Tech Tips II *Temperature Systems Inc.*

Madison -- Green Bay -- Jan 06

Economizer Basics

Questions

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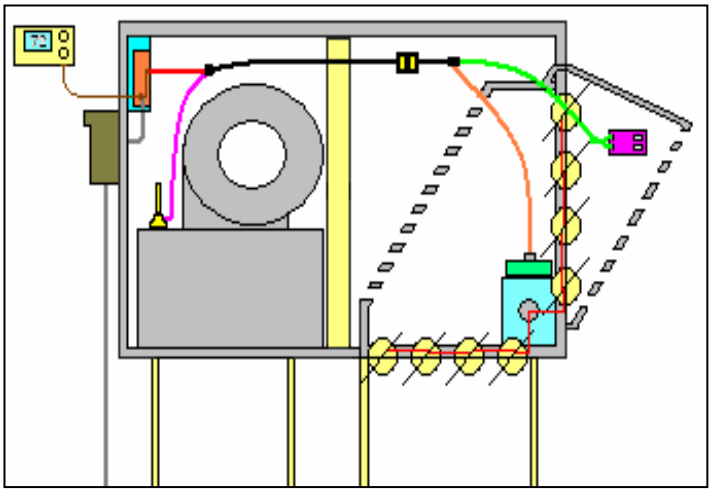
Purpose of the Economizer

The purpose of an economizer in a HVAC system is to take advantage of "***free cooling"***. In commercial buildings heat loads may be high due to office machinery, computers and occupants all generating heat. To reduce electrical costs, the economizer monitors outside air temperature and in some cases humidity (enthalpy) to determine if it can be used for cooling. Another feature is its ability to bring in fresh air to satisfy minimum ventilation requirements.



Sequence of Operation

1. During fan operation a signal is sent to the economizers microprocessor allowing fresh air dampers to move to the minimum position
2. On a call for fan & cooling a signal is sent to the economizer's microprocessor.
3. The microprocessor looks at outside air temperature/enthalpy to determine if it is suitable
4. If not suitable the compressor is energized
5. If suitable, return air dampers close, fresh air dampers open and outside air is brought in.
6. The processor monitors discharge air temperature to maintain 50-56°F by modulating dampers
7. If discharge air temp drops below 50°F the economizer will fully close
8. If discharge air temp reaches 56°F or above the economizer fully opens
9. If a fully open economizer can not maintain 50 to 56°F the microprocessor energizes the compressor
10. If not satisfied within the processors time limit Y2 is energized.
11. Once satisfied the economizer closes to the minimum fresh air position

Power Exhaust

In some applications using an economizer to bring in fresh air can lead to over pressurization; causing excessive building pressure or duct work expansion. A power exhaust is added to a system and works with the economizer to insure proper building pressure (typically slightly higher than atmospheric). Power exhaust units consist of exhaust dampers, exhaust motors, and a method of determining building pressure. As the pressure increases power exhaust motors are energized, exhaust dampers open and excess pressure is relieved. Following are descriptions of the most common control methods.

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Mercury Bulb

The mercury bulb is connected directly to the economizer's damper actuator motor. When the motor reaches its end position indicating the economizer is fully open, the mercury in the switch moves closes a contact and sends 24 volts to the power exhaust contactor. This energizes the motor and opens the exhaust damper, relieving the excessive pressure. It does not monitor building pressure. It works off of economizer position assuming a fully open economizer will over pressurize the space. Bulb position can be adjusted to regulate when the power exhaust is energized

End Switch

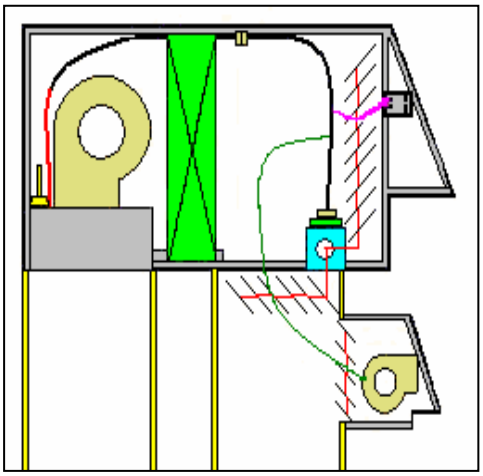
A two wire end switch is mounted on the economizer's actuator motor arm. When the motor reaches its end position indicating the economizer is fully open, the switch closes sending 24 volts to the power exhaust contactor, which energizes the motor, opens the exhaust dampers relieving excess pressure. This control does not monitor building pressure. It works off of economizer motor position assuming a fully open economizer will over pressurize the space.

Micro Switch

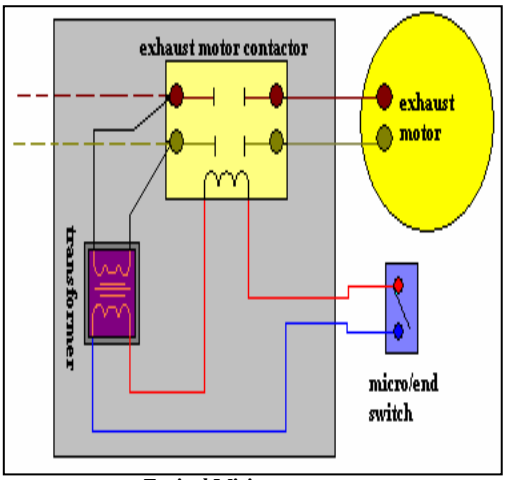
The micro switch works off of the same principle as the end & mercury bulb switches. It is installed near the exhaust damper. When the damper reaches the fully open position, the blade makes contact with the micro switch closing the contact, which energizes the power exhaust contactor & motor.

Internal Voltage feedback

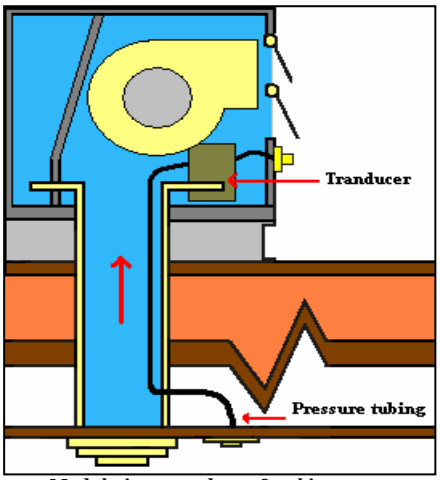
New power exhaust units have done away with all of the above mentioned options. They are using new technology to sense building pressure. Most actuator motors deliver a voltage output to the control module letting it know the actual position. Typically 2-10 VDC signal. 2 volts indicating it is fully closed and 10VDC indicating it is fully open. A potentiometer on the control sets the voltage where the power exhaust will energize.



Typical Installation



Typical Wiring



Modulating transducer & tubing

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Modulating Power Exhaust

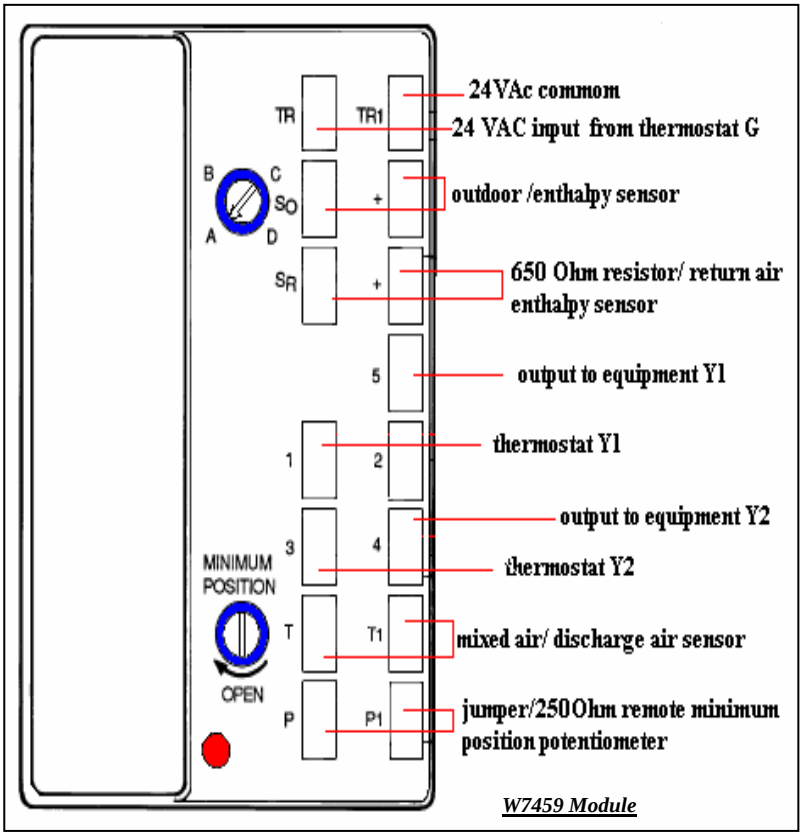
This power exhaust contains a control that varies the blower speed in order to maintain the desired building pressure. It uses a pressure transducer that compares room pressure to atmospheric. The transducer sends a signal to the motor controller which varies the motor voltage/VFD in order to provide pressure relief.

Honeywell W7459 Economizer

Used by several equipment manufacturers, the module directly connects to an M series actuator motor.

Installation

1. Discharge Air (Mixed Air) sensor mounts in the Blower compartment and connects to T, T1
2. Outdoor air /Enthalpy sensor is mounted in the outdoor air hood and connects to So, So+
3. A 650 Ohm resistor is installed at the Sr, Sr+ terminals. An optional mixed air enthalpy sensor can be used
4. A jumper is connected to P, P1. A 250 Ohm remote minimum position potentiometer can be used
5. Set temperature setting; refer to installation instructions for dry bulb/enthalpy temperature charts.
    - *(typical dry bulb settings A = 73, B = 70 , C = 67 , D = 63)*
6. Set minimum position
7. Test the module, jumper R to G dampers move to minimum position
8. Jumper R, Y & G, if the outdoor air is good the economizer should go full open.
9. If outdoor air is not suitable jumper So, So+ and the economizer should go to full open position



W7459 Module

Economizer Troubleshooting

1. Shut unit power off
2. Test discharge air sensor. Refer to installation instructions for temperature/resistance chart
3. Check So, So+ for proper connection and polarity of outdoor air/enthalpy sensor
4. Check Sr, Sr+, 650 Ohm resistor or return air Enthalpy Sensor must be connected
5. Make sure P to P1 jumper or remote 250 Ohm potentiometer is connected
6. Disconnect all thermostat wires from the unit
7. Turn on unit power.
8. Jumper R to G at the unit terminal block
9. Blower should be on, if no blower, check blower relay & voltage to blower relay.
10. Measure voltage at TR & TR1 (24 VAC)
11. If there is no voltage check wiring harness & connector plug
12. If there is voltage, damper should drive to minimum position

13. If damper does not move, check minimum position potentiometer
14. If damper still does not move, check motor (See motor trouble shooting)
15. Adjust temperature setting to the D setting
16. Jumper So to So+, the red light should come on, if no red light change out module, or remove the 650 Ohm resistor
17. Jumper R to Y, dampers should go full open
18. If dampers do not go full open, check the position of the push rods (damper actuator linkage)
19. To check the mixed air sensor use some ice or cold spray; apply it to the sensor, the dampers should start to close
20. If you jumper T to T1 the dampers will close to minimum position

Motor Troubleshooting

1. Shut the unit power off
2. Remove the control module from the motor
3. Remove the connectors from the TR & TR1 terminals on the control module, push the terminals onto the Motor TR & TR1 terminals
4. Turn unit back on
5. Jumper R to G
6. The motor will start and then stop or may do nothing
7. Put a jumper between T & T1 or between P & P1
8. The motor should drive full open
9. Remove the jumper and the motor should drive full closed
10. If power is removed when the motor is full open it will use the spring return to close

Final Thoughts

Studies show that less than 30% of installed economizers work correctly.

Economizers can save a great deal of energy. They can also waste energy if they are not operating properly or are improperly adjusted. For example, if the outside air dampers are not closing properly when the outside air temperature is high, then hot air is unnecessarily entering the building and causing the air conditioning compressor to operate longer and under higher loads thus consuming a great deal more energy than necessary.

If the dampers are open too far during the heating season the heating system must heat the extra outside air entering the structure. Such extra heating and cooling costs can be quite high. The cost of a service call to repair such a problem is often less than the cost of one or two months of energy wasted.

Many economizers are not functioning at all or are out of service because they are not well understood by some service technicians. Many service technicians simply disable them. It is essential that economizers are working properly and saving energy rather than increasing costs.

Since air economizers control and vary the amount of outside (fresh) air brought into a structure, they play an integral role in maintaining the quality of indoor air. A properly operating economizer can greatly improve indoor air quality (IAQ) and reduce air quality related illnesses. Therefore, it is important for the service technician have at least some knowledge of indoor air quality and its relationship to the heating and cooling system operation.

Don't let malfunctioning economizers waste money. Take the time to troubleshoot the equipment you are working with, repair it or replace it when needed.