

# DIRECTIONAL CONTROL VALVES CETOP 5/NG10

## INTRODUCTION

The ARON directional control valves NG10 designed for subplate mounting with an interface in accordance with UNI ISO 4401 - 05 - 04 - 0 - 94 standard (ex CETOP R 35 H 4.2-4-05), and can be used in all fields on account of their excellent capacity and pressure specifications.

The use of solenoids with wet armatures means that the construction is extremely functional and safe completely dispensing with need for dynamic seals. The solenoid dust cover is screwed directly onto the valve casing whilst the coil is kept in position by a ring nut.

Great care has been taken in the design and the production of the ducts and the improvement of the spools has allowed relatively high flow rates to be accommodated with minimal pressure drops ( $\Delta p$ ). The operation of the directional valves can be electrical, pneumatic, oleodynamic, mechanical or lever operated .

The centring position is achieved by means of calibrated length springs which, once the action of impulse is over, return the spool to the centre or end travel position.

The solenoids constructed with protection class in accordance with DIN 40050 standards are available in either direct current (IP65) or alternating current (IP66) with different voltage and frequencies.

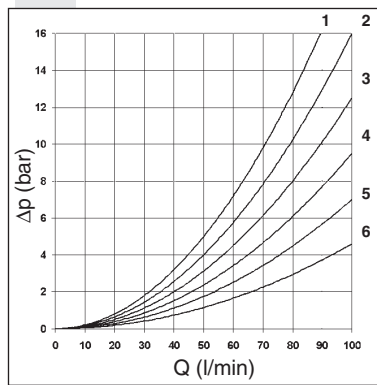
All types of electrical controls can be fitted, on request, with different types of manual emergency controls. The electrical supply takes place through connectors meeting DIN 43650 ISO 4400 standards; connectors are also available with built in rectifier or pilot lights.

The valves are designed for use with DIN 51524 standard hydraulic mineral oils and it is recommended that filters should be fitted to ensure a maximum contamination level of class 10 in accordance with NAS 1638,  $\beta_{25} \geq 75$ .

### CETOP 5/NG10

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## PRESSURE DROPS



The diagram at the side show the pressure drop curves for spools during normal usage. The fluid used is a mineral oil with a viscosity of 46 mm<sup>2</sup>/s at 40°C; the tests have been carried out at a fluid temperature of 40°C.

For higher flow rates than those in the diagram, the losses will be those expressed by the following formula:

$$\Delta p_1 = \Delta p \times (Q_1/Q)^2$$

where  $\Delta p$  will be the value for the losses for a specific flow rate Q which can be obtained from the diagram,  $\Delta p_1$  will be the value of the losses for the flow rate Q<sub>1</sub> that is used.

Spool type	Connections				
	P→A	P→B	A→T	B→T	P→T
01	2	2	5	5	
02	3	3	6	6	3
03	2	2	6	6	
04	3	3	4	4	1
05	3	3	5	5	
06	2	2	5	5	
66	2	2	5	5	
07		1	5		
10	3	3	5	5	
11	4			5	
	Curve No.				

Spool type	Connections				
	P→A	P→B	A→T	B→T	P→T
22		4	5		
14	3	3	6	6	2
15	2	2	4	5	
16	2	2	4	5	
17	3	3			
19	3	3	4	5	
20	3	3	4	5	
21	3	3			
28	3	3	6	6	2
	Curve No.				

**ORDERING CODE**

<b>AD</b>	Directional valve
<b>5</b>	CETOP 5/NG10
<b>*</b>	Type of operator (tab.1)
<b>**</b>	Spools (see tables on page I•30)
<b>*</b>	Mounting type (tab.2)
<b>*</b>	Voltage (tab.3)
<b>**</b>	Variants (tab.4)
<b>2</b>	Serial No.

**TAB.1  
TYPE OF OPERATOR**

<b>E</b>	Electrical
<b>D</b>	Direct mechanical
<b>O</b>	Oleo-pneumatic
<b>L</b>	Lever

**TAB.2  
MOUNTING**

STANDARD	
<b>C</b>	
<b>D</b>	
<b>E</b>	
<b>F</b>	
SPECIALS (WITH PRICE INCREASING)	
<b>G</b>	
<b>H</b>	
<b>I</b>	
<b>L</b>	
<b>M</b>	

**TAB.3 - "E" TYPE OPERATION**

AC VOLTAGE	
<b>A</b>	24V/50Hz
<b>B</b>	48V/50Hz*
<b>J</b>	115V/50Hz - 120V/60Hz
<b>Y</b>	230V/50Hz - 240V/60Hz
<b>E</b>	240V/50Hz*
<b>F</b>	24V/60Hz*
DC VOLTAGE	
<b>L</b>	12V
<b>M</b>	24V
<b>N</b>	48V*
<b>P</b>	110V*
<b>Z</b>	102V*
<b>X</b>	205V*
<b>K</b>	Without AC coils
<b>W</b>	Without DC coils
<b>Z</b>	other controls

115Vac/50Hz 120Vac/60Hz with rectifier
230Vac/50Hz 240Vac/60Hz with rectifier

Voltage codes are not stamped on the plate, their are readable on the coils.

\* Special voltage

• Mounting type **D** is only for valves with detent

• In case of **mounting D** with detent a maximum supply time of 2 sec is needed (only for AC coils).

• The springs for the version with detent (mounting **D**) are different from those for standard versions.

**TAB.4 - VARIANTS**

VARIANT	CODE	◆	PAGE
No variant (without connectors)	S1(*)	◆	
Viton	SV(*)		
Emergency button	ES(*)		I•35
Preset for microswitch - (E/F/G/H only) see below note ◊	MS(*)	◆	I•31- I•34
Rotary emergency button	P2(*)		I•35
Marine version (AD.5.O..)	H1	◆	
Preset for microswitch + Viton	MV	◆	
Spool movement speed control (VDC only) with ø 0.5 mm diameter orifice	5S(*)	◆	I•32
Spool movement speed control (VDC only) with ø 0.6 mm diameter orifice	6S(*)	◆	I•32
Spool movement speed control (VDC only) with ø 0.7 mm diameter orifice	7S(*)	◆	I•32
Spool movement speed control (VDC only) with ø 0.8 mm diameter orifice	8S(*)	◆	I•32
External draining solenoid (electrically operated only)	S5(*)	◆	I•32
Microswitch+ Detent (for lever operation)	MD	◆	
Detent for lever control	D1	◆	

◊ = Maximum counter-pressure on T port: 4 bar      ◆ = Variant codes stamped on the plate

(\*) Coils with Hirschmann connection supplied without connectors. The connectors can be ordered separately, ch. I page 19.

1

TWO SOLENOIDS, SPRING CENTRED "C" MOUNTING			
Spool type		Covering	Transient position
01		+	
02		-	
03		+	
04*		-	
05		+	
66		+	
06		+	
07*		+	
08*		+	
10*		+	
22*		+	
11*		+	
12*		+	
13*		+	
14*		-	
28*		-	

ONE SOLENOID, SIDE A "E" MOUNTING			
Spool type		Covering	Transient position
01		+	
02		-	
03		+	
04*		-	
05		+	
66		+	
06		+	
08*		+	
10*		+	
12*		+	
15		-	
16		+	
17		+	
14*		-	
28*		-	

STANDARD SPOOLS

(\*) Spool with price increasing

• With spools 15 / 16 / 17 only the mounting E / F are possible

• 19 / 20 / 21 spool not planned for AD.5.E...J\*

• For lever operated the spools used are different.

Available spools for this kind of valve are: 01 / 02 / 03 / 04 / 05 / 06 / 66 / 07 / 22 / 13 / 15 / 16 / 17

ONE SOLENOID, SIDE B "F" MOUNTING			
Spool type		Covering	Transient position
01		+	
02		-	
03		+	
04*		-	
05		+	
66		+	
06		+	
08*		+	
10*		+	
22*		+	
12*		+	
13*		+	
07*		+	
15		-	
16		+	
17		+	
14*		-	
28*		-	

TWO SOLENOIDS "D" MOUNTING			
Spool type		Covering	Transient position
19*		-	
20*		+	
21*		+	



## "A16" DC COILS FOR CETOP 5



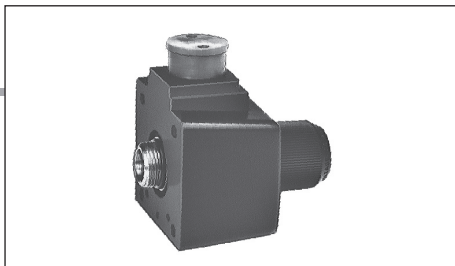
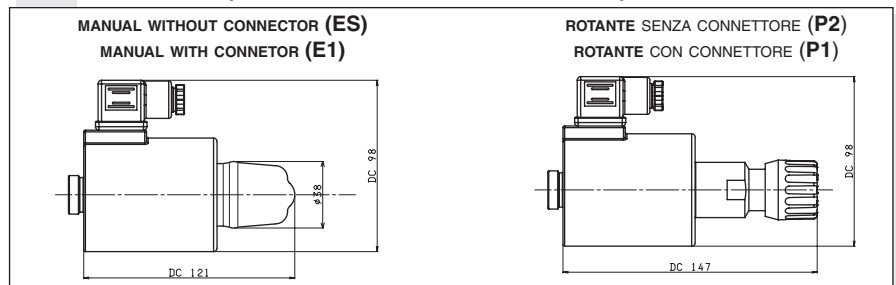
Type of protection (in relation to the connector used)	IP 65
Number of cycles	18.000/h
Supply tolerance	±10%
Ambient temperature	-30°C ÷ 60°C
Duty cycle	100% ED
Insulation class wire	H
Weight	0,9 Kg

1

VOLTAGE (V)	MAX. WINDING TEMPERATURE (AMBIENT TEMPERATURE 25°C)	RATED POWER (W)	RESISTANCE AT 20°C (OHM) ±7%
12V	106°C	45	3,2
24V	113°C	45	12,4
48V*	-	45	-
102V*	-	45	-
110V*	118°C	45	268
205V*	-	45	-

(\*) Special voltage ETA16 - 03/2002/e

### EMERGENCY (COILS WITH HIRSCHMANN CONNECTION)



## "K16" AC SOLENOIDS FOR CETOP 5

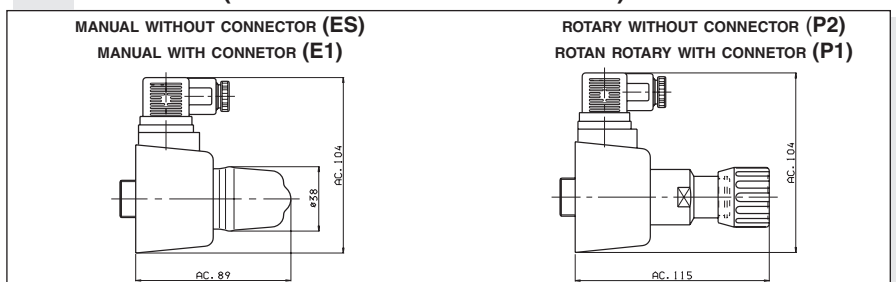


Type of protection (in relation to the connector used)	IP 66
Number of cycles	18.000/h
Supply tolerance	+10% / -10%
Ambient temperature	-54°C ÷ 60°C
Duty cycle	100% ED
Max. pressure static	210 bar
Insulation class wire	H
Weight	0,8 Kg

VOLTAGE (V)	MAX. WINDING TEMPERATURE (AMBIENT TEMPERATURE 25°C)	RATED POWER (VA)	IN RUSH CURRENT (VA)	RESISTANCE AT 20°C (OHM) ±10%
24V/50Hz	134°C	124	454	0.56
24V/60Hz*	115°C	103.5	440	0.55
48V/50Hz*	134°C	113	453	2.10
115V/50Hz-120V/60Hz	121°C - 138°C	-	-	10.8
230V/50Hz-240V/60Hz	121°C - 138°C	-	-	43.0
240V/50Hz*	134°C	120	456	47.39

\* Special voltage ETK16 - 01/2000/e

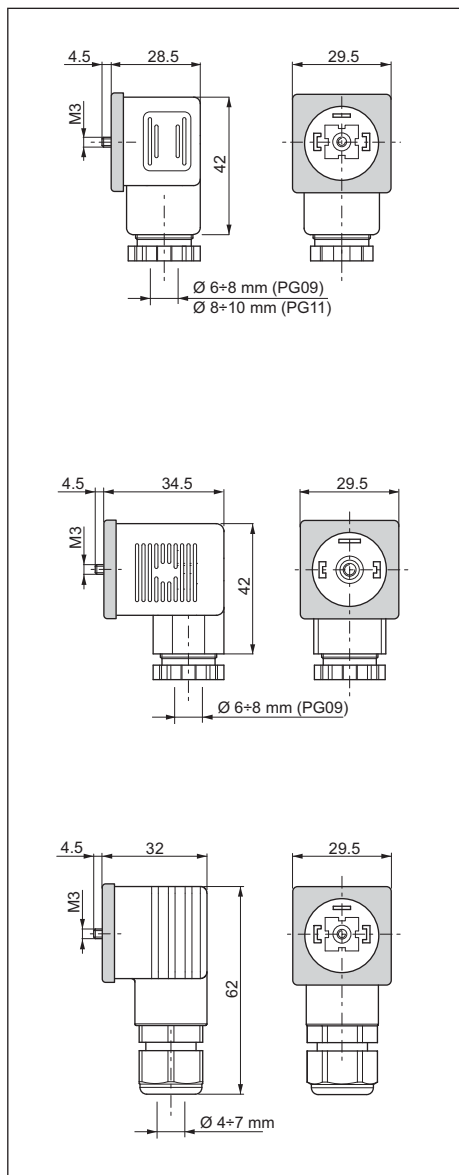
### EMERGENCY (COILS WITH HIRSCHMANN CONNECTION)



# CONNECTORS DIRECTIONAL CONTROL VALVES IN ACCORDANCE WITH DIN 43650/ISO4400



1



Connector	Protection level	Type	Cable gland	Code
Standard	IP65	Black color	PG09	V86 05 0002
		Grey color	PG09	V86 05 0004
		Black color	PG11	V86 05 0006
		Grey color	PG11	V86 05 0008
Lens cover with pilot light (*)	IP65	12 VAC/VDC	PG09	V86 10 0018
		24 VAC/VDC	PG09	V86 10 0012
		115 VAC/VDC	PG09	V86 10 0020
		230 VAC/VDC	PG09	V86 10 0022

Screw tightening torque: 0.60 Nm

Connector	Protection level	Type	Cable gland	Code
With rectifier (*) Inlet voltage 12÷230 VAC Outlet voltage 9÷205 VDC	IP65	Black color	PG09	V86 20 0002
		Grey color	PG09	V86 20 0004
Lens cover with pilot light and rectifier (*) Inlet voltage 12÷230 VAC Outlet voltage 9÷205 VDC	IP65	12 VAC	PG09	V86 25 0018
		24 VAC	PG09	V86 25 0019
		48 VAC	PG09	V86 25 0020
		115 VAC	PG09	V86 25 0021
		230 VAC	PG09	V86 25 0022

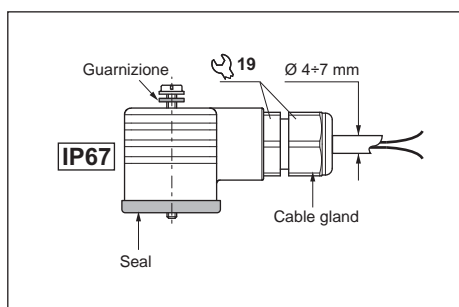
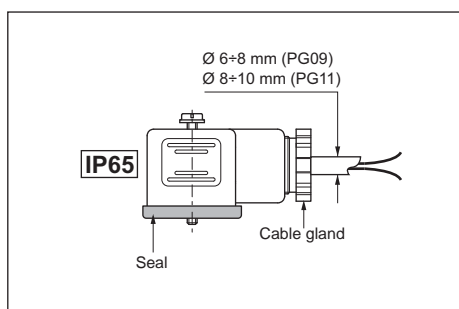
Screw tightening torque: 0.60 Nm

Connector	Protection level	Type	Cable gland	Code
With protection level IP67	IP67	Black color	—	V86 28 0001
		Grey color	—	V86 28 0002

Screw tightening torque: 0.60 Nm

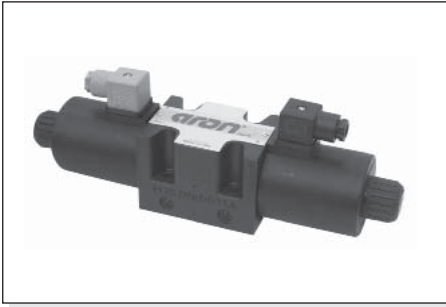
(\*) Don't use for proportional versions

## ELECTRICAL FEATURES OF CONNECTORS



Description	IP65	IP67
AC rated voltage	Max. 250 V	Max. 250 V
DC rated voltage	Max. 300 V	Max. 300 V
Pin contact rated flow	10A	10A
Pin contact max. flow	16A	16A
Max. section cable	1.5 mm <sup>2</sup>	1.5 mm <sup>2</sup>
Cable gland PG09 - M16x1,5	Ø cable 6 ÷ 8 mm	Ø cable 4 ÷ 7 mm
Cable gland PG11 - G 1/2" - M20x1,5	Ø cable 8 ÷ 10 mm	—
Protection level	IP65 EN60529	IP67 EN60529
Insulation class	VDE 0110-1/89	VDE 0110-1/89
Operating temperature	-40°C ÷ 90°C	-20°C ÷ 80°C

The degrees of protection indicate is guaranteed only if the connectors were properly mounted with his original seals.

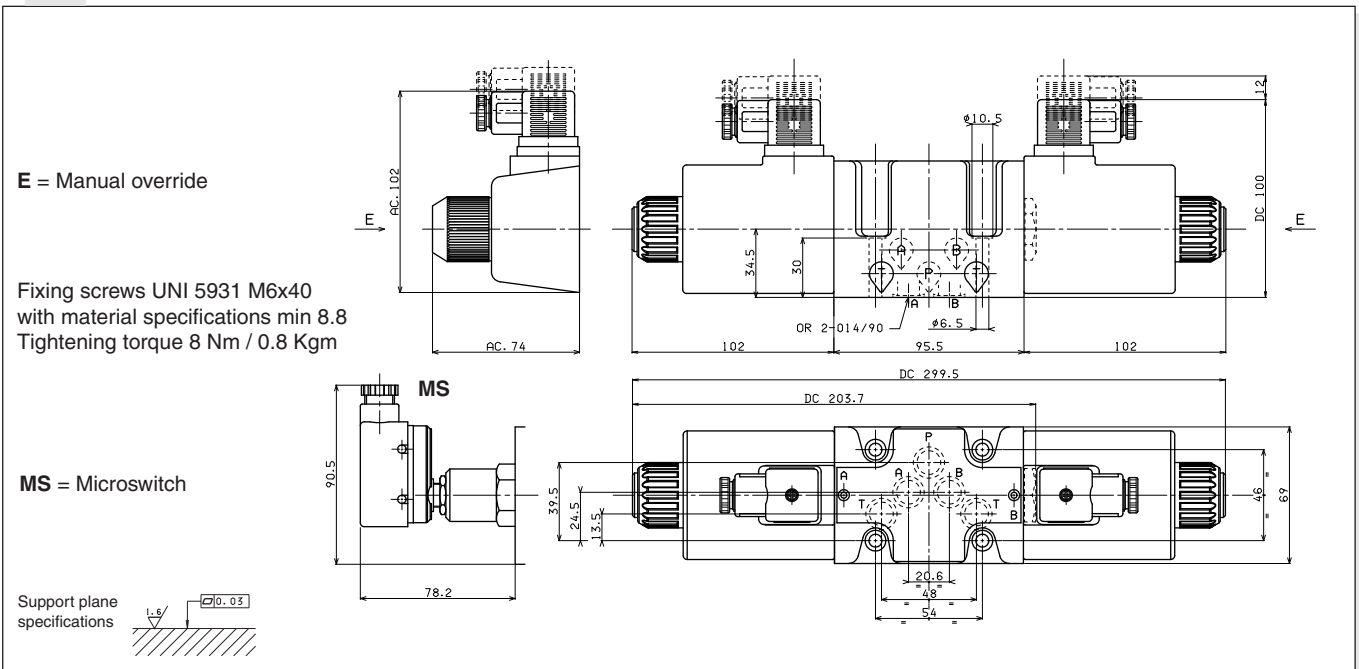


A max. counter-pressure of 4 bar at T is permitted for the variant with a microswitch (MS).

Max. pressure ports P/A/B	350 bar
Max. pressure port T (DC coil) see note (*)	250 bar
Max. pressure port T (AC coil)	160 bar
Max. flow	100 l/min
Max. excitation frequency	3 Hz
Duty cycle	100% ED
Fluid viscosity	10 ÷ 500 mm <sup>2</sup> /s
Fluid temperature	-25°C ÷ 75°C
Ambient temperature	-25°C ÷ 60°C
Max. contamination level	class 10 in accordance with NAS 1638 with filter β <sub>25</sub> ≥ 75
Weight (with one DC solenoid)	4 Kg
Weight (with two DC solenoids)	5,1 Kg
Weight (with one AC solenoid)	3,5 Kg
Weight (with two AC solenoids)	4,3 Kg

(\*) Pressure dynamic allowed for 2 millions of cycles.

OVERALL DIMENSIONS



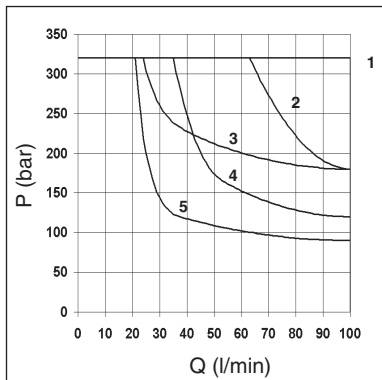
LIMITS OF USE (MOUNTING C-E-F)s

The tests have been carried out with solenoids at operating temperature and a voltage 10% less than rated voltage with a fluid temperature of 40°C. The fluid used was a mineral oil with a viscosity of 46 mm<sup>2</sup>/s at 40°C. The values in the diagram refer to tests carried out with the oil flow in two directions simultaneously T = 2 bar (e.g. from P to A and the same time B to P).

In the cases where valves 4/2 and 4/3 were used with the flow in one direction only, the limits of use could have variations which may even be negative. Rest time: the values are indicative and depend on the following parameters: hydraulic circuit, fluid used and variations in hydraulic scales (pressure P, flow Q, temperature T).

Direct current	Energizing	60 ÷ 95 ms.	Alternating current:	Energizing	12 ÷ 30 ms.
	De-energizing	25 ÷ 70 ms.		De-energizing	10 ÷ 55 ms.

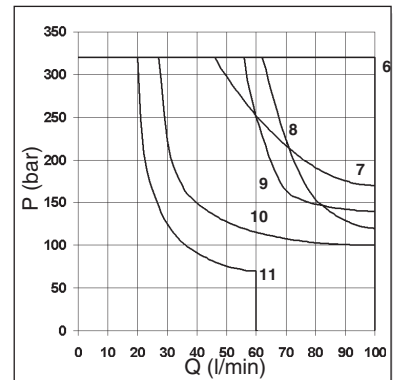
DIRECT CURRENT SOLENOIDS (DC)



Spool type	Solenoids	
	DC	AC
01	1	8
02	1	6
03	2	7
04	4	10
05	1	6
06 - 66	3	9
14-28	5	11
15	3	10
16	1	6

Curves

ALTERNATING CURRENT SOLENOIDS (AC)



# AD.5.E...J\* VALVES WITH SPOOL MOVEMENT SPEED CONTROL VARIANT J\*



1

## Valves type AD5.E... with spool movement speed control.

These ON-OFF type valves are used when a lower spool movement speed than usual for conventional solenoid valves is required to prevent impacts which could adversely affect the smooth running of the system. The system consists of reducing the transfer section for the fluid from one solenoid to the other by means of calibrated orifice.

• This version can only be used with a direct current (DC) and also involves a **reduction in the limits of use so that we suggest to always test the valve in your application.**

- To order AD5.J\* version valves, specify the orifices code.
- The operation is linked to a minimum counter-pressure on the T line (1 bar min.)
- The switching time referred to the spool travel detected by a LVDT transducer can vary for the NG10 valve a minimum of 200 to a maximum of 400 ms depending on 5 fundamental variables:
  - 1) Diameter of the calibrated orifice (see table)
  - 2) Hydraulic power for clearance referring to flow and pressure values through the valve
  - 3) Spool type
  - 4) Oil viscosity and temperature
  - 5) Counter-pressure at T line

• Possible mounting: C / E / F / G / H

• 19 / 20 / 21 spools not planned for AD.5.E...J\*

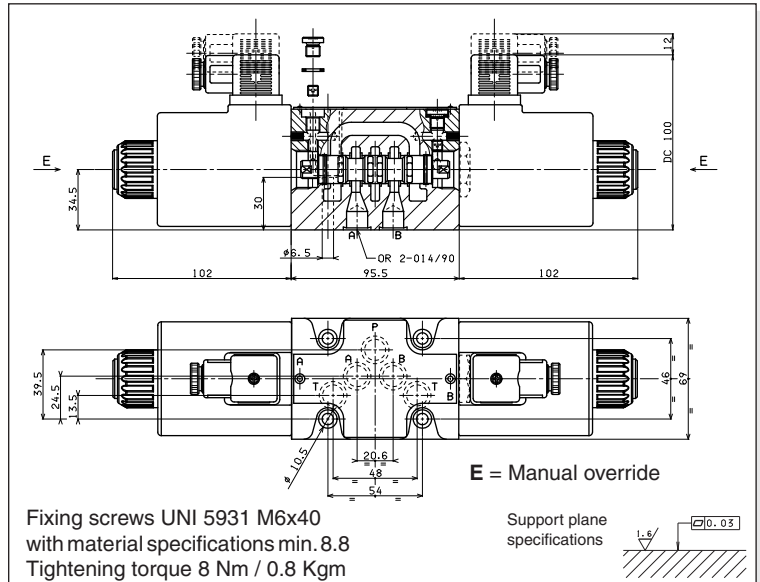
CALIBRATED ORIFICE AVAILABLE		
ø (mm)	M6x6	Code
0.5	M89.10.0031	5S (J5+S1)*
0.6	M89.10.0026	6S (J6+S1)*
0.7	M89.10.0032	7S (J7+S1)*
0.8	M89.10.0033	8S (J8+S1)*

\* Old code

EAD5E...JS - 00/2000/e

Max. pressure ports P/A/B	320 bar
Max. pressure port T - see note (*)	250 bar
Max. flow	100 l/min
Duty cycle	100% ED
Fluid viscosity	10 ÷ 500 mm <sup>2</sup> /s
Fluid temperature	-25°C ÷ 75°C
Ambient temperature	-25°C ÷ 60°C
Weight with one DC solenoid	3,6 Kg
Weight with two DC solenoids	4,5 Kg

(\*) Pressure dynamic allowed for 2 millions of cycles.



# AD.5.E...Q5 VALVES WITH EXTERNAL DRAINING SOLENOID - VARIANT Q5



## Valves type AD5.E...Q5 with external draining solenoid.

This involves valves with solenoid drainage chambers separated by line T in the CETOP 5 interface distinguished by the letter L. This solution makes it possible to operate with a maximum counter-pressure at T up to 320 bar using only 12.9 material fixing screws to ensure the maximum safety of the solenoid valve fixing and use of an additional drain. This version can be used for direct current (DC) and alternating current (AC), but involves a reduction in the limits of usage depending on the pressure at T.

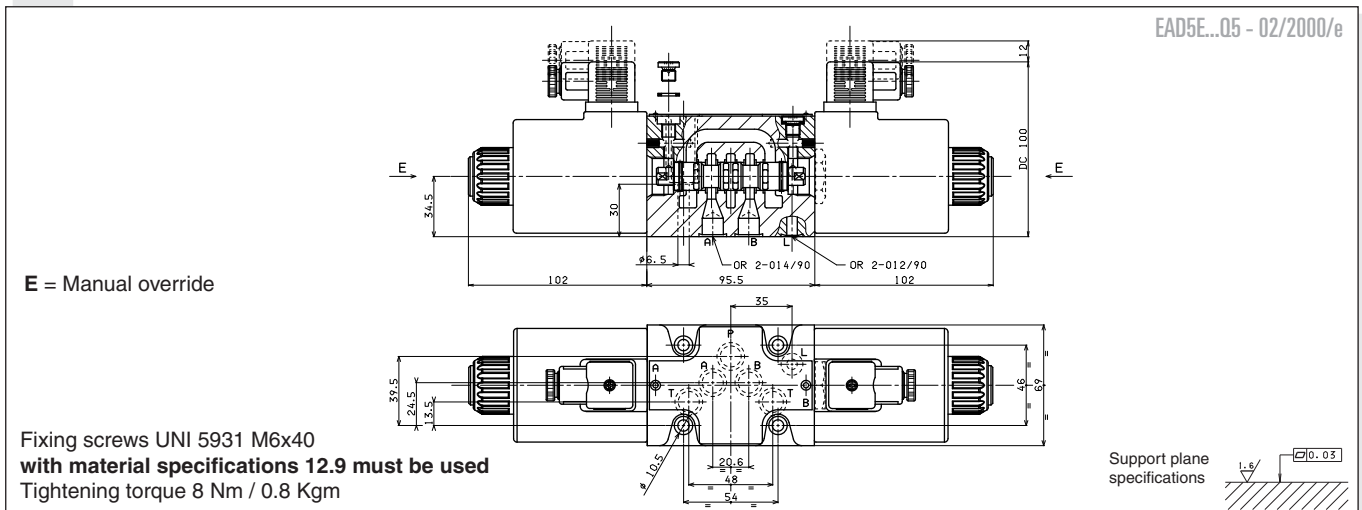
- Mounting possible: C / D / E / F / G / H / I / L / M
- For subplate see BSH.5.31..

Max. pressure ports P/A/B/T	320 bar
Max. pressure port L (DC coils) see note (*)	250 bar
Max. pressure port L (AC coils)	160 bar
Max. flow	100 l/min
Max. excitation frequency	2 Hz
Duty cycle	100% ED
Fluid viscosity	10 ÷ 500 mm <sup>2</sup> /s
Fluid temperature	-25°C ÷ 75°C
Ambient temperature	-25°C ÷ 60°C
Weight with one DC solenoid	3,6 Kg
Weight with two DC solenoids	4,5 Kg
Weight with one AC solenoid	3,5 Kg
Weight with two AC solenoids	4,3 Kg

(\*) Pressure dynamic allowed for 2 millions of cycles.

### OVERALL DIMENSIONS

EAD5E...Q5 - 02/2000/e

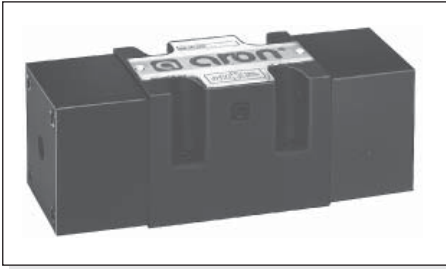




# AD.5.O... OLEO-PNEUMATIC OPERATION TYPE VALVES CETOP 5/NG10



1



Max. pressure ports P/A/B	320 bar
Max. pressure port T	160 bar
Max. flow	100 l/min
Min. operating pressure	4 + [0.027 x (pt*)] bar - see note
Max. operating pressure	200 bar
Fluid viscosity	10 ÷ 500 mm <sup>2</sup> /s
Fluid temperature	-25°C ÷ 75°C
Ambient temperature	-25°C ÷ 60°C
Max. contamination level	class 10 in accordance with NAS 1638 with filter $\beta_{25} \geq 75$
Weight (single pilot)	4,1 Kg
Weight (twin pilot)	5,4 Kg

- Possible mounting: C / D / E / F / G / H / I / L / M
  - Ordering code see page I\*29
- (pt\*) = Pressure at port T

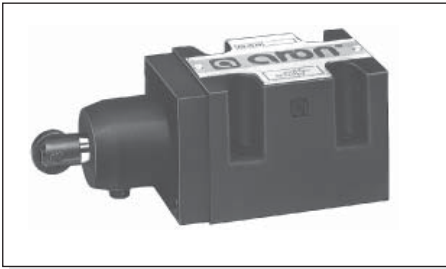
## OVERALL DIMENSIONS

Fixing screws UNI 5931 M6x40 with material specifications min. 8.8  
Tightening torque 8 Nm / 0.8 Kg

Support plane specifications

EAD50 - 02/2000/e

# AD.5.D... DIRECT MECHANICALLY OPERATED TYPE VALVES CETOP 5/NG10



Max. pressure ports P/A/B	320 bar
Max. pressure port T	20 bar
Max. flow	100 l/min
Operating force - see note (*)	8 Kg - see note (**)
Fluid viscosity	10 ÷ 500 mm <sup>2</sup> /s
Fluid temperature	-25°C ÷ 75°C
Ambient temperature	-25°C ÷ 60°C
Max. contamination level	class 10 in accordance with NAS 1638 with filter $\beta_{25} \geq 75$
Weight	3,8 Kg

- Possible mounting: E / F / G / H
- Ordering code see page I\*29
- Notes: (\*) In the absence of counter-pressure at port T
- (\*\*) 10 Kg with a pressure of 20 bar at T

## OVERALL DIMENSIONS

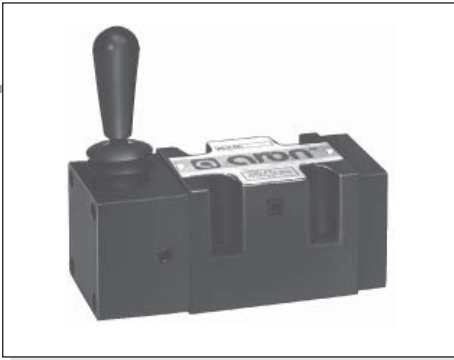
Fixing screws UNI 5931 M6x40 with material specifications min. 8.8  
Tightening torque 8 Nm / 0.8 Kg

Support plane specifications

Stroke 8 mm  
Extra stroke 2 mm  
Working stroke 4 mm

EAD5D - 03/2000/e





# AD.5.L... LEVER OPERATED TYPE VALVES CETOP 5/NG10



Max. pressure ports P/A/B	320 bar
Max. pressure port T	160 bar
Max. flow	100 l/min
Lever angle	2 x 15°
Fluid viscosity	10 ÷ 500 mm <sup>2</sup> /s
Fluid temperature	-25°C ÷ 75°C
Ambient temperature	-25°C ÷ 60°C
Max. contamination level	class 10 in accordance with NAS 1638 with filter $\beta_{25} \geq 75$
Weight	4,7 Kg
Weight with M1 variant	5,35 Kg

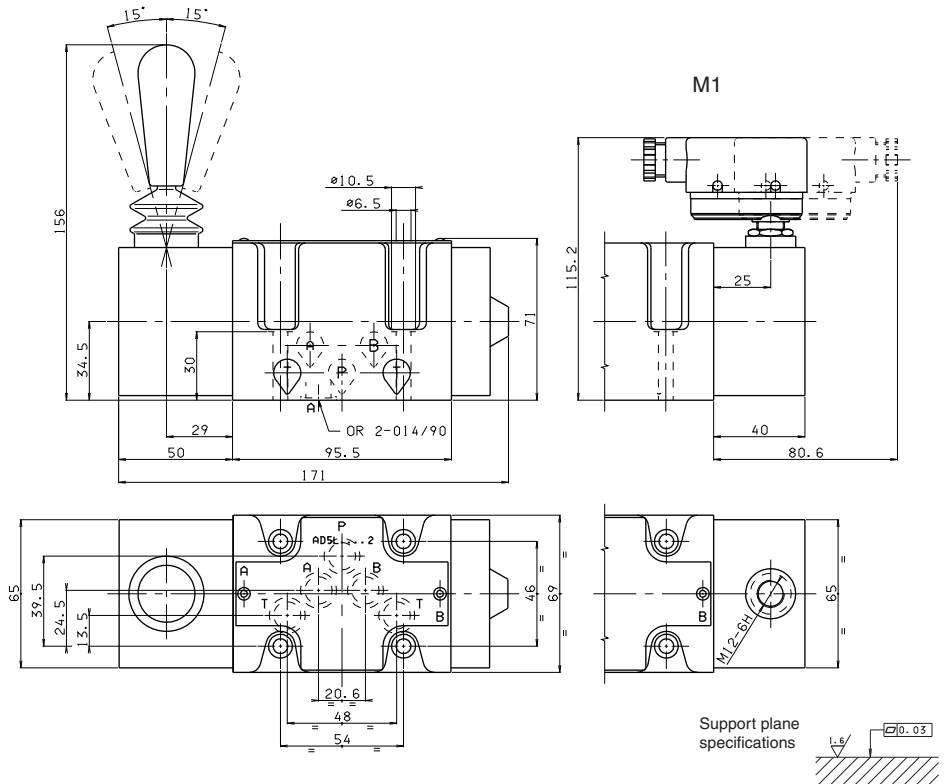
- Possible mounting: **C / E / F**
- There is no **D** type mounting
- The variant **D1** specifies the detent (mechanical connection) for lever operation
- The springs for the version with detent (variant **D1**) are different from those for standard versions.

<b>AD.5.L...</b>	
ORDERING CODE	Ch. I PAGE 29
STANDARD SPOOLS	Ch. I PAGE 30

- Completely different spools are used for these (lever operated) valves than for all other types of operation (e.g. electrical, mechanical, pneumatic operation, .....)
- Available spools: 01 / 02 / 03 / 04 / 05 / 06 / 66 / 07 / 22 / 13 / 15 / 16 / 17 (for hydraulic symbols see page 1•30)
- Available on request NATIONAL AM1107 type microswitch

## OVERALL DIMENSIONS

M1 = Microswitch



Fixing screws UNI 5931 M6x40  
with material specifications min. 8.8  
Tightening torque 8 Nm / 0.8 Kgm