



CONTROL AMPLIFIER
for analogue control of stepping motor

Typ
StA 01 D

The control amplifier StA 01 is designed for the analogue control of hydraulic flow and pressure control valves with stepping motor - type adjustment. Stepping motors allow simple positioning with a high degree of reliability and accuracy when they are electronically controlled. This control amplifier offers a modern design for the control with the following features.

SPECIAL FEATURES

- High resolution due to micro - step operation
- Current - guided sine - wave control
- Output - stages with low power loss due to the " **chopper principle**"
- Short - circuit - proof power output
- Motor current limitation adjustable in six stages
- Non - interchangeable power supply voltage input
- LED display for the power supply voltage and for the operating conditions of the motor
- Separate adjustment of the opening and closing speeds
- The control amplifier is designed as a plug - in printed - circuit board standardized size, Euroform 100 x 160 mm
- Can be incorporated in all 19" mounting racks according to DIN 41494
Spatial requirement: 5 TE. 32 - pole connector as per DIN 41612, style D.

CHARACTERISTICS

Power supply voltage	24 V DC +10/-5%, 24V AC +/-10%, non interchangeable
Power input at 24V	3 W without motor 22 W with full control
Fusing	1,25 A (time - delay)
Output variable	the switched - mode output current is limited and can be adjusted in six stages: 150, 200, 325, 500, 700 and 1000 mA
Supply voltage for integrated switching and set point generator	10 V +/-0,5%, stabilized by internal voltage regulator
Internal resistance of the set point input	1 M Ohm
External load rating of the stabilized supply voltage	20 mA
Permissible ambient temperature	-10°C to +50°C
Resolution	≤ 25 mV relative to 10 V set point input or 100% valve control

ORDER INFORMATION

Bezeichnung Steuerverstärker StA 01 D A S M... ()

Typ _____
 Series (letter) _____
A = analogue _____
S = plug - in printed - circuit board _____
Modifications-No. for special models / options _____

We recommend that you have the amplifier calibrated by us. To do this, state here the type and the letter denoting the series of the valve for which the amplifier is intended (this data is not a constituent of the type designation).

ACCESSORY

plug - in p. c. b. holder Order - No.: 44-003-00001 see sheet 5 for illustration
set point potentiometer Order - No.: 44-001-00024 see sheet 5 for technical data

TECHNICAL DESCRIPTION

Power supply

The power supply comprises a bridge rectifier with electrolytic filter capacitor (supply for the stepping motor), an integrated voltage regulator with current limitation and thermal link and a chopper - type transducer to produce the necessary, internal operating voltage or the supply voltage (reference voltage) for the set point and actual value potentiometer. This voltage is set to 10V +/-0,5% with P5 ex - works. (The supply voltage will be connected to 2a/c and 4a/c. The polarity is of free choice. Recommendation: + to 2a/c; - to 4a/c because 2a/c is secured)

Difference Amplifier

Power input

The position of the valve is measured by the slider position of an actual value potentiometer - which is connected to the reference voltage produced in the amplifier - and compared with any set point (e. g. the slider position of a set point potentiometer or of an external voltage of min. 2 volts or max. 10 volts for complete control). As soon as a difference arises, the subsequent comparator is activated. The potentiometer P6 (amplification) and P4 (zero point) are arranged ahead of the difference amplifier for any set point adaptation necessary. The valve characteristic can be rotated around the zero point with P6 and the characteristic can be displaced in a parallel direction with P4. The controller is switched off in the event of too small or too large a set point value being entered if the end of the permissible correcting range is reached; the motor can then alter its position only in the opposite direction. This is indicated by the LED5. The limitation of correcting range is set at the set point voltages (at the measurement connection 18c) 0,1 and 9,9 volts. The overload resistance of the set point input is $\Delta U_{max} +15/-5$ volts relative to connection 28c.

Current loop input

If the set point value is input via a current loop (0 - 20 mA), a resistance of 270 Ohm/0,25 W must be soldered between the points M5 and M6 on the board. In the case control via a current loop, the connection points must be connected via an external voltage source as in the case of the control.

Comparator logic

The comparator is used to detect the direction of rotation and controls one of the two clock generators. One component of the comparator is the potentiometer P3 (system deviation); with this potentiometer, a reference voltage is set and sent to the input of the comparator. This is necessary in order to avoid system oscillations as a stepping motor drive only has limited resolution and 100% compensation cannot be achieved. When adjusting this reference voltage, the creep feed generator is also affected; the greater the set value, the more creep feed steps are executed.

Clock Generator

The clock generators are constructed for separately for anti - clockwise and clockwise rotation so that the valve opening and closing speed or the stepping frequency can be adjusted. Using the potentiometers P1 and P2, the frequency of the generators can be set within the range from 2 kHz....12 kHz which corresponds to a setting range of 33 ...200 full steps per second. Depending on the number of steps, the motors implemented and the required motor revolution, the possible recovery times result.

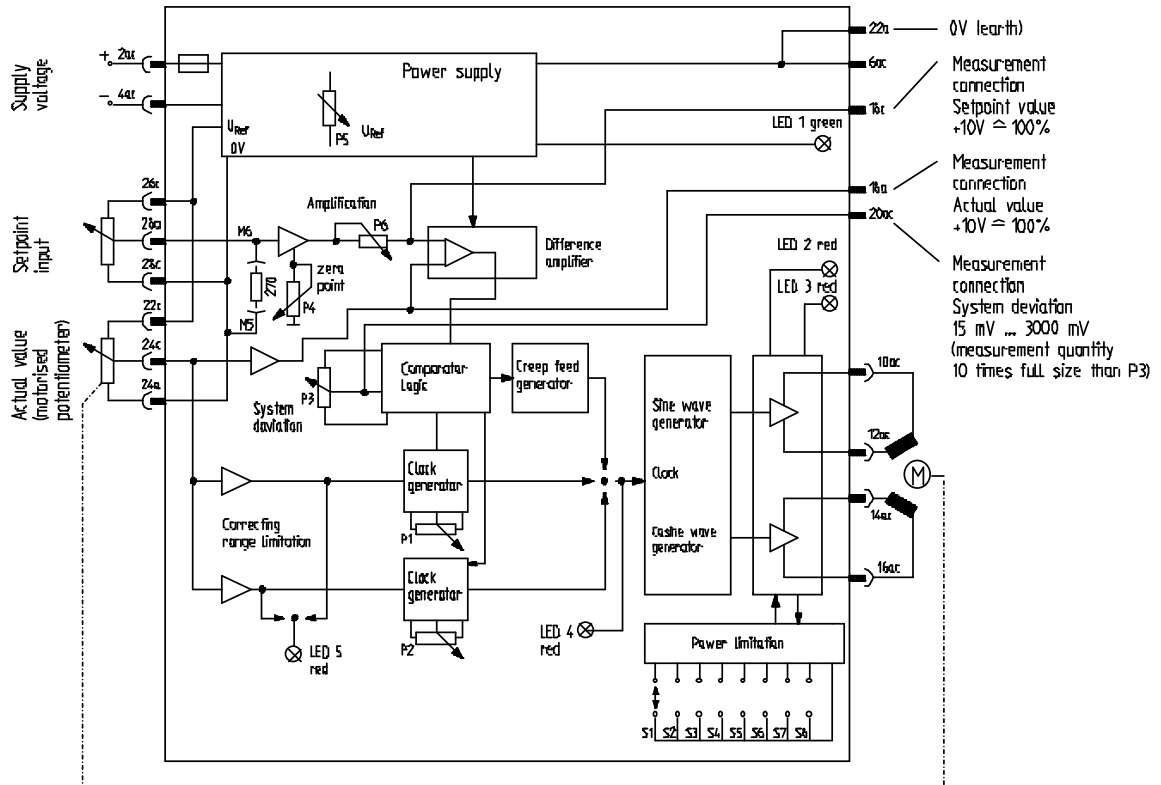
Sine and cosine - wave generators

The clock generators control the clock input of the sine and cosine wave generator. It basically comprises two up and down counters which address a memory (EPROM). The numerical values output from the memory according to the counter status are converted to voltage in digital / analogue converters which control the current inputs of the output element.

Power output element

The output element comprises two drivers which supply the output current for the two windings of a bipolar stepping motor. The output current can be limited in six stages with the switches S 1 to S 6 (150; 200; 325; 500; 700; 1000 mA). The output elements are fused with over temperature tripping. The currents per winding are displayed with LEDs which change their intensity proportional to the current.

Block diagram



The voltage is 0 to + 10 V when controlling via an external voltage source.
The voltage must be connected as follows: plus at 28a and minus at 28c.

Correcting range and initial setting of potentiometer and switches

The control amplifier is fitted with an initial setting as per the table if the valve type for which it is intended is not known. It is set when the valve type is known.

Designation	Potentiometer	Correcting range	Initial setting
Closing speed (stepping frequency)	P 1	33 - 200 full steps per second	160 full steps per second
Opening speed (stepping frequency)	P 2	33 - 200 full steps per second	160 full steps per second
System deviation	P 3	1,5 mV ... 300 mV	50 mV
Zero point displacement	P 4	ca. -5% ... +20%	0 V
Reference voltage	P 5	10 V +/- 5%	10 V +/- 0,5%
Setpoint amplification	P 6	Faktor 0,2 ... 5%	Faktor 1
<u>Motor current limitation</u>	<u>Switch position</u>	<u>Setting for valve</u>	<u>Switch position</u>
150 mA	S 1	16 GA; 26 GA; 36 FA	S1
200 mA	S 2	260FA-M528; 261EA-M528; 66 CA; 663 CA; 664 EA; 666 DA	
325 mA	S 3		
500 mA	S 4	261 FA	
700 mA	S 5		
1000 mA	S 6		
	S 7 without		
	S 8		

The set value of all potentiometers declines anti - clockwise rotation. See " Appliance dimensions", sheet 5, for the location of the potentiometer and switches on the board.

Inspection displays

LED 1	:	green	= supply voltage present
LED 2 and 3	:	red	= motor coils are supplied with power
LED 4	:	red	= motor running; goes out when ref. position reached
LED 5	:	red	= motor has reached electrical limit position of correcting range; set point value too small or too large

Anschlußbelegung

Terminal	Designation
2ac/4ac	Non - interchangeable supply voltage 24 V DC +10% / -5%; 24 V AC +/-10%
6ac	Zero volts (earth)
10ac/12ac	Power output of coil 1
14ac/16ac	Power output of coil 2
18a	Actual value of measurement connection (motorized potentiometer)
18c	Set point value measurement connection
20ac	Measurement connection - measuring - circuit voltage of set system deviation (value 10 times greater than actual set value)
22a	Zero volts (earth)
22c	Reference voltage +10 V (motorized potentiometer)
24a	Zero volts (motorized potentiometer)
24c	Actual value (motorized potentiometer - center tap)
26c	Reference voltage +10 V (set point value potentiometer)
28a	Set point value input (set point value potentiometer center tap)
28c	Zero volts (set point value potentiometer)

Configuring and setting instructions

The power should be supplied by a separate transformer with a minimum capacity of 25 VA. An electric line measuring $7 \times 0,34 \text{ mm}^2$ is recommended as the supply lead from the control amplifier to the valve up to a length of approx. 20 m, for lengths $>20 \text{ m}$ up to 50 m, a supply lead measuring $7 \times 0,5 \text{ mm}^2$ recommended. The set point value can be input either by applying an external voltage or via a potentiometer.

The residual ripple of an external set point voltage must not exceed 20 mVss. The resistance value for the set point potentiometer can lie between 1 and 10 Ohm. The same data apply to the supply lead cross - sections and lengths as to the supply lead between the control amplifier and valve. Shielded lines do not have to be used. If the control amplifier has not been set by us to the valve type to be controlled, the system deviation may possibly have to be adapted. After the control amplifier has been connected properly and a set point value has been entered, the pilot motor moves to the position. After the reference position has been reached, LED4 must go out. If this is not the case, the system deviation is slowly increased with P3 until LED4 does go out. This procedure must be repeated for several different set points. The system deviation set with P3 can be measured between the terminals 20ac and 22a and the system deviation actually remaining between the set point and actual value voltage can be measured between terminals 18a and 18c. If the valve and control amplifier function correctly, the value of the voltage difference between terminals 18a and 18c must be $<25 \text{ mV}$. Losses of voltage can occur in the case of very long lines to the actual value potentiometer in the valve. These can be compensated with the potentiometer P6 by reducing the amplification.

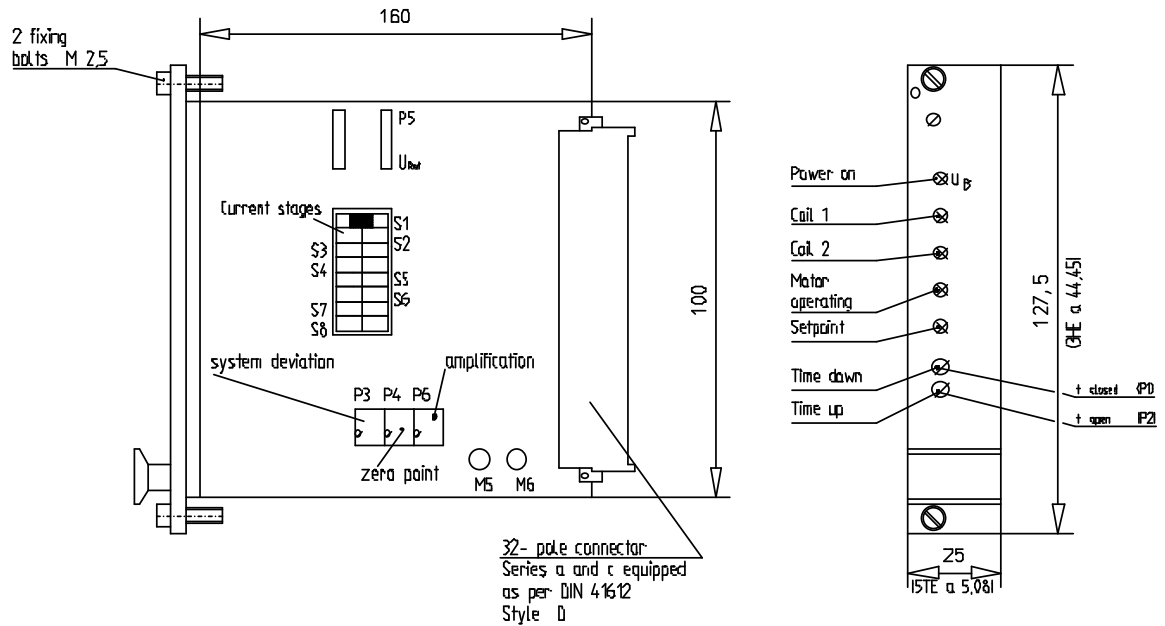
Instructions for trouble - shooting in the event of malfunctions

LED1 off	:	check operating voltage check 1,25 A fuse ambient temperature too high
LED2 and LED3 off	:	check motor connections
LED4 continuously on :		system deviation set too low operating voltage too low motor current set incorrectly motor has seized
LED5 continuously on:		motor has reached electrical limit position and can no longer follow reference value. Adapt the set point voltage (18c) to actual value voltage (18a). Alter the set point input (28a) or adapt with the potentiometer P6 (amplification) or P4 (zero point).

Behaviour in the event of cable breakage

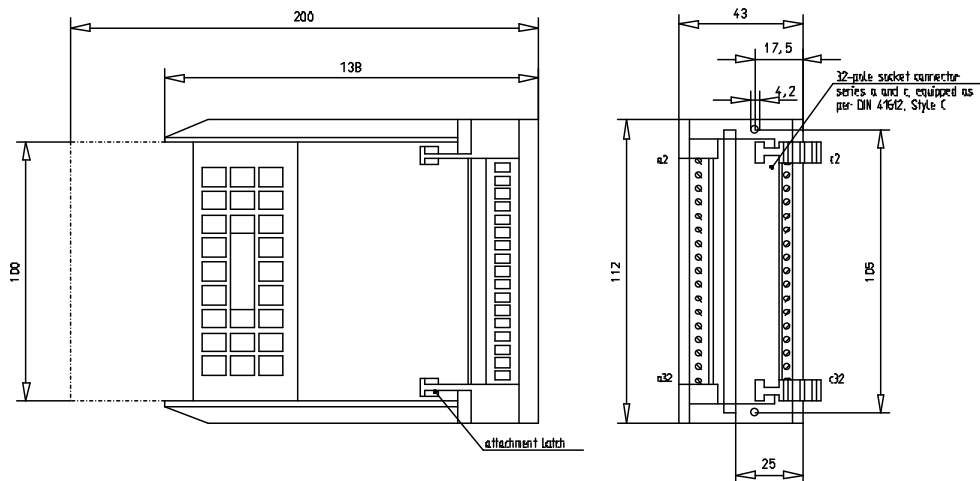
1. The pilot motor stops in the event of power cut (LED1 = off).
2. The valve switches to " closed " position if set point inputs are open (LED5 = on).
3. The valve moves to the " open " position if the 0 volt line to the set point value potentiometer is interrupted (LED5 = on).
4. The motor stops if one of the four motor supply lines is interrupted (only if there is no set point / actual value deviation).
5. The valve moves up against one of the limit stops if an actual value input is open (LED4 and LED5= on).

Appliance Dimensions control amplifier



The control amplifier is mounted on a printed - circuit board in the Euroform 100 x 160 mm. The front plate, which is naturally anodized and has a handle, bears clear legends for the inspection displays and the opening and closing time of the reference potentiometer. The module can be integrated into all 19" mounting racks according to DIN 41494 and ICE.

Accessories plug - in p. c. b.

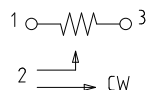


A plug - in printed - circuit board holder is available for the individual installation of the control amplifier. Thus, there is the possibility of mounting the plug - in printed - circuit board at any point in a switch cabinet and of wiring it up without any problem be means of a screw terminal.

Set point - Potentiometer

Characteristic values

Symbol



Resistance value

10 K Ohm

Load rating

2 W at +20°C (0 W at +105°C)

Linearity tolerance

+/- 0,2%

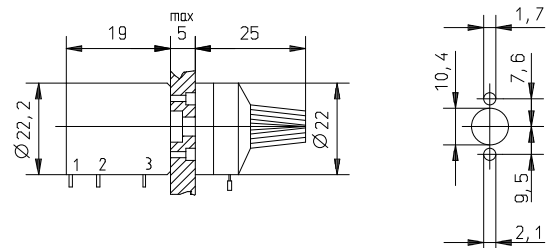
Electrical angle of rotation

3600°

Counting range with

0 - 1000

analogue setting knob



All data given here should be used as description for the product only and they are not to understand as warranty (guaranteed quality) in the sense of law.