

# Application Note Series

## Automotive HVAC and Duct and Filter Performance Testing



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| <b>Product Platform:</b> | Airflow Research and Development Instrumentation                     |
| <b>Product:</b>          | °C Port3600 Air Velocity and Temperature Data Acquisition Instrument |
| <b>Purpose:</b>          | Multi-Point Air Velocity and Temperature Testing                     |
| <b>Testing Range:</b>    | 0.15 m/s to 40.0 m/s [30 fpm to 4000 fpm]                            |

### ABSTRACT:

High performance automotive HVAC designs require increasingly complex duct geometries and vent configurations to provide the air flow delivery control that today's clients demand. Passenger comfort is a function of airflow velocity and temperature, and the rate at which heated or cooled air (heat energy) is deployed to a specific region of the cabin. Today, passengers expect to have independent HVAC controls to maintain their individualized comfort needs. Because so many real-time vent, flowrate and temperature configurations exist to provide this level of performance, test and measurement solutions are needed in the design, testing and quality phases of new HVAC system development. Measurement tools which offer multi-point measurement, with simultaneous data polling of velocity, temperature and humidity, are necessary to conduct efficient and repeatable tests in order to quantify performance.



### SOLUTION:

To provide simultaneous, multi-point airflow readings at up to 36 points in automotive ducts, vents or open cabin space, Degree Controls developed the °C Port3600. Single point measurement devices such as vein anemometers or hand-held probe anemometers are cumbersome, interfere with the airflow profile, and are generally non-repeatable due to the nature of the hand-held setup. The °C Port3600 takes care of these limitations and logs airflow data with an easy to use, Windows compatible software tool called AccuTrac™.



Insertion probe option for ducts and plenums



36 Sensor Channels for Easier Data Acquisition

*Using patented sensor technology, degreeC has developed a 36-channel, air velocity and temperature measurement instrument with real-time logging software, to facilitate multiple-point airflow testing. It's called the °C Port3600, and it is revolutionizing automotive HVAC testing.*

Using the °C Port3600, clients are able to install an air velocity and temperature sensor probe into each of the ducts of the HVAC system. Additionally, a system level humidity sensor can be deployed downstream of the condenser/blower, to provide real-time system humidity measurement. With sensors in place, many useful duct-level experiments can be conducted, to determine total flow, total heat energy or heat flux, which would be otherwise impossible, with single point measurement tools. With this kind of multi-point test setup, the engineer can measure these parameters, against varying vent positions, vent ON/OFF selections, heating/cooling levels, and selected blower speeds in the vehicle's HVAC system. Effects of cabin filter clog can also be determined and correlated to degraded levels of flow, heat flux, or defrost performance.

Each sensor location provides real-time data, logged in the AccuTrac™ software, included in your °C Port3600 tool set. The °C Port3600 is connected via a Ethernet cable interface to your laboratory PC or network switch, and the test data is available real-time to other technicians who may be monitoring the testing remotely by PC, Tablet or smartphone.

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AccuTrac™ software allows the user to modify units of measure, data polling rates, measurement type, and to query sensors for calibration information. It can also provide real-time graphing functions, so a user can see the flow performance from duct to duct, when an external parameter, such as vent selection, blower speed, or heating/cooling load is modified during the experiment.

AccuTrac™ can conveniently export the log file to any mathematical tool or spreadsheet application. Auto save functions and convenient time saving tools are embedded in the software and experiments can be started and stopped by remote PC or smartphone devices of any kind.



### AUTOMOTIVE HVAC TESTING:

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- Heat Flux Testing:** Generate models of heat flux available at different blower speeds and heat/cooling settings, for each duct in the HVAC system. Vital for passenger comfort performance modeling.
- Filter Clog Testing:** Useful for developing models correlating filter clog to air flow performance within different cabin ducts.
- Cabin Exhaust Port Testing:** Useful for correlating duct flow performance as a function of the airflow impedance of the cabin exhaust port.
- Duct to Duct Comparison:** Useful for profiling flow and heat flux performance in each duct, under different vent ON/OFF configurations.
- °C SPAR Compatible:** The °C SPAR is a Sensor Pole Array, which is a tubular pole with sensors mounted along the length, in a customized pitch. See [www.degreeC.com](http://www.degreeC.com) for more information on the °C SPAR and how it can be used to measure flow uniformity across a planar area, such as a defrost flow plane.
- Warm-up Testing:** Developing models of time-after-cold-start vs heat flux performance for cabin comfort applications.
- Air-Recycle Performance Modeling:** Developing models of heat flux and humidity performance in cabin air recycle mode vs outdoor intake air mode.
- Real-time Display:** The °C Port3600 will show profiles and duct comparisons in real time, with multi-user support, and remote control of the experiment via smartphone or tablet.
- Custom calibration ranges:** Many calibration ranges available for the UAS series of air velocity and temperature sensors.
- Manufacturing excellence:** Degree Controls has more than 25 years of airflow sensor experience and is used by many Fortune 500 companies. RoHS Compliant.

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## PERFORMANCE CHARACTERISTICS:

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|---------------------------|--|
| Operating Temperature:    | 0-70 °C [32 to 160 °F]   |
| Velocity Range Available: | 0.15 m/s to 20.0 m/s [30 fpm to 4000 fpm]  |
| Temperature Accuracy:     | ± 1°C  |
| Velocity Accuracy:        | greater of 5% of reading or 0.05 m/s [10 fpm]<br>*call for custom ranges and accuracy requirements   |
| PC requirements:          | Windows 7 or higher, USB 2.0/3.0 Interface.  |
| Sensor types:             | Air velocity and air temperature – UAS1000 Series<br><br>Humidity – UHS1000 Series<br><br>Thermocouple (for case/surface temperature measurements) – UTS1000 Series<br><br>Sensor Pole Array - °C SPAR |

## CONTACT:

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To find out more about Degree Controls sensor and control products, contact us at 1-877-degreeC, or visit our website at [www.degreeC.com](http://www.degreeC.com). Email inquiries to [sales@degreeC.com](mailto:sales@degreeC.com).

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