



USER'S GUIDE AND MAINTENANCE REFERENCE FOR ELECTROMECHANICAL PRESSURE AND VACUUM SWITCHES

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1. GENERAL

Pressure/vacuum switches are electro mechanical equipments which send an electric or pneumatic signal as a fixed value of pressure (or negative pressure) is reached. Depending of the using, there are two different types:

1.1 Diaphragm pressure/vacuum switch (M): mechanical type, very sensible, for very low pressures. **1.2 Piston pressure switch (P):** mechanical type, less sensitive but fit for higher pressures.

⚠ WARNING! • A pressure/vacuum switch isn't a safety device!
• Fixing, wiring and settings must be performed by qualified staff, and only after a careful reading of this User's Guide.

2. TECHNICAL DATA

2.1 This User's Guide and Maintenance Reference must be considered an integrating part of the shipment. Always check that the goods received are integral and corresponding to the order. Compare the inscription printed on the label of the equipment, on the order and on the delivery note, issued by FOX s.r.l.; in case of discordance, don't install the instrument on the system but contact immediately FOX Srl.

2.2 Before fixing the equipment, compare technical data shown in Tab. 1 to those printed on the label on the device.

Tab.1

Shaping, material and treatment standards:	Hexagons: Ch. 24 (K4-F4-WF4), Ch. 27 (F3), Ch. 32 (K9). Trivalent zinking steel. Available in (X) AISI 316L and (L) brass.	Square: 30x30 mm (K6-K7-KR6-F5), 40x40 mm (F3S-K5-K51-W3). Anodized aluminium. Available in (X) AISI 316L and (L) nickel plated brass.										
min/MAX (°C) working temperature, TS:	TS -20÷+80 (K4 - F3 - F3S - K6 - KR6 - K7 - K9 - F5 - K5 - K51 - W3 - WF4) Note: Min. and Max. working temperature are the project installation, or the pressurised circuit temperature.	TS -25÷+85 (F4)										
WORKING	K4	F4	F3	F3S	K6-KR6	K7	K9	F5	K5	K51	W3	WF4
Commutation freq. (cycles/min ⁻¹):	90	90	90	90	90	120	120	120	120	120	90	60
Hysteresis (% setting at 20°C – diaph.):	-10	-10	-10	-7	-10	-15	-	-	-	-10	-15	-20
Hysteresis (% setting at 20°C – piston):	-20	-15	-15	-	-15	-15	-15	-15	-15	-	-	-
Intervention precision (% at 20°C):	±5	±4	±4	±3	±4	±3	±2	±3	±2	±2	±7	±15
°Operating point:	3 ³	4 ⁴	4 ⁴	4 ⁴	5 ⁵	5 ⁵	6 ⁶	5 ⁵	3 ³ (P 7)	3 ³ (P 7)	4 ⁴	4 ⁴
Signal condition:	D means setting for lowering pressure; U means setting for rising pressure											
MAX Loading Am at Volt-(AC):	0.5-250	0.5-250	0.5-250	0.5-250	0.5-250	0.5-250	0.5-250	0.5-250	0.5-250	0.5-250	3.0-125	3.0-125
MAX Loading Am at Volt-(DC):	0.25-125	0.25-125	0.25-125	0.25-125	0.25-125	0.25-250	0.25-250	0.25-250	0.25-250	0.25-250	0.25-125	0.25-125
Weight (kg):	0,06	0,05	0,08	0,10	0,20	0,20	0,40	0,15	0,35	0,35	0,10	0,055
Mechanical and electrical life:	Mechanical life is, for all, 10 ⁶ cycles at 70 bar (1000 psi), at 20 °C Electrical life is, for all, inversely proportional to the contacts loading.											
Installation position:	For all: position is non relevant, as soon as the technical room for connection fixing/removing is provided											
	*Note on trigger: 3 ³ External screw; 4 ⁴ Internal screw; 5 ⁵ Internal screw, protected by a safety cap; 6 ⁶ External gear; 7 ⁷ Knob											

Pressure switch - K4						
Regulation range (bar)	Type	MAX PS (bar)	Contact and electrical connection	Hydraulic connection	Body material	
R 0.2÷2.5	M	25	A=NO	0=1/8"BSP	X=AISI 316L	
S 1÷12	M	150	C=NC	1=1/4"BSP	L=Brass	
SM 1÷12	M	150		2=1/8"BSPT	B=Nickel plated brass	
SP 1÷12	P	300		3=M10x1		
T 5÷50	P	300		4=1/8"NPT		
TM 5÷50	M	150	F=6.3mm fast-on end.	5=1/4"NPT		
V 10÷100	P	300	O=screwed conn.	6=1/4"BSPT		
VM 1÷12	M	150				
Z 20÷200	P	300				
Y 50÷400	P	600				

Pressure switch F4						
Regulation range (bar)	Type	MAX PS (bar)	Contact and electrical connection	Hydraulic connection	Body material	
R 0.2÷2.5	M	25		0=1/8"BSP	X=AISI 316L	
S 1÷12	M	150		1=1/4"BSP	L=Brass	
SM 1÷12	M	150		2=1/8"BSPT	B=Nickel plated brass	
SP 1÷12	P	300		3=M10x1		
T 5÷50	P	300		4=1/8"NPT		
TM 5÷50	M	150		5=1/4"NPT		
V 10÷100	P	300		6=1/4"BSPT		
VM 1÷12	M	150				
Z 20÷200	P	300				
Y 50÷400	P	600				

Pressure switch F3						
Regulation range (bar)	Type	MAX PS (bar)	Contact and electrical connection	Hydraulic connection	Body material	
F30 0.2÷2.5	M	10			X=AISI 316L	
F31 1÷10	M	25			L=Brass	
F31M 1÷10	M	150				
F31P 1÷10	P	300	M2=16x16 connector	1/4"BSP Male		
F33 5÷50	P	300	M3=30x30 connector			
F35 10÷100	P	300				
F37 30÷250	P	300				
F39 100÷400	P	600				

Pressure switch F3S						
Regulation range (bar)	Type	MAX PS (bar)	Contact and electrical connection	Hydraulic connection	Body material	
F3S1 0.05÷0.5	M	15		M2=16x16 connector	X=AISI 316L	
F3S2 0.1÷1	M	15		M3=30x30 connector	P=PVC	
F3S3 0.5÷5	M	15				
F3S4 1÷10	M	15				

Pressure switch K6-KR6						
Regulation range (bar)	Type	MAX PS (bar)	Contact and electrical connection	Hydraulic connection	Body material	
K(R)60 0.2÷2	M	25				
K(R)61 1÷15	M	200			B=Nickel plated brass	
K(R)63 4÷40	P	300	M3=30x30 conn.	1/4"BSPT Male		
K(R)6415÷150	P	300	M12=M12 conn.			
K(R)6525÷250	P	300				

Pressure switch K7						
Regulation range (bar)	Type	MAX PS (bar)	Contact and electrical connection	Hydraulic connection	Body material	
K71 1÷12	M	25			X=AISI 316L	
K73 5÷50	P	300	M4=conn. by light signal	1/4"BSP Male		
K75 15÷150	P	350				
K77 30÷300	P	400				

Pressure switch K9						
Regulation range (bar)	Type	MAX PS (bar)	Contact and electrical connection	Hydraulic connection	Body material	
K93 2÷40	P	200				
K94 5÷100	P	300				
K95 20÷200	P	400				
K97 30÷300	P	600	M3=30x30 conn.	1/4"BSP Male		
K99 40÷400	P	600				

Pressure switch F5						
Regulation range (bar)	Type	MAX PS (bar)	Contact and electrical connection	Hydraulic connection	Body material	
F53 5÷50	P	300				
F55 15÷150	P	350				
F57 30÷300	P	400				

Pressure switch K5						
Regulation range (bar)	Type	MAX PS (bar)	Contact and electrical connection	Hydraulic connection	Body material	
K53 2÷40	P	200				
K54 5÷100	P	300				
K55 20÷200	P	400	M4=conn. by light signal	1/4"BSP Female	40x40mm Anodized aluminium	
K57 30÷300	P	500				
K59 40÷400	P	600				

Pressure switch K51						
Regulation range (bar)	Type	MAX PS (bar)	Contact and electrical connection	Hydraulic connection	Body material	
K51.1 0.2÷2	M	12			X=AISI 316L	
K51.2 0.5÷5	M	15				
K51.3 1÷15	M	15	M4=conn. by light signal	1=1/4"BSP Female	40x40mm Anodized aluminium	
K51.4 3÷15	M	20				

Vacuum switch W3						
Regulation range (bar)	Type	MAX PS (bar)	Contact and electrical connection	Hydraulic connection	Body material	
W31-0.05÷-0.5	M	10	P2=fast-on endings	1/4"BSP Female	X=AISI 316L	
W32-0.15÷-0.8	M	10	M2=16x16 conn. M3=30x30 conn.		40x40mm Anodized aluminium	

Vacuum switch WF4						
Regulation range (bar)	Type	MAX PS (bar)	Contact and electrical connection	Hydraulic connection	Body material	
WF4 -0.1÷-0.8	M	10	M2=16x16 conn. M3=30x30 conn.		1=1/4"BSP Female 2=1/8"BSPT Female 3=M10x1	X=AISI 316L L=Brass - If missing, means zinc-plated carbon steel

3. COMPATIBILITY AND TECHNICAL DATA OF ELASTOMERS AND GASKETS

3.1 During the assembling, always protect the elastomer (if present) with grease.

3.2 Hereunder the table of fluids compatibility and the min/MAX temperatures of the standard gaskets supplied by FOX s.r.l.

⚠ WARNING!

- Never try to repair gaskets
- Replace gaskets after five operating years
- Before disposing of gaskets, verify the leaking cause. Perhaps the problem is different.
- Elastomers are special non toxic littering.

Tab. 2

FOX s.r.l. SYMBOL	ISO SYMBOL	ELASTOMER DESCRIPTION	ELASTOMERS TEMP. RANGE	FLUIDS COMPATIBILITY
-	NBR	Acrylonitrile, Butadiene	-40°C ÷ +120°C	Very good resistance to mineral and animal fats and oils, aliphatic hydrocarbons. Resistant to alkali. Not suitable for use with amines, ketones, esters, benzene ethers, chloridated solvents and concentrated acids.
E	EPDM	Ethylene-Propylene Diene	-30°C ÷ +110°C	Very good resistance to heat, atmospheric agents; long life and good performance. Very good compatibility with acids, alcohols, ketones and esters. Bad resistance to oils and fats.
T	PTFE	Polytetrafluorethylene (Teflon®)	-50°C ÷ +150°C	Very good resistance to heat and to almost any chemical aggression; not suitable for use with dichlorobenzene, dietilamine, fluorite, gold cyanide, vaseline.
V	FPM	Fluorine elastomer (Viton®)	-20°C ÷ +140°C	Very good resistance to heat, oils and silicon-based fats, aliphatic and dying hydrocarbons, gasoline, diesel, vinegar, phenol, chloride, nitric and sulfuric acids, cleaners, ethylene glycol, plating solutions.

NOTE: Min and max limits of temperature are shown in Tab.1 as min/MAX (°C) **working temperature, TS.** The temperature supported by elastomer will always be equal or higher than the equipment one. For detailed information on chemical compatibility between fluids and elastomers, write to Manufacturer, FOX s.r.l. communicating the exact symbol of the fluid in use and the working temperature.

4. CONNECTIONS WIRING

4.1 All the connections satisfy DIN 43650 Directions. The wiring must be performed by clean hands (not grease stained), by qualified staff, in a clean room; after fixing, check with a tester the signal quality; protect contacts with specific silicon based grease; tighten the screw; always leave slightly loosen the threads in the connector and tighten the cable clamp.

4.2 In the following table are shown the detailed projects of two standard connections used commonly by FOX s.r.l.

Fig. 1

P2 ELECTRICAL CONN.	M2 ELECTRICAL CONNECTION	M3 ELECTRICAL CONNECTION	EXPLODE FOR CONNECTIONS TYPE M2 AND M3

NOTE: Electrical protection according to DIN 40050 Directions - IP54 with protection cap for P2, IP65 for M2 and M3.

5. EQUIPMENT FIXING

5.1 The gasket seat (side implantation) must be void of defaults: rust free surface and integral thread. Apply some grease for elastomers and screw the equipment in its place side installation (see table aside, Tightening coupling). The use of a dynamometric key becomes capital with less resistant material, as aluminium, brass and AISI 316. Always use recommended tools to prevent warrant exclusion.

5.2 The same procedure must be used in presence of adaptors male-, female- or flange-connected.

	TIGHTENING COUPLING (Nm)		
MATERIALS	10x1	1/8"	1/4"
Steel	20	20	30
AISI 316	15	15	20
Brass	7.5	7.5	15
Aluminium	6.2	6.2	12.5

- Tightening coupling values change depending of the thread width, not on thread type: the loading difference due to thread type is meaningless, while it's relevant depending of the used material.
-Always take into account a ±10% tolerance on the values shown.

FEMALE CONN.	MALE CONN.	K7 AND K9 ADAPTER

Fig. 2

FOX s.r.l. can supply on demand many hydraulic adaptors, even upon Customer's project. As these items may vary considerably, the matter won't be discussed in this Handbook, but all details are explained in the drawing that Manufacturer sends for approval.

6. PRESSURE TEST (PT)

6.1 Before joining the connection to the equipment, it's highly recommended to produce an hydraulic test to verify that the equipment body is installed correctly on the plant. The necessary pressure, PT, according to the ruling Directive, is calculated as $PT=PS \text{ (bar)} \times 1.43$, where PS means plant max. admissible pressure, and 1.43 is the minimum coefficient shown by 2014/68/UE Directive. Two can be the fluid leaking reasons:

Leaking through the equipment thread (external leaking); in this case, check if the equipment is correctly tightened, the bearing seat is free from manufacturing scraps and the gasket is insert in its place.

Leaking through the diaphragm/piston (internal leaking); in this case, contact as soon as possible the Manufacturer, to obtain the replacement of the product under warranty. Don't try to repair or manipulate the instrument, as this could cause the warranty withdrawal.

7. LINK CONNECTOR - PRESSURE/VACUUM SWITCH

7.1 Check that contacts are clean and rust free: they must appear metal colored and polished; during the insertion, the connector should not be forced, and it should enter thoroughly in its seat. At this moment tighten the screw in the center of the connector: the pressure switch is now installed and linked.

8. SETTING OF ELECTROMECHANICAL PRESSURE SWITCHES

Fig. I When electrical connectors 16x16 and 30x30 (called M2, M3) are placed at the top of the equipment, the setting can be performed removing the fixing screw of the connector, and introducing in the hole a **2mm hexagonal spanner** which will locate the **setting grub screw** put inside of the equipment.

Fig. II For series K9, the setting can be performed turning clockwise the anodized aluminum gear to increase, and anti-clockwise to decrease the value. For all other mechanical pressure switches by FOX s.r.l., the setting of the operating point can be performed working on a knob, a screw or a grub screw put on the top of the equipment.: turning clockwise, the pre-loading of the spring increases, while it decreases when turning anti-clockwise.

Each mechanical pressure switch has its own regulation range. The equipment works at its best when the setting value is in the central part of the range.

8.1 Check by a tester the signal quality. For a longer electrical life, it's strongly recommended to supply a steady voltage rating and to keep always an eye to the data shown in Tab. 1 (WORKING); it's important to not exceed them.

8.2 Temperature and ageing of the equipment affect the intervention precision; this condition can compromise the repetition of the settled signal. It's recommended to perform a fine setting at full rating, and to replace the equipment when the intervention precision exceeds the tolerance percentage shown in Tab. 1 (Working).

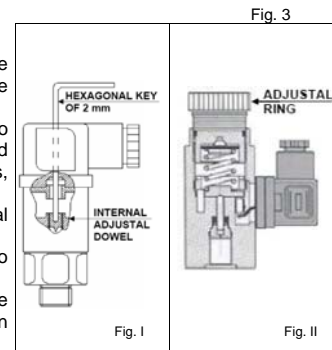


Fig. 3

9. MAINTENANCE

There's no need of maintenance. In case of shock or breaking, the Manufacturer supplies technical assistance and spare parts; contact in writing the FOX s.r.l. Post-Sale Assistance. It's strongly recommended to use only original spare parts.

10. GUARANTEE

The product is under warranty, provided that all preceding conditions are met. The Manufacturer cannot be held responsible for accidental damage to persons, animals or goods caused by improper or irresponsible use of the equipment.