Analog amplifier RA

RE 95230
Edition: 08.2015
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- For control of simple functions of electrohydraulic components
- Two power outputs (PWM) and one switching output
- Each output has a separately adjustable time for upwards and downwards ramps
- Each output has separately adjustable minimum and maximum currents

Features

- Optional interlock of actuation for proportional solenoids
- Supply voltage for external setpoint potentiometer
- Monitoring of setpoint potentiometer for cable breakage and short circuit
- Externally actuated switching output
- Error output
- Overload protection, overvoltage protection, conditional short-circuit protection
- Externally adjustable PWM frequency

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Type code

01	02		03
RA	**2-1**	**/**	**10**

Type

01	Analog amplifier	**RA**

Version

02	1st position: number of proportional outputs 2nd position: number of switching outputs	**2-1**

Series

03	Series 1, index 0	**10**

Ordering details

Type	Version		Series	Material Number
RA	2-1	/	10	R902091800

Mating connector

Order designation for 25-pin Bosch mating connector comprising:

Designation	Material number
Handle shell, angled	Bosch 1 928 401 013
Contact carrier	Bosch 1 928 400 952
Screw for contact carrier	Bosch 1 928 491 082
Flat sealing ring for screws	Bosch 1 928 300 198
Locking piece, lilac color	Bosch 1 928 401 566
Clamping collar, large	Bosch 1 928 400 890
2 screws for the clamping collar	Bosch 1 928 491 151
Sleeve, angled, 18 mm	Bosch 1 928 300 284
Seal for contact carrier	Bosch 1 928 300 191
Clamping band for sleeve	Bosch 1 928 401 280
25 contacts	AMP 927775-3

The mating connector is not included in the scope of delivery.
It can be ordered from Bosch Rexroth under the material number R902603063.

Description

The analog amplifier activates up to two proportional solenoids. The specified control voltage is processed in the amplifier as an input variable. The analog amplifier provides a regulated electric current as an output variable for actuation of proportional solenoids.
The amplifier outputs for the proportional solenoids are activated by applying approx. 5% of the maximum setpoint voltage at the input, i.e., the minimum output current is applied. The level of this minimum output current can be adjusted separately for both proportional outputs using a trimming potentiometer. If the setpoint voltage at the input is increased, the output current for each respective proportional solenoid increases linearly.
The maximum output current can also be separately adjusted using a trimming potentiometer for the outputs. The gradient of the output curve is influenced by this.
The analog amplifier contains time ramp functions which can be used to adjust the period in which the output current can be adapted to match a modified setpoint. The ramp time adjustment range extends from 100 ms to 10 s. The time ramp functions can be adjusted using trimming potentiometers for each solenoid.

Service options

The RA analog amplifier can be used to actuate up to two proportional solenoids in a single device (for example a toggling axial piston unit or a valve section with separate actuation of the proportional solenoids) or to actuate two devices independently of each other (for example, two individual axial piston units or valves). The use of only one proportional output is possible. A 1 A output for a switching function is also available.

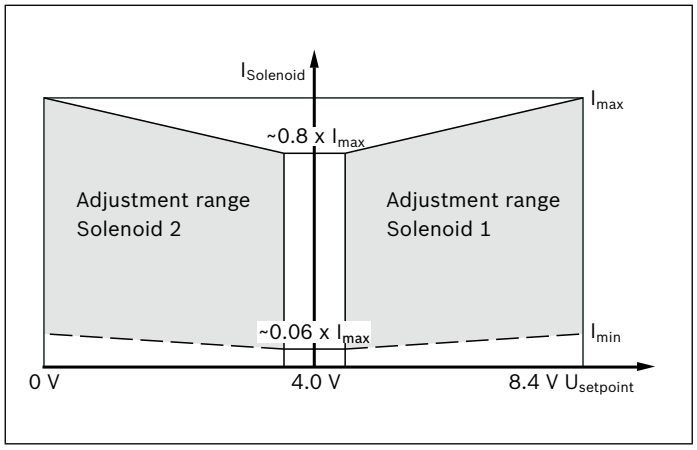
Technical data

Analog amplifier RA2-1		
Nominal voltage		12 and 24 V
Residual ripple (DIN 40839, Section 1), maximum		± 2 V
Supply voltage, perm. range		10 to 32 V
Current consumption		
without load		150 mA
with load, max.		6 A
Fuse		
internal		–
external: for switching and proportional solenoid outputs and for electronics		7.5 A T
Potentiometer supply voltage		0 V, 4.0 V
for setpoint potentiometer 2 to 5 kΩ	depending on load	7.2 V to 8.4 V
Voltage input (differential amplifier) (differential voltage)	4.0 V	2
Switch input	> 5.0 V	1
Proportional solenoid outputs (PWM)		
Current range	0 to 2.3 A	2
Pulsation frequency	100, 200 or 350 Hz	
Switch output (MOSFET)	max. 1 A	1
LED indicators		
red	Error (error display)	●
green	Power (operating state indicator)	●
yellow	I1 (PWM current channel 1)	●
yellow	I2 (PWM current channel 2)	●
Error detection		
Potentiometer: for broken wires and short circuit	Exception: wiper	●
Voltage supply: undervoltage monitoring		●
Resistance to short circuits To supply voltage and ground for all inputs and outputs (Exception: potentiometer supply 4.0 V to supply voltage)		●
Reverse polarity protection Supply/battery		●
Electromagnetic compatibility		
Spurious interference (motor vehicles directive 95/54/EC)	Details on request	100 V_{ms}/m
Line-bound interference (ISO 7637-1/-2/-3)	Values on request	●
Load dump		70 V
Max. power loss	at 32 V	4 W
Operating temperature, case		–40 to 85 °C
Storage temperature, case		–40 to 85 °C
Vibration resistance		
Sinusoidal vibration (IEC 60086-2-6)	20 cycles per axis	10*g* / 57 to 2000 Hz
Random vibration (IEC 60086-2-36)	30 min. per axis	0.05 g^2/Hz
Shock resistance		
Transport shock (IEC 60068-2-27)	3X in each direction (pos./neg.) and in each axis	15*g* / 11 ms
Continuous shock (IEC 60068-2-29)	1000X in each direction (pos./neg.) and in each axis	25*g* / 6 ms

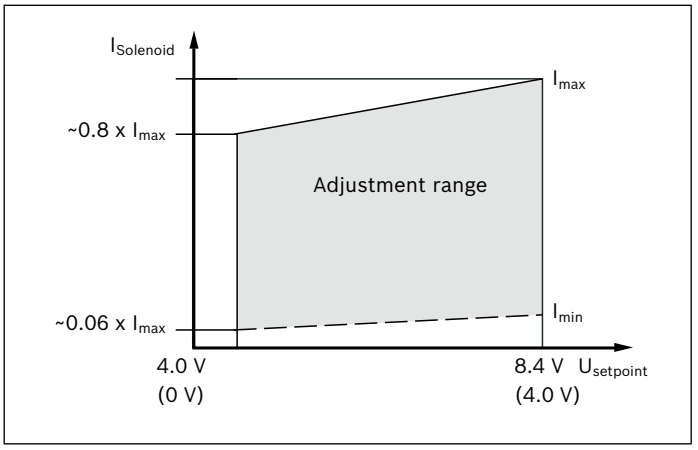
Analog amplifier RA2-1		
Resistance to moisture IEC 60068-2-30Db; version 2	90 % (+25 °C to +55 °C)	●
Resistance to salt spray IEC 60068-2-11	72 h, 35°C, 5% NaCl	●
Type of protection (DIN / EN 60529)	with installed mating connector[1)]	IP65
Case material	Plastic injection molding PA66 GF 35	●
Mass, approx.		0.3 kg
Outer dimensions	Length	108 mm
	Width	135 mm
	Height	42 mm

Characteristic curves

For 2 solenoids with interlocked actuation (toggling mode)

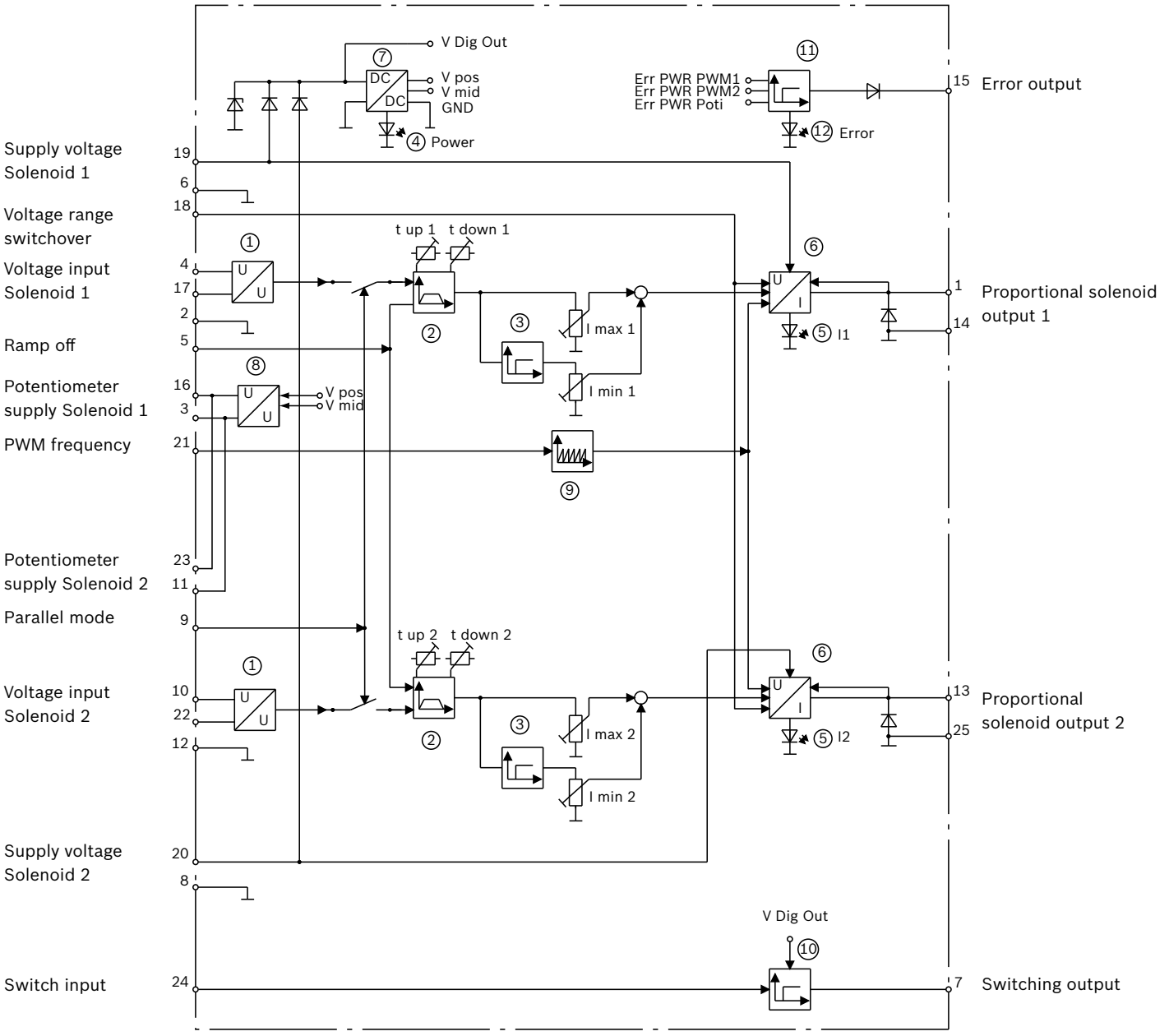


For 2 solenoids with independent actuation (parallel mode)



1) For the appropriate routing of the connection cable, see “Installation position”

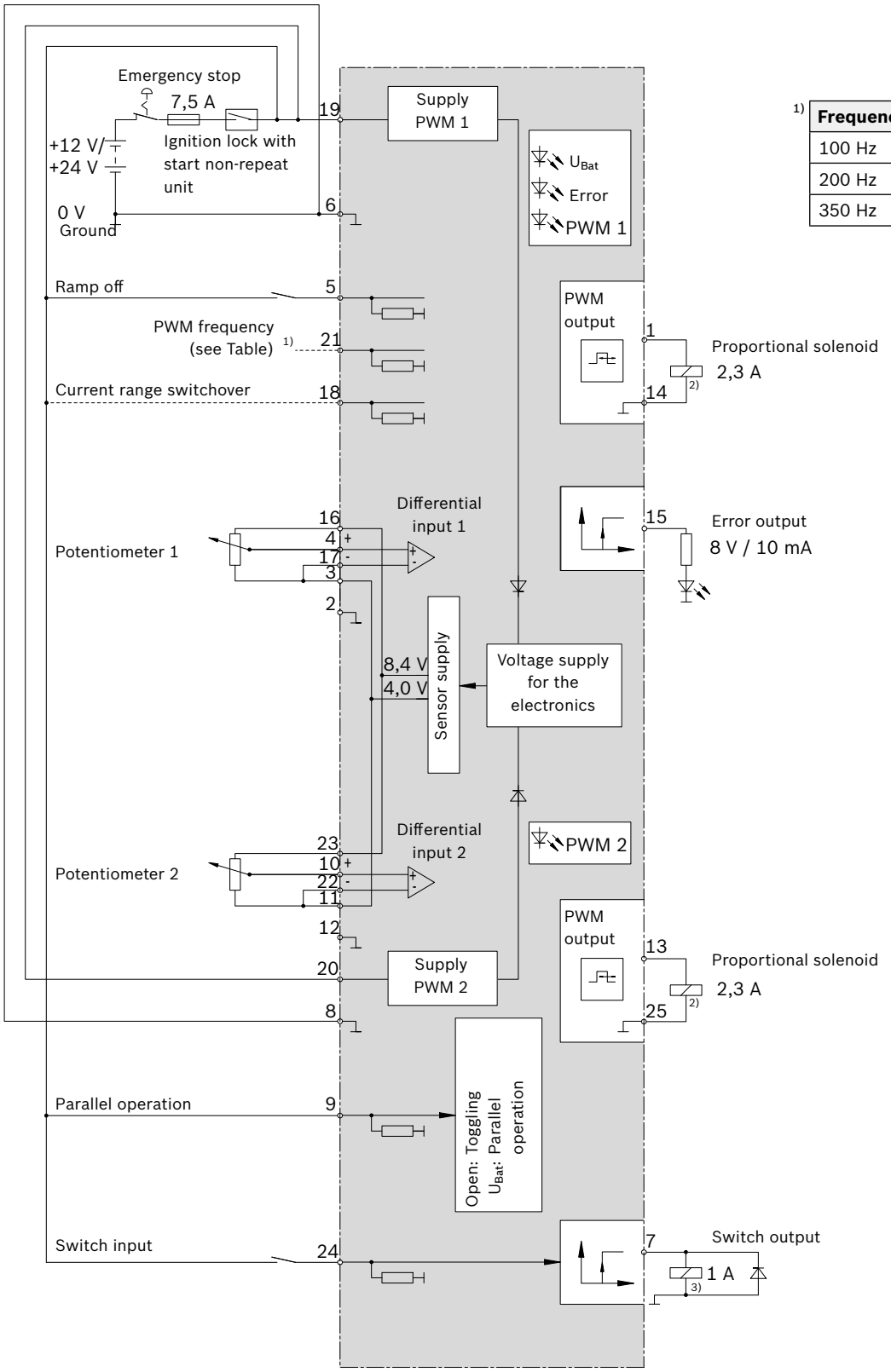
Block circuit diagram



Key	
(1)	Differential amplifier
(2)	Time ramp function
(3)	Reference voltage generation
(4)	LED operational status (Power)
(5)	LED displaying PWM current (I1 or I2)
(6)	PWM output stage

Key	
(7)	Internal voltage supply
(8)	Sensor or potentiometer supply
(9)	Clock-pulse generator
(10)	Switch output
(10)	Error detection
(12)	LED displaying error (Error)

Terminal connection



1)

Frequency	Pin 21	Bridge from 21
100 Hz	open	–
200 Hz	to GND	to 2 or 12
350 Hz	to U_{Bat}	to 19

1) 3 connection options to switch over the PWM dither frequency (see Table): 100 Hz, 200 Hz, 350 Hz if required

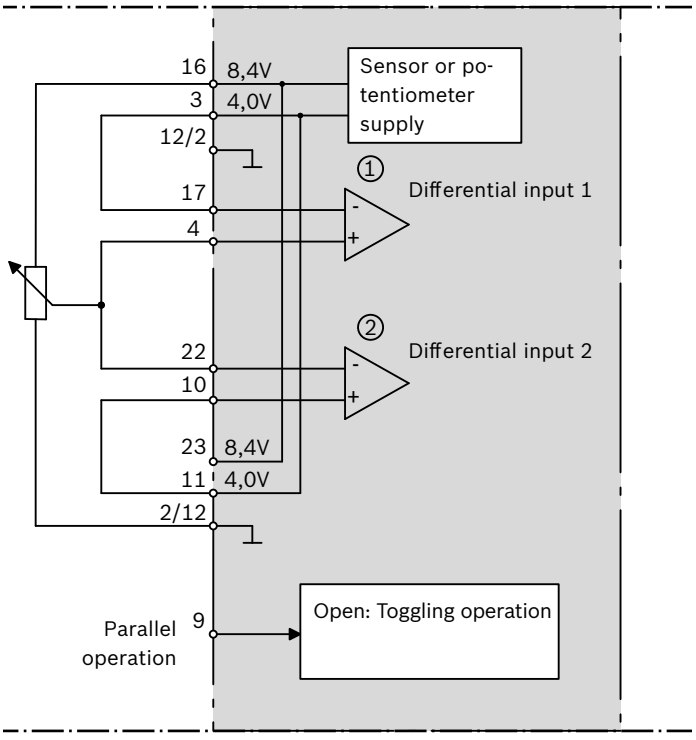
2) Ground connection for solenoid return lead to the battery (or chassis) possible

3) Separate ground connections to the battery (or chassis) required; in the case of an inductive load, a freewheeling diode must be connected

Terminal connection variant

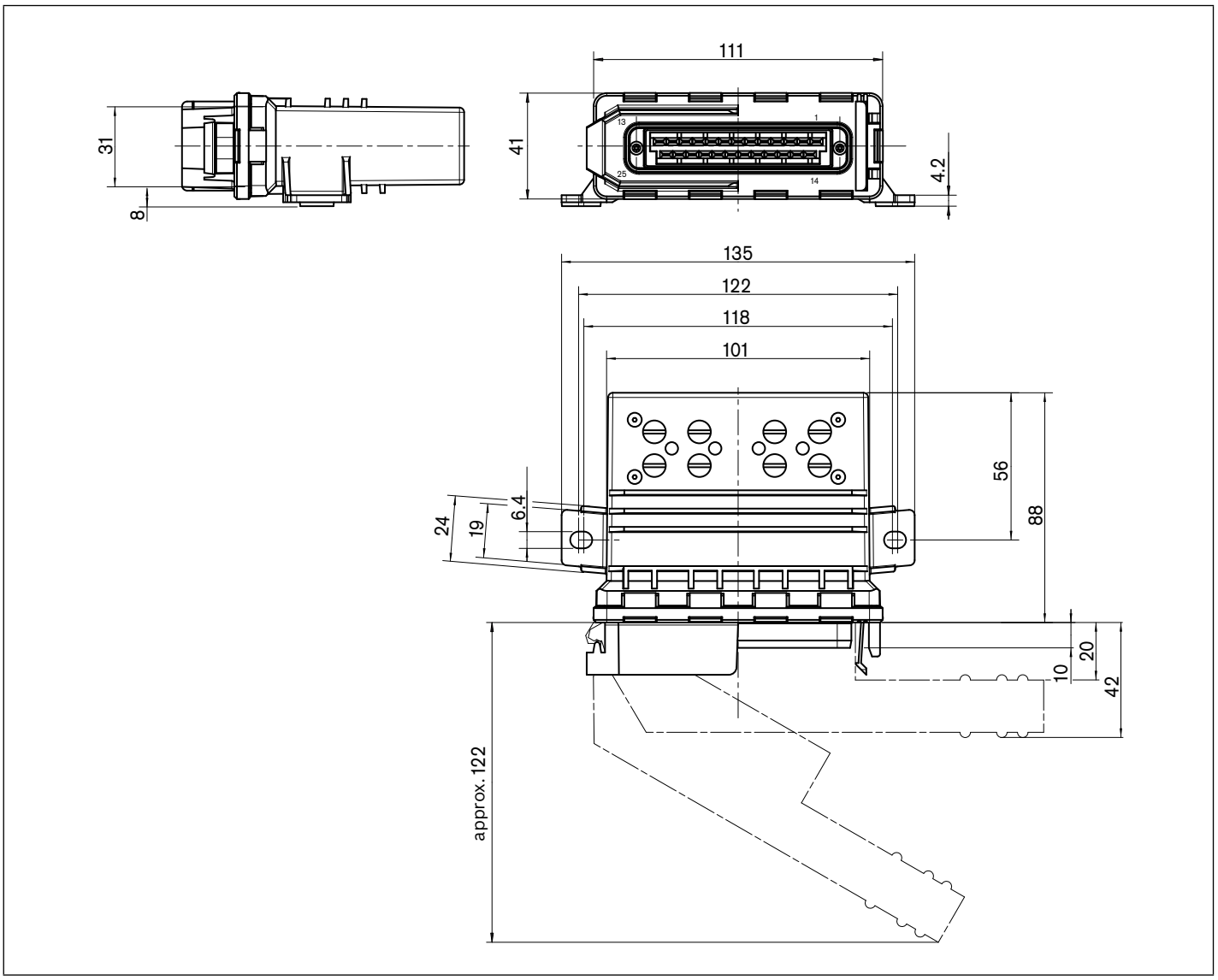
Further terminal assignments e.g. for the control voltage or the control current specification can be found in the instruction manual 95230-B.

Toggling operation with single potentiometer
If the analog amplifier RA is used in the toggling operation with just one potentiometer, then the potentiometer must be connected as per the following section:



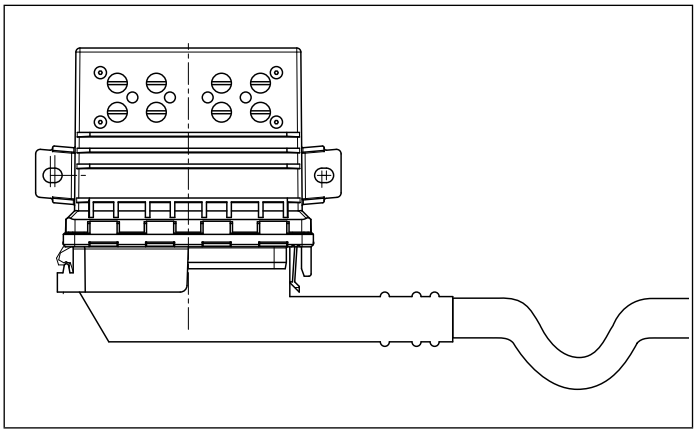
Key	
①	Analog input 1 (4.0 V ... 8.4 V): Setpoint ($U_{setpoint}$) for output signal amplifier 1 (solenoid 1)
②	Analog input 2 (4.0 V ... 0.0 V): Setpoint ($U_{setpoint}$) for output signal amplifier 2 (solenoid 2)

Dimensions



Installation position

The permissible installation position is with the plug positioned vertically downwards.
The cable must be routed such that it lies completely or partially below the amplifier connection (see illustration).
The IP65 type of protection is only achieved in the shown installation position in combination with a sealing of the connector relative to the wiring harness sleeve. Any ingress of water into the analog amplifier by way of the wiring harness must be avoided by routing the wiring harness accordingly.



Project planning notes

- The instruction manual 95230-B must be observed during project planning and commissioning.
- The total of setpoints for parallel wired potentiometers must lie in a range between 2 kΩ and 5 kΩ. Potentiometers with 4.7 kΩ or 5 kΩ are recommended.
- The externally actuated switch output can be used to actuate an additional device such as, e.g. for an emergency valve or a horn.
- Do not use a freewheeling diode in the the lines to the solenoids at Pin 1 and 13.
- Other inductive consumers in the system must be equipped with freewheeling diodes.
- External switching contacts in the solenoid lines are not permissible.
- Toggling or parallel mode is applied to Pin 9:
  - Not connected: toggling mode, interlocked actuation of Solenoid 1 and Solenoid 2
  - wired with $+U_{Bat}$ parallel mode, independent of each other actuation of Solenoid 1 and Solenoid 2
- To switch off the time ramp function, Pin 5 (ramp off) must be connected.
- The PWM frequency of the output current is set by connecting pin 21 (PWM frequency).
- The PWM output stages are supplied with voltage via Pin 19 (Solenoid 1) or Pin 20 (Solenoid 2) separately. Interruption of the supply voltage enables them to be switched off individually and independent from each other.
- Connection of Pin 24 (Dig In) activates switch output (Pin 7, Dig Out).

Safety instructions

- In contrast to digital control units analog amplifiers only allow a limited diagnosis and monitoring capability. The use of an analog amplifier in applications in which – in the event of a error – hazardous machine states may arise, is therefore not permissible without additional external protective measures.
- If an analog amplifier develops a error – i.e. unintended actuation or switching off of one or several solenoids – then malfunctions cannot be reliably prevented.
- The suggested circuits do not imply any technical liability of Bosch Rexroth for the system.
- The safety instructions in instruction manual 95230-B must be observed.
- In emergency situations or a malfunction the operating voltage is to be externally interrupted. To this end, interruption of the electronic circuit‘s supply voltage is to be effected using an emergency stop switch. The emergency stop switch must be installed in an easily accessible position for the operator. Safe braking must be ensured when the emergency stop function is activated.
- To avoid malfunctions the lines shielded from and to the potentiometers are to be connected on one side with low-impedance to

  devices or vehicle ground.
- Cables to the electronics must not be routed close to other power-conducting cables in the machine or vehicle.
- A sufficient distance to radio systems must be maintained.
- All connectors must be unplugged from the electronics during electrical welding operations.
- The analog amplifier may only be wired up when in de-energized state.
- Cable connection must have a strain relief and be attached such that vibration will not cause any corrosion to the plug contacts. Contacts must be protected against corrosion.
- If the solenoid output is overloaded (short circuit) the relevant output is not constantly switched off.
- The two PWM outputs must not be connected to each other (bridged)!
- Faulty connections could cause unexpected signals at the outputs of the analog amplifier.

- Opening, modifying or repairing the analog amplifier RA is not permissible. Modifications or repairs to the wiring could lead to dangerous malfunctions.
- Make sure no pins are energized when the analog amplifier RA is not receiving power.
- System developments, installations and commissioning of electronic systems for controlling hydraulic drives must only be carried out by trained and experienced specialists who are sufficiently familiar with both the components used and the complete system.
- No defective or incorrectly functioning components may be used. If the components should fail or demonstrate faulty operation, then repairs must be performed immediately.
- If the analog amplifier RA is dropped, continued use is not permissible because unseen damage may affect its reliability.
- Operation of the analog amplifier RA must generally occur within the operating ranges specified and released in this data sheet, particularly with regard to voltage, current, temperature, vibration, shock and other described environmental influences.

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