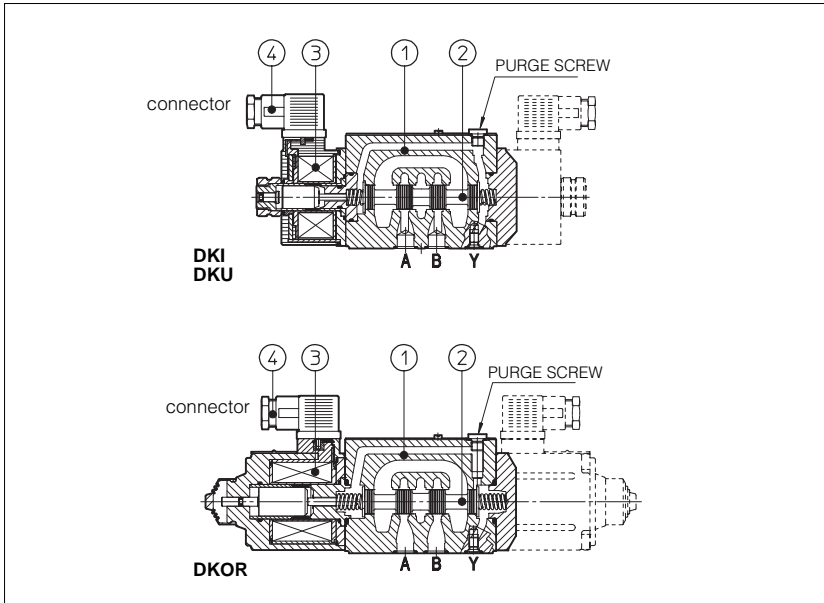


Solenoid directional valves type **DKI, DKU, DKOR**

direct operated, ISO/Cetop size 05



DKI, DKU and DKOR are spool type, three or four way, two or three position direct operated solenoid valves designed to operate in oil hydraulic systems.

They are operated by wet and pressure sealed solenoid (3) with manual override:

- AI solenoid suitable for AC and DC supply;
- AU solenoid for DC supply with improved performance;
- AOR solenoid for DC supply with high performance.

Moving parts are protected, lubricated and cushioned in oil.

Shell-moulding casting (1) are 5 chambers machined by transfer lines and then cleaned by thermal deburring.

Optimized flow paths largely cored with extrawide channels to tank for low pressure drops.

Interchangeable spools (2) available in a wide variety of configurations.

DKU and DKOR valves can be supplied with optional devices for control of switching times.

Standard electric/electronic connectors (4) able to satisfy the requirements of modern machines for electric interfaces characteristics.

Coils are fully encapsulated (class H). In DKI and DKU coils are easily replaceable without the aid of tools.

Rugged execution suitable for outdoor use.

Surface mounting ISO/Cetop 05.
Max flow up to 100 l/min for DKI/DKU and up to 120 l/min for DKOR.
Max pressure: 315 bar.

1 MODEL CODE

DKI - 1 63 1/2 /A - X 24 DC ** /*

Directional control valves ISO/Cetop 05

- DKI-1** = solenoid AI for AC and DC supply
- DKU-1** = solenoid AU for DC supply
- DKOR-1** = solenoid OO for DC supply

Valve configuration, see table 2

- 61** = single solenoid, center plus external position, spring centered
 - 63** = single solenoid, 2 external positions, spring offset
 - 67** = single solenoid, center plus external position, spring offset
 - 70** = double solenoid, 2 external positions, without spring
 - 71** = double solenoid, 3 positions, spring centered
 - 75** = double solenoid, 2 external positions, with detent (not available for DKOR models)
- Other configurations are available on request.

Spool type, see table 3.

- Synthetic fluids
- WG** = water glycol
- PE** = phosphate ester

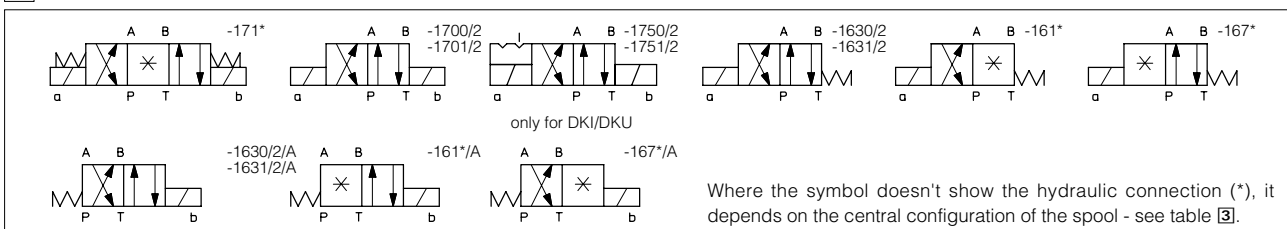
Design number

External supply voltage see section 5
00 = valve without coils (only for DKI and DKU).

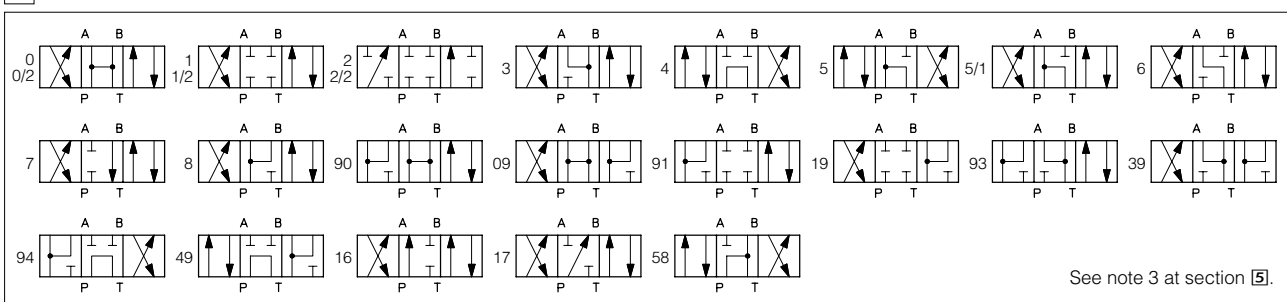
X = without connector
 See note 2 at section 5 for available connectors, to be ordered separately

Options, see note 1 at section 5.

2 CONFIGURATION




3 SPOOLS - for intermediate passages, see tab. E001.



See note 3 at section 5.

4 MAIN CHARACTERISTICS OF DKI, DKU AND DKOR DIRECTIONAL VALVES

| | |
|------------------------------|--|
| Assembly position / location | Any position for all valves except for type - 170* (without springs) that must be installed with horizontal axis if operated by impulses |
| Commissioning | For correct AC operation, the valve must be full of hydraulic fluid, otherwise some vibrations may occur. In this case fill the valve with oil by opening the screw  , see sketch at section 10 and 11 . A check valve on T line aids to keep valve full. |
| Subplate surface finishing | Roughness index $\sqrt{0.4}$ flatness ratio 0,01/100 (ISO 1101). |
| Ambient temperature | from -20°C to +70°C. |
| Fluid | Hydraulic oil as per DIN 51524 535; for other fluids see section 11 . |
| Recommended viscosity | 15 ÷ 100 mm ² /s at 40°C (ISO VG 15 ÷ 100). |
| Fluid contamination class | ISO 19/16, achieved with in line filters at 25 µm value to $\beta_{25} \geq 75$ (recommended). |
| Fluid temperature | T ≤ 80°C if T ≥ 60°C select /PE seals |
| Flow direction | As shown in the symbols of tables 2 and 3 . |
| Operating pressure | Ports P,A,B: 315 bar; Port T with port Y plugged: 120 bar for DKI; 160 bar for DKU and 210 bar for DKOR; On port T pressure up to 315 bar are allowed if port Y is drained; For versions with proximity switches (/FI/NC and /FI/NO versions) port Y must be drained |
| Rated flow | See diagrams Q/Δp at section 7 . |
| Maximum flow | 100 l/min for DKI and DKU; 120 l/min for DKOR, see operating limits at section 8 . |
| Relative duty factor | 100% |
| Supply voltage and frequency | See model code at section 11 . |
| Supply voltage tolerance | ± 10% |

5 NOTES

1 Options

- A** = Solenoid mounted at side of port B (only for single solenoid valves). In standard versions, solenoid is mounted at side of port A.
WP = prolonged manual override protected by rubber cap (standard for DKOR models).
L, L1, L2, L3, LR, see section [10](#) = device for controlling switching time (only for DKU and DKOR models). Not available for valves with connectors E-SA or E-SE. For spools 4, 4/8, 5/1 only device L1 is available.
F* = with proximity switch for monitoring spool position: see tab. E110.

2 Type of electric/electronic connector with connector DIN 43650 to be ordered separately

- SP-666** = standard connector IP-65 for direct connection to electric supply source.
SP-667 = as SP-666, but with built-in signal led.
SP-669 = with built-in rectifier bridge for supplying DC coils by alternate current (AC).
E-SA = electronic connector (only for DKI and DKU valves) which improves performances and give faster shifting times for DC solenoid supplied by AC power.
E-SE = electronic connector (only for DKI and DKU valves) which improves performances and reduces power consumption for DC solenoid supplied by DC power.
E-SR = electronic connector which permits switching of solenoid valves by a low power signal (max 20mA).
E-SD = electronic connector which eliminates electric disturbances when solenoid valves are de-energized.
 Note: disturbance suppressor devices, similar to E-SD are, standard, built in all E-SA, E-SE, E-SR.

3 Spools

- spools type 0/2, 1/2, 2/2 are only used for two position valves: single solenoid valves, type DK*-163*/2; double solenoid valves type DK*-170*/2 and DK*-175*/2.
- spools type 0 and 3 are also available as 0/1 and 3/1 that, when in centre position, oil passage from ports to tank are restricted.
- spools type 1,4 and 5 are also available as 1/1, 4/8 and 5/1. They are properly shaped to reduce water-hammer shocks during the swiching. Note that the configuration of spool 5/1 is inverted in respect with spool 5: see section [3](#).
- spools type 1,3 and 1/2 are also available as 1P, 3P and 1/2P to limit valve leakage.
- Other types of spools can be supplied on request.

6 ELECTRIC FEATURES

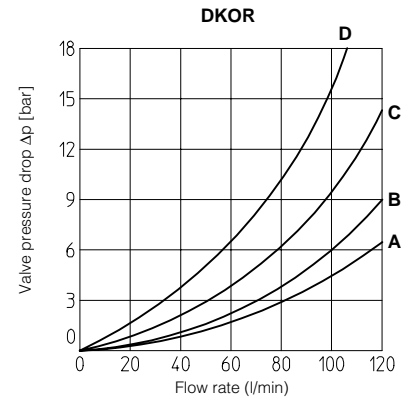
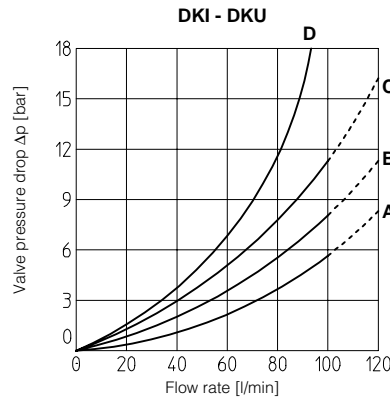
| Valve | External supply nominal voltage (1) (2) | Type of connector | Power consumption (4) | Code of spare coil (8) | Colour of coil label | |
|---------------|---|-------------------|-----------------------|-------------------------|----------------------|-------|
| DKI and DKU | DIRECT CURRENT | 6 DC | 52 W | SP-CAU-6DC / 80 | brown | |
| | | 12 DC | | SP-CAU-12DC / 80 | green | |
| | | 24 DC | | SP-CAU-24DC / 80 | red | |
| | | 48 DC | | SP-CAU-48DC / 80 | silver | |
| | ALTERNATE CURRENT | 12 DC | E-SE | 13 W (5) | SP-CAU-6DC / 80 | brown |
| | | 24 DC | | | SP-CAU-12DC / 80 | green |
| | | 110/50 AC | E-SA | 105 VA (6) | SP-CAU-24DC / 80 | red |
| | | 120/60 AC | | 95 VA (6) | | |
| DKI | ALTERNATE CURRENT | 230/50 AC | 105 VA (6) | SP-CAU-48DC / 80 | silver | |
| | | 230/60 AC | 95 VA (6) | | | |
| | | 110/50 AC | SP-669 | 58 VA | SP-CAU-110RC / 80 | gold |
| | | 120/60 AC | | 53 VA | | |
| DKOR | DIRECT CURRENT | 230/50 AC | 58 VA | SP-CAU-230RC / 80 | blue | |
| | | 230/60 AC | 53 VA | | | |
| | | 110/50 AC (3) | 110 VA (7) | SP-CAI-110/50/60AC / 80 | yellow | |
| | | 120/60 AC | | SP-CAI-120/60AC / 80 | white | |
| 230/50 AC (3) | SP-CAI-230/50/60 AC / 80 | light blue | | | | |
| 230/60 AC | SP-CAI-230/60AC / 80 | silver | | | | |
| DKOR | DIRECT CURRENT | 12 DC | 40 W | - | - | |
| | | 24 DC | | - | - | |
| | | 110 DC | | - | - | |
| | | 220 DC | | - | - | |
| | ALTERNATE CURRENT | 110/50 AC | SP-669 | 46 VA | - | - |
| | | 120/60 AC | | 42 VA | - | - |
| | | 230/50 AC | | 46 VA | - | - |
| | | 230/60 AC | | 42 VA | - | - |

- (1) Tolerance on the nominal voltage is ± 10%.
- (2) Other supply voltages are available on request: 28DC, 110DC, 125DC, 220DC, 48/50/60 AC.
- (3) Coil can be supplied also with 60 Hz of voltage frequency: in this case the performances are reduced by 10÷15% and the power consumption is 55 VA.
- (4) Average values based on tests performed at nominal hydraulic condition and ambient/coil temperature of 20°C.
- (5) In a cycle, where solenoid is energized/deenergized in 1 second (1 Hz), the average power consumption is 13 W; for longer cycles, the power consumption is lower.
When solenoid is energized the inrush current is 9 A at 12 V_{DC} and 6 A at 24 V_{DC} corresponding to power consumption peak of 130 W. These current peaks persist for a period shorter than 100 msec and they must be considered when electric circuit is designed.
- (6) When solenoid is energized the inrush current is 7 A at 110 V_{AC} and 3,5 A at 230 V_{AC}; the power consumption peak is 800 VA; these current peaks persist for a period shorter than 40 msec and they must be considered when electric circuit is designed.
- (7) When solenoid is energized, the inrush current is approx 3 times the holding current. Inrush current values correspond to a power consumption of about 350 VA.
- (8) Protection class H; Duty cycle: 100%. Connector protection degree: IP 65.

7 Q/ΔP DIAGRAMS

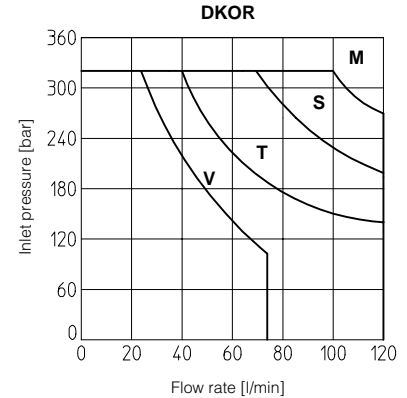
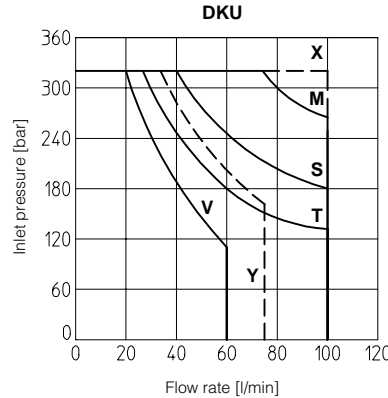
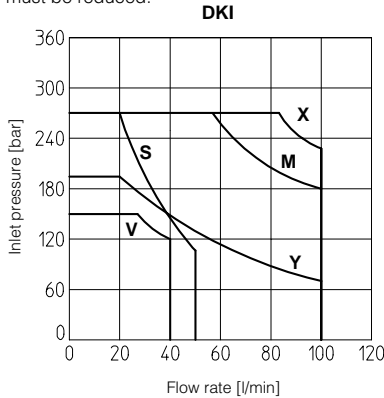
| Flow direction Spool type | P→A | P→B | A→T | B→T | P→T |
|------------------------------|---------|-----|-----|-----|-----|
| | 0, 2, 3 | B | B | B | B |
| 0/2, 1, 8 | B | B | A | A | |
| 1/2, 2/2 | C | C | B | B | |
| 4, 5, 9* | D | D | D | D | C |
| 6 | B | B | A | B | |
| 7 | B | B | B | A | |

Based on fluid viscosity of 43 mm²/s at 40°C.



8 OPERATING LIMITS

The diagrams have been obtained with warm solenoids and power supply at lowest value ($V_{nom} - 10\%$). The curves refer to application with symmetrical flow through the valve (i.e. P→A and B→T). In case of asymmetric flow and if the valves have the devices for controlling the switching times the operating limits must be reduced.



X = Spools 0, 0/2, 1, 1/2, 3, 6, 7, 8, with E-SA or E-SE connectors.

M = Spools 0, 1, 1/2, 3 with electric connectors.

S = Spools 2, 2/2, *9, 9* with E-SA or E-SE connectors.

Y = Spools 0/2, 4, 5, 6, 7 with electric connectors.

V = Spools 2, 2/2, *9, 9* with electric connectors.

X = Spools 0, 0/2, 1, 1/2, 3, 6, 7, 8 with E-SA or E-SE connector.

M = Spools 0, 1, 1/2, 8 with electric connectors.

S = Spools 0/2, 3, 6, 7 with electric connectors.

Y = Spools 2, 2/2, *9, 9* with E-SA or E-SE connectors.

V = Spools 2, 2/2, *9, 9* with electric connectors.

T = Spools 4, 5 with electric connectors.

M = Spools 0, 0/2, 1, 1/2, 8.

S = Spools 3, 6, 7.

V = Spools 2, 2/2, *9, 9*

T = Spools 4, 5.

9 SWITCHING TIMES (average values in msec)

| Valve | Switch-on AC | Switch-on DC | Switch-off |
|------------------------|--------------|--------------|------------|
| DKI + SP-666 SP-667 | 35 | 60 | 30 |
| DKI + SP-669 | 60 | - | 90 |
| DKI + E-SA | 25 | - | 45 |
| DKI + E-SD E-SR | 35 | 60 | 60 |
| DKI + E-SE | - | 40 | 40 |

| Valve | Switch-on AC | Switch-on DC | Switch-off |
|------------------------|--------------|--------------|------------|
| DKU + SP-666 SP-667 | — | 60 | 30 |
| DKU + SP-669 | 60 | — | 90 |
| DKU + E-SA | 25 | — | 45 |
| DKU + E-SD E-SR | — | 60 | 60 |
| DKU + E-SE | — | 40 | 40 |
| DKU-*L* | — | 75-150 | 45-150 |

| Valve | Switch-on AC | Switch-on DC | Switch-off |
|-------------------------|--------------|--------------|------------|
| DKOR + SP-666 SP-667 | — | 65 | 35 |
| DKOR + SP-669 | 65 | — | 95 |
| DKOR + E-SD E-SR | — | 65 | 65 |
| DKOR-1**L* | — | 75-150 | 50-150 |

Test conditions:

- 50 l/min; 150 bar
- nominal voltage
- 2 bar of counter pressure on port T
- mineral oil: 43 mm²/s viscosity at 40°C.

The elasticity of the hydraulic circuit and the variations of the hydraulic characteristics and temperature affect the response time.

10 DEVICES FOR SWITCHING TIME CONTROL

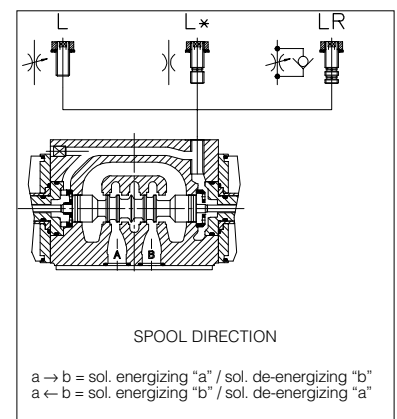
These devices are only available for DKU and DKOR without E-SA or E-SE and can check the switching time and therefore reduce the coil hammering in the circuit. The different types available are shown in the figure.

The functionality of the device depends on the type of regulating element.

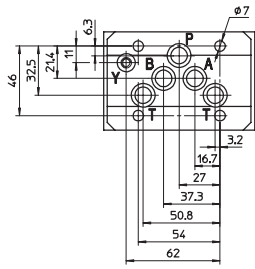
- **L**: checks and regulates the switching time in both moving directions of the spool: regulation is carried out by screwing/unscrewing the element itself (regulating choke);
- **L1/L2/L3**: checks the switching time in both moving directions of the spool with fixed regulation of this time (gauged flow)
ØL1 = 1,25 mm; ØL2 = 1 mm; ØL3 = 0,75 mm;
- **LR**: checks and regulates the switching time in the b→a direction of the spool movement. The device does not intervene in the control of the switching time (standard time) in the opposite direction a→b of the spool movement.

In all cases where it is necessary to obtain damped switching, pair these devices with progressive spools (1/1, 4/8, 5/1) which in the intermediate passages are properly shaped to reduce reversal shocks.

The passage in which the regulating element is inserted must be completely full of fluid for it to function properly, see also "commissioning" at section [4].



11 INSTALLATION DIMENSIONS [mm]



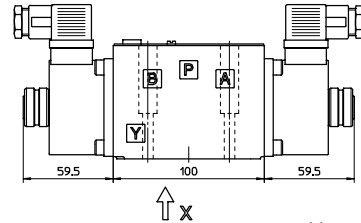
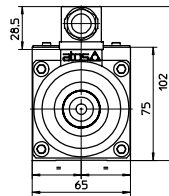
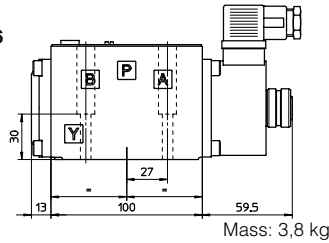
ISO/Cetop 05

Fastening bolts: 4 socket head screws M6x40
 Seals: 5 OR 2050.1 OR 108
 Ports P,A,B,T: $\varnothing = 11.5$ mm (max)
 Ports Y: $\varnothing = 5$ mm

P = PRESSURE PORT
A, B = USE PORT
T = TANK PORT
Y = DRAIN PORT

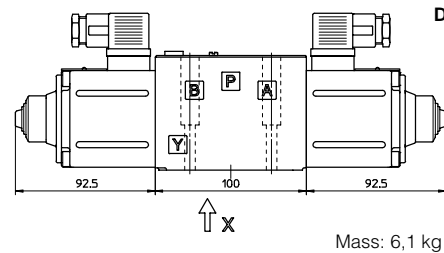
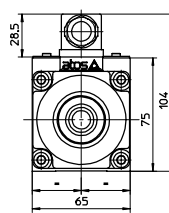
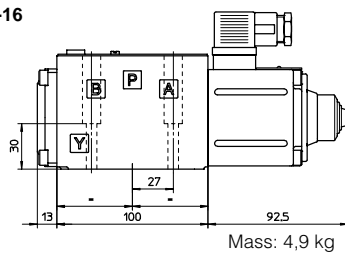
For the max pressures on ports, see section 4

**DKI-16
DKU-16**



**DKI-17
DKU-17**

DKOR-16



DKOR-17

Overall dimensions refer to valves with connectors type SP-666

11 ELECTRIC/ELECTRONIC CONNECTORS ACCORDING TO DIN 43650 - The connectors must be ordered separately

| | | | | |
|--|---|---|---|--|
| <p>SP-666, SP-667 (for AC or DC supply) E-SD/DC (for DC supply)</p> <p>SP-666, SP-667 1 = Positive ⊕ 2 = Negative ⊖ ⊕ = Coil ground</p> | <p>SP-669 (for AC supply)</p> <p>SP-669 1,2 = Supply voltage V_{AC} 3 = Coil ground</p> | <p>E-SA (for AC supply) E-SE (for DC supply) E-SR/AC (for AC supply)</p> <p>E-SA 1,2 = Supply voltage V_{AC} 3 = Coil ground</p> <p>E-SE 1 = Positive ⊕ 2 = Negative ⊖</p> <p>E-SR/AC 1,2 = Supply voltage V_{AC} 3 = Coil ground 4 = Negative pilot signal V_{bc} 5 = Positive pilot signal V_{bc}</p> | <p>E-SR/DC (for DC supply)</p> <p>Power supply V_{bc}: RED = Positiv ⊕ BLUE = Ground ⊖</p> <p>Pilot signal V_{bc}: YELLOW = Positive ⊕ WHITE = Negative ⊖</p> <p>Supplied with 5 m long cable.</p> | <p>E-SD/AC (for AC supply)</p> <p>1,2 = Supply voltage V_{AC}</p> |
|--|---|---|---|--|

13 MOUNTING SUBPLATES

| Model | Ports location | GAS Ports A-B-P-T (X-Y) | Ø Counterbore [mm] A-B-P-T (X-Y) | Mass [kg] |
|--------|--|----------------------------|--|--------------|
| BA-308 | (/Y) Ports A, B, P, T (X, Y) underneath | 1/2" (1/4") | 30 (21,5) | 2,5 |
| BA-428 | (/Y) Ports A, B, P, T (X, Y) underneath | 3/4" (1/4") | 36,5 (21,5) | 5,5 |
| BA-434 | (/Y) Ports P, T, (X, Y) underneath; Ports A, B on lateral side | 3/4" (1/4") | 36,5 (21,5) | 8,5 |

The subplates are supplied with 4 fastening bolts M6x40. Also available are multi-station subplates and modular subplates. For further details see table K280.