APPLICATION OF FLOWCON SM AS ENERGY METER

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The FlowCon SM series of valves are dynamic temperature control valves for use in HVAC applications to control the rate of fluid flow to a specific terminal unit or coil.

The FlowCon SM includes an innovative self adjustment feature which enables each valve to be continuously self-balanced. This ensures delivery of precise flow rate that is required by each terminal unit, independent of pressure fluctuations in the hydronic system. Each FlowCon SM can also be adjusted to set an accurate maximum flow rate limit to each circuit.

Besides the ability to delivery flow rate at +/- 5% regardless of load variations, FlowCon SM functions as the follows:

1. Control Valve
2. Balancing Valve
3. Flow Meter

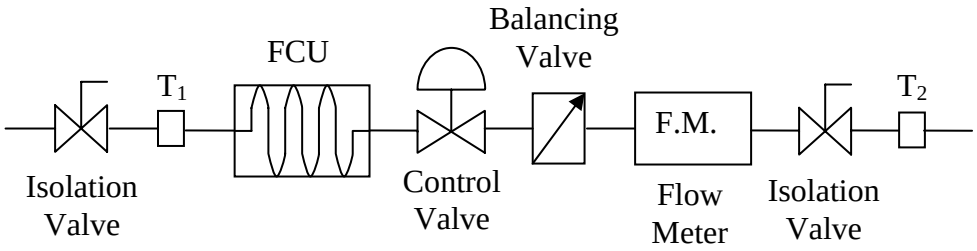


Figure 1: Traditional design of a HVAC system to measure BTU/ HR of the FCU

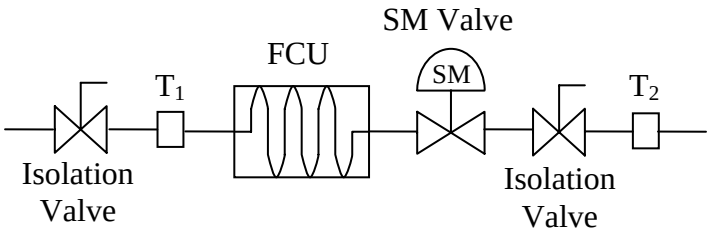


Figure 2: Simplification of design with FlowCon SM

By comparison between Figure 1 and Figure 2, it is noted that system with FlowCon SM is much simplify as compared with system with individual control valve, balancing valve and flow meter installed. The simplification of design allows FlowCon SM to be price competitive as compared to HVAC systems with individual components of control valve, balancing valve and flow meter installed. In addition, the simplification of the design allows smaller pump size and lower power consumption. This is made possible due to the fact that system with FlowCon SM has lower system pressure drop compared to the traditional system.

In addition, its innovative and unique feature as a flow meter allows user to monitor amount of chilled water passing through the AHU or FCU. This is especially useful in such situation where owner of a building has to charge every tenant the amount of chilled water being used per month. This can be easily accomplished by substituting flow rate readings from FlowCon SM and the temperature readings from temperature sensors to the following equation:

$$\text{BTU/HR} = 8.33 \text{ X GPM X } 60 \text{ X Specific Gravity X } (T_2 - T_1)$$

The flow rate reading from FlowCon SM is accomplished through a formula tabulation by inputting reading of the feedback signal of its actuator. The flow rate can be either

- Manually tabulated at the spot.
- Automatically tabulated by the use of program where the flow rate readings will be automatically showed on the control panel in the control room.

Followings are the procedures of determine flow, Q by monitoring the feedback signal. Likewise, the steps can also be programmed into a program and flow, Q can be determined automatically.

Step 1: Determine feedback signal or output signal of the actuator either in the form of voltage (V_{out}) or mill amperes (I_{out}). It is noted that feedback or output signal of the valve is proportional to number of turn, R. And they related by the R-V or R-I Equation

Step 2: Substitute the feedback signal into the R-V or R-I Equations depending on the form of feedback signal.

For signal in the form of voltage, use the following R-V equation:

$$R=MPO * (Vout-2)/8$$

For signal in the form of mill amperes, use the following R-I equation:

$$R=MPO * (Iout-4)/16$$

Note: MPO = Maximum permissible opening position, in terms of rotation. This value can be found from the SM flow setting table. And it depends on the maximum allowable flow rate, pressure control range and valve size.

For example, SM of 50 MM, control pressure range of 35 – 400kPaD, maximum allowable flow of 4.12 L/S, from the SM flow setting table, MPO = 1.7

Step 3: Compare and tally the calculated R value to the R values in the SM flow setting table. And Q can be determined from the table by finding the Q corresponding to the calculated R values. Sometimes interpolation is needed.

For example

SM of size 50 MM
Control pressure range = 35-400 kPaD
Vout=6
MPO=1.7

R=1.7*(6-2)/8=1.7*0.5=0.85 turn.

From the lookup table Q(0.8)=1.968 L/S and Q(0.9)=2.214 L/S. By interpolation Q(0.85) = 2.09 L/S.

Note: When the valve has reached its stable position $V_{in} = V_{out}$. This feature can be used to monitor if the valve is jammed.

SM Valve Flow Setting Look up table (Rotations vs Flow l/s)			
Rotation		Maximum flow rate	
		50-80 mm	
		SM	SMX
		35-400 Kpad	80-400 Kpad
0		0	0
0.1		0.246	0.35
0.2		0.492	0.7
0.3		0.738	1.05
0.4		0.984	1.4
0.5		1.23	1.75
0.6		1.476	2.1
0.7		1.722	2.45
0.8		1.968	2.8
0.9		2.214	3.15
1		2.46	3.5
1.1		2.73	3.79
1.2		2.99	4.08
1.3		3.26	4.38
1.4		3.52	4.67
1.5		3.79	4.96
1.6		3.95	5.19
1.7		4.12	5.42

Table 1: Typical SM flow setting table

CASE STUDY

Project Name:	Parcel ‘G’ Shop House, China Square Central
Location:	China Street, Singapore
Quantity:	160 nos of size 25/32/40 164 nos of size 15/20/25
Control Manufacturer:	Johnsons Control

Following shows the pictures of the above mentioned project in Singapore where FlowCon SM is used as control valve, balancing valve and flow meter to charge tenants the amount of chilled water used.

Isolation Valve FlowCon SM Valve Temperature Sensor, T_2

Temperature Sensor, T_1

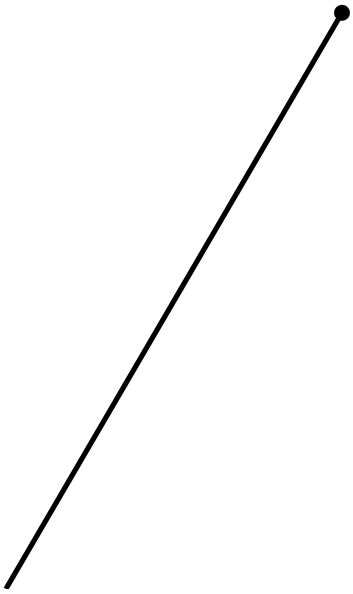
FEATURES AND BENEFITS OF FLOWCON SM

PERFORMANCE

- Replace installed 2 way control valves with no system changes and achieve much improved performance and stable control => retrofitting made easier
- Easy selection procedures that requires no tedious Cv calculation at every terminal
- Eliminates valve over sizing problems
- Control flow with an accuracy of +/- 5%
- 100% valve authority
- Ability to achieve controllability regardless of disturbance in the system
- Simplification of the HVAC system
- Increase actuator life expectancy due to no hunting effect
- A combination of more than 50 numbers of maximum controlled flow available which can be set through simple binary combination
- Ability to functions as control valve, balancing valve and flow meter
- Self calibrating actuator enables proportional modulating mode, on-off mode or tri-state mode
- Balanced system can still be achieved even actuator fails
- Maximum interchangeability for low spare parts inventory with 1 actuator for 11 sizes of SM valves
- Pressure or temperature can be monitored with the built in P/T measurement fittings
- Optional fail safe power storage feature to open and closed valve without an external power supply
- Optional LED displays enables readout of current, maximum flow rate positions and notification of jamming situation
- Manual over ride feature allows checking of the conditions of valve prior to jamming

COST

- Replace balancing valve, control valve, flow meter and balancing labour with a single FlowCon SM at less cost
- Reduce total installation cost
- Eliminate design and analysis cost of valve sizing
- Require smaller pump thus lower power consumption
- Lower the possibility of replacing burnt actuator



Temperature Sensor, T_1