Alco Controls

Electrical Control Valves EX4/5/6/7/8 Series

Technical Bulletin

ALCO Controls **EX4 / EX5 / EX6 / EX7 / EX8** are stepper motor driven valves for precise control of refrigerant mass flow in air conditioning, refrigeration, heat pumps, close control, and industrial process cooling applications.
The Control Valves can be used as thermo-expansion duty, liquid injection duty, hot gas bypass, evaporator pressure regulator, crank-case pressure regulator, head pressure regulator, or liquid level control.

EX4 /EX5 / EX6

EX7

EX8

Features

- Multifunction as expansion valves, hot gas bypass, suction gas throttling, head pressure, liquid level actuator etc.
- Fully hermetic design
- Applicable to all common refrigerants (HCFC, HFC) and for subcritical CO_2 applications
- Stepper motor driven
- Short opening and closing time
- Very fast full stroke time
- High resolution and excellent repeatability
- Bi-flow versions with positive shut-off in both flow directions
- Positive shut-off function to eliminate the use of an additional solenoid valve
- Linear flow capacity
- Extremely wide capacity range (10 … 100%)
- Continuous modulation of mass flow, no stress (liquid hammering) in the refrigeration circuit
- Direct coupling of motor and valve for high reliability (no gear mechanism)
- Ceramic slide and port for accurate flow and minimal wear
- Balanced force design
- Corrosion resistant stainless steel body and connections
- Europe patent No. 0743476, USA patent No. 5735501, Japan patent No. 28225789

Selection table

Type	Part No.	Flow pattern	Capacity range	Inlet connection	Outlet connection	Electric connector
EX4-I21	800 615	Uni-flow	10 … 100%	3/8” ODF	5/8” ODF	M12 plug
EX4-M21	800 616			10 mm ODF	16 mm ODF	
EX5-U21	800 618			5/8” (16 mm) ODF	7/8” (22 mm) ODF	
EX6-I21	800 620			7/8” ODF	1-1/8” ODF	
EX6-M21	800 621			22 mm ODF	28 mm ODF	
EX7-I21	800 624			1-1/8” ODF	1-3/8” ODF	
EX7-M21	800 625			28 mm ODF	35 mm ODF	
EX8-M21	800 629			42 mm ODF	42 mm ODF	
EX8-U21	800 630			1-3/8” (35 mm)	1-3/8” (35 mm)	
EX8-I21	800 631			1-5/8” ODF	1-5/8” ODF	
EX4-U31	800 617	Bi-flow (Heat pump)		5/8” (16 mm) ODF	5/8” (16 mm) ODF	
EX5-U31	800 619			7/8” (22 mm) ODF	7/8” (22 mm) ODF	
EX6-I31	800 622			1-1/8” ODF	1-1/8” ODF	
EX6-M31	800 623			28 mm ODF	28 mm ODF	
EX7-U31	800 626			1-3/8” (35 mm)	1-3/8” (35 mm)	

EX4/5/6/7/8 are delivered without cable/connector assembly (order separately).

Cable and connector assembly

Type	Part No.	Temperature	Length	Connector type to valve	Connector type to driver board or controller	Illustration
EXV-	804 663	-50 … +80°C	1.5 m	M12	Loose wires	
EXV-	804 664		3.0 m			
EXV-	804 665		6.0 m			

Nominal capacities as expansion valves and liquid injection valves kW (10% … 100%)

Valve Type	R 407C	R 22	R 134a	R 404A	R 410A	R 23	R 124	R 744
EX4	2 ... 17.4	2 ... 16.5	1 ... 12.8	1 ... 11.5	2 ... 19.3	2 ... 17.8	1 ... 9.2	3 ... 33.5
EX5	5 ... 53	5 ... 50	4 ... 39	4 ... 35	6 ... 58	5 ... 54	3 ... 28	10 ... 102
EX6	15 ... 126	15 ... 120	10 ... 93	10 ... 84	15 ... 140	13 ... 130	7 ... 67	24 ... 244
EX7	35 ... 347	35 ... 330	25 ... 255	25 ... 230	40 ... 385	-	-	70 ... 670
EX8	100 ... 925	90 ... 880	70 ... 680	60 ... 613	100 . 1027	-	-	180 . 1789

Note 1: EX Bi-flow versions are not released for use with R124 and R23 refrigerants.
Note 2: EX Bi-flow versions have identical capacity in both flow direction.
Note 3: Emerson SELECT program is available for selection of valves for other operating conditions.

Overview of working pressure regardless of applied refrigerant type

Valve type	Flow pattern	Maximum working pressure PS	Factory test pressure PT
EX4, EX5, EX6, EX7	Uni-flow/Bi-flow	60 bar	66 bar
EX8	Uni-flow	45 bar	49.5 bar

Nominal capacities as hot gas bypass regulator, kW

Valve Type	Kv, m^3/h	R 22/R 407C	R 134a	R 404A/R 507
EX4	0.21	4.9	3.4	4.6
EX5	0.68	16	11	15
EX6	1.57	37	26	35
EX7	5.58	131	92	126
EX8	16.95	399	278	382

Remarks: Bi-flow versions are not released for hot gas flow applications.
The valve must be installed with motor downward for life expectancy.

Nominal capacities as suction pressure regulator (evaporator or crankcase), kW

Valve Type	Kv, m^3/h	R 407C	R 22	R 134a	R 404A
EX6	1.57	3.9	4.1	3.1	3.5
EX7	5.58	14	15	11	13
EX8	16.95	42	45	34	38

Remarks: Bi-flow versions are not released for use below -40°C.
The valve must be installed with motor downward for life expectancy.

Nominal capacities as condensing pressure regulator and liquid duty, kW

Valve Type	Kv, m^3/h	R 407C	R 22	R 134a	R 404A
EX5	0.68	18	20	18	13
EX6	1.57	43	46	42	30
EX7	5.58	153	162	151	106
EX8	16.95	463	491	458	323

Nominal capacities for hot gas flow such as heat reclaim application, kW

Valve Type	Kv, m^3/h	R 22 / R 407C	R 134a	R 404° / R 507	R 410A
EX6	1.57	11	9	10	13
EX7	5.58	39	33	36	47
EX8	16.95	119	101	108	144

Remarks: Bi-flow versions are not released for hot gas flow applications.
The valve must be installed with motor downward for life expectancy.

The nominal capacity is based on the following conditions:

Refrigerant	Evaporating temperature	Condensing temperature	Subcooling	Pressure Drop **(For suction duty)**	Pressure drop **(For liquid duty)**	Pressure drop **(For hot gas flow duty)**	Isentropic efficiency **(For hot gas flow duty)**
R 22, R 134a, R 404A, R 410A	+4°C	+38°C	1K	0.15 bar	0.35 bar	0.5 bar	80%
R 407C	+4°C dew point	+38°C bubble +43°C dew point					
R 124	+20°C	+80°C					
R 23	-60°C	-25°C					
R 744	-40°C	-10°C					

Technical data

CE marking EX4/EX5/EX6: EX7/EX8:	 not required required, Cat I, Module A
Compatibility (not released for use with inflammable refrigerants)	HCFCs, HFCs, CO_2 Mineral and POE lubricants
MOPD (maximum operating pressure differential)	EX4/EX5/EX6: **40** bar EX7: **35** bar EX8: **30** bar
Max. working pressure, PS	EX4/5/6/7: **60** bar EX8: **45** bar
Ambient temperature Storage temperature	-40 to +55°C -40 to +70°C
Medium temperature range Bi-flow version: Uni-flow version	 TS: -40 to +80°C TS: -50 to +100°C
Salt spray test	non-corrosion stainless steel body
Humidity	5 to 95% r.H.
Connections	ODF stainless steel fittings

Protection accordance to IEC 529, DIN 40050	IP67 with Alco supplied cable connector assembly
Vibration for non-connected and fastened valve	4g (0 to 1000 Hz, 1 octave /min.)
Shock	20g at 11 ms 80g at 1 ms
Net weight (kg)	0.5 kg (EX4), 0.52 kg (EX5), 0.60 kg (EX6), 1.1 kg (EX7), 1.5 kg (EX8)
External leakage	≤ 3 gram / year
Seat leakage	Positive shut-off better than solenoid valves
Accessories	See table on page 2
Package and delivery (individual)	without electrical connector

Electrical data

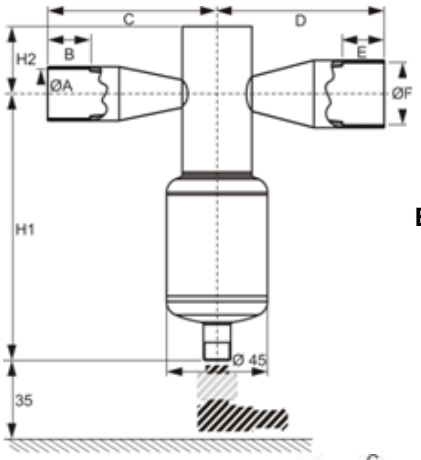
Stepper motor type	Bi-polar, phase current by chopper control (constant current)
Electrical connection	4 pin terminal via plug
Reccom. driver supply	24 VDC (nominal)
Driver supply voltage range	18 … 36 VDC
Phase current, operating	EX4/EX5/EX6: 500mA max, -10% EX7: 750mA ±10% EX8: 800mA ±10%
Holding current	EX4/EX5/EX6: 100mA EX7: 250mA EX8: 500mA
Nominal input power per phase	EX4/EX5/EX6: 3.5W EX7/EX8: 5W

Phase inductance	EX4/EX5/EX6: 30 mH ± 25% EX7: 20 mH ± 25% EX8: 22 mH ± 25%
Step mode	2 phase full step
Step angle	1.8° per step ± 8%
Stepping rate	500Hz
Total number of steps	EX4/EX5/EX6: 750 full steps EX7: 1600 full steps EX8: 2600 full steps
Winding resistance per phase	EX4/EX5/EX6: 13Ohm ±10% EX7: 8Ohm ±10% EX8: 6Ohm ±10%
Full travel time	EX4/EX5/EX6: 1.5 seconds EX7: 3.2 seconds EX8: 5.2 seconds
Reference position	Mechanical stop at fully close position

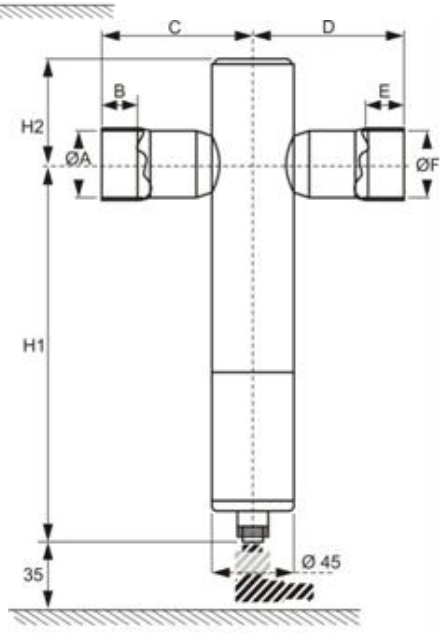
Dimensions (mm)

Valve Type	B	C	D	E	H1	H2
EX4-I21	8	45	55	11	113	25
EX4-M21	8	45	55	11	113	25
EX4-U31	11	55	55	11	113	25
EX5-U21	11	55	65	16	113	25
EX5-U31	16	65	65	16	113	25
EX6-I21	16	65	75	19	113	25
EX6-M21	16	65	75	19	113	25
EX6-I31	19	75	75	19	113	25
EX6-M31	19	75	75	19	113	25
EX7-I21	20	77.5	82.5	23	157	42
EX7-M21	20	77.5	82.5	23	157	42
EX7-U31	23	82.5	82.5	23	157	42
EX8-M21	20	80	80	20	200	56
EX8-U21	20	80	80	20	200	56
Ex8-I21	20	80	80	20	200	56

Ø A / Ø F see selection table



EX4/5/6/7



EX8