

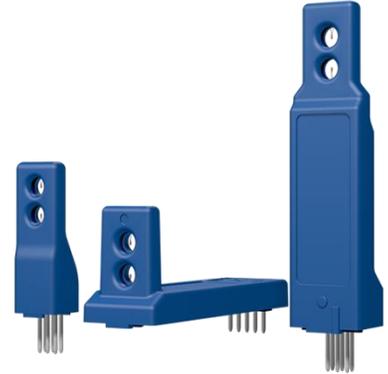
Application Note Series

Board Mount Series –Airflow Measurement in Electronics

Product Platforms: Board Mount Airflow Sensors & Instrumentation

Products:

- F66x Board Mount Digital Airflow Sensor
- RFS300 Board Mount Digital Airflow Sensor (Reference Design)
- °C Port Data Acquisition Instrument
- AccuTrac™ Software



Purpose: Measure airflow within dense electronic systems and enclosures for monitoring, control and alarm

Testing Range: 0.15 m/s to 20 m/s [30 fpm to 4000 fpm]

Part 1: Board Mount Air Velocity Sensors for Dense Electronics

ABSTRACT:

Moving air is an effective option to keep electronics cool. When hardware issues such as fan failure occur within dense electronic systems and enclosures, overheating, component damage, unstable operation or even catastrophic failure may result.

Airflow management using an air velocity sensor to provide real-time feedback can identify problem areas before damage occurs. Degree Controls' [board mounted air velocity and temperature sensor platform](#) with digital output is designed to measure complex, spatial airflow inside electronic or ducted systems.

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Compact PCB Mount Airflow Sensors in Vertical and Horizontal Profiles:

The [F660/F662](#) board mount sensor from [Degree Controls](#) is the smallest form factor, vertical profile digital airflow sensor on the market. It uses high performance dual element sensing technology and can be soldered directly to a printed circuit board or plugged into a surface-mount socket for easy removal. Air velocity range and input voltage is configurable, and a choice of UART or I2C digital output simplifies integration to microprocessors.

The F660/F662 is ideal for 2RU chassis or computer mil-style chassis and cabinets. For applications where component height is even further restricted, our [F661/F663](#) board mount sensor with horizontal flow profile, compatible with 1RU and blade server systems, is available.



Figure 1 Vertical & Horizontal Profiles

Board-Mount Reference Airflow Sensor:

Contact Degree Controls to learn about our [RFS300](#) digital board mount sensor for even greater positioning flexibility. The RFS300 uses a reference design circuit that the client integrates onto their board creating an even smaller sensor footprint, (6mm x 6mm) and low power consumption.



Figure 2 RFS300 - Reference Design

Part 2 of our *Board Mount Series – Airflow Measurement Within Electronics* describes using Degree Controls [F66x Board Mount Digital Airflow Sensors](#) for filter clog sensing.

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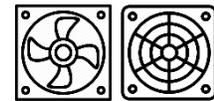
Board Mount Series – Airflow Measurement in Electronics

Part 2: Airflow Measurement for Filter Clog Detection:

Note: Part 1 of our *Board Mount Series – Airflow Measurement in Electronics* outlines the importance of airflow management in electronics and presents [F66x](#) PCB mount air velocity and temperature sensors.

Clogged Filters Cause Problems:

Fan cooling is an efficient way to keep electronics cool in enclosed spaces, and fan filters help prevent the intrusion of contaminants that could damage those electronics and circuitry. Fan filters perform well, as long as they are not clogged or damaged. Clogged filters have reduced performance and obstruct airflow, leading to increased system temperatures. Measurement of air velocity within dense electronic systems and enclosures is essential, as premature component or system failures may result when typically tight thermal margins are exceeded.



Board Mount Air Velocity and Temperature Sensors Manage Filter Clog:

[Degree Controls](#) has the tools available to address the need to measure and monitor airflow within dense PCBAs in enclosed spaces. Our [F66x board mount digital air velocity and temperature sensors](#) use dual element sensing technology and can be directly soldered or socketed to your PCBA to manage clogged filters and air flow intake and exhaust disruptions.

F66x Airflow Sensors Can Help

The F66x board mount air velocity sensors can be used inside electronic systems to:

- augment existing temperature-based environmental sweeps on board assemblies,
- track fan air filter health over time, and
- provide watchdog functionality for accidental airflow blockage,

ensuring that filtration performance and the supply of air is not compromised. If air is not moving optimally, the user is alerted to the fact that the fan’s air filter is clogged.

Airflow measurement with these integrated board mount sensors enables maintenance alarms, signaling when it’s time to take action to clean or replace a filter, and provides a means for

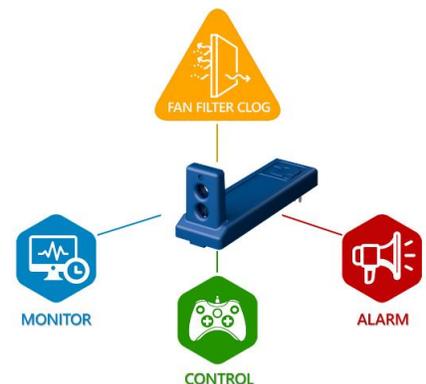


Figure 3 Board Mount Airflow Sensor Modes of Operation

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additional control, such as changing fan speed or making shutdown decisions. Air velocity and temperature data logging can also provide protection against early product failure liability.

Digital Output for Communication, Control and Alarm

The F66x board mount sensors measure air velocity and air temperature inside electronic systems in real time, and communicate across the I2C or UART bus. Sensors



Figure 4 Airflow Sensor Digital Output

can be operated as *monitor* only, sharing velocity and temperature data with the system controller, or as a closed loop fan *controller* with PWM output. In addressable, multi-sensor deployments, air velocity across an area or volume can be measured at multiple locations. F66x board mount air velocity sensors can also be configured to function as a switch and provide an *alarm* output.

Part 3 of our *Board Mount Series – Airflow Measurement in Electronics* describes our [pcb mount airflow sensors](#), with [instrumentation](#), as a solution for load card testing.

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Part 3: Load Card Testing with Airflow and Temperature Sensors:

Note: Part 2 of our *Board Mount Series – Airflow Measurement in Electronics* describes using Degree Controls [F66x Board Mount Digital Airflow Sensors](#) for filter clog sensing.

Thermal Analysis Tool with Airflow Sensors:

Thermal analysis is an essential part of the design of PCBAs (printed circuit board assemblies) for manufacture and operation. Thermal modeling provides designers with useful information, however it does have limitations. Designers and engineers obtain additional empirical thermal data using a thermal load board or load card to simulate an actual application PCBA. Typically, thermal load boards approximate the application PCBA mechanically and thermally, have a means to adjust power dissipation, and include multiple airflow sensors for thermal testing. Thermal load boards help to improve system performance and reduce development time of complex electronic assemblies.



Figure 5 Airflow Sensors with Instrumentation Solution for Thermal Analysis

Thermal Load Card / Product Evaluation PCBA:

A typical thermal load card or product evaluation PCBA is illustrated below. The load card includes multiple sockets to accept Degree Controls small footprint [RFS300](#) board mount sensor heads for maximum positioning flexibility. The user plugs in RFS300s wherever they want to collect real time air velocity and air temperature data.

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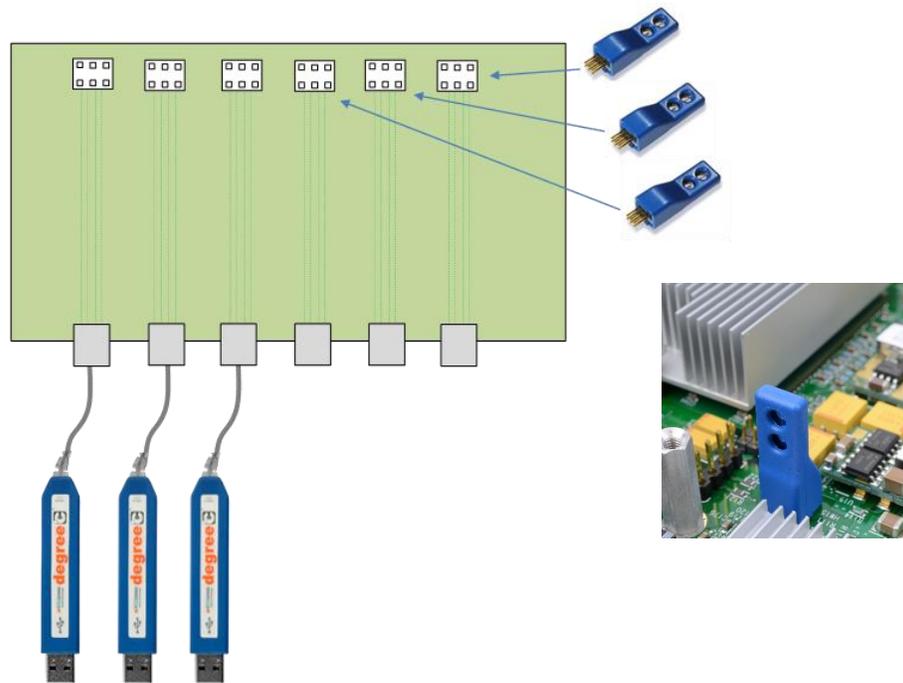


Figure 6 Load Card with Board Mount & USB Air Velocity Sensors

Traces on the load card run from RFS300 locations to USB PCB edge connectors for direct connection to [UAS sensors](#). The UAS sensors connect to a [°C Port1200](#) or [°C Port3600](#) data acquisition instrument, having 12 or 36 sensor channels respectively. The °C Port then connects to either a PC or local network switch via Ethernet, and Windows® based [AccuTrac™ software](#) collects air velocity, air temperature, humidity and barometric pressure data in real time. Optional [UTS100 thermocouples](#) can be added at any time to include case temperatures in the airflow studies.

CONTACT:

To find out more about Degree Controls' sensor products and solutions, contact us at 1-877-degreeC, or visit our website at www.degreeC.com. Email sales inquiries to sales@degreec.com.

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