

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

Product Bulletin

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QREVxx-xxx
PSHCxx-xxx
WHA-PSHC-150-1

Refer to the [QuickLIT website](#) for the most up-to-date version of this document.

Introduction

The Quick Response Expansion Valve (QREV) with the Precision Superheat Controller (PSHC) is 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, providing maximum evaporator efficiency by quickly reaching the preferred superheat. The QREV includes a silicon-based micro electromechanical 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 greatly extending valve life. QREVs are offered in several capacity ranges.

The PSHC is an electronic superheat controller that provides precise control to the QREV through varying load conditions. The PSHC is installed 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 17 approved refrigerants for easy commissioning.

Figure 1: Quick Response Expansion Valve, Precision Superheat Controller, 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® RTU Compliant Subordinate Device**—Provides remote monitoring and adjustment on modbus networks.
- **Compact Solution**—Allows use in limited-space applications.



Applications

IMPORTANT: Use this Quick Response Expansion Valve (QREV) and Precision Superheat Controller (PSHC) only as an operating control. Where failure or malfunction of the QREV and PSHC 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.

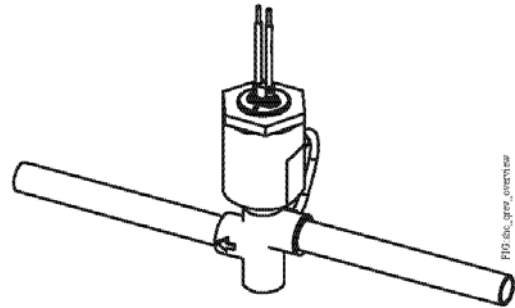
IMPORTANT : Utiliser ce Quick Response Expansion Valve (QREV) et Precision Superheat Controller (PSHC) uniquement en tant que dispositif de contrôle de fonctionnement. Lorsqu'une défaillance ou un dysfonctionnement du QREV et PSHC risque de provoquer des blessures ou d'endommager l'équipement contrôlé 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, along with the PSHC, is designed to replace electronic expansion valves (EEVs) and standard thermostatic expansion valves (TEV/TXVs) in commercial refrigeration and HVAC applications.

The QREV, with the PSHC, is a closed loop solution that does not require any additional controller. This allows for easy installation and commissioning. The QREV and the PSHC are designed to provide rapid response superheat control through varying load conditions.

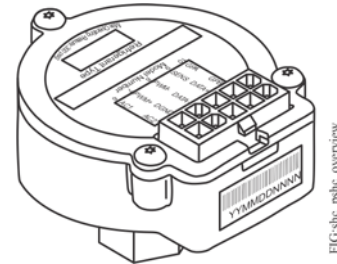
The QREV is compact and lightweight. The QREV is installed at the evaporator coil inlet just like an EEV or standard TXV.

Figure 2: Quick Response Expansion Valve



The PSHC is installed 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 and connects to a temperature sensor (on the wiring harness) at the evaporator outlet. The PSHC, temperature sensor, and QREV are connected together with the wiring harness (Figure 4). Each PSHC model is factory-set to operate with one of 17 approved refrigerants.

Figure 3: Precision Superheat Controller



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

For the QREV and PSHC dimensions, see *Physical Features and Dimensions, mm (in.)*. For detailed information on ordering the QREV and PSHC, see *Precision Superheat Controller*.

Figure 4: QREV and PSHC Installed on a Typical Evaporator

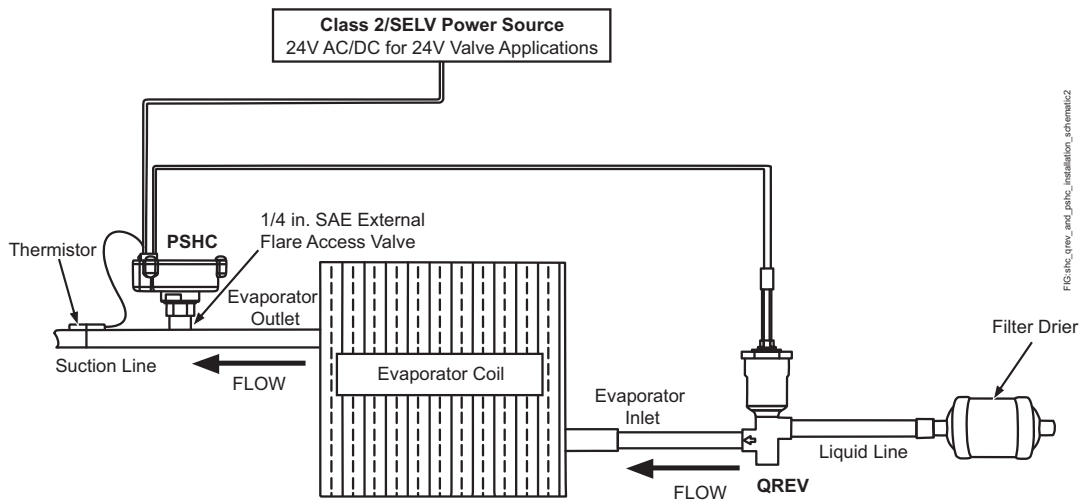


FIG.5:qrev_and_pshc_installation_schematic2

Operation

The PSHC senses both temperature and pressure at the evaporator outlet and calculates the actual superheat sensed at the outlet. As 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 (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 flowing through the QREV.

Figure 5: Microelectromechanical System Layers

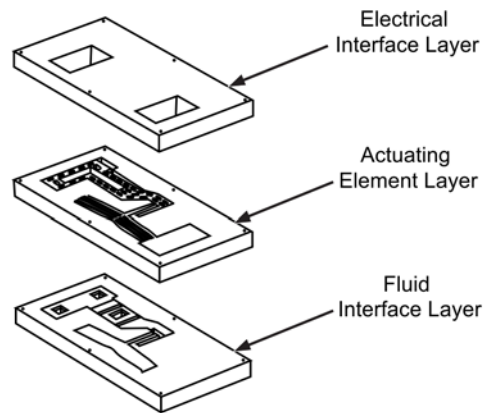


FIG.5:ic MEMS_Microvalve_Layers

Physical Features and Dimensions, mm (in.)

Figure 6: Quick Response Expansion Valve: QREV01-QREV05 Type Valves

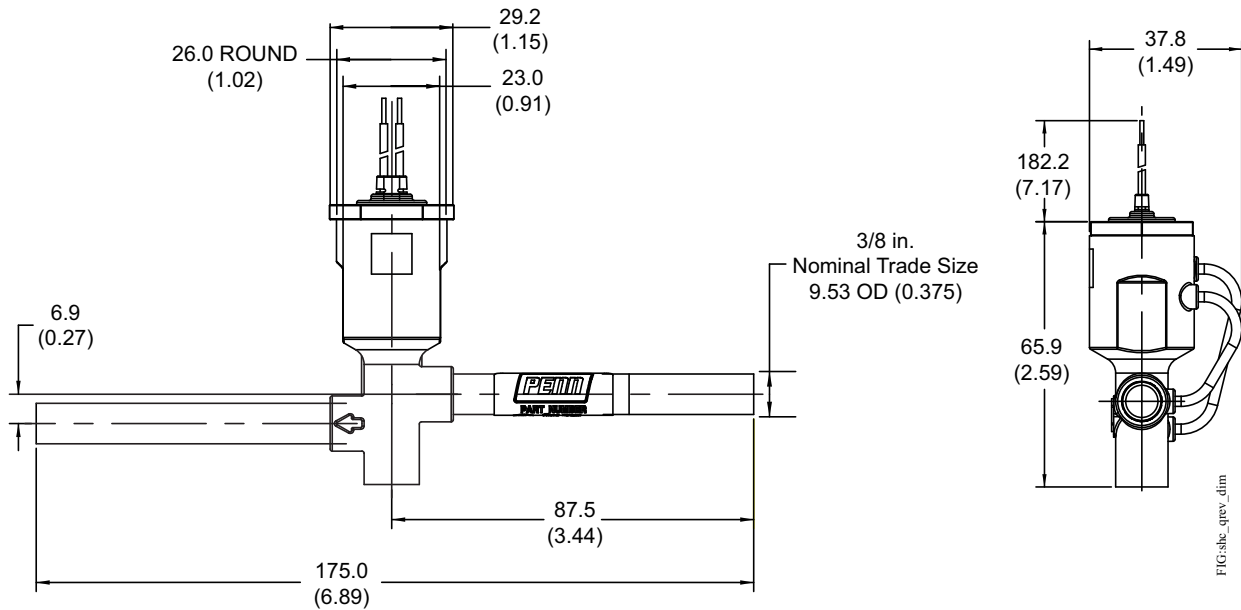


Figure 7: Quick Response Expansion Valve: QREV09-QREV15 Type Valves

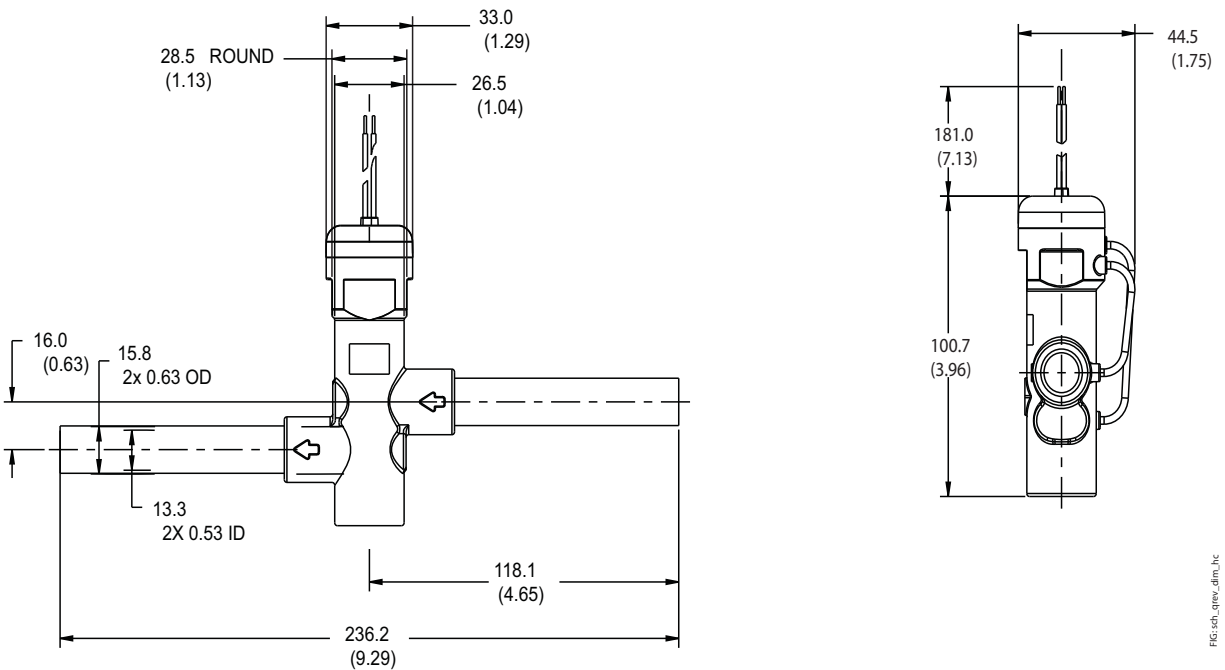
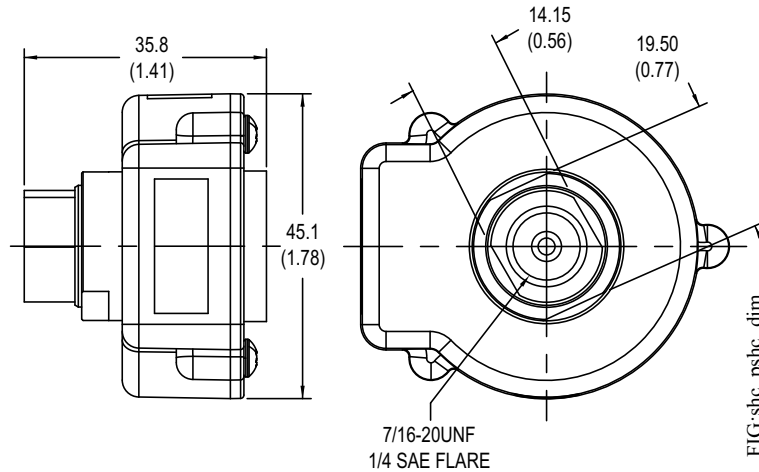


Figure 8: Precision Superheat Controller



Ordering Information

Table 3 and Table 4 provide the nominal capacities for each Quick Response Expansion Valve (QREV) model. Table 5 provides the Precision Superheat Controllers (PSHC) refrigerant type and product code numbers. Select the appropriate model by QREV nominal capacity and the appropriate refrigerant for the PSHC. Table 6 provides ordering information for the standard wiring harness available for the PSHC.

The standard QREV, PSHC, and wiring harness shown in Table 3, Table 4, Table 5, and Table 6 are available through most Johnson Controls/PENN® authorized distributors.

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

Note: A QREV/PSHC application requires an expansion valve (QREV model), a controller (PSHC model), and wiring harness. You 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

	Code Letter/Number and Description	QREV	01	-	24	SC	-	C
Family Prefix								
Sequence Code*	01-05							
	09-15							
Valve Voltage	12 = 12 VDC**							
	24 = 24 VDC/VAC							
Valve Body Type	SC = Straight Body Connection							
Packaging	C = Individual							

*See Table 3 and Table 4 to determine the required QREV capacity.

**Contact your Johnson Controls sales representative about 12 VDC availability.

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

	Code Letter/Number and Description	PSHC	01	-	134A	-	C
Controller Series							
Firmware Version	01-02						
Refrigerant Type	134A = R134A 0022 = R22 404A = R404A 407A = R407A 407C = R407C 407F = R407F 410A = R410A 417A = R417A 422A = R422A 422D = R422D 427A = R427A 438A = R438A 448A = R448A 449A = R449A 405A = R405A 0507 = R507 513A = R513A						
Packaging	C = Individual						

These nominal QREV capacities 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 01-05 (Part 1 of 2)

		Sequence Codes and Nominal Capacities kW (ton)				
Refrigerant	QREVxx					
	01	02	03	04	05	
R134A	1.76 (1/2)	5.28 (1-1/2)	7.03 (2)	8.79 (2-1/2)	10.55 (3)	
R22	2.64 (3/4)	6.15 (1-3/4)	8.79 (2-1/2)	10.55 (3)	14.07 (4)	

Table 3: QREV Valve Selection Guide and Nominal Capacities: QREV 01-05 (Part 2 of 2)

Sequence Codes and Nominal Capacities kW (ton)					
Refrigerant	QREVxx				
	01	02	03	04	05
R404A	1.76 (1/2)	3.52 (1)	6.15 (1-3/4)	7.03 (2)	10.55 (3)
R407A	2.64 (3/4)	6.15 (1-3/4)	8.79 (2-1/2)	10.55 (3)	14.95 (4-1/4)
R407C	2.64 (3/4)	7.03 (2)	8.79 (2-1/2)	11.43 (3-1/4)	15.83 (4-1/2)
R407F	2.64 (3/4)	7.03 (2)	9.67 (2-3/4)	12.31 (3-1/2)	16.71 (4-3/4)
R410A	2.64 (3/4)	7.03 (2)	10.55 (3)	13.19 (3-3/4)	17.58 (5)
R417A	1.76 (1/2)	4.4 (1-1/4)	6.15 (1-3/4)	7.91 (2-1/4)	10.55 (3)
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)
R422D	1.76 (1/2)	4.4 (1-1/4)	6.15 (1-3/4)	7.03 (2)	10.55 (3)
R427A	2.64 (3/4)	6.15 (1-3/4)	7.91 (2-1/4)	10.55 (3)	14.07 (4)
R438A	1.76 (1/2)	5.28 (1-1/2)	7.03 (2)	8.79 (2-1/2)	12.31 (3-1/2)
R448A	2.64 (3/4)	6.15 (1-3/4)	8.79 (2-1/2)	10.55 (3)	14.95 (4-1/4)
R449A	2.64 (3/4)	6.15 (1-3/4)	8.79 (2-1/2)	10.55 (3)	14.07 (4)
R450A	1.76 (1/2)	4.4 (1-1/4)	6.15 (1-3/4)	7.03 (2)	9.67 (2-3/4)
R507	1.76 (1/2)	4.4 (1-1/4)	6.15 (1-3/4)	7.03 (2)	9.67 (2-3/4)
R513A	1.76 (1/2)	4.4 (1-1/4)	5.28 (1-1/2)	7.03 (2)	9.67 (2-3/4)

Table 4: QREV Valve Selection Guide and Nominal Capacities kW (ton): QREV 09-15

Sequence Codes and Nominal Capacities kW (ton)							
Refrigerant	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: Precision Superheat Controller Product Code Numbers and Refrigerant Types

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

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.

Technical Specifications

Quick Response Expansion Valve (Part 1 of 2)

Power Supply	AC: 24 V AC ±15% (for 24 V QREVs)
Electrical Connection	Two 0.81 mm diameter (20 AWG), UL 1332, copper wires, with black FEP insulation
Power Consumption	Max power 10±1 W, Nominal 5±1 W _{t_{operating}} ≥ 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 01-05: 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, R507, and R513A
Refrigerant Oil Compatibility	Polyolester (POE); Alkylbenzene (AB); Polyalkylene Glycol (PAG); Mineral Oil (MO)
Brazed Connector Fittings—Diameter and Material	QREV 01-05: 9.5mm (3/8 in.) O.D. Copper Tube QREV 09-15: 15.8 mm (5/8 in.) O.D. Copper Tube
Brazed Connector Fittings—Length	QREV 01-05: 6.9cm (3 in.) each QREV 09-15: 10.4 cm (4.1 in.) each
Enclosure	IP67 when using dielectric grease on the wire harness connector


Quick Response Expansion Valve (Part 2 of 2)

Moisture/Corrosion	100 hour salt spray test ASTM B117
Fluid Cleanliness Requirement	ISO 11171 18/16/13
Warranty	3 years
Compliance	North America: United States: cULus Listed, File YIOZ.MH3536 Canada: All Models cULus YIOZ7.MH3536

Precision Superheat Controller (Part 1 of 2)

Dimensions L x W x H (±1 mm)	48 x 42.9 x 36.2 mm (1.89 x 1.69 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 or 60 Hz at 24 VAC +/- 1Hz
Voltage	24 AC/DC ±15% (
Power	% Duty cycle at 24 VDC P < 500 mW. This does not include valve power.
Current	Operating: 1.5 A minimum
	Peak _{t=10s} : 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
Communication Standard	Non-isolated RS-485 half-duplex
Temperature (Storage and Operating)	-40°C to 70°C (-40°F to +158°F)
Suitable Environmental Humidity	< 95% RH
Superheat Factory Set Point	5.5°C (10°F)
Power Consumption	≤ 12 W at 95% Duty cycle at 24 VDC
Operating Differential Pressure Across Valve	1.44 to 16.54 bar (21 to 240 psia)
Pressure Accuracy	± 0.1 bar for 1.38 bar < P ≤ 13.79 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, R450A, R507, 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.

Precision Superheat Controller (Part 2 of 2)

	North America: United States: cULus Listed; File XACN.E27734 FCC Compliant to Emissions, Part 15 Class B Canada: cULus Listed; UL File XACN7.E27734 Industry Canada Compliant to ICES-103
	Europe: CE Mark – Johnson Controls declares that this product is in compliance with the essential requirements and other relevant provisions of the RoHS, LVD, and EMC Directives.

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.

United States Emissions Compliance

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.

Canadian Emissions Compliance

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.



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