

Application Note 2031: Variable Condenser Water Flow Control on L Generation Water Source VRF

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Reference Documents 2015 Engineering Manual – WY & WR2 – Section & Design
(**L Generation Only**)

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Introduction

This application note is to serve as a detailed guide when applying the new available 0-10V output functionality on the L generation water source product to modulate condenser water flow with the PIV (Pressure Independent Valve) accessory product.

This document is to serve as a supplement to the technical data already contained within the Mitsubishi Electric CITY MULTI® engineering manuals, submittal sheets, other service, operation, installation manuals and information contained in “Application Note 2017: Water-Source VRF Application Guide”

This document will cover the application of the 0-10V condenser water modulation control for the following products:

WR2-Series: PQRY-P72T/YLMU-A through PQRY-P336T/Y(S)LMU-A

WY-Series: PQHY-P72T/YLMU-A through PQHY-P360T/Y(S)LMU-A

Please Note: This document is NOT applicable to the prior H-generation (HMU) water source VRF equipment. The prior H-generation (HMU) water source application guide can be made available upon request. The PIV accessory noted in this application note can NOT be applied to the prior H generation product.

Variable Condenser Water Flow Rate Capability & Functionality

The L generation water source units have improved capability to provide a modulating 0-10V output signal to drive a field installed motorized valve.

This allows the water source units to vary condenser water flow rate through each module individually as load is reduced on each module. Utilizing this feature can allow for significant central station pumping savings, specifically on large buildings with several water source modules located throughout the building, all served by a central station condenser water system with central station pumps.

Modulation of this valve is completely autonomous to the VRF water source module pre-programmed algorithms. Other means to modulate a field provided valve not utilizing the Mitsubishi WS module 0-10V output signal should NOT be attempted.

The table below (Figure 1) summarizes the nominal published flow rates for each Mitsubishi water source VRF module size. These nominal flow rates result in no penalty for capacity and power input to the water source module based on flow rate alone at full load conditions (other de-rates still apply).

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	Module Sizes							
	P72	P96	P120	P144	P168	P192	P216	P240
Nominal Flow (gpm)	25.5	25.5	25.5	31.8	31.8	31.8	50.5	50.5
Max Pressure	290 PSI							
Standard EWT Range (F)	50 -113F							
Glycol/Geo Mode EWT Range (F)	23 - 113F							

Figure1. Water Source VRF Nominal Flow Rates

Figure 2 below summarizes the variable flow turndown capability at each water source module when utilizing this 0-10V function:

Variable Flow Turndown Summary				
Module	Model Size (Single Module)	Water Source Module Connection Size (in)	Full Nominal Flow (gpm)	Min Valve Flow (gpm)
P	72	1-1/2"	25.5	13.2
P	96	1-1/2"	25.5	13.2
P	120	1-1/2"	25.5	13.2
P	144	1-1/2"	32	19.8
P	168	1-1/2"	32	19.8
P	192	1-1/2"	32	19.8
P	216	1-1/2"	50	26.4
P	240	1-1/2"	50	26.4

Figure 2 – Waters Source Module Variable Flow Rate Range

Each water source module will attempt to vary flow rate through each module by modulating the 0-10V output signal as shown in the below illustrated operational pattern. **The water source module is set up from factory by default for a normally open valve pattern and this should NOT be changed when attempting this application with the prescribed valve accessory PIV product described later in this application note.**

5. Water flow rate range With Variable Valve Signal - Per Factory

Model	Circulating water operating flow rate range
P72 to P120	13.2~31.7GPM (3.0~7.2m3/h)
P144 to P192	19.8~50.9GPM (4.5~11.6m3/h)
P216 to P240	26.4~63.4GPM (6.0~14.4m3/h)

Pattern	A	B	C
Operation	Stop	Thermo OFF	Compressor in operation
DipSW4(810) = OFF	10V	5V	5~0V(100% Load)
DipSW4(810) = ON	0V	7.6V	7.6~9.1V(100% Load)

Figure 3 – Water Source Module 0-10V Valve Modulation Pattern

Please note in Figure 3 above that the upper flow rate range is the maximum permissible charted flow rate range through the modules but this offers NO significant benefit in capacity and power input – **only the “full nominal flow” rates shown in Figure 2 above need to be considered for the full flow peak design.**

Also please note, as per Figure 3 above, the motorized modulating valve will not receive a closed signal until all indoor units are OFF. This would typically only occur during night set back periods when all indoor units are actively scheduled OFF. When all indoor units are thermally satisfied the motorized valves will still be provided with a signal for minimum flow (5V Signal-normally open configuration), regardless of how many modules in a twinned set are thermally active/inactive.

PIV Assembly Accessory Product

A challenge with the 0-10V output functionality on the L generation product, as shown in above figure 3 is with regard to balancing the minimum flow rate through the water source module. The current L generation product does NOT have voltage output adjustability for the valve minimum position.

The valve minimum position and minimum flow is critical for safe operation of the brazed plate heat exchanger and must be maintained as illustrated above during operation. Without adjustability on voltage output on the board to properly balance minimum valve position and with inherent fluctuations on operating system pressure in building condenser water loops, issues may arise with maintaining minimum flow and cause nuisance flow switch tripping in installations attempting to install other third party control valves.

To alleviate this concern for proper balancing of minimum flow but also to ensure targeted flow at all voltage output signals is maintained, a pressure independent valve (PIV) accessory is available.

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This PIV is custom programmed for the L generation water source modules, mapped to the voltage output and corresponding expected flow at each voltage output signal level.

The PIV will continuously modulate and maintain flow target by constant feedback of a built in ultrasonic flow meter to ensure efficient and stable operation at all load conditions of the water source module.

The PIV valve will also provide flow proving functionality and interface with flow proving contacts on the L generation board preventing damage during operation if flow rates fall below the minimum allowed values; thus improving overall life and longevity of the water source product.

Since this valve has constant pressure independent feedback of flow at all load conditions all manual hydronic balancing labor is eliminated.

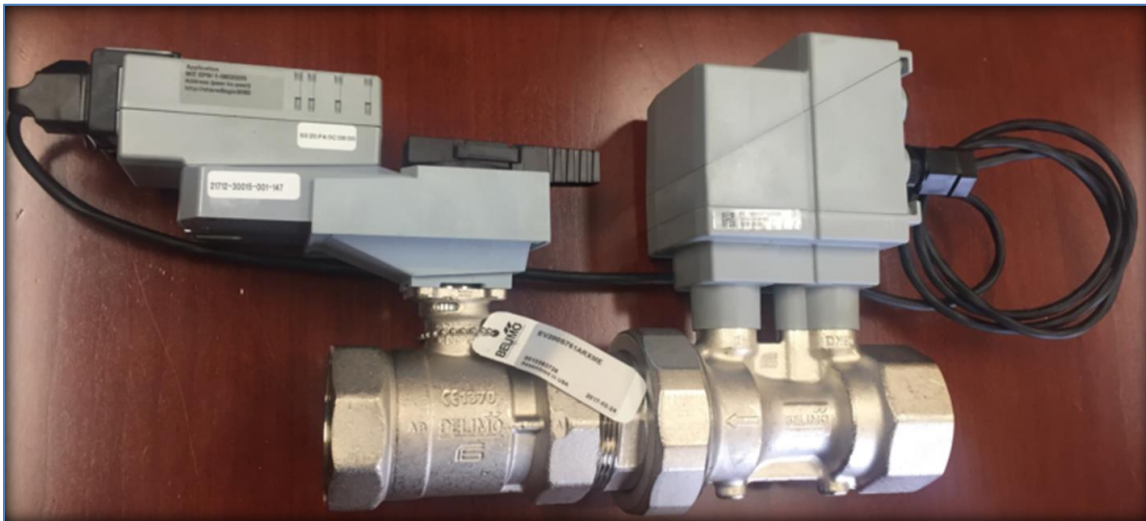


Figure4 – Image of Accessory PIV product with Integral Ultrasonic Flow meter.

The required accessory PIV selection based on module size is shown below:

Size	Model	Description
1-1/2"	EV150S3956NRXME	1.5" EPIV Valve w/ Shared Logic Actuator for WY/WR2 (P72-P192 Module Size)
2"	EV200S761ARXME	2" EPIV Valve for w/ Shared Logic Actuator WY/WR2 (P216-P240 Module Size)

Please Note – these valves are only available through MEUS distributors and must be applied with the involvement of MEUS application support.

Figure5 – PIV Accessory Product Model Listing / WS Module Matchup.

PIV Piping Installation

As noted in “Application Note 2017: Water-Source VRF Application Guide” all water source modules, including each module in twinned set, requires a minimum level of piping provisions.

The most important of these piping provisions are inclusion of a strainer (60 Mesh) as well as balancing and flow switch provisions at each module. The PIV accessory will provide the flow switch and balancing (both min and max flow) so these additional accessories need not be provided when installing the PIV.

The below diagram depicts the piping requirements (per module, every module in twinned set) when applying the PIV accessory:

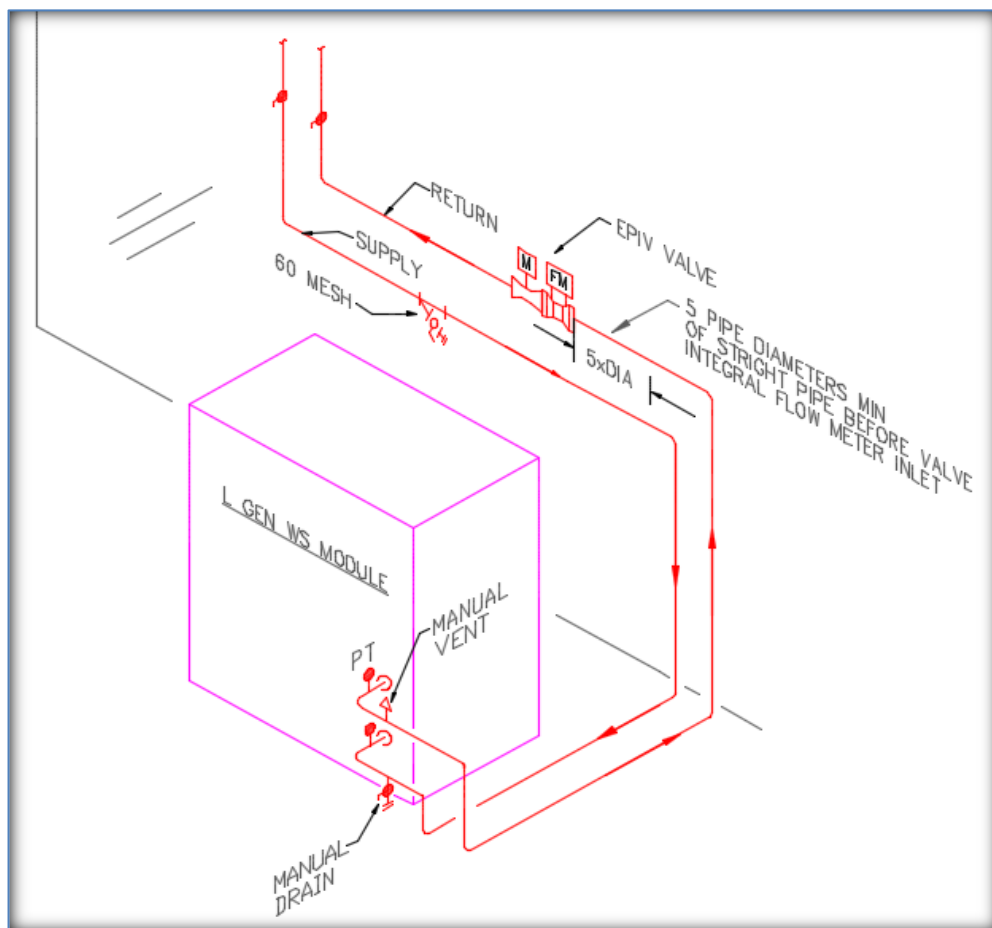


Figure6 – PIV Field Installed Piping Requirements

As mentioned previously, each water source module will require a dedicated PIV with dedicated tie-in to the respective water source module proof of flow contacts. **Also please note that each WS module IO board that provides the 0-10V signals to the PIV for modulation must be supplied with its own independent 24VAC power supply separate from the PIV (L Gen -A1 Self Powers IO Board).** The below diagram depicts the wiring provisions that must be made in field for each PIV installation location.

Figure7 – PIV Field Installed Wiring Requirements

