

JOHNSON  
CONTROLS

*Exceeding Your  
Expectations!*

## Electric Valve Actuators RA-3xxx-7x2x (ERA1600, ERA1800, ERA3000)

### General:

This Service and Data Information (in brief SDI) are operating instructions and comprise the necessary information for safe installation and operation of RA-3xxx-7xxx electric valve-actuators. In the event of difficulties, which cannot be resolved with the aid of this SDI, please consult the supplier.

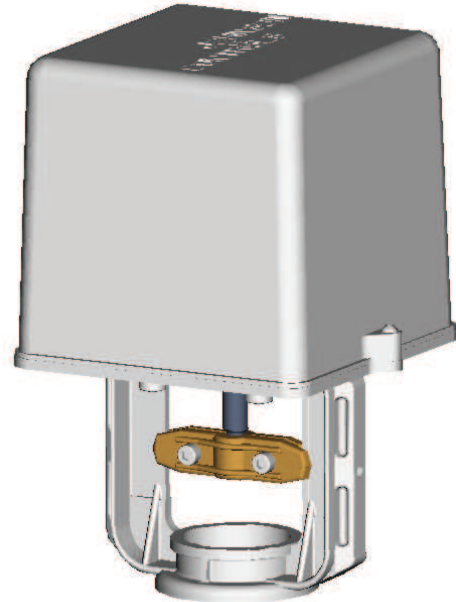
This SDI meets the requirements of the relevant safety standards and regulations of the EU.

When operating valve-actuators outside of the Federal Republic of Germany, it is the responsibility of the control system administrator or operator to ensure that the valid national control directives are followed.

The manufacturer reserves all rights in regard to technical modifications and improvements at any time.

The SDI users qualifications are a prerequisite to their application (See: "Qualified Personnel")

Operating personnel must receive SDI instructions.



### Qualified personnel

These are persons conversant with the erection, installation, commissioning, operation and service of the product and in possession of the respective qualifications through their activities and functions, e.g.:

- Instruction about and obligation to maintain adherence to all operative regional / internal ordinances and requirements, conditional to application.
- Training or instruction in accordance with standards of safety in maintenance and utilisation of adequate safety- and protective equipment.
- Training in first aid, etc. (See TRB 700).

### Application:

RA-3xxx-7xxx electric valve-actuators are to be used in conjunction with the following valve series:

**VG8000N, VG8000V, VG8000H, VG8300N, VG8300H, VG9000, VBF and VBD/VBB**



### Danger:

Safe operation of the valve is only ensured if the valve is installed, commissioned and serviced by qualified personnel in compliance with warning references in this SDI. In addition, the general installation- and safety regulations for pipelines, installation construction and the professional use of tools and safety equipment must be guaranteed. Observe unconditionally during all work on the control valve. Ignoring this information may cause physical or material damages.

### Storage:

- Storage temperature -40°C to 70°C, dry and free of dirt.
- Do not damage the lacquer. The lacquer is a foundation intended only as a protection against corrosion while in storage and during transport.
- In rooms where moisture or condensation are present use heating or a drying agent to maintain moisture free atmosphere.

**Transport:**

- Transport temperature -40°C to 70°C.
- Protect against external forces (shock, Vibration etc.).
- Do not damage the protective lacquer.

**Installation site information:**

The valve installation site should be easily accessible and provide sufficient room for service and removal of actuators. Manual shut-off valves should be located up and downstream of the control valve, to facilitate service and repairs without draining the piping system. The control valve should preferably be installed vertically with the actuator installed in the upright position. When carrying out inclined to horizontal installation of actuators the stanchions must be aligned vertically one above the other.

Pipelines should be insulated to protect actuators against high temperatures; here sufficient room is to be left for servicing the stem seal pack. For trouble free function of the control valve the pipe immediately upstream of the valve should be straight for the length of at least 2x DN and the pipe immediately downstream for the length of at least 6x DN.

**Actuator mounting-and removal information:**

The control valve is normally supplied complete with actuator. It is not permitted to remove or replace an actuator on systems in operation, under operating temperature and pressure. For conversion or service, the actuator mounting procedure should follow the actuator SDI. During mounting procedure the plug should NOT be rotated with downward pressure. Ensure adherence to max. valve operating forces for actuator replacement.

**Removal of Actuators:**

In addition to the valid, general guidelines for installation and the TRB 700, the following point should be observed:

**Danger**

- Pressure free pipe system
- Cooled fluid
- Drained pipe system
- With corrosive or aggressive fluids the pipe system should be vented.
- Work to be performed by qualified personnel only

**Caution:**

When laying electric wiring, regulations for setting up high-voltage systems must be observed. Mains voltage and frequency must match with data on the ID plate.

The DA-30xx-761x Actuator has no on/off switch. Because of this, an isolation switch should be installed in the supply line of the device.

**Supply Voltage Connection:**

Wire gauge min. 1 mm<sup>2</sup>, max. 2.5 mm<sup>2</sup>

**Supply Voltage Fusing, System-Side:**

max. 6A, 2A by 24V, DIN VDE 116 must be observed!

**Danger****Electrical isolation System-Side:**

Prior to the removal of the actuator cover, e.g. for mechanical maintenance and adjustment, line voltage supply must be disconnected by means of an isolation switch, safeguarded against inadvertent operation.

**Electrical Connection:**

- Lead cable through the cable adapter to the respective terminals, and then remove insulation from wire tips. Inside the actuator, wires must be routed or fastened so that they are protected against damage by moving or rotating parts and removal or replacement of the actuator cover.
- Ground conductor should be secured on the ground conductor terminal (not in a 24V apparatus).
- Tighten cable adapter to achieve a reliable strain relief

**Fitting of accessories: ER 2 (ER 135)**

Fitting and testing must be in accordance with accessory by-pack installation instructions.

**Technical Data**

Product	RA-3xxx-712x (ERA 1600)	RA-3xxx-722x (ERA 1800)	RA-3xxx-732x (ERA 3000)
<b>Valve types</b>	VG8000V+N+H DN 15 – DN 40	VG8000V+N+H DN 50 – DN 80	VG8000V+N+H DN 50 – DN 150
	VG8300N+H DN 40	VG8300N+H DN 50 – DN 80	VG8300N+H DN 65 – DN 100
	VBD, PN 25 DN 15 – DN 40	VBF, PN 6 & PN 10 DN 65 – DN 100	VBF, PN 6 & PN 10 DN 65 – DN 100
	-----	VBD, PN 25 DN 50 – DN 65	VBD, PN 2 5 DN 50 – DN 150
	-----	VBB, PN 16 & PN 25 DN 50 – DN 65	VBB, PN 16 & PN 25 DN 80 – DN 150
	-----	VG9000, PN 6 & PN 10 DN 80 – DN 100	VG9000, PN 6 & PN 10 DN 80 – DN 100
<b>Operating voltage</b> <b>Tolerance: +10% / -15%</b>	24V, 50 / 60Hz 230V, 50 / 60Hz	24V, 50 / 60Hz 230V, 50 / 60Hz	24V, 50Hz or 24V, 60Hz 230V, 50Hz or 230V, 60Hz
<b>Power consumption</b>	16VA, 18VA with EPOS	12VA, 14VA with EPOS	16VA, 18VA with EPOS
<b>Motor</b>	Reversible for 3-point output or 0-10V (0 - 20mA) Input signal with EPOS, (24V only)		
<b>Continuous running time</b>	= 100%	= 100%	= 50%
<b>Minimum thrust</b>	1600N	1800N	3000N
<b>Stroke timing [s/mm] 50/60 Hz</b>	6.2 / 5.2	4.2 / 3.5	4.4 / 3.7
<b>Permissible ambient temperature</b>	-10°C to +60°C -10°C to +50°C with EPOS		
<b>Weight</b>	Approx. 4.0kg		Approx. 4.5kg
<b>Enclosure</b>	IP 54		

**Switch S7**

The electrical supply can be switched off manually by operating the button S7 on the underside of the motor unit housing.

The terminals (19 + 20) can be used as potential free feedback contacts for building automation systems.

**Optional manual operation**

The crank for optional manual operation is mounted on the side of the actuator cover. To operate the actuator manually, remove the plastic plug from the cover. In this procedure it is sensible to isolate power by using switch "S7", (preventing automatic return travel on models with EPOS). Manual actuation is achieved by pushing the crank gently inwards and turning in clockwise or anti-clockwise direction, depending on action mode. A friction clutch safeguards the gear train against damage. The desired valve stroke position is visible on the stroke indication scale. Removing the crank and pushing switch "S 7" restores automatic operation.

**Optional auxiliary switches**

The cams for the auxiliary switches "S3" and "S4" are not set from the factory and so, on delivery, have no function. The switches "S3" and "S4" are therefore free for user implementation. Please note that "S3" is operated by the **extending** actuator stem and "S4" by the **retracting** actuator stem. To attain the required settings the special tool fixed inside the actuator cover can be used. After the settings have been carried out the set cam positions *must* be fixed by tightening the Phillips screw on the cam disc.

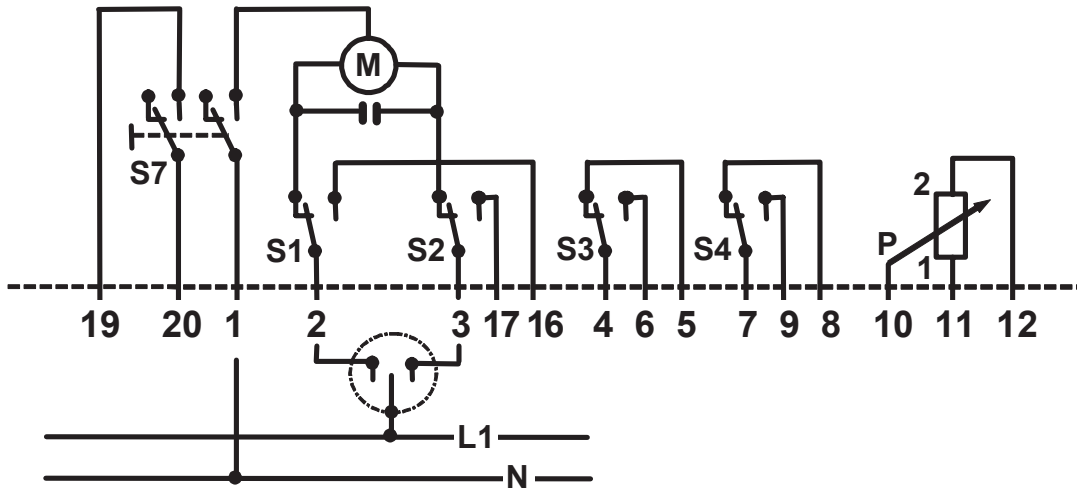


**WARNING!**

**Electric Shock Hazard**

Prior to wiring connections, isolate power supply to prevent electric shock.

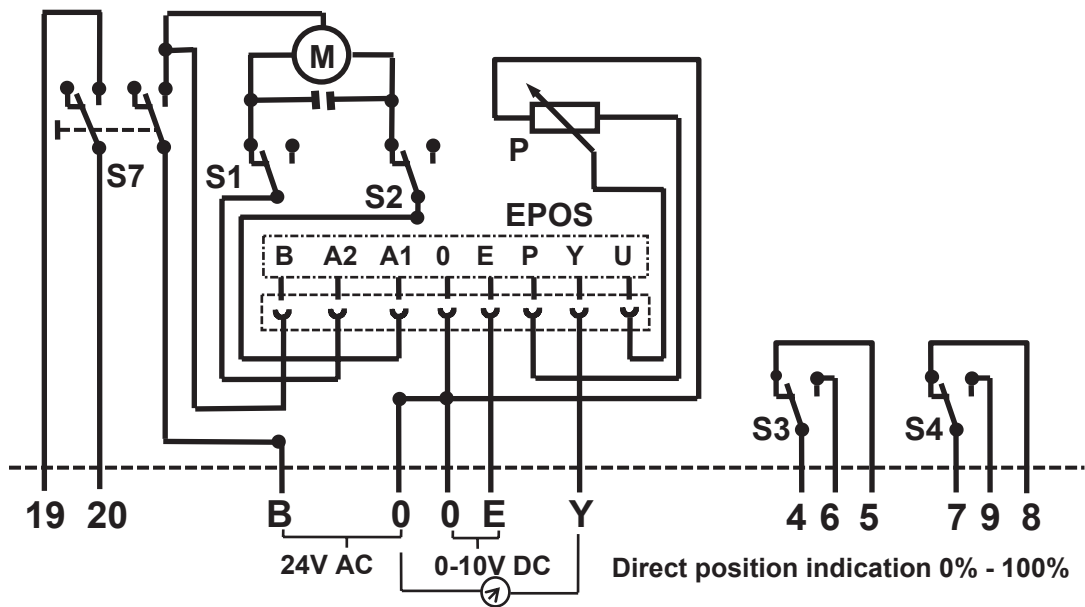
**Wiring diagram:** Max. options without positioner



**Caution:**

Connect grounding cable to ground terminal except on 24 V AC models

**Wiring diagram:** Max. options 24 V AC with positioner



**Condition at delivery:****Actuator fitted to valve**

Valve configuration	Valve setting	Actuator stem
PDTC	Open	Retracted
PDTO	Open	Extended
Mixing valve	Inlet 1 - outlet Open	Extended
Diverting valve	Inlet – outlet1 Open	Retracted

**The following is set:****Control-valve without positioner**

**Terminal connection 1 + 2:** Actuator stem is extended.

**Terminal connection 1 + 3:** Actuator stem is retracted.

**Control-valve with positioner**

- Standard –factory setting 0-10V (possible to change setting to 0-20mA through jumper)
- Span 100%
- Start-point 0%
- The following is given with 24V~ connected and a control signal of 0-10V DC (0-20mA)

**0 Volt (0mA) = Valve closed**

**10 Volt (20mA) = Valve open**

- The action mode switch is set as follows:

**DA (switch position II)** for two-way PDTC, mixing and bypass valves.

**RA (switch position I)** for two-way PDTO valves.

Valve configuration	Action mode	Valve position at 0 Volt control signal	Actuator stem
PDTC	DA	Open	Extended
PDTO	RA	Open	Retracted
Mixing valve	DA	Inlet 1 - outlet Open	Extended
Diverting valve	RA	Inlet – outlet1 Open	Extended

**Model with feedback potentiometer and auxiliary switches:**

The following is set:

With the actuator stem extended the nominal value of the potentiometer can be measured between contacts 10 and 12.

The cams for the auxiliary switches “S3” and “S4” are not set from the factory and so, on delivery, have no function. The switches “S3” and “S4” are therefore free for user implementation.

**Order information for retrofit kit**

Installation instructions included.

Description	Code	Order code
Aux. switch and 2 k $\Omega$ position feedback potentiometer	ER2	EQ-5687-7011
Cable adapter 20, black, EN 50262	-	282 3703 202
M20 x 1.5 nickel plated brass nut	-	282 3802 202

## Function

### Valve actuator without positioner

**Terminal connection 1 + 2:** Actuator stem is extended.

**Terminal connection 1 + 3:** Actuator stem is retracted.

### Valve actuator with positioner

**With 0V (0 mA) on terminal E:**

**Direct action (DA):** Actuator stem is extended.

**Reverse action (RA):** Actuator stem is retracted.

**“Y” output:**

0 Volt (0 mA)

10 Volt (20 mA)

### Note:

Parallel operation of several valve actuators without built-in positioner is only possible using isolation relays!

### Electronic positioner EPOS

Actuators for 0...10 V (20 mA) control are fitted with an electronic positioner EPOS. The EPOS is a company made pcb.

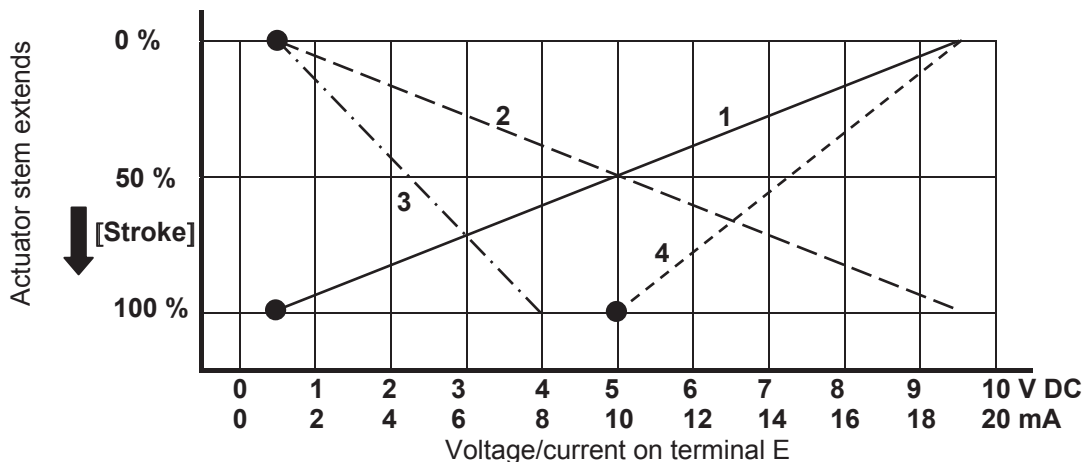
Span, start point and action are adjustable.

**Curve 1** Direct action (DW) Start point 0.5 V (1 mA) Span 9 V (18 mA)

**Curve 2** Reverse action (UW) Start point 9.5 V (19 mA) Span 9 V (18 mA)

**Curve 3** Reverse action (RA) Start point 4 V (8 mA) Span 3.5 V (7 mA)

**Curve 4** Direct action (DA) Start point 5 V (10 mA) Span 4.5 V (9 mA)



### Models with auxiliary switches

The auxiliary switches S3 and S4 (B) or operated by cam disk. The cam disks can be set for any stroke position using a special tool provided.

### Models with position feedback

The feedback potentiometer (C) serves to indicate the position and can be adjusted on the shaft / friction clutch with a screwdriver.

### Not valid for models with positioner

If the actuator stem has been driven to the extended end position (terminals 1 and 2), then the nominal resistance of the potentiometer can be measured between terminals 10 and 12.

### Installation orientation

Do not install the actuator at angles greater than 90° from the vertical position. The cover should always be easily accessible (e.g. for EPOS adjustment) so it may be necessary to rotate the *actuator*.

### The following is valid for the flow direction:

Install the valve so that the plug seats against the direction of flow as indicated by the arrow(s) on the valve body.

### Actuators supplied as separate units:

Actuators are pre-set in the factory to facilitate installation with minimum adjustment.

### **WARNING!**



#### **Actuator damage hazard**

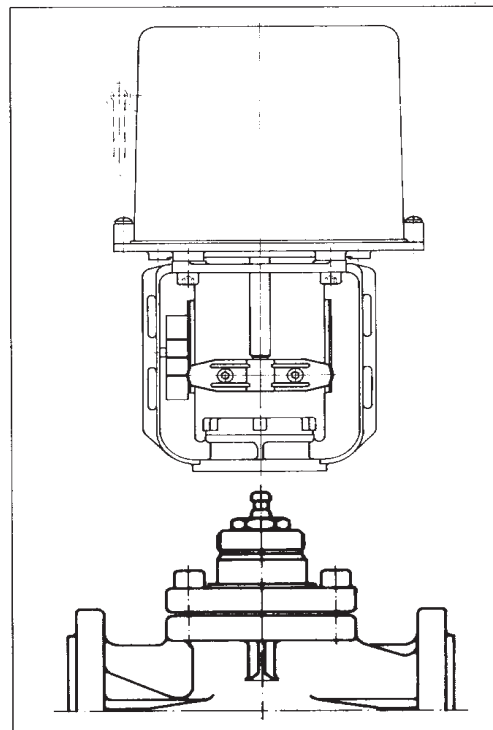
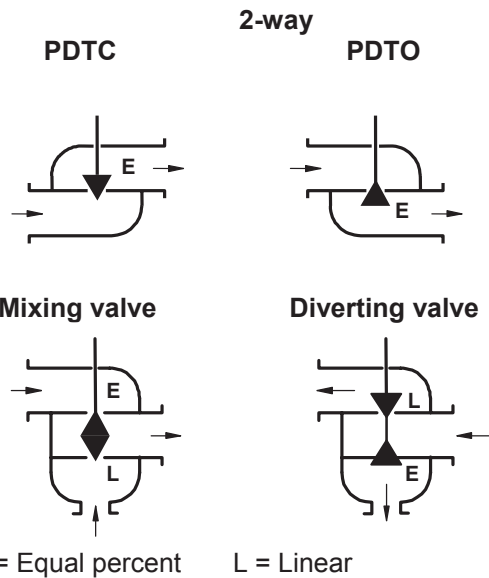
Do not operate the actuator when **NOT** mounted on a valve. This actuator is pressure controlled. Limit switches calibrated to operate at a certain force switch off the motor when this exact mechanical pressure has been achieved.

### Mounting actuator on valve:

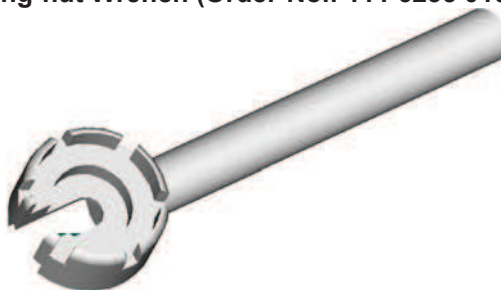
The valve stem coupling is fitted to avoid disturbance of the pre-set stem position.

Observe the following procedure:

- a) Push valve stem to lowest position.
- b) Remove coupling from actuator.
- c) Place actuator on valve and position ring-nut.
- d) Mount coupling and tighten.
- e) Connect actuator electrically.
- f) Activate actuator electrically until actuator yoke has smooth fit on valve bonnet.
- g) Only now may the ring-nut be fastened.**
- h) Mount stroke indication scale in readable position on clean surface.



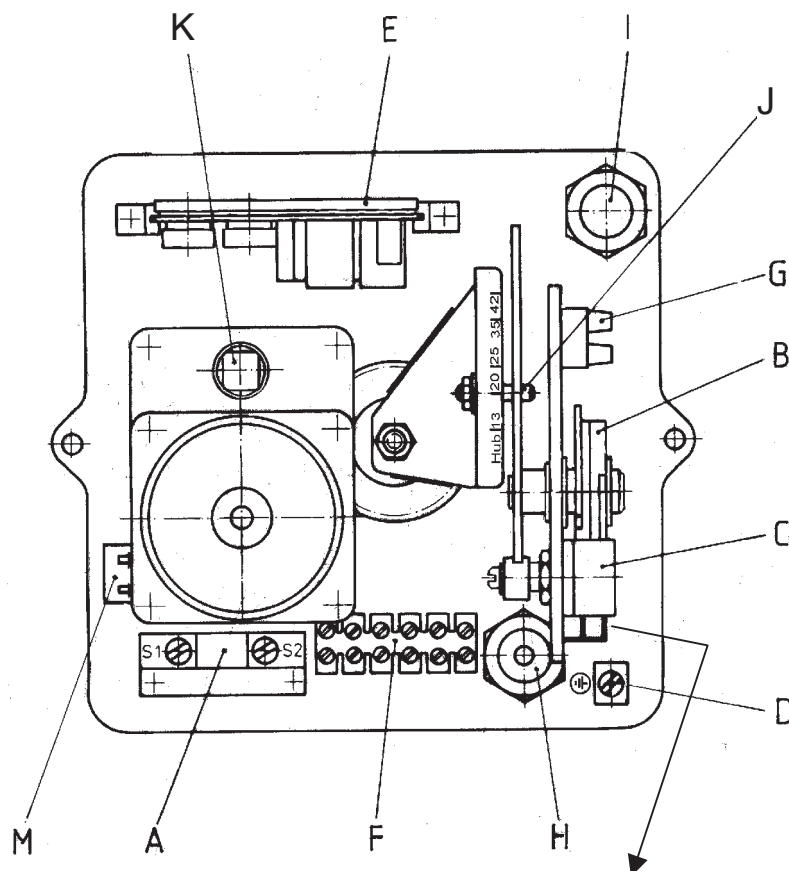
**Ring-nut Wrench (Order-No.: 111 6235 010)**





**General information:**

- A = Motor operation limit switches S1 and S2. Switches are factory adjusted and should not be manipulated.
- B = Additional signal switches S3 and S4, for arbitrary usage. Adjustable with 2 switch cams.
- C = Feedback potentiometer. Without EPOS as accessory for user. With EPOS an integrated element of resistance balance bridge.
- D = Ground terminal (not for 24 V version)
- E = Electronic positioner EPOS (Plug-in module) for modulating control.
- F = Terminal strip for connection of motor and limit switches S1 and S2. On actuator versions with EPOS, terminal strip for line voltage and input signal connection 0...+ 10 V (0...20 mA).
- G = Terminal strip for signal switches S3 and S4 and feedback potentiometer.
- H = Cable adapter 20 as per EN 50262.
- I = Cable fitting 20 for additional cable adapter as per EN 50262.
- J = Adjustment transfer bolt to feedback potentiometer and signal switches.
- K = Square shaft for manual operation crank
- M = Switch S7 for line voltage interruption

**Aux. switches:**

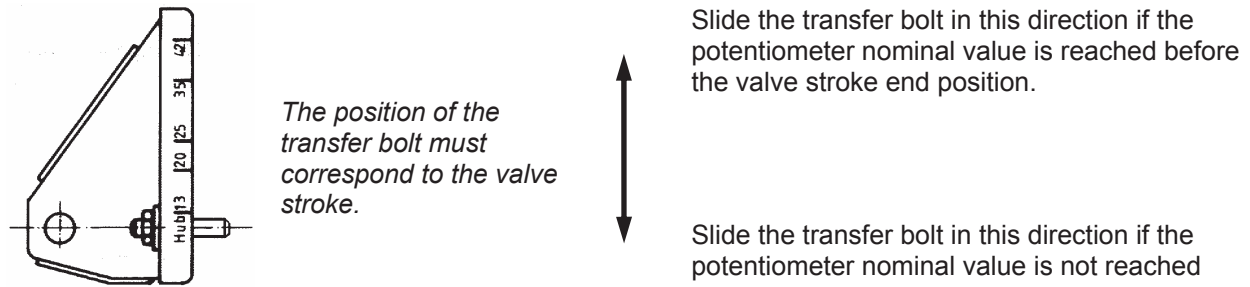
S3 = back - S4 = front

**Model with feedback potentiometer and auxiliary switch:**

The nominal potentiometer value is measured between terminals 10 and 12 with the actuator stem extended.

The cams for the auxiliary switches S3 and S4 are positioned just before the valve end positions and are free for user application. The S3 auxiliary switch is operated when the actuator stem is extended and S4 auxiliary switch when the actuator stem is retracted.

Due to tolerances in the valve stroke, it may be necessary to carry out setting adjustments.



The friction clutch on the potentiometer shaft allows the shaft to be adjusted, using a screwdriver. Make electrical connection to terminal 1 and 2. After driving the actuator to the end position, connect voltmeter to terminals 10 and 11. Using a screwdriver set the potentiometer to 0 Ohm. Drive the actuator in the opposite direction and in the end position read the resistance value. If the nominal value has been reached before the end position or has not been reached before the end position, correct the transfer bolt position by sliding it in the appropriate direction (see sketch). Drive the actuator to end positions again to test.

**Model with electronic positioner (EPOS 7.0) and auxiliary switches**

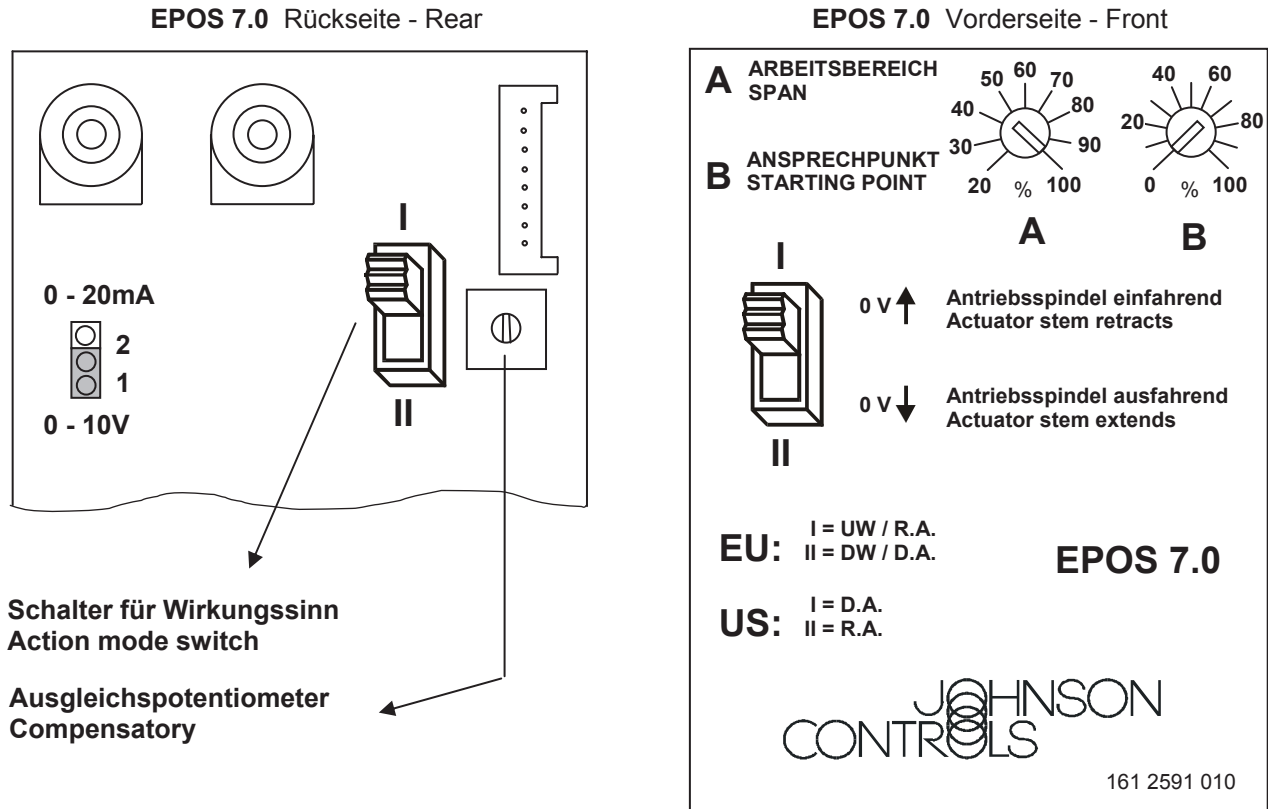


Fig. 1

**Setting procedure**

- ◆ The position of the transfer bolt must correspond to the valve stroke see Fig. 2

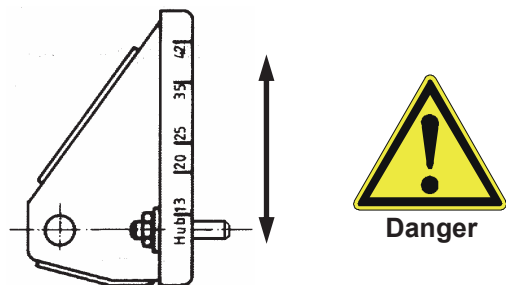


Fig. 2

If the transfer bolt setting is less than the actual valve-stroke capability the potentiometer reaches the friction clutch areas too soon and the control range is inhibited. This can lead to premature wear and eventual machine failure.

If the transfer bolt setting is greater than the actual valve-stroke capability the control range is not achieved.

**Remedy:**

In both cases ensure correct adjustment of the transfer bolt.



Adjustments are easier to make with the positioner pcb removed from its bracket

- Jumper position 1 for: 0 –10 V, see fig 1
- Jumper position 2 for: 0 –20 mA, see fig 1

- ◆ Action mode switch in position II, Span at 100% and start-point at 0%, turn compensatory potentiometer in the anti-clockwise direction to stop, see fig.1.
- ◆ 24 V AC on terminal B, 0 V DC (0 mA) input voltage on terminal E. Operate actuator until stem extends and is brought to a halt by the S1 micro-switch, see fig.3.

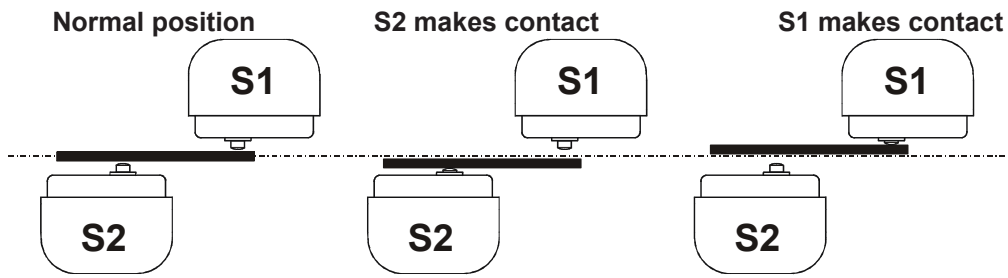
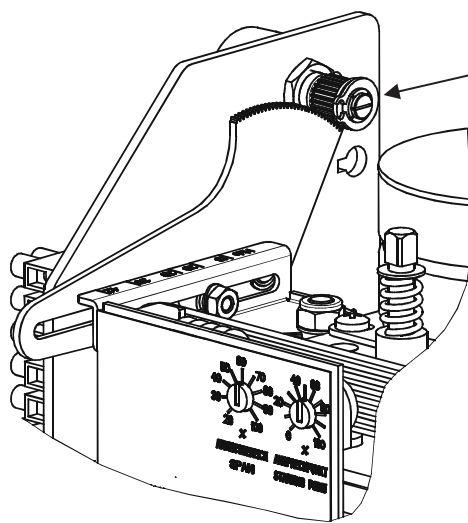


Fig. 3

- ◆ Turn the feedback potentiometer clockwise to the stop see Fig. 4. This is the setting point for the stroke when the actuator stem is extended.



**Feedback potentiometer:**

The friction clutch on the potentiometer shaft allows adjustment of the potentiometer shaft. The adjustment can be made with a screwdriver.



Fig. 4

- ◆ Connect voltmeter (ammeter) to terminal Y.
- ◆ Increase input voltage on terminal E to 10 V DC (20 mA). Retract actuator stem until the motor is switched by the micro-switch S2.

**Output signal Y lesser 10VDC:**

- ◆ Turn the compensating potentiometer anti-clockwise until output signal Y is equal 10VDC. If 10VDC is not achievable the transfer bolt must be adjusted with regard to the stroke. Then the entire setting procedure must be carried out again.

**Output signal Y equal 10VDC:**

- ◆ First turn the compensating potentiometer clockwise until output signal Y is lesser 10VDC. Then Turn the compensating potentiometer anti-clockwise until output signal Y is equal 10VDC
- ◆ Remove the voltmeter. This ends the basic setting procedure.
- ◆ If another action mode is required, the action mode switch must be moved to the corresponding position, see Fig. 1.

**Actuator selection table****Close-off pressures for VG8000N and VG8000V-Valves, PN 16**

Actuator	Nominal size / Close-off pressure (kPa)										
	15	20	25	32	40	50	65	80	100	125	150
RA-3xxx-712x (ERA 1600)	1600	1600	1600	1600	1250						
RA-3xxx-722x (ERA 1800)						700	540	240			
RA-3xxx-732x (ERA 3000)						1350	1050	500	310	190	110

**Close-off pressures for VG8000H - Valves, PN 25**

Actuator	Nominal size / Close-off pressure (kPa)										
	15	20	25	32	40	50	65	80	100	125	150
RA-3xxx-712x (ERA 1600)	2500	2500	2500	1930	1180						
RA-3xxx-722x (ERA 1800)	-	-	-	-	-	650	500	220			
RA-3xxx-732x (ERA 3000)	-	-	-	-	-	1300	1010	480	290	170	100

**Close-off pressures for VBF-Valves, PN 6**

Actuator	Nominal size / Close-off pressure (kPa)									
	15	20	25	32	40	50	65	80	100	100
RA-3xxx-722x (ERA 1800)	-	-	-	-	-	-	-	380	230	130
RA-3xxx-732x (ERA 3000)	-	-	-	-	-	-	-	730	460	280

**Close-off pressures for VBF-Valves, PN 10**

Actuator	Nominal size / Close-off pressure (kPa)									
	15	20	25	32	40	50	65	80	100	100
RA-3xxx-722x (ERA 1800)	-	-	-	-	-	-	-	360	220	120
RA-3xxx-732x (ERA 3000)	-	-	-	-	-	-	-	720	450	270

**Close-off pressures for VBD-Valves, PN 25**

Actuator	Nominal size / Close-off pressure (kPa)									
	15	25	40	50	65	80	100	125	150	150
RA-3xxx-712x (ERA 1600)	2500 (PDTO)	1970 (PDTO)	1100 (PDTO)							
	2500 (Mixer)	1070 (Mixer)	710 (Mixer)							
RA-3xxx-722x (ERA 1800)				480	220					
RA-3xxx-732x (ERA 3000)				1130	590	330	180	90	40	

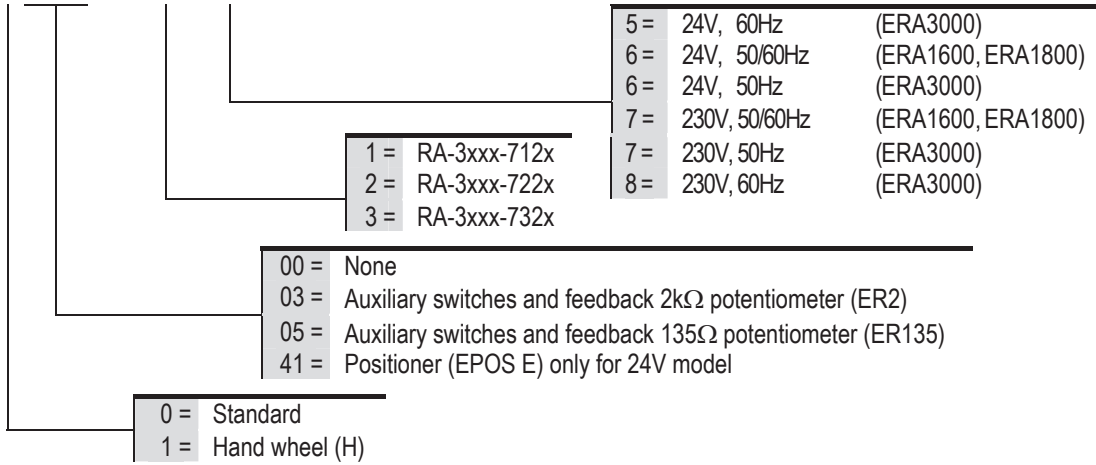
**Close-off pressures for VG9000 Valves, PN 6 and PN 10**

Actuator	Close-off pressure (kPa)				Close-off pressure (kPa)			
	DN 80, PN 6		DN 100, PN 6		DN 80, PN 10		DN 100, PN 10	
RA-3xxx-722x (ERA 1800)	280 (PDTO)	270 (Mixer)	170 (PDTO)	160 (Mixer)	280 (PDTO)	260 (Mixer)	170 (PDTO)	160 (Mixer)
RA-3xxx-732x (ERA 3000)	510 (PDTO)	500 (Mixer)	320 (PDTO)	310 (Mixer)	510 (PDTO)	490 (Mixer)	320 (PDTO)	310 (Mixer)

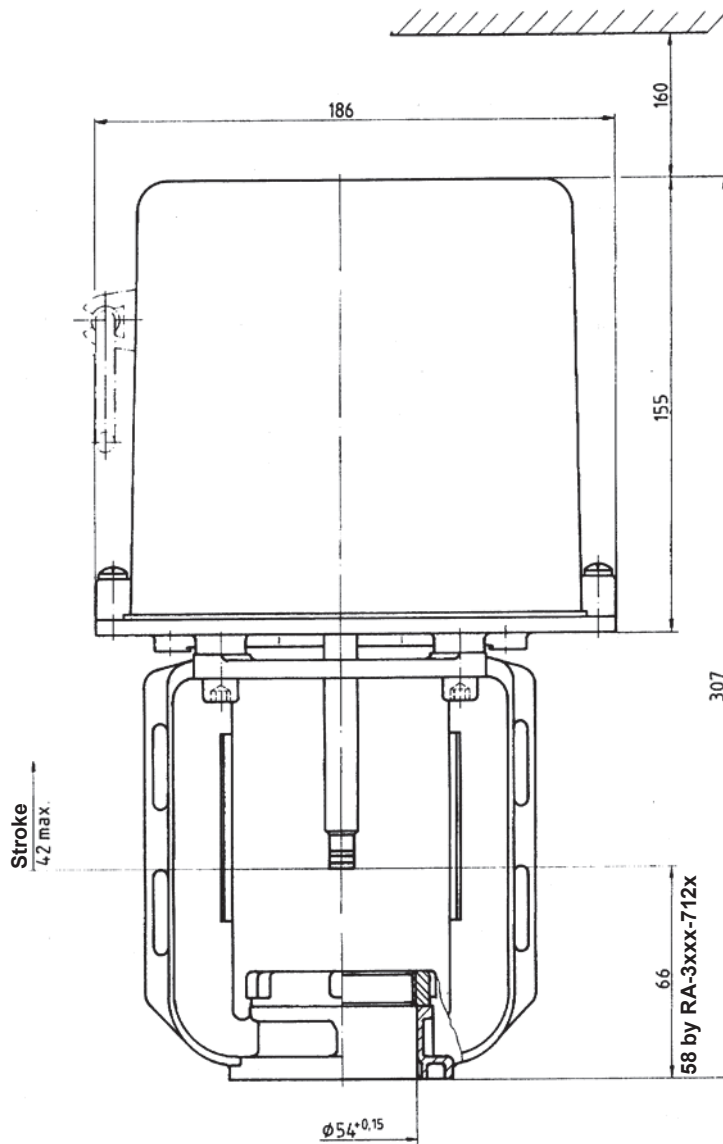
**Close-off pressures for VBB-Valves, DN 50-150, PN 16 = 1600 kPa, PN 25 = 2500 kPa**

**Device code**

RA - 3 x x x - 7 x 2 x



**Dimensions (in mm):**



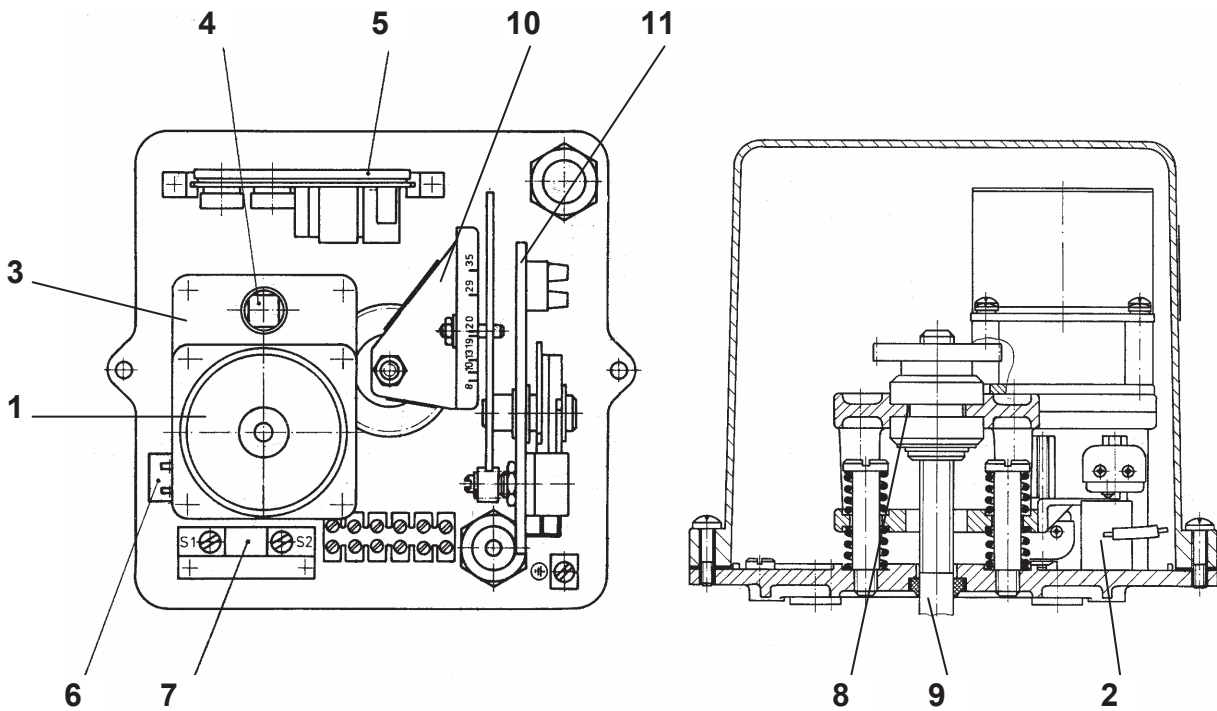
**Spare Parts:**

	Pos. 1	Pos. 2	Pos. 3	Pos. 4	Pos. 5
	*Motor with pinion	*Condenser	Gear	Gear Hand wheel	EPOS pcb
<b>RA-3xxx-712x</b> (ERA1600)	111 6153 010 (230V, 50/60Hz)	111 6309 211	111 5535 010	111 5882 010	EQ-0572-7041 Only for 24V
	111 6153 020 (24V, 50/60Hz)	111 6309 021			
<b>RA-3xxx-722x</b> (ERA1800)	111 6188 010 (230V, 50/60Hz)	111 6309 231			
	111 6188 030 (24V, 50/60Hz)	111 6309 031			
<b>RA-3xxx-732x</b> (ERA3000)	111 6100 010 (230V, 50Hz)	111 6309 251	111 5894 020	111 5895 020	
	111 6100 030 (24V, 50Hz)	111 6309 051			
	111 6100 010 (230V, 60Hz)	111 6309 241			
	111 6100 030 (24V, 60Hz)	111 6309 041			

\* Always order the motor and capacitor together!

	Pos. 6	Pos. 7	Pos. 8	Pos. 9	Pos. 10	Pos. 11
	Switch (S7) Assy.	Micro switch Assy.	Gear base plate Assy.	Stem	Bracket	Accessories ER2
<b>RA-3xxx-712x</b>	111 6102 011	111 5641 011	111 5553 021	111 6033 020	111 5562 010	111 5542 011
<b>RA-3xxx-722x</b>				111 6033 010		
<b>RA-3xxx-732x</b>						

Retrofit kits see page: 4



## **DECLARATION OF CONFORMITY**

**We**

**Johnson Controls  
JCI-Regelungstechnik GmbH  
Westendhof 8  
D-45143 Essen**

**declare under our sole responsibility that the product**

**Electrical actuators:**

**RA-3xxx-7x2x (ERA1600; ERA1800; ERA3000)**

**to which this declaration relates is in conformity with the following  
standard(s)**

**EN 50081-1; EN 50082-1; EN 60335-1**

**Following the provisions of Directive(s)**

**EMV directive 89/336/EEC  
Amendment 91/263/EEC, Amendment 92/31/EEC, Amendment 93/68/EEC,  
Amendment 93/97/EEC**

**Low voltage directive 73/23/EEC  
Amendment 93/68/EEC**

  
W. Tessler (Managing Director)

D-45143 Essen, 16.01.2003

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*Exceeding Your  
Expectations!*