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PRODUCT: Terminal Units – Controls
SUBJECT: Troubleshooting – Using CT Relays as Fan Proving Switches with ECM's
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THE ISSUE

It is sometimes advantageous for the building operators to be able to verify fan operation in the control room without having to go to the terminal unit. For this purpose, a fan proving switch of some kind is useful. In the past, current transducer (CT) relays have been used. When placed around one of the motor power wires, the motor current will cause a switch to make in the relay providing a signal to the local controller and then to the BMS that indicates the fan motor is running. When the motor de-energizes, the relay opens. This process has worked well in the past. It is currently the most common use for CT's in fan powered VAV terminal units.

EC Motors (ECM's)

Fan powered VAV terminal units equipped with ECM's have very different operating characteristics from those units utilizing permanent split capacitor (PSC) induction motors. PSC motors are either on or off, with the current through the power wires on the motor at zero when the motor is off. This is not true for ECM's. ECM's are more like a modern television. The power supply is always energized, even in the off mode. That is why the modern televisions are instant-on with no warm up time required. The ECM is similar in that the power supply is always on. In the off mode, there is no current flowing into the motor, but the power wires energize the power supply, which in turn energizes the motor. So there is always some current flowing through the power supply and consequently the motor power wires, even when the motor is in the off mode.

There are some CT relays that are adjustable and allow the minimum amount of current to be set. Those have their own independent power supply and the necessary electronics to allow the user to set the range of operation desired. Compared to the more prevalent non-adjustable type, these are very expensive. Those that are used as fan proving switches are non-adjustable. Since they are non-adjustable they have fairly large operating ranges setting the on and off points far enough away from one another to provide a reasonable amount of hysteresis in the signal to not allow false tripping. This, in turn, causes two problems with their operation as fan proving switches in the VAV terminal units. First the turn on point is greater than the amperage most units with ECM's will achieve, requiring multiple loops of wire through the relay pickup point. Sometimes this is difficult due to limitations on the size of the hole that is designed for the single pass wire. Second, the CT relays require the current to reach 0 before the relay will reset and open. Since the power supply is always on, this does not happen, and the multiple loops required for activating the relay now hold the relay on and disallow it to disengage. So, it takes extra effort to get it to energize, and then once it energizes, it will not de-energize unless the power to the unit is turned off. Consequently, non-adjustable CT relays will not work as fan proving switches on fan powered VAV terminal units.