Going Beyond Traditional Cooling for Telecom Equipment with "Smart" Fan Controls and High Performance Specifications

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Fans specified for telecom equipment, including enclosures, server rooms, wide area networks and WiMax transmitters, are required to do more than simply keep the electronics cool. While thermal management of telecom equipment is paramount to its proper functionality, conserving energy and maximizing equipment performance are also in the forefront of design considerations. Fan manufacturers are meeting these requirements through the use of various intelligent control and feedback options, as well as high performance specifications.

Increased Functionality and Energy Conservation through Special Functions

Manufacturers of telecom equipment, especially enclosures and server rooms, continually face demands for reduced energy consumption and limited space – in addition to the challenge of managing the high heat generated by telecom equipment. Fan manufacturers solve these problems by employing special functions in their fans' design and construction, such as tachometer output, locked rotor alarm, pulse width modulation (PWM) input, and thermal and constant speed controls.

Tachometer output, for example, provides design engineers with an accurate means of monitoring and reporting a fan's rotational speed, as well as indicating if the fan's speed falls below a specified RPM. This signal can serve as a lower cost alarm or indicator by monitoring the fan speed to determine relative temperature. Typically, the tachometer output option is available as either a 5V TTL signal, or as an "open collector" signal.

Fans and fan trays equipped with locked-rotor alarms indicate whether a fan has stopped operating by transmitting a high or low output signal, thus avoiding a potential overheating situation; while PWM input varies the width of the electrical pulse in order to control the average voltage delivered to the fan, allowing for a higher efficiency than linear control provides. A PWM option also allows users to digitally control the speed of the fan through an existing bus system or PLC.

These special functions or "smart controls" not only provide intelligent control options and feedback that increase fan functionality and optimize fan performance, but they also maximize energy conservation by allowing manufacturers the ability to better monitor airflow and operating temperature, ensuring the fans are operating properly and at optimal conditions. This is particularly true with thermal and constant speed controls.

Fans or fan trays with thermal speed controls employ a thermistor-controlled circuit that increases fan speed only when the temperature rises above a determined set point. This "green" option reduces overall energy consumption by lowering fan speed when temperatures within the enclosure are below the set point, therefore only cooling when and what is necessary. In server farms, for example, a thermistor-controlled fan will only turn

on (or speed up) if the temperature warrants it, conserving energy and preventing the fan from continually operating.

Thermistor control circuits can be mounted directly in the fan hub or remotely mounted via a lead wire, and can be positioned anywhere, giving design engineers the flexibility to regulate fan speed based on ambient temperature in a specific area. In addition, a constant speed function senses variable input voltage, which can cause variations in power output (and thus fan speed and airflow), and compensates to maintain the fan's constant speed regardless of input voltage fluctuations.

Image: Fan manufacturers are solving the problems of high heat, reduced energy consumption and increased functionality in telecom equipment by employing smart controls on AC and DC fans, such as the DC fan shown above

Design Considerations for Maximizing Performance

Server rooms today include a greater amount of equipment, computer processors and WiMax transmitters that are running at higher speeds than ever before, and all of the equipment is packed much more densely to meet the growing demand for smaller devices. Higher operating speeds and more components in a smaller area are producing more heat, resulting in greater thermal management requirements than ever before.

Fan manufacturers are meeting these thermal management design challenges by increasing their CFM rating (cubic feet per minute). By increasing the airflow of the fan, more air is circulated through the enclosure and the electronics within the device are kept below the threshold temperature, thus reducing the overall temperature of the telecom equipment. Some fan manufacturers have responded with various fan models that provide airflow in excess of 1100 CFM to meet these demands, while other solutions are designed to maximize airflow in nearly sealed, exceptionally high static pressure environments (that is, a measure of the differential air pressure inside the enclosure versus outside the enclosure), such as within telecom networking enclosures and industrial cabinets. Maintaining airflow within an increased static pressure stabilizes the temperature, allowing the electronics to operate at maximum capacity.

Fans designed to maximize airflow in nearly sealed, high static pressure environments provide a significantly higher CFM in a smaller frame package size than comparable cooling solutions. For example, a 60mm fan is capable of outputting the airflow equivalent of an 80mm fan, and a 120mm fan is capable of producing nearly 300 CFM in packages as small as 4.5 inches.

Image: Orion Fans' high performance VA Series vane axial fans provide significantly higher CFM and pressure ratings in a smaller frame package size than comparable cooling solutions

Despite the increased airflow provided by high CFM fans, some applications, such as densely packed industrial enclosures, often require additional cooling to maintain optimum temperature in specified areas within the cabinet. The use of enhanced "spot cooling" fans increases airflow to specific "hot spots" within the enclosure, and are often supplied with a standard AC power cord and plug, providing enclosure manufacturers the flexibility to add them anywhere within their cabinets. Such "spot cooling" fans allow manufacturers to quickly and efficiently solve an elevated temperature problem – especially one that is discovered after the enclosure is already built and being tested – without a costly redesign, or even the need for rewiring to add a fan, as most AC spot coolers simply require an outlet to plug in.

In addition to moving more air via higher fan CFM ratings, fan manufacturers are also providing increased performance specifications within fan trays. Each fan within a fan tray may be equipped to adjust its speed in direct relation to the ambient air temperature between 55% and 100% of full speed, maximizing fan life, saving energy and minimizing noise. Fan and fan tray expansion modules also allow customers to add or subtract fan modules quickly and easily as their cooling needs change.

In terms of size considerations, because fans are being specified as the primary means of thermal management in a variety of space-constrained applications including datacom equipment, fan manufacturers are designing much smaller frame fan structures. Lower-profile fans are becoming increasingly popular, as they meet the needs of smaller package sizes and thin 1U rack systems. Directional blowers are also being employed as these low-profile devices provide directional cooling similar to spot coolers but in flat, compact designs. Even in larger applications such as server rooms, directional blowers are utilized in applications where rather than blasting air out of the back of the device, the requirement is to direct the air in smaller, more controlled directions, such as up, down or diagonally. Along with meeting the space and directional requirements of various applications, blowers can also provide the speed and airflow necessary to optimize thermal management.

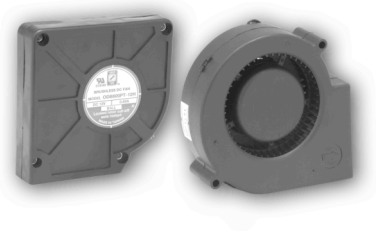

Image: DC blowers provide directional and spot cooling in space-constrained applications

Conclusion

Fans today are being used for much more than just cooling, particularly in densely packed telecommunications enclosures. Through the use of intelligent control and feedback options, as well as increased performance specifications (including higher CFM ratings), end users are provided with greater functionality while also conforming to "green" specifications. Superior thermal management capabilities through exceptional airflow maximize equipment performance and make fans ideal for any application requiring the movement of a large amount of air – particularly within telecom and networking equipment.