



SmartAire™ S Installation Guide

Rev. 5, 10/13/11



Introduction

Tate's SmartAire™ Automatic Variable Air Valve Damper provides the user with unparalleled local control of airflow to precisely meet individual rack cooling demands without user intervention. Automatic control based on user a defined set point guarantees that each piece of IT hardware installed in the users rack is supplied with sufficient air volume at all times.

Method of Operation

Tate's SmartAire™ product is design to work in conjunction with the DirectAire™ Directional Grate to provide for precise local control, and accurate air flow deliver to the rack face. Since IT loads are rarely stable on a rack to rack basis, the SmartAire™ is designed to throttle the amount of air delivered to an individual rack based on its current inlet air temperatures. This guarantees sufficient air delivery to the rack, as hot air recirculation would occur in insufficient airflow delivery situations. This balancing act is managed by a high speed PID controller which monitors the temperature sensor in a constant evaluation mode. The single sensors is installed at the rack face are polled for current temperature value monitoring. This control point is then used to determine the correct opening percentage for the variable damper. The command signal is sent to the actuator, which then articulates the damper allowing more or less air to pass through the DirectAire™.

The impact of the greater or smaller airflow from each DirectAire™ has a cumulative effect on the underfloor static air pressure. This static pressure is ideally transmitted through the means of pressure sensors which provides a signal to the variable speed fans in the air handling equipment to reduce or increase speed to hold the minimum required air pressure. During normal operation each air handler will seek to maintain a constant average static pressure in its zone of influence, while the total airflow delivered to the floor may vary being dependent on current rack level demand. Figures 1, 2 and 3 illustrate this simple operational process on the following page.

Figure 1 - Idle load condition for variable flow damper

Figure 2 - Partial Load condition for variable flow damper

Figure 3 - Full Load condition for variable flow damper

Installation Instructions

1. Remove the SmartAire™ unit from the factory packaging. Take care to check that each required separate component is in the shipping packaging as listed below. Figure 4 depicts each part.
 - A. 1 x SmartAire™ Automatic Variable Airflow Valve Damper
 - B. 1 x Low Voltage Power Cord with Male/Male Connectors (**Order Length Required Separately**)
 - C. 1 x Single Temperature Sensor
 - D. 10 x Temperature Sensor Tree Zip Ties
 - E. 4 x Tool Less Roll Formed Stringer Hangers
 - F. A power module is required for every four or sixteen units but is ordered separately, confirm that these are available, or that there is remaining capacity on preexisting units
 - G. The appropriate electrical power cord is provided with the power module ordered separately
 - H. The SmartAire™ is designed for use only with Tate's DirectAire™ airflow panel which is ordered separately; other airflow panels are not recommended for use with the SmartAire™.



Figure 4 – Illustrated Parts List

2. Remove the existing airflow panel, and installed the four Tool Less Roll Formed Stringer Hangers into the stringer system. The hangers should be oriented with the larger angled bottom hook facing into the

center of the removed panel. Simply orient the hanger at a 45 degree angle with the floor, sliding hanger's smaller angled hook surface into the gap in the roll formed stringer's bottom surface, and then allow the hanger to roll back perpendicular to the floor surface. Repeat this for all four sides of the panel.



Figure 5 – Step 1, position hanger parallel to the floor with short angled edge aligned to opening in roll form stringer

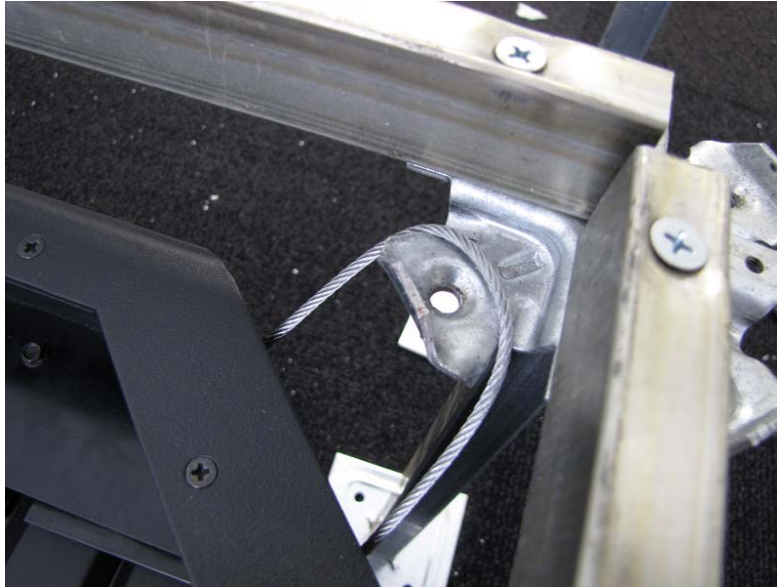


Figure 6 - Insert hanger into roll form opening and catch the top angle inside the stringer



Figure 7 - Release hanger and allow it to return perpendicular to the floor

A more flexible alternative method of attaching the unit to the raised floor understructure can also be realized by the use of the corner cable hangers. These cable hangers shown in the figure below, can allow unit to hang from the pedestal head in cases where non roll formed stringers are in use. It may be necessary to install a screw in the pedestal head on which to hook the unit for hanging.



3. Each SmartAire™ unit must be powered from another SmartAire™ unit or from a Power Module with sufficient remaining power to meet the demands of the additional unit. Two Power Modules can be ordered, a four SmartAire™ power unit or a unit capable of powering sixteen SmartAire™ units. No more than four SmartAire™ units can be powered from a single outlet on the Power Module due to NEC codes, therefore up to four units may be daisy chained together. Additional units may be home ran to the power module, with up to 4 modules fed from each supply outlet on the Power Module. See figure 8 for an example of a 16 unit Power Module.

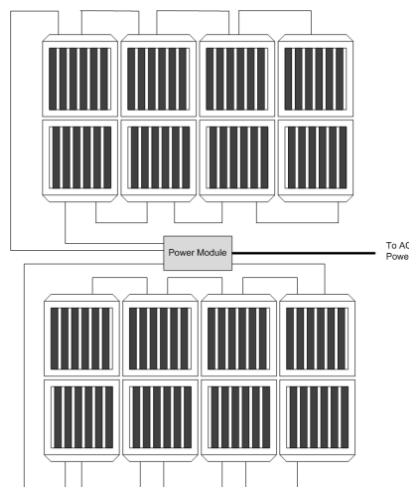


Figure 8 - 16 unit Power Module

4. SmartAire units will at some point be connected the appropriate Power Module which can be ordered in 3 different supply voltages, 100-120V, and 200-240V. Each Power Module will have a number of output connections, 2 in the case of the 4 unit module and 4 in the case of the 16 unit module. As stated before, each output should have no more than 4 SmartAire™ units connected to it through daisy chaining of the individual units. The Power Module maybe installed below the raised floor in close proximity to the units it will feed. The unit is powered by the supplied power cord, and should be connected to an outlet with the appropriately sized over current protective device. Each Power Module is equipped with a C14 inlet, and is shipped with a 6' power cord and the required outlet for each input voltage is listed in table 1 below. If the supplied cord does not meet the site requirements, a user supplied cord set may be used if it meets the voltage and amperage requirements of the power module. Figure 9 and 10 illustrate the installation of the Power Module.

Table 1 - Power Feed for Power Modules

SmartAire™ Power Module Power Feed Requirements	
Voltage	Outlet Required
100- 120V	NEMA 5- 15R
200- 240V	NEMA L6- 15R

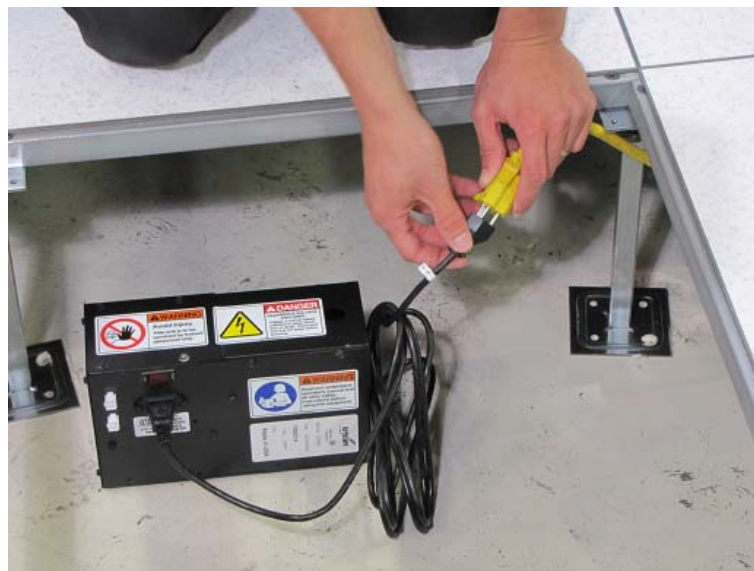


Figure 9 - Plugging Power Module into Outlet



Figure 10 - Powering the Power Module On

5. Once the power feed location for the SmartAire™ unit has been determined, place the SmartAire unit near the installation location, and route the power cord to the power feed. This may be the neighboring unit, or back to the power module. Be sure to collect any slack power cable and bundle it together to lessen its impact on airflow beneath the floor.



Figure 11 - Connecting LV power to SmartAire Unit



Figure 12 - Connecting LV Power feed to Power Module



Figure 13 - Powering SmartAire from neighboring unit



Figure 14 - Connecting next SmartAire from neighboring unit

6. Pick up the SmartAire™ unit using the inside lip around the inside perimeter of the SmartAire™ unit. Be sure to orient the SmartAire™ unit so that the shroud extends below the IT equipment rack. Lower the SmartAire™ unit at the edge that extends beyond the perimeter of the unit first so that this edge will be oriented beneath the rack see figure 11 below. Lock the lip of the unit into the hanger, and then lower the opposite side into the waiting Tool Less hanger. Once this side is also resting in the hanger support, manipulate the unit so that each hanger on the alternate sides are also securing the unit into place.



Figure 15 - Installing SmartAire unit into Floor



Figure 16 - SmartAire™ Unit Installed on hangers

7. Plug in the temperature sensor tree into the labeled connection port on the left side of the unit when facing the rack. Route the temperature probe into the rack. This can typically be done by routing the probes through the cable entry hole serving the rack, or by drilling a new 0.5" hole at the front of the rack, through the panel directly below the rack. If a new hole is required, ensure that the hole is sealed after the temperature probes are completely routed, and that the holes edges are appropriately grommets to decrease the risk of cable damage.



Figure 17 - Connection of temperature sensor tree

8. The placement of the sensor is at the user's discretion. The suggest location however would be along the perforated face of the rack door, with the sensor installed directly above the highest piece of installed IT equipment. The best method to accomplish this is to route the main trunk of the temperature sensor tree

along the hinge side of the door, and then route the probe to the door surface, securing the probe to the inside surface of the door, while the door is completely open to ensure sufficient slack. Zip tie the cable trunk along the rack frame or where appropriate. Other alternatives for mounting the temperature sensor may include the installation along the frame of the rack or directly at the server inlets through various methods. In cases where racks are wider than a typical 24" panel, an individual rack may receive partial cooling from two panels. In these cases, simply double the sensor probes in these racks to allow for parallel operation of the SmartAire™ units in question. The goal is to position the sensors in such a way that they are exposed to the continuous flow of intake air during normal IT operation. See figure 18, 19 and 20 for routing examples.

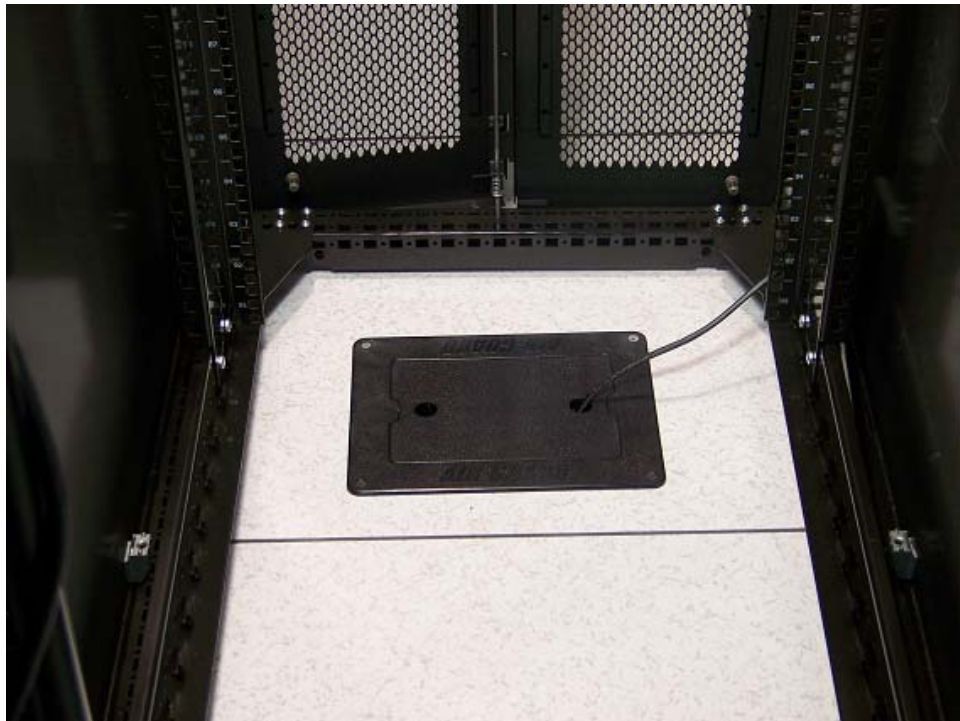


Figure 18 - Routing temperature sensor tree through cable entry point

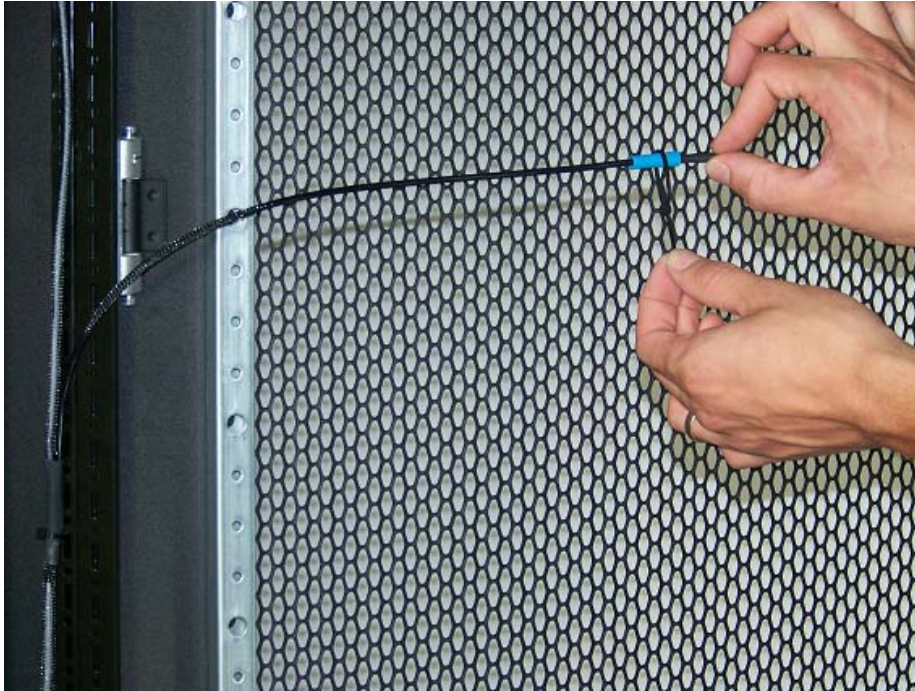


Figure 19 - Temperature Sensor installation



Figure 20 - Securing Sensor Tree to Rack with Sufficient Slack for Door Operation

9. The unit will have been powered on when power was connected to the unit in step 4 and all controls should now be functional. The user should now set the desired supply air temperature that should not be exceeded at the IT rack intake. The menu of the controller is accessed as follows.

- A. Pressing the SET button and hold it for approximately 2 seconds will display the value ST1, and then show the set point in flashing characters. Simply use the up and down buttons to adjust the set point. Press set once more and the new set point value will be stored.

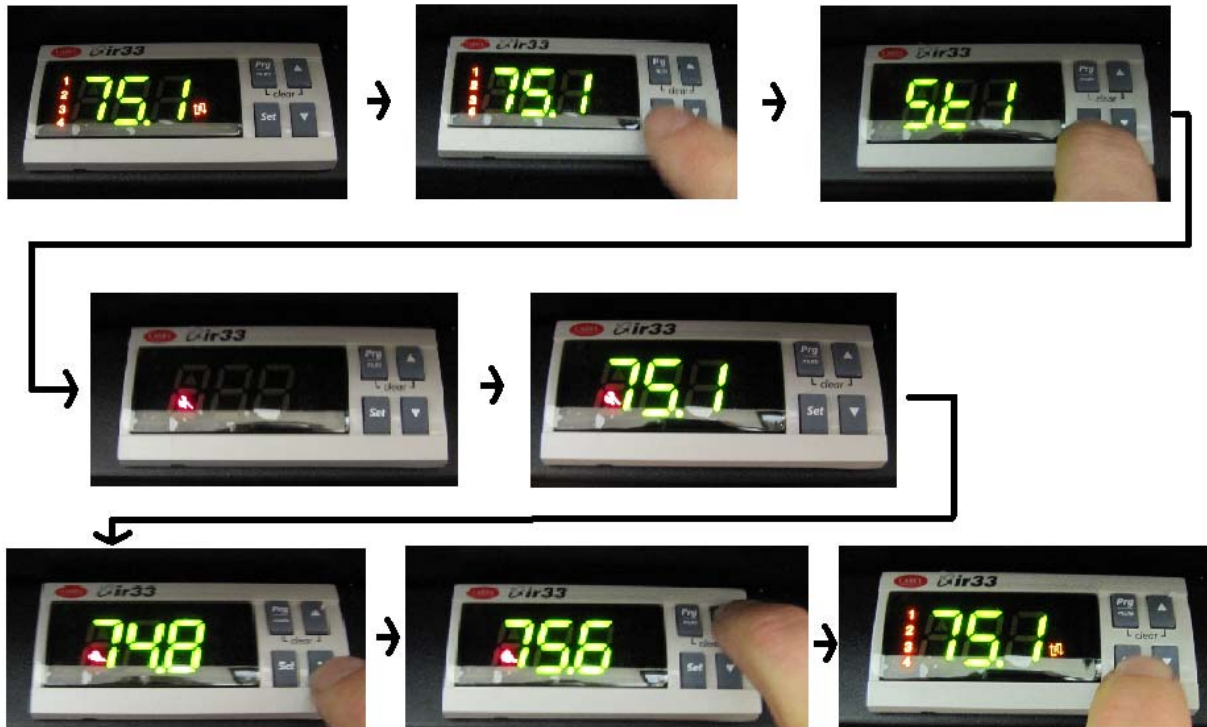


Figure 21 – Setting Temperature Setpoint

10. Once the value has been set, and all programming completed. Reinstall the DirectAire™ above the SmartAire™ unit and proceed to the next unit. It is best to work right to left due to the connector layout on the SmartAire™ unit. Each subsequent unit can fully access connector points on its neighboring unit, allowing for easier access to power connections for daisy chaining up to 4 units together.
11. The SmartAire™ unit is design to function in parallel with variable speed fan systems installed in the air handling equipment. As outlined in figures 1-3, a pressure sensor is used to provide feedback to the air handling equipment to increase or decrease fan speed. Locating this sensor maybe influenced by many factors, but general recommendations can be made.
 - A. Locate the sensor(s) of the air handling equipment nearest to the zone being deployed within a few tile locations of the SmartAire™ units.
 - B. Do not locate the sensors in close proximity to the air handling equipment.
 - C. After installation, measure the airflow from each grate, and compare these values along with the measured static pressure at the air handling equipment to the flow rate curves for the SmartAire™ unit at the 100% open condition. Adjust the location of the sensor location until the values produced are in agreement.



Figure 23 - Installation of DirectAire Panel

12. While setting the control points at the air handling equipment exceeds the scope of this installation manual, a few guidelines are listed below to assist with the understanding of best use of the SmartAire™ unit with variable speed air handling equipment.
 - A. In installations which are fully deployed with SmartAire™ units, it is best to control the speed of the individual air handling equipment with the use of static pressure transducers installed near the SmartAire™ units to be supplied. This will allow the air handling equipment to sense the change in demand in airflow through the indirect reduction in static pressure due to the higher open area as the damper increases its opening percentage. Conversely as the damper closes the increase in static pressure will signal the air handling equipment that demand is lessening, allowing for the reduction in speed.
 - B. In locations with only partial deployments of SmartAire™ units, it is best to deploy the units at racks with low loads versus racks with higher loads. This will allow the SmartAire™ units to reduce the amount of air delivered to these smaller users, thereby directing more air to the units that may need it. In these instances, the use of variable speed fans may not be required, as full advantage is only realized in total or nearly total deployments.
13. The SmartAire™ units are completely maintenance free. The temperature display will continue to show the current peak temperature during normal operation. Power failure, or control failure will result in 100% opening of the damper for fail safe operation, upon power restoration the unit will return to the last operating set point. Inherent redundancy will also be realized by the effect of a single failure on neighboring racks, which will sense the increase in cold aisle temperature, and increase their flow rates to meet the demand. Disconnecting any temperature probes will result in a constant error tone from the unit. Removing power from the unit will reset the unit which will then resume normal operation.
14. Figure 24 below shows the location of each user accessible input or output connection.



Figure 24 - User accessible input and output locations

- A. Input power from Power Module or neighboring unit
- B. Output power to neighboring unit
- C. Temperature Sensor input port