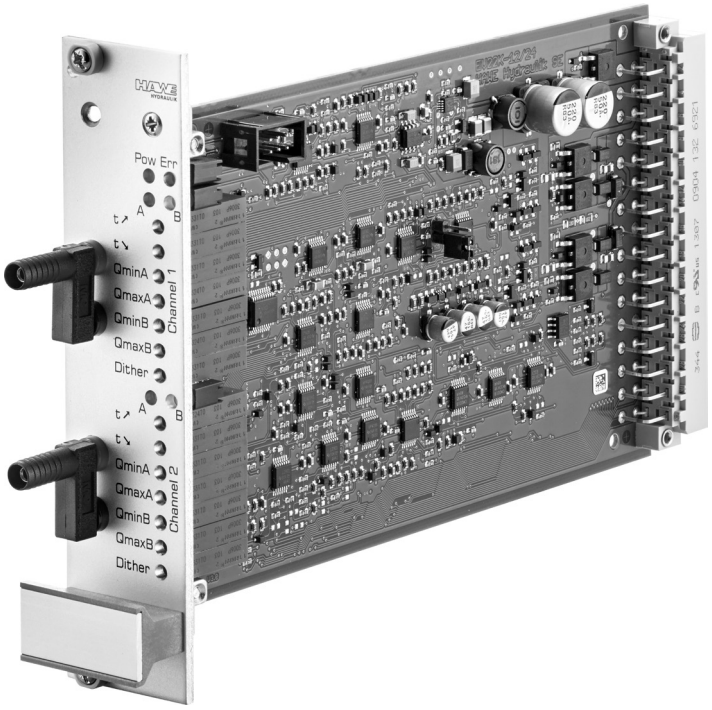
Proportional amplifier type EV22K5

Product documentation

Card design

Supply voltage U_B:	9...32 V DC
Output current $Q_{A\ max}$:	1,8 A



D 7817/2
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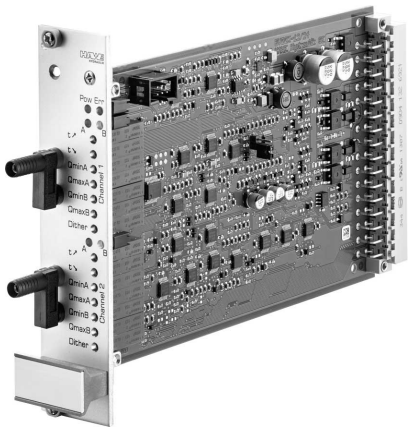
HAWE HYDRAULIK

Contents

1 Overview of proportional amplifier type EV22K5

Proportional amplifiers actuate proportional solenoid valves by converting an input signal into a corresponding control current.
Thanks to the excellent control accuracy and highly precise feedback measurement, even challenging hydraulic applications can easily be realised.
A multi-turn potentiometer is used to configure the valve parameters such as the base and maximum current, dither and ramps. The EV22K5 has two independent proportional amplifiers for mutual control of two twin solenoids or two sets of two single-action solenoids.
The amplifier module is mounted either on a mounting surface using an additional card holder or on a 35 mm standard support rail by means of a snap-on foot. It has the same dimensions as a Eurocard, with a front panel width of 6 HP.



Proportional amplifier type EV22K5

Features and benefits:

- Short-circuit-proof fixed voltage regulator ±5 V DC or ±10 V DC
- Compact design
- Easy commissioning
- Functions tailored to HAWE products
- EDs for status monitoring

Intended applications:

- For controlling proportional valves
- Switch cabinet installation in industrial and mobile environments

2 Available versions, main data

Amplifier module

Order coding example:

EV	22	K	5	12/24

- **12/24** – Supply voltage 12 V DC/24 V DC (nominal value)
- **5** – Plug-in card version
- **K** – Two twin solenoids or two sets of two single proportional solenoids alternately actuated
- **22** – Basic type
- **EV** – Basic type

Card holder mounting accessories

Card holder for an amplifier card

KH 7817 901

Card holder

Description: The card holder consists of a frame with guide rail and a screw terminal strip. The card holder is attached to a mounting surface using M4 screws provided.

Support rail snap-on foot for card holder

S 7817 902

Support rail snap-on foot

Description: The snap-on foot is attached to the underside of the card holder KH 7817 901. The card holder can therefore be mounted on a 35 mm standard support rail either vertically or horizontally

Module rack for two or three amplifier cards

BT 7817 950

Module rack

Description: The module rack consists of a screwed frame housing with 3 guide rails. The screw terminal strips are mounted on the side and are easily accessible. Unused slots can be sealed with reactive plates.

3 Parameters

3.1 General

General data

Nomenclature	Proportional amplifier for 12 V DC to 24 V DC
Design	Cards with 32-pin terminal block according to DIN EN 60603-2
Installation position	Any
Weight	▪ **Total: 900 g** ▪ Board approx. 50 g ▪ Card holder approx. 150 g ▪ Module rack approx. 700 g
Protection class	IP 00 according to DIN VDE 0470, EN 60529 or IEC 529
Ambient temperature	-20°C...+70°C

3.2 Electrical Data

Supply voltage	U_B	9...32 V DC
Max. permissible ripple factor	w	10% ripple
Required filter capacitor	C_B	
Output voltage	U_A	U_B - 1.8 V DC
Output current	I_A	Max. 1.8 A short-circuit-proof
Setting range		I_{min} = 0...0.8 A Pre-setting 0.25 A I_{max} = 0...1.8 A Pre-setting 0.6 A
No-load current	I_L	max. 110 mA (depending on voltage)
Voltage ranges	U_{nom}	-10 - 0 - +10 V DC (BR open) [1] -5 - 0 - +5 V DC (bridge set) [1]
Reference voltage	U_{St}	At I_{st} 10 mA max. ± 10 V DC (bridge open) [1] ± 5 V DC (bridge set) [1] Short circuit-proof and overload protected
Input resistance	R_e	≈ 400 kΩ
Ramp time rise-fall	t_R	0.1 to 5, factory-set pre-setting 0.1 s
Dither frequency	f	≈ 55 Hz
Dither amplitude	I	100 to 600 $mA_{tip\ to\ tip}$ Factory-set pre-setting ≈ 140 $mA_{tip\ to\ tip}$

[1] BR = bridge on the card for switching the target value voltage ranges (-10 to +10 V DC or -5 to +5 V DC) and the stabilised voltages (see Chapter 4, "Dimensions").

3.3 Specific parameters

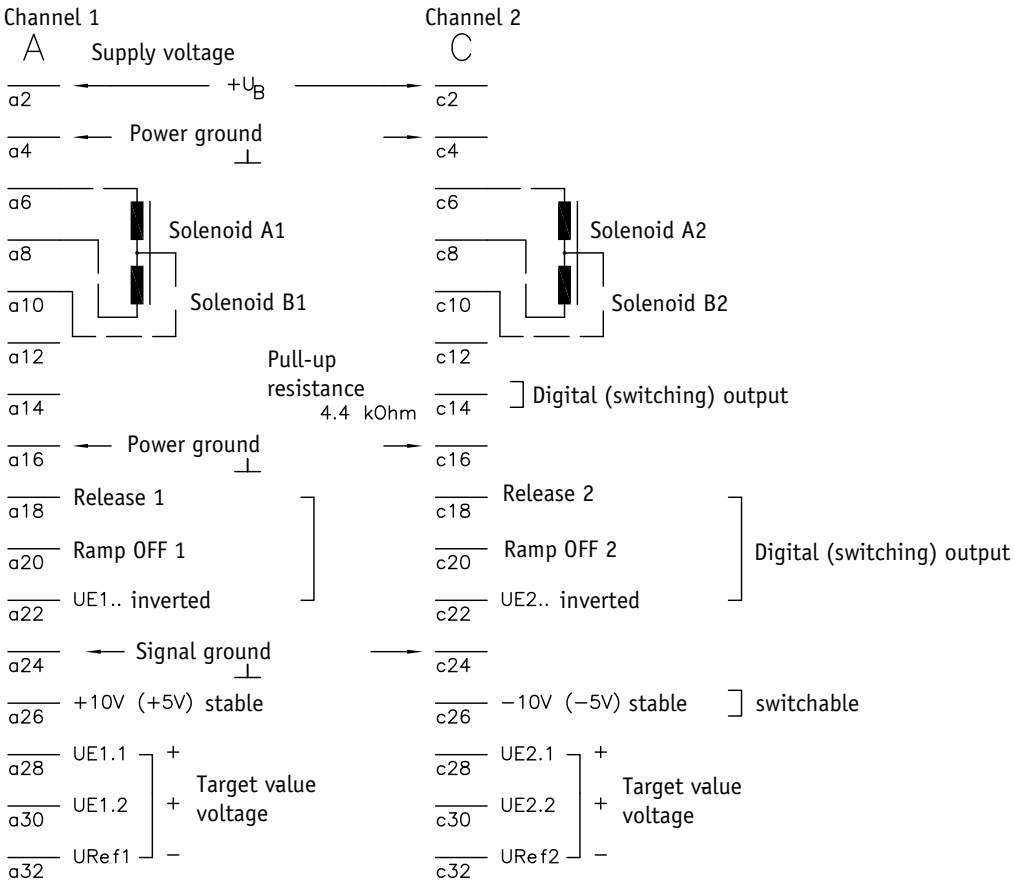
Digital inputs

Input resistance	≈ 10 kΩ	
Input voltage level	**BR open**	**BR set**
logical 0	0 V ≤ U ≤ 4.5 V	0 V ≤ U ≤ 1.3 V
logical 1	9.5 V ≤ U ≤ U_B	6 V ≤ U ≤ U_B

Digital output

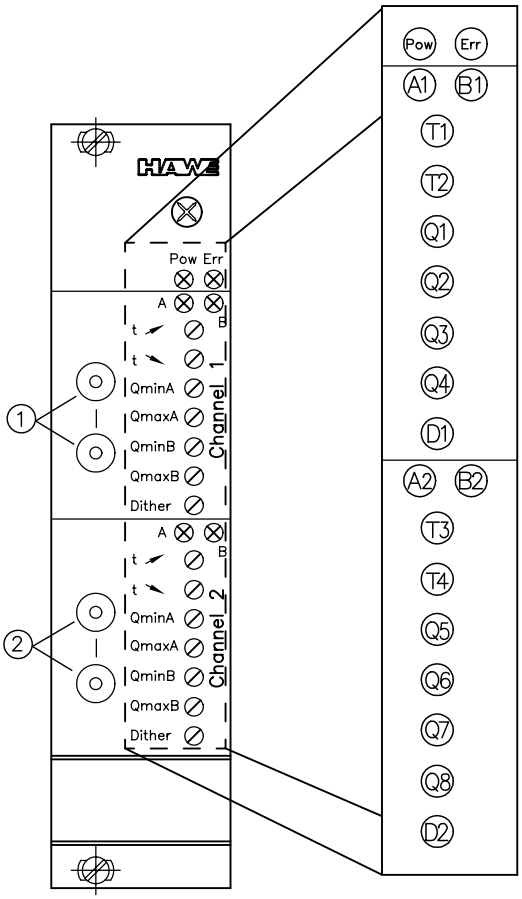
Output voltage	U_A	35 V
Max. output current	I_A	Max. 9 mA

Amplifier front plate and terminal assignment of the terminal block



Terminal block according to DIN EN 60603-2

Amplifier front plate



Amplifier front plate

1 2 x 2 mm sockets for current measurement (channel 1)

2 2 x 2 mm sockets for current measurement (channel 2)

General

Pow	Supply voltage (green LED)
Err	Fault (red LED)

Channel 1

A1	Solenoid A1 control (green LED)
B1	Solenoid B1 control (yellow LED)
T1	Ramp rise time
T2	Ramp fall time
Q1	Q_{min} (I_{min}) solenoid A1
Q2	Q_{max} (I_{max}) solenoid A1
Q3	Q_{min} (I_{min}) solenoid B1
Q4	Q_{max} (I_{max}) solenoid B1
D1	Dither amplitude

Channel 2

A2	Solenoid A2 control (green LED)
B2	Solenoid B2 control (yellow LED)
T3	Ramp rise time
T4	Ramp fall time
Q5	Q_{min} (I_{min}) solenoid A2
Q6	Q_{max} (I_{max}) solenoid A2
Q7	Q_{min} (I_{min}) solenoid B2
Q8	Q_{max} (I_{max}) solenoid B2
D2	Dither amplitude

3.4 Electro-magnetic compatibility (EMC)

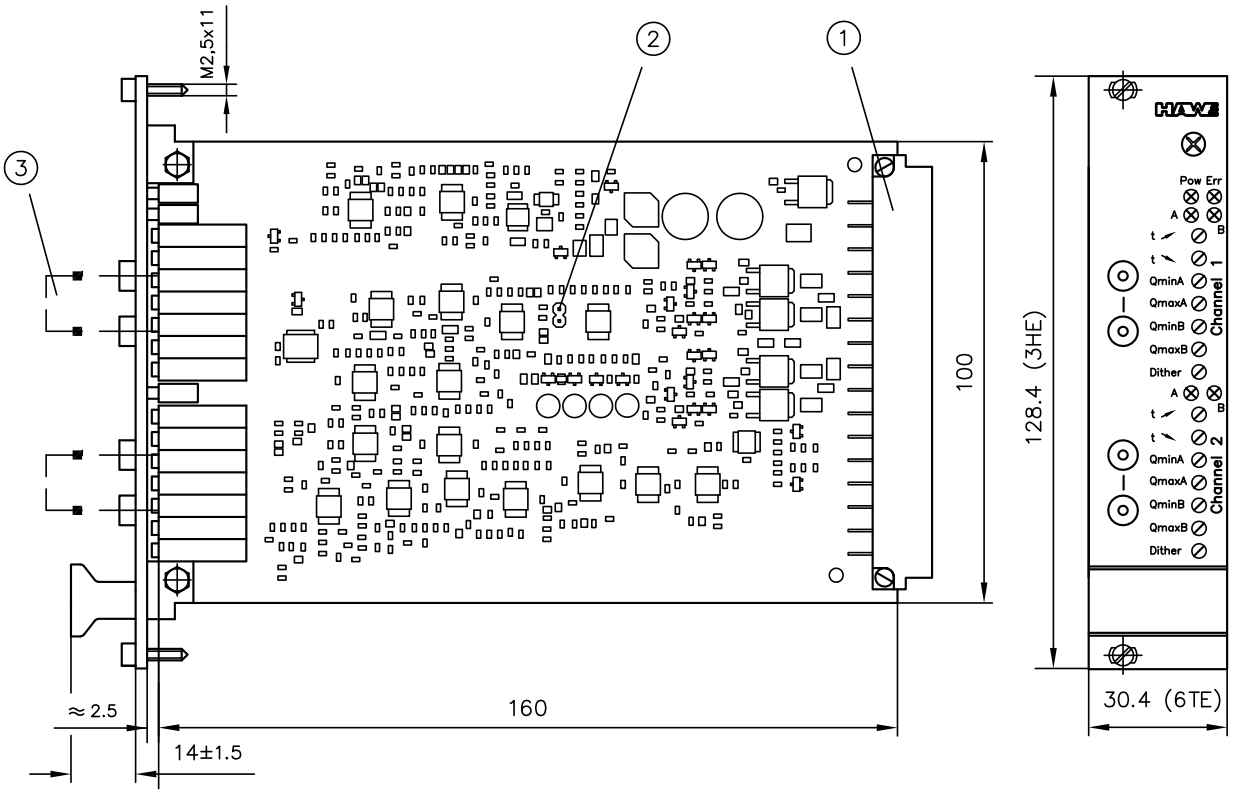
The EMC of the device was tested using an accredited testing laboratory (emitted interference DIN EN 61000-6-3 and immunity to interference according to DIN EN 61000-6-2 evaluation criterion "B"). The test set-ups only represent typical use. This EMC testing does not release the user from carrying out adequate prescribed EMC testing of their complete system (according to Directive 2014/30/EU). If the EMC of the complete system must be further amplified, the following measures can be tested and introduced:

- The required smoothing capacitor in accordance with Chapter 3.2, "Electrical Data" is not only needed to ensure the device functions correctly, but also to guarantee compliance with EMC guidelines (conducted emitted interference).
- The equipment should be installed in an metal cabinet (shielding)
- Supply lines, such as inputs and outputs to and from the device, should be as short as possible. If necessary they should be shielded and twisted in pairs (to reduce the antennae-like effect for increasing the immunity to interference).

4 Dimensions

All dimensions in mm, subject to change!

4.1 Amplifier card type EV22K5



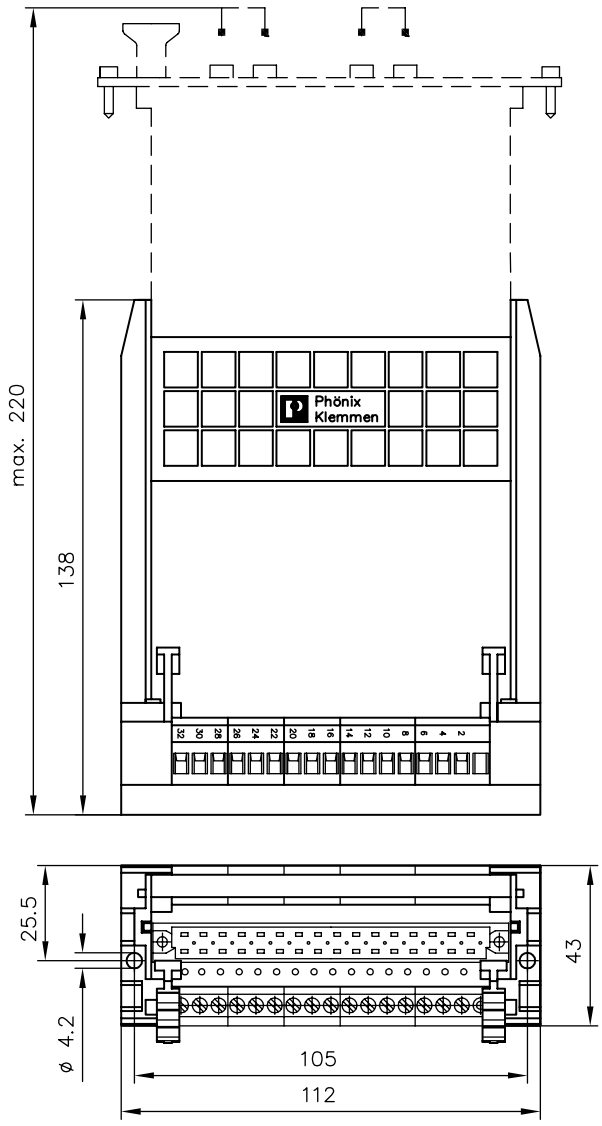
Overview of module type EV22K5

1 Female multipoint connector according to DIN EN 60603-2
2 Bridge BR
3 Short-circuit bridges for connection of 2 mm sockets to the front plate

For explanation of amplifier front plate, see Chapter 3.3, "Specific parameters".

4.2 Card holder

Protection class	IP 00 according to DIN EN 60529
Mass (weight)	approx.150 g



Overview of card holder

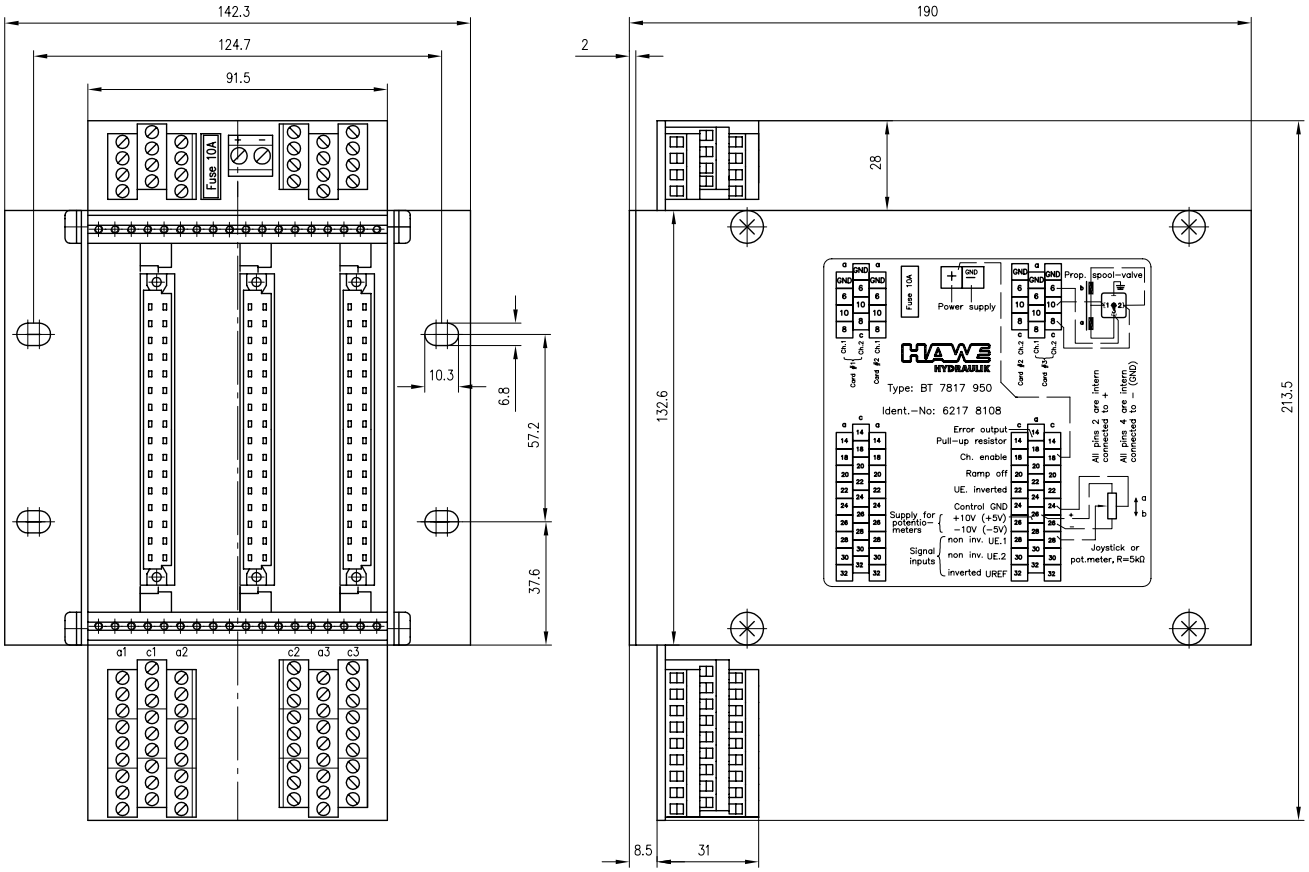
Note

A snap-on foot can be attached to the bottom of the card holder. This enables attachment to 35mm support rails according to DIN EN 60715 either longitudinally or transversely.

The snap-on foot must be ordered separately.

4.3 Module rack

Protection class	IP 00 according to DIN EN 60529
Mass (weight)	approx. 700 g



Overview of module rack

5 Installation, operation and maintenance information

5.1 Information on setting

Note
When delivered, the proportional amplifier EV22K5-12/24 has been set up so that it can be used, without any further setting, together with the proportional spool valve type PSL or PSV according to publication D 7700 ff. More precise matching between the proportional spool valve and proportional amplifier should only be undertaken if the appropriate specialist personnel and measuring equipment are available.

The arrangement (see Chapter 5.2, "Setting instructions") is the circuit used for EV22K5-12/24 with a target value potentiometer with centre tap (see Chapter 6.1, " Actuation of hydraulic valves using one proportional twin solenoid each or two proportional single solenoids").

The card is connected using a card holder or module rack (see "Available versions, main data"). The designation of the terminals corresponds to the designation of the terminal block (see Chapter 3.3, "Specific parameters").

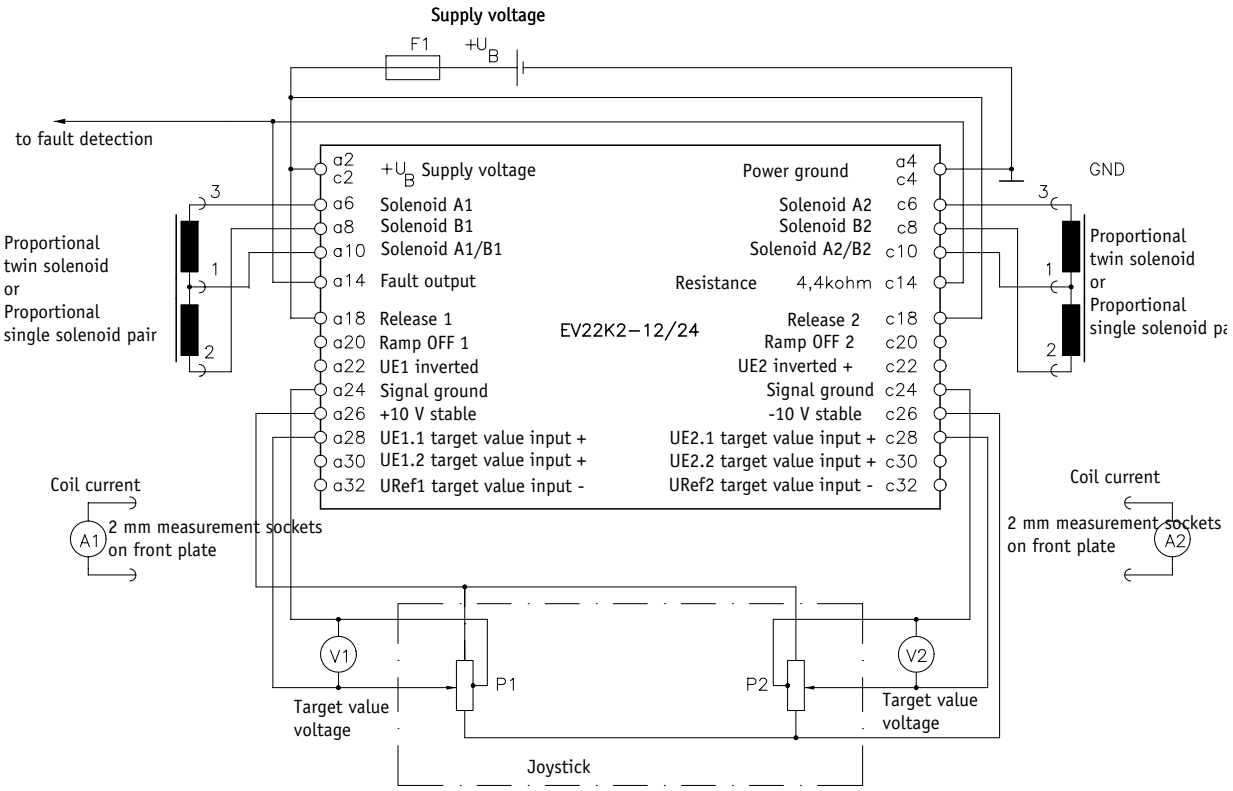
Shielded connecting lines with wires twisted in pairs should be used for connection lengths of more than 3 m to minimise emitted interference and/or to increase immunity to interference.

I_{max} must not exceed the I_{lim} value specified for the proportional solenoid for long periods. An external target value voltage must not exceed or fall below the set range of the reference voltages by more than 1 V for long periods. Otherwise this can lead to an incorrect reaction of the proportional amplifier. Use of the card as a single proportional amplifier for controlling single proportional solenoids (see Chapter 6.2, "Actuation of hydraulic valves using a proportional solenoid").

Note
Check the mains supply if any faults occur during the setting procedure, or during commissioning. The ammeter used for current measurement must not have a voltage drop of more than 0.5 V, otherwise the current measurement value displayed on the front plate via the measurement sockets can be wrong.

- For bridge rectification: Is an electrolyte filter capacitor of at least 2200 µF/A coil current connected in parallel to the supply voltage?
- Is the supply voltage for the proportional amplifier high enough? Under load, the supply voltage should be at least 1.8 V DC higher than the voltage that would be required to generate the set maximum current I_{max} for a warm solenoid without proportional amplifier.

5.2 Setting instructions



EV22K5 connection diagram

F1 3.5 A fuse

Note
Max. 3 cards may be protected with one fuse (10 A)

V1, V2 Control voltmeter for measuring the target value voltage, measuring range 0 to 10 V DC

A1, A2 Control ammeter for measuring the coil currents, measuring range 0 to 2 A DC

P1, P2 Joystick e.g. 1 x type EJ2-10 according to publication D 7844

Preparing the module

1. Turn ramp potentiometer anti-clockwise
✓ The slide of the potentiometer in the transparent housing is furthest away from the front plate
2. Connect the amplifier card and measurement devices according to the circuit example
3. Check the position of the bridge BR
4. Switch on the supply voltage
✓ The green LED on the front plate lights up

Note
If the red LED (Err) lights up, there is a fault. For diagnostics and fault elimination (see Chapter 5.4, "error management")

Setting the minimum current

1. Move Joystick P1 in one direction and hold it there until LED A1 lights up
2. Read off the voltage on voltmeter V1
3. Set the minimum current Imin A for direction A using the multi-turn potentiometer Qmin A1. Turning it clockwise increases the coil current
4.

> **Note**
> The indicative value for a PSL or PSV proportional spool valve with 24 V solenoids is approx. 290 mA, with 12 V solenoids approx. 580 mA

5. Read off the coil current on ammeter A1.
6. Move joystick P1 in the other direction and hold it there until LED B1 lights up
7. Set the minimum current Imin B for direction B using the multi-turn potentiometer Qmin B1. Turning it clockwise increases the coil current

Setting the maximum current

1. Move joystick P1 in direction A as far as the stop and hold it there
2. Read off the maximum target value voltage on voltmeter V1
3. Set the maximum current Imax A for direction A using the relevant multi-turn potentiometer Qmax A1. Turning it clockwise increases the coil current.

> **Note**
> The indicative value for a PSL or PSV proportional spool valve with 24 V solenoids is approx. 600 mA, with 12 V solenoids approx. 1200 mA

4. Read off the coil current on ammeter A1.
5. Move joystick in direction B as far as the stop and hold it there
6. Set the maximum current Imax B for direction B using the relevant multi-turn potentiometer Qmax B1. Turning it clockwise increases the coil current.
7. Read off the coil current on ammeter B1.
8. Set the dither amplitude so that with the joystick moved approximately half way, vibration is clearly felt with the hand on the lever of the proportional spool valve, but no interference is caused in the hydraulic system.

> **Note**
> Indicative values for type PSL(V) according to D 7700-.. UN = 24 V and with coil current 0.4 A approx. 140 mAS-S.
> Values for the dither amplitude can only be measured with an oscilloscope.

Setting the ramp times

1. Set ramp time for ascending ramp on the multi-turn potentiometer (t-)
2. Set ramp time for descending ramp on the multi-turn potentiometer (t^-)
3. Turning it clockwise extends the ramp time

5.3 Radio interference

In rare cases, it is possible for the proportional amplifier to go to fault status in the place where it is being used due to electromagnetic interference (e.g. where solenoid valves are being used which have no or inadequate interference suppression). In such cases, we recommend subsequent interference suppression of on/off solenoid valves and/or series incorporation of an EMC filter in the supply voltage on the module rack.

In mobile hydraulics e.g.: high-performance EMC filter type: FN332-10A from Schaffner EMV GmbH in 76185 Karlsruhe, Germany

5.4 error management

- LEDs on the front plate indicate the operating states of the amplifier card.
- Green LED (Pow): Lights up when the supply voltage is connected.
- Red LED (Err): Lights up in the event of a fault status. The faulty channel is also indicated by simultaneous flashing of the green (A) and orange (B) channel-specific LEDs.
- In parallel to the red LED, a signal output (NPN transistor, pin a14) is present. The fault indication (red LED) and the fault signal (pin a14) remain active until acknowledgement. However, the amplifier card functions once again as soon as the cause of the fault has been eliminated.

Possible faults

LED error code				Possible cause	Possible cause
Pow (green)	Err (red)	A (green)	B (yellow)		
●	●	●	●	Supply voltage too low U_B < 9.1 V	⇨ Increase supply voltage ⇨ Check smoothing and improve if necessary **Resetting the fault display** ⇨ Automatic reset
☼	☼	◑	◑	Cable break or short-circuit at the output (coil side)	⇨ Check connected solenoids and supply lines for short-circuits ⇨ Check interruptions **Resetting the fault display** ⇨ After fault elimination ⇨ Switch supply voltage on again OR produce a positive flank on PIN 18 [1] (release) of the relevant amplifier

● = LED remains off ☼ = LED lights up ◑ = LED flashes

Note
A fault status can only be detected by the electronics if the coil currents have exceeded the permissible limits on actuation. Therefore, one cannot predict a short-circuit or cable break at the output if the TARGET VALUE VOLTAGE = 0 or with the RELEASE BLOCKED (PIN 18) Such faults will only be reported shortly after actuation of the relevant side (end stage).

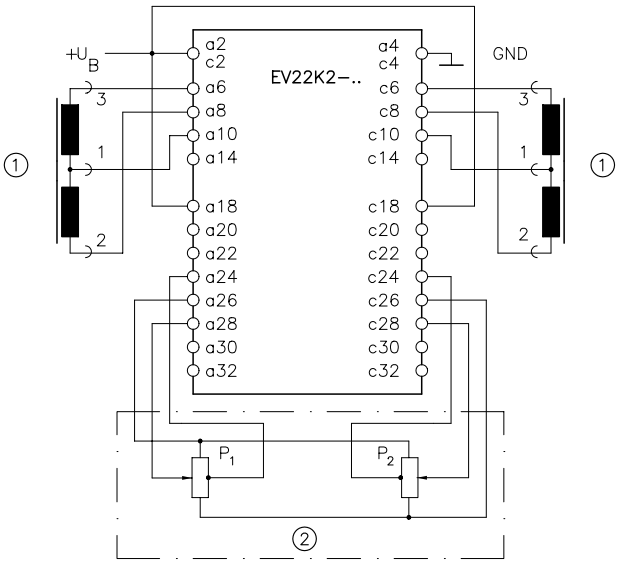
[1] When the RELEASE is blocked (PIN 18), the solenoid current is switched off without delay, but switched back on when released again via the set ramp function.

6 Typical circuits

6.1 Actuation of hydraulic valves using one proportional twin solenoid each or two proportional single solenoids

For a description of the connections, see Chapter 3.3, "Specific parameters".

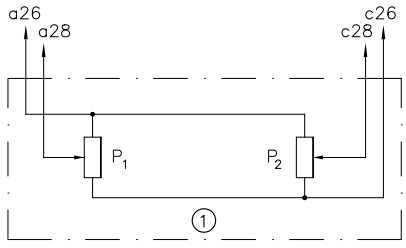
Example 1



1 Proportional twin solenoid or proportional single solenoid
2 Joystick

The signal emitter connected consists of two potentiometers with centre tap, e.g. two single-axis joysticks or one dual-axis joystick. The target value voltage is bipolar.
This basic circuit is protected against malfunction of the non-activated proportional twin solenoid in the event of a wire break at the input (target value potentiometer). In the event of such a wire break, the non-activated proportional valve remains in the neutral position, as the target value voltage at the input of the proportional amplifier remains zero.

Example 2



1 E.g. joystick

Two single potentiometers with only three connections (without centre tap) are used as signal emitters. The target value voltage is bipolar. This relatively cheap version does however have the disadvantage that, for example, if a supply line from the target value potentiometer to the reference voltage +10 V (a26) breaks, the target value voltage at the input of the proportional amplifier immediately jumps to -10 V. This means that the proportional solenoid of the non-activated proportional valve is fully controlled and therefore the valve moves as far as the stop with unchecked movement and max. speed of the consumer connected to it. Such a circuit should therefore only be advocated if the signal emitter and amplifier card are installed so close to one another that it is unlikely there will be any damage to the supply lines. The circuit according to example 1 or example 3 is preferable for safety reasons.

Example 3

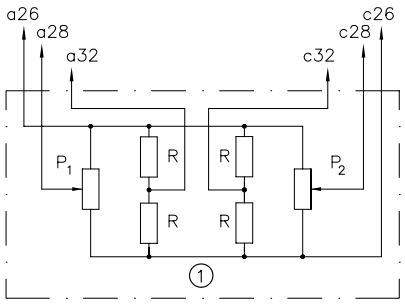


Diagram showing actuation of hydraulic valves with a proportional solenoid

1 E.g. joystick

As in example 2, two single potentiometers are used as signal emitters. The target value voltage is bipolar. The absent centre tap of the target value potentiometers is simulated in each case by two additional resistances of the same size between 5 and 10 kΩ, 0.25 W. This avoids the safety disadvantages of example 2 and the same applies as in example 1.

Example 4

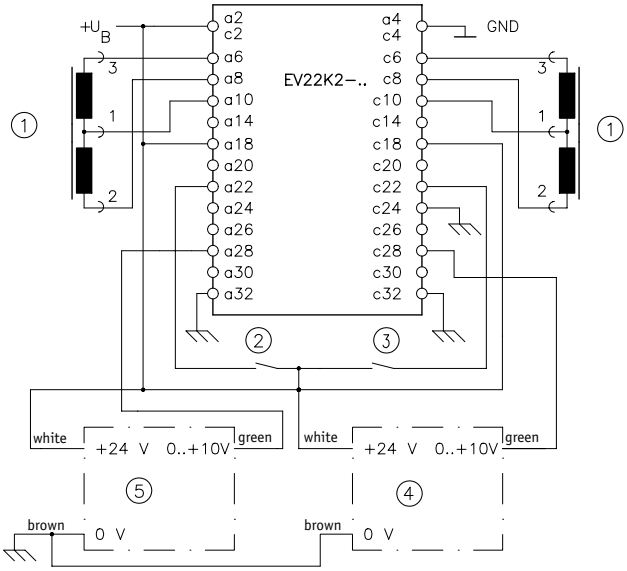


Diagram showing actuation of hydraulic valves with a proportional solenoid

1 Proportional twin solenoid or proportional single solenoid
2 Reverser 1
3 Reverser 2
4 Optical absolute encoder 2
5 Optical absolute encoder 1

Connection of a joystick switch with active setpoint generator, target value voltage unipolar, e.g.: controller with opto-electronic absolute encoder
Type: CSOVR 8P1.8P1 -2 OEG 010U from Spohn & Burkhardt in 89143- Blaubeuren, Germany
Reverser coupled internally mechanically with absolute encoder: Reverser 1 – with optical absolute encoder 1. Reverser 2 – with optical absolute encoder 2.

Example 5

Connection to a PLC, CNC or PC, target value voltage bipolar

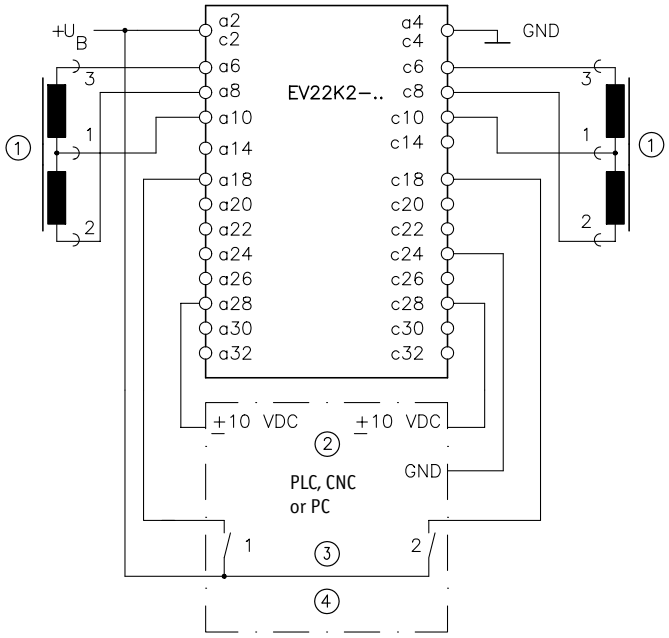


Diagram showing actuation of hydraulic valves with a proportional solenoid

1 Proportional twin solenoid or proportional single solenoid
2 Analogue outputs
3 Release
4 Relay outputs

Example 6

Connection to a PLC, CNC or PC, target value voltage unipolar

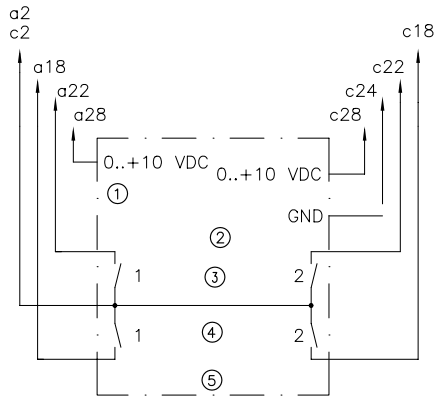


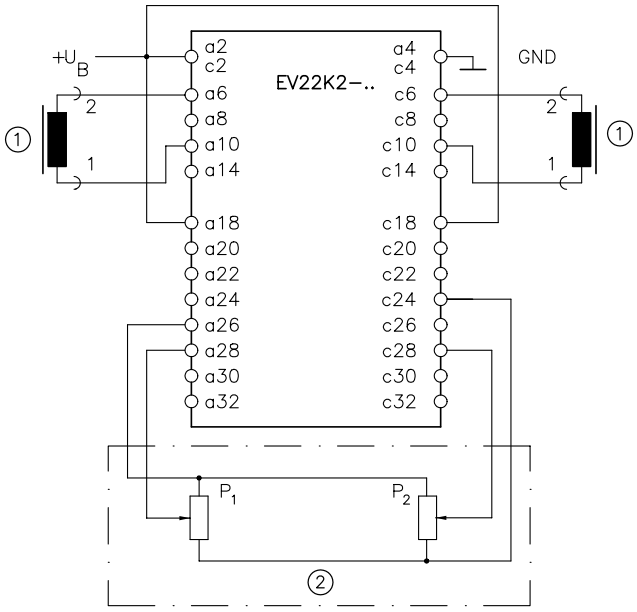
Diagram showing actuation of hydraulic valves with a proportional solenoid

1 Analogue outputs
2 PLC, CNC or PC
3 Inverted
4 Release
5 Relay output

6.2 Actuation of hydraulic valves using a proportional solenoid

For a description of the connections, see Chapter 3.3, "Specific parameters".

Example 7



Actuation of hydraulic valves using a proportional solenoid

1 Proportional single solenoid
2 Joystick

Use as a proportional amplifier for two single solenoids. The two proportional solenoids should be connected to the ports a6 to a10 or c6 to c10 and a unipolar target value voltage selected.

Note
In the event of inversion (a22 or c22) or a change in polarity of the target value voltage applied, the amplifier would go to fault status, because this would be equivalent to actuating the absent second coils and, as ports a8 and c8 were unoccupied, it would be interpreted as a wire break.

Further information

Additional versions

- Proportional amplifier type EV2S: D 7818/1
- Proportional amplifier type EV1M3: D 7831/2
- Proportional amplifier type EV1D: D 7831 D
- CAN node type CAN-IO: D 7845-IO 14

Application

- Proportional directional spool valve, type PSL and PSV size 2: D 7700-2
- Proportional directional spool valve, type PSL, PSM and PSV size 3: D 7700-3
- Proportional directional spool valve, type PSL, PSM and PSV size 5: D 7700-5
- Proportional directional spool valve banks, type PSLF, PSVF and SLF size 7: D 7700-7F
- Proportional directional spool valve type PSLF, PSVF and SLF size 3: D 7700-3F
- Proportional directional spool valve type PSLF, PSVF and SLF size 5: D 7700-5F
- Proportional directional spool valve type EDL: D 8086
- Directional spool valve bank type SWS: D 7951

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