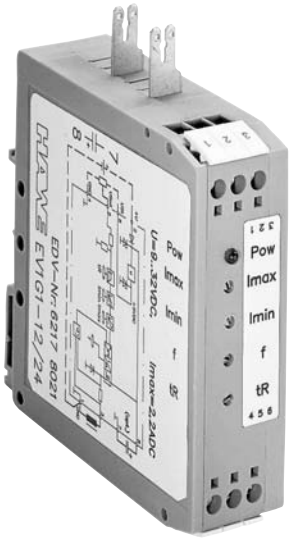
Electronic amplifier type EV1G1-12/24

for the control of proportional valves
design with housing

1. General

1.1 Brief description and circuitry



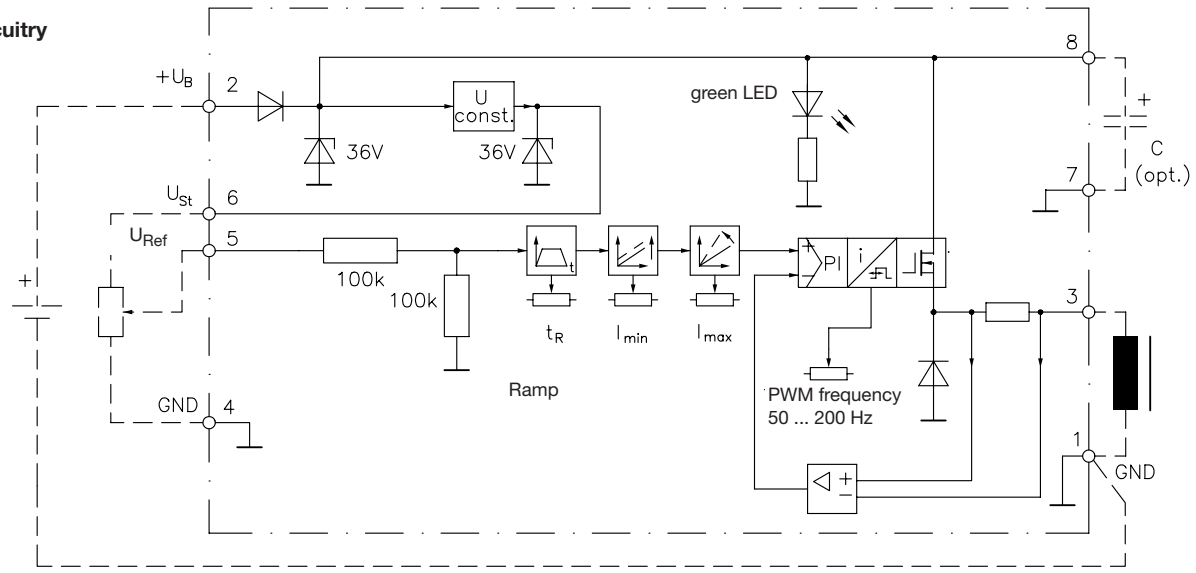
Compact amplifier with good price/performance ratio for the actuation of proportional valves using one single acting proportional solenoid only.

Main components:
Voltage regulator generating a stabilized voltage of 5V DC
Linear ramp generator (Integrator)
Current-regulated, pulse width modulated voltage output (PWM), and short-circuit protected final stage

Main features:
Low hysteresis of the actuated proportional valve
Adjustable Imin, Imax, frequency and ramp time (up- and downwards together)
Dither effect due to the low frequency of the final stage
Reverse voltage protection of the power supply, proper connection indicated by a green LED
Provision for retrofitting of a filter capacitor (optional)
Wide power supply voltage range

This module features screw terminals plus 2 x 6.3 mm blade terminals for an external filter capacitor. The performance of this amplifier enables connection of all HAWE proportional valves with one single acting proportional solenoid.

Circuitry



2. Available version, type coding key

2.1 Order coding

EV 1 G 1 - 12 / 24

- Basic type coding for electronic amplifier
- For one prop. solenoid only
- Design with housing, screw and blade terminals
- Construction and development version (internal coding)
- Supply voltage 9 to 32 VDC

2.2 Technical data

2.2.1 General parameters

Nomenclature	Electronic amplifier for proportional solenoids
Design	Module with housing, featuring screw and blade terminals
Connection wiring	max. 1.5 mm²
Blade terminals	6.3 or 2.8 mm (AMP-Faston) for optional, external filter capacitor
Fastening	To be clicked on 35 mm mounting rail (EN 50 022) or 32 mm (EN 50 035) or 15 mm (EN 50 045)
Protection class DIN EN 60529 resp. IEC 60529	IP 20 (intended for installation in a cabinet)
Installed position	Any
Mass (weight)	approx. 90 g
Ambient temperature	-20 ... 50°C (up to +70°C, derating to 75% of the max. current output I_A)

2.2.2 Electrical parameters

Voltage supply	U_B	9 ... 32V DC
Max. ripple factor	w	10%
Minimum filter capacitor	C_B	2200 µF per 1 A coil current
Voltage output	U_A	U_B -1.2V DC (pulse width modulated)
Current output	I_A	max. 2.2 A Adjustable range: I_{min} 0.05 ... 0.5 A; I_{max} 0.3 ... 2.2 A Pre-set by HAWE: I_{min} = 0.05 A; I_{max} = 1 A
Power consumption	I_L	approx. 30 mA (internal)
Set-point voltage range	U_S	0 ... 5V DC
Input impedance	R_E	> 200 kΩ
Set-point potentiometer	R_S	min. 2.2 kΩ; max. 10 kΩ; load capacity min. 0.1W
Reference voltage	U_{St}	+ 5V DC ±5% Max. load capacity 5 mA (stabilized voltage for the set-point potentiometer)
Ramp time, up and down	t_R	Set simultaneously 0.3 ... 10 s (linear ramp) pre-set by HAWE 0.3 s
Dither frequency (PWM frequency of the final stage)	f	Adjustment range 50 ... 200 Hz pre-set by HAWE 80 Hz

2.2.3 Electro-magnetic compatibility (EMC)

The electro-magnetic compatibility has been tested by an accredited approval institute (criteria "B": Interference emission acc. to EN 50 081 and interference immunity acc. to EN 50 082). This EMC test doesn't relieve the user from the proper execution of a specified EMC check for his complete system (accordingly to regulation 89/336/EWG), since the test assemblies represent only a typical application. The following measures should be checked, if the EMC of the complete system must be strengthened further:

- The required filter capacitor (see sect. 2.2.2) is not only necessary for flawless performance of the device, but also to ensure compliance of the EMC (wire bound interference emission)
- The equipment should be installed in an metal cabinet (shielding)
- All cables, leading in or out of the device should be kept as short as possible. The should be also be shielded and twisted in pairs. (This will reduce the antenna effect and increase the interference immunity).

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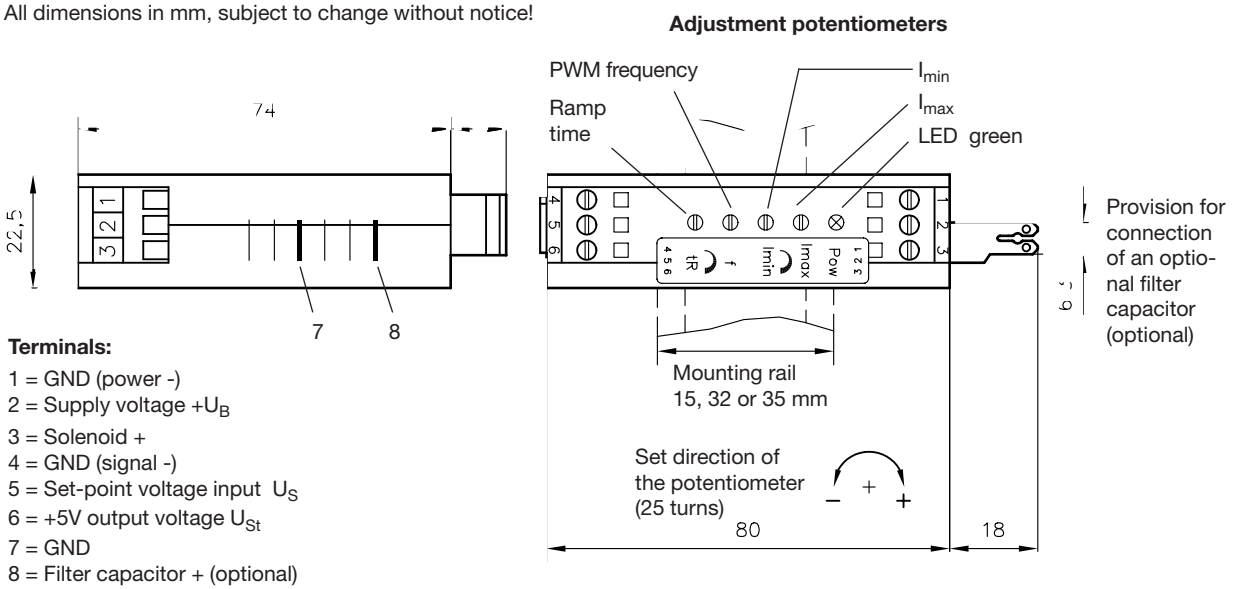
3. Unit dimensions

All dimensions in mm, subject to change without notice!



Terminals:

1 = GND (power -)
2 = Supply voltage +U_B
3 = Solenoid +
4 = GND (signal -)
5 = Set-point voltage input U_S
6 = +5V output voltage U_{St}
7 = GND
8 = Filter capacitor + (optional)

4. Mounting and adjustment instructions

4.1 Adjustment manual

Attention: The externally supplied voltage must not become negative! Negative voltage can cause malfunctions and ultimately lead to the destruction of the proportional amplifier. If the maximum allowed voltage of 5V DC is exceeded, the set point for current I_{max} or $I_{max\ oper}$ will become ineffective. As a result of this I_{max} or $I_{max\ oper}$ will increase above the set limit.

When the connecting cable is longer than 3 m, a twisted-pair cable should be used to minimise noise and to increase interference protection.
The maximum inductive current I_{max} is not allowed to exceed the value of I_{Lim} for the proportional magnet for any length of time, as this could cause a thermal overload and ultimately cause the solenoid to fail.

F1 = Fuse 2.5 A (medium time lag)
A1 = Amp-meter for measuring the coil current
P1 = Set-point potentiometer 2 - 10 kΩ (e.g. wire wound potentiometer 10 kΩ, 2 W)
V1 = Voltmeter to the measuring of the set-point voltage

① Amplifier Connection:
Connect an elektrolyt condensor, if required, with correct polarity to blade terminals 7 and 8 (see also sect. 4.2).
Proportional solenoid to screw terminals 1 and 3
Connect the amp-meter A1 in series (measuring the coil current)
Connect set-point potentiometer to screw terminals 4, 5, and 6
Connect power supply to terminals 1 and 2

② Adjust the set-point potentiometer to minimum (0 V) for step ⑥
(GND side: terminal 4)

③ Switch-on power supply (green LED emits)

④ Set ramp times t_{up} and t_{down} to minimum (turn ramp potentiometer anti-clockwise until reaching the end position. Potentiometer 25 turns)

⑤ Readjust dither frequency, if necessary
(only if a frequency-meter is available, otherwise do not alter the pre-setting!)

⑥ Set I_{min} -potentiometer to the minimum current $I_{min\ oper}$ which corresponds to the desired low point according to the Q-I- or Δp-I-characteristic line of the proportional valve; for the adjustable I_{min} range refer to section 2.2.2; $I_{min\ oper}$ can be read off the amp-meter A1

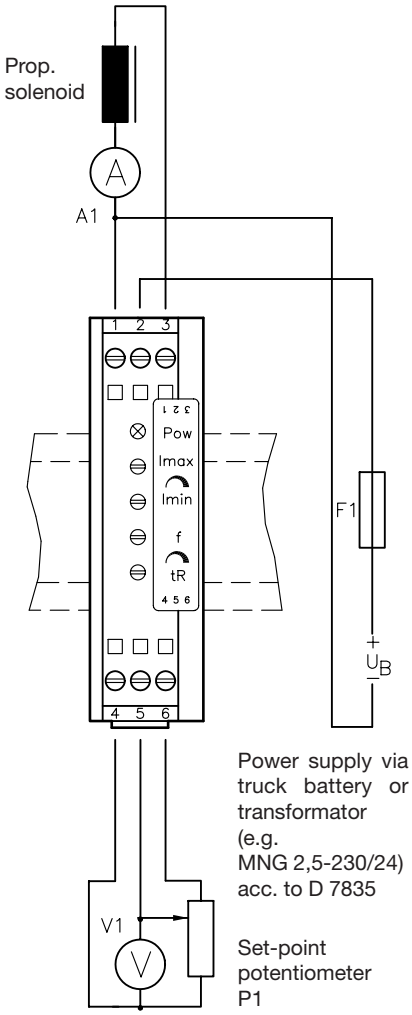
⑦ Adjust the set-point potentiometer to maximum for step ⑧.
Read the set-point voltage at volt-meter V2. (approx. 5 V)

⑧ Set I_{max}-potentiometer to the maximum current $I_{max\ oper}$ which corresponds to the desired high point according to the Q-I- oder Δp-I-characteristic line of the proportional valve; for the adjustable I_{max} range refer to section 2.2.2.

⑨ The dither frequency f is factory-set to 80 Hz. This is sufficient for most cases. It can be readjusted but this should be always monitored frequency meter or an oscilloscope.
When this is not available the correct dither amplitude can be determined by turning the dither-potentiometer clockwise until vibrations on the proportional valve can just be felt but without it beginning to cause disturbances (potentiometer 25 turns).

⑩ Adjust the ramp time t_R to the desired rate. The ramp times are always valid for the total range of the set-point voltage (5 VDC).

⑪ Check the adjusted parameter $I_{min\ oper}$ (step ⑥) is at U_{Soll} = 0V DC;
$I_{max\ oper}$ (step ⑧) at U_{Soll} = 5V DC; dither frequence (step ⑨) and ramp times (step ⑩) if necessary repeat the calibration.



Power supply via truck battery or transformator (e.g. MNG 2,5-230/24) acc. to D 7835

Set-point potentiometer P1

⑫ Other notes
Always check the power supply first, when any difficulties appear during calibration or initial operation
For bridge rectification, check if an electrolytic filter capacitor of at least 2200 µF/A coil current is connected in parallel to the terminals 7 and 8.
Check that the supply voltage is high enough for the prop. amplifier. The supply voltage should be about 2V DC higher than would be necessary to generate the set maximum current $I_{max\ oper}$ with a warmed up coil without the proportional amplifier.

It is possible to use coils for 12V for proportional amplifiers of 24V DC rated value supply voltage. In this case the supply voltage is transferred automatically to 12V-level with low losses via the PWM output for the valve. It is vital to make sure that the permissible maximum output current I_A for the proportional amplifier and the limiting current I_{Lim} for the field coil are not exceeded!
Advantages: As the proportional valve is operated above its nom. voltage rating (i.e. from 12 to 32V DC), its response time will be reduced and therefore the hydraulic systems can work faster.

4.2 Use of an external filter capacitors

The blade terminals 7 and 8 at the proportional amplifier type EV1G1 12/24 serve to connect an external filter capacitors. In most cases these terminals remain however unused.
In some cases, however, they can be very useful. In case of inadequate smoothing of the supply voltage it can be smoothened sufficiently for use with prop. amplifiers by means of an electrolytic capacitor connected directly at + and - terminals of the power supply. The capacity of the condensor should be 2200 µF per 1 A load. The load on the power supply may be rather high if it covers also other solenoids even if these do not require a smoothened voltage. When using the proportional amplifier type EV1G1-12/24 this capacity of the filters capacitor can be reduced to the actual demand of the prop. solenoids. The circuitry (page 1) illustrates that the capacitor is connected after the reverse polarity protection diode. This way the smoothing for the prop. amplifier is separated from the smoothing for other consumers. Therefore the required capacity can be kept at a minimum.

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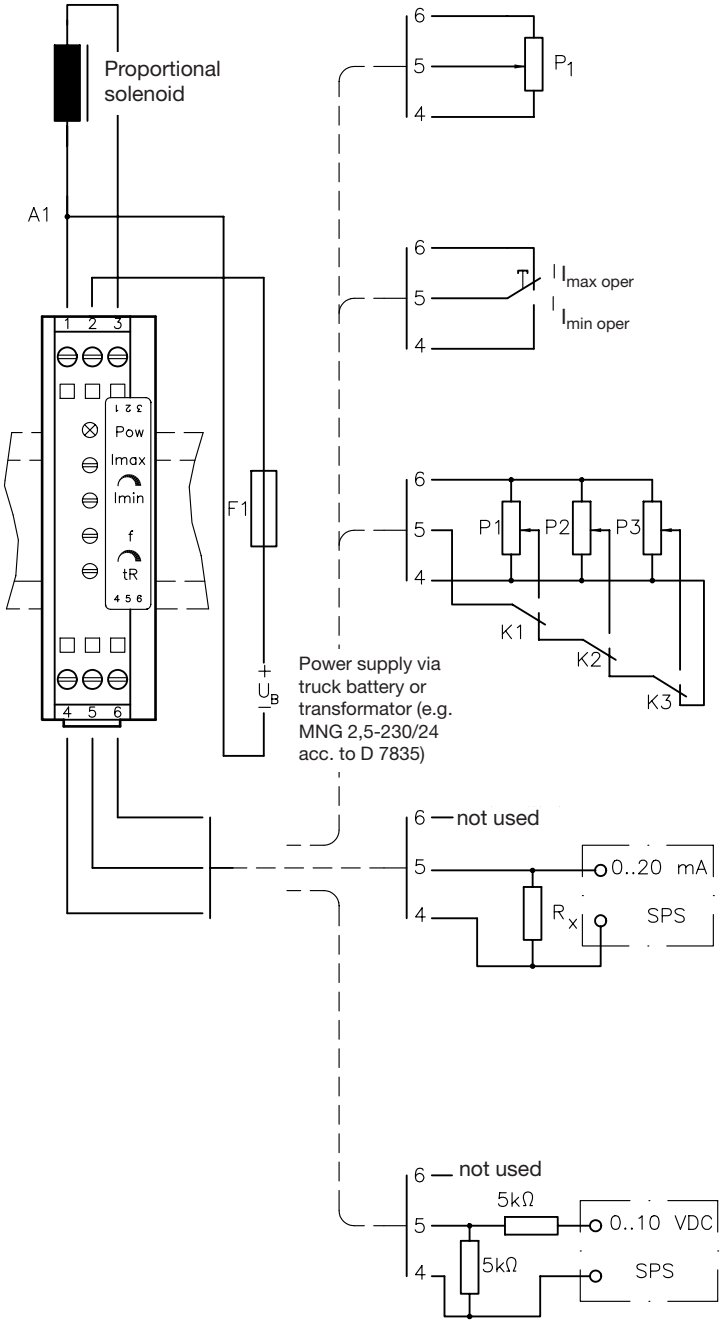
5. Example circuits

5.1 Control of hydraulic valves with a proportional solenoid



Example a: Operation with external set point potentiometer

F1 = Fuse; 2.5 A (medium time lag, max. 3 x I_N)

P1 = Set-point potentiometer 10 kΩ, min. 0.1 W

Example b: With set point switch for the two adjusted set points $I_{min\ oper}$ and $I_{max\ oper}$

F1 = like example a

Example c: Operation with priority switch for four set-point figures (relais circuit)

Example:
Rapid traverse 1 - K1→ P1
Rapid traverse 2 - K2 → P2
Creeping - K3 → P3
Stop - K1 → K2 → K3 →⊥

F1 = like example a

Example d: Operation via external current output signal e.g. SPS, CNC or PC

Attention: Observe the max. load rating of the current source !

F1 = like example a
Rx = 250 Ω/ 0,5 W

Example e: Operation via external voltage output signal e.g. SPS, CNC or PC

Attention: The set max. output current will rise, if the maximum allowed voltage of 5V DC is exceeded at the terminal of the prop. amplifier.

The connected solenoids may be damaged or destoyed due to overheat!

F1 = like example a