



Quick Response Expansion Valve (QREV) and Precision Superheat Controller (PSHC) Product Bulletin

Introduction

The Quick Response Expansion Valve (QREV) and the Precision Superheat Controller (PSHC) together are a compact, electronic, closed loop, rapid response superheat control solution for refrigeration and HVAC applications.

The QREV is next generation electronic expansion valve (EEV) technology, and provides maximum evaporator efficiency by quickly reaching the preferred superheat. The QREV includes a silicon-based microelectromechanical system (MEMS) pilot valve that responds to a signal from the PSHC and pilots a smooth gliding spool valve that regulates refrigerant flow through the QREV, virtually eliminating valve wear and extending valve life. You can order QREVs in several capacity ranges.

The PSHC is an electronic superheat controller that provides precise control to the QREV through varying load conditions. You install the PSHC on a pressure port at the evaporator outlet. The PSHC uses an internal pressure sensor and an external temperature sensor to control the QREV flow and maintain the preferred superheat at the evaporator outlet. The PSHCs are currently set up to control one of 18 approved refrigerants for easy commissioning.

Figure 1: QREV, PSHC, and wiring harness



Features and benefits

Quick response valve

Provides rapid precision control of evaporator outlet superheat.

Silicon-based MEMS technology and smooth-action spool valve

Reduces valve wear and extends valve life.

Closed loop solution

Simplifies installation and commissioning without the need for a front-end or supervisory controller.

Modbus® Remote Terminal Unit (RTU) compliant subordinate device

Provides remote monitoring and adjustment on modbus networks.

Compact solution

Use in limited-space applications.

Applications

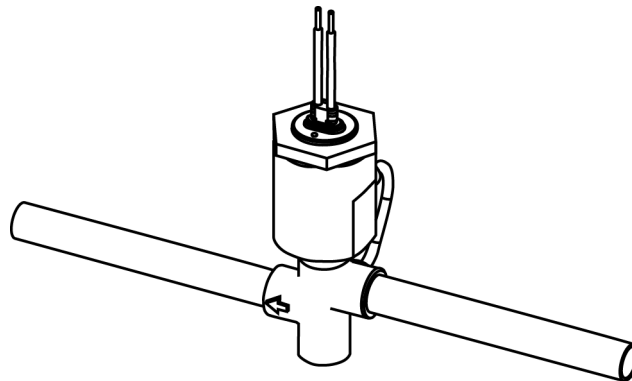
- **Important:** Use the Quick Response Expansion Valve (QREV) and Precision Superheat Controller (PSHC) only as an operating control. Where failure or malfunction of the valve and controller could lead to personal injury or property damage to the controlled equipment or other property, additional precautions must be designed into the control system. Incorporate and maintain other devices, such as supervisory or alarm systems or safety or limit controls, intended to warn of or protect against failure or malfunction of the QREV and PSHC.
- **Important:** Utiliser ce Quick Response Expansion Valve (QREV) et Precision Superheat Controller (PSHC) uniquement en tant que dispositif de contrôle de fonctionnement. Lorsqu'une défaillance ou un dysfonctionnement du QREV et PSHC risque de provoquer des blessures ou d'endommager l'équipement contrôlé ou un autre équipement, la conception du système de contrôle doit intégrer des dispositifs de protection supplémentaires. Veiller dans ce cas à intégrer de façon permanente d'autres dispositifs, tels que des systèmes de supervision ou d'alarme, ou des dispositifs de sécurité ou de limitation, ayant une fonction d'avertissement ou de protection en cas de défaillance ou de dysfonctionnement du QREV et PSHC.

The QREV and the PSHC replace electronic expansion valves (EEVs) and standard thermostatic expansion valves (TEV/TXVs) in commercial refrigeration and HVAC applications.

The QREV and the PSHC form a closed loop solution that does not require any additional controller so that you can install and commission it easily. The QREV and the PSHC provide rapid response superheat control through varying load conditions.

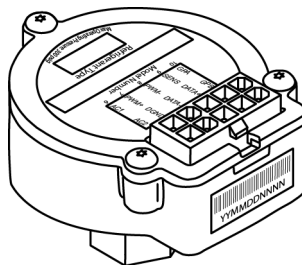
The QREV is compact and lightweight. Install the QREV at the evaporator coil inlet just like an EEV or standard TXV.

Figure 2: QREV



Install the PSHC at the evaporator coil outlet. It has a standard 1/4 inch SAE internal flare fitting with integral Schrader® depressor. The PSHC has an internal pressure sensor and a microprocessor that you connect to a temperature sensor on the wiring harness at the evaporator outlet. You connect the PSHC, temperature sensor, and QREV together with the wiring harness. See Figure 4. Each PSHC model is factory-set to operate with one of 18 approved refrigerants.

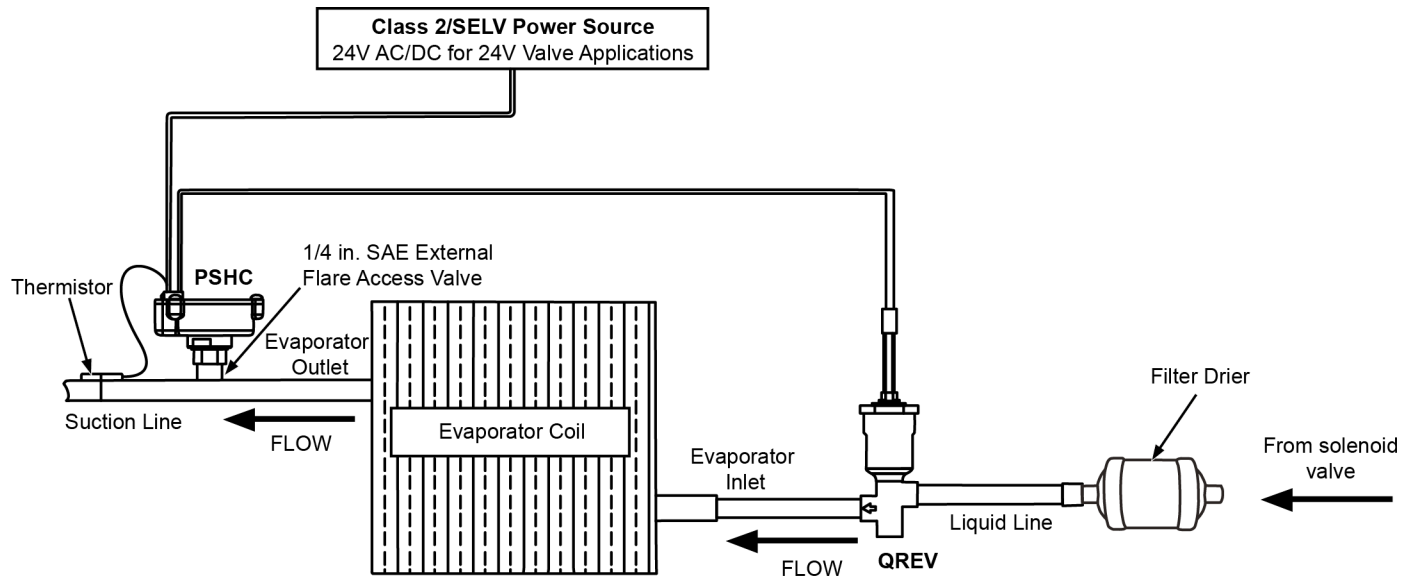
Figure 3: PSHC



You can use the QREV and PSHC for HVAC and refrigeration systems that use any of the approved refrigerants in Table 3. At the specified conditions, the nominal capacity of available QREV models is listed in Table 3 and Table 4.

For the QREV and PSHC dimensions, see [Physical features and dimensions](#). For detailed information about ordering the QREV and PSHC, see [Ordering information](#).

Figure 4: QREV and PSHC installed on a typical evaporator



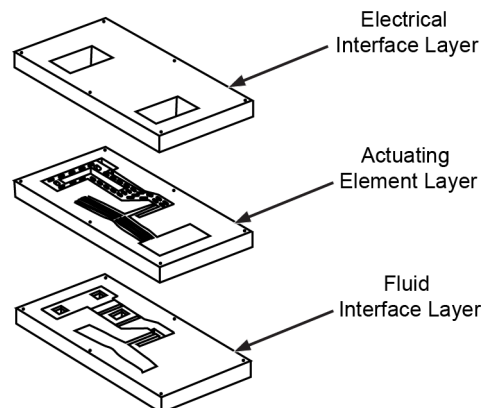
Operation

The PSHC senses both temperature and pressure at the evaporator outlet and calculates the actual superheat sensed at the outlet. Because the sensed superheat value varies away from the user-selected superheat value, the PSHC modulates the electronic signal to the QREV.

The QREV has an electronically actuated, silicon-based MEMS pilot valve that receives the electronic signal and then provides a proportional command pressure to the spool valve. See Figure 5.

The spool valve uses feedback pressure to balance the command pressure, and the spool position is determined by the balance between these two pressures. The spool position in the valve body determines the size of the main spool valve orifice and the refrigerant volume that flows through the QREV.

Figure 5: Microelectromechanical system layers



Physical features and dimensions

Figure 6: QREV01-QREV05 type valve dimensions, mm (in.)

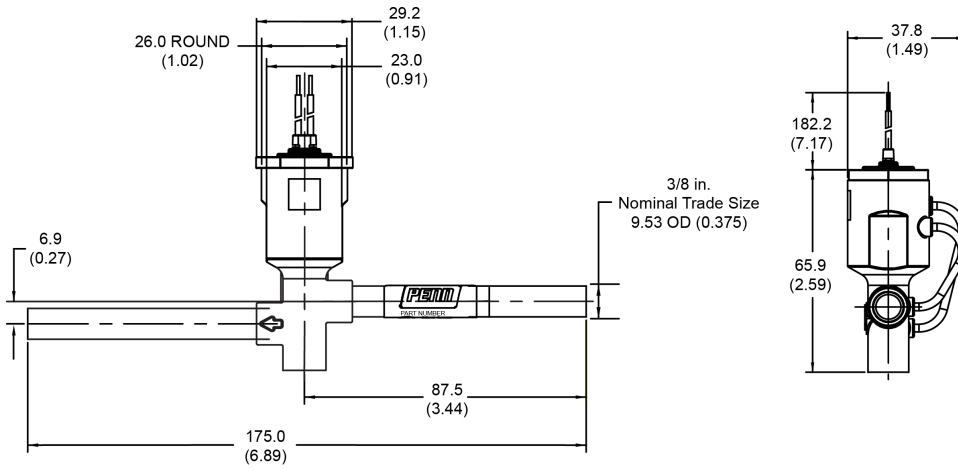


Figure 7: QREV06-QREV08 type valve dimensions, mm (in.)

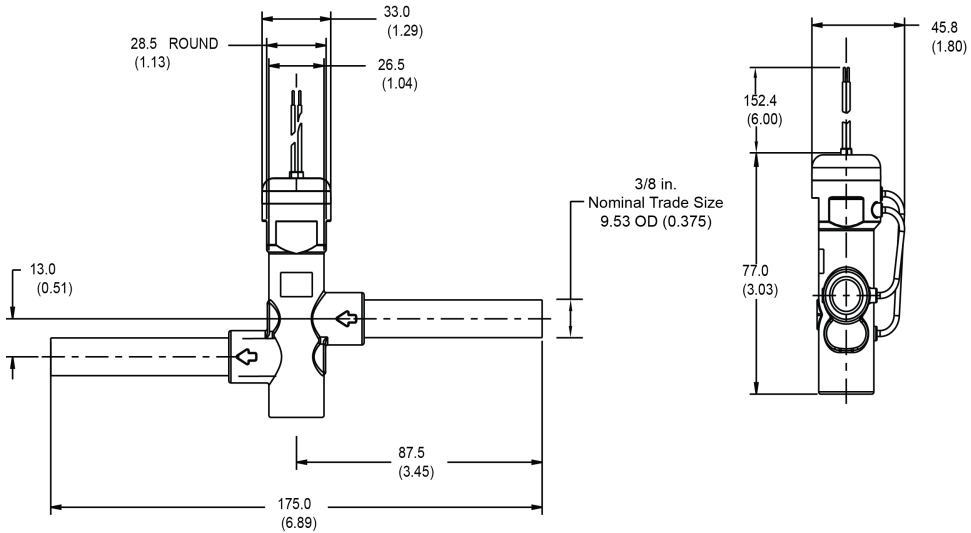


Figure 8: QREV09-QREV15 type valve dimensions, mm (in.)

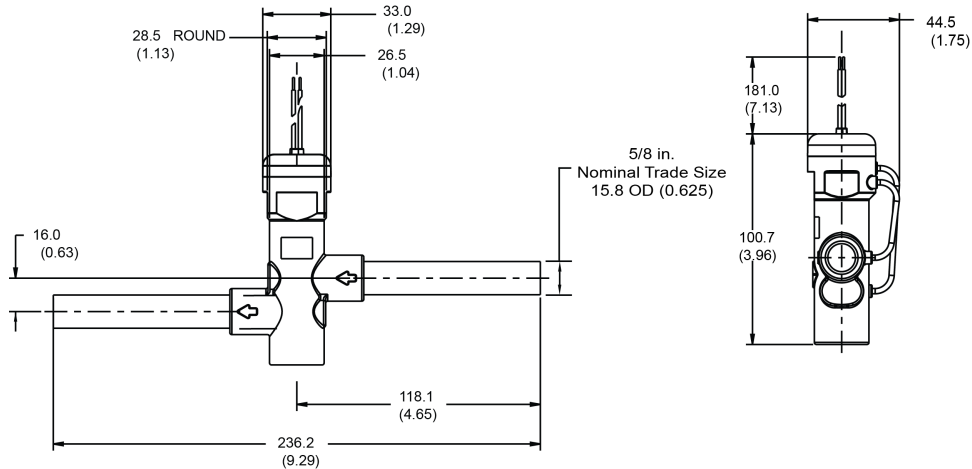
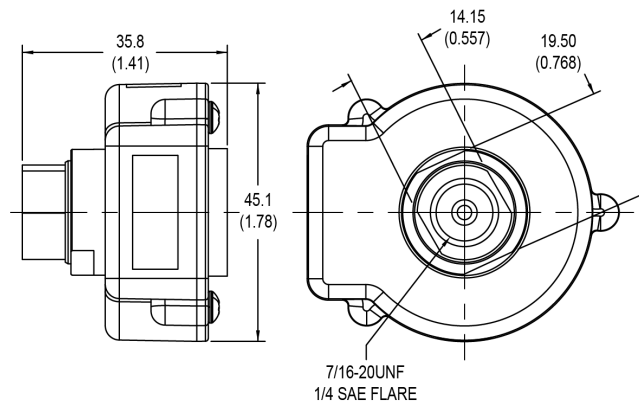


Figure 9: PSHC dimensions, mm (in.)



Ordering information

Table 3 and Table 4 provide the nominal capacities for each QREV model. Table 5 provides the PSHC refrigerant type and product code numbers. Select the appropriate model by selecting the QREV nominal capacity and the appropriate refrigerant for the PSHC. Table 6 provides ordering information for the standard wiring harness available for the PSHC.

You can order the standard QREV, PSHC, and wiring harness described in Table 3, Table 4, Table 5, and Table 6 from most Johnson Controls®/ PENN® authorized distributors.

Contact your local Johnson Controls/PENN sales representative for more information about available options.

- ① **Note:** A QREV and PSHC application requires an expansion valve (QREV model), a controller (PSHC model), and wiring harness. Order these three components separately.

The following table explains the naming convention for the QREV model numbers, using the example code QREV01-24SC-C.

Table 1: QREV product code matrix

Feature	Code letter or number and description	Product code example: QREV01-24SC-C
Family code	QREV	QREV
Sequence Code	01-08 09-15	01
Valve voltage	12 = 12 VDC 24 = 24 VDC/VAC	24
Valve body type	S = Straight body connection	SC
Engineering version	C = Alpha character	
Packaging	C = Individual	C

① **Note:** See Table 3 and Table 4 to determine the QREV capacity that you require.

Contact your Johnson Controls account representative about availability of 12 VDC QREV models.

The following table explains the naming convention for the PSHC model numbers, using the example code PSHC01-134A-C.

Table 2: PSHC product code matrix

Feature	Code letter or number and description	Product code example: PSHC01-134A-C
Controller series	PSHC	PSHC
Firmware version	01	01
Refrigerant type	134A = R-134A	134A
	0022 = R-22	
	404A = R-404A	
	407A = R-407A	
	407C = R-407C	
	407F = R-407F	
	410A = R-410A	
	417A = R-417A	
	422A = R-422A	
	422D = R-422D	
	427A = R-427A	
	438A = R-438A	
	448A = R-448A	
	449A = R-449A	
	405A = R-405A	
452A = R-452A		
0507 = R-507		
513A = R-513A		
Packaging	C = Individual	C

The nominal QREV capacities in Table 3 and Table 4 are determined at AHRI-ANSI standard expansion valve lab test conditions. The actual capacity required by your refrigeration system may vary significantly depending on local ambient conditions and the load encountered during system operation. The best practice is to select the valve size tonnage that meets the highest load requirements of your system.

Table 3: QREV valve selection guide and nominal capacities: QREV 01-08

Refrigerant	Sequence codes and nominal capacities kW (ton)							
	QREVxx							
	01	02	03	04	05	06	07	08
R134A	1.76 (1/2)	5.28 (1 1/2)	7.03 (2)	8.79 (2 1/2)	10.55 (3)	13.19 (3 3/4)	15.83 (4 1/2)	18.46 (5 1/4)
R22	2.64 (3/4)	6.15 (1 3/4)	8.79 (2 1/2)	10.55 (3)	14.07 (4)	17.59 (5)	20.22 (5 3/4)	23.74 (6 3/4)
R404A	1.76 (1/2)	3.52 (1)	6.15 (1 3/4)	7.03 (2)	10.55 (3)	12.31 (3 1/2)	14.95 (4 1/4)	16.71 (4 3/4)
R407A	2.64 (3/4)	6.15 (1 3/4)	8.79 (2 1/2)	10.55 (3)	14.95 (4 1/4)	17.59 (5)	21.1 (6)	23.74 (6 3/4)
R407C	2.64 (3/4)	7.03 (2)	8.79 (2 1/2)	11.43 (3 1/4)	15.83 (4 1/2)	18.46 (5 1/4)	21.98 (6 1/4)	25.5 (7 1/4)

Table 3: QREV valve selection guide and nominal capacities: QREV 01-08

Refrigerant	Sequence codes and nominal capacities kW (ton)							
	QREVxx							
	01	02	03	04	05	06	07	08
R407F	2.64 (3/4)	7.03 (2)	9.67 (2 3/4)	12.31 (3 1/2)	16.71 (4 3/4)	19.34 (5 1/2)	22.86 (6 1/2)	26.38 (7 1/2)
R410A	2.64 (3/4)	7.03 (2)	10.55 (3)	13.19 (3 3/4)	17.58 (5)	21.1 (6)	24.62 (7)	28.14 (8)
R417A	1.76 (1/2)	4.4 (1 1/4)	6.15 (1 3/4)	7.91 (2 1/4)	10.55 (3)	13.19 (3 3/4)	14.95 (4 1/4)	17.59 (5)
R422A	1.76 (1/2)	4.4 (1 1/4)	5.28 (1 1/2)	6.15 (1 3/4)	8.79 (2 1/2)	11.43 (3 1/4)	13.19 (3 3/4)	14.95 (4 1/4)
R422D	1.76 (1/2)	4.4 (1 1/4)	6.15 (1 3/4)	7.03 (2)	10.55 (3)	12.31 (3 1/2)	14.07 (4)	16.71 (4 3/4)
R427A	2.64 (3/4)	6.15 (1 3/4)	7.91 (2 1/4)	10.55 (3)	14.07 (4)	16.71 (4 3/4)	20.22 (5 3/4)	22.86 (6 1/2)
R438A	1.76 (1/2)	5.28 (1 1/2)	7.03 (2)	8.79 (2 1/2)	12.31 (3 1/2)	14.95 (4 1/4)	17.59 (5)	20.22 (5 3/4)
R448A	2.64 (3/4)	6.15 (1 3/4)	8.79 (2 1/2)	10.55 (3)	14.95 (4 1/4)	17.59 (5)	21.1 (6)	23.74 (6 3/4)
R449A	2.64 (3/4)	6.15 (1 3/4)	8.79 (2 1/2)	10.55 (3)	14.07 (4)	17.59 (5)	20.22 (5 3/4)	23.74 (6 3/4)
R450A	1.76 (1/2)	4.4 (1 1/4)	6.15 (1 3/4)	7.03 (2)	9.67 (2 3/4)	12.31 (3 1/2)	14.07 (4)	15.83 (4 1/2)
R452A	2.64 (3/4)	4.4 (1 1/4)	6.15 (1 3/4)	8.79 (2 1/2)	11.43 (3 1/4)	13.19 (3 3/4)	15.83 (4 1/2)	17.59 (5)
R507	1.76 (1/2)	4.4 (1 1/4)	6.15 (1 3/4)	7.03 (2)	9.67 (2 3/4)	12.31 (3 1/2)	14.07 (4)	16.71 (4 3/4)
R513A	1.76 (1/2)	4.4 (1 1/4)	5.28 (1 1/2)	7.03 (2)	9.67 (2 3/4)	11.43 (3 1/4)	13.19 (3 3/4)	15.83 (4 1/2)

Table 4: QREV valve selection guide and nominal capacities kW (ton): QREV 09-15

Refrigerant	Sequence codes and nominal capacities kW (ton)						
	QREVxx						
	09	10	11	12	13	14	15
R134A	24.61 (7)	31.65 (9)	35.16 (10)	39.68 (11)	45.72 (13)	49.24 (14)	52.75 (15)
R22	31.65 (9)	39.68 (11)	45.72 (13)	52.75 (15)	56.27 (16)	63.30 (18)	70.34 (20)
R404A	21.10 (6)	28.13 (8)	31.65 (9)	35.16 (10)	42.20 (12)	45.72 (13)	49.24 (14)
R407A	31.65 (9)	39.68 (11)	45.72 (13)	49.24 (14)	56.27 (16)	63.30 (18)	70.34 (20)
R407C	35.16 (10)	42.20 (12)	49.24 (14)	52.75 (15)	59.79 (17)	66.82 (19)	77.37 (22)
R407F	35.16 (10)	42.20 (12)	49.24 (14)	56.27 (16)	63.30 (18)	73.85 (21)	80.89 (23)
R410A	35.16 (10)	45.72 (13)	52.75 (15)	59.79 (17)	70.34 (20)	77.37 (22)	87.92 (25)
R417A	24.61 (7)	28.13 (8)	31.65 (9)	39.68 (11)	42.20 (12)	45.72 (13)	52.75 (15)
R422A	17.58 (5)	24.61 (7)	28.13 (8)	31.65 (9)	35.16 (10)	39.68 (11)	45.72 (13)
R422D	21.10 (6)	28.13 (8)	31.65 (9)	35.16 (10)	39.68 (11)	45.72 (13)	49.24 (14)
R427A	31.65 (9)	39.68 (11)	42.20 (12)	49.24 (14)	56.27 (16)	63.30 (18)	66.82 (19)
R438A	31.65 (9)	31.65 (9)	39.68 (11)	42.20 (12)	49.24 (14)	52.75 (15)	59.79 (17)
R448A	31.65 (9)	39.68 (11)	45.72 (13)	52.75 (15)	56.27 (16)	63.30 (18)	70.34 (20)
R449A	31.65 (9)	39.68 (11)	45.72 (13)	49.24 (14)	56.27 (16)	63.30 (18)	70.34 (20)
R450A	21.10 (6)	24.61 (7)	31.65 (9)	35.16 (10)	39.68 (11)	42.20 (12)	49.24 (14)
R507	21.10 (6)	24.61 (7)	31.65 (9)	35.16 (10)	39.68 (11)	42.20 (12)	49.24 (14)
R513A	21.10 (6)	24.61 (7)	28.13 (8)	31.65 (9)	39.68 (11)	42.20 (12)	45.72 (13)

Table 5: PSHC product code numbers and refrigerant types

Product Code Number	Refrigerant
PSHC01-134A-C	R134A
PSHC01-0022-C	R22
PSHC01-404A-C	R404A
PSHC01-407A-C	R407A
PSHC01-407C-C	R407C
PSHC01-407F-C	R407F
PSHC01-410A-C	R410A
PSHC01-417A-C	R417A
PSHC01-422A-C	R422A
PSHC01-422D-C	R422D
PSHC01-427A-C	R427A
PSHC01-438A-C	R438A
PSHC01-448A-C	R448A
PSHC01-449A-C	R449A
PSHC01-450A-C	R450A
PSHC01-452A-C	R452A
PSHC01-0507-C	R507
PSHC01-513A-C	R513A

Table 6: Wiring harness product code number

Product code number
WHA-PSHC-150-1C

Repair information

If a QREV or PSHC fails to operate within its specifications, replace the unit. For a replacement QREV or PSHC, contact the nearest Johnson Controls representative.

QREV and PSHC technical specifications


Table 7: QREV technical specifications

Specification	Description
Power supply	12 VDC ±15% for 12 V QREV control 24 VAC or 24 VDC ±15% (50/60 Hz ± 1%) for 24 V QREV control
Electrical connection	Two 0.50 mm ² (20 AWG), UL 1332, copper wires, with black FEP insulation
Power consumption	Max power 10±1 W, Nominal 5±1 W <i>t_{operating}</i> ≥ 0.5 S
Working principle	Specialized pulse signal
Time to fully open	250 ms
Media temperature	-40°C to 70°C (-40°F to 158°F)
Operating and storage temperature	-40°C to 70°C (-40°F to 158°F)
Environmental humidity	< 95% RH
Minimum valve opening pressure (VOP)	1 bar (100 kPa) (14.5 psi)
Maximum working pressure	34 bar (500 psi)
Maximum overpressure	48 bar (700 psi)
Burst pressure	QREV 01-08: 241.3 bar (3,500 psi) QREV 09-15: 224.5 bar (3,300 psi)
Refrigerant compatibility	R134A, R22, R404A, R407A, R407C, R407F, R410A, R417A, R422A, R422D, R427A, R438A, R448A, R449A, R450A, R452A, R507, and R513A
Refrigerant oil compatibility	Polyolester (POE); Alkylbenzene (AB); Polyalkylene Glycol (PAG); Mineral Oil (MO)
Braze connections—diameter and material	QREV 01-08: 9.5mm (3/8 in.) O.D. copper tube QREV 09-15: 15.8 mm (5/8 in.) O.D. copper tube
Braze connections—length	QREV 01-08: 6.9cm (3 in.) each QREV 09-15: 10.4 cm (4.1 in.) each
Enclosure	IP67 when you use dielectric grease on the wire harness connector
Moisture and corrosion	100 hour salt spray test ASTM B117
Fluid cleanliness requirement	ISO 11171 18/16/13
Warranty	3 years
Compliance	North America: United States: ULus Listed; File YIOZ.MH3536 Canada: cUL Listed; File YIOZ7.MH3536

Table 8: PSHC technical specifications

Specification	Description
Dimensions (L x W x H (±1 mm))	48 mm x 42.9 mm x 36.2 mm (1.89 in. x 1.69 in. x 1.425 in.)
Weight	75 g (2.65 oz.)
Pressure connection	1/4 in. SAE 45° flare with Schrader® valve depressor, internal thread (16.26 N·m [12 ft·lb])
Enclosure IP rating	IP 54 when the wire harness is not connected
	IP 65 with the wire harness connected
	IP 67 with the wire harness connected and dielectric grease applied to the connector
Frequency	50 Hz or 60 Hz at 24 VAC
Voltage	24 VAC/VDC ±15%
Power	% Duty cycle at 24 VDC P < 500 mW not including valve power.
Current	Operating: 1.5 A minimum
	Peak <i>t</i> = 10 S: 2.5 A minimum
External temperature sensor accuracy	±1.2°C for -40°C to +70°C (± 2.2°F for -40°F to +158°F)
Response time	250 ms
Pulse-width modulation (PWM) control range	Operating: 0% to 98%
Temperature (storage and operating)	-40°C to 70°C (-40°F to +158°F)

Table 8: PSHC technical specifications

Specification	Description
Suitable environmental humidity	< 95% RH
Superheat factory setpoint	5.5°C (10°F)
Voltage requirements	12 VDC ±15% for 12 V QREV control 24 VAC or 24 VDC ±15% (50/60 Hz ± 1%) for 24 V QREV control
Power consumption	≤ 12 W at 95% duty cycle at 24 VDC
Operating pressure	1.4 bar to 16.5 bar (20 psi to 239 psi)
Pressure accuracy	± 0.1 bar for 1.4 bar < P ≤ 13.8 bar, -20°C to 40°C (± 1.5 psi for 20 psia < P ≤ 200 psia, -4°F to 104°F) +/- 0.17 bar for 13.79 bar < P ≤ 16.33 bar, (same temperature as current -20°C to 40°C) +/- 2.5 psia for 200 psi < P ≤ 240 psia, (same temperature -4°F to 104°F)
Proof pressure	41.1 bar (600 psi)
Burst pressure	103.4 bar (1500 psi)
Refrigerant compatibility	R134A, R22, R404A, R407A, R407C, R407F, R410A, R417A, R422A, R422D, R427A, R438A, R448A, R449A, R452A, R450A, R507A, and R513A
Refrigerant oil compatibility	Polyolester (POE); Polyalkylene Glycol (PAG); Mineral Oil (MO), Alkylbenzene Oil (AB)
Communication	An external isolated RS-485 adapter is required when communicating with the PSHC.
Warranty	3 years
Compliance	North America: United States: ULus Listed; File XACN.E27734 FCC Compliant to Emissions, Part 15 Class B Canada: cUL Listed; File XACN7.E27734 Industry Canada Compliant to ICES-003 Issue 5
	Europe: CE Mark – Johnson Controls declares that this product is in compliance with the essential requirements and other relevant provisions of the RoHS Directive, and EMC Directive.

The performance specifications are nominal and conform to acceptable industry standards. For application at conditions beyond these specifications, consult the local Johnson Controls office. Johnson Controls shall not be liable for damages resulting from misapplication or misuse of its products.

North American Emissions Compliance

United States

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Canada

This Class (B) digital apparatus meets all the requirements of the Canadian Interference-Causing Equipment Regulations.

Cet appareil numérique de la Classe (B) respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.

