INSTALLATION AND MAINTENANCE INSTRUCTIONS

LINEAR ELECTRIC ACTUATORS
Type EL

EL12 / EL20 / EL45 / EL80 / EL120 / EL250

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1 SAFETY

Dangers of non-compliance with safety regulations

EA actuators are built to state-of-the-art technology and are safe to operate. Despite this, the actuators may be hazardous if operated by personnel that have not been sufficiently trained or at least instructed, and if the actuators are handled improperly, or not used as per specification. This may

- cause danger to life and limb of the user or a third party,
- damage the actuator and other property belonging to the owner,
- reduce safety and function of the actuator,

To prevent such problems, please ensure that these Operating Instructions and the Chapter on "Safety" in particular have been read and understood by all personnel involved in the installation, commissioning, operation, maintenance and repair of the actuators.

Basic safety notes

- The actuators may only be operated by skilled and authorized operating personnel.
- Make sure to follow all security advices mentioned in this manual, any national rules for accident prevention, as well as the owner's instructions for work, operation and safety.
- The isolating procedures specified in these Operating Instructions must be followed for all work pertaining to the installation, commissioning, operation, change of operating conditions and modes, maintenance, inspection, repair and installation of accessories
- Before opening the actuator cover, ensure that mains supply is isolated and prevented from unintended re-connection.
- Areas that can be under voltage have to be isolated before working on them.
- Ensure that the actuators are always operated in faultless condition. Any damage or faults, and changes in the operational characteristics that may affect safety, must be reported at once.

Danger signs

The following warning symbols are used in this manual:



Caution! There is a general risk of damage to health and/or properties.



Danger! Electrical voltages may be present that are dangerous to life!
There is a risk of damage to health and/or properties with danger to lives.

Other notes

- The motor surface may have elevated temperature when servicing, inspecting or repairing it immediately after operation. Danger of burning the skin!
- Always observe the relevant operating instructions when fitting accessories or operating the actuator with accessories.
- Connections for signal in- and output are double isolated from circuits that can be under dangerous voltage.

2 USAGE AS PER SPECIFICATION

- The EL linear actuators are exclusively designed as electric valve actuators. They are meant to be mounted on valves for motor-operation.
- Any other use is considered to be not in accordance with standard specification, and the manufacturer cannot be held liable for any damage resulting from it.
- The actuators may not be used outside the limits laid out in data sheets, catalogs and order documentation. Otherwise the manufacturer cannot be held liable for any resulting damage.
- Usage as per specification includes the observance of the operating, service and maintenance conditions laid down by the manufacturer.
- Not to be regarded as usage as per specification are mounting and adjustment of the actuator, and servicing. Special precautions have to be taken while doing this!
- The actuators may only be used, serviced and repaired by personnel that are familiar with them and informed about potential hazards. The specific regulations for the prevention of accidents have to be observed.
- Damages caused by unauthorized modifications carried out on the actuators are excluded from the manufacturer's liability.
- Supply voltage may be switched on only after properly closing the main cover or terminal box.
- Regarding the power supply, the actuator with 220V (60Hz) and 230V (50Hz) have a tolerance of +/- 10%.

3 STORAGE

The following must be observed with regards to proper storage:

- Only store the actuators in ventilated, dry rooms.
- Store the actuators on shelves, wooden boards etc. to protect them from floor moisture.
- Cover the actuators with plastic foil to protect them from dust and dirt.
- Protect the actuators against mechanical damage.

4 OPERATIONAL DESCRIPTION

The rotational motion of the motor in the linear actuator is transmitted via a spur gearing onto the centre gear with internal screw thread. It is in this internal screw thread that the driving rod is running provided with external thread. This driving rod is safeguarded against torsion via an anti-rotation assembly adjacent to the yoke. The driving rod executes a linear draw or thrust motion, when the centre gear with the internal screw gear is turned via the motor gearing. The anti-rotation assembly serves at the same time as a stroke indication. The linear actuator can also be screwed via flange mounting F05 directly onto a valve with a cast yoke from customer's side. The driving rod of the actuator must then be safeguarded against torsion.

5 INSTALATION CONDITIONS AND MOUNTING POSITION

The mounting spot for the linear actuator must be chosen in a way that

- the actuator is easily accessible
- sufficient free space is available for taking the hood off, resp. in order to carry out adjusting works
- the linear actuator will be protected against strong heat radiation
- the environmental temperature will not be more than +60 °C
- In open air the linear actuator must be protected with an additional coverage against
- rain
- direct insolation
- strong draught air
- dust influence

In case of strongly oscillating ambient temperatures and high air humidity the installation of a heating resistor is recommendable in order to minimize the formation of condensate in the actuator. Actuator coverages with suppressed cold bridges (double hoods) are recommended. In the open, respectively an environment having high pollutant concentrations, e.g. areas having a high traffic rate, industrial areas (chemical plants, sewage works, etc.) coastal regions and open sea, the actuators must additionally be provided with external blinds of non-corrosive material and also with a special lacquering.

The installation position is arbitrary, however not overhead. In case of an installation position with horizontally situated driving rod the linear actuator is mounted in a way that both columns of the yoke are situated in a vertical level one above the other.

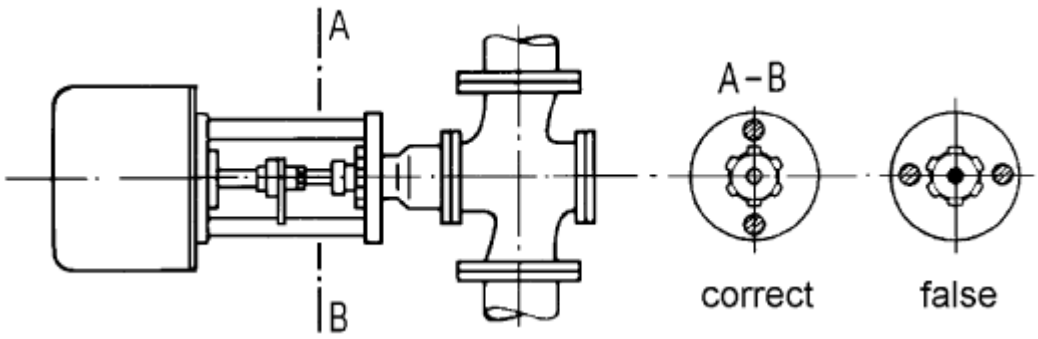


Figure 1: Installation position

6 MANUAL OPERATION

A handwheel is supplied in order to operate the actuator in case of power loss or during installation work such as mounting onto a valve or setting the limit positions.

The manual adjustment must **not** be disengaged or engaged while the motor is running. Execute the manual adjustment only with motor being at standstill; hereto

- With the left hand press the disengaging rod with plate in direction of the outgoing driving rod toward the bottom
- Simultaneously turn the handwheel with the right hand until the coupling-in has sensibly been executed
- To actuate the linear actuator now turn the handwheel; hold the disengaging rod with the plate in engaged position

Do not exceed the adjusted electrical stroke limits, by handwheel.
The mechanical limits must be set accordingly.
Failure to observe can damage the actuator!

Do not operate the handwheel using excessive force. Failure to observe this warning may result in damage to the actuator.

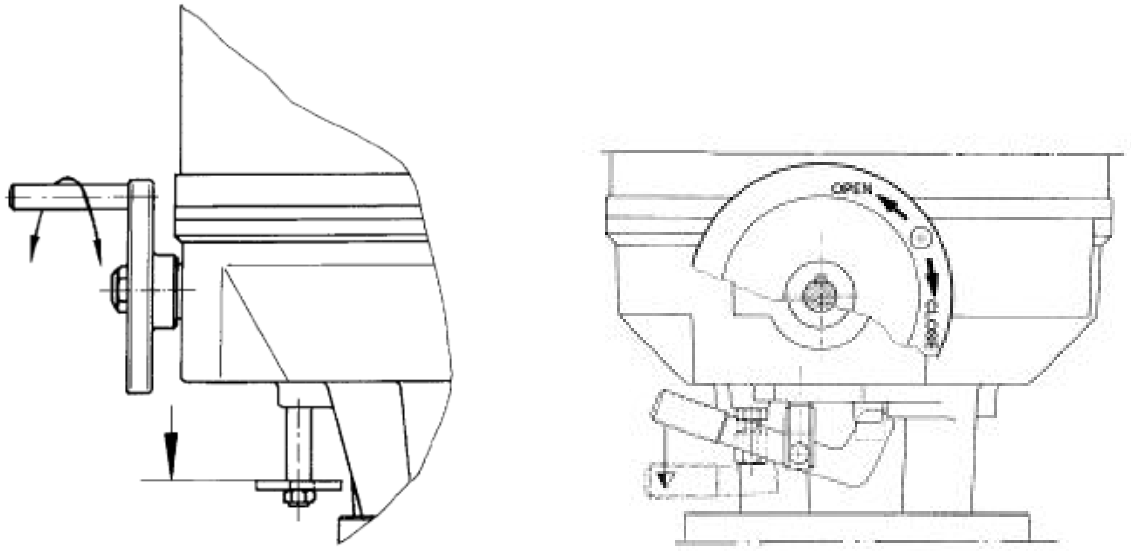


Figure 2: Manual Operation

Turn crank handle to the right (clockwise) → driving rod moves out of the actuator

Turn crank handle to the left (anti-clockwise) → driving rod moves into the actuator

The linear actuator is automatically switched back to motoric operation, as soon as the disengaging rod will be released.

7 MOUNTING THE ACTUATOR ONTO THE VALVE

Before making the assembly check whether

- the technical data of the linear actuator conform to the conditions of application
- the valve is complete (tie-bar at actuator or valve)
- the thread of the valve stem conforms with the threaded bush of the linear actuator
- the linear actuator is complete with the tie-bar or yoke columns and coupling parts for the
- assembly with the provided valve
- the perhaps required additions in the actuator have already been built in
- the to-be-connected operating voltage conforms to the voltage of the actuator
- the indications on the name plate conform with the indications given on the motor
- the adjusted or still to-be-adjusted stroke of the actuator conforms with the stroke of the valve

In the state of delivery the driving rod of the actuator is moved out until the lower final position. Further procedure (see figure 3):

- Insert valve stem into the valve all the way to limit stop
- Move driving rod of the linear actuator into threaded bush by turning the handwheel anti-clockwise by about 20 mm or by at least the screw-in depth of the valve stem
- Turn counter nut onto the valve stem until run-out of thread
- Untighten and screw out both hexagon socket screws [66], with which the locking plate [61] has been screwed down
- Lay the locking plate [61] over the valve spindle
- Lift the actuator over the valve stem and put it onto the upper valve part
- Fix the actuator loosely with impact nut or fixing screw/fastening nut

When mounting pay attention that the flow restrictor in the valve or control element is not pressed onto the seat and is not turned (could be caused by the tightening of the impact nut or of the fixing screw/fastening nut). That would lead to damaging the control element and perhaps the actuator.

- Slide valve stem against threaded bush [59] and simultaneously turn threaded bush [59], until the thread of the valve stem will reach the screw-in depth (screw-in depth max. 25 mm)
- Push locking plate [61] over threaded bush [59]
- If necessary, turn threaded bush [59] slightly, so that the locking plate will be congruent with the fixing holes in the coupling flange [58]
- Screw in both hexagon socket screws [66] and tighten them
- Turn counter nut against threaded bush [59] and counterfasten it
- Tighten impact nut or fixing screws/fastening nuts

Mount the linear actuator accordingly to other control elements, p.e. regulating flaps with mounting yoke.

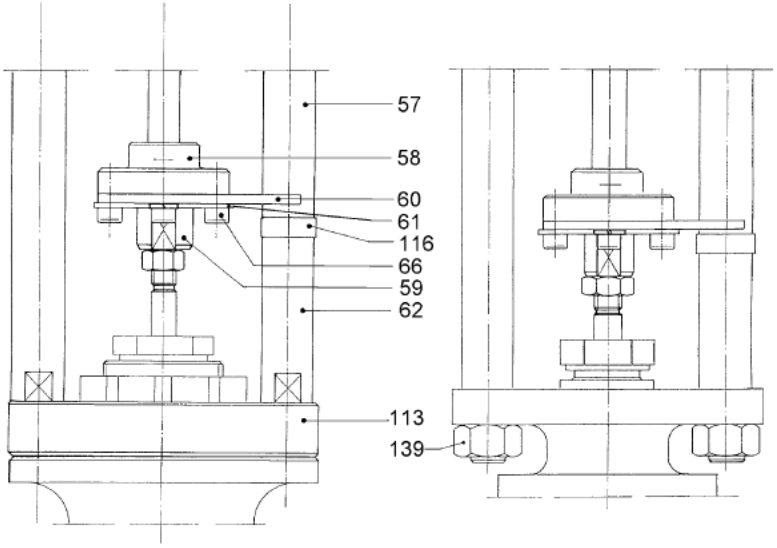


Figure 3: Coupling/mounting the actuator onto a valve

8 REMOVING THE COVER



In case of maintenance and adjustment works switch the supply line to dead state first!

- Screw off cap nut
- Take off gasket
- Embrace the hood on the cover and pull it off under slight pressure

9 MAKING THE ELECTRIC CONNECTION

The standard limit switches serve to switch-off the motor when the limits have been reached. Additional limit switches are free of voltage and serve to indicate the valve position. These are available as optional extras.

The cover must be removed in order to set the limit switches.

On principle the wiring diagram glued into the hood is applicable.

- Move the previously mounted actuator by means of manual adjustment (see Chapter 6) approximate stroke middle
- Remove the blanking plate in the existing screwed cable gland
- Slide the supply line through the screwed cable gland until enough length of line exists corresponding supply terminals
- Strip the line wrapping about 1 cm above the screwed cable gland
- Strip the individual cores at a distance of about 5 mm from the end
- Concerning the cores of stranded wires the end sleeves are to be slided onto the and be crimped
- Guide and fasten the lines in the actuator in a way that they are protected from moving rotating parts and are not damaged when taking the hood off or putting it back

9.1 Forces dependent switch connection

- Operation with single-phase alternating current (three-step triggering)
- Final switch-off: driving rod moving in/out load-dependently via force dependent “DE”-switches S1 and S2

If the actuator is driven by only 2 force dependent switches DE – S1 and DE – S2, attention must be paid that the control element (valve) can be driven also on load on both sides. Observe the documentation concerning the control element!

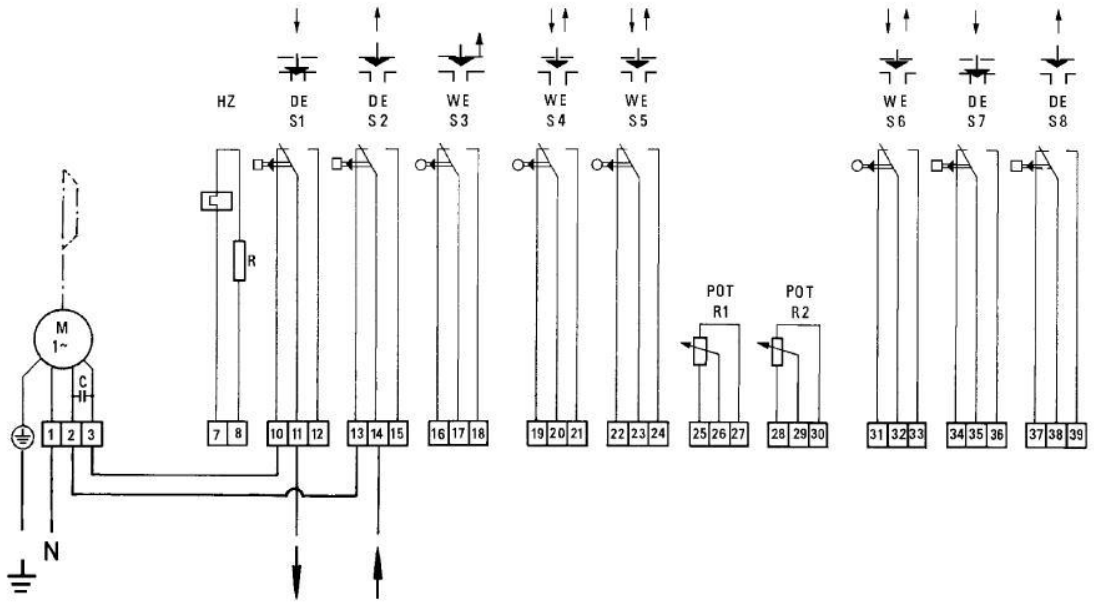


Figure 4: Wiring diagram to apply on EL12, EL20 and EL45

For actuators EL12, EL20 and EL45 do the following connections (as per figure 4):

- Connect earthed conductor of the supply line (core green/yellow) onto provided safety earth terminal
- Connect zero conductor N of the supply line to terminal 1
- Connect control cable for outgoing driving rod to terminal 11
- Connect control cable for ingoing driving rod to terminal 14
- Set in bridges; from terminal 10 to terminal 3 and from terminal 13 to terminal 2

For actuators EL80, EL120 and EL250 please follow below instructions (as per figure 5)

- Connect earthed conductor of the supply line (core green/yellow) onto provided safety earth terminal
- Connect zero conductor N of the supply line to terminal 4 (actuators 6–15 kN with synchronous motor to terminal 1)
- Connect control cable for outgoing driving rod to terminal 11
- Connect control cable for ingoing driving rod to terminal 14
- Set in bridges; from terminal 10 to terminal 3, from terminal 13 to terminal 2 and from terminal 5 to terminal 1 (with asynchronous motor)

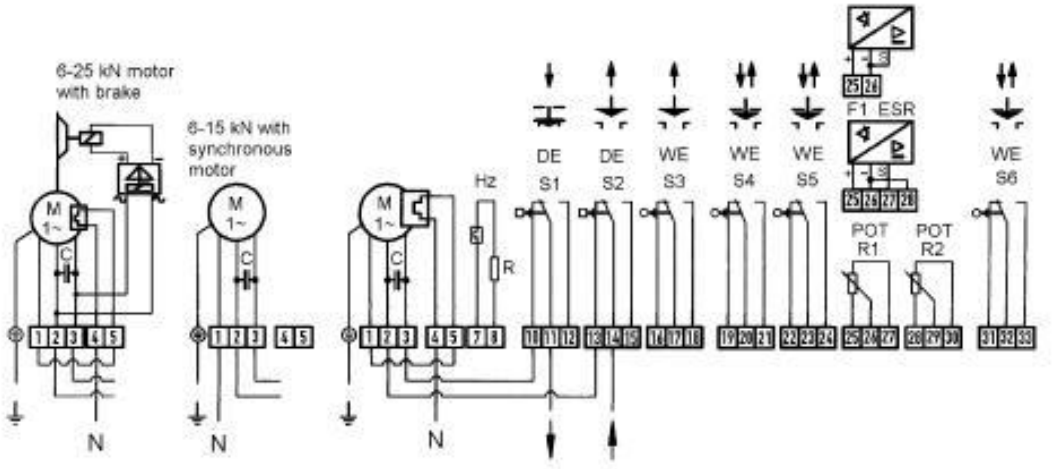


Figure 5: Wiring diagram to apply on EL80, EL120 and EL250

9.2 Forces/Travel dependent switch connection

(only possible with travel dependent switch S3 incorporated in the actuators EL12, EL20 and EL45 on the DE-mounting Angle or with switching and signalling device with travel switch “WE” S3 incorporated in the actuator EL80, EL120 and EL250).

- Operation with single-phase alternating current (three-step triggering)
- Final switch-off of driving rod moving out of the actuator load-dependently via force dependent DE-switch S1
- Final switch-off of driving rod moving into the actuator load-dependently via DE-switch S2 connected in series with WE-switch S3 (mounted to DE-mounting angle)

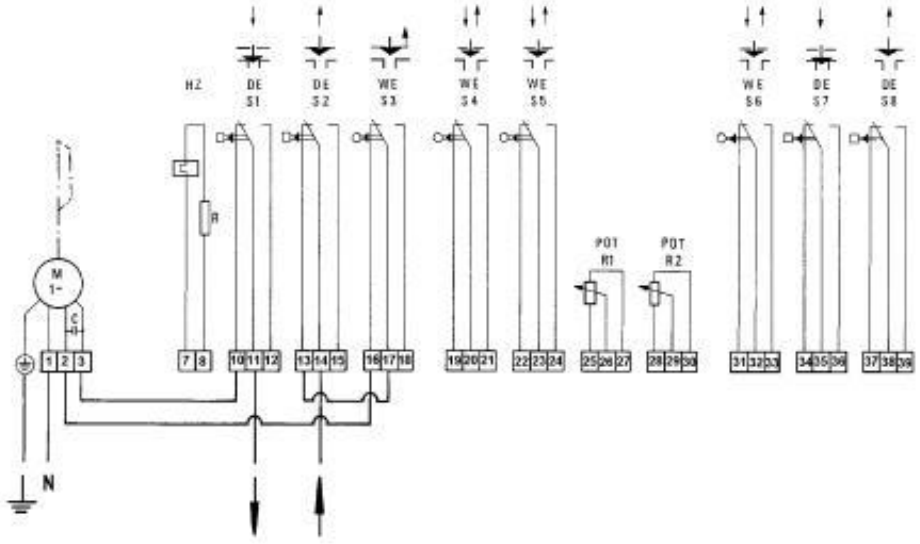


Figure 6: Wiring diagram to apply on EL12, EL20 and EL45

Connect the actuators EL12, EL20 and EL45 as follows (as per figure 6):

- Connect earthed conductor of the supply line (core green/yellow) to provided safety earth terminal
- Connect zero conductor N to terminal 1
- Connect control cable for outgoing driving rod to terminal 11
- Connect control cable for ingoing driving rod to terminal 14
- Inset bridges; from terminal 10 to terminal 3, from terminal 16 to terminal 2 and from terminal 13 to terminal 17
- Adjust positioning travel by shifting the travel dependent switch S3 (see Appendix A)

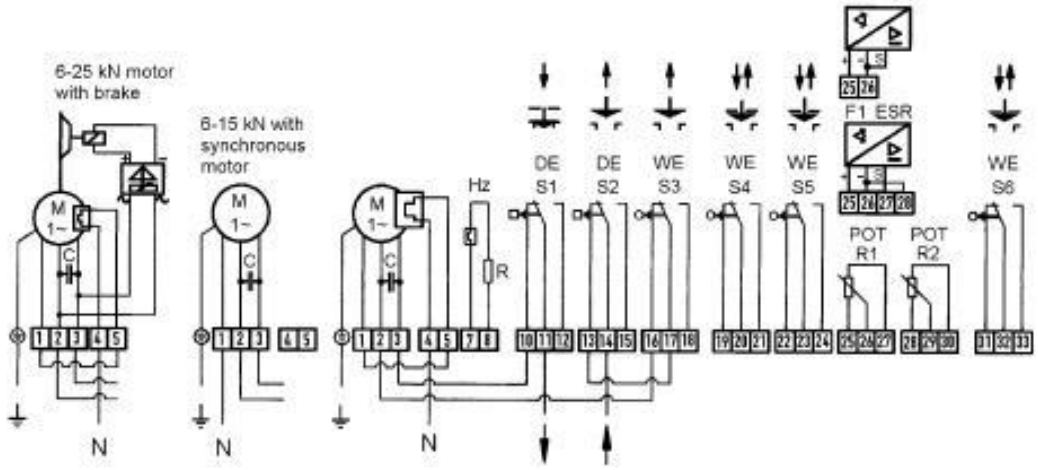


Figure 7: Wiring diagram to apply on EL80, EL120 and EL250

Connect the actuators EL80, EL120 and EL250 as follows:

- Connect earthed conductor of the supply line (core green/yellow) to provided safety earth
- terminal
- Connect zero conductor N to terminal 4 (actuators 6–12 kN with synchronous motor to terminal 1)
- Connect control cable for outgoing driving rod to terminal 11
- Connect control cable for ingoing driving rod to terminal 14
- Inset bridges; from terminal 10 to terminal 3, from terminal 16 to terminal 2, from terminal 13 to terminal 17 and from terminal 5 to terminal 1 (with asynchronous motor)
- Adjust positioning travel with slider [261] on adjusting lever [260] (see Appendix A)
- Adjust tripping cams for travel switch S3 on switching and signalling device [114] (see Appendix A)

9.3 Operation with three-phase alternating current

This actuator can be equipped with a three-phase alternating current motor. The electrical connection is effected via an external, mechanically and electrically locked contactor-type reversing starter combination. The motor feed bridges to terminals 2 and 3 are not applicable (see wiring diagrams in figures 8, 9, 10 and 11)). The rotation direction check is made by actuating the switches with an insulated screw driver. If necessary the motor connections must be exchanged on terminals 2 and 3.

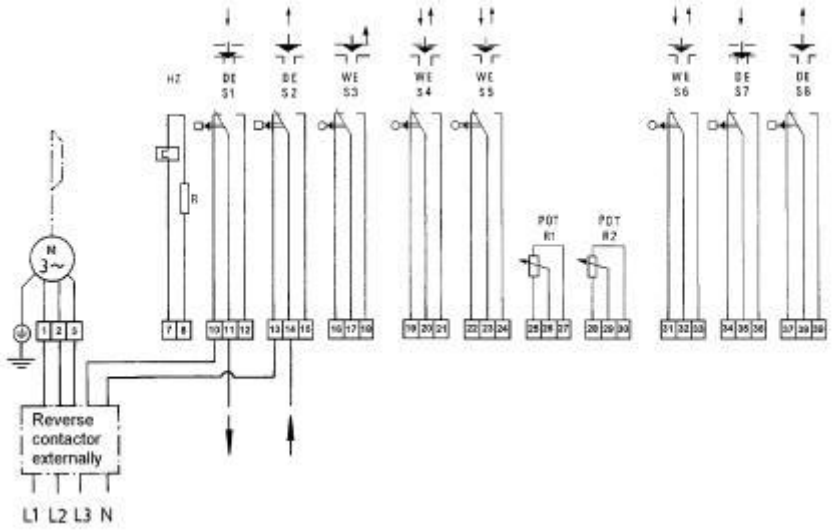


Figure 8: Wiring diagram – on both sides force dependent - on EL12, EL20 and EL45

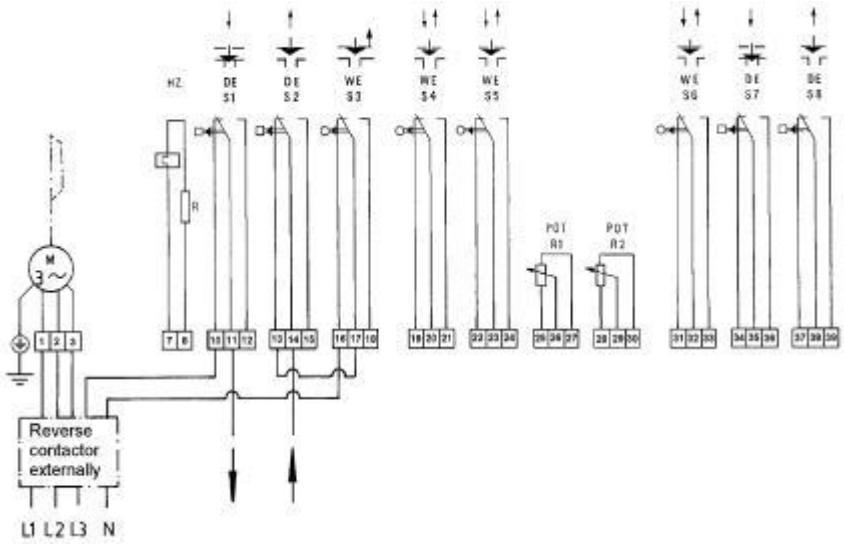


Figure 9: Wiring diagram – outgoing force dependent, ingoing force and travel dependent via S3 - on EL12, EL20 and EL45

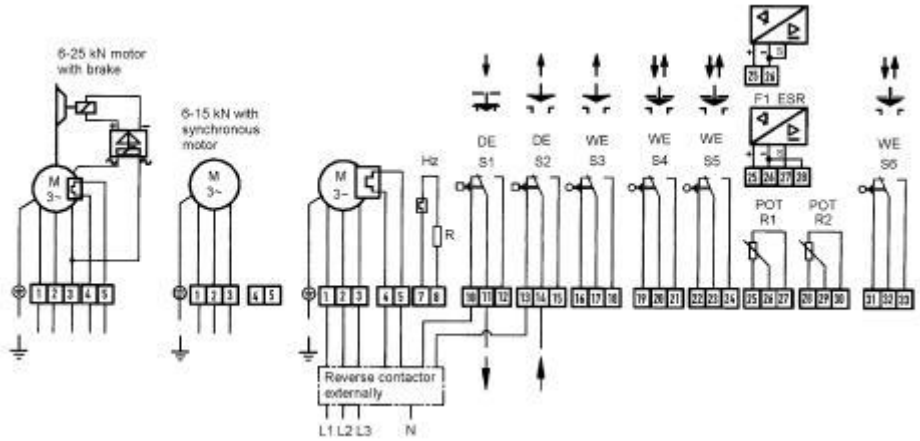


Figure 10: Wiring diagram – on both sides force dependent - on EL80, EL120 and EL250

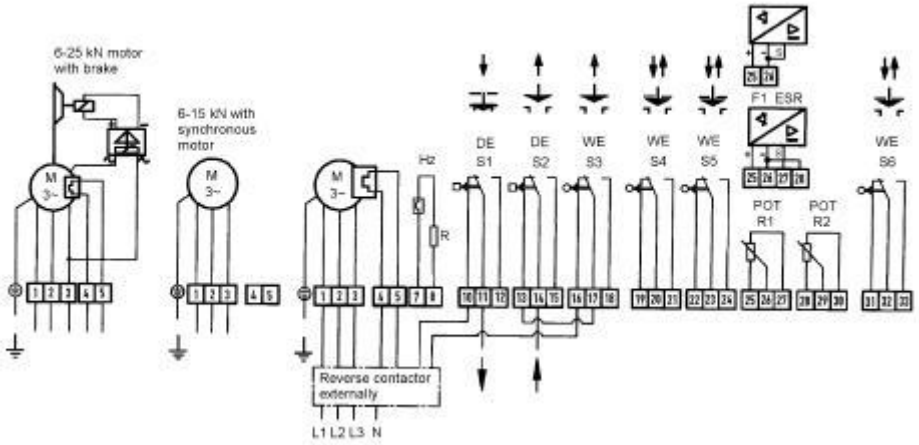


Figure 11: Wiring diagram – outgoing force dependent, ingoing force and travel dependent via S3 - on EL80, EL120 and EL250

10 COMMISSIONING

- Put the cover on, and re-install the handwheel (see Chapter 11 “Refitting the Cover”).
- Drive the valve to the centre of the stroke using the handwheel
- Switch on the mains.
- Switch the setting signal briefly between OPEN and CLOSE and check that the drive operates in the correct direction. If necessary, reverse the setting signal for OPEN/CLOSE.
- Drive the actuator, in both directions, using the setting signal until the limit switch cuts-off. Check that the limit switch position is correct. If necessary re-adjust the limit switch (see Chapter 9 “Making the electric connection”).

11 REFITTING THE COVER

- Set on hood cautiously, the hood must rest evenly on the housing rim; if necessary, correct hood position on the actuator by slight turning
- Lay gasket over the lug of the thread of the hood fixing bolt
- Screw on and tighten cap nut

Do not force the cover down and avoid damaging the cover. If necessary turn cover slightly in both directions until the cover noticeably locks into position. Push cover down until it reaches the housing.

12 SERVICE / MAINTENANCE

The gearing and the threading of the driving rod should be relubricated about every three years with normal operation of the linear actuator, in case of a higher strain after about 200,000 double strokes (required lubricant Klüber Microlube GL261).

For carrying out maintenance works on the linear actuator or final control element and before taking the hood off, switch off the mains supply. Safeguard the actuator against unintentional switch-on. Observe all safety information and prescriptions.

12.1 Cleaning

The actuators should be cleaned dry.

12.2 Spare Parts

EL actuators are compact functional units. In case of malfunction or damage, we recommend to replace the whole unit.

Defective actuators can be returned to us, or to our representatives, for evaluation of failures and repair.

13 APPENDIX

13.1 Technical Data and Accessories

Various auxiliaries are available in order to adapt the actuators to the various ambient conditions. A list of auxiliaries for each actuator type is available on the actuator data sheet.

Mounting and start-up instructions are available separately for each auxiliary.

- Appendix A: Additional Position Switches WE
- Appendix B: Potentiometer POT
- Appendix C: Electronic Position Transmitter ESR
- Appendix D: Heating Resistor HZ/WP
- Appendix E: Electronic Positioner PEL

APPENDIX A – ADDITIONAL POSITION SWITCHES “WE”

A.1 Travel dependent end position switches “WE” S3 and “WE” S6 for actuators EL12, EL20 and EL45

With this actuator on DE-mounting angle [36] 2 travel dependent switches S3 [124] and S6 [125] can be built in. These can switch off the actuator in the end positions travel dependently, e.g. if the control element is not to be moved onto its limit stop or if the switching and signalling device [114] (see appendix B) has not been built in, resp. if the WE-switches S4 and S5 [282] are occupied for other purposes. The WE-switches S3 [124] and S6 [125] are actuated via a contact piece [37], which is screwed down on the threaded lug of the driving rod.

WE-switch S3 → for end position moved-in driving rod
WE-switch S6 → for end position moved-out driving rod

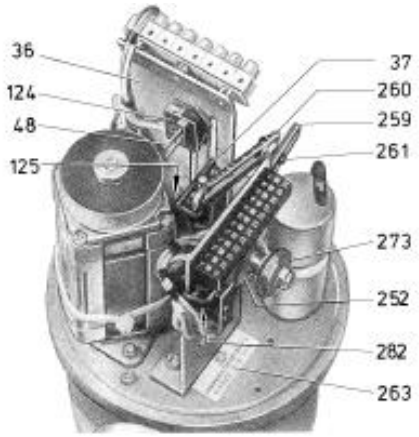


Figure A1: Position of WE-switches

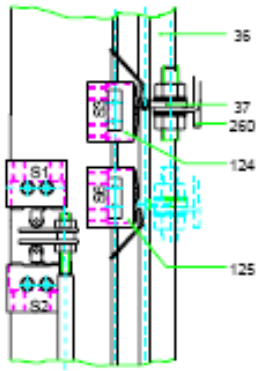


Figure A2: Schema of WE-switches

A.1.1 Adjustment of the travel dependent switch S3

- Move driving rod into end position “moved-in driving rod” by manual adjustment (see Chapter 6)
- Untighten cheese head screws [48] a little from the rear side of the DE-mounting angle [36] WE-switch S3 [124] for limiting the positioning travel in direction of “ingoing driving rod” (going into the actuator) must at first be above contact piece [37]; if necessary push the switch up.
- Push switch S3 [124] downward until this one will be switched by contact piece [37]
- Verify tripping point with measuring instrument, if so needed
- Tighten cheese head screws [48] again

A.1.2 Adjustment of the travel dependent switch S6

- Move out driving rod by manual adjustment to end position "extended driving rod”
- Untighten cheese head screws [48] a little from the rear side of the DE-mounting angle [36]
- WE-switch S6 [125] for limiting the positioning travel in direction of “outgoing driving rod” must at first be underneath contact piece [37], if necessary push the switch down.
- Push switch S6 [125] upward until it will be switched by contact piece [37]; verify tripping point with measuring instrument, if so needed
- Tighten cheese head screws [48] again

A.1.3 Retrofit of the travel dependent switches S3 and S6

- Verify scope of delivery (WE-switches S3 [124] and S6 [125]) concerning its completeness
- Move actuator to stroke middle
- Switch actuator free from voltage
- Untighten cap nut on actuator hood and remove it
- Take off sealing washer
- Hold hood by gripping the envelope and pull it off by turning slightly
- Insert both cheese head screws [48] with face plates [271] from the side of the terminal strip into the small slot of the DE-mounting angle [36]
- Hook an insulating plate [293] onto both cheese head screws [48]
- Hook on corresponding WE-switches S3 resp. S6
- Hook on second insulating plate [293]
- Screw down switch traverse [33] with cheese head screws [48]
- Connect stranded interconnection wires of WE-switch S3 into vertically standing terminal strip on DE-mounting angle [36]; stranded wire green into terminal 16, stranded wire red into terminal 17, stranded wire yellow into terminal 18
- Connect stranded wires of WE-switch S6 in horizontally lying terminal strip at top; stranded
- wire green into terminal 31, stranded wire red into terminal 32, stranded wire yellow into
- terminal 33
- Adjustment of WE-switches S3 and S6 as previous

Do electric circuitry as e.g. described in Chapter 9.2.

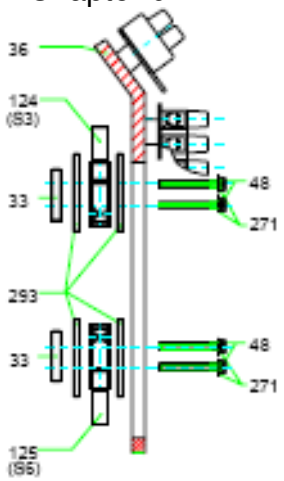


Figure A3: Retrofitting WE-switches

A.2 Switching and signalling devices for actuators EL12, EL20 and EL45

These actuators can be equipped with a switching and signalling device **[114]**. It comprises:

- 1 or 2 travel dependent switches “WE” – S4 and S5 **[282]** to be utilised as end position switches or signal switches
- 1 or 2 potentiometers **[283]** as signalling module

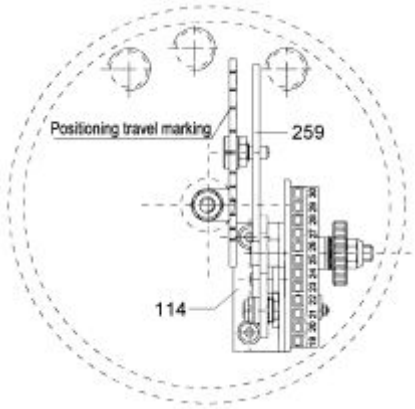


Figure A4: Switching and signalling device

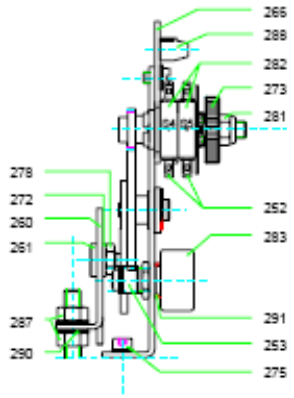


Figure A5: Switching and signalling device with potentiometer and WE-switches S4 and S5

The actuation is effected by the axial motion of the driving rod via the adjusting lever [260] fixed on the lug of thread of the driving rod, with an infinitely variably adjustable slider [261], engaging in the slot of the tappet lever. This lever then converts the axial motion into a rotary motion on a toothed wheel, which in turn actuates the potentiometers and via a pinion the camshaft for the WE-switches S4 and S5.
Upon delivery of the linear actuator with built-in switching and signalling device with WE-switches S4 and S5 [282] and/or potentiometer the slider [261] in the adjusting lever [260] is adjusted to the positioning travel as desired when ordering. Concerning actuators without yoke columns to be delivered and without anti-torsion device of the driving rod the adjusting lever [260] has not been mounted onto the lug of the thread of the driving rod because of the risk of being damaged. Adjusting lever [260] with slider [261], nuts [287] and toothed discs [290] are attached to the actuator separately.

A.2.1 Assembly and adjustment of the switching and signalling device

After the assembly of the linear actuator with the control element has been effected acc. to Chapter 7, mount the separate or previously removed adjusting lever (see figures A5 and A1):

- Move driving rod out of the actuator into end position by means of manual operation, until the DE-switch S1 will be switching (if necessary, check with measuring instrument)
- Turn a nut [287] onto the lug of the thread of the driving rod
- Lay a toothed disc [290] onto the nut
- Turn the cam shaft in a way that the tappet lever [259] points upward
- Hang adjusting lever [260] with slider [261] into the slot of the tappet lever
- Set adjusting lever [260] above the lug of the thread of the driving rod

- Turn cam shaft back and guide the adjusting lever via the lug of the thread
- With WE-switches S3 and S6 built on DE-mounting angles slide the contact piece [37]
- (see figure A2) over the threaded lug; the switch finger must herewith be rectangular to the mounting angle
- Lay the second toothed disc [290] over the lug of the thread
- Turn the second nut [287] onto the lug of the thread
- Readjust the adjusting lever [260] on the lug of the thread of the driving rod by turning both hexagon socket nuts [287] in a way that the adjusting lever [260] and the tappet lever [259] are exactly parallel to each other in their inclined position
- Tighten the adjusting lever [260] with nuts [287]; pay hereto attention that both levers are aligned parallel to each other also viewed from the top

When tightening the upper nut [287] with a fork wrench size of jaw 10 keep holding the lower nut [287], in order to prevent a torsion of the threaded lug.

A.2.2 Adjustment of a different positioning travel

If it is necessary to adjust a different positioning travel, this must be carried out in end position of “driving rod being moved out”.
Adjusting lever [260] and tappet lever [259] must be exactly parallel to each other in their inclined position.

- Untighen the flat nut [278] from the slider [261] with fork wrench size of jaw 10
- Shift slider [261] and adjust the desired positioning travel by means of the markings on the adjusting lever; tighten flat nut [278] again

The positioning travel concerning this actuator type is infinitely variably adjustable from 16–75 mm. Therefore any intermediate position can be adjusted (markings for the positioning travel with 16 – 20 – 25 – 30 – 35 – 40 – 50 – 60 – 70 – 75 mm).
If the positioning travel was altered by means of the slider [261] in the adjusting lever [260], it must be readjusted in each case, if the WE-switch S3 [124] has been mounted on the DE-mounting angle [36] (see Appendix A.1).

A.2.3 Adjustment of the potentiometers

- Move linear actuator into end position of “driving rod being moved out” by manual operation, until the DE-switch S1 switches; the adjusting lever [260] (see figure A1) and the tappet lever [259] must be parallel in their inclined position
- Set the wiper of the potentiometers to end position; for this purpose turn the potentiometer shaft anticlockwise by means of a screw driver on the rear side of the potentiometer, until a limit stop is felt
- Move the actuator by the adjusted positioning travel into end position “driving rod moved in”; the potentiometers herewith rotate into the other end position
- Observe the potentiometer motion with a measuring instrument (ohmmeter), whether the whole turning angle of the potentiometers is passed

Upon reaching the end position the potentiometers must not touch the limit stop, as otherwise the slip would respond between the potentiometer pinion and the potentiometer shaft. A reproducibility is in this latter case no longer granted.

- Adjust the slider [261] in the adjusting lever [260] to a correspondingly longer positioning travel

A.2.4 Adjustment of the travel switch S4 in direction “ingoing driving rod” into the actuator

- Move the driving rod by the adjusted positioning travel into the actuator
- Untighten knurled nut [273] up to the self-locking nut [281]
- Insert the screw driver into one of the slots of the cam (cam set situated the closest to the mounting angle) for switch S4 [282]
- Keep turning the cam until the roller lever of switch S4 is lifted by the cam and the switch switches; determine the tripping point with a measuring instrument, if necessary
- Adjust the tripping cam for switch S5 [282] for “outgoing driving rod” or intermediate positions accordingly
- Tighten the knurled nut [273] again after the adjustment will have been terminated

The self-locking nut [281] must not be regulated. The tripping cams are sluggish during the regulation. It is recommendable to seize hold of the toothed wheel with the tappet lever [259] (see figure A1) when turning the tripping cams. On principle it must be observed that the tripping cams [252] always actuate the WE-switches S4 and S5 [282] only from the side of the operating lever suspension.
If necessary, the operating lever can be relocated after previous detachment of the switch screw fittings and by opening the switches.

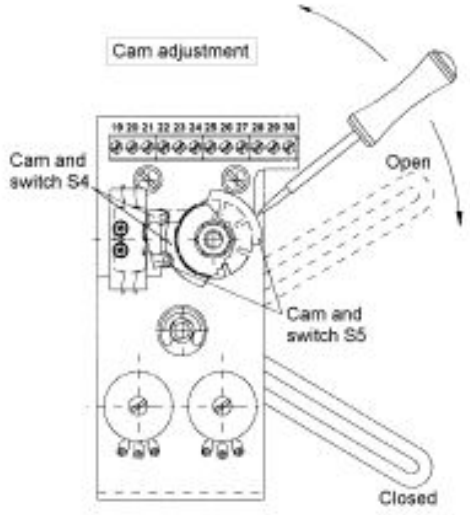


Figure A6: Cam adjustment

A.2.5 Retrofit of travel switches S4 and S5

With the switching and signalling device already being built in the WE-switches S4 and S5 [282] can be retrofitted.

- Check scope of delivery for completeness
- Move actuator into end position “driving rod moved out”
- Switch actuator dead
- Untighten and remove cap nut
- Take off gasket
- Embrace hood at its cover and pull it off under slight turning
- Screw nuts [276] off stay bolt [295]
- Take off face plates [271]
- Remove one insulating plate [293]
- Slide switch S4 with longer wiring harness onto stay bolt [295]

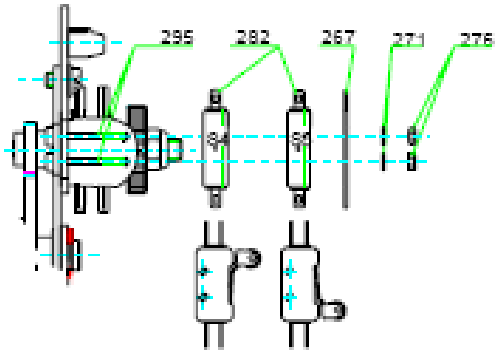


Figure A7: WE-switches S4 and S5

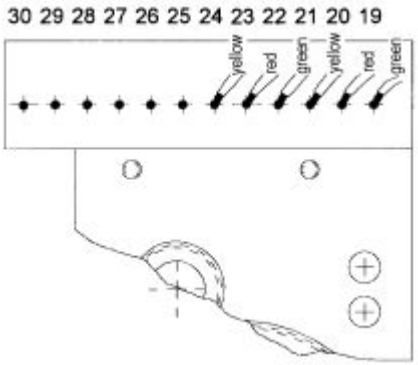


Figure A8: Terminal assignment for S4 and S5

The fulcrum of the operating lever of switch S4 must be at bottom, the switching roller must be at top. The red stranded interconnecting wire must also be at top. If necessary, open the switch a little, take the operating lever out and hang it in at the fulcrum situated opposite.

- Slide switch S5 with longer wiring harness onto stay bolt [295]; the same colour combination as with S4

The spigot of switch S4 must snap into the centre hole of switch S5. Concerning switch S5 the fulcrum of the operating lever must be at top, the switching roller must be at bottom. If necessary, open the switch a little, take the operating lever out and hang it in at the fulcrum situated opposite.

- Lay insulating plate [267] onto the switch
- Lay face plates [271] over the stay bolt
- Screw on and tighten nuts [276]
- Solder stranded interconnecting wires on the rear side of the clamp support board onto the provided soldered joints
- Guide the stranded wires from the top to the soldered joints
- Solder stranded interconnecting wires of WE-switch S4 onto the soldered joints; green stranded wire to terminal 19, red stranded wire to terminal 20 and yellow stranded wire to terminal 21
- Solder on the stranded interconnecting wires of WE-switch S5; green stranded wire to terminal 22, red stranded wire to terminal 23 and yellow stranded wire to terminal 24
- For adjusting the WE-switches S4 and S5 see previous page.

A.2.6 Retrofit of the switching and signalling device

The switching and signalling device [114] can be installed subsequently into the linear actuator:

- First of all check the retrofit kit for complete scope of delivery
- Move the actuator into end position “driving rod moved out”
- Switch the actuator dead
- Untighten and take off cap nut on the actuator hood
- Take off gasket
- Embrace hood at its cover and pull it off with slight turning
- Remove both hexagon socket screws [275] on the housing at the spot for the switching and signalling device
- Screw the switching and signalling device tight on the housing with these two screws

A.3 Switching and signalling devices for actuators EL80, EL120 and EL250

This actuator can be equipped with a switching and signalling device [114]. It comprises:

- 1, 2 or 3 travel dependent switches “WE” – S3, S4 and S5 [282] to be utilised as end position switches or signal switches (as special design 4 “WE” are available)
- 1 or 2 potentiometers [283] as signalling module

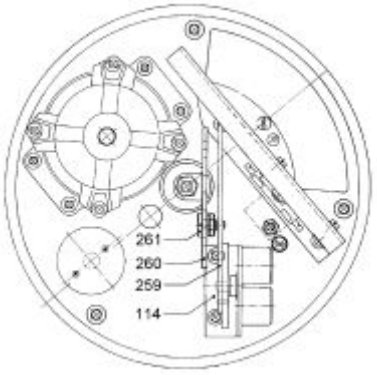


Figure A9: Switching and signalling device

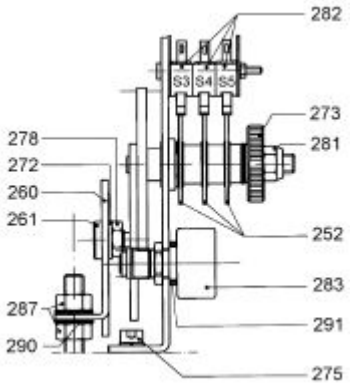


Figure A10: Switching and signalling device with potentiometer and WE-switches S3, S4 and S5

The actuation is effected by the axial motion of the driving rod via the adjusting lever [260] fixed on the lug of thread of the driving rod, with an infinitely variably adjustable slider [261], engaging in the slot of the tappet lever. This lever then converts the axial motion into a rotary motion on a toothed wheel, which in turn actuates the potentiometers and via a pinion the camshaft for the WE-switches S3, S4 and S5.

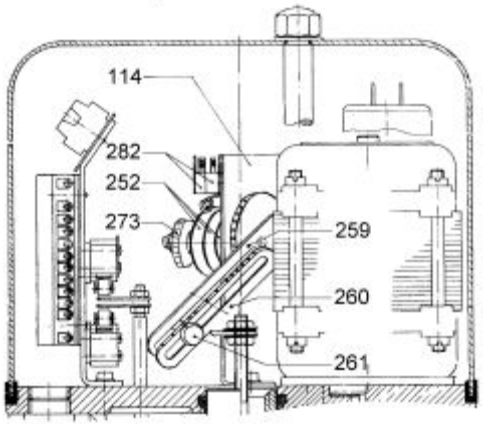


Figure A11: Position of the switching and signalling device in the actuator

Upon delivery of the linear actuator with built-in switching and signalling device with WE-switches S3, S4 and S5 [282] and/or potentiometer the slider [261] in the adjusting lever [260] is adjusted to the positioning travel as desired when ordering.
Concerning actuators without yoke columns to be delivered and without anti-torsion device of the driving rod the adjusting lever [260] has not been mounted onto the lug of the thread of the driving rod because of the risk of being damaged. Adjusting lever [260] with slider [261], nuts [287] and toothed discs [290] are attached to the actuator separately.

A.3.1 Assembly and adjustment of the switching and signalling device

After the assembly of the linear actuator with the control element has been effected acc. to Chapter 7, mount the separate or previously removed adjusting lever (see figure A9 and A10):

- Move driving rod out of the actuator into end position by means of manual operation, until the DE-switch S1 will be switching (if necessary, check with measuring instrument)
- Turn a nut [287] onto the lug of the thread of the driving rod
- Lay a toothed disc [290] onto the nut
- Turn the cam shaft in a way that the tappet lever [259] points upward
- Hang adjusting lever [260] with slider [261] into the slot of the tappet lever
- Set adjusting lever [260] above the lug of the thread of the driving rod
- Turn cam shaft back and guide the adjusting lever via the lug of the thread
- Lay the second toothed disc [290] over the lug of the thread
- Turn the second nut [287] onto the lug of the thread
- Readjust the adjusting lever [260] on the lug of the thread of the driving rod by turning both hexagon socket nuts [287] in a way that the adjusting lever [260] and the tappet lever [259] are exactly parallel to each other in their inclined position
- Tighten the adjusting lever [260] with nuts [287]; pay hereto attention that both levers are aligned parallel to each other also viewed from the top
- When tightening the upper nut [287] with a fork wrench size of jaw 10 keep holding the lower nut [287], in order to prevent a torsion of the threaded lug.

A.3.2 Adjustment of a different positioning travel

If it is necessary to adjust a different positioning travel, this must be carried out in end position of "driving rod being moved out".
Adjusting lever [260] and tappet lever [259] must be exactly parallel to each other in their inclined position.

- Untighen the flat nut [278] from the slider [261] with fork wrench size of jaw 10
- Shift slider [261] and adjust the desired positioning travel by means of the markings on the adjusting lever; tighten flat nut [278] again

The positioning travel concerning actuator types EL80 and EL120 are infinitely variably adjustable from 16–80 mm and concerning actuator type EL250 from 16–100 mm. Therefore any intermediate position can be adjusted (markings for the positioning travel with 16 – 20 – 25 – 30 – 35 – 40 – 50 – 60 – 70 – 75 – 80 mm with EL80 or EL120 and additionally 90 – 100 mm with EL250).

A.3.3 Adjustment of the potentiometers

- Move linear actuator into end position of "driving rod being moved out" by manual operation,until the DE-switch S1 switches; the adjusting lever [260] (see figure A9) and the tappet lever [259] must be parallel in their inclined position
- Set the wiper of the potentiometers to end position; For this purpose turn the potentiometer shaft anticlockwise by means of a screw driver on the rear side of the potentiometer, until a limit stop is felt
- Move the actuator by the adjusted positioning travel into end position "driving rod moved in"; the potentiometers herewith rotate into the other end position
- Observe the potentiometer motion with a measuring instrument (ohmmeter), whether the whole turning angle of the potentiometers is passed

Upon reaching the end position the potentiometers must not touch the limit stop, as otherwise the slip would respond between the potentiometer pinion and the potentiometer shaft. A reproducibility is in this latter case no longer granted.

- Adjust the slider [261] in the adjusting lever [260] to a correspondingly longer positioning travel (see section A.3.2)

A.3.4 Adjustment of the travel switch S3 in direction "ingoing driving rod" into the actuator

- Move the driving rod by the adjusted positioning travel into the actuator
- Untighten knurled nut [273] up to the self-locking nut [281]
- Insert the screw driver into one of the slots of the cam (cam set situated the closest to the mounting angle) for switch S3 [282]
- Keep turning the cam until the roller lever of switch S3 is lifted by the cam and the switch switches; determine the tripping point with a measuring instrument, if necessary

- Adjust the tripping cam for switch S4 [282] for “outgoing driving rod” or intermediate positions accordingly
- Adjust the tripping cam for switch S5 accordingly
- Tighten the knurled nut [273] again after the adjustment will have been terminated

The self-locking nut [281] must not be regulated. The tripping cams are sluggish during the regulation. It is recommendable to seize hold of the toothed wheel with the tappet lever [259] (see figure A11) when turning the tripping cams. On principle it must be observed that the tripping cams [252] always actuate the WE-switches S3, S4 and S5 [282] only from the side of the operating lever suspension. If necessary, the operating lever can be relocated after previous detachment of the switch screw fittings and by opening the switches.

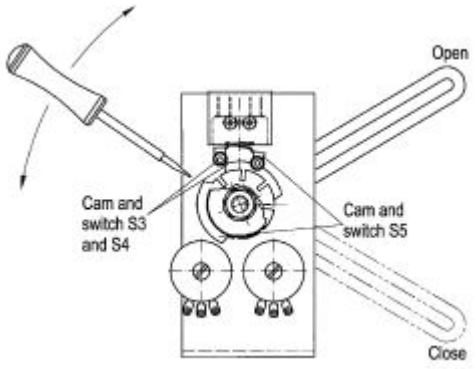


Figure A12: Cam adjustment

A.3.5 Retrofit of travel switches S3, S4 and S5

With the switching and signalling device already being built in the WE-switches S3, S4 and S5 [282] can be retrofitted.

- Check scope of delivery for completeness
- Move actuator into end position “driving rod moved out”
- Switch actuator dead
- Untighten and remove cap nut
- Take off gasket
- Embrace hood at its cover and pull it off under slight turning
- Screw nuts [276] off stay bolt [295]
- Take off face plates [271]
- Remove one insulating plate [293]
- Slide switch S4 with longer wiring harness onto stay bolt [295]

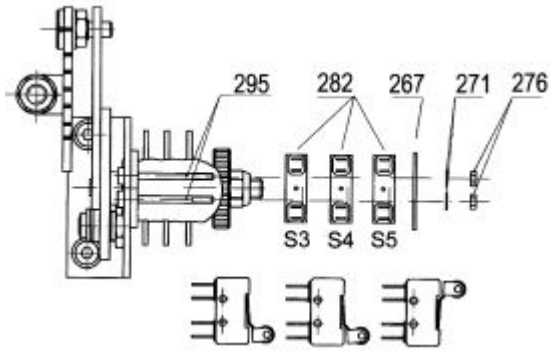


Figure A13: WE-switches S3, S4 and S5

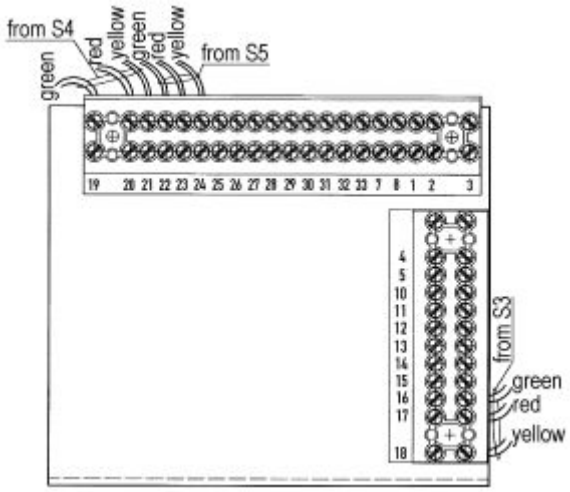


Figure A14: Terminal assignment for S3, S4 and S5

The fulcrum of the operating lever of switch S3 must be on the right side, the switching roller must be on the left side. The red stranded interconnecting wire must also be on the right side. If necessary, open the switch a little, take the operating lever out and hang it in at the fulcrum situated opposite.

- Slide switch S4 with shortest wiring harness onto stay bolt [295]; the same colour combination as with S3

The spigot of switch S3 must snap into the centre hole of switch S4. Concerning switch S4 the fulcrum of the operating lever must also be on the right side, the switching roller must be on the left side. If necessary, open the switch a little, take the operating lever out and hang it in at the fulcrum situated opposite.

- Slide switch S5 with medium length wiring harness onto stay bolt [295]; the same colour combination as with S3 and S4

The spigot of switch S4 must snap into the centre hole of switch S5. Concerning switch S5 the fulcrum of the operating lever must be on the left side, the switching roller must be on the right side. If necessary, open the switch a little, take the operating lever out and hang it in at the fulcrum situated opposite.

- Lay insulating plate [267] onto the switch
- Lay face plates [271] over the stay bolt
- Screw on and tighten nuts [276]
- Connect stranded interconnecting wires to corresponding terminals
- Stranded interconnecting wires of switch S3 to perpendicular terminal strip: green stranded wire to terminal 16, red stranded wire to terminal 17 and yellow stranded wire to terminal 18
- Stranded interconnecting wires of switch S4 to horizontal terminal strip: green stranded wire to terminal 19, red stranded wire to terminal 20 and yellow stranded wire to terminal 21
- Stranded interconnecting wires of switch S5 also to horizontal terminal strip: green stranded wire to terminal 22, red stranded wire to terminal 23 and yellow stranded wire to terminal 24
- For adjusting the WE-switches S3, S4 and S5 see section A.3.4.
- Guide the wiring harnesses along the terminal strips and fasten them

APPENDIX B – RETROFIT POTENTIOMETERS “POT”

With the switching and signalling device already being built in the potentiometers R1 and R2 can be retrofitted.

- Check scope of delivery for completeness
- Move actuator into end position “driving rod moved out”
- Switch actuator dead
- Untighten and remove cap nut
- Take off gasket
- Embrace hood at its cover and pull it off under slight turning
- Pull off pinion [253] with circlips [274] from the potentiometer shaft
- Screw nut off the potentiometer and remove it together with the serrated lock washer
- Slide potentiometer [283] with spacer ring [291] from the side of the tripping cam into the provided bore (see figure B1 for actuators EL12, EL20 and EL45 or figure B2 for actuators EL80, EL120 and EL250)
- Slide serrated lock washer over the potentiometer dog point
- Screw hexagon nut onto potentiometer lug
- Align the potentiometer
- Pull the hexagon nut tight
- Slide potentiometer pinion [253] together with circlips [274] onto potentiometer shaft
- Check the meshing

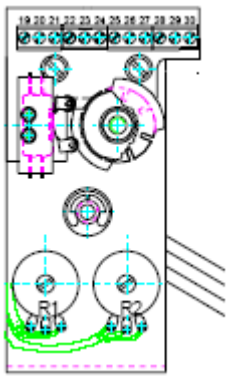


Figure B1: “POT” at EL12, EL20 and EL45

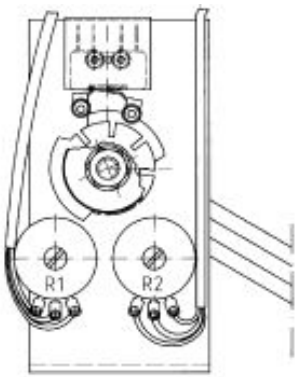


Figure B2:”POT” at EL80, EL120 and EL250

There must be a minor play between the toothed wheel and the potentiometer pinion.

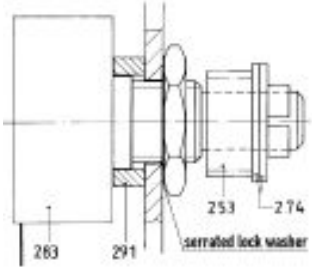


Figure B3: Pot. with potentiometer pinion

B.1 Wiring connections for actuators EL12, EL20 and EL45

- Solder potentiometer pigtails on the rear side of the clamp support board onto the provided soldered joints
- Guide the stranded wires of R1 from top onto the soldered joints; red stranded wire to terminal 25, grey stranded wire to terminal 26 and yellow stranded wire to terminal 27
- Guide the stranded wires of R2 from top onto the soldered joints; red stranded wire to terminal 28, grey stranded wire to terminal 29 and yellow stranded wire to terminal 30
- Do the potentiometer connection externally

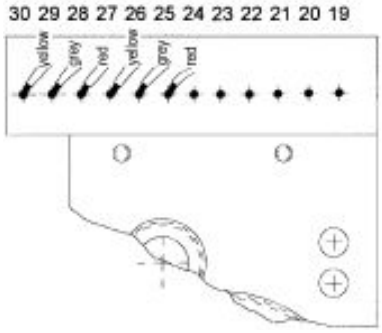


Figure B4: Terminal assignment for R1 and R2

B.2 Wiring connections for actuators EL80, EL120 and EL250

- Connect the potentiometer cords to the horizontal terminal strip
- From R1: red stranded wire to terminal 25, grey stranded wire to terminal 26 and yellow stranded wire to terminal 27
- From R2: red stranded wire to terminal 28, grey stranded wire to terminal 29 and yellow stranded wire to terminal 30
- Do the potentiometer connection externally

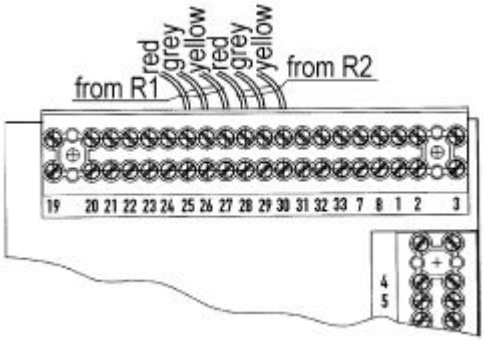


Figure B5: Terminal assignment for R1 and R2

B.3 Adjustment of the potentiometers

Proceed according to sections A.2.3 or A.3.3 depending on type of actuator. Observe Chapters 9 and 11.

APPENDIX C - ELECTRONIC POSITION TRANSMITTER “ESR”

The actuators EL80, EL120 and EL250 can be equipped with an electronic position transmitter, which is installed as an additional module in the linear actuator, in connection with a special switching and signalling device [114]. The electronic position transmitter transforms a rotational motion contactless into an output signal. This output signal is an impressed direct current of 0/4 ... 20 mA with four-wire/three-wire connection or only 4 ... 20 mA with two-wire connection.

The transformation of the axial motion of the actuator driving rod into a rotational motion is effected by a special switching and signalling device. This device is fitted with a contrite gear, which engages with the outer toothed wheel of the electronic position transmitter.

The electronic position transmitter is polarized. It can electrically directly be connected via

- two-wire connection with output current 4 ... 20 mA or
- four-wire/three-wire connection with output current 0 ... 20 mA or 4 ... 20 mA on indicator, recorder, controller or process computer

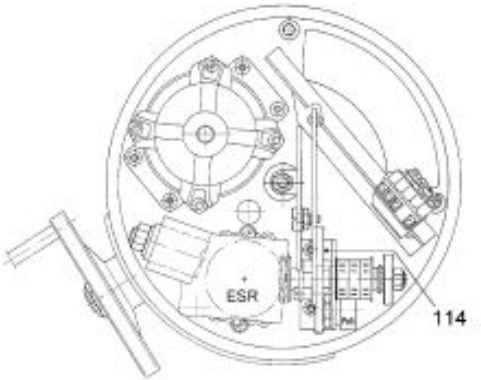


Figure C1: Actuator 6–25 kN, cover top view with “ESR”

C.1 Mode of operation of the electronic position transmitter

The rotational motion generated by the switching and signalling device is transfered via the toothed wheel to a rotor in the interior of the electronic position transmitter. The position of the rotor is measured with a capacitive callipering system.
Ten stator segments (see figure C2) are excited with timely consecutive impulses (2). The phase position of the signal – capacitively uncoupled by the rotor – is dependent on the turn angle. The signal is amplified (4) and converted via the phase comparator (5) and the voltage current transformer (6) into a turn-angle-proportional output current.

Legend

1 Voltage stabilization
2 Impulse generator
3 Stator rotor
4 Amplifier
5 Phase comparator
6 Voltage/current transformer
7 Three-wire connection
8 Two-wire connection
9 Apparent ohmic resistance

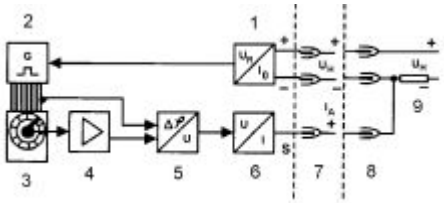


Figure C2: Block diagram

C.2 Technical data for the electronic position transmitter

With an incorporated electronic position transmitter only 1 potentiometer can be mounted onto the switching and signalling device. If a potentiometer is built on, the electronic position transmitter can only be connected with a three-wire connection.

TECHNICAL DATA		
ELECTRIC CONNECTION	TWO WIRE CONDUCTOR	THREE WIRE CONDUCTOR
Accessory energy Uh	12-30 VDC	18-30 VDC
Max. Apparent ohmic resistanc	50(Uh-12) Ω	50(Uh-2,5) Ω
Output current	4-20 mA	0/4 - 20 mA

C.3 Electric connection of the electronic position transmitter

In order to avoid a possible inducing of the supply and signalling line with disturbance pulses, this line must be arranged as a separate line with shielding tin-plated copper wicker covering to the actuator.

- Remove screwed cable gland or blind plug from actuator housing
- Screw corresponding screwed cable gland for shielded control cable into actuator housing
- Strip the outer sheath of the cable to make the individual cores sufficiently long for connecting them to the terminals 25–28
- Cut back screen mesh to about 9–12 mm to the outer sheath
- Then slide union nut, squeezing rubber and inner cone sleeve of the screwed connection one after the other across the cable end stripped from insulation
- Turn up the existing screen mesh over the inner cone sleeve
- Slide outer cone sleeve over the cable end and under the screen mesh
- Keep sliding the cable through the screwed underpart into the actuator until the outer cone sleeve will hit
- Press the squeezing rubber into the screwed underpart
- Screw on union nut and tighten it
- Strip inner sheath of the cable about 1 cm above the actuator housing
- Strip off the individual cores at about 5 mm off the end
- With the cores of stranded wire slide the end sleeves onto the stripped-off end and crimp them
- Lay and fix the lines in the actuator in a way that they are protected from moving or rotating parts and lest they are damaged when taking off of putting on the hood

C.3.1 Connection

- with three-wire conductor system: negative pole to terminal 26, positive pole to terminal 25, output mA positive pole to terminal 27
- with four-wire conductor system: negative pole to terminal 26, positive pole to terminal 25, output mA positive pole to terminal 27, output negative pole to terminal 28

- with two-wire conductor system: positive pole to terminal 25, negative pole to terminal 26; the signal tapping is thus effected in the supply line without feedback core

C.3.2 Feeding the operating voltage

- with three-wire/four-wire conductor system: 18–30 VDC
- with two-wire conductor system: 12–30 VDC

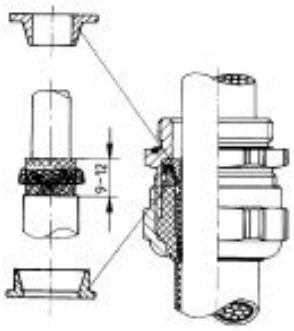


Figure C3: Screwed gland for shielded cable

C.4 Adjustment of the electronic position transmitter

The position transmitter can be operated in two ways. The operating modes are selected with the adjusting device (1) for operating modes.

Normal operation “N”:

- rising characteristic curve with turning the drive wheel clockwise, resp. ingoing driving rod into the actuator
- falling characteristic curve with turning the drive wheel anticlockwise, resp. outgoing driving rod out of the actuator

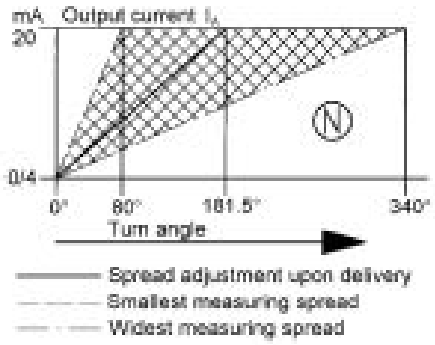


Figure C4: Setting range in normal operation

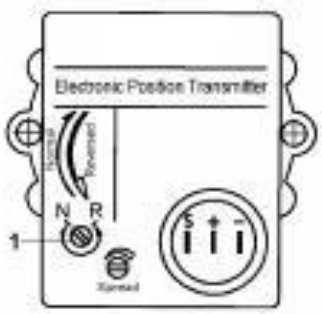


Figure C5: Setting device for operating mode and spread

Reversed operation “R”:

- rising characterisic curve with turning the drive wheel anticlockwise, resp. outgoing driving rod out of the actuator or
- falling characteristic curve with turning the drive wheel clockwise, resp. ingoing driving rod into the actuator

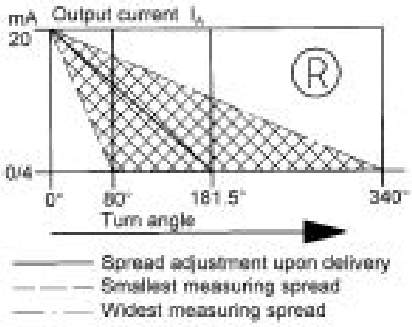


Figure C6: Setting range in reverse operation

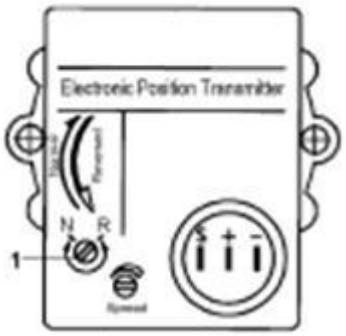


Figure C7: Setting device for operating mode and spread

C.5 Setting to normal operation “N”

- Set the positioning travel at the switching and signalling device (see section A.3.2)
- Turn the setting device (1) at the electronic position transmitter clockwise until stop “N”

The setting device (1) for operating mode must always be in end position, otherwise the function of the position transmitter is disturbed (initial and final values cannot be set). Turn screw carefully lest the stop be damaged in end position.

C.6 Setting to reversed operation “R”

.

- Set the positioning travel at the switching and signalling device (see section A.3.2)
- Turn the setting device (1) at the electronic position transmitter anticlockwise until stop “R”

The setting device (1) for operating mode must always be in end position, otherwise the function of the position transmitter is disturbed (initial and final values cannot be set). Turn screw carefully lest the stop be damaged in end position.

C.7 Setting the output current 0 or 4 mA

- Move the linear actuator into position, in which the output current is to be 0 or 4 mA
- Turn black regulating wheel (2) vis-a-vis white drive toothed wheel (1) manually or by means of screw driver in order to set the output current to 3.98–4.02 mA (with two-wire connection) resp. to 0.01–0.02 mA (with three-wire connection)



Figure C8: Setting the output current to 0 or 4 mA

With three-wire/four-wire connection no presign change is effected during zero crossing. The instrument indicates 0 mA via a range of 8°. Therefore set a small as possible value, however deviating from zero (e.g. + 0.01 mA).

C.8 Setting the output current to 20 mA

- Move the linear actuator into the position, in which the output current is to be 20 mA
- Adjust the output current by means of setting device for spread (3) to 20 ± 0.02 mA
- Check the setting and readjust, if necessary

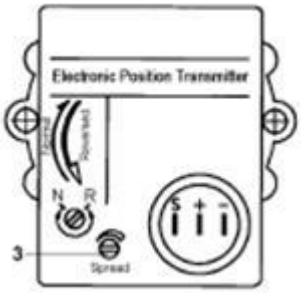


Figure C9: Setting the output current to 20 mA

C.9 Retrofit of the electronic position transmitter “ESR”

The electronic position transmitter can later-on be built into the linear actuator. This retrofit is comprehensive and should only be done in exceptional cases.

- Check the retrofit kit for complete scope of supply (ESR with wiring harness plugged, 4 support bolts, fixing screws, switching and signalling device with contrate gear and with restoring spring, capacitor angle for 6–15 kN with one-phase operation)
- Move the linear actuator to end positoin of “driving rod moved out”
- Switch the actuator dead
- Untighten cap nut on the actuator hood and take it off
- Remove sealing washer
- Embrace hood on cover and pull it off by turning it slightly
- With 6–15 kN actuators with capacitor: screw capacitor out of casing
- In this bore hole screw down capacitor angle with hexagon socket screw M8 x 10

- Fix the capacitor on the angle and align it
- On the housing, right on the spot for the switching and signalling device, untighten and remove both hexagon socket screws [275] (see figure A10)
- Tighten the switching and signalling device with these two screws

Further way of proceeding according to sections A.3.1 and A.3.2.

With already built-in switching and signalling device without contrate gear (see figure A10):

- On the terminal strips disconnect the wiring harnesses from the perhaps existing travel dependent switches and potentiometers
- Untighten and remove fixing screw [275]
- Remove the existing switching and signalling device
- Mount the new switching and signalling device with contrate gear to replace the one already removed
- Hang slider [261] of adjusting lever [260] into the slot of the tappet lever [259]
- Tighten switching and signalling device with the previously removed hexagon socket screws [275]
- Connect wiring harnesses of travel dependent switches resp. of the potentiometer acc. To wiring diagram on the terminal strips (see also Appendix A and B)
- Press 4 support bolts into the bores of the bearing surface of the electronic position transmitter
- Premount the electronic position transmitter with a screw (with 6–15 kN “EL80 and EL120”: M4 x 30, with 15–25 kN “EL250”: M4 x 35) together with washer and toothed disc

The electronic position transmitter with restoring spring has stops, which delimit the rotational motion.
To avoid a damage of the stops, resp. of the actuator elements in case of false direction of rotation, observe at the following:

- Turn the drive wheel of the position transmitter about 4 teeth off the limit stop
- Seize hold of the drive wheel and swivel it into the toothing of the contrate gear of the switching and signalling device
- Set in the second M4-screw and tighten both screws (observe sufficient tooth play!)
- Connect the plugged wiring harness on the terminal strip

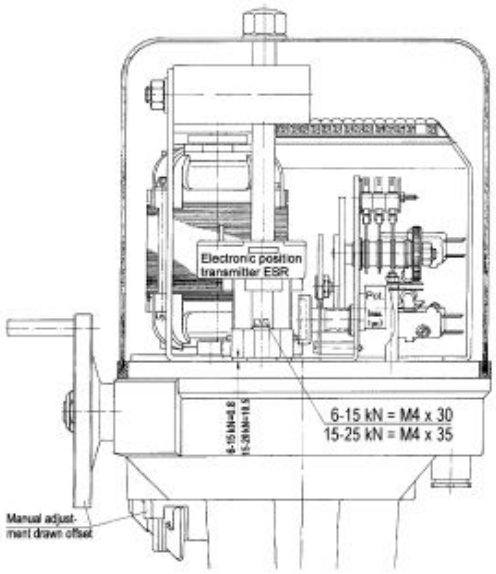


Figure C10: Linear actuator 6–2 5 kN with electronic position transmitter

- With three-wire system: negative pole (blue stranded wire) coming from plug contact “–” to terminal 26, positive pole (red stranded wire) coming from plug contact “+” to terminal 25, apparent ohmic resistance (green stranded wire) coming from plug contact “S” to terminal 27
- With four-wire system: negative pole (blue stranded wire) coming from plug contact “–” to terminal 26, positive pole (red stranded wire) coming from plug contact “+” to terminal 25, apparent ohmic resistance (green stranded wire) coming from plug contact “S” to terminal 27, insert bride from terminal 26 to terminal 28
- With two-wire system: negative pole (blue stranded wire) coming from plug contact “–” to terminal 26, positive pole (red stranded wire) coming from plug contact “+” to terminal 25, apparent ohmic resistance (green stranded wire) coming from plug contact “S” to terminal 28, insert bridge from terminal 26 to terminal 28
- Connect line from externally, see section C.3
- Adjust electronic position transmitter, see section C.4 until C.8

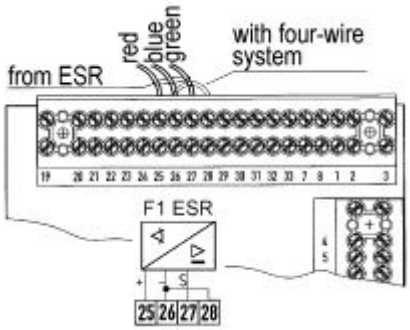


Figure C11: Connection with 3 or 4 wire system

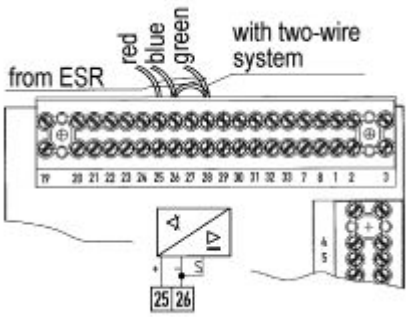


Figure C12: Connection with 2 wire system

APPENDIX D – HEATING RESISTOR

The installation of a heating resistor as a protection against the formation of condensate under the hood is recommendable in case of:

- strongly varying ambient temperatures
- high humidity of the air
- application in the open

The heating resistor is regulated by a thermostat “TW” (bimetallic contact). The switch-off temperature is about +60 °C, the restore-power temperature about +40 °C. For operating the heating resistor a continuous duty voltage is required. The connection is made via the teminal strips 7 and 8. The value of the operating voltage is to be indicated when ordering. It serves to determine the resistance value.

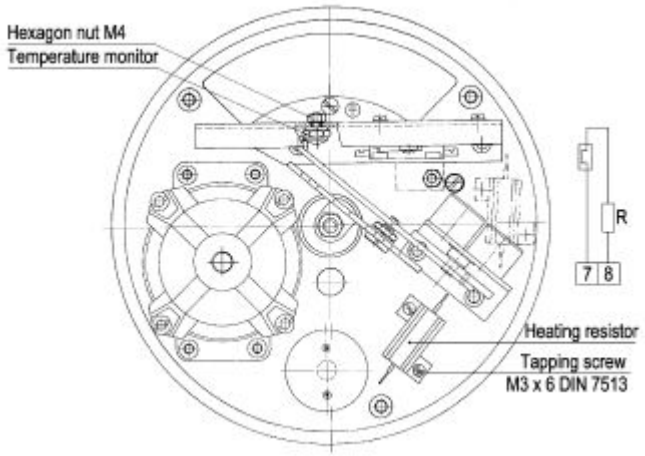


Figure D1: Assembly for EL80, EL120 and EL 250

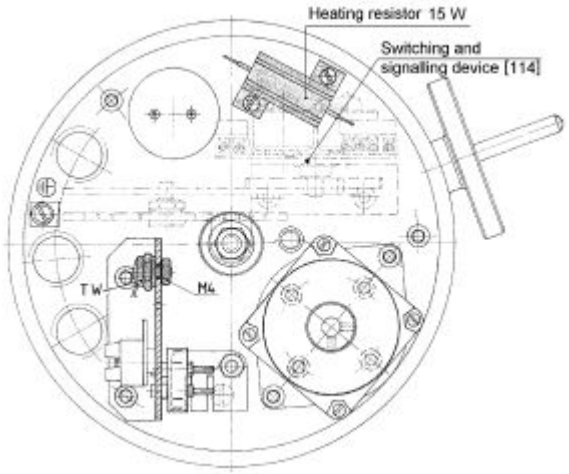


Figure D2: Assembly for EL12, EL20 and EL45

D.1 Retrofit of the heating resistor

- Check scope of delivery for completeness
- Switch actuator dead
- Untighten and remove cap nut
- Take off gasket
- Embrace hood at its cover and pull it off under slight turning
- Fix the heating resistor at the hereto provided position on the actuator cover with the two supplied tapping screws
- Insert the temperature monitor “TW” into the slot of the DE-mounting angle, slide it all the way up and tighten with nut M4
- Connect one stranded wire end of the “TW” and one stranded wire of the heating resistor in terminals 7 and 8
- Lay and fix the lines in the actuator in a way that they are protected from moving or rotating parts and that they will not be damaged with taking off or putting on the hood
- Connect feed line

APPENDIX E – ELECTRONIC POSITIONER "PEL"

The electronic positioner serves to control, regulate and position final controlling elements, such as linear, part-turn and turn actuators. The position regulator operates the actuator into the position defined by a continuous input signal. The controlled variable (actual value) is compared to the reference variable (setpoint), and, in case of deviation, a manipulated variable is generated to trigger the control element. The triggering is kept until the setpoint and the actual value are equal.
The actual value requires a potentiometer within the actuator to record the movement of the actuator.

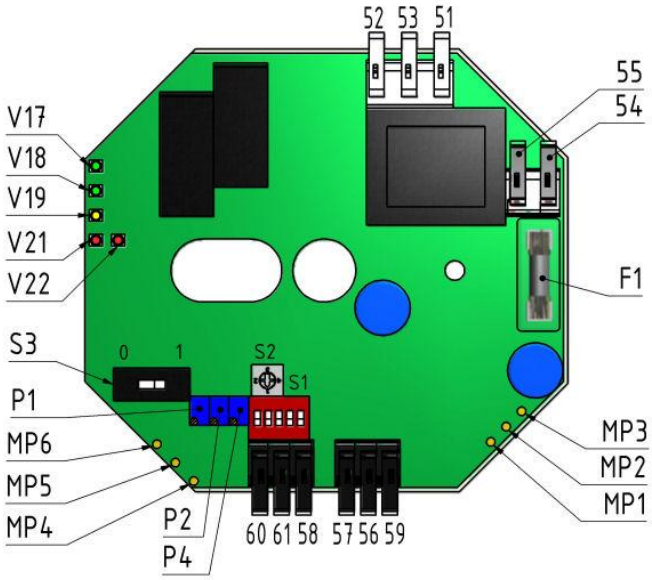


Figure E1: Position regulator board PEL 100

The light emitting diodes on the position regulator board indicate the status of the electronic positioner.

LED	Meaning	Indication
V17	Supply voltage ok	Green
V18	Operation "Ingoing actuator stem" (OPEN)	Green
V19	Operation "Outgoing actuator stem" (CLOSED)	Yellow
V21	Dead time active	Red
V22	E1 < 4mA	Red

Table: Meaning of the LEDs on the position regulator board

Settings such as stroke adjustment, split range, reversing and dead zone are made via the trimmers P1, P2, P4.
The DIP switches at S1 define additional functions such as zero point presetting, spreading of the potentiometer signal and the behaviour on loss of signal.

A minimum dead time of 200 ms is set as default in the position regulator to avoid sudden changes of direction or very short switching on and off procedures.
As standard, the feedback signal is available on the position regulator and indicates the current position of the control element. The range corresponds to the input signal range.
The feedback signal is not galvanically isolated from the input.
The positioning signal type (voltage or current) is defined by the configuration of the terminals. Switching over or re-soldering is not required.

E1. Assembly of the position regulator

The mechanical set-up is performed in the factory. Subsequent fitting of the position regulator is not always possible. If the actuator is designed for retrofitting of the position regulator, a PEL kit can be used for retrofitting.
The actuator has to be equipped with a potentiometer required for operation (and, if necessary, the switching and signalling device) before installling the position regulator.

Once the actuator is mounted on the valve and the switching and signalling device is set, the zero point of the potentiometer has to be set. The procedure is described the “Adjustment of the potentiometer” chapter.

E2. Electrical connection

Mains connection and commissioning of the linear actuator requires expert knowledge on the erection of power installations (DIN VDE 0100), knowledge on the prevention of accidents and the special conditions for commissioning the linear actuator.
These tasks may only be carried out by qualified personnel.
Failure to observe this warning can result in death, serious injury or considerable property damage!

- Perform mains connection with switched off power supply only! Safeguard against accidental switching on!
- When installing electric lines and the mains connection, the DIN/VDE regulations for the erection of power installations as well as the provisions of the local electricity board must be observed!
- Check whether the mains connection voltage and the mains frequency comply with the data on the name plate of both the linear actuator and the actuator motor.
- The conductor cross section must always be sized according to the power consumption of the linear actuator and the required cable length. The permissible cable cross section is 0.8…2.5 mm² (AWG 28…12).
- Mains disconnection with regard to the installation: For the disconnection and voltage release from the power line to the actuator for maintenance and adjustment work, a suitable breaker unit must be used ensuring an all-pole disconnection (except the earth wire). This breaker unit must be lockable in the state of breaking and be safeguarded against accidental switching on.
- Mains fuse protection with regard to the installation: max. 6 A.

E.2.1 Configuration of terminals

To avoid interference pulses on the signal cables, they have to be laid separately from the supply voltage cables. We recommend using a shielded cable with voltage signals and placing the shield on the protective earth (PE) of the actuator housing.

Terminal X4:

Terminal	Function	
60	mA output	0 (4)…20 mA
61	Volt output	0 (2)…10 V
58	GND	Ground
57	GND	Ground
56	Volt input	0 (2)…10 V
59	mA input	0 (4)…20 mA

The impedance of the mA input is 50Ω. When using the volt input, the impedance is 20kΩ.

Terminal X2:

Terminal	Function		
54	L	Mains input phase	50/60Hz
55	N	Mains input, protective earth	

Terminal X3:

Terminal	Function		
51	L⇧	Phase, direction “Ingoing stem”	50/60Hz
52	N	Mains input, protective earth	
53	L⇩	Phase, direction “Outgoing stem”	50/60Hz

Plug X4:

A plug is used to connect the potentiometer to the position regulator board.

Pin	Function	
1	Maximum value	Blue
2	Measured at the slider	Green
3	Zero point	Red

Colour assignment depends on the actuator type

E.2.2 Determining the input and output signal

The actuator is either preconfigured to 0…10 V, 0…20 mA or 2…10 V, 4…20 mA. Depending on the configuration, the cables of the input and output signals are connected to terminal X4. The configuration of the position regulator can be modified. The procedure is described in chapter 0 “E3.6 Modification of the preset setpoint signal range”

E.3 Commissioning and settings

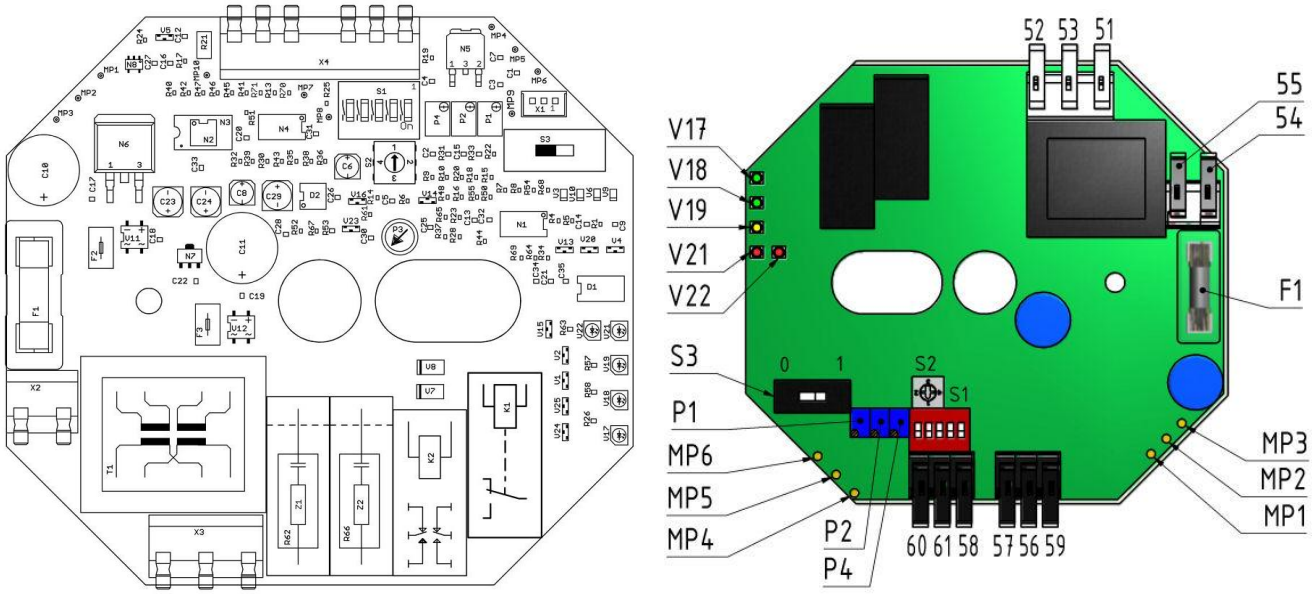


Figure E2: Electronic positioner PEL 100, parameters

Trimmer

P1	Adjustment of lower limit value	Clockwise rotation reduces the value
P2	Adjustment of upper limit value	Clockwise rotation reduces the value
P4	Span adjustment	Counterclockwise rotation results in electronic spreading of the potentiometer signal

Switches

	Description	**ON**	**OFF**
S1.1	Zero point preselection	0 mA	4 mA
S1.2	Spread	Off	On
S1.3	FAIL CLOSE	On	Off
S1.4	FAIL OPEN	On	Off
S1.5	FAIL function	On	Off

	Description	Position	
S2	Dead zone	1 2 3 4	1.5 % 1.0 % 0.5 % 0.25 %
S3	Inverse operation / reversing	0 1	Off On

Measuring points

	Description		**Signal**
Mp1	Supply voltage +15 V		+15 V
Mp2	Supply voltage –5 V		–5 V
Mp3	Ground		

Mp4	Voltage at max. value (actual value)	At 0…10 V, or 0…20 mA	10.1 V
Mp5	Voltage from the potentiometer slider		
Mp6	Voltage at min. value (actual value)	At 0…10 V, or 0…20 mA At 2…10 V or 4…20 mA	0 V 2 V

F1	Fuse	250 mA / 230V 1 A / 24 V
V1 + V2	Quenching element	Possibly required spark quenching elements for relay contacts

E3.1 Electric adjustment to the positioning travel

The electronic positioner is configured for the indicated travel in the factory. Only minor adjustments should therefore be required.

Prerequisite for further actions:

- Proper mounting of the actuator on the valve
- Correct adjustment of the switching and signalling unit to the valve stroke
  Zero positon of the potentiomenter has to match the lower end position of the stroke
- Adjustment of the end positon switches to the valve stroke is completed

The electronic positioner can be set so that the actuator is switched off in the end positions either via the switches (DE, WE) or via the electronic positioner itself.

If the actuator is switched off via the switches, the trimmers on the electronic positioner have to be set as to ensure that the LEDs are only just illuminated when reaching the end position.

The lower setpoint (0 or 4 mA, 0 V) is defined as the lower end position for the input.
Trimmer P1 is turned counterclockwise until the actuator is switched off via the respective switch and LED V19 is only just illuminated. This can be checked by turning back the trimmer.
Trimmer P2 in combination with LED V18 is used in the upper end position.
The setpoint for the upper end position is predefined.
By turning trimmer P2 clockwise, the switch-off point is increased. In case of tripping via switches, the position of the trimmer has to be changed until the LED is only just illuminated.

If the swing angle of the potentiometer cannot be fully used as the travel is very small, the input range can be adapted using the spread function. The function is activated if switch S1.2 is set to OFF.
By turning trimmer P4 counterclockwise, the upper switch-off point is reduced.

E3.2Setting the dead zone

The set dead zone of the actuator depends on the actuator type. The parameter is preset in the factory and should not be changed. If the dead zone is set too narrow, the actuator oscillates at the setpoint, which results in premature wear of both the position regulator and the actuator.

If an oscillation is detected, this can be avoided by increasing the dead zone.

When replacing the electronic positioner, accept the preset values.

E3.3 Reversing

If the running direction of the actuator is to be reversed with regard to the setpoint, this can be achieved by changing over at switch S3. The end position or the travel possibly has to be readjusted (refer to chapter 0 “E3.1 Electric adjustment to the positioning travel”).

E3.4 Wire break detection

The wire break detection determines whether the input signal is incorrect. The function can be activated or deactivated using switch S1.5. The input signal has to be set to 4…20 mA or 2…10 V as a prerequisite for this function.

If the wire detection function is used for an input signal of 0…20 mA or 0…10 V, the position regulator fails.

As soon as the input signal falls below 3.5 mA, the FAIL function is tripped. Switches S1.3 and S1.4 can be used to define the actuator behaviour on loss of signal.

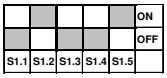
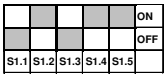
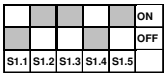
Position of the DIP switches	Function
	FAIL AS IS
	FAIL OPEN
	FAIL CLOSE

Figure E3: Switch positions of S1.1, S1.3, S1.4, S1.5 for behaviour on loss of signal

E3.5 Split range operation

To set the split-range operation, the actuator is controlled with the setpoint for the upper end position (e.g. 12 mA).
Adjust trimmer P2, until the stroke corresponds to the upper end position. Counterclockwise rotation makes the actuator stem retract.
The lowest settable value for the upper switch-off point is ~8 mA or ~4.0 V.

The setpoint is now set to the lower end position (e.g. 6 mA). Counterclockwise rotation of trimmer P1 changes the position of the actuator stem to outgoing actuator stem.
The top settable value for the lower switch-off point is ~13,2 mA or ~6.6 V.

Check the end positions by approaching the upper and lower end position again.

E3.6 Modification of the preset setpoint signal range

The electronic position can be preset without input signal by means of measuring points. The adjustment to the actuator is made according to the “Electric adjustment to the positioning travel” chapter.

E3.7 Set signal 4…20 mA or 2…10 V:

Configuration of the DIP switches S1:

					ON
					OFF
S1.1	S1.2	S1.3	S1.4	S1.5	

- Connect voltage to the electronic positioner on terminals 54 and 55
- Measure the voltage between measuring point 3 and measuring point 6
- Use trimmer P1 to set voltage to 2.0 V
- Measure the voltage between measuring point 3 and measuring point 4
- Use trimmer P2 to set voltage to 10.0 V

E3.8 Set signal 0…20 mA or 0…10 V:

Configuration of the DIP switches S1:

					ON
					OFF
S1.1	S1.2	S1.3	S1.4	S1.5	

- Connect voltage to the electronic positioner on terminals 54 and 55
- Measure the voltage between measuring point 3 and measuring point 6
- Use trimmer P1 to set voltage to 0.0 V
- Measure the voltage between measuring point 3 and measuring point 4
- Use trimmer P2 to set voltage to 10.0 V

E4. Technical data

Controlled signal	0 (4)…20 mA, Ri approx. 50 Ω 0 (2)…10 V, Ri approx. 20 kΩ
Feedback signal	0 (4)…20 mA or 0 (2)…10 V corresponds to the control signal
Indication	LED
Potentiometer	1000 Ω to 10 kΩ
Switching stage	Relay contacts max. 250 V / 50/60 Hz, 2 A
Power supply	24VAC /110V AC / 230 VAC

Power consumption	
Connection terminals	Snap-type terminal for 1.5 mm² solid wire or cords with wire end sleeves
Ambient temperature	–10 °C…+50 °C

E.4.1 Wiring examples

The wiring diagrams are just examples and serve as orientation. The terminal plan attached to the actuator is binding.
The connection of the load-dependent DE and the travel-dependent WE switches depends on the application (valve type, tripping in end position, ...) and has to be determined by the operator.

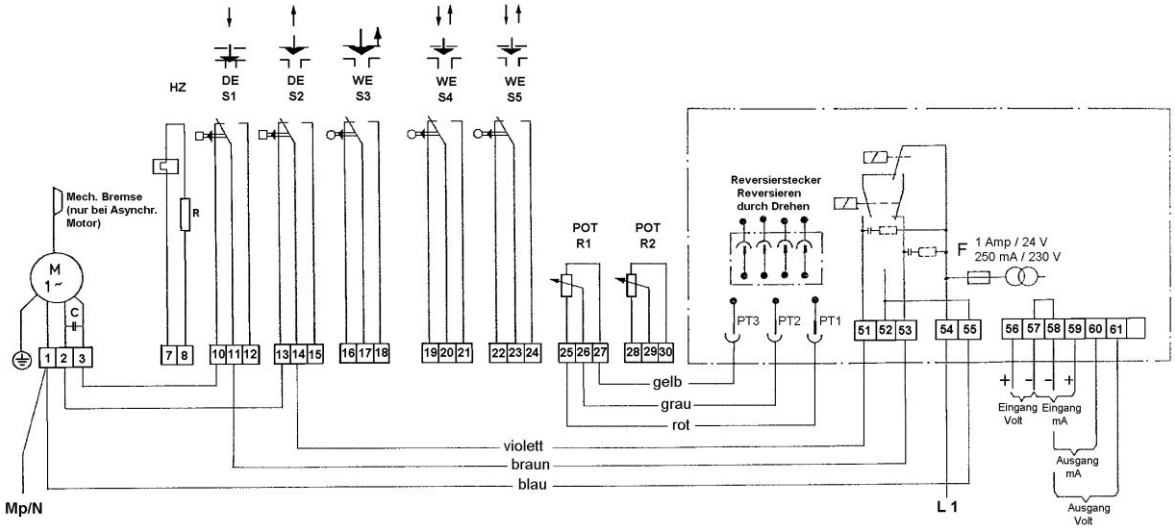


Figure E4: Wiring diagram with 2 DE switches S1 and S2

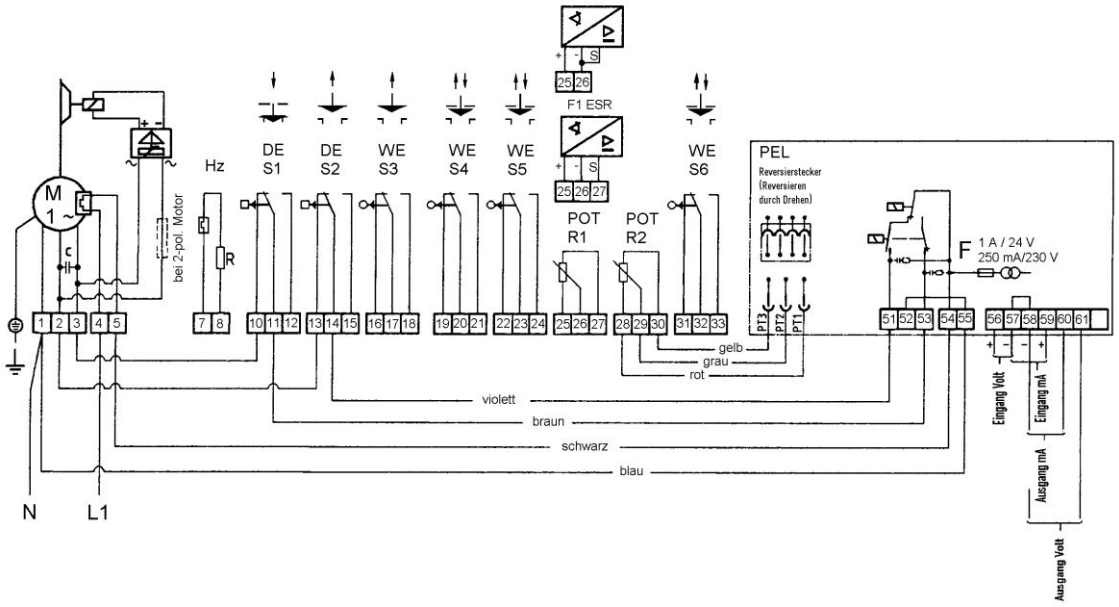


Figure E5: Wiring diagram with 2 DE switches S1 and S2, 1-phase AC motor with thermoswitches

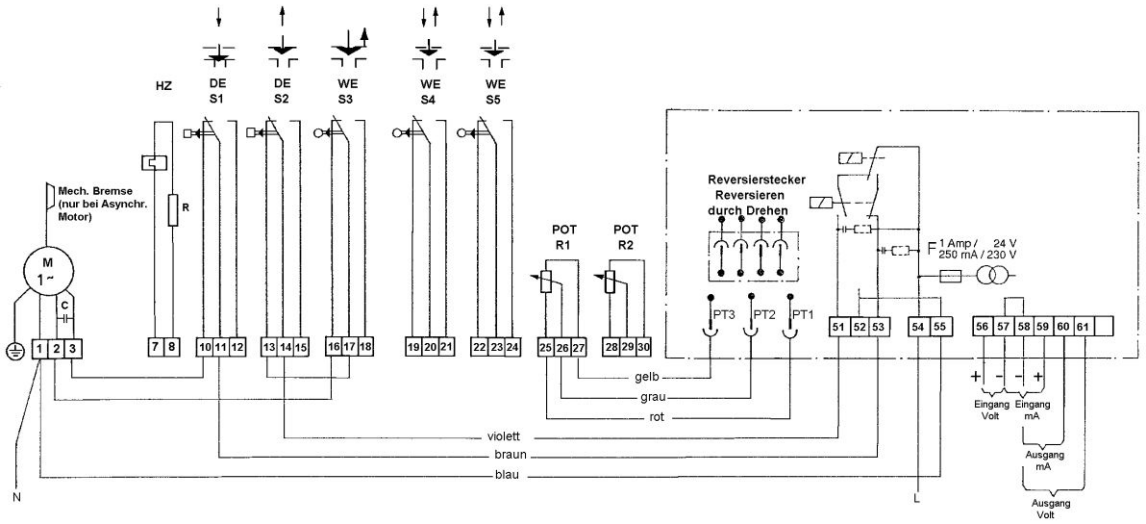


Figure E6: Wiring diagram with 2 DE switches S1 and S2 and WE switch S3

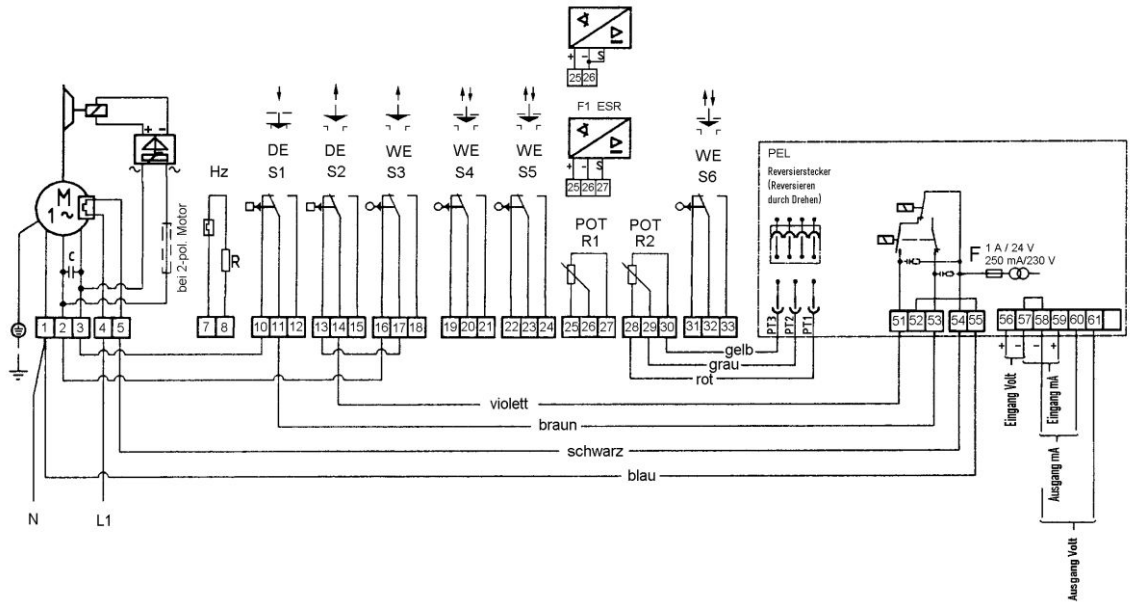


Figure E7: Wiring diagram with 2 DE switches S1 and S2 and WE switch S3, 1-phase AC motor with thermoswitches.

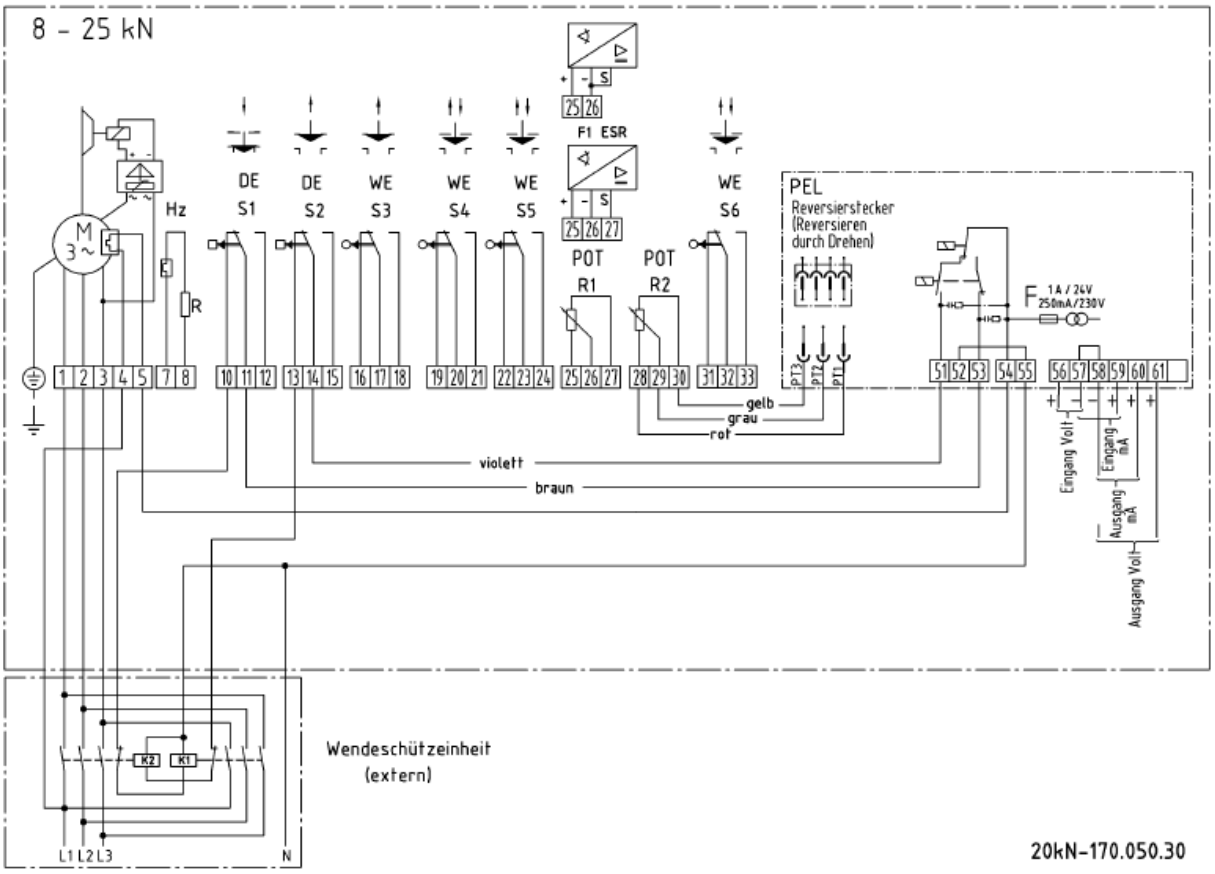


Figure E8: Wiring diagram with 2 DE switches S1 and S2 and WE switch S3, 3-phase AC motor, separate reversing contactor unit

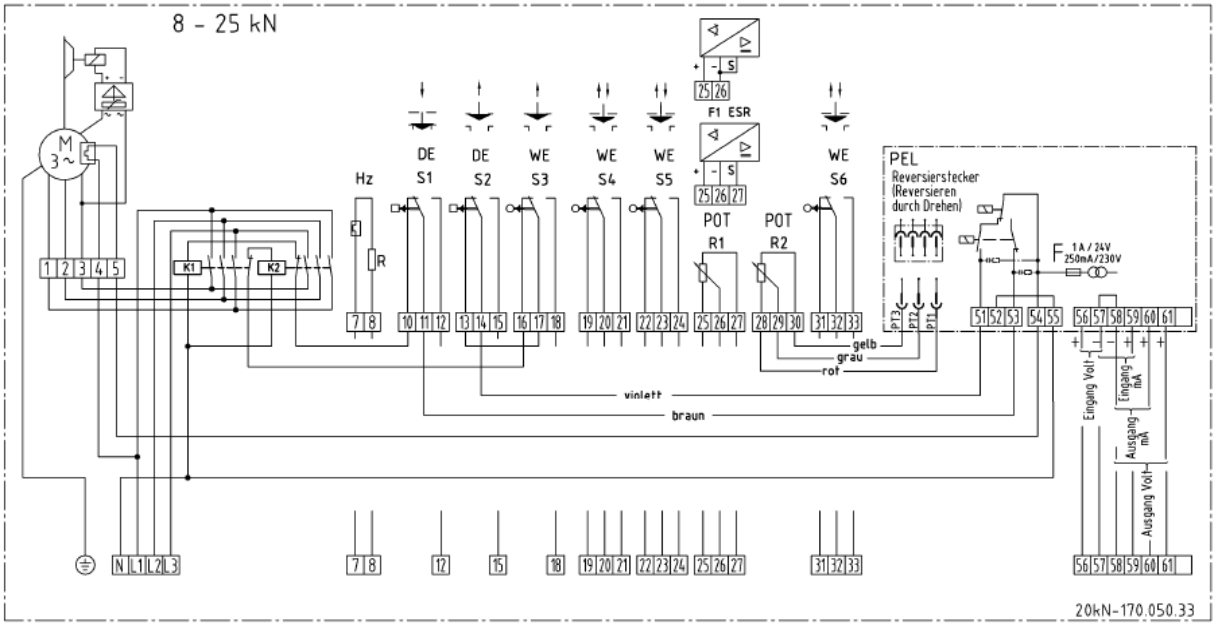


Figure E9: Wiring diagram with 2 DE switches S1 and S2 and WE switch S3, 3-phase AC motor with thermoswitches, integral reversing contactor unit

Legend to the wiring diagrams

Mech. Bremse (nur bei Asynchr. Motor)	mech. brake (async. motor only)
Reversierstecker	reversing plug
Reversieren durch Drehen	reversing by turning
gelb	yellow
grau	grey
rot	red
violett	violet
braun	brown
blau	blue
Eingang Volt	Volt input
Eingang mA	mA input
Ausgang Volt	Volt output
mA Ausgang	mA output
Wendeschützeinheit (extern)	reversing contactor unit (external)