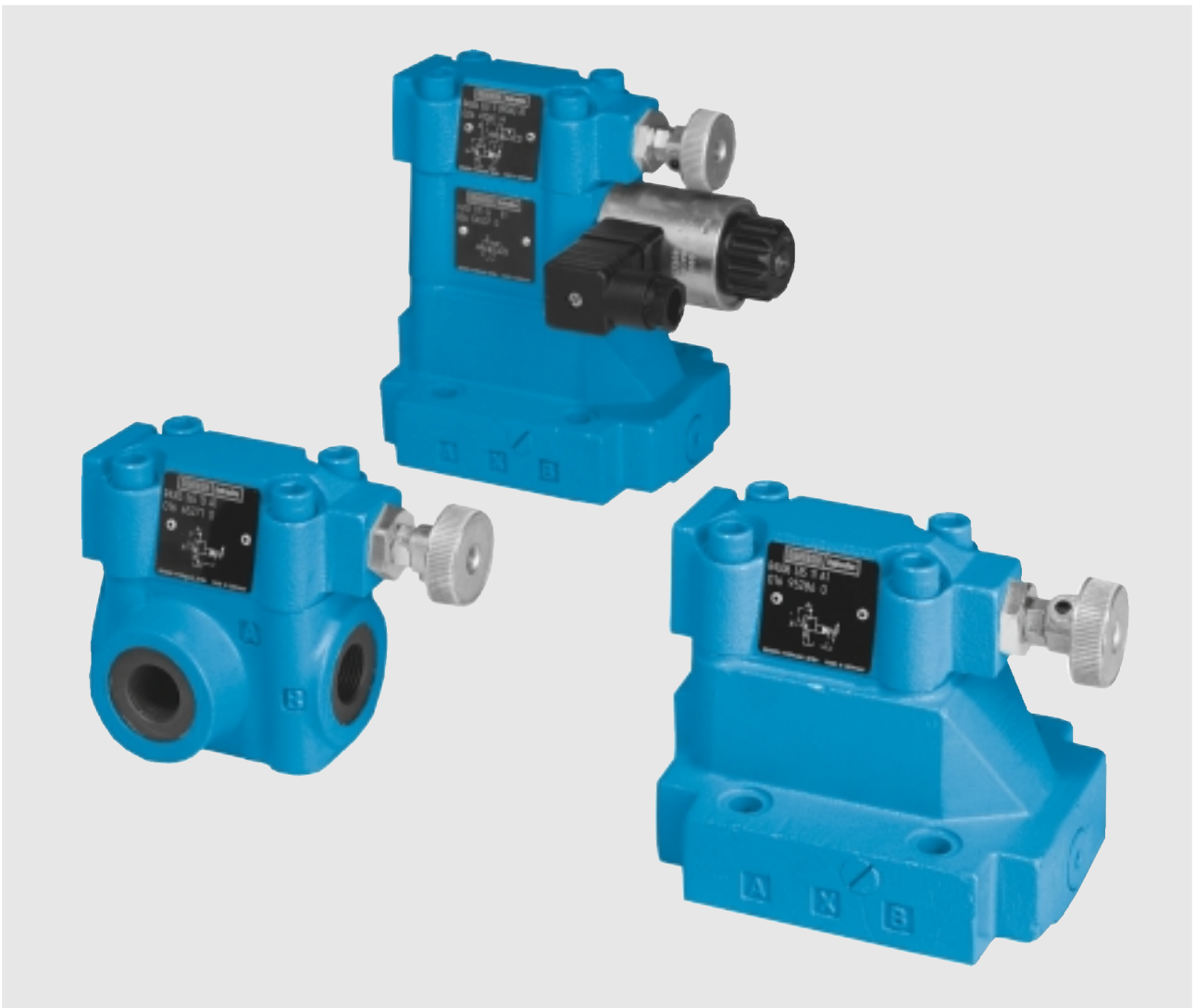


# DENISON HYDRAULICS

## Unloading Valves

Series R4U



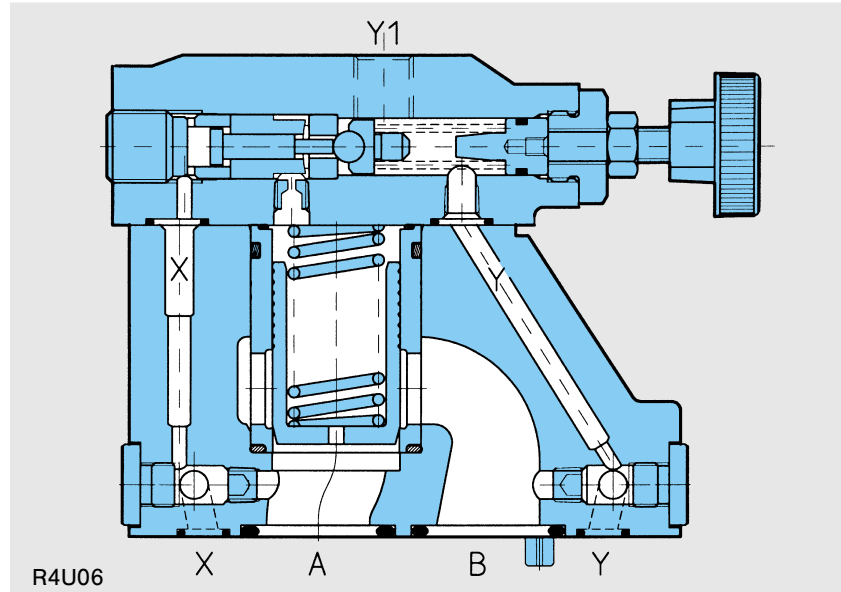
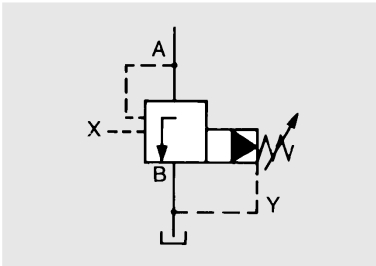
Publ. 3-EN 2500-C (dig.)

**DENISON** Hydraulics

FEATURES

- **Outstanding Design:** DENISON Pressure Controls, Series R4, are exceptional – both in function and design – even under high flow conditions. Pacemaking in design, these valves offer improved features.
- **High Performance:** R4 valves are designed for a maximum pressure of 350 bar and a flow capacity ranging from 90 l/min (3/8”) to 600 l/min (1 1/4”). The pilot stage design reduces pressure overshoot and cracking flow to a minimum, thus reducing heating, power and production losses in high pressure operation.
- **Fast Response:** With the DENISON design, which combines a poppet type seat valve with a pilot stage, precise adjustment and quick response eliminate pressure variations and system shocks. For optimum control, three standard springs are available.
- **Wide Selection:** In addition to the various mounting options for the main valve body, or as cartridge for manifold applications, the ordering code offers a range of control options for valves and accessories. A solenoid vent valve is available (VV01). Integrally mounted, it requires no additional piping, and can be vented in either energized or de-energized condition.
- **Standardized Mounting:** Mounting configurations for R4 Pressure Controls are in accordance with international standards, and conform to CETOP-RP 121 H, ISO 6264. Subplate mounting, L-body and flow-through T-body are available as standard. Vent valve option allows for remote pressure control.

SYMBOL



OPERATION

With the secondary Port B unpressurized, the system pressure in Port A is applied, via an orifice in the main poppet, to the top surface of the main poppet, and through a second orifice to the pilot stage. The hydraulically balanced main poppet is held against the seat by the comparatively weak main spring. In this state there is no flow through the valve. The adjusted spring force acting on the ball determines the pressure setting of the valve.

If the pressure in Port A exceeds the set point, the ball in the pilot section is lifted from its seat, releasing a small pilot flow to tank. This limits the holding pressure on the top of the main poppet to the set point. The result is a pressure drop across the main poppet.

The system pressure in Port A, which now exceeds the holding pressure, lifts the poppet from the seat, allowing flow from Port A to Port B.

In the resulting float position only enough flow is passed from Port A to Port B to limit the inlet pressure in Port A to that of the pilot head setting.

If an external pressure greater than the pilot setting is applied to Port X, the unloading piston lifts the ball clear of the seat, thus removing the holding pressure on the top surface of the main poppet. In this state the system flow passes from Port A to Port B with a pressure drop of about 4 bar.

When the pressure in Port A falls approximately 15% or 28% below the set pressure, the main poppet closes with a snap action, which restores the pump flow to the hydraulic system. In order to ensure the correct functioning of the R4U valve, excessive restriction in the tank line and the pilot pressure line supplying Port X must be avoided.

The pilot drain chamber is normally connected to Port B. Alternative external drain option through Port Y or Port Y1 available.

## DESCRIPTION

### GENERAL

DENISON Unloading Valves are pilot operated controls consisting of two sections: a high flow, poppet type seat valve controlled by the low flow, adjustable pilot mounted on top. The R4U can be vented by means of an optional vent valve, VV01. This valve can be sandwiched between the pilot valve and the main body.

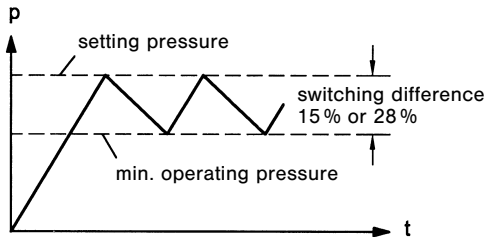
The precise poppet mass to area ratio is especially advantageous, as it enables such features as fast response, high accuracy and quiet, flutter free control.

The outstanding features of the pilot allow the R4U to function as a relief valve at the adjusted pressure setting, with the unloading function controlled via the external pilot Port X.

R4U pressure unloading valves are used to unload a circuit at low pressure when a port signal (Port X) is maintained at a pressure that is higher than the pilot setting. A typical application for an R4U is to unload a pump that is connected to an accumulator circuit. Another use for the R4U is to unload the low pressure side of a double pump.

In applications with an accumulator, it should be noted that the R4U and its accompanying check valve should be mounted as close to the accumulator as possible.

This will prevent the  $\Delta p$ , caused by long feed lines between the R4U and the accumulator, from reducing the 15% or 28% pressure differential (prevention of switching oscillations).



When the system pressure (in an accumulator for example) has fallen 15% or 28% below the pilot setting, the valve will close, and the pump flow will be restored to the hydraulic system.

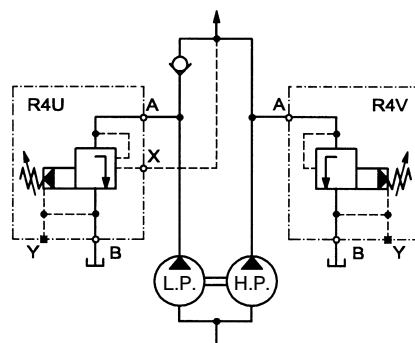
R4U...1/3 = 28%

R4U...5 = 15%

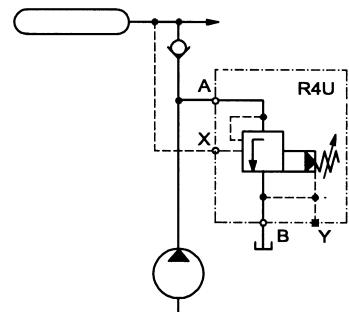
**Note:** The mentioned switching difference values are theoretical and can vary between 12... 15%, respectively between 20... 28%.

### TYPICAL APPLICATIONS

Hydraulic system to vent the low pressure side (L.P.) of double pumps



Accumulator system



## TECHNICAL DATA

### GENERAL

- |   |  |
|---|--|
| <ul style="list-style-type: none"> <li>• Type of unit</li> <li>• Design</li> <li>• Type of mounting</li> </ul>  | Pilot operated unloading valve<br>Poppet type<br>Threaded body<br>Subplate mounting<br>Cartridge |
| <ul style="list-style-type: none"> <li>• Port sizes</li> <li>• Mounting position</li> <li>• Direction of flow</li> <li>• Ambient temperature range</li> <li>• Suitability for special working conditions</li> </ul> | 3/8", 3/4", 1 1/4" nominal<br>optional<br>A→B<br>- 20 ... + 60 °C<br>Consult DENISON             |

### HYDRAULIC CHARACTERISTICS

- |  |  |
|--|--|
| <ul style="list-style-type: none"> <li>• Operating pressure range                             <ul style="list-style-type: none"> <li>- inlet (Port A)</li> <li>- outlet (Port B) min</li> <li style="text-align: right;">max</li> </ul> </li> <li>- Port X</li> <li>- Port Y, Y1</li> <li>• Pressure setting range                             <ul style="list-style-type: none"> <li>- min</li> <li>- max</li> </ul> </li> <li>• Fluid</li> <li>• Fluid temperature range</li> <li>• Viscosity range</li> <li>• Recommended operating viscosity</li> <li>• Contamination level</li> </ul> | 0 ... 350 bar<br>0 bar<br>3.5 bar at internal<br>and 30 bar at external pilot drain<br>0 ... 350 bar<br>without pressure to tank<br>depends on flow (see page 6)<br>up to 350 bar<br>Mineral oil according to DIN 51524/25<br>(other fluids on request)<br>- 18 ... + 80 °C<br>10 ... 650 cSt<br>30 cSt<br>Max. permissible contamination level<br>according to NAS 1638 Class 8 (Class 9<br>for 15 micron and smaller) or ISO 17/14<br>R4U03 (3/8") R4U06 (3/4") R4U10 (1 1/4")<br>60 l/min 200 l/min 450 l/min<br>90 l/min 300 l/min 600 l/min |
| <ul style="list-style-type: none"> <li>• Nominal flow</li> <li>• Max. flow</li> </ul>  | 60 l/min 200 l/min 450 l/min<br>90 l/min 300 l/min 600 l/min   |

### TYPE OF ADJUSTMENT

- |  |   |
|--|---|
| <ul style="list-style-type: none"> <li>• <b>Manual</b></li> <li>• Rotation</li> <li>• Operating torque</li> <li>• <b>Electric</b> (Vent valve VV01)</li> <li>• Nominal voltage</li> <li>• Permissible voltage difference</li> <li>• Max. coil temperature</li> <li>• Type of current</li> <li>• Input power</li> <li>• Holding</li> <li>• Inrush</li> <li>• Relative operating period</li> <li>• Type of protection</li> </ul> | Handwheel<br>3.75 rev.<br>0.72 Nm<br>by solenoid<br>Refer to ordering code page 5<br>+ 5 % ... - 10 %<br>+ 180 °C (temperature class H)<br>Alternating current (AC)<br>Direct current (DC)<br>31 W<br>78 VA<br>264 VA<br>100 %<br>IP 65 |
|--|---|

**If the performance characteristics outlined above do not meet your requirements, please consult your local DENISON Office.**

## ORDERING CODE

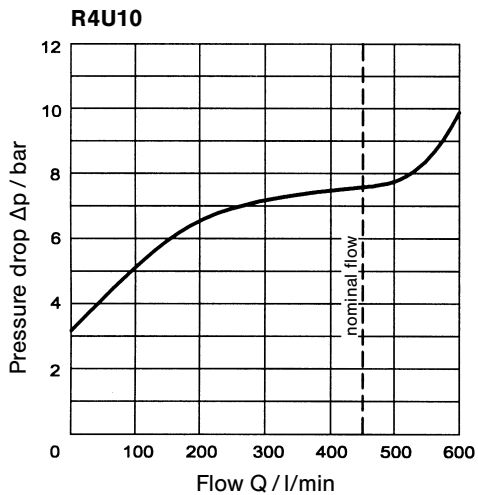
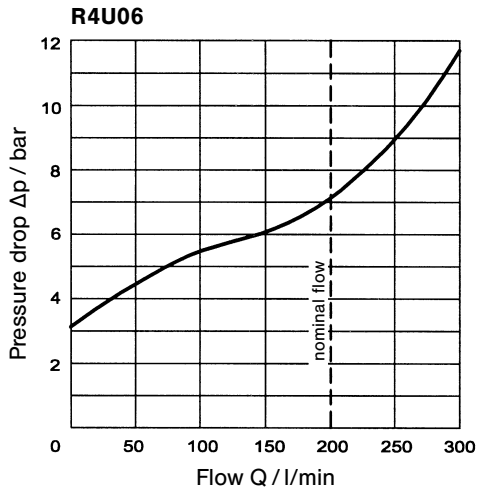
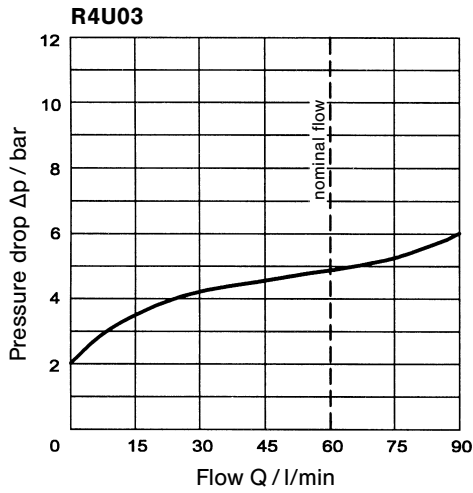
**Model Number:**

	<b>R4U</b>	..	-	.	.	-	.	.	-	..	-	...	-	<b>A</b>	<b>1</b>	-	
<p><b>1 Series</b> R4U = Unloading Valve</p> <p><b>2 Size</b> 03 = 3/8" 06 = 3/4", 1" 10 = 1 1/4"</p> <p><b>3 Max. Pressure</b> 0 = for cartridges only 5 = for body valves only } 350 bar</p> <p><b>4 Body Mounting</b> Cartridge with pilot valve: 0 = without Y1 port G = Y1 port = G 1/4" E = Y1 port = SAE-4 (7/16"-20 UNF) Subplate mounting: 3 = without Y1 port 9 = Y1 port = G 1/4" 7 = Y1 port = SAE-4 (7/16"-20 UNF) Threaded body: 6 = R4U03 = G 1/2" T-body = R4U06 = G 1" T-body D = R4U06 = G 3/4" L-body = R4U10 = G 1 1/4" L-body } X, Y1 ports <sup>1)</sup> = G 1/4" 4 = R4U03 = SAE-8 T-body = R4U06 = SAE-16 T-body B = R4U06 = SAE-12 L-body = R4U10 = SAE-20 L-body } X, Y1 ports <sup>1)</sup> = SAE-4 (7/16"-20 UNF) <small><sup>1)</sup> Port Y1 is only available at <b>Drain line</b> (code 2) external from the pilot head</small></p> <p><b>5 Pressure Setting Range</b> 1 = 7...105 bar (pressure differential nominal 28%) 3 = 7...210 bar (pressure differential nominal 28%) 5 = 7...350 bar (pressure differential nominal 15%)</p> <p><b>6 Type of Control</b> 1 = Hand knob 32 mm dia. 2 = Hand knob 50 mm dia. (not for version with vent valve VV01) 3 = Acorn nut with lead seal 4 = Adjusting device with key lock, key order no. 700-70619-8</p> <p><b>7 Drain Line (Ports Y, Y1)</b> 0 = internal 1 = external from the subplate/manifold (Y) 2 = external from the pilot head (Y1); (not for <b>Body mounting</b> codes 0 or 3)</p> <p><b>8 3-Way Vent Valve VV01</b> 09 = with manual override } Solenoid de-energized: open to tank 10 = without manual override } Solenoid energized: vent line blocked 11 = with manual override } Solenoid de-energized: vent line blocked 12 = without manual override } Solenoid energized: open to tank</p> <p><b>9 Solenoid Voltage and Current</b> W01 = 115 V / 60 Hz } W02 = 230 V / 60 Hz } AC W06 = 115 V / 50 Hz } W07 = 230 V / 50 Hz } G0R = 12 V } G0Q = 24 V } DC G0H = 48 V }</p> <p><b>10 Design Letter</b></p> <p><b>11 Seal Class</b> 1 = NBR-seals (Standard) 4 = EPDM-seals 5 = FPM-seals (Viton®)</p> <p><b>12 Modifications</b></p>	1	2	3	4	5	6	7	8	9	10	11	12	-	-	-	-	-

omit  
for version  
without  
VV01

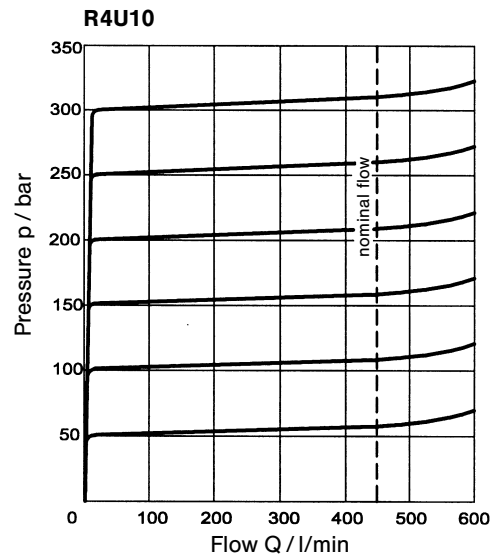
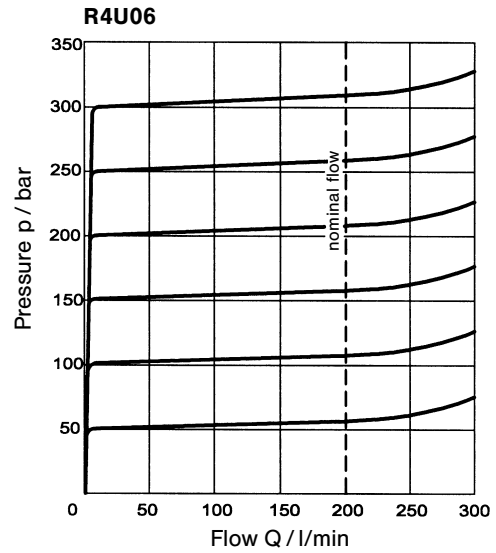
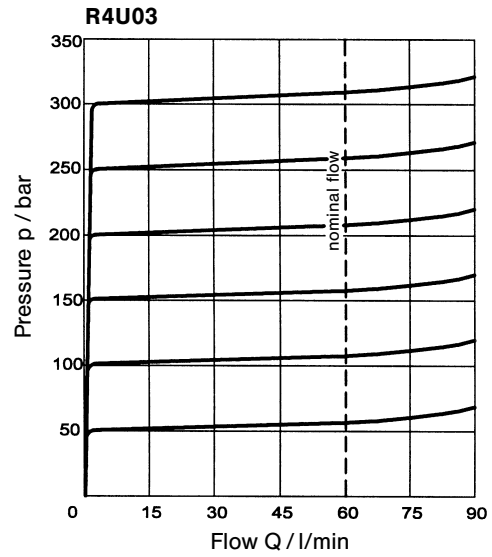
# CURVES

Unloading Function  
free flow P-T



Min. pressure setting  $\geq 4$  bar  
(depending on flow and viscosity).  
Fluid 40 cSt and  $50^\circ\text{C} \pm 0.5^\circ\text{C}$ .

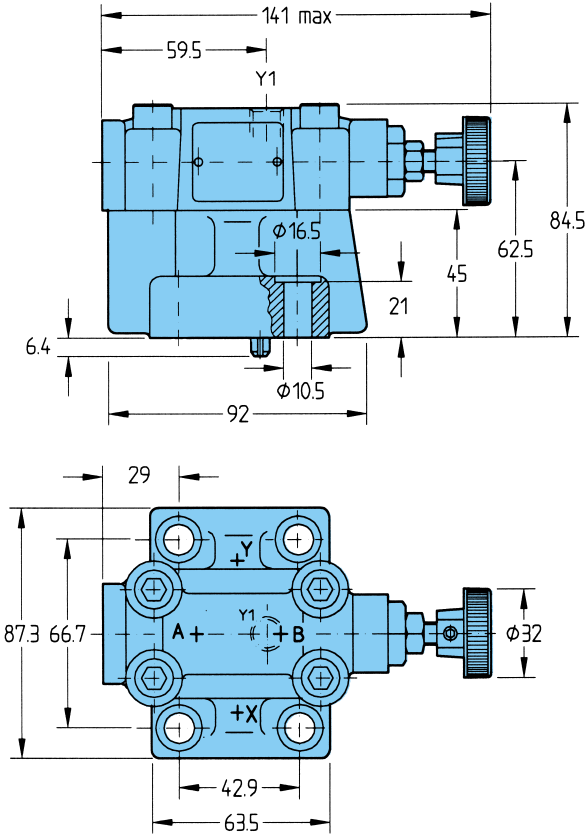
Overridden Pressure Relief Function





## R4U03 (3/8") SUBPLATE MOUNTING

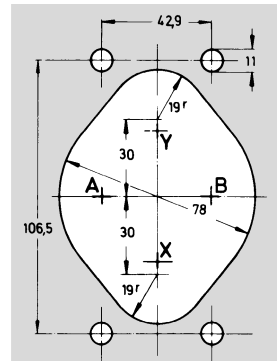
Weight: 2.7 kg



Ports	Function
A	Pressure (inlet)
B	Tank (outlet)
X	Remote control or vent connection
Y (Y1)	external drain <sup>1)</sup>

<sup>1)</sup> optional from pilot head or subplate. Port Y1 is only available at **Drain line** (code 2) external from the pilot head.

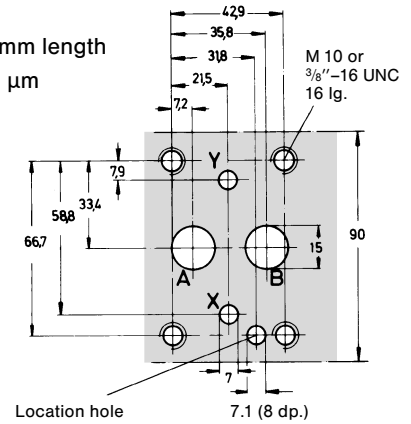
### Panel opening



### Block mounting face

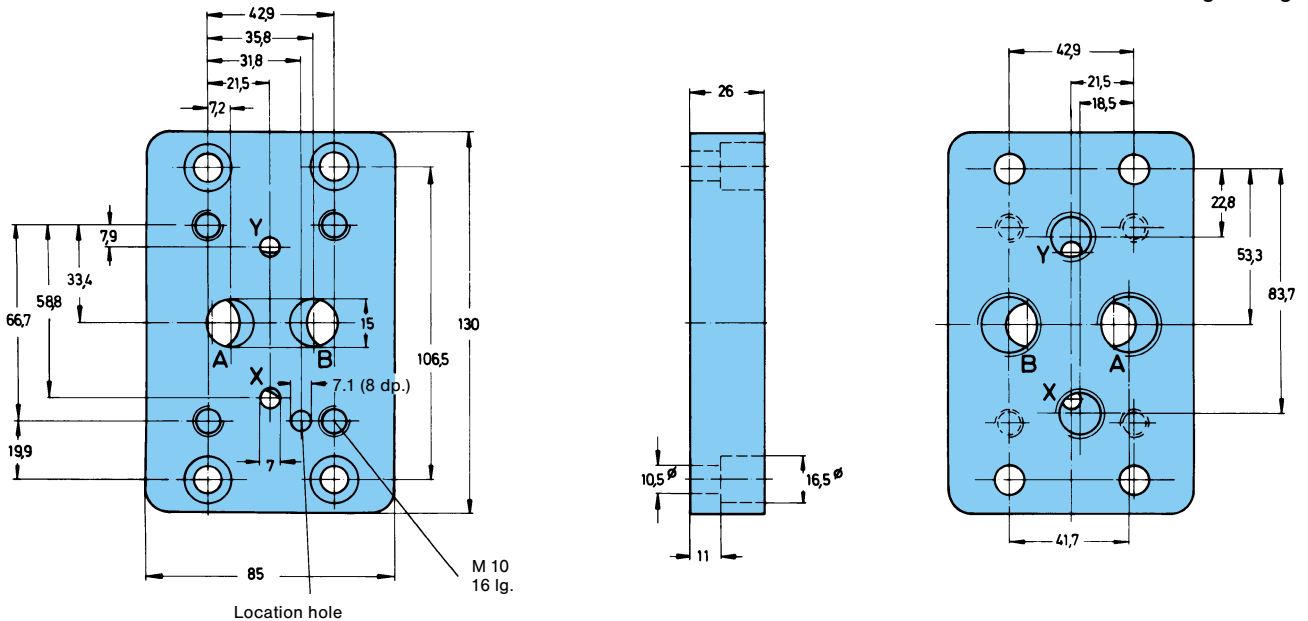
Flatness 0.01 mm / 100 mm length

Surface finish CLA 1.27 µm



## SUBPLATES

Weight: 2 kg



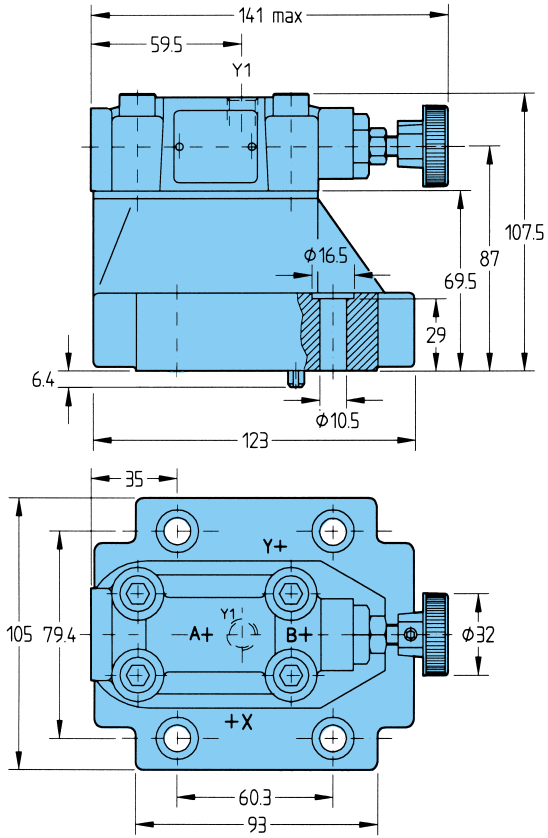
Model No.	Order No.	Port sizes		4 Mounting screws* (Torque 68 Nm)		
		A + B	X + Y	Dimension	Order No.	min. tensile strength
SS-B-08-G 113	S16-63124-0	G 1/2"	G 1/4"	M 10 x 35 DIN 912-12.9	700-70039-8	at p ≤ 210 bar = 100 daN/mm <sup>2</sup> at p > 210 bar = 120 daN/mm <sup>2</sup>

\* Mounting screws are included in subplate order.  
For valves ordered without subplate, mounting screws must be ordered separately.



# R4U06 (3/4") SUBPLATE MOUNTING

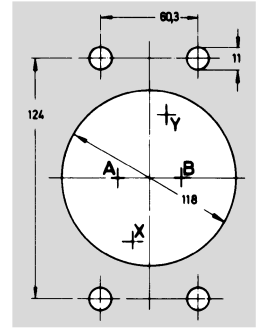
Weight: 4.5 kg



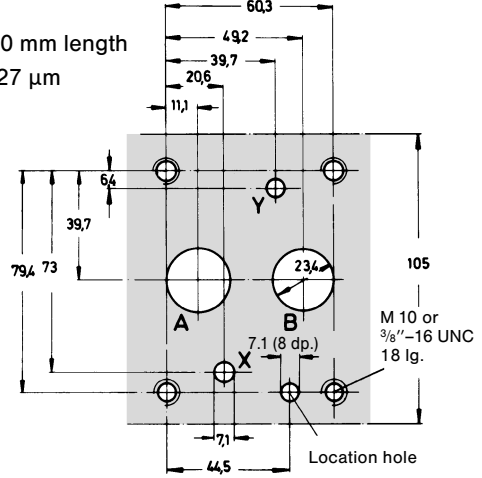
Ports	Function
A	Pressure (inlet)
B	Tank (outlet)
X	Remote control or vent connection
Y (Y1)	external drain <sup>1)</sup>

<sup>1)</sup> optional from pilot head or subplate. Port Y1 is only available at **Drain line** (code 2) external from the pilot head.

## Panel opening

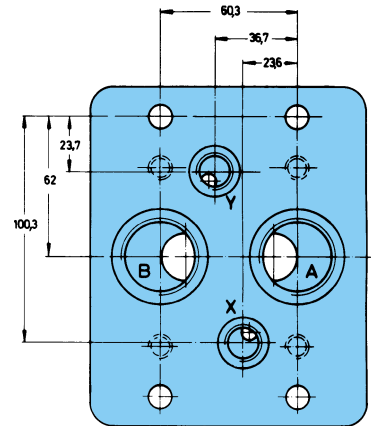
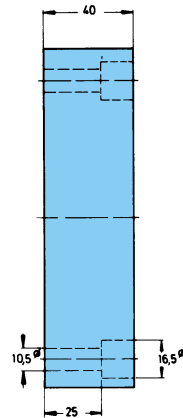
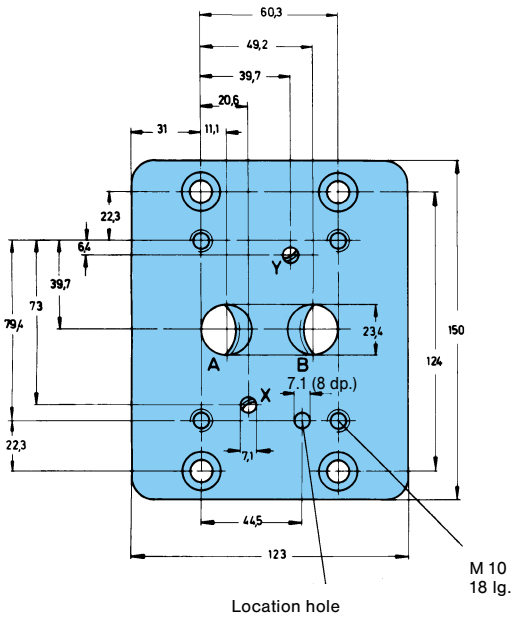


**Block mounting face**  
 Flatness 0.01 mm / 100 mm length  
 Surface finish CLA 1.27 µm



## SUBPLATES

Weight: 4.8 kg

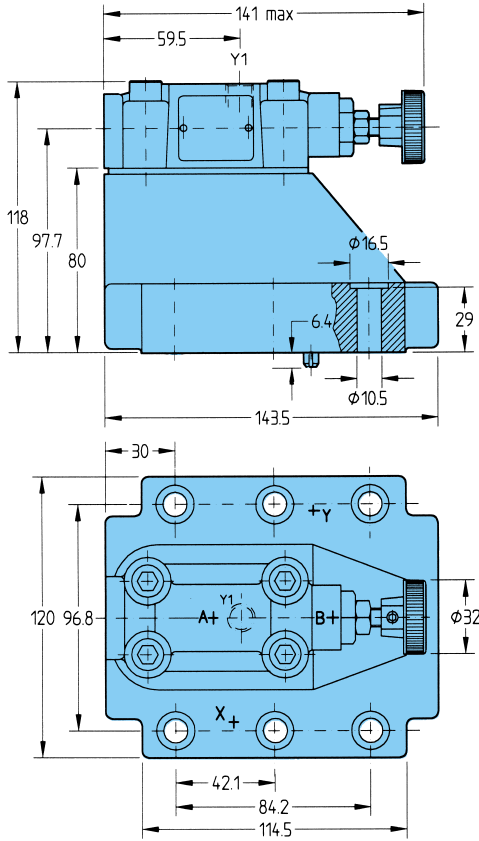


Model No.	Order No.	Port sizes		4 Mounting screws* (Torque 68 Nm)		
		A + B	X + Y	Dimension	Order No.	min. tensile strength
SS-B-16-G 115	S16-39168-0	G 1"	G 1/4"	M 10 x 45 DIN 912-12.9	700-71602-8	at p ≤ 210 bar = 100 daN/mm <sup>2</sup> at p > 210 bar = 120 daN/mm <sup>2</sup>

\* Mounting screws are included in subplate order.  
 For valves ordered without subplate, mounting screws must be ordered separately.

## R4U10 (1 1/4") SUBPLATE MOUNTING

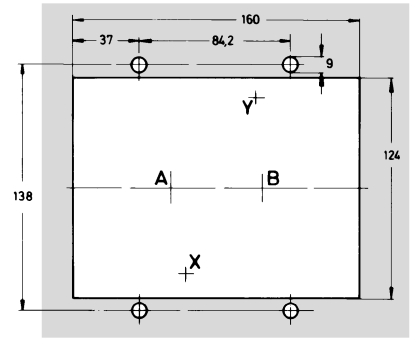
Weight: 6 kg



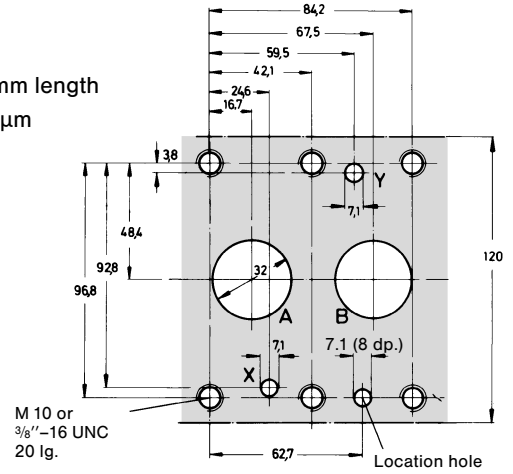
Ports	Function
A	Pressure (inlet)
B	Tank (outlet)
X	Remote control or vent connection
Y (Y1)	external drain <sup>1)</sup>

<sup>1)</sup> optional from pilot head or subplate. Port Y1 is only available at **Drain line** (code 2) external from the pilot head.

### Panel opening

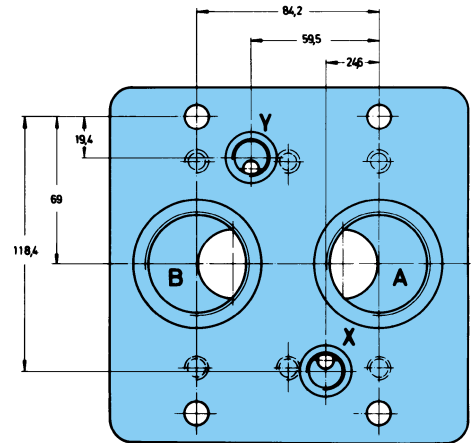
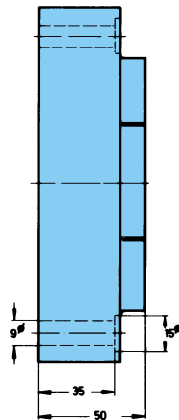
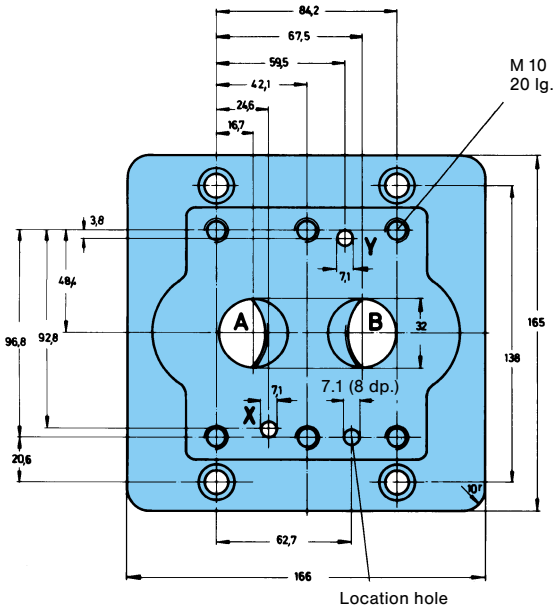


**Block mounting face**  
Flatness 0.01 mm / 100 mm length  
Surface finish CLA 1.27 µm



## SUBPLATES

Weight: 8.5 kg



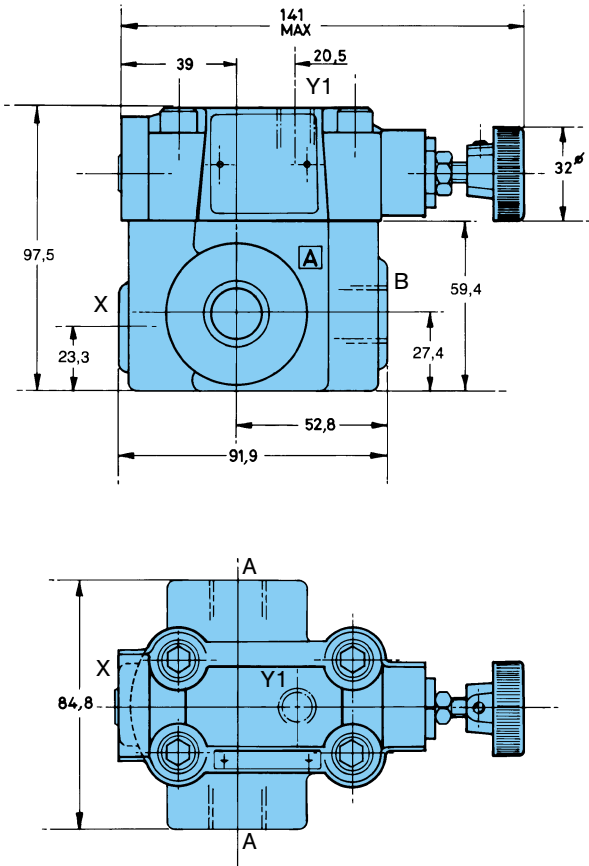
Model No.	Order No.	Port sizes		6 Mounting screws* (Torque 68 Nm)		
		A + B	X + Y	Dimension	Order No.	min. tensile strength
SS-B-24-G 117	S16-39197-0	G 1 1/2"	G 1/4"	M 10 x 45 DIN 912-12.9	700-71602-8	at p ≤ 210 bar = 100 daN/mm <sup>2</sup> at p > 210 bar = 120 daN/mm <sup>2</sup>

\* Mounting screws are included in subplate order.  
For valves ordered without subplate, mounting screws must be ordered separately.

## R4U03 (3/8") – R4U06 (3/4") THREADED BODY

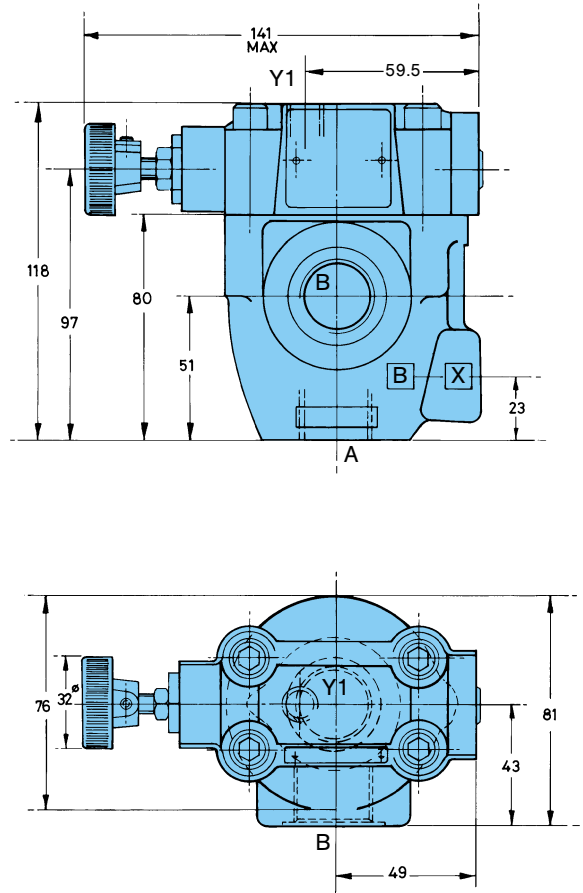
### R4U03 (3/8")

Weight: 3.2 kg



### R4U06 (3/4")

Weight: 3.3 kg

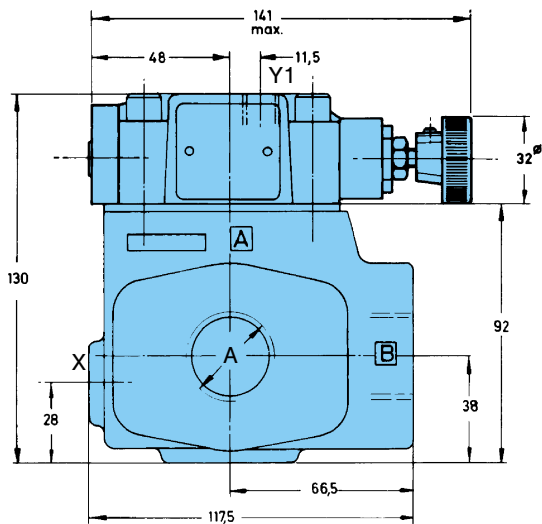


Ports	Function	Port Sizes
A (2)	Pressure (inlet)	G 1/2" or SAE-8 ( 3/4"-16 UNF)
B	Tank (outlet)	G 1/2" or SAE-8 ( 3/4"-16 UNF)
X	ext. remote control or vent connection	G 1/4" or SAE-4 ( 7/16"-20 UNF)
Y1	external drain	G 1/4" or SAE-4 ( 7/16"-20 UNF)

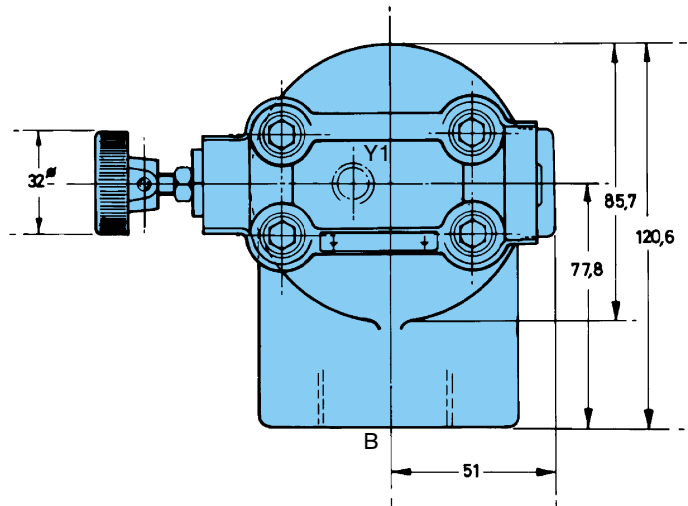
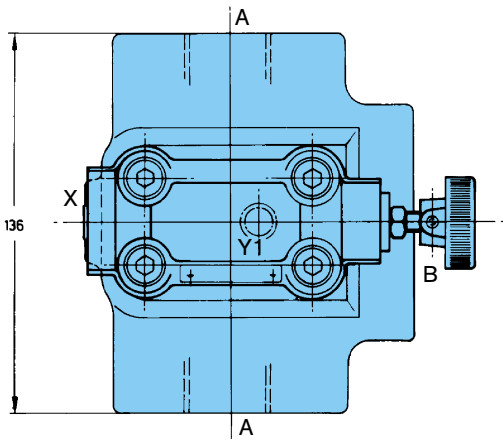
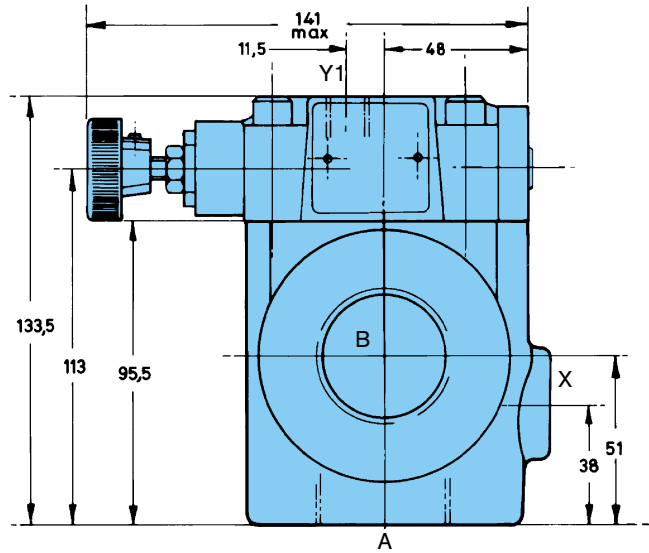
Ports	Function	Port Sizes
A	Pressure (inlet)	G 3/4" or SAE-12 ( 1 1/16"-12 UN)
B	Tank (outlet)	G 3/4" or SAE-12 ( 1 1/16"-12 UN)
X	ext. remote control or vent connection	G 1/4" or SAE-4 ( 7/16"-20 UNF)
Y1	external drain	G 1/4" or SAE-4 ( 7/16"-20 UNF)

## R4U06 (3/4") – R4U10 (1 1/4") THREADED BODY

**R4U06 (1")**  
Weight: 6.6 kg



**R4U10 (1 1/4")**  
Weight: 5.6 kg



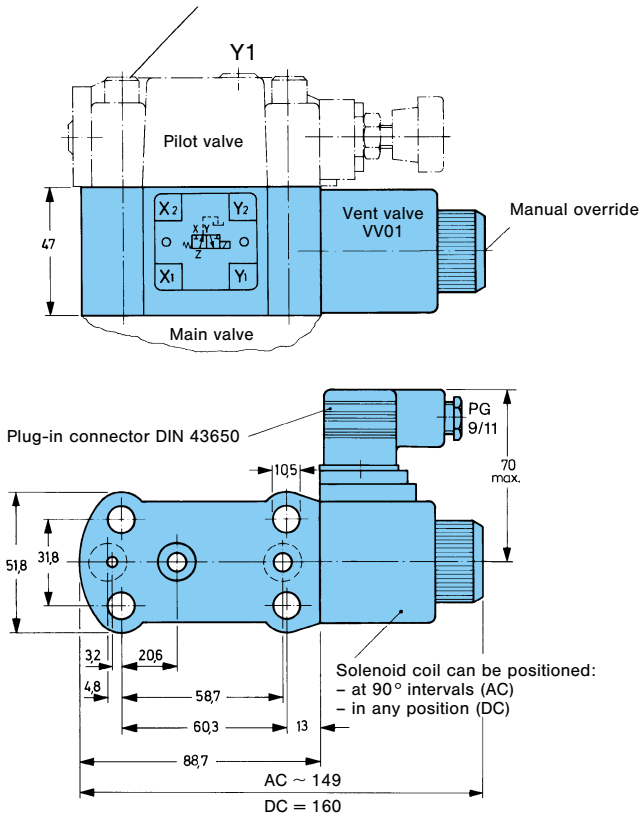
Ports	Function	Port Sizes
A (2)	Pressure (inlet)	G 1" or SAE-16 (1 5/16"-12 UN)
B	Tank (outlet)	G 1" or SAE-16 (1 5/16"-12 UN)
X	ext. remote control or vent connection	G 1/4" or SAE-4 ( 7/16"-20 UNF)
Y1	external drain	G 1/4" or SAE-4 ( 7/16"-20 UNF)

Ports	Function	Port Sizes
A	Pressure (inlet)	G 1 1/4" or SAE-20 (1 5/8"-12 UN)
B	Tank (outlet)	G 1 1/4" or SAE-20 (1 5/8"-12 UN)
X	ext. remote control or vent connection	G 1/4" or SAE-4 ( 7/16"-20 UNF)
Y1	external drain	G 1/4" or SAE-4 ( 7/16"-20 UNF)

## VERSION WITH VENT VALVE VV01

Weight (VV01): 1.7 kg

Screws for additional vent valve installation.  
4 x 3/8"-24 UNF x 3 1/2" lg., order no. 359-15340-0.



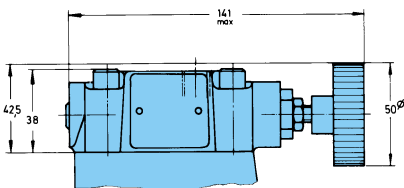
**Symbols:**  
R4U-Unloading Valve with Vent Valve VV01

Code	Internal drain	External drain
11 or 12		
09 or 10		

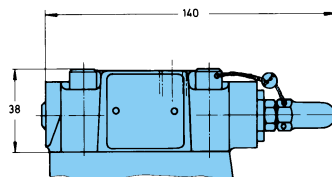
**Note:**  
For full details of the vent valve VV01 refer to bulletin 3-EN 215.

### ADDITIONAL TYPES OF CONTROL

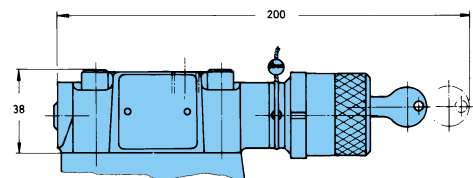
**Type of Control-Code 2**  
Hand knob 50 mm dia.  
(not for version with vent valve VV01)



**Type of Control-Code 3**  
Acorn nut with lead seal



**Type of Control-Code 4**  
Adjusting device with key lock.  
Key must be ordered separately,  
order-no. 700-70619-8



The product described is subject to continual development and the manufacturer reserves the right to change the specifications without notice.