

Local positioner for hydraulic actuator with proportional valve



Positioner

PVR10-10

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Application

The positioner PVR10-10 is used as a positioning system for proportionally-driven hydraulic actuators.

The positioner contains the receiver for position and position demand, the positioner amplifier, the drive logic for the blocking element and alarm relay, and the power units for the proportional valve, blocking element and two additional solenoid valves.

The positioner module PVR10-10 will be mounted in a control cabinet.

Local directly beside the valve is the terminal box PVK20 for connection of all lines from and to the valves.

Positioner for control valve (basic function)

The positioner receives the positioning demand Y_s from the process controller. The actual position Y is sent back.

Position Y is driven to by means of a position controller. The control characteristic of the positioner can be adjusted by software using various parameters. For test and setting purposes the positioner can be switched to manual and the valve be moved via software. Modified parameters are stored in a non-volatile memory, so that they will be kept during power-off.

Position receiver

A two-wire position transmitter can be directly connected to the position receiver SG+ (37) / SG- (19). The measurement range of the position receiver is 4...20 mA. By means of the parameterisation software „PASO“ zero point and gain can be automatically or manually adjusted. The adjustment does not influence the output of the position signal. The supply of the position transmitter is short-circuit proof and between 13 V and 28 V (depending on the supply voltage).

Position output

The position output Y_+ (35) / Y_- (17) is a galvanically isolated current signal (4...20 mA). The position output signal is defined through the settings on the position transmitter.

Position demand

The input of the position demand Y_{s+} (36) / Y_{s-} (18) with an input range of 4...20 mA is galvanically isolated.

To close the valve tightly the positioner needs in normal case a negative position demand signal (<4 mA). In case the master process controller can not give a output signal <4 mA, the tight closing of the valve must be forced by a closing command. Such a „Closing function $Y_s < 1.5\%$ “ at a position demand <4.24 mA can be activated by means of the software „PASO“. For „balanced valves“ there is a possibility to increase the threshold of the closing function up to 9.9%, which corresponds to a position demand of 5.58 mA resp. 2.79 V.

Proportional solenoid outputs

The two outputs for the proportional valve coils PVB+ (25) / PVB- (7) and PVA+ (26) / PVA- (8) have a 1000 Hz pulse-width-modulated current output with an superimposed dither. The dither signal is used to overcome any friction and hysteresis effects in the proportional valve. By means of the parameterisation software „PASO“ the minimum and maximum current for each solenoid of the proportional valve can be adjusted. The outputs are short-circuit proof and be permitted to load with a maximum of 1.8 A each. Except for driving the /BL-SX input the proportional solenoids are shut off with each blocking command. To minimise the power dissipation of the solenoid of the proportional valve, for modules from version „M“ onwards, the solenoid current is going to be reduced about 75% of the maximum solenoid current, if the position demand is $<3,8$ mA or if the parameter „Closing function = yes“ is activated.

Blocking

The hydraulic actuator is equipped with a blocking element between proportional valve and hydraulic cylinder. In normal operation the blocking element is energised and thereby open. If the blocking element is deenergised, the oil flow and thereby the actuator is blocked. If required the blocking element can be deenergised via a number of logic inputs (/BI-HV, BI1, BI2, /BI, /BI-SX). The inputs /BI-HV, /BI and /BI-SX are inverted inputs. That means that the blocking element will be deenergised if the inputs are going into the idle state. At all inputs except /BI-SX the blocking element and also the proportional valve will be deenergised. The output IV (22) is used as voltage supply for controlling the logic inputs via potential-free contacts.

At the input /BI-HV the signal „pressure too low“ (open contact) from the hydraulic supply unit HV... has to be connected. There is an other possibility to give the signal „pressure too low“ from the hydraulic supply unit via process controller to the /BI-HV inputs of the positioners, which are supplied in common from the same HV.

The inputs BI1 and BI2 are being used only for valves for emergency closing or fast opening in the mode „energised to be activated“ and otherwise open. The inputs /BI and /BI-SX are redundant inverting blocking inputs, which are used together with a safety circuit or for emergency closing valves working in the mode „deenergised to be activated“. If not used these inputs have to be connected with the outputs IV.

Alarm and status indications

There are three signalisation LED's on the positioner, which indicate the following conditions:

- LED green: supply voltage present
- LED yellow: valve in position
- LED red flashing: parting of a cable, short-circuit
- LED red lights: controller error

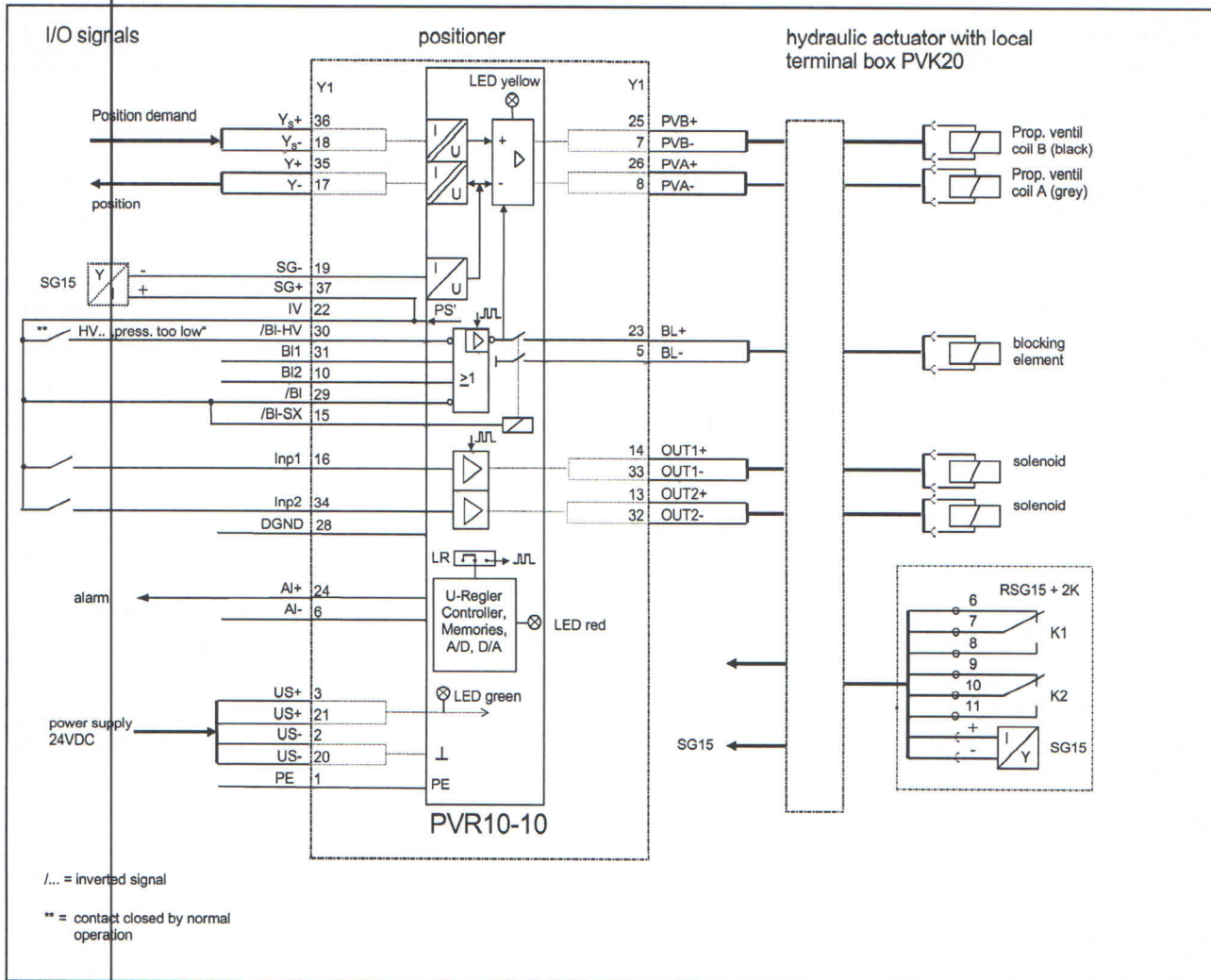


Fig. 1 Block diagram positioner for hydraulic actuator with proportional valve

To reduce the power consumption of the solenoids (BL, OUT1, OUT2), for modules from version „M“ onwards, a staggered starting with power reduction is realised which can be turned on respectively turned off through a pluggable jumper (LR 1,0). With that on the one hand the power dissipation of the power supply and the solenoids can be reduced, on the other hand the life time is going to be increased. The power reduction is realised by means of pulse-width-modulation. It is controlled in function of the supply voltage and allows a constant power reduction of about 40% over the whole supply voltage range of 19...30 V. The power reduction of the PVR10 is default turned on. With longer lines between the PVR10 and the solenoids, pay attention that the control voltage on the solenoid through the voltage drop on the lines must not

under step 17 V. The solenoid outputs OUT1 and OUT2 are working further on independent of a controller error. In that case the power reduction is turned off and the power outputs are following the logic inputs Inp1 and Inp2.

The adjustment of the parameters takes place using the PC software (PASO). To do this, a PC is connected to the positioner via an RS232 interface. The parameterisation software is described in detail in a separate description („PASO Parameterisation of PVR positioner for proportional valve“).

Technical Data

Electronics

Dimension (WxDxH)	163 x 111 x 51 mm
Weight	0,8 Kg
Connection interface	
Socket	37pol. D-Sub socket
Supply voltage U_s	+24 V (19...30 V)
Superimposed ripple voltage	± 10 % max.
Current consumption without solenoids	290 mA typ.
with solenoids (depends on variant)	2.2 A...5.1 A
typical current	see variant specific data sheet
Operating temperature	-25...+65°C
Storage temperature	-40...+85°C
Position receiver	SG+, SG-
Input current, nominal	4...20 mA
Input burden	200 Ω
Acquisition error	≤ 0.5 %
Drift	35 ppm/°C
Position demand	Y_s+ , Y_s- galvanically isolated
Isolation voltage	500 VDC
Input current, nominal	4...20 mA
Input burden	200 Ω
Acquisition error	≤ 0.5 %
Drift	75 ppm/°C
Position output	$Y+$, $Y-$ galvanically isolated
Isolation voltage	500 VDC
Output current, nominal	4...20 mA
Burden	550 Ω max.
Conversion error	≤ 0.5 %
Drift	70 ppm/°C
Monitoring system referred to Y and Y_s	
lower limit	< 2 mA
upper limit	> 22 mA
Auxiliary voltage IV	$> U_s - 2$ V
Output loading	100 mA max., short-circuit proof
Log. inputs	log 0
	log 1
Input load	0...+4 V +13...+30 V max. 1.2 mA
Proportional outputs	
Minimum current I_{min} adjust.	0...900 mA, short-circuit proof
Maximum current I_{max} adjust.	I_{min} ...1800 mA, short-circuit proof
Blocking element output	
Output voltage	$> U_s - 2$ V
Output current	2 A, short-circuit proof
OUT1/OUT2-output	

Output voltage	$> U_s - 2$ V
Output current	2 A, short-circuit proof

Switch-on delay with activated staggered starting and power reduction	
BL-output	≤ 30 ms
OUT1-output	≤ 300 ms
OUT2-output	≤ 570 ms

Switch-on delay without staggered starting and power reduction	
BL-, OUT1-, OUT2-output	≤ 30 ms

Switch-off delay	
BL-, OUT1-, OUT2-output	≤ 50 ms

Cable length to the solenoid Valve (supply voltage 24VDC)	
wire cross-section 1.5 mm ²	210m max
wire cross-section 2.5 mm ²	350m max

Dither	
Frequency	100 Hz
Level	100 mA

Alarm output	AI+, AI-
Output voltage	PS -2 V
Output current	100 mA max. Short-circuit proof

RS 232C-interface	
Socket	9pol. D-Sub socket
Level	V.24
Baud rate	4800 Bd
Parity bit	even
Data bits	8
Stop bit	1

Immunity to interference	EN 50082-2, March 1995
Emitted interference	EN 55011, March 1991
Radiated emission (30 MHz - 1 GHz)	class A

Ordering information

PVR10-10	Art. No. 103.215.285.210
PASO (Software incl. RS232 connection cable)	Art. No. 103.216.068.200
Plug 37pol D-Sub (incl 1m cable)	Art. No. 103.195.792.200

Application note

The module must be fused with 6 AT. In respect to the wiring of the module, the corresponding wire cross-sections have to be wired. Supply „PS“ and „M“ with 1 mm². The power outputs „PVA+/PVA-“, „PVB+/PVB-“, „BL+/BL-“, „OP+/OP-“, „CL+/CL-“ with 1 mm².

I/O cables and power cables must be shielded and be connected to the shield rail in the cabinet, which is connected to earth. The power supply cable may not be shielded.

For parameterisation of PVR20, „PASO“ software version 2.4 or higher is needed.

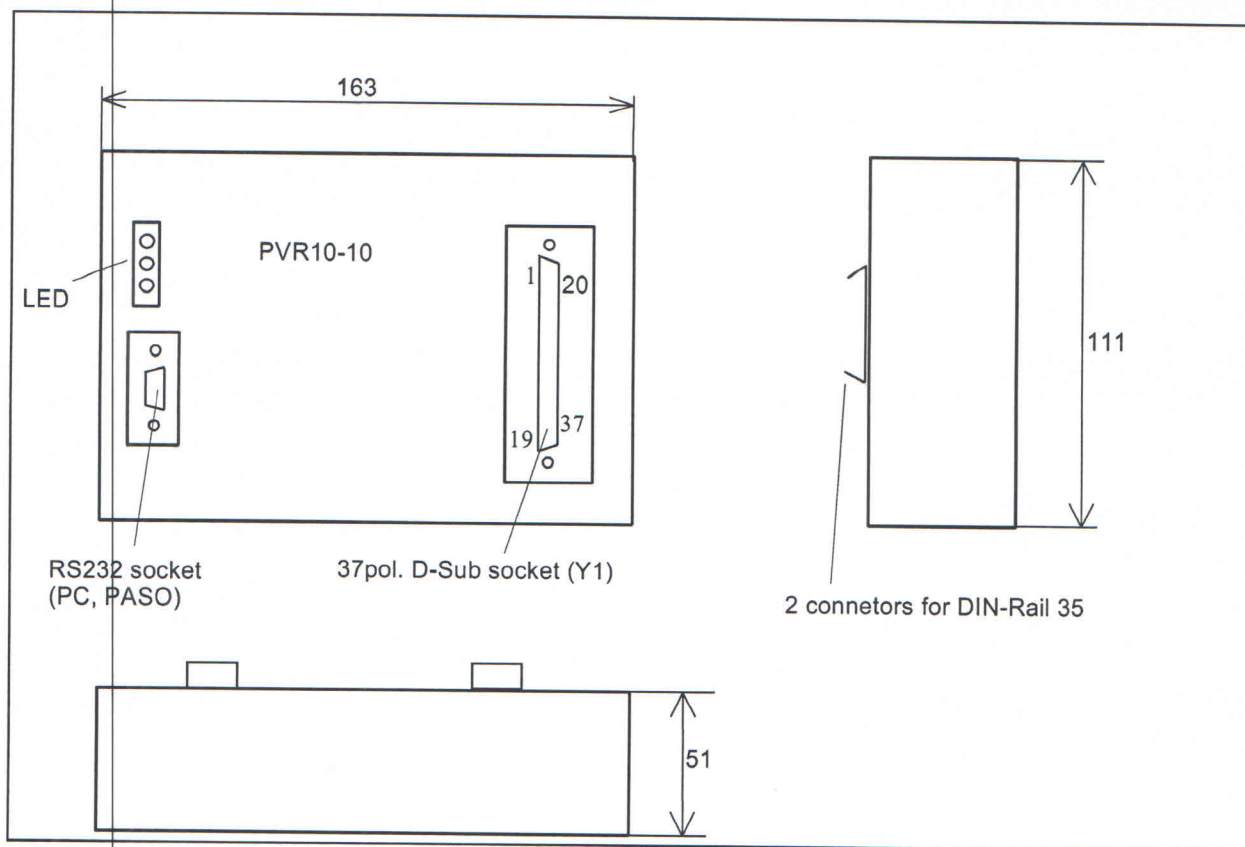


Fig. 2 Positioner module dimensions



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FEEDBACK TRANSMITTER R – SG 16 + 4K

The Feedback Transmitter is produced in different versions for example:

- R-SG 16 + 4K Position transmitter and 4 limit switches
- R-4K only 4 limit switches

Feedback Transmitter R-SG 16 + 4K is for control valve. The Position transmitter SG 16 measures the valve position and transmits the position to the Position controller. The Position controller compares the valve position with the demand position and moves the valve according the deviation. The limit switches are not used for positioning but may be used for indicating Valve positions.

The Feedback Transmitter R - SG 16 is for Valve with Open/Close Function.

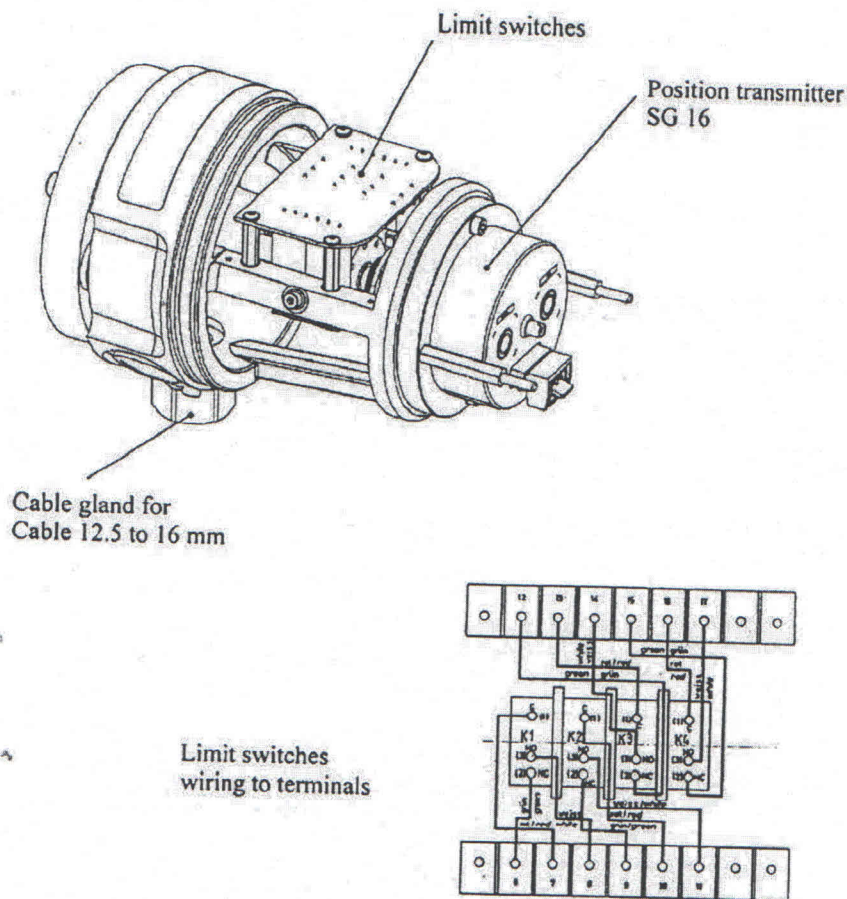


Fig. 3-17: Feedback Transmitter R – SG 16 + 4K



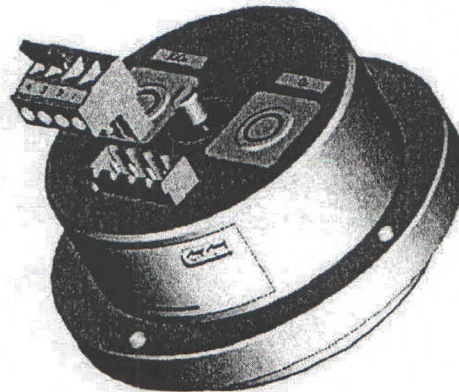
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POSITION TRANSMITTER SG 16

1 Application

The SG 16 is a position transmitter using a magneto resistive sensor to detect the angular position. The solid and compact design assures high resistance to climatic and mechanical influences as well as electrical interference. It is simple to install and to calibrate.

The SG 16 position transmitter converts a mechanical position (angle of rotation) into an analog electrical signal for rotation angles within 30° to 360°.



2 Function

Signal acquisition is processed by an integrated hallsensor converting the changes in the field of a permanent magnet into a digital encoded signal. The magnet is connected to the driving shaft. Finally a digital/analog interface is converting the information proportionally to the angle into a current signal of 4 – 20 mA.

The current interface is designed for 2-wire operation of the transmitter. The output signal can be set by membrane keys to any angular range. The applicable extend of angular range is 330° (saw tooth progression). By the means of a jumper the sense of rotation can be varied according to user's requirements. The sensor is equipped with a four-pole plug-in screw type terminal for the electrical connections.

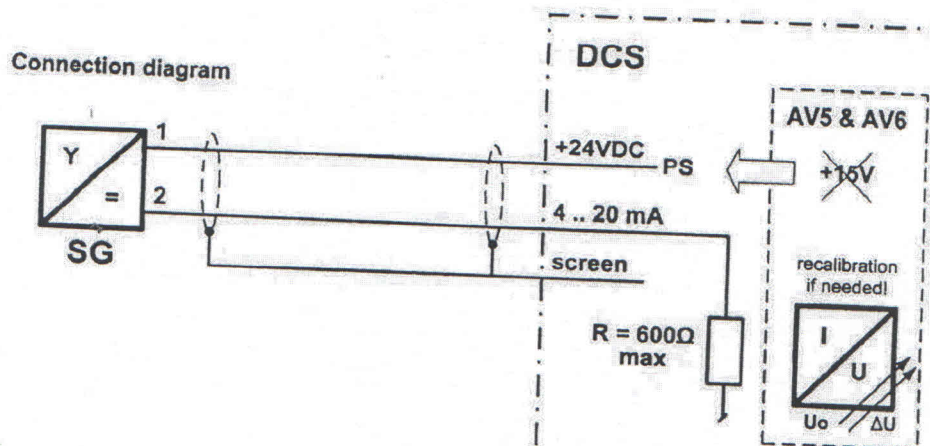
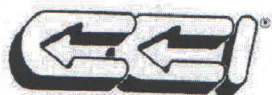


Fig. 3-18: SG 16 Connection Diagram



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Technical Data

Tab. 3-1: SG 16 Mechanical Specification:

Casing material	Saltwater proof aluminum
Casing protection	IP 65
Terminal protection	IP 20
Shaft material	Stainless steel
Shaft bearing	Ball bearing
Angular range	30°...360°
Operating temp. range	-25°C...+80°C
Stability referred to full rotation angle (e.g. 70°):	-25°...+80°C ±1,0 % FSR
Shock	50g, 6ms
Vibration	10g, 5-200 Hz
EMC Performance	EN 50 082-2
Transient emission	EN 61000-6-2 EN 61000-6-3
Weight	ca.. 450g

Tab. 3-2: SG 16 Electrical Specification:

Signal output	4...20 mA, 2-wire system
Pre-adjustment	0...140°
Error output current	22.1 mA
Max. burden	500 Ohm
Time constant on power-up	Ca. 20ms
Signal adjustment	Via membrane keys
Adjustment sense of rotation	Via jumper
Supply voltage	18...33 V DC
Resolution	12bit / FSR *)
Linearity	±0,5 % FSR
Test voltage	500 V AC
Electrical connection	Via plug-in terminals
Valid data	0.8s after switching-on *) FSR = Full Scale Range



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4 Application Note

The cable of the position transmitter should be twisted and single-shielded. The cable screen should be connected with the source (conn. diag.)

The SG16 replaces all types of SG (SG10 ... 15). The application on systems like AV5 or AV6 may involve a signal recalibration of U_0 and ΔU and a wiring modification to the power supply of 24VDC. If used on a system prior to AV5 please contact us.

4.1. Dimension and Characteristic

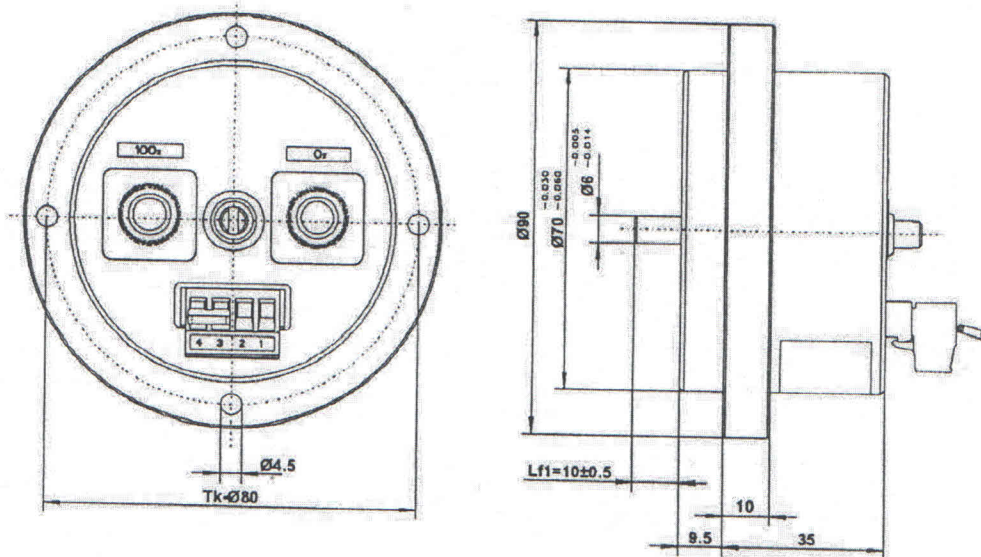


Fig. 3-19: SG 16 Dimensions

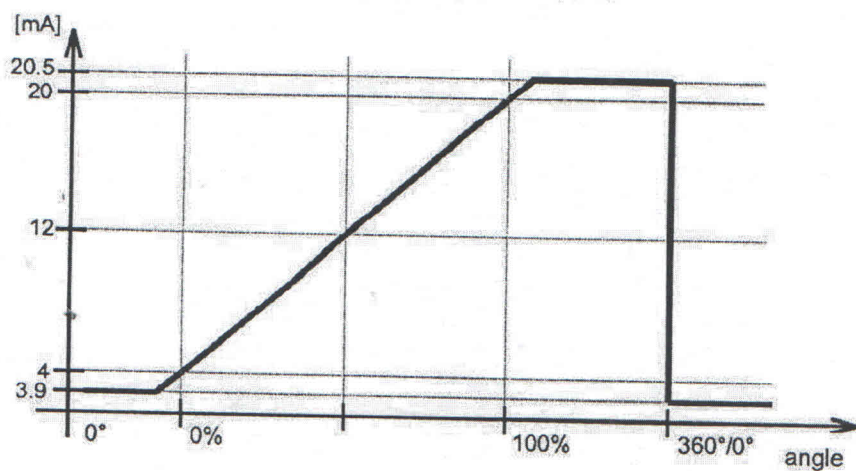
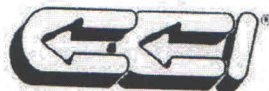


Fig. 3-20: SG 16 Characteristics



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4.2. Ordering Information

- SG 16 Art. Nr. 103.196.160.200

4.3. Setting Instructions

Factory-provided pre-adjustment of the magnetic rotary encoder is as follows:

- Signal output: 4 ... 20 mA
- Angular range: 0 ... 140°
- Sense of rotation: clockwise (jumped)

The sensor is calibrated in the following way (after mech. and el. connections correctly established):

1. Adjusting the sense of rotation (unplug to modify!):
Connection of terminal 3/4 open: counter clockwise
Connection of terminal 3/4 jumpered: clockwise.
2. Setting of the initial position (0 % = 4 mA):
Move valve to "Closed" position. Push button "0 %" for a time of 0.5 .. 1 s
3. Setting of the final position (100 % = 20 mA):
Move valve to "Opened" position. Push button "100 %" for a time of 0.5 .. 1 s

4.4. Important Information

1. Programming order (0 % ; 100 %) has to be kept
2. In case of pushing a button too long or too short (>1s or <0.5s) during a setting operation the setting is not stored.