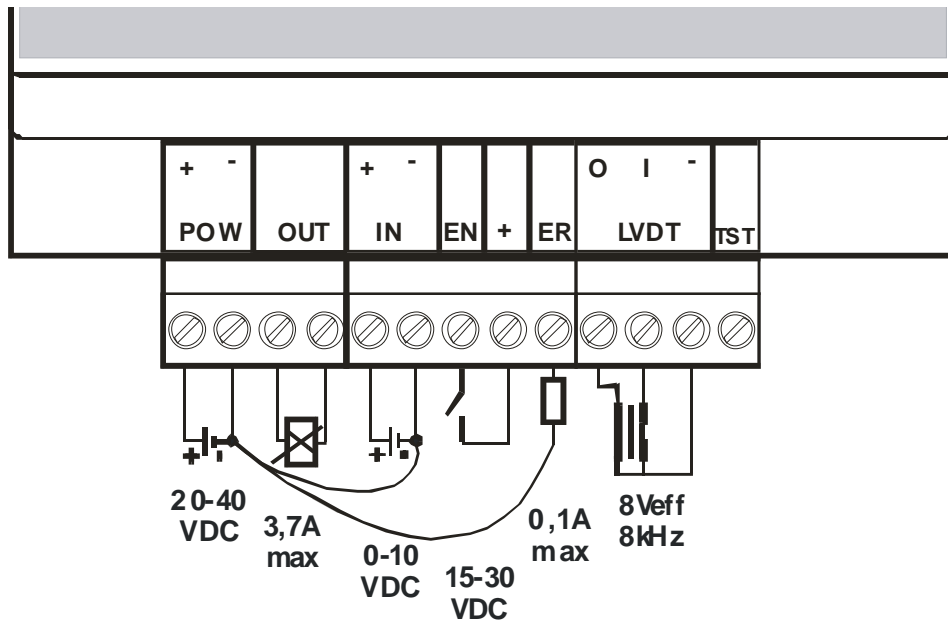
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<b>Power supply:</b>	
<i>nominal</i>	24 VDC / 50 VA
<i>range</i>	20 – 40 VDC
<i>rectified</i>	21 – 28 VAC
<i>overvoltage protection</i>	43 VDC
<i>reverse connection protection</i>	internal replaceable fuse 4 A / 5 x 20 mm
<i>PS cables</i>	1,5 mm <sup>2</sup>
<b>Input command signal</b>	0 – 10 VDC
<i>dead zone</i>	0 - 0,25 V
<b>Enable input</b>	15 – 30 VDC on pin EN
<b>Position transducer (LVDT):</b>	
<i>output</i>	8 kHz / 8 Vrms short-circuit protected
<i>cable</i>	20m max 100 pF/m max
<b>Solenoid output:</b>	
<i>open source MOS transistor</i>	3,0Amax / 40VDC
<i>current protections</i>	5A instantaneous value
	3,0Arms for 1s
<i>output voltage</i>	PWM 200 Hz
<i>cable</i>	1,5 mm <sup>2</sup> 20m max
<b>Alarm output:</b>	
<i>open emitter NPN transistor</i>	0,1A max / 40VDC
<i>activation conditions</i>	Short circuit or break in the sensor or activated current protection of the coil
	24 VDC
<i>ON level</i>	
<b>Test output</b>	0 – 2,5 VDC short-circuit protected with Ri= 10kΩ
<b>Control algorithm:</b>	
<i>on the position</i>	PID on 100 ms
<i>on the current</i>	PI on 10 ms
<b>Front panel:</b>	
<i>Indication</i>	3-digit 7-segment
<i>and LEDs:</i>	
- for the input voltage	IN (green)
- for the output current	OUT (green)
- for the position	POS (green)
<i>Buttons</i>	arrows UP,DOWN and ENTER
<i>LEDs:</i>	
- power supply	POW (green)
- enable	ENABLE (green)
- error	ERROR (red)
- transducer error	LVDT (red)
- current protection	Imax (red)
<b>Trimmers to adjust:</b>	multiturn
<i>zero(Z)</i>	0 - 80%
<i>gain(G)</i>	50 – 150%
<i>Acceleration ramp</i> (  )	0,1 – 5 s / step 0,1s (at full input range)
<i>Deceleration ramp</i> (  )	0,1 – 5 s / step 0,1s (at full input range)
<b>Order specifications:</b>	
<i>Dimensions (w, h, d)</i>	105x86x58 mm
<i>Installation</i>	DIN rail 35 mm
<i>Connectors</i>	1,5 mm <sup>2</sup> screw, removable
<i>Protection:</i>	IP40
<i>Working conditions</i>	0 – 50 °C / 0 – 70 % RH without condensations
<i>Storage conditions</i>	-20 – 80 °C / 0 – 95 % RH

# Block diagram



## Wiring diagram and pin assignment

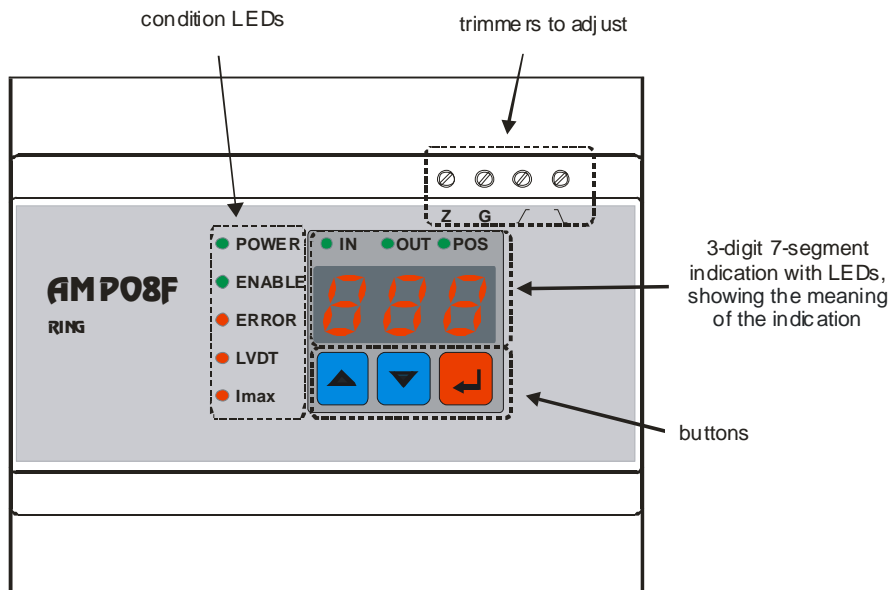


PIN	NAME	DESCRIPTION	VALUE
1	POW+	Power supply voltage "+"	20 – 40 VDC
2	POW-	Power supply voltage "-"	
3	OUT	Output for solenoid connection	3,0 Arms max
4	OUT		
5	IN+	Command voltage "+"	0 – 10 VDC
6	IN-	Command voltage "-"	
7	EN	Enable input	15 – 30 VDC
8	+	Internal connected to POW+	
9	ER	Output for error indication	Open emitter 0,1A max
10	LVDT O	Output to position transducer	8 Vrms / 8 kHz
11	LVDT I	Input from position transducer	8 Vrms max
12	LVDT -	Common connection to transducer	
13	TST	Test output	0 – 2,5 V Ri=10 kΩ

### Caution!

- ☞ Pin **IN-** must be connected externally to pin POW-.
- ☞ The load of pin **ER** must be connected to power supply "-".
- ☞ Do not use free-wheeling diode on solenoid output.
- ☞ On TST outputs:
  - When the LED "IN" is ON – the input voltage (command value)
  - When the LED "OUT" is ON– the output current
  - When the LED "POS" is ON– the feedback voltage from LVDT

## Front panel



### **Indication.**

AMP08F has a three-digit 7-segment LED display. Above display has 3 LEDs indicating the meaning of the indicated number:

-IN – lights when is indicating the value of the input voltage (in V)

-OUT – lights when is indicating the solenoid current (in A)

-POS – lights when is indicating the voltage feedback from position transducer (in %).

Scrolling is done by pressing the button ENTER.

### **Buttons.**

There are 3 keys- to UP, DOWN and ENTER. With them you can set the parameter or can move over the amplifier menu.

### **Condition LEDs.**

-POWER (green) – lights when the power supply voltage is between working limits

-ENABLE (green) – lights when on terminal EN is applied voltage (with the necessary value) for permission of the amplifier

-ERROR (red) – lights when the CPU detected error

-LVDT (red) – lights when there is short-circuit or break in the sensor cable  
-Imax (red) – lights when is detected over current on output of solenoid.

### **Adjustment trimmers.**

There are provided four multiturn trimmers:

-Z- It adjusts the position at the minimum value of the input reference

-G- It adjusts the position at the maximum value of the input reference

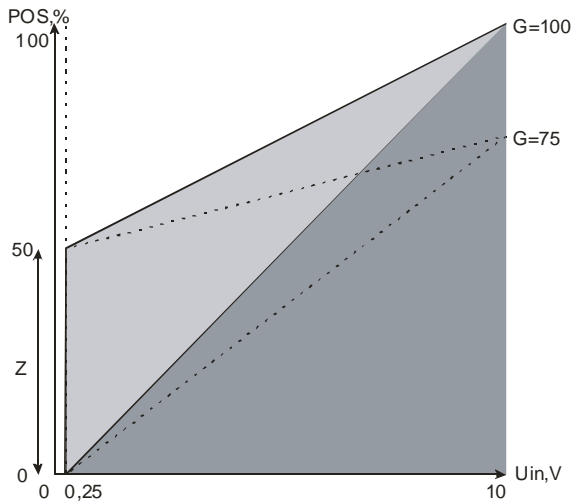
The trimmers Z and G have minimum difference 8%.

-J- It adjusts the length of the leading edge of the output to reach the position reference (0V->10V)

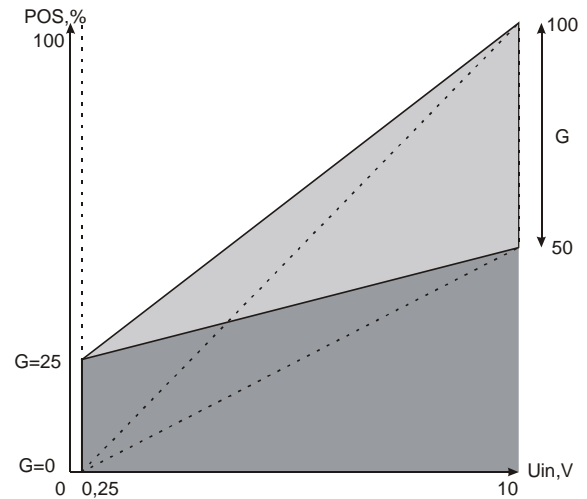
-L- It adjusts the length of the trailing edge of the output to reach the position reference (10V->0V).

## Trimmers adjustment

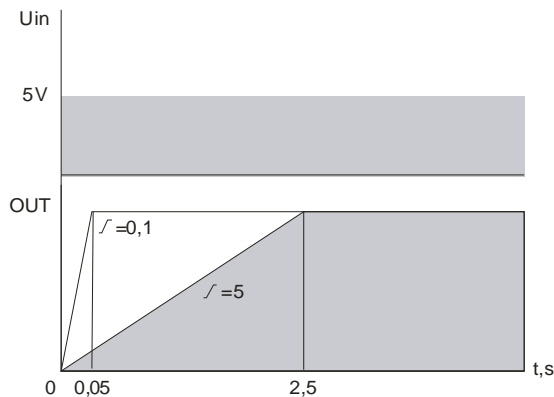
Turning the adjustment trimmer the display automatically shows the value of the trimmer while the LEDs IN, OUT and POS does not light. The values shown for trimmers Z and G are in % and for  $\tau$  and  $\bar{\tau}$  - in seconds.



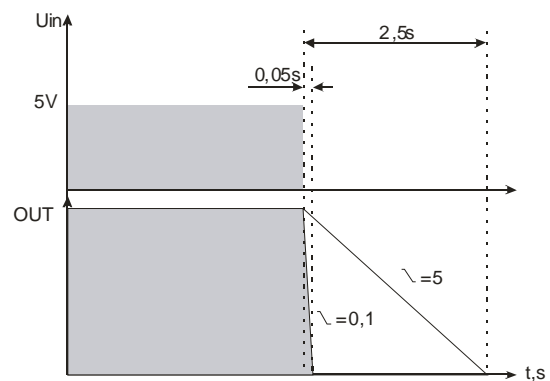
The figure shows the change of the amplifier characteristic by adjusting the trim of the offset (Z), at two values of the trimmer for the gain (G) - 100% and 75%.



The figure shows the change of the amplifier characteristic by adjusting the trimmer for the gain (G) at two values of the offset trim (Z) - 25% and 0%.



The figure shows the change in output over time when changing the reference from 0V to 5V, at two settings of leading edge trimmer ( $\tau$ ) - 0,1s and 5s.



The figure shows the change in output over time when changing the reference from 5V to 0V, at two settings of trailing edge trimmer ( $\bar{\tau}$ ) - 0,1s and 5s.

## Description of the coefficients of regulators

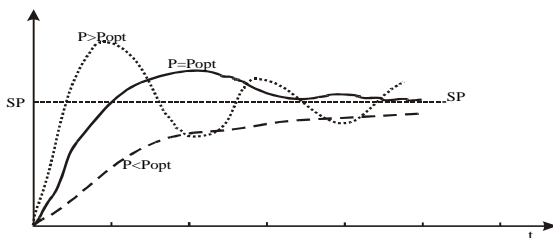
Parameter	Indication	Designation	Factory setting	Range
Proportional coefficient for the current	$P_i$	Set the coefficient of proportionality of the current regulator.	200	0..999
Integral coefficient for the current	$I_i$	Set the integral coefficient for the current regulator.	150	0..999
Proportional coefficient for the position	$P_P$	Set the coefficient of proportionality of the position regulator.	100	0..999
Integral coefficient for the position	$I_P$	Set the integral coefficient for the position regulator.	50	0..999
Differential coefficient for the position	$d_P$	Set the differential coefficient for the position regulator.	10	0..999

To access the coefficient of regulators must be pressed and hold ENT for 3 seconds.

## Setting of the coefficients of regulators

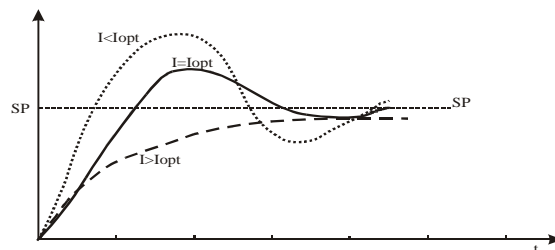
If there is a need for adjustment of the coefficients, it is recommended to do such only for the position regulator. This can be performed when the screen displays the value of the position (the diode POS lit), to the input is submitted position reference (eg 5V) and on terminal TST with an oscilloscope is observed the change of the position..

➤ *Proportional coefficient.* If its value is greater than the optimum, it creates a large overshoot at a change of the reference. If the value is less than the optimum, then are obtained slowly set point achievement.

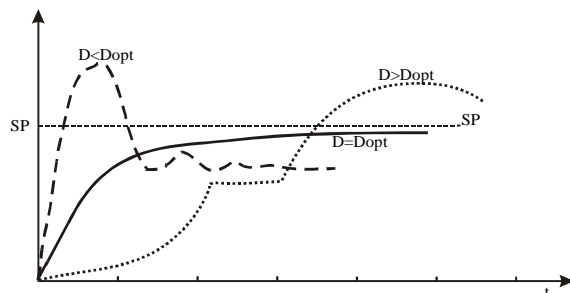


➤ *Integral coefficient.* If its value is less than optimal, then are obtained small fluctuations in steady state mode. If the

value is greater than the optimum, then are obtained slowly set point achievement and error in the steady state mode.



➤ *Differential coefficient.* The controller is adjusting according to the following graphic.



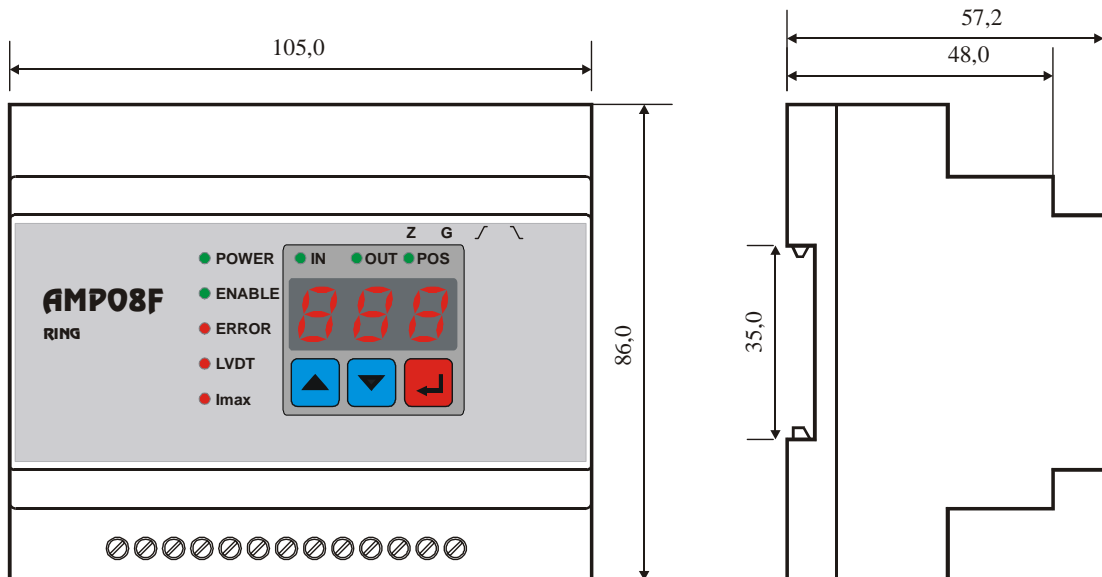
## Alarms

Alarm is obtained in case of emergency situation.

ALARM	INDICATION
disconnected position sensor	lit diodes <i>ERROR</i> and <i>LVDT</i> and activates the output <i>ER</i>
Short- circuit in the wires of the position transducer	lit diodes <i>ERROR</i> and <i>LVDT</i> and activates the output <i>ER</i>
the measured value of the current through the coil of the valve is greater than the maximum instantaneous value (measured every 30 $\mu$ s)	lit diodes <i>ERROR</i> and <i>I<sub>max</sub></i> and activates the output <i>ER</i>
the measured value of the current through the coil of the valve is greater than the maximum effective value (there is a filter for 1 s)	lit diodes <i>ERROR</i> and <i>I<sub>max</sub></i> and activates the output <i>ER</i>

The alarm automatically turns off in case of emergency loss.

## Mechanical dimensions and mounting



The device is mounted on a DIN rail 35 mm.



## **Warnings**

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- The amplifier can be operated only at specified operating conditions.
- The amplifier not be operated in the presence of corrosive gas and a large dusty conditions.
  - The amplifier should not be installed near the equipment and devices emitting strong electromagnetic fields.
  - Wiring of the amplifier can be made only when the power is off.
  - The wires connected to the inputs must be shielded and separated from those that are connected to the outputs and the power supply to avoid mutual influence.
  - For proper operation of the amplifier the supply voltage is necessary to be well filtered. Closest to the power terminals must have electrolytic capacitor with a minimum value 2000  $\mu\text{F}$  / 50V.
  - Parallel to the coil of the valve should not be connected free-wheeling diode or oder protective device.
  - The manufacturer has set the parameters so that the amplifier to work well in certain situations. The user needs to set parameters alone according to the specific object and needs.