**BUCHER**
hydraulics

Amplifier Card for Proportional Valves

1-channel for valves with one solenoid
Series SAN-535-10 / SAN-535-60

- CE - approved
- For 12 VDC and 24 VDC solenoids
- SAN-535-10: Ramp ranges 0…10 s
  SAN-535-60: Ramp ranges 0…60 s
- With reverse-polarity protection
- External "Ramp Disable" function
- Short circuit-proof
- Separate Ramp Up and Ramp Down adjustments

1   Description

The SAN-535… servo amplifier has been designed for single solenoid proportional valves. Applications include the control of proportional pressure- and throttle valves. The module is provided with various setpoint inputs 4…20 mA, 0…20 mA, 0…5 V, 0…10 V, user selectable, 10 kΩ / V. The ramp gradients can be set separately for rise and fall. In addition, I_{max}, I_{min} and the dither amplitude can be set via multi-turn resistors. **The pin assignments and functions of the SAN-535… are compatible with the SAN-135.**

2   Technical data

General characteristics	Description, value, unit
Supply voltage	24 V DC (18 - 36 V DC) 15 - 26 V AC
Reference voltage	-12 V, ca. 50 mA, stabilised
Output current I_{max}	2000 mA
Setpoint inputs	1x 4…20 mA, 100 Ω 1x 0…20 mA, 100 Ω 1x 0…5 V, 50 kΩ 1x 0…10 V, 100 kΩ 1x user selectable 10 kΩ / V MAX
Dither	2 jumper-selectable ranges approx. 140 Hz (plug in position J5) approx. 45 Hz (plug in position J1) Amplitude can be set using the DITHER potentiometer, approx. 0…10% of rated current
Multi-turn I_{max} resistors	I_{max} …2 A I_{min} approx. 0…25 % of I_{max} Ramp up 2…140 V/s (-20 %) (70 ms 5s) Ramp down 2…140 V/s (-20%) (70 ms 5s)
Connection	32-pole male multipoint connector, DIN 41612 D32
Dimensions	169 mm x 100 mm x 30 mm (Overall dimensions)
Weight	~ 125 g

3 Block circuit diagram

4 Dimensions

For individual mounting, a card holder with screw terminals is availble (Weidmüller, type SKHD 32 S) and must be separately ordered.

32-pin male multipoint connector to DIN 41 612, type D32

32-pin female connector to DIN 41 612, type D32 is supplied with the card
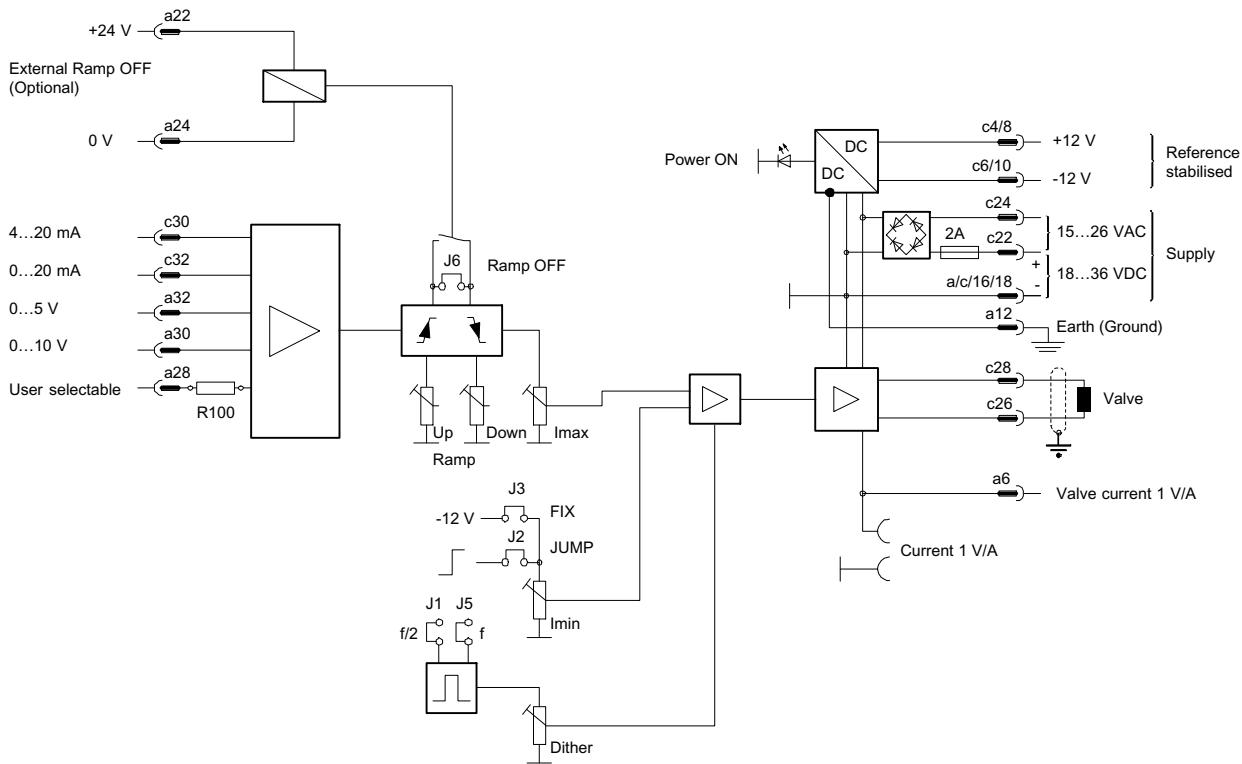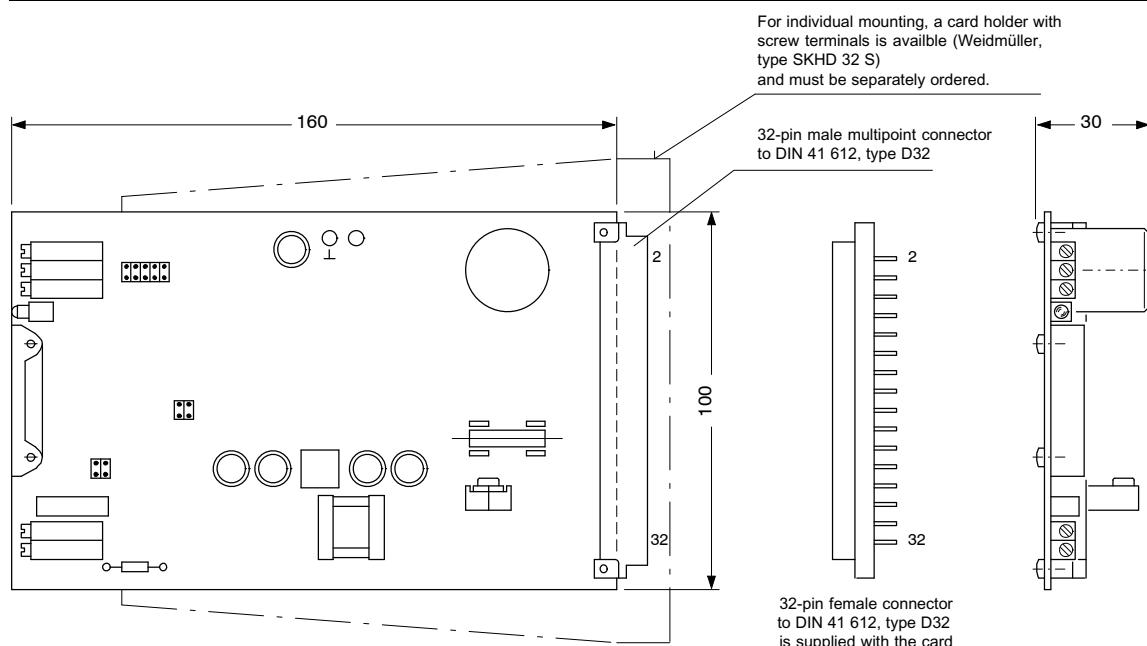
5 Power supply

The SAN-535 servo-amplifier is supplied by means of a 24 V DC voltage. A polarity diode is used to exclude the possibility of incorrect polarity of the card. Since the module is equipped with a pulse-width modulated end stage, it should be regarded as a DC/DC converter, with the result that the feed current taken up is generally lower than the solenoid current. The supply voltage may vary between 18 and 36 V. The DC voltage should be connected to the following connector pins: c22 = +24 V

a/c 16/18 = 0 V (GND)
a12 = Earth (Ground)

A supply voltage of approx. 30 to 35 V should be used for a valve with a 24 V solenoid. This ensures complete actuation of the valve even in case of elevated solenoid temperature. An AC voltage in the 15 to 26 V range can also be used to supply the module, however; this voltage should be connected to the following connector pins:

c22, c24 = 15 to 26 V AC
a12 = Earth (Ground)

The module is protected against overload and short-circuit by means of a fusible cutout (2 A, medium time-lag).

6 Reference voltage

The reference voltages are generated on the card in a DC/DC converter. The two reference voltages of ± 12 V are available for external supply of setpoint potentiometers. They can also be used for supply of external modules. The

reference voltages are routed out via the following connector pins:

c4/8 = +12 V stabilized
c6/10 = -12 V stabilized

7 End stage

The end stage is of pulse-width modulated type and functions at a PWM frequency of approx. 6 kHz. The end stage is equipped by means of circuiting provisions with a high-

speed de-excitation function. Maximum end stage output current is 2 A. The coil of the solenoid should be connected to Connector Pins c26 and c28.

8 Dither

A square-wave generator (dither generator) is provided, in order to overcome static friction in the valve and reduce hysteresis. Two dither frequency ranges can be selected (Jumpers): J5 installed: approx. 140 Hz
J1 installed: approx. 45 Hz

Dithers amplitude can be set within a range from 0 to 10% (referred to nominal current)
using the Dither potentiometer on the front panel.

9 I_{min}

Proportional valves generally require a minimum current in order to reach the start of their pressure / volumetric flow characteristics curve. This current is generally approx. 10 to 20 % of maximum current. This current can be applied

either as a selectable fixed value or in the form of a selectable I_{min} jump. A deflection of the setpoint of approx. 1.5 % is firstly necessary in the case of an I_{min} jump. The setpoint will then jump to the set value.

I_{min}-jump as a function of Jumpers J3 and J2
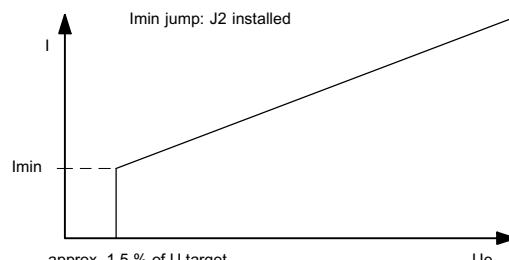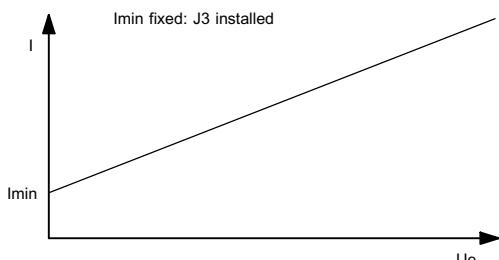
10 Ramp

A ramp generator, which can be deactivated by means of the jumper, is integrated into the module. It is necessary for this purpose to remove the RAMP jumper (J7) and install the OFF jumper (J6). A supplementary circuit, via which the ramp can also be switched in and out externally, is also op-

tionally available. The ramp gradients can be set by means of two separate potentiometers on the amplifier card:
Ramp Up / Ramp Down:

$$\text{SAN-535-10} = 0\ldots10\text{ s}$$
$$\text{SAN-535-60} = 0\ldots60\text{ s}$$

11 Inputs

The servo-amplifier is equipped with the usual inputs: 4…20 mA Pin c30 / 0…20 mA Pin c32 / 0…5 V Pin a32 / 0…10 V Pin a30
In addition, the module also features a freely selectable voltage input (Pin a28), which can be easily adapted to the user's individual needs.
The input must be circuited at 10 kΩ / V. It is necessary for this purpose to install a resistor of the required value in place of the resistor R100 on the card.

Jumper J4 (4 mA compensation) must be installed if the 4…20 mA input is used.
Jumper J4 must be installed in Spare Position J9 if one of the other inputs is to be used. Otherwise 4 mA compensation will be applied to the other outputs, causing falsification of the setpoint.
Input voltages and currents for selection of setpoints must have positive polarity.

12 Instructions for commissioning

1. Connect the servo-amplifier in accordance with the technical data and the block circuit diagram.
Take special care to ensure that the supply voltage is correct!

2. Valve current can be measured at the **CURRENT** measuring point on the board or at Pin a6.
The measuring range data can be found in the Technical Data.

3. The **POWER ON** LED must illuminate. Check through the entire installation procedure again if this is not the case.

4. Set spindle resistance I_{max} to 0 by turning it to the left up to the stop.

5. If the servo-amplifier is being used for activation of a throttle, operation should normally be with an I_{min} jump, i.e., the valve moves to the start of its volumetric flow characteristics curve at approx. 1.5% of the setpoint (J2 installed).
A fixed I_{min} is generally used if the servo-amplifier is being used for a pressure adjustment valve. Jumper J3 (FIX) must be installed in this case.

6. With Jumper J3 installed, increase I_{min} until the drive starts to move or until pressure builds up. Then decrease again slightly until zero state is reached again. With Jumper J2 installed, firstly apply a setpoint of +10 V and increase I_{min} until the drive starts to move. Then decrease again slightly until zero state is reached again.

7. Volumetric flow / pressure amplification for the valve is implemented by application of a setpoint of +10 V on Input a30.
The required speed / pressure can now be set by modifying spindle resistance I_{max}.
Turn the potentiometer to the right to increase
Flow / Pressure
Turn the potentiometer to the left to decrease
Flow / Pressure

8. The ramp gradients can be set on the spindle resistances: Ramp up rising characteristics curve
           Ramp down falling characteristics curve
Turn the potentiometer to the left to increase time.
Turn the potentiometer to the right to decrease time.

13 Jumper positions
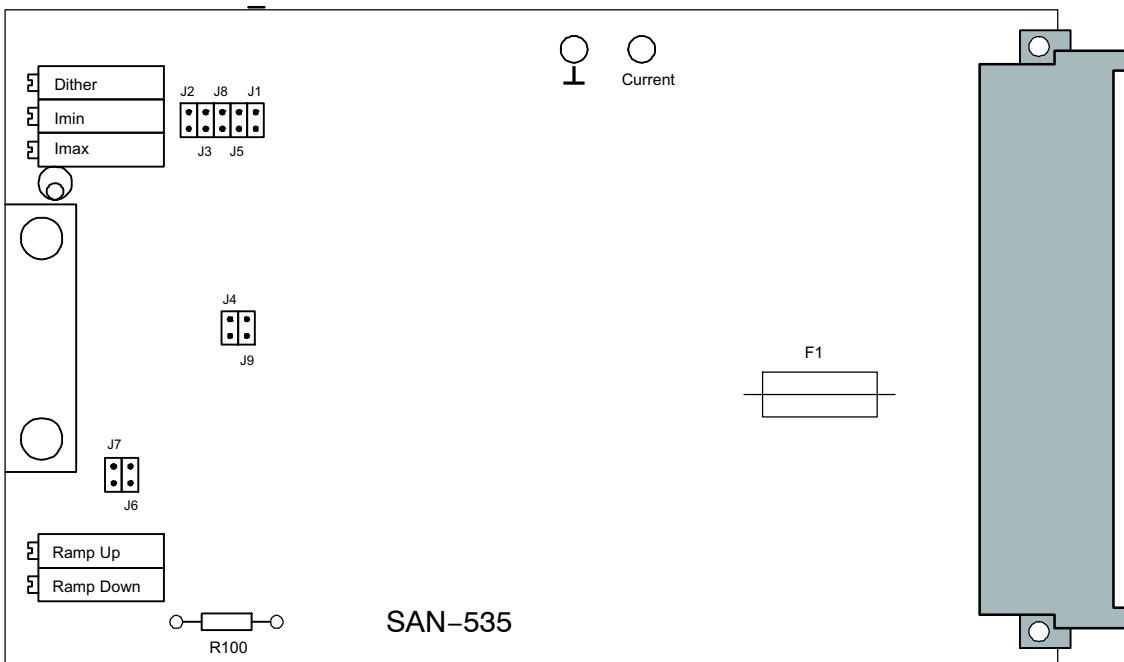
J1) Dither-frequency (f/2): approx. 45 Hz	J6) Ramp OFF
J2) I_{min}: Jump	J7) Ramp ON
J3) I_{min}: Fix	J8) Spare Position
J4) 4 mA compensation	J9) Spare Position
J5) Dither-frequency (f): approx. 140 Hz	F1) Fusible cutout, 2 A medium time-lag

14 Pin assignment

Female connector acc. to DIN 41 612, Type D32
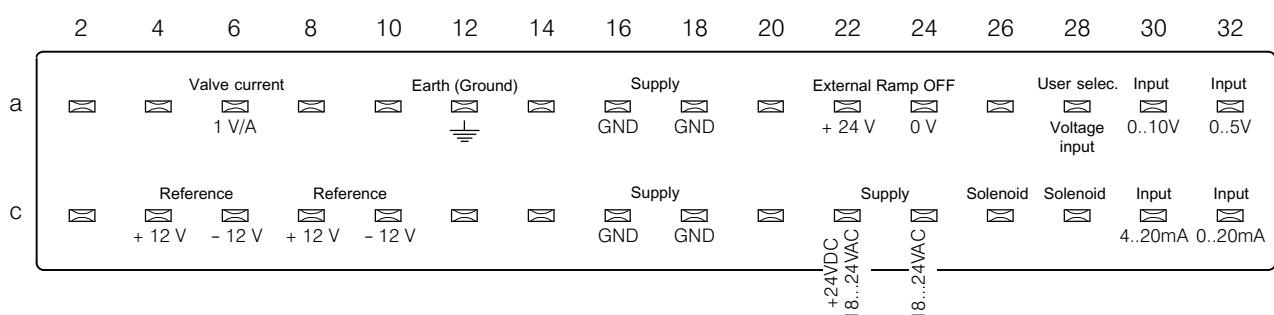
15   Application examples

VCC   GND
+24 V   0 V

c22   c24

0...10 V   a30 ┌─────────┐ c26
         │ SAN–535 │
SPS   │   │
         a16 └─────────┘ c28

Control by PC / PLC

VCC   GND
+24 V   0 V

c22   c24

       c8 ┌─────────┐ c26
       a30 │ SAN–535 │
          │   │
       a16 └─────────┘ c28
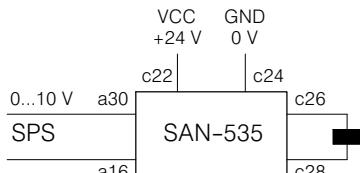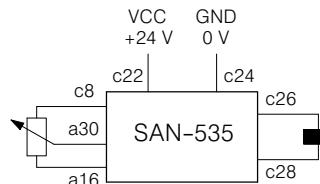
Control by externally connected potentiometer (s)

Notes

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