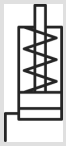
Power units

max. operating pressure 500 / 250 / 160 bar

Table of contents

1 Validity of the documentation

Power units of the data sheet D80115. The following types or part numbers are concerned:

Cylinder type SA / DA without / with pressure switch MI* (at the power unit)	**Directional control valves**		**Electric control**	**Terminal box**	**Switch**			**Flow rate / max. operating pressure**			
	3/2	**4/2**			Manual switch	Foot switch	without	13.67 0.82 500 **Part-no.**	35 2.1 250 **Part-no.**	58.5 3.51 160 **Part-no.**	[cm³/s] [l/min] [bar] Weight [kg]
	1		•		1			**8405121**	**8405221**	**8405321**	29.5
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	1		•				•	**8405131**	**8405231**	**8405331**	28.5
	1			•			•	**8405141**	**8405241**	**8405341**	28.0
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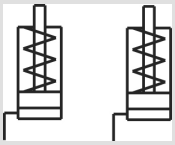
	1		•			1		**8405182**	**8405282**	**8405382**	31.5
	1		•				•	**8405187**	**8405287**	**8405387**	29.5
	1			•			•	**8405143**	**8405243**	**8405343**	29.0
	2		•		2			**8405105**	**8405225**	**8405325**	31.5
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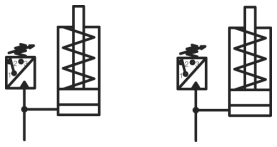
	2		•				•	**8405113**	**8405233**	**8405333**	29.5
	2			•			•	**8405142**	**8405242**	**8405342**	29.0
	2		•		2			**8405185**	**8405285**	**8405385**	32.5
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	2			•			•	**8405145**	**8405245**	**8405345**	29.0
		1	•		1			**8405109**	**8405209**	**8405309**	30.0
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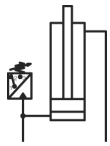		1	•		1			**8405117**	**8405217**	**8405317**	31.0
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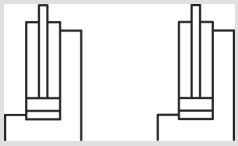		2	•		2			**8405107**	**8405207**	**8405307**	32.5
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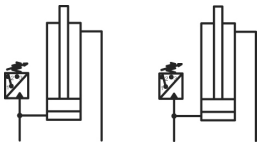		2	•		2			**8405137**	**8405237**	**8405337**	34.0
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		2		•			•	**8405140**	**8405240**	**8405340**	33.0
-	-	-	•				•	**8405110**	**8405210**	**8405310**	27.5

*) MI = machine tool interlock

Possible optional equipment

The above-described power units are also available with additional equipment.

When ordering, please keep to the following sequence:

8405 XXX **B**	handle
8405 XXX **E**	electronic pressure switch for MI*)
8405 XXX **T**	oil level and temperature control

Combination possibilities

When ordering, please keep to the following sequence:

"T" + "B"	8405 XXX **T B**
"T" + "E"	8405 XXX **T E**
"B" + "E"	8405 XXX **B E**
"T" + "B" + "E"	8405 XXX **T B E**

*) MI = machine tool interlock

2 Target group of this document

2.1 Operator

Tasks:

Operation in setting or automatic mode.

Qualification

No special requests, introduction on the basis of the operating instructions, danger instruction, minimum age 18 years.

2.2 Qualified personnel

Tasks:

Transport, installation, start up, setting mode, trouble shooting, putting out of service, checks, maintenance works.

- Specialists, fitters and set-up men of machines and installations with hydraulic expert knowledge.
- Specialists, fitters and set-up men of machines and installations with expert knowledge in electrical engineering.

Qualification of the personnel

Expert knowledge means that the personnel must

- be in the position to read and completely understand technical specifications such as circuit diagrams and product-specific drawing documents,
- have expert knowledge (electric, hydraulic, pneumatic knowledge, etc.) of function and design of the corresponding components.

An **expert** is somebody who has due to its professional education and experiences sufficient knowledge and is familiar with the relevant regulations so that he

- can judge the entrusted works,
- can recognize the possible dangers,
- can take the required measures to eliminate dangers,
- knows the acknowledged standards, rules and guidelines of the technology.
- has the required knowledge for repair and mounting.

2.3 Expert / qualified person

Tasks:

Maintenance and test of safety equipments.

Qualification

The specifications in the operating safety regulations (BetrSichV) after professional training and prompt professional activity are as follows:

- Technical professional training, e. g. as skilled worker,
- At least two years work experience,
- After classification of the dangerousness corresponding tests passed,
- Regular further training,
- Knowledge of relevant rules and standards (regulations, standards),
- Involvement in the handling of the corresponding products and regular test activities.

An expert / qualified person is a person who has sufficient knowledge in design, control and applications due to their professional education and experience:

- Safety devices as:
  - Two-hand control,
  - Safety light curtains and light grids
  - Separating safety devices,
  - etc.
- Hydraulic components as:
  - Safety-related parts of controls,
  - Hydraulic hoses,
  - Accumulators,
  - etc.
- Electric components as:
  - Safety-related parts of controls,
  - etc.
- Technical professional training, e. g. as skilled worker,
- etc.

and is familiar with the respective national work safety regulations, accident prevention directions, guidelines and generally accepted technical rules and regulations (e. g. DIN standards, VDE regulations, technical rules of other EC member states) so that he is in the position to judge the working safety and to carry out the delegated tasks.

3 Safety instructions

⚠ DANGER

Danger of life / heavy health damages

Stands for an imminent danger.

If it is not avoided, death or very severe injuries will result.

⚠ WARNING

Person damage

Stands for a possibly dangerous situation.

If it is not avoided, death or very severe injuries will result.

⚠ CAUTION

Easy injuries / property damage

Stands for a possibly dangerous situation.

If it is not avoided, minor injuries or material damages will result.

Hazardous to the environment

The symbol stands for important information for the proper handling with materials that are hazardous to the environment.
Ignoring these notes can lead to heavy damages to the environment.

Mandatory sign!

The symbol stands for important information, necessary protection equipment, etc.

NOTE

This symbol stands for tips for users or especially useful information. This is no signal word for a dangerous or harmful situation.

4 For your safety

4.1 Basic information

The operating instructions serve to information and avoidance of dangers for transport, operation and maintenance.

Only in strict compliance with these operating instructions, accidents and property damages can be avoided as well as trouble-free operation of the product can be guaranteed.

Furthermore, the consideration of the operating instructions will result in:

- reduced down times and repair costs,
- increased service life of the products.

4.2 Safety instructions

⚠ WARNING

Unexpected start of the connected cylinders when switching on the power units!

- When switching on, the operating pressure will be generated and in the process the cylinders can move!
- Secure the working area adequately!

Injuries due to non-compliance of the operating instructions!

- The product may only be operated, if the operating instructions - especially the chapter "Safety instructions" have been read and understood.

Injuries due to misuse, incorrect operation or abuse!

Injuries can occur if the product is not used within the intended use and the technical performance data.

- Before start up, read the operating instructions!

Injury due to overturning product!

- Overturning product due to inappropriate means of transportation.
- Do not stand below the load during lifting and lowering, stay outside the danger zone.
- Use suitable means of transportation.
- Pay attention to the weight of the equipment.
- Pay attention that the product is safely located (centre of gravity see instruction sign).

Poisoning due to contact with hydraulic oil!

- For handling with hydraulic oil consider the material safety data sheet.
- Wear protection equipment.

Injury by high-pressure injection (squirting out of hydraulic oil under high pressure)!

- Improper connection can lead to escapes of oil under high pressure at the connections.
- Mounting or dismounting of the element must only be made in depressurised mode of the hydraulic system.
- Connection of the hydraulic line as per DIN 3852/ISO 1179.
- Unused connections have to be locked professionally.
- Use all mounting holes.

Burning due to hot oil!

- In operating conditions oil temperatures up to 70 °C can appear due to environment influences.
- All works must only be made in cool mode!

Burning due to hot surface!

- In operating conditions, surface temperatures of more than 70 °C can appear at the product.
- All maintenance and repair works must only be effected in cooled mode or with safety gloves.

Injury / burning due to contact with energized parts!

- Before working on electric equipment, the energized parts must be de-energized and secured.
- Do not open protection covers at electric parts.
- All electrical works must only be realised by electricians.

⚠ CAUTION

Work by qualified personnel

- Works only to be effected by authorised personnel.

Performance of the product!

The admissible performance data of the product, see chapter "Technical characteristics", may not be exceeded.

Aggressive cleaning agents

The product must not be cleaned with:

- Corrosive or corroding components or
- Organic solvents as halogen or aromatic hydrocarbons and ketones (cellulose thinner, acetone, etc.),

because this can destroy the seals.

NOTE

Qualification of personnel

All works may only be effected by qualified personnel familiar with the handling of hydraulic components.

4.3 Personal protective equipment

For works at and with the product, wear safety goggles!

For works at and with the product, wear protective gloves!

For works at and with the product, wear safety shoes!

For all works at the product, the operator has to make sure that the necessary protection equipment will be worn.

4.4 Safety devices

Figure 1: Safety device, warning

5 Description of the product

⚠ DANGER

Unexpected start of the connected cylinders when switching on the power units!

- When switching on, the operating pressure will be generated and in the process the cylinders can move!
- Secure the working area adequately!

These power units are particularly suited for small and medium sized power workholding fixtures.

The system pressure is automatically maintained by switching of the pump motor (intermittent cycle). If the power fails, the undervoltage switch will be released and the power unit must be switched on again. Subsequently the adjusted system pressure will be produced.

5.1 Description of the additional equipment

5.1.1 Machine tool interlock

As an option, every clamping circuit is checked by an additional pressure switch, which has to be electrically connected directly to the control of the processing machine.

Messages:

1 Clamping pressure available
→ The workpiece can be machined

0 Clamping pressure dropped below 80 %
→ Stop machining immediately

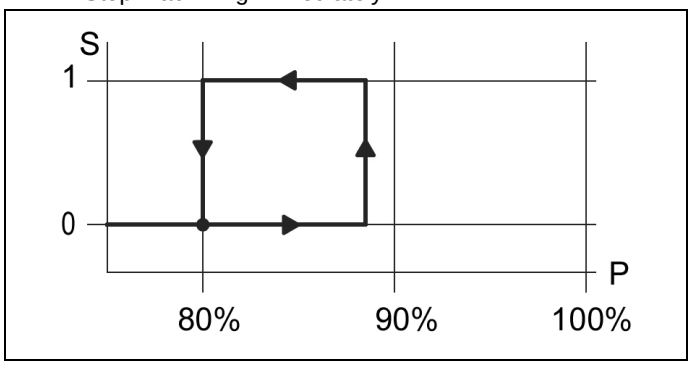

Figure 2: Switching points for machine tool interlock

S Switching output	P Operating pressure

The switching point must be adjusted to 80% of the adjusted clamping pressure.

NOTE

If the pressure must be frequently changed, the electronic pressure switch is easier to adjust (identification letter "E").

5.1.2 Electronic pressure switch for machine tool interlock "E"

(instead of the mechanical pressure switch)

The lower switching point (80 % of the clamping pressure) of electronic pressure switches is firmly programmed and can be stored in teach mode for every desired clamping pressure by pressing a button.

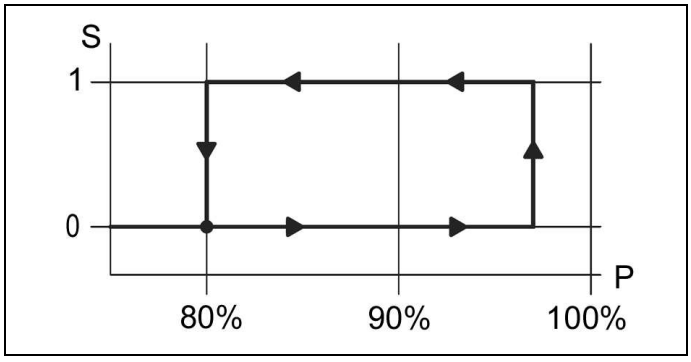

Figure 3: Switching points for machine tool interlock

S Switching output	P Operating pressure

Example of ordering

Power unit 8405-185 with 2 electronic pressure switches for machine tool interlock

Part-no. 8405 185 E

5.1.3 Handle "B"

With the handle, the power unit can be easily transported by two persons to different places of installation.

Example of ordering

Power unit 8405-221 with handle

Part-no. 8405-221B

5.1.4 Oil level and temperature control "T"

The oil level and temperature control is installed in the reservoir cover and electrically connected to the control box. In case of an error message, the control LED below the main switch is lit.

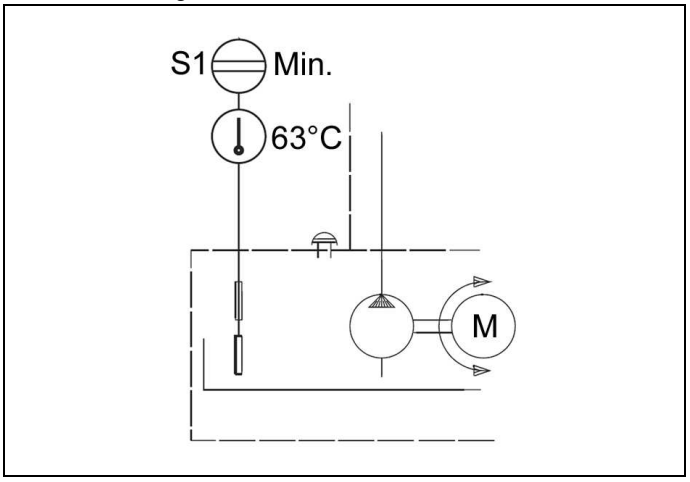

Figure 4: Schematic mounting location with limit temperature

Possible errors:

1 Oil filling quantity < 2.3 l
  Shortage 0.7 l below the minimum oil level gauge.
  Required refilling quantity min.1.5 l
2 Oil temperature > 63° C

NOTE

As long as the error message is available the electric motor does no longer start to avoid damages due to overheating. This means that in the case of a pressure drop the pump does not deliver!

Recommendation:

Above all with automated operation the oil level and temperature control should only be used for machine tool interlock in combination with pressure switches. This is the only way to ensure that during the switch-off of the electric motor the workpiece machining will be interrupted in the case of a pressure drop of more than 20%.

Example of ordering

Power unit 8405-238 with machine tool interlock and oil level and temperature control

Part-no. 8405 238 T

6 Application

6.1 Intended use

The products are used to generate hydraulic pressure in industrial applications for bending or clamping of workpieces and / or to operate fixtures alternatively hydraulic actuators within closed, low in dust rooms.

Furthermore the following belongs to possible uses:

- Use within the capacity indicated in the technical characteristics (see data sheet).
- Use as per operating instructions.
- Compliance with service intervals.
- Qualified and trained personnel for the corresponding activities.
- Mounting of spare parts only with the same specifications as the original part.

6.2 Misapplication

⚠ WARNING

Injuries, material damages or malfunctions!

- Do not modify the product!

The use of these products is not admitted:

- For domestic use.
- On pallets or machine tool tables in primary shaping and metal forming machine tools.
- If due to vibrations or other physical / chemical effects damages of the products or seals can be caused.
- In machines, on pallets or machine tool tables that are used to change the characteristics of the material (magnetise, radiation, photochemical procedures, etc.).
- In areas for which special guidelines apply, especially installations and machines:
  - For the use on fun fairs and in leisure parks.
  - In food processing or in areas with special hygiene regulations.
  - For military purposes.
  - In mines.
  - In explosive and aggressive environments (e.g. ATEX).
  - In medical engineering.
  - In the aerospace industry.
  - For passenger transport.
- For other operating and environmental conditions e.g.:
  - Higher operating pressures than indicated on the data sheet or installation drawing.
  - With hydraulic fluids that do not correspond to the specifications.
- With other specifications of the hydraulic fluids than the ones approved below technical specifications.

7 Transport

Hazardous to the environment

During improper transit, escaping oil residuals can lead to environmental pollutions.

Transport the product only in an upright position!

Pay attention to the sign on the packaging: "Top, do not overturn".

⚠ WARNING

Injury due to overturning product!

- Overturning product due to inappropriate means of transportation.
- Do not stand below the load during lifting and lowering, stay outside the danger zone.
- Use suitable means of transportation.
- Pay attention to the weight of the equipment.
- Pay attention that the product is safely located (centre of gravity see instruction sign).

For works at and with the product, wear suitable protection equipment!

The product is delivered in a solid carton box (on a throw-away pallet) and may only be transported to the installation site by means of a corresponding conveyor (pay attention to the min. lifting force).

The product must only be lifted down from the transport pallet by means of a conveyor, the product must centrally rest on the two fork rakes e.g. of the fork-lift truck.

8 Installation

⚠ WARNING

Injuries caused by missing safety devices!

- To avoid injuries appropriate safety devices must be provided by the customer.

Injury by high-pressure injection (squirting out of hydraulic oil under high pressure)!

- Improper connection can lead to escapes of oil under high pressure at the connections.
- Mounting or dismounting of the element must only be made in depressurised mode of the hydraulic system.
- Connection of the hydraulic line as per DIN 3852/ISO 1179.
- Unused connections have to be locked professionally.
- Use all mounting holes.

Poisoning due to contact with hydraulic oil!

Wear, damage of the seals, ageing and incorrect mounting of the seal kit by the operator can lead to escapes of oil.

Incorrect connection can lead to escapes of oil at the ports.

- For handling with hydraulic oil consider the material safety data sheet.
- Wear protection equipment.

For works at and with the product, wear suitable protection equipment!

8.1 Overview of components

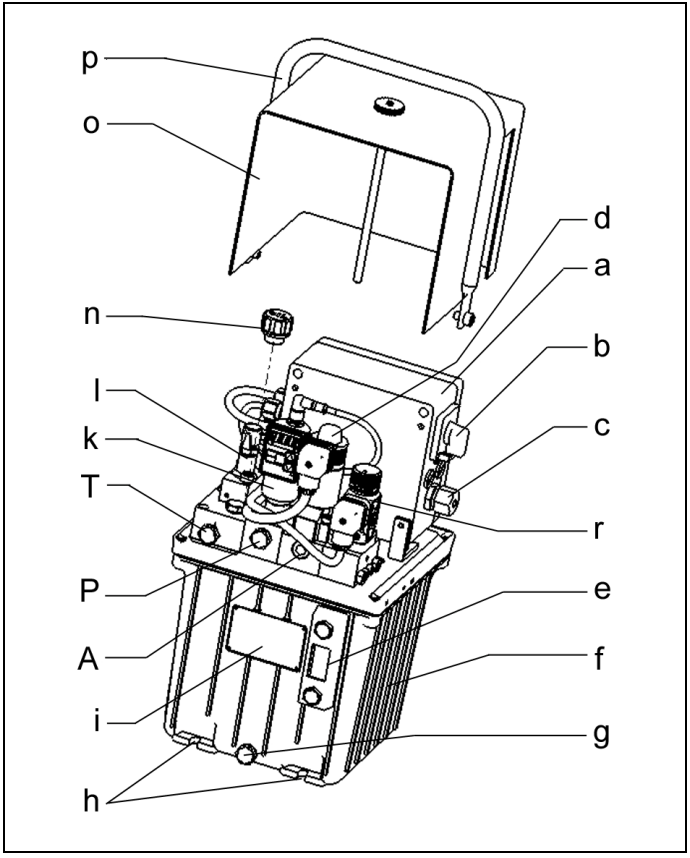

Figure 5: Schematic figure, components according to design

a	Electric control / wiring box	i	Name plate
b	Main switch	k	Pressure switch with pressure display
c	Connection for push-button / foot-actuated switch (option)	l	Pressure relief valve for maximum system pressure
d	Valve(s) (optional)	n	Filler screw with air filter
e	Oil level gauge	o	Protection cover (accessory)
f	Reservoir with electric motor and pump	p	Handle (accessory)
g	Oil drain plug	r	Pressure switch for machine tool interlock (option)
h	Fixing possibilities		

Connection	Function
P	Pressure line
T	Reservoir / return line
A1 / A2	Clamping line (single acting)
A1	Clamping line (double acting)
A2 / B1	Unclamping line (double acting)

9 Installation

⚠ CAUTION

Malfunctions!

Chips, coolants and cutting fluids can cause malfunctions.

- Protect the power units against penetration of chips, coolants and cutting fluids!

NOTE

Dirt from entering the system

- With increasing dirt penetration into the hydraulic system, additional high-pressure filters have to be provided in front of the connections.

The power unit has to be mounted in upright position, if possible above the installation or fixture.

If the power unit will be installed below the fixture, an air bleeding possibility has to be provided at the highest point of the installation.

- Install the power unit at an appropriate place.
- If required mount at the provided holes / plates at the bottom of the reservoir (see chapter Overview of components).

9.1 Connection of the hydraulic equipment

1. Connect hydraulic lines to qualifying standards and pay attention to scrupulous cleanness (A = Extend, B = Retract)!

NOTE

More details

- See ROEMHELD data sheets A 0.100, F 9.300, F 9.310 and F 9.360.

Screwed Plug

- Use only fittings "screwed plug B and E" as per DIN 3852 (ISO 1179).

hydraulic connection

- Do not use sealing tape, copper rings or coned fittings.

Pressure fluids

- Use hydraulic oil as per ROEMHELD data sheet A 0.100.

NOTE

Connection of the hydraulic

Further connection data, plans or similar (e. g. hydraulic, electric circuit diagrams or electrical parameters) see enclosures!

9.2 Electric connection

⚠ WARNING

Injury / burning due to contact with energized parts!

- Before working on electric equipment, the energized parts must be de-energized and secured.
- Do not open protection covers at electric parts.
- All electrical works must only be realised by electricians.

⚠ CAUTION

Work by qualified personnel

- Works only to be effected by authorised personnel.

9.2.1 Control box

Note

Pay attention to the enclosed electric circuit diagram and electrical characteristics!

1. Check if the electric connection is in accordance with the operating voltage of the motor (see name plate).
2. In case of power units with electric control put the main switch to "0".
3. Open the cover of the terminal box / electric control.
4. For power units with terminal box:
   Insert the motor connecting line into the provided fitting and connect it to the terminals L1, L2, L3 and PE.
   For power units with electric control:
   Insert the mains connecting line into the provided fitting and connect it to the terminals L1, L2, L3 and PE.
5. Insert the lines for machine tool interlock into the provided fittings and connect them to the provided terminals.
6. Close the cover of the terminal box / electric control.

9.2.2 Mechanical pressure switch to adjust machine tool interlock (optional)

The closing function of the pressure switch is directly connected to the machine control (pin 3). Also the power supply is effected by an external source, as a rule as well by the machine control.

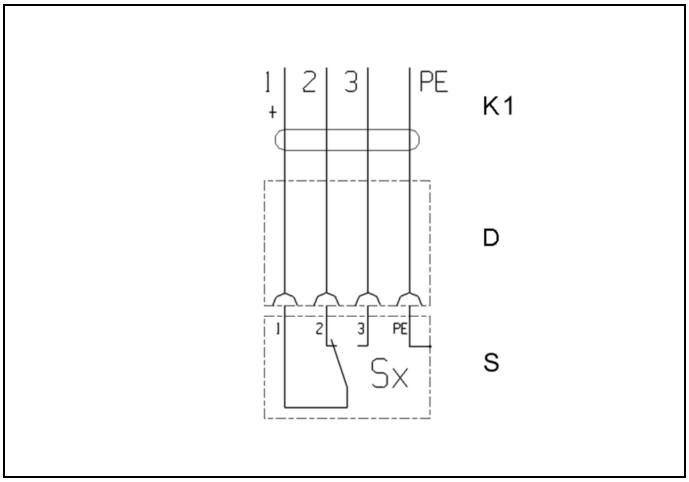

Figure 6: Connection, cable plug without LED

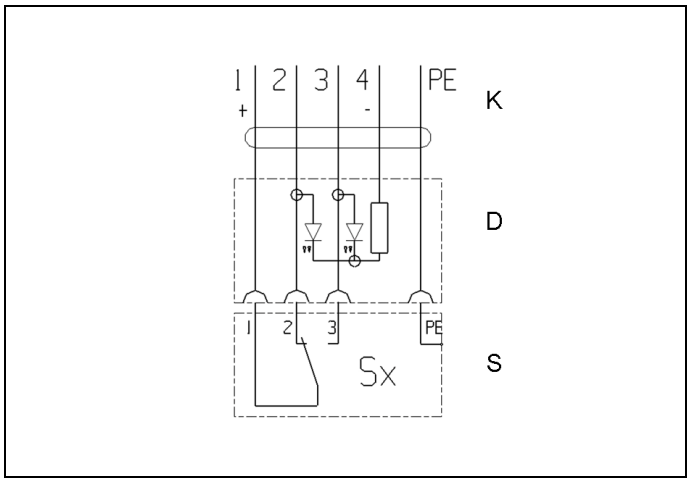

Figure 7: Connection, cable plug with LED

K1 Cable 4 x 0.75 mm^2 K Cable 5 x 0.75 mm^2	D Cable socket without or with LED S Pressure switch

9.2.3 Electronic pressure switch

The closing function of the pressure switch is directly connected to the machine control (pin 2). The power supply is also effected by an external source, as a rule also by the machine control.

Note

- Power supply as per EN 50178.
- Use shielded cable box in order to avoid possible interference coupling.

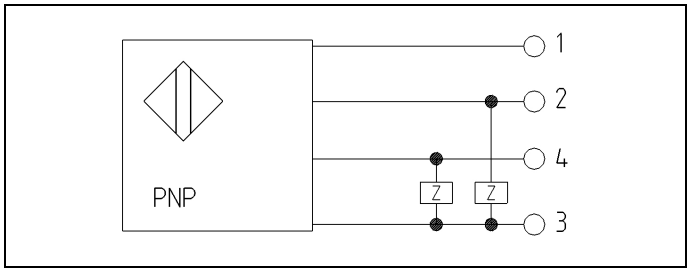

Figure 8: Circuit diagram of the pressure switch

Pin	Function	Wire colour
1	**+U_B**	brown
2	**Output 2** • Switching output e.g. machine tool interlock (switch-back point 80%) • Analogue output • Alarm output	white
3	**0 V**	blue
4	**Output 1** • Switching output e.g. system pressure (switch-back point 90%)	black

NOTE

Connection of the hydraulic

Further connection data, plans or similar (e. g. hydraulic, electric circuit diagrams or electrical parameters) see enclosures!

10 Start up

10.1 Charging with hydraulic oil

⚠ WARNING

Poisoning due to contact with hydraulic oil!

- For handling with hydraulic oil consider the material safety data sheet.
- Wear protection equipment.

For works with operating fluids, pay attention to the safety data sheets!

For works at and with the product, wear suitable protection equipment!

NOTE

The pressure generator is delivered without oil filling.

- Filling must only be made when the connected hydraulic actuators and accumulators are in off-position.
- Accumulated oil volume in actuators or accumulators can lead to overflowing of the oil reservoir!

Hydraulic fluids

Operation of the products with hydraulic fluids that do not correspond to the specifications is inadmissible. See technical characteristics:

Hydraulic oil use according sign

Use hydraulic oil as per sign at the oil filler neck (see also technical characteristics).

Impurities in the oil tank to avoid!

No impurities must enter into the oil reservoir.
Use clean filter cloth!

For oil filling proceed as follows:

1. Make sure that all hydraulic drives (hydro-cylinders, etc.) are retracted in off-position!
2. Switch off main switch at the electric control, switching position "0", or disconnect from the mains.
3. Depressurise the system e.g. by pressing the emergency stop at the valves (depending on the type).
4. Unscrew the cover of the air filter and the oil filler neck **(OIL)**.
5. Insert clean funnel with filter or filter cloth (see purity class) in oil filler neck.
6. Filling of hydraulic oil until hydraulic oil can be seen between the two markings at the oil level gauge.
7. Screw in cover.
8. Operate the fixture several times.
(For the first start up pay attention to "Bleeding of the hydraulic system".)
9. Check oil level and refill hydraulic oil, if necessary.

10.2 Bleeding of the hydraulic system

After filling the hydraulic oil there is still residual air in the internal and external pipes and the hydraulic drives (hydraulic cylinders, etc).

Air in hydraulic systems has among other things the following undesirable effects:

- longer extending and retracting times e.g. of the hydrocylinder.
- short cycling
- Accelerated ageing of the oil.
- Increased wear at seals and pump.

To avoid these undesirable effects the whole hydraulic system (power unit, valves, drives and piping) have to be bled by repeated operation of the hydraulic drive!

Procedure:

1. For bleeding the oil pressure has to be reduced to a very low value!
2. Adjust pressure relief valve to the lowest possible value by screwing counterclockwise (see section "Adjust operating pressure" in the chapter "Start up").
3. Pressurise clamping line.
4. Loosen carefully a bleeding screw or a fitting at the highest or remotest point of the fixture.
5. Pump until bubble free oil comes out.
6. Close bleeding point.
7. If double-acting elements are used, bleeding has to be effected also for the unclamping line.
8. Refill lost oil.

Note

Carry out function test.

The operating direction of the control units must be obvious to the direction of motion of the plant.

10.3 Adjust operating pressure

⚠ WARNING

Injury due to movement of the connected drives!

- Connected drives can carry out a movement.
- Secure the working area of the drives.

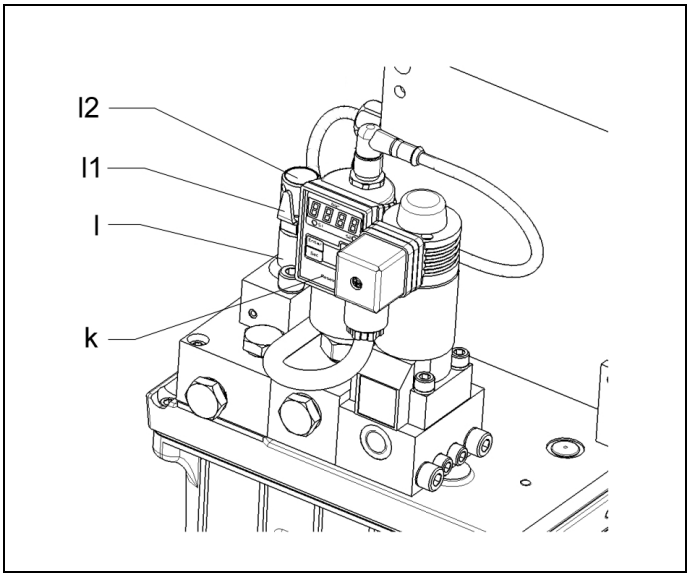

Figure 9: Components at the pressure relief valve, depending on the type

k	Pressure switch with pressure display	l1	Lock nut
l	Pressure relief valve	l2	Knurled screw of the pressure relief valve

If a separate pressure switch is available for machine tool interlock (see hydraulic circuit diagram) the following procedure is required:

- first adjust machine tool interlock (see section "Adjust machine tool interlock (optional)“,
- then adjust the operating pressure.

10.4 Adjust pressure switch for machine tool interlock (optional)

10.4.1 Adjust machine tool interlock (optional)

The pressure switch is adjusted to approx. 80% of the operating pressure or the pressure indicated on the hydraulic circuit diagram and electrically interlinked with the control of the machining machine.

So the machine tool interlook can only start if the fixture is clamped.
On the other hand the machining machine is immediately switched off, if the pressure in the system drops by more than 20%.

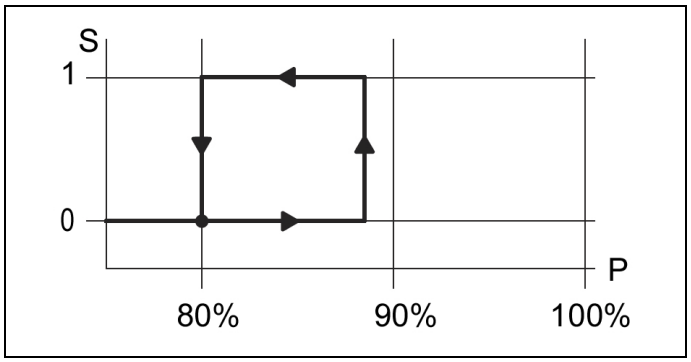

Figure 10: Switching points for machine tool interlock

S Switching output	P Operating pressure

The switching point must be adjusted to 80% of the adjusted clamping pressure.

Procedure for adjustment:

- Adjust pressure relief valve to 80% of the operating pressure.
  (Pump motor must permanently run against pressure)
- Operate the corresponding valve.
- Turn the pressure switch **counterclockwise** until the switching point is obtained (LED illuminates green)
- Turn the pressure switch **clockwise** until the switching point is obtained (LED illuminates yellow)

After adjustment of the machine tool interlock the operating pressure has to be readjusted.

The pump motor must be correctly switched off or the pump must be relieved by an "unpressurized cycle" *.

* Only possible for power units with external motor.

10.4.2 Electronic pressure switch to adjust machine tool interlock (optional). (Accessory "E").

The pressure switch is adjusted by "teaching" to 80% of the operating pressure ("Ou2" = switching output 2).

The switching output 2 (wire colour "white“) is electrically interlinked with the control of the machine tool.

So the machine tool interlock can only start if the fixture is clamped.
On the other hand the machine tool is immediately switched off, if the pressure in the system drops by more than 20%.

Note

Parallel to this, the system pressure switch should be also set by means "RESET function“ to the TEACH MODE (then the pump is running against the pressure).

This is required for the exact adjustment of the system pressure switch to the pressure switch machine tool interlock.

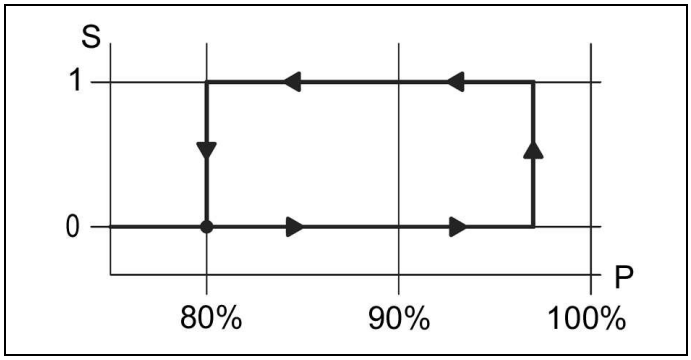

Figure 11: Switching points for machine tool interlock

S Switching output	P Operating pressure

Procedure for adjustment:

1. Activate TEACH MODE (system pressure switch)

- Main switch ON (or connect operating voltage).
  The device is automatically in RUN mode
  The current pressure is displayed.
- Simultaneously actuate the push-buttons at the pressure switch ▲ and ▼ (Reset/Esc) for at least 3 seconds (see operating instructions of the Teach-In pressure switch).
  Thus the TEACH mode is activated.
  The digital display extinguishes cyclically in TEACH mode and the pump runs in continuous operation against pressure.

2. Activate TEACH MODE (pressure switch machine tool interlock)

- Connect operating voltage.
  The device is automatically in RUN mode
  The current pressure is displayed.
- Simultaneously actuate the push-buttons at the pressure switch ▲ and ▼ (Reset/Esc) for at least 3 seconds (see operating instructions of the Teach-In pressure switch).
- Thus the TEACH mode is activated.
  The digital display extinguishes cyclically in TEACH mode.
  - Operate the corresponding valve (clamp clamping circuit)
  - Actuate the push-button Enter/Set at the pressure switch for machine tool interlock.
    The digital display now permanently shows the current clamping pressure.
    The opening function (Pin 2, wire colour "white") opens, if the pressure in the clamping circuit reduces by more than 20%.
  - Actuate the push-button Enter/Set at the system pressure switch.
    The digital display now shows permanently the current system pressure.

Now the pump switches off and/or the valve (optional) for unpressurised cycle relieves the pump (clearly audible).

* Only possible for power units with external motor.

10.4.3 Adjust operating pressure with electronic Teach-In system pressure switch.

Figure 12: Design of the pressure switch with Teach-In function

1 Pressure increase

- Main switch ON (connect operating voltage).
  The device is automatically in RUN mode
  The current pressure is displayed.
- Simultaneously actuate the push-buttons at the pressure switch ▲ and ▼ (Reset/Esc) for at least 3 seconds (see operating instructions of the Teach-In pressure switch).
- Thus the TEACH mode is activated.
  The digital display extinguishes cyclically in TEACH mode and the pump
  runs in continuous operation against pressure.
- Adjust at the pressure relief valve ("I") the desired higher pressure by clockwise turning of the knurled screw. Control by digital display.
- Tighten lock nut.
- Actuate push-button Enter/Set.
  The digital display now shows permanently the current system pressure.

Now the pump switches off and/or the valve (optional) for unpressurized cycle
* relieves the pump (clearly audible).

After a pressure drop of 10% (return switching point pressure switch) the pump supplies again.

* Only possible for power units with external motor.

Note

A pressure reduction is not possible in this cylce. See next section.

2 Pressure reduction

- Simultaneously actuate the push-buttons at the pressure switch ▲ and ▼ (Reset/Esc) for at least 3 seconds (see operating instructions of the Teach-In pressure switch).
- Turn out the knurled screw at the pressure relief valve ("I") by some counterclockwise turns
- Operate for a short time the cylinder control for the pressure relief of the system.
- The current pressure is displayed.
- Adjust at the pressure relief valve the desired higher pressure by clockwise turning of the knurled screw. Control by digital display.
- Tighten lock nut.
- Actuate push-button Enter/Set.
  The digital display now shows permanently the current system pressure.

Note

Check and readjust, if required, the adjustment in warm operating mode.

Adjust the operating pressure - see chapter: "Adjust operating pressure with electronic Teach-In system pressure switch."

11 Operation

⚠ WARNING

Burning due to hot surface!

- In operating conditions, surface temperatures of more than 70 °C can appear at the product.
- All maintenance and repair works must only be effected in cooled mode or with safety gloves.

⚠ CAUTION

Avoid overheating of the system

In order to avoid overheating of the system the maximum running time (relative duty cycle) must not be exceeded.

For works at and with the product, wear suitable protection equipment!

Note

- Operating pressure
  Adjust the operating pressure to the clamping element or cylinder with the lowest admissible clamping pressure (see section "Adjust operating pressure").

- Switches
  The power units are operated by a push-button or foot-actuated switch:
  1. Operation: Clamping
  2. Operation: Unclamping
  The pilot light is lit, as soon as the clamping pressure is obtained.

- Relative duty cycle
  The pump motor is cooled in the hydraulic reservoir by the hydraulic oil or in case of low oil level by air. Therefore the admissible cycle time depends on the oil lever and the environmental temperature.

Oil level	8405 1XX	8405 2XX	8405 3XX
max.	40 %	25 %	20 %
min.	25 %	20 %	16 %

Maximum duty cycle (ED) in % at an ambient temperature of 23°C

Calculate duty cycle

This power unit can only be used intermittently similar to section S3 of VDE 0530. The electric motor will be cut off by the mounted pressure switch as soon as the preset operating pressure is reached.

The relative duty cycle (%ED) can be calculated as follows:

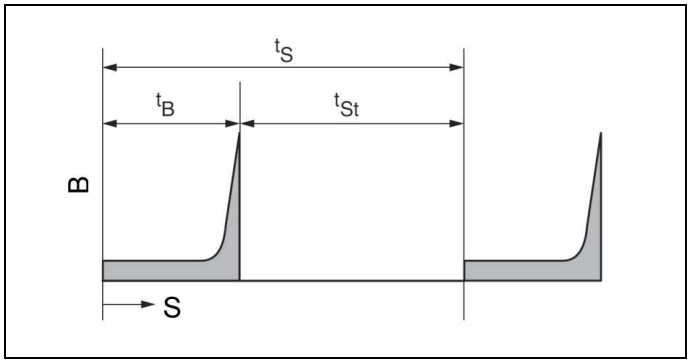

Figure 13: Diagram relative duty cycle

B Load (pressure)	tS Cycle time
S Start	tSt Load-unload time
tB Time elapsed from motor start to motor cut off (running time)	

$$\%\,ED = \frac{t_B}{t_B + t_{St}} \cdot 100 = \frac{t_B}{t_S} \cdot 100$$

Different motor running and idle times are simply added.

Example:

Clamping fixture with double-acting cylinders

Clamping time	tB1 = 5 s
Machining time	tSt1 = 60 s
Unclamping time	tB2 = 3 s
Load-unload time	tSt2 = 12 s
Cycle time	tS = 80 s

$$\%ED = \frac{t_{B1} + t_{B2}}{t_S} \times 100 = \frac{5s + 3s}{80s} \times 100$$

$$\%ED = 10\ \%$$

The max. relative duty cycle is a function of the motor load. Motor winding temperature of the submerged motor is dependent among others on oil temperature and oil level.

With filled oil reservoir (up to the reservoir cover) the whole winding is oil-cooled. When extracting the complete usable oil volume (2.95 l), the winding is air-cooled. Since air is a relatively poor heat conductor, the relative duty cycle has to be reduced with decreasing oil level.

The below indicated values of the max. relative duty cycle have been determined with an environmental temperature of 23°C.

The max. oil temperature is 60 °C.

12 Maintenance

⚠ WARNING

Burning due to hot surface!

- In operating conditions, surface temperatures of more than 70 °C can appear at the product.
- All maintenance and repair works must only be effected in cooled mode or with safety gloves.

For works at and with the product, wear suitable protection equipment!

NOTE

Operating instructions

- Further operating instructions for individual components are available in the internet (www.ROEMHELD.com) or on request!

12.1 Plan for maintenance

Maintenance works	Interval	Realisation
Cleaning	As required	Operator
Check	daily	Operator
Checking of hydraulic system and components	yearly	Qualified personnel
Exchange of the hydraulic fluid after start up	after 250 operating hours or 3 months	Qualified personnel
Check the hydraulic fluid	after 1250 operating hours or 6 months	Qualified personnel
Exchange of hydraulic fluids	in case of damages	Qualified personnel
Repair		ROEMHELD service staff

12.2 Regular checks

Checks by the operator have to be effected as follows:

12.3 Daily checks

- Check all fixing screws, retighten if required.
- Check all cable fixings and fittings, retighten if required.
- Check if hydraulic hoses, pipes and cables are damaged, or have chafe marks, etc.).
- Check hydraulic components for external leakage - retighten fittings, if required.
- Hydraulic hoses must not get in contact with substances which can cause a damage (acids, lys, solvents, ...).
- Check the oil level of the hydraulic power unit (see chapter Charging of the hydraulic power unit with oil) - if required refill oil (specifications see chapter Technical characteristics).
- Check safety devices as per chapter Safety devices.

12.4 Yearly checks

Hydraulic system, hydraulic hoses

An expert has to check all hydraulic components at least once a year if they are still work-proof. Assessed damages have to be repaired immediately.

The following checks and works have to be effected:

- An expert has to check all hydraulic hoses at least once a year if they are still work-proof. Assessed damages have to be repaired immediately.
- The hydraulic hoses of the device have to be exchanged as per BGR 237 at least after 6 years by new ones.

12.5 Cleaning

⚠ WARNING

Injury by flying out components or oil!

- For cleaning works always wear safety goggles, protective shoes and safety gloves.

⚠ CAUTION

Aggressive cleaning agents

The product must not be cleaned with:

- Corrosive or corroding components or
- Organic solvents as halogen or aromatic hydrocarbons and ketones (cellulose thinner, acetone, etc.),

because this can destroy the seals.

The following cleaning works have to be effected daily at the mechanical components:

- Clean the product only with cleaning clothes.
- Afterwards lubricate slightly movable components (piston rods, guides etc.) and not coated steel components.

12.6 Maintenance and check of the hydraulic fluid

Important factors that influence the degree of contamination of the hydraulics fluid are:

- Contamination of the surroundings
- Size of the hydraulic system
- Design of the hydraulic system as specified
- Number of consumer elements,
- Cycle time,
- Number of fluid circulations through the filter per time unit,
- Implementation of the maintenance schedules,
- Training of the maintenance personnel.

They change the operating characteristics of hydraulic fluids and lead to their ageing.

The monitoring of the condition and a filtration adapted to the requirements of the application (if necessary, draining and degasification) are indispensable for the maintenance of the operating characteristics and guarantee of a long service life of hydraulic fluids and components.

The hydraulic fluid must be regularly exchanged or examined by the lubricant manufacturer and/or qualified staff.

A reference investigation according to the maintenance schedule with analysis as per ISO 4406 or mass of impurities with analysis as per E 12662 is recommended

Note

For guarantee, liability and warranty claims, maintenance proofs and/or the results of analysis of the hydraulic fluids have to be submitted to us.

Purity of the hydraulic fluids

The admissible contamination (unsolved impurities in the hydraulic fluid) depends on the component of the hydraulic system that is most sensitive to dirt. The indicated purity class is the maximally admissible value that should not be exceeded, with regard to the operating safety (clogging of gaps, orifices as well as the locking of the control piston) and the service life (wear reduction).

Application	Minimum purity as per NAS 1638	Minimum purity as per ISO 4406	attainable with filter fineness *
Radial piston and gear pumps, valves and cylinders	8 (recommended: 5 up to 7)	20 / 17 / 13	≤ 20 µm
Proportional pressure and flow control valves	7 (recommended: 5 up to 6)	18 / 16 / 13	≤ 10 µm

***** Important influential factors see chapter: "Maintenance and check of the hydraulic fluid"

Especially with proportional valves, the repetitive accuracy depends especially on the purity degree of the hydraulic fluid.

Note

New hydraulic fluid

- Please note that a new hydraulic fluid "on tap" does not meet the requirements of cleanness. If necessary, use cleaned oil.

Mixing of different types of hydraulic fluid

- Mixing of different types of hydraulic fluid can lead to unintended chemical reactions with mud formation resinification or similar.
- Therefore, the respective manufacturers should be consulted for a change between different hydraulic fluids.
- In any case, the entire hydraulic system is to be rinsed thoroughly.

12.7 Oil change

Hazardous to the environment

Due to possible environmental pollution, the individual components must be disposed only by an authorised expert company.

⚠ WARNING

Burning due to hot oil!

- In operating conditions oil temperatures up to 70 °C can appear due to environment influences.
- All works must only be made in cool mode!

Burning due to hot surface!

- In operating conditions, surface temperatures of more than 70 °C can appear at the product.
- All maintenance and repair works must only be effected in cooled mode or with safety gloves.

⚠ CAUTION

Short circuit of internal components!

In case of high water entry (condensation, coolants, etc.) into the oil reservoir, a short circuit can result.

- It is imperative to stick to the interval for the oil change!

For works with operating fluids, pay attention to the safety data sheets!

NOTE

- Oil changes must only be made in depressurised mode.

Hydraulic oil use according sign

Use hydraulic oil as per sign at the oil filler neck (see also technical characteristics).

Filtration and cleanliness level of the hydraulic fluid

Pay attention to the indication for filtration and purity class of the hydraulic fluid (see technical characteristics).

To change the oil proceed as follows:

1. Make sure that all hydraulic drives (hydro-cylinders, etc.) are retracted in off-position!
2. Switch off main switch at the electric control, switching position "0", or disconnect from the mains.
3. Depressurise the system e.g. by pressing the emergency stop at the valves (depending on the type).

- Unscrew oil drain plug.
- Drain oil completely
- Apply oil drain plug - if required screw in new screw (see spare parts list).

4. Unscrew the cover for oil filling at the return filter or the fill-in and venting filter.
5. Insert clean funnel with filter or filter cloth (see purity class) in oil filler neck.
6. Filling of hydraulic oil until hydraulic oil can be seen between the two markings at the oil level gauge.
7. Screw in cover.
8. Operate the fixture several times.
   (For the first start up pay attention to "Bleeding of the hydraulic system".)
9. Check oil level and refill hydraulic oil, if necessary.

13 Trouble shooting

Trouble	Cause	Remedy
Power unit does not start:	Safety fuse defect	Check and exchange, if required
	Pressure switch misaligned	Adjustment (see "Adjust operating pressure")
	Electric control is not o.k., e.g. overload current, parting of cable	⚠ **Caution ! Works only to be effected by authorised personnel.** Reset protection switch
	Oil level too low or oil temperature too high, the light in the door of the control box or at the main switch is lit	Refill oil or let cool oil
Motor does not switch off after reaching operating pressure	Pressure switch misaligned	Adjustment (see "Adjust operating pressure")
	Pressure switch defect	Exchange pressure switch

Trouble	Cause	Remedy
Operating pressure will not be obtained	Pressure relief valve adjusted too low	Adjustment (see section "Adjust operating pressure")
	External leakage	Eliminate leak, e.g. by tigthening fittings or replacing pipes or hoses.
	Solenoid valves are leaky	Replace solenoid valve(s)
	Pump defect	Exchange pump or return power unit for repair
	Leckage of a hydraulic drive	Check which drive is leaky.
	Pressure switch misaligned	Adjustment (see section "Adjust operating pressure")
Pump motor will be switched on and off in short intervals in position "Clamping" and "Unclamping":	Check valve in the mounting plate of the pressure switch leaky	Loosen nuts from connecting bolts, dismantle the valve block and exchange complete mounting plate with built-in check valve
	Leakage at the cylinder (clamping element/ cylinder or similar)	Squeeze pressure line to locate the leakage, exchange seal or element.
	Fittings are leaky	Retighten fittings
	Solenoid valve(s) are leaky (internal leakage)	Replace solenoid valves

NOTE

After the exchange or the repair of hydraulic components, their function must be tested.

14 Technical characteristics

Hydraulic fluids

Details of the hydraulic fluids to be used are attached to the oil filler neck.

NOTE

For piston pumps

Use hydraulic oil as per DIN 51524-2 HLP 22.

Purity of the hydraulic fluids

The admissible contamination (unsolved impurities in the hydraulic fluid) depends on the component of the hydraulic system that is most sensitive to dirt. The indicated purity class is the maximally admissible value that should not be exceeded, with regard to the operating safety (clogging of gaps, orifices as well as the locking of the control piston) and the service life (wear reduction).

Application	Minimum purity as per NAS 1638	Minimum purity as per ISO 4406	attainable with filter fineness *
Radial piston and gear pumps, valves and cylinders	8 (recommended: 5 up to 7)	20 / 17 / 13	≤ 20 µm
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***** Important influential factors see chapter: "Maintenance and check of the hydraulic fluid"

Especially with proportional valves, the repetitive accuracy depends especially on the purity degree of the hydraulic fluid.

Note

New hydraulic fluid

- Please note that a new hydraulic fluid "on tap" does not meet the requirements of cleanness. If necessary, use cleaned oil.

Mixing of different types of hydraulic fluid

- Mixing of different types of hydraulic fluid can lead to unintended chemical reactions with mud formation resinification or similar.
- Therefore, the respective manufacturers should be consulted for a change between different hydraulic fluids.
- In any case, the entire hydraulic system is to be rinsed thoroughly.

NOTE

Dirt from entering the system

- With increasing dirt penetration into the hydraulic system, additional high-pressure filters have to be provided in front of the connections.

Hydraulic characteristics

Max. operating pressure	500 bar	250 bar	160 bar
Operating pressure	continuously adjustable, min. 50 bar		
Max. oil charge	5 l (up to the reservoir cover)		
Usable oil volume	2.95 l (with max. filling)		
Max. oil temperature	60 °C		
Max. flow rate	84051XX	84052XX	84053XX
[l/min]	0.82	2.1	3.51

Electrical characteristics

Operating voltage	3 / PE, 400 V, 50Hz
Type	2-pole three-phase motor
Code class	IP 54
Relative duty cycle (ED) see name plate	See section "Operation"

Electric control (if available)

Control voltage for the valves	24 V DC
Fuse	See name plate of the electric control or electric circuit diagram
Connection	Cable 4 × 1.5 mm^2

Environment

Environmental temperature	+ 5 °C to + 35 °C
Humidity	< 80 %, not condensing
Noise level	max. 80 dB (A) (in 1 m distance and height above the floor)

Note

Further characteristics see name plate of the power unit or electric control.

14.1 Environmental conditions

The products are designed for a moderate climate zone.

In an environment with high risk of contamination, for example

- dust
- swarf
- coolants
- humidity (see environment)
- or the like

A protective housing is to be planned.

14.3 Hydraulic circuit diagrams for single-acting actuators

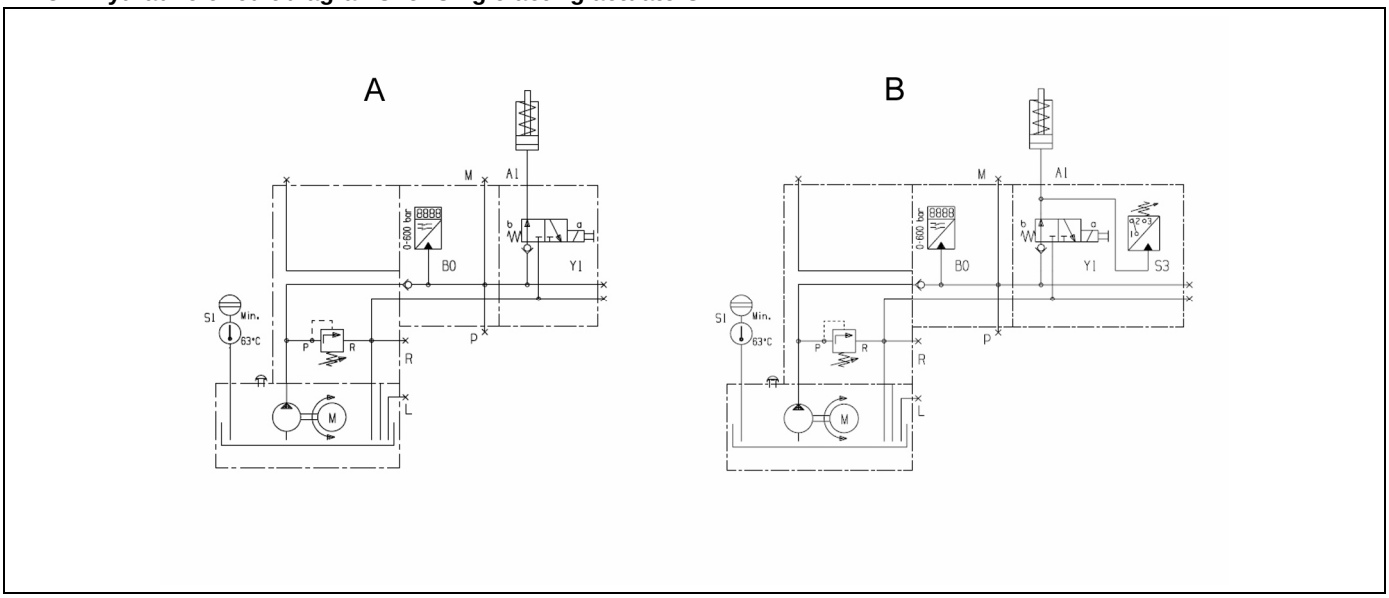


Figure 14: Hydraulic circuit diagrams for single-acting actuators

A For single-acting actuators	B For single-acting actuators, with pressure switch for machine tool interlock

14.4 Electric circuit diagram for single-acting actuators

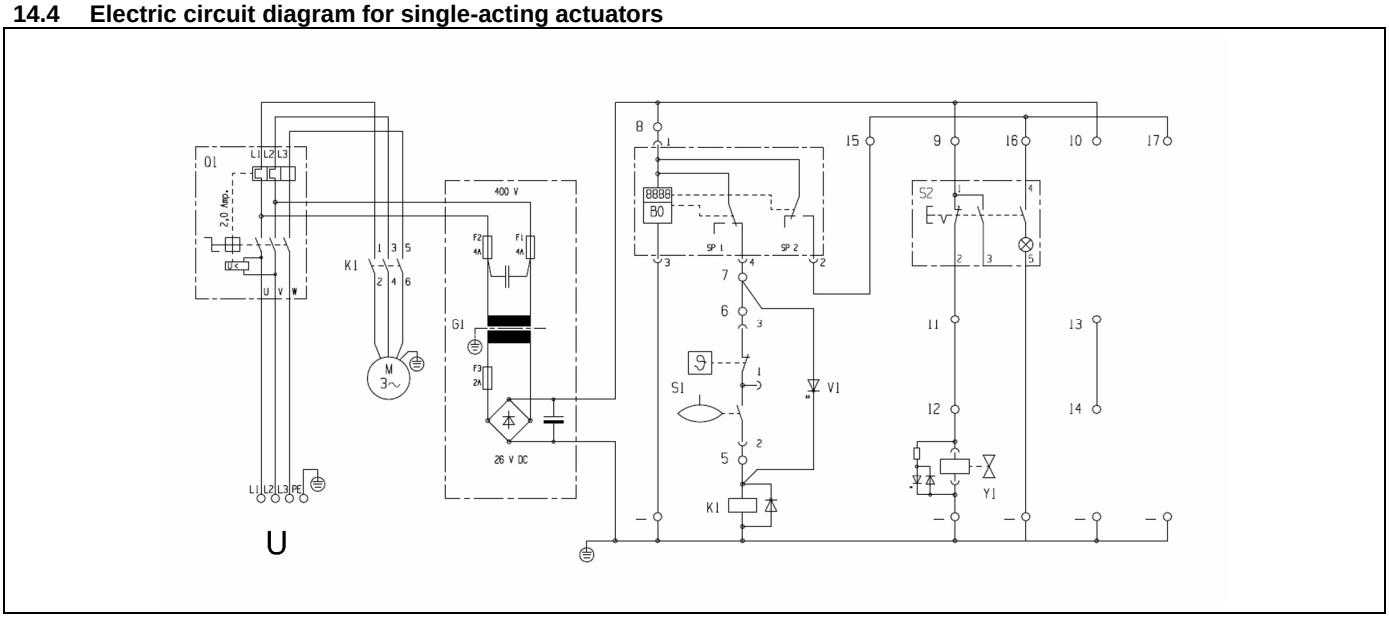


Figure 15: Electric circuit diagram for single-acting actuators

Q1 Undervoltage release	B0 Pressure switch (see notes)
G1 Transformer / rectifier (24 V DC)	S1 / V1 = Oil control (accessory)
M Motor: 0.75 kW; 1.95 A; 400 V; 50 Hz	S2 Manual switch
U 3 / PE ~ 50 Hz, 400 V, safety fuse max. 6 A slow	Y1 3/2 Solenoid valve

NOTE

Pressure switch for machine tool interlock are directly connected. For connection of the oil level and temperature control the bridge between terminal 5 and 6 has to be removed. An effective clamping pressure control has to be effected by a pressure gauge at the fixture.

14.5 Hydraulic circuit diagrams for double-acting actuators

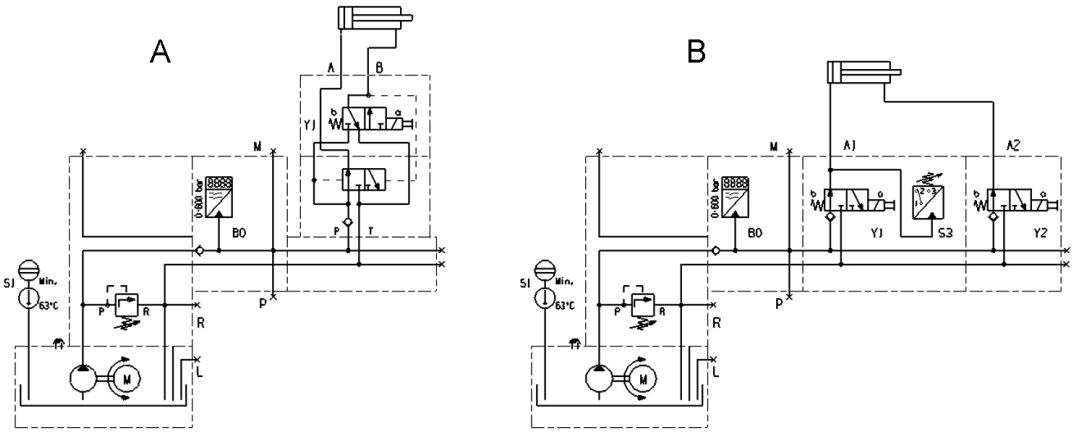


Figure 16: Hydraulic circuit diagrams for double-acting actuators

A For doube-acting actuators	B For double-acting actuators, with pressure switch for machine tool interlock

14.6 Electric circuit diagram for double-acting actuators

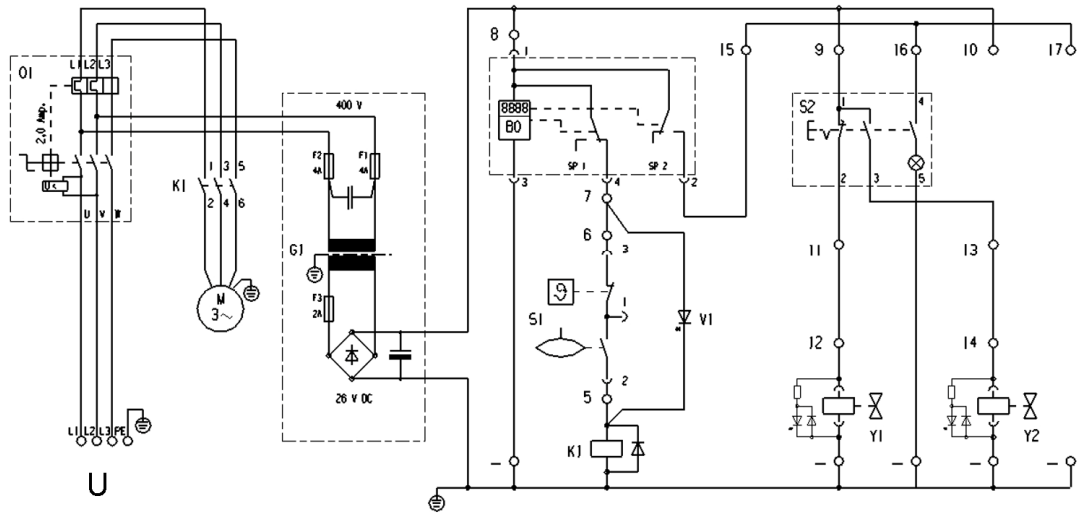


Figure 17: Electric circuit diagram for double-acting actuators

Q1 Main / motor protective switch and undervoltage release	B0 Pressure switch (see notes)
G1 Transformer / rectifier (24 V DC)	S1 / V1 = Oil control (accessory)
M motor: 0.75 kW; 1.95 A; 400 V; 50 Hz	S2 Manual switch
U 3 / PE ~ 50 Hz, 400 V, Safety fuse max. 6 A slow	Y1 3/2 Solenoid valve
	Y2 3/2 Solenoid valve

NOTE

Pressure switch for machine tool interlock are directly connected. For connection of the oil level and temperature control the bridge between terminal 5 and 6 has to be removed. An effective clamping pressure control has to be effected by a pressure gauge at the fixture.

14.7 Hydraulic circuit diagrams for two independent pressure circuits, for single-acting actuators

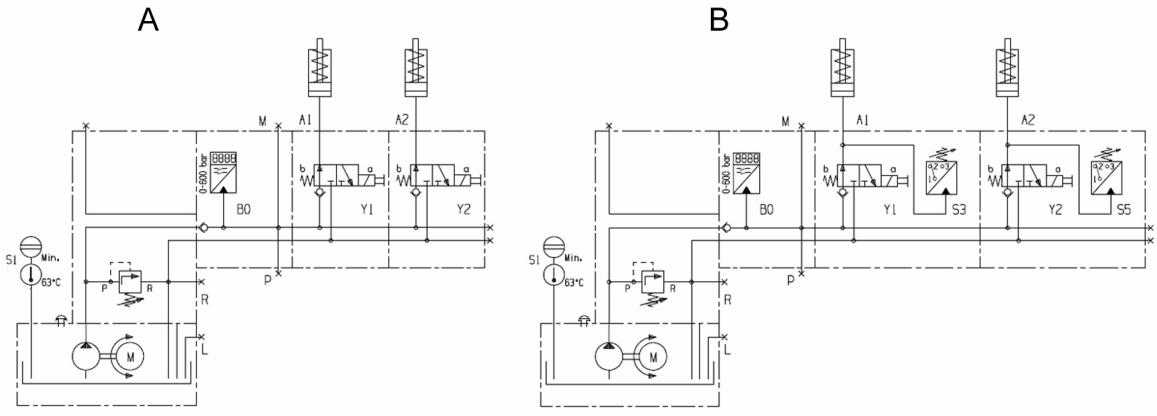


Figure 18: Hydraulic circuit diagrams for two independent pressure circuits

A For two independent pressure circuits, for single-acting actuators	B For two independent pressure circuits, for single-acting actuators, with pressure switch for machine tool interlock

14.8 Electric circuit diagram for two independent pressure circuits, for single-acting actuators

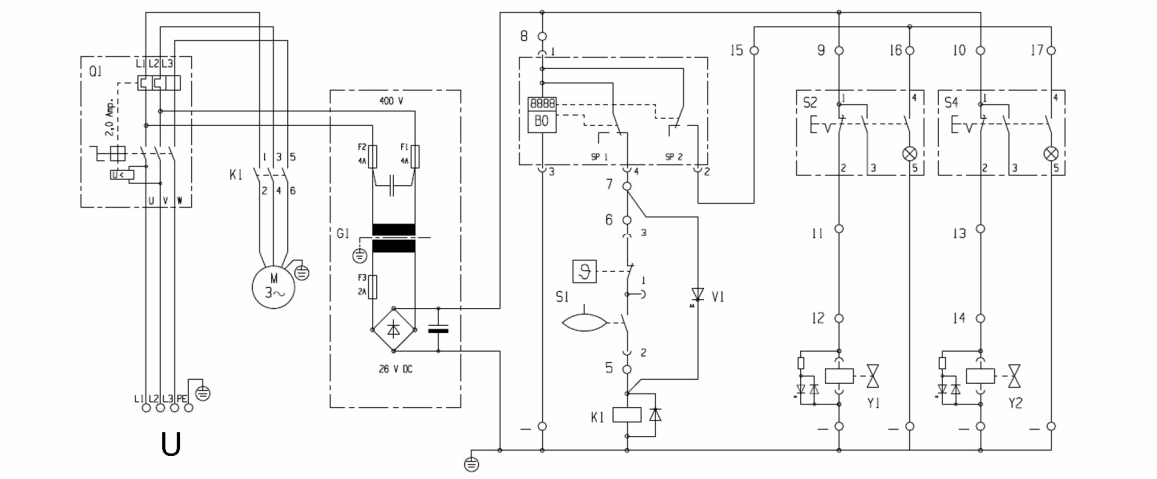


Figure 19: Electric circuit diagram for two independent pressure circuits, for single-acting actuators

Q1 Main / motor protective switch and undervoltage release G1 Transformer / rectifier (24 V DC) M motor: 0.75 kW; 1.95 A; 400 V; 50 Hz U 3 / PE ~ 50 Hz, 400 V, Safety fuse max. 6 A slow	B0 Pressure switch (see notes) S1 / V1 = Oil control (accessory) S2 / S4 Manual switch Y1 3/2 Solenoid valve Y2 3/2 Solenoid valve

NOTE

Pressure switch for machine tool interlock are directly connected. For connection of the oil level and temperature control the bridge between terminal 5 and 6 has to be removed. An effective clamping pressure control has to be effected by a pressure gauge at the fixture.

14.9 Hydraulic circuit diagrams for two independent pressure circuits, for double-acting actuators

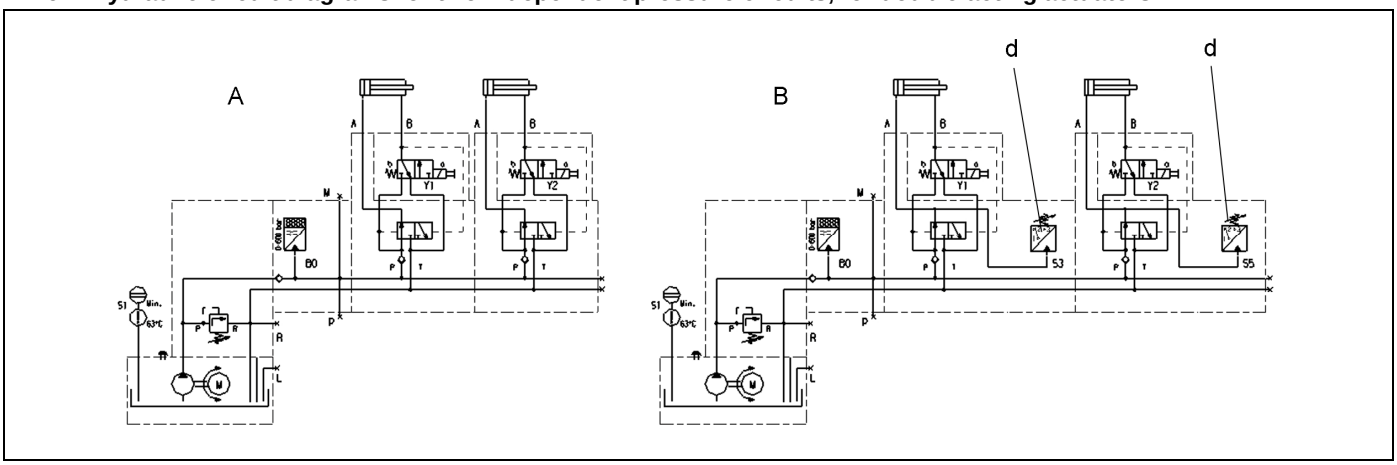


Figure 20: Hydraulic circuit diagrams for two independent pressure circuits

A Hydraulic circuit diagrams for two independent pressure circuits, for double-acting actuators	B Hydraulic circuit diagram for double-acting actuators d Mechanical pressure switch to adjust machine tool interlock (optional)

14.10 Electric circuit diagram for two independent pressure circuits, for double-acting actuators

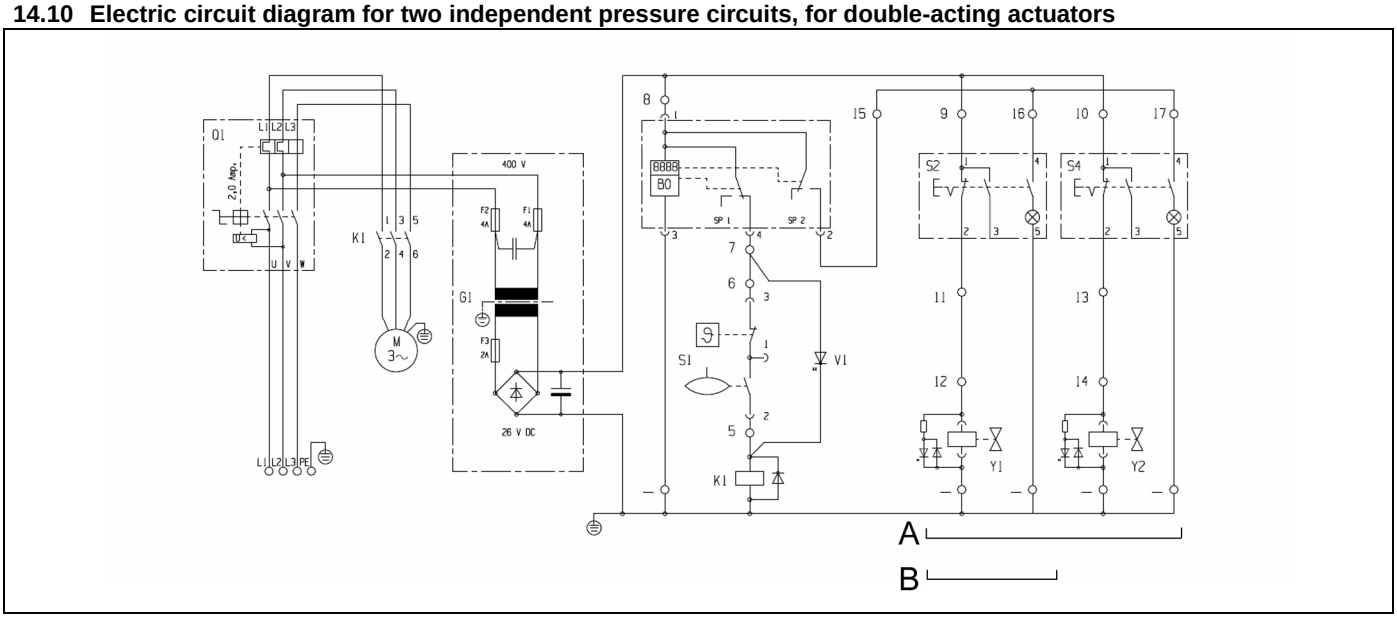


Figure 21: Electric circuit diagram for two independent pressure circuits, for double-acting actuators

Q1 Main / motor protective switch and undervoltage release G1 Transformer / rectifier (24 V DC) M motor: 0.75 kW; 1.95 A; 400 V; 50 Hz U 3 / PE ~ 50 Hz, 400 V, Safety fuse max. 6 A slow	B0 Pressure switch (see notes) S1 / V1 = Oil control (accessory) S2 Manual switch S4 Manual switch Y1 3/2 Solenoid valve Y2 3/2 Solenoid valve

NOTE

Pressure switch for machine tool interlock are directly connected. For connection of the oil level and temperature control the bridge between terminal 5 and 6 has to be removed. An effective clamping pressure control has to be effected by a pressure gauge at the fixture.

14.11 Hydraulic circuit diagram without valves

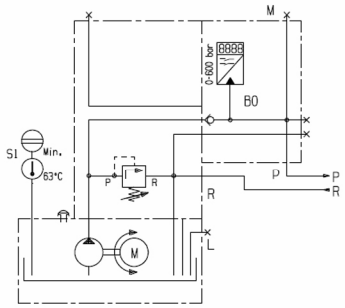


Figure 22: Hydraulic circuit diagram without valves

14.12 Electric circuit diagram without valves

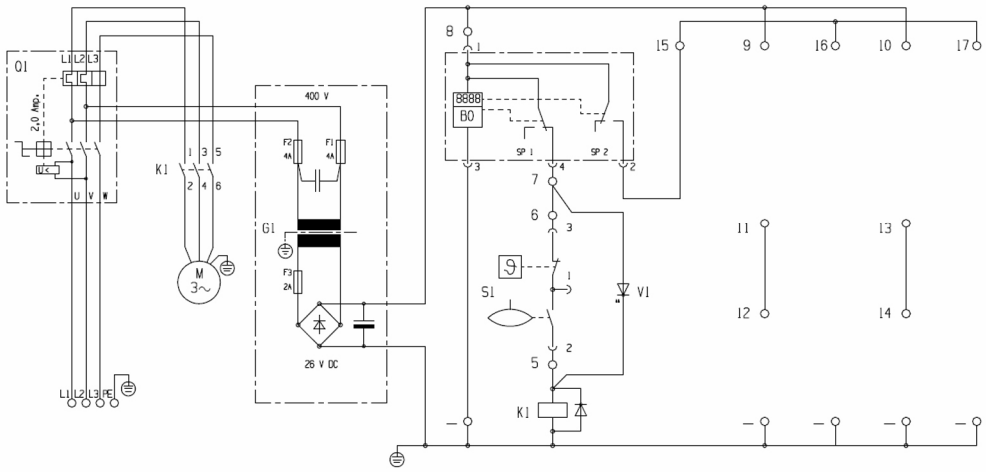


Figure 23: Electric circuit diagram for two independent pressure circuits, for single-acting actuators

Q1 Main / motor protective switch and undervoltage release	B0 Pressure switch (see notes)
G1 3 / PE ~ 50 Hz, 400 V, Safety fuse max. 6 A slow	S1 / V1 = Oil control (accessory)
M motor: 0.75 kW; 1.95 A; 400 V; 50 Hz	Y1 3/2 Solenoid valve
	Y2 3/2 Solenoid valve

NOTE

Pressure switch for machine tool interlock are directly connected. For connection of the oil level and temperature control the bridge between terminal 5 and 6 has to be removed. An effective clamping pressure control has to be effected by a pressure gauge at the fixture.

14.13 Terminal connection plan for maximum equipping

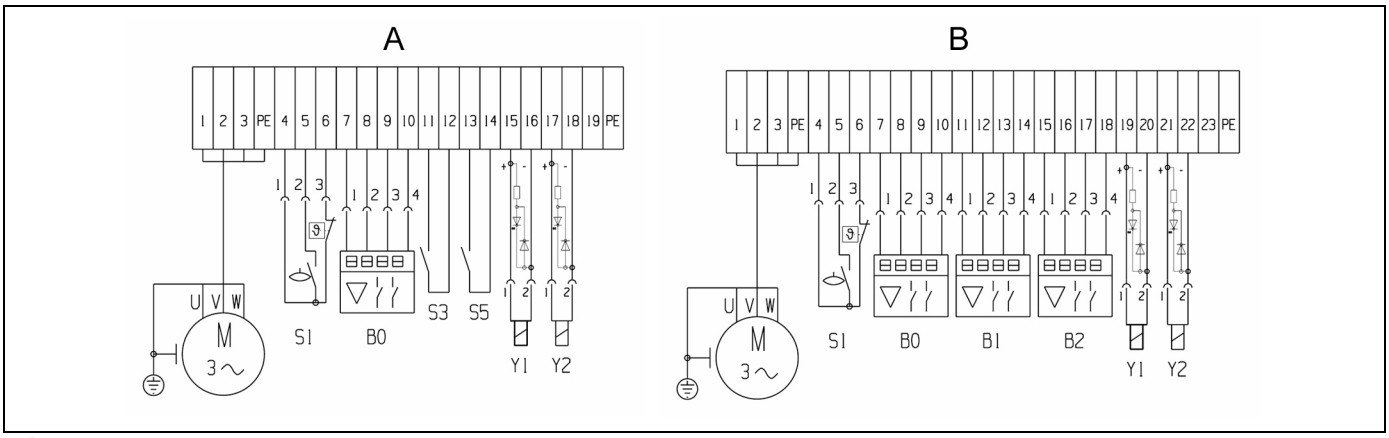


Figure 24: Terminal connection plan for maximum equipping

A Terminal connection for standard equipping **B Terminal connection for equipping with electronic pressure switches, max. equipping** **M Motor** **B0 Pressure switch (see notes)**	**S1 Oil control (accessory)** **S3 Machine tool interlock** **S5 Machine tool interlock** **B1 Machine tool interlock** **B2 Machine tool interlock** **Y1 3/2 Solenoid valve** **Y2 3/2 Solenoid valve**

Function and wiring of the electronic pressure switch B0

Pin	Function	Wire colour
1	**+U_B**	brown
2	**Output 2** Switching output Analogue output Alarm output	white
3	**0 V**	blue
4	**Output 1** Switching output	black

NOTE

Pay attention of polarity for valves and pressure switches with luminous diodes!
Operating voltage: 24V DC connect grounded conductor terminals.

NOTE

Pressure switch for machine tool interlock are directly connected. For connection of the oil level and temperature control the bridge between terminal 5 and 6 has to be removed. An effective clamping pressure control has to be effected by a pressure gauge at the fixture.

15 Disposal

Hazardous to the environment

Due to possible environmental pollution, the individual components must be disposed only by an authorised expert company.

The individual materials have to be disposed as per the existing regulations and directives as well as the environmental conditions.

Special attention has to be drawn to the disposal of components with residual portions of hydraulic fluids. The instructions for the disposal at the material safety data sheet have to be considered.

For the disposal of electrical and electronic components (e.g. stroke measuring systems, proximity switches, etc.) country-specific legal regulations and specifications have to be kept.

CE

16 EC-Declaration of conformity

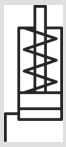
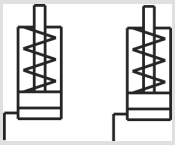
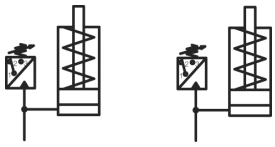
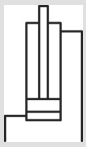
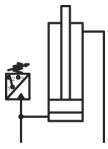
16.1 Manufacturer

Manufacturer

Römheld GmbH Friedrichshütte
Römheldstraße 1-5
35321 Laubach, Germany
Tel.: +49 (0) 64 05 / 89-0
Fax: +49 (0) 64 05 / 89-211
E-mail: info@roemheld.de
www.roemheld.com

16.2 Validity of the documentation

Power units of the data sheet D80115. The following types or part numbers are concerned:

Cylinder type SA / DA without / with pressure switch MI* (at the power unit)	**Directional control valves**		**Electric control**	**Terminal box**	**Switch**			**Flow rate / max. operating pressure**			
	3/2	**4/2**			Manual switch	Foot switch	without	13.67 0.82 500 **Part-no.**	35 2.1 250 **Part-no.**	58.5 3.51 160 **Part-no.**	[cm^3/s] [l/min] [bar] Weight [kg]
	1		•		1			**8405121**	**8405221**	**8405321**	29.5
	1		•			1		**8405122**	**8405222**	**8405322**	30.5
	1		•				•	**8405131**	**8405231**	**8405331**	28.5
	1			•			•	**8405141**	**8405241**	**8405341**	28.0
	1		•		1			**8405181**	**8405281**	**8405381**	30.5
	1		•			1		**8405182**	**8405282**	**8405382**	31.5
	1		•				•	**8405187**	**8405287**	**8405387**	29.5
	1			•			•	**8405143**	**8405243**	**8405343**	29.0
	2		•		2			**8405105**	**8405225**	**8405325**	31.5
	2		•			2		**8405106**	**8405226**	**8405326**	33.5
	2		•				•	**8405113**	**8405233**	**8405333**	29.5
	2			•			•	**8405142**	**8405242**	**8405342**	29.0
	2		•		2			**8405185**	**8405285**	**8405385**	32.5
	2		•			2		**8405186**	**8405286**	**8405386**	33.5
	2		•				•	**8405189**	**8405289**	**8405389**	31.5
	2			•			•	**8405145**	**8405245**	**8405345**	29.0
		1	•		1			**8405109**	**8405209**	**8405309**	30.0
		1	•			1		**8405111**	**8405211**	**8405311**	31.0
		1	•				•	**8405112**	**8405212**	**8405312**	29.0
		1		•			•	**8405147**	**8405247**	**8405347**	28.5
		1	•		1			**8405117**	**8405217**	**8405317**	31.0
		1	•			1		**8405118**	**8405218**	**8405318**	32.0
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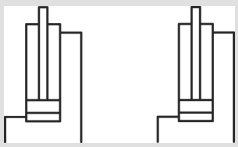		2	•		2			**8405107**	**8405207**	**8405307**	32.5
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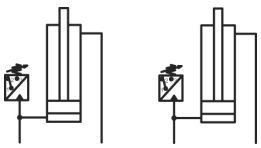
		2	•				•	**8405115**	**8405215**	**8405315**	31.5
		2		•			•	**8405146**	**8405246**	**8405346**	31.0
		2	•		2			**8405137**	**8405237**	**8405337**	34.0
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		2	•				•	**8405139**	**8405239**	**8405339**	33.0
		2		•			•	**8405140**	**8405240**	**8405340**	33.0
-	-	-	•				•	**8405110**	**8405210**	**8405310**	27.5

*) MI = machine tool interlock

Possible optional equipment

The above-described power units are also available with additional equipment.

When ordering, please keep to the following sequence:

8405 XXX **B**	handle
8405 XXX **E**	electronic pressure switch for MI*)
8405 XXX **T**	oil level and temperature control

Combination possibilities

When ordering, please keep to the following sequence:

"T" + "B"	8405 XXX **T B**
"T" + "E"	8405 XXX **T E**
"B" + "E"	8405 XXX **B E**
"T" + "B" + "E"	8405 XXX **T B E**

*) MI = machine tool interlock

16.3 EC-Declaration of conformity

The listed products are designed and manufactured in line with the relevant versions of the EC directives **2006/95/EC - Low voltage directive** and in compliance with the valid technical rules and standards.

In accordance with **2006/42/EC** (EC MSRL) and DIN EN ISO 4413 these products are components that are not ready for use and are exclusively designed for the installation into an incomplete machine / machine.

The products may only be put into operation after it was assessed that the incomplete machine / machine, in which the product shall be installed, corresponds to the machinery directives (2006/42/EC).

The manufacturer commits to transmit the special documents of the products to state authorities on request.

The technical documentation as per appendix IV was prepared for the products.

16.4 List of the applied standards

2006/42/EC Machinery Directive

2001/95/EC, General product safety

2004/108/EC EMC - Electromagnetic compatibility

2006/95/EC, Low voltage directive

92/58/EEC, Minimum requirements for the provision of safety and/or health signs at work

89/391/EEC, Introduction of measures to encourage improvements in the safety and health of workers at work

89/655/EEC, Minimum safety and health requirements for the use by workers of personal protective equipment at the workplace

2002/95/EC, Directive on the restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS)

Operating safety regulations (BetrSichV) for the transposal of the directive on the introduction of measures to encourage improvements in the safety and health of workers at work. (German implementation of the Work Equipment Directive 89/655/EEC)

Product Safety Act - PSG; November 2011

EMC law (Germany)

DIN EN ISO 12100, 2011-03, Safety of machinery; Basic concepts, General principles for design (replacement for part 1 and 2)

DIN EN ISO 12100-2, 2004-04, Safety of machinery - Basic concepts, General principles for design - Part 2: Technical principles

DIN EN ISO 14121-1, 2007-12, Safety of machinery- Risk assessment- Part 1: Principles

DIN EN ISO 13732-1, 2008-12, Ergonomics of the thermal environment - Methods for the assessment of human responses to contact with surfaces - Part 1: Hot surfaces

DIN EN 614-1 a. 2, 2009-06, Safety of machinery - Ergonomic design principles

DIN EN 626-1, 2008-09, Safety of machinery - Reduction of risks to health from hazardous substances emitted by machinery

DIN EN ISO 13849-1, 2008-12, Safety of machinery - Safety-related parts of control systems - General principles for design

DIN EN ISO 13849-2, 2008-09, Safety of machinery - Safety-related parts of control systems - Validation

DIN EN ISO 4413, 2011-04, Hydraulic fluid power - General rules and safety requirements for systems and their components

DIN EN ISO 11201, 2009-11, Acoustics - Noise emitted by machinery and equipment - Measurement of emission sound pressure levels at a work station

DIN EN 60073; 2003-05, Basic and safety principles for man-machine interface

DIN EN 60204-1; 2007-06, Safety of machinery - Electrical equipment of machines, Part 1: General requirements

DIN EN 60529; 2000-09, Degrees of protection provided by enclosures (IP- Codes)

DIN EN 61000-6-2; 2006-03, Electromagnetic compatibility (EMC) - Generic standards - Immunity for industrial environment

DIN EN 61310-1; 2008-09, Safety of machinery - Indication, marking and actuation. Requirements on signals

DIN EN 81714-2, 2007-08, Design of graphical symbols for use in the technical documentation of products

Responsible person for the documentation:
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Römheld GmbH
Friedrichshütte

Laubach, 04.02.2014

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