

**Centralized Sensing:
More Sensing, Fewer Sensors™**





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AWARD-WINNING TECHNOLOGY



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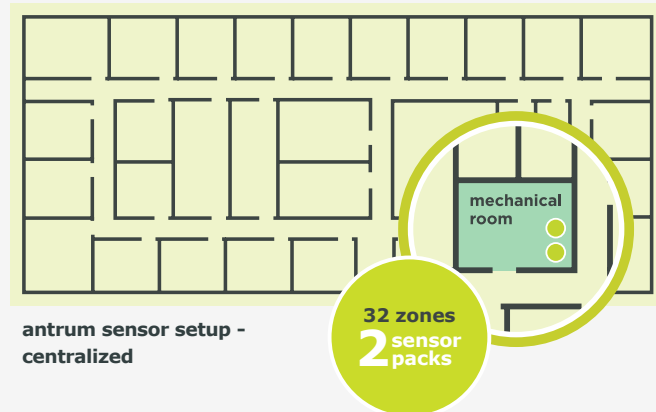
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Case Study:
Grand Valley
State University

WHY ANTRUM

AntrumX™ is a centralized indoor air quality monitoring solution. Our award-winning technology delivers more accurate and consistent data than wall-mounted sensors, allowing building managers to save on energy and maintenance costs while creating healthier, more efficient buildings.

Antrum's patented technology monitors the IAQ of up to 32 zones from a single location, allowing facilities to easily calibrate all sensed locations in under one minute.



"We calibrate our sensors regularly."

– Said Nobody...EVER



Accurate

One sensor for both Outdoor Air (OA) and Indoor Zones, canceling sensor drift.



Maintainable

Less than one minute to calibrate or replace 16 zones at a time.



Scalable

Increase sensing capabilities as your building and/or code evolves, with a simple sensor pack upgrade.



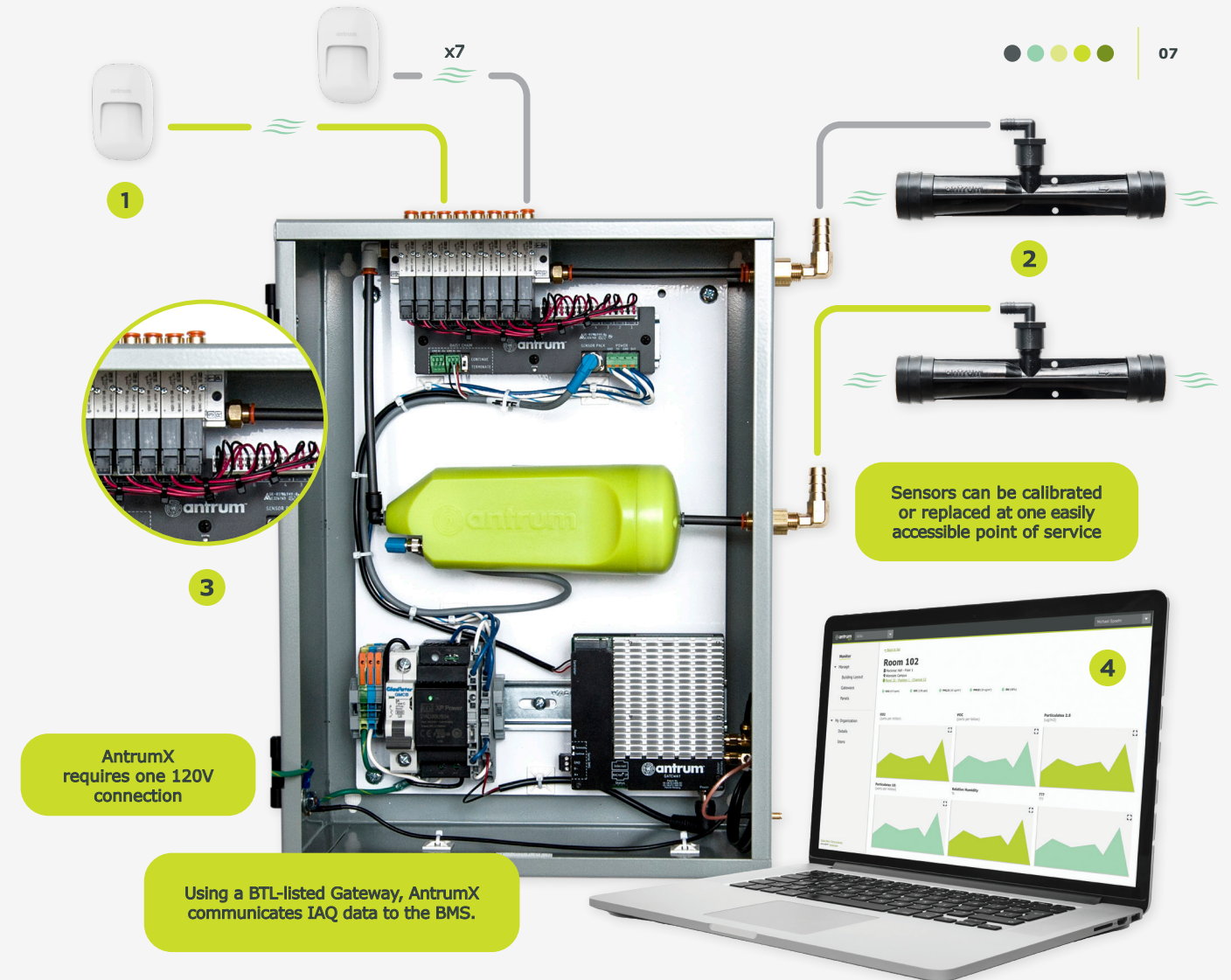
Cost-effective

Reduced total cost of ownership (TCO) for the life of the building.

HOW IT WORKS

Centralized Sensing: More Sensing, Fewer Sensors.™

- 1 Quarter inch tubing transports air samples from the faceplate or duct probe located in the monitored zones to the sensor pack.
- 2 Using building differential pressure, the air accelerator is connected to the supply duct to create a vacuum and draw air samples from the zone to the monitoring panel.
- 3 Air samples from each zone are drawn back to the panel simultaneously. Using a bank of solenoid valves each zone is monitored independently while all other zones are exhausted.
- 4 Using a BTL-listed gateway AntrumX communicates data to the BMS and cloud over a secure network.



SYSTEM



AX 08/16/32
The AntrumX monitoring panel is available in three sizes and installed in a centrally located area to the monitored zones.



Tubing
Quarter inch tubing transports air samples from the monitored zone to the sensor pack. Multiple tubing options available based on application.



Sensor Pack
The sensor pack can be calibrated or replaced at one easily accessible point of service.



Gateway
Using a BTL-listed Gateway, AntrumX communicates IAQ data to the BMS.



Air Accelerator
Our patented air accelerator uses the building's static pressure to create a vacuum, allowing air samples to be drawn from each zone.



Faceplate /Duct Probes
Air samples are drawn from faceplates and duct probes to the monitoring panel.

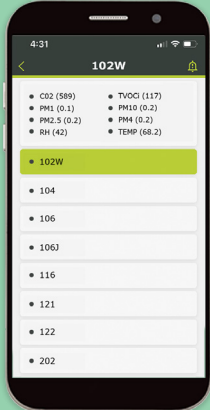


Fan Kit
The fan kit is available for parking garages/other applications where ductwork access is limited. The variable-speed fan works with our air accelerators to provide the necessary vacuum for the system.

AntrumEYE

Know your air.

AntrumEYE™ software illuminates the space-level IAQ data measured by AntrumX. The smart analytics dashboard is accessible on a computer or mobile device, delivering critical IAQ data anywhere, anytime. AntrumEYE comes standard with AntrumX.



LABORATORY

Use the AntrumX™ centralized sensing platform for demand-based control to achieve your safety and sustainability goals.

OPTIMIZED VENTILATION

Traditionally, laboratories are designed with a fixed number of air changes per hour (ACH), usually between 6 to 12 which results in over-ventilation.

According to ANSI Z9.5, 2022, the ventilation rate may vary based on measurements of specific contaminants at selected locations in the room or in the exhaust duct connected to the room.

AntrumX Benefits:

Safety

- Safely reduces lab air change rates to as low as 2 ACH when the lab air is “clean” and the fume hood exhaust or room cooling load requirements do not require higher airflow rates.

Maintainability

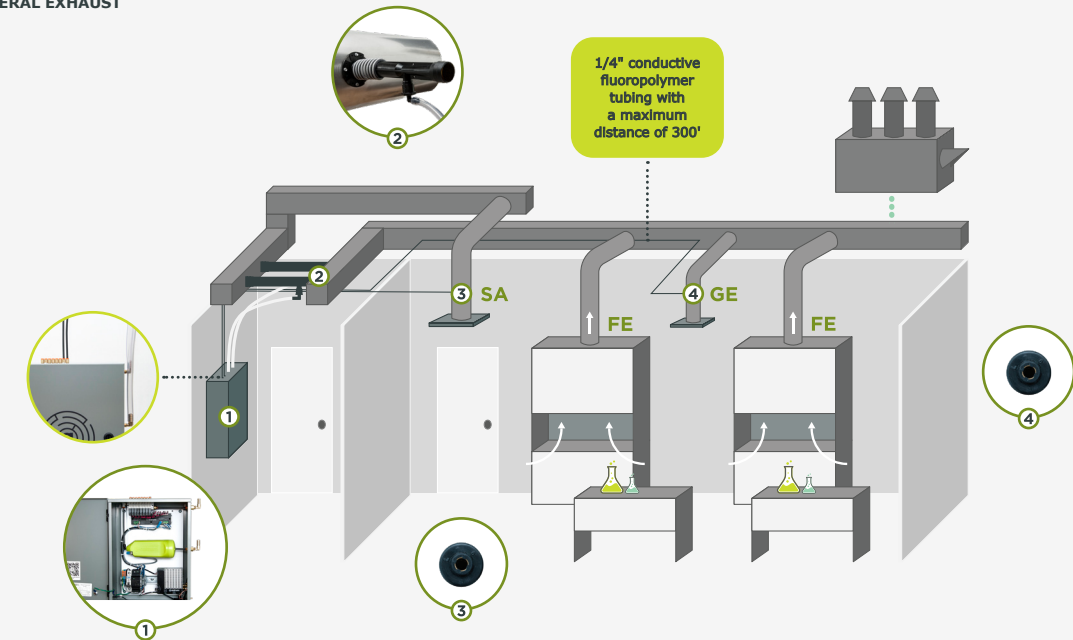
- AntrumX’s patented technology uses the building’s differential pressure to draw air to the monitoring panel without the need for loud, maintenance-intensive pumps.

Energy

- Reduces ventilation in laboratories and vivariums with real-time sensing.

SAMPLE INSTALLATION

- | | |
|-------------------------------------|----------------------|
| ① MONITORING PANEL | SA SUPPLY AIR |
| ② AIR ACCELERATOR | GE GENERAL EXHAUST |
| ③ 1" DUCT PROBE – SUPPLY AIR PICKUP | FE FUME HOOD EXHAUST |
| ④ 1" DUCT PROBE – GENERAL EXHAUST | |



COMMONLY SENSED POINTS: NH_3 | CO_2 | CO | DP | CH_2O | NO_2 | O_2 | O_3
 PM0.1 | PM0.3 | PM0.5 | PM1.0 | PM2.5 | R-410a, R32, R454B | RH | TVOC | TVOC (PID) | TVOCi

LABORATORY

Monitor your laboratory exhaust to allow for substantial energy savings.

CHEMICAL-MONITORED EXHAUST

Recent regulatory updates have significantly modified the suggested operation of laboratory exhaust fans. As stated in the 2022 version of ANSI Z9.5: *"Maintaining a constant exit velocity or assigning a prescriptive minimum allowable minimum exit velocity is not sufficient to meet this standard."*

AntrumX Benefits:

Safety

- Ensures concentrations of toxic emissions remain at or below allowable thresholds under all operating conditions with continuous sensing.

Maintainability

- Engineered on a scalable platform that streamlines maintenance and doesn't require pumps, allowing AntrumX to provide significant value to laboratory facilities at a fraction of the cost of other centralized sensing solutions.

ROI

- Proven ROI in a matter of months using estimated \$0.40-\$0.75/CFM annual savings.

SAMPLE INSTALLATION

- ①

MONITORING PANEL
- ②

AIR ACCELERATOR
- ③

1" DUCT PROBE – SUPPLY AIR PICKUP
- ④

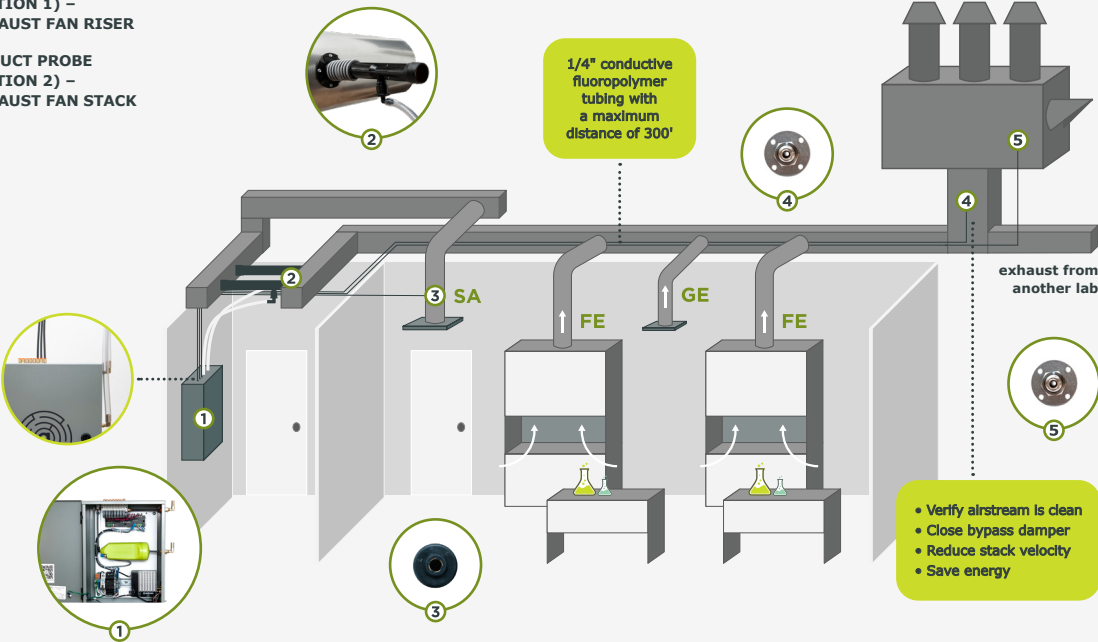
8" DUCT PROBE (OPTION 1) – EXHAUST FAN RISER
- ⑤

8" DUCT PROBE (OPTION 2) – EXHAUST FAN STACK
- SA

SUPPLY AIR
- GE

GENERAL EXHAUST
- FE

FUME HOOD EXHAUST



COMMONLY SENSED POINTS: NH₃ | CO₂ | CO | DP | CH₂O | NO₂ | O₂ | O₃
PM0.1 | PM0.3 | PM0.5 | PM1.0 | PM2.5 | R-410a, R32, R454B | RH | TVOC | TVOC (PID) | TVOCi

EDUCATION

AntrumX™ replaces 16 wall-mounted sensors with one centralized sensor, allowing you to calibrate or upgrade 16 zones simultaneously in under one minute.

DCV FOR CLASSROOMS

Indoor Air Quality and energy savings continue to be an important topic of conversation in education. Most schools simply do not have the resources to maintain/calibrate the volume of sensors required to achieve their desired goals.

AntrumX allows educational facilities to comply with ASHRAE 62.1, which specifies that all sensors failing to meet accuracy standards must be recalibrated or replaced.

AntrumX Benefits:

Maintainability

- Uses 6% of the sensors used in wall-mounted sensing solutions, allowing 16 zones to be calibrated simultaneously in less than one minute.

Scalability

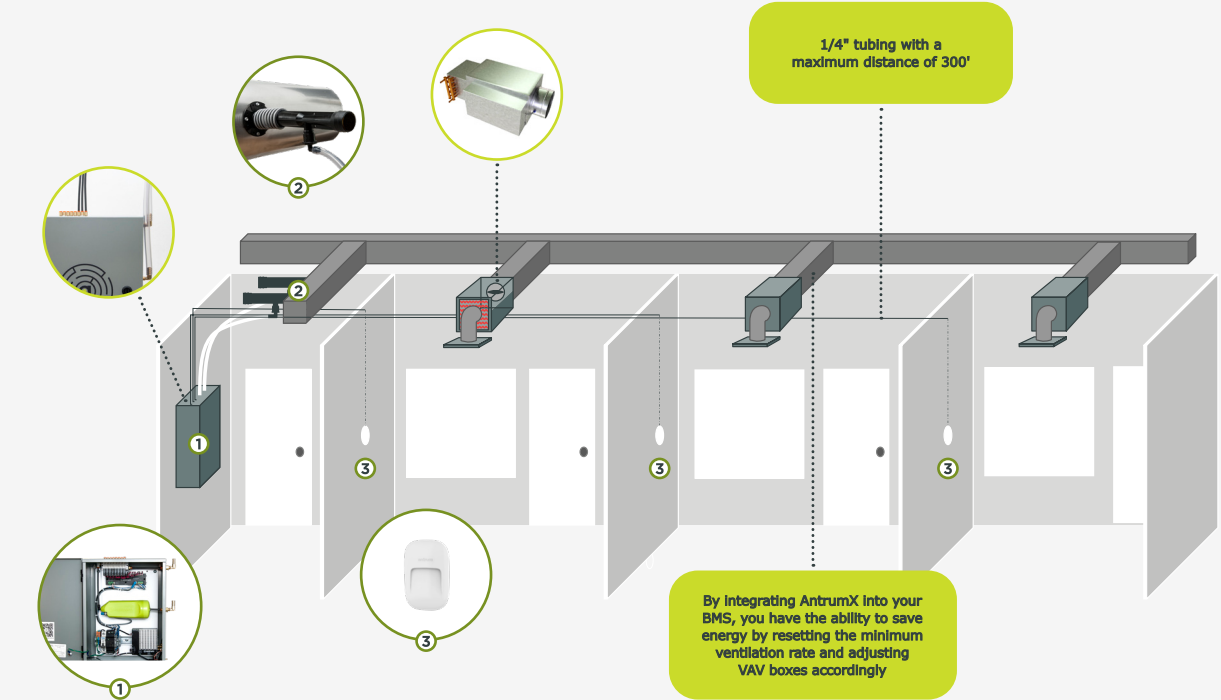
- Provides your facility the ability to increase sensing capabilities at a fraction of the cost; upgrade 16 zones simultaneously with a one-minute sensor pack replacement.

Total Cost of Ownership

- Saves 45-60% compared to traditional wall-mounted solutions, not including energy savings through more accurate and actionable data.

SAMPLE INSTALLATION

- ① MONITORING PANEL
- ② AIR ACCELERATOR
- ③ FACEPLATE



| | | | | | | | | | | | |
|---|-------|-------|-------|-------|--------------------|----|------|------------|-------|--|--|
| COMMONLY SENSED POINTS: NH ₃ CO ₂ CO DP CH ₂ O NO ₂ O ₂ O ₃ | | | | | | | | | | | |
| PM0.1 | PM0.3 | PM0.5 | PM1.0 | PM2.5 | R-410a, R32, R454B | RH | TVOC | TVOC (PID) | TVOCi | | |

INDOOR AGRICULTURE

AntrumX™ enables repeatable results, creating the opportunity to maximize yield while keeping your environment wash-down ready by locating sensors outside of the grow environment.

ENVIRONMENTAL MONITORING FOR CANNABIS CULTIVATION

Cannabis operations typically include multiple types of grow rooms, each with unique environmental conditions. To further complicate the situation, monitoring at the canopy level has proven to be both difficult and costly.

AntrumX centralized sensing monitors the Indoor Air Quality of up to 32 unique zones from a single location, leading to more accurate and consistent data for increased yield and repeatable results.

AntrumX Benefits:

Maximize Yield

- With the ability to monitor one, two, or even 12 indoor pollutants, AntrumX provides growers with comprehensive data, allowing them to create and maintain an ideal indoor growing environment.

More Sensing, Fewer Sensors

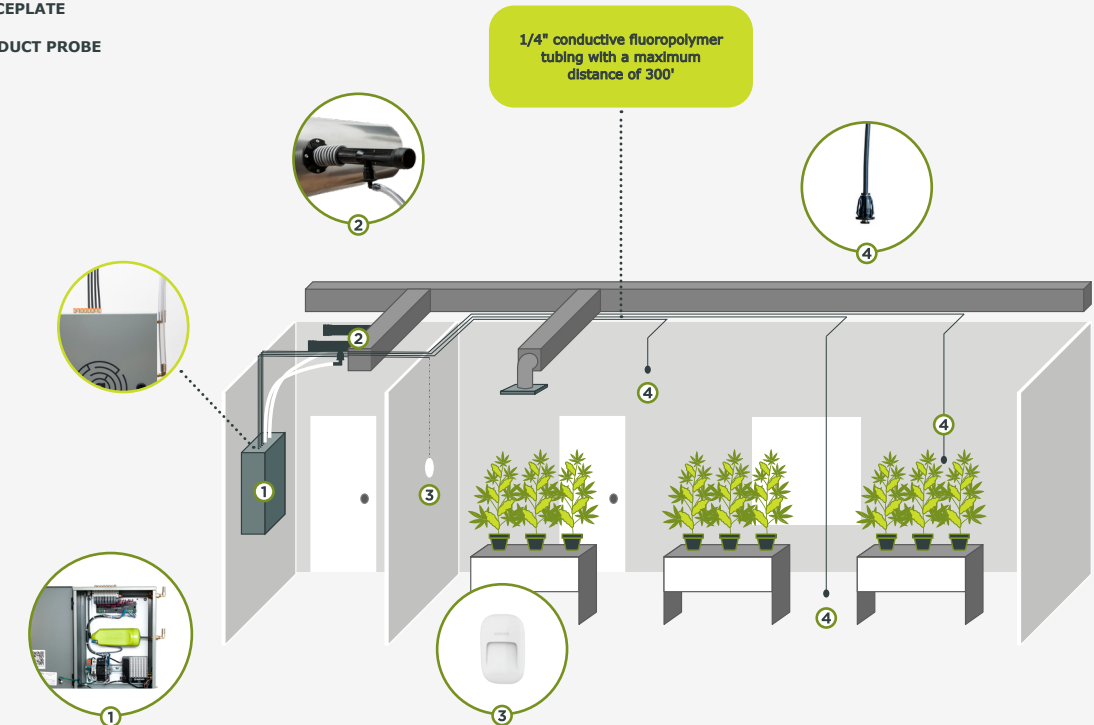
- AntrumX has the ability to analyze 16 individual zones with one device, resulting in a 94% reduction of sensors deployed.

Wash-Down Capable

- Using duct probes and faceplates, AntrumX removes all electronics from the grow environment.

SAMPLE INSTALLATION

- ① MONITORING PANEL
- ② AIR ACCELERATOR
- ③ FACEPLATE
- ④ 1" DUCT PROBE



COMMONLY SENSED POINTS: NH₃ | CO₂ | CO | DP | CH₂O | NO₂ | O₂ | O₃
 PM0.1 | PM0.3 | PM0.5 | PM1.0 | PM2.5 | R-410a, R32, R454B | RH | TVOC | TVOC (PID) | TVOCi

COMMERCIAL

Unlike wall-mounted sensors, which provide data based on assumptions, AntrumX™ uses actual data to save energy and create a healthier indoor environment.

IAQ MONITORING

Traditional wall-mounted sensing systems make maintenance difficult, leading to uncalibrated, unreliable sensors.

The AntrumX centralized sensing platform has revolutionized the way facilities are managed, providing **more sensing with fewer sensors**.

AntrumEYE's smart analytics dashboard is accessible on a computer or mobile device, delivering critical IAQ data anywhere, anytime.

AntrumX Benefits:

Maintainability

- Uses 6% of the sensors used in wall-mounted sensing solutions, allowing 16 zones to be calibrated simultaneously in less than one minute.

Scalability

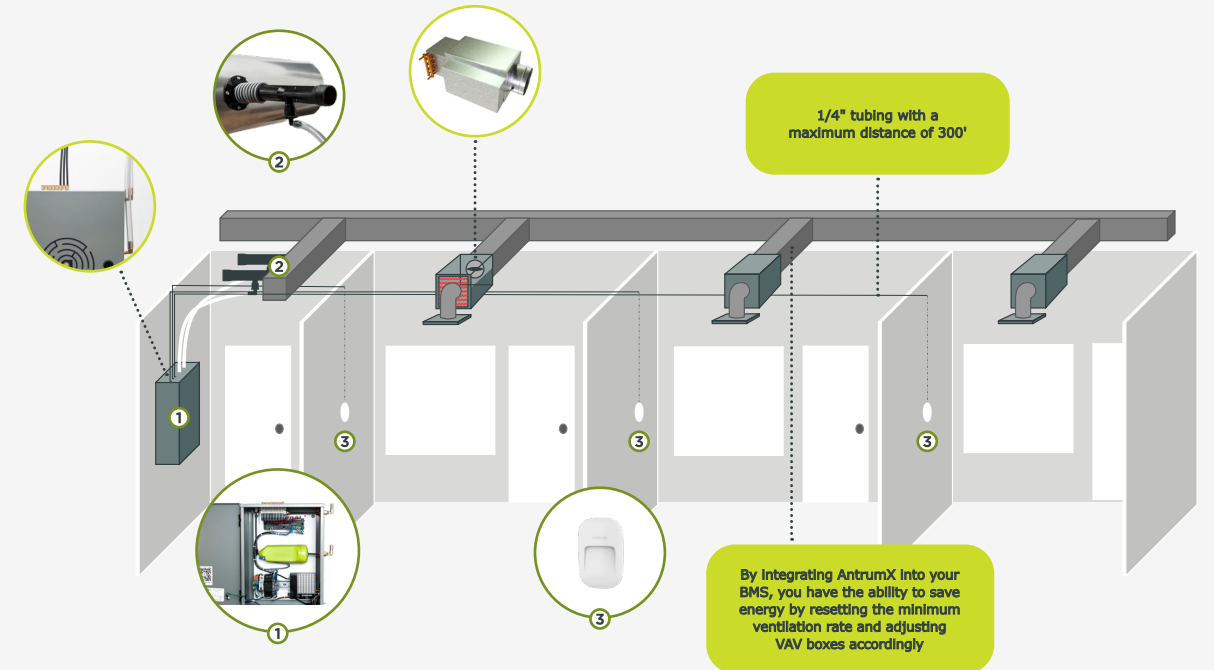
- Provides your facility the ability to scale monitoring capabilities at a fraction of the cost; upgrade 16 zones simultaneously with a one-minute sensor pack replacement.

Total Cost of Investment

- Saves 45-60% compared to traditional wall-mounted solutions, not including energy savings through more accurate and actionable data.

SAMPLE INSTALLATION

- ① MONITORING PANEL
- ② AIR ACCELERATOR
- ③ FACEPLATE



COMMONLY SENSED POINTS: NH₃ | CO₂ | CO | DP | CH₂O | NO₂ | O₂ | O₃
 PM0.1 | PM0.3 | PM0.5 | PM1.0 | PM2.5 | R-410a, R32, R454B | RH | TVOC | TVOC (PID) | TVOCi

GAS DETECTION

Toxic gas detection for demand-based ventilation.

CO AND NO₂ MONITORING

CO and NO₂ are two common airborne contaminants in parking structures. Their presence raises safety concerns and underscores the need for demand-based ventilation.

The AntrumX™ centralized sensing platform has revolutionized the way facilities are managed. By consolidating 32 individual sensors or transmitters into a single device, AntrumX provides **more sensing with fewer sensors**.

AntrumX Benefits:

Safety

- Using one sensor for 16 independent locations provides more accurate data, leading to better control and a safer environment.

Energy

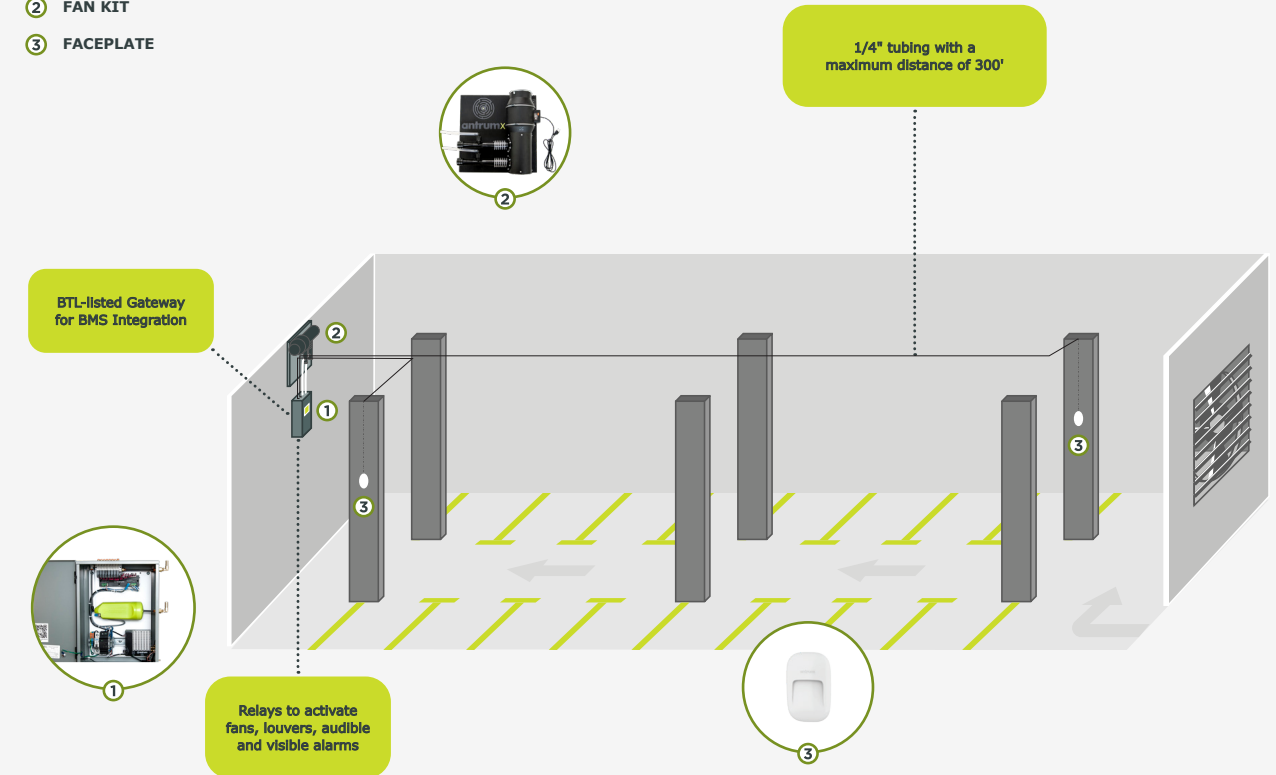
- Monitoring the indoor environment for gases eliminates the need for costly predetermined air change rates.

Maintainability

- AntrumX uses only 6% of the number of sensors compared to traditional solutions, allowing 16 locations to be calibrated simultaneously in under one minute without the need for calibration gas kits.

SAMPLE INSTALLATION

- ① MONITORING PANEL
- ② FAN KIT
- ③ FACEPLATE



COMMONLY SENSED POINTS: NH₃ | CO₂ | CO | DP | CH₂O | NO₂ | O₂ | O₃
 PM0.1 | PM0.3 | PM0.5 | PM1.0 | PM2.5 | R-410a, R32, R454B | RH | TVOC | TVOC (PID) | TVOCi

GAS DETECTION

AntrumX's centralized sensing platform is the ideal solution for IAQ sensing in Variable Refrigerant Volume (VRV) and Variable Refrigerant Flow (VRF) environments.

VRV/VRF REFRIGERANT MONITORING

Pressurized refrigerant systems are susceptible to leaking. When they do, they can create a hazardous indoor environment.

The primary standards regarding refrigerant use are ASHRAE standards 15 and 34, which are classified as "National Voluntary Consensus Standards" and are therefore left up to the local Authority Having Jurisdiction (AHJ).

AntrumX Benefits:

Safety

- In the event of a refrigerant leak, AntrumX allows facilities to identify the location of the leak and take appropriate action. This will be even more critical as new flammable refrigerants are introduced.

System Efficiency

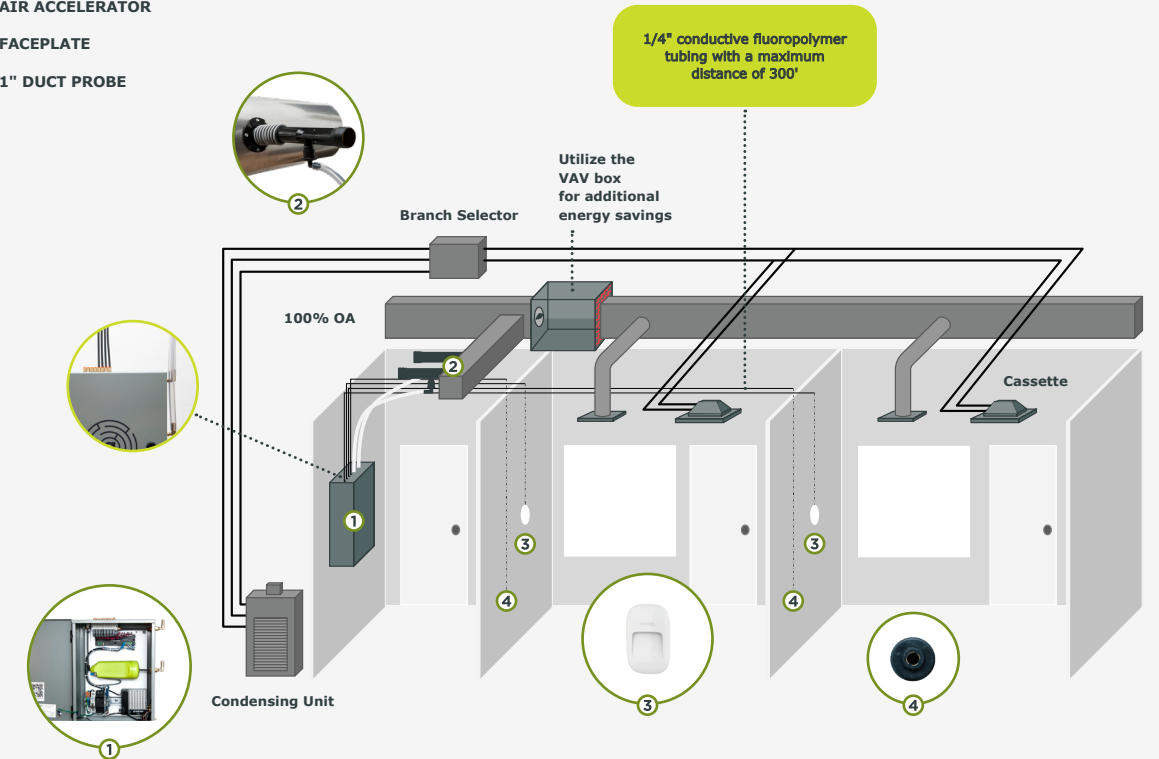
- Reduce refrigerant expenses, limit repair costs, and minimize revenue losses.

Scalability

- Leverage the AntrumX platform to sense CO₂, RH, and many other indoor pollutants along with refrigerant.

SAMPLE INSTALLATION

- ① MONITORING PANEL
- ② AIR ACCELERATOR
- ③ FACEPLATE
- ④ 1" DUCT PROBE



COMMONLY SENSED POINTS: NH₃ | CO₂ | CO | DP | CH₂O | NO₂ | O₂ | O₃
 PM0.1 | PM0.3 | PM0.5 | PM1.0 | PM2.5 | R-410a, R32, R454B | RH | TVOC | TVOC (PID) | TVOCi

HEALTHCARE

A cost effective solution for monitoring oxygen in MRI rooms.

OXYGEN DEPLETION FOR MRI ROOMS

MRI machines require large amounts of helium to maintain the required magnetic field. In the event of a helium leak, the machine may not operate properly and any individuals in the room may be at risk of oxygen deprivation.

AntrumX Benefits:

Reliability

- Competitive systems use pumps, whereas AntrumX uses duct static pressure generated by the building's HVAC system. Zero moving parts means zero loud, maintenance-intensive pumps and zero energy input to the system.

Calibration

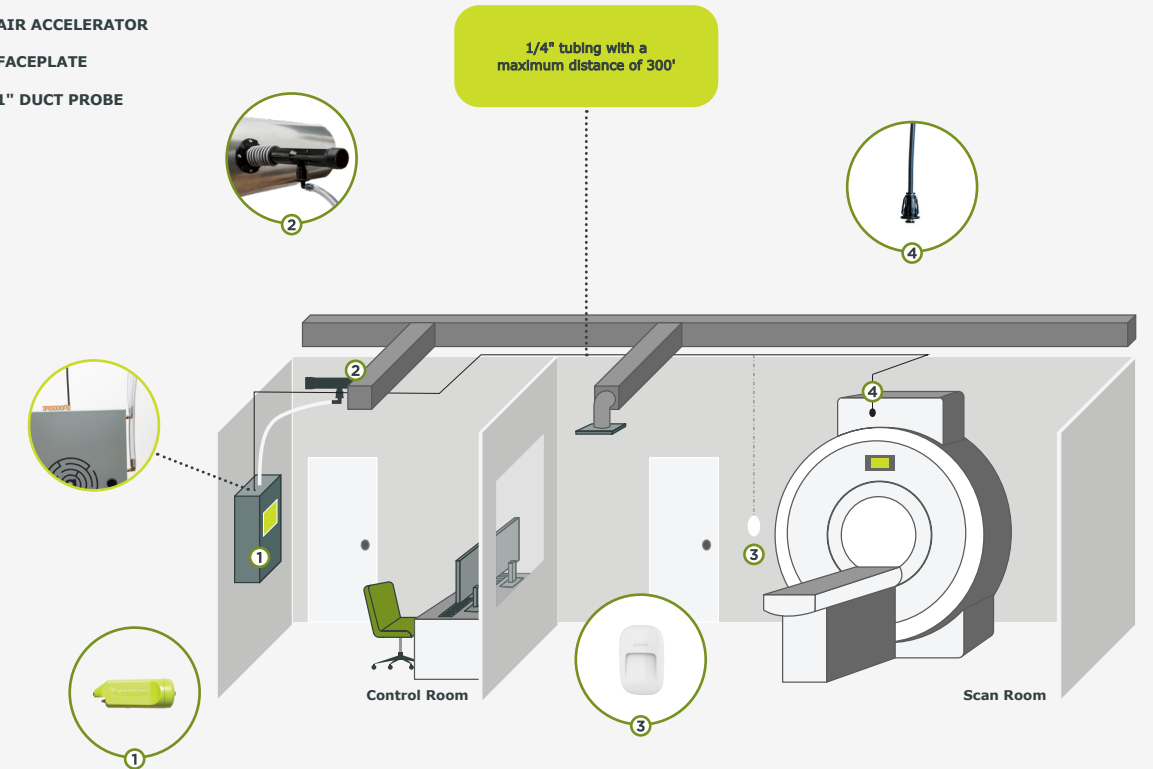
- Unlike competitive products that require field calibration gas, the AntrumX sensor pack can be replaced in under one minute.

Total Cost of Ownership

- AntrumX provides owners with a more reliable and cost-effective solution.

SAMPLE INSTALLATION

- 1 SENSOR PACK
- 2 AIR ACCELERATOR
- 3 FACEPLATE
- 4 1" DUCT PROBE



COMMONLY SENSED POINTS: NH₃ | CO₂ | CO | DP | CH₂O | NO₂ | O₂ | O₃
 PM0.1 | PM0.3 | PM0.5 | PM1.0 | PM2.5 | R-410a, R32, R454B | RH | TVOC | TVOC (PID) | TVOCi

CASE STUDY

Grand Valley State University (GVSU) Cook-DeVos Health Sciences Building, Grand Rapids, Michigan

Installed: 2012

Scope: Entire CHS Building

Square Feet: 217,000

Rooms: 233

AntrumX Results:

Increased Occupant Comfort

- Fewer hot/cold calls.

Total Cost of Ownership

- Extended life of capital equipment due to running at partial capacity.

Savings

- Reduced maintenance expense due to equipment running at partial capacity.

Sustainability


- Energy savings.

10 - 30%
energy savings

94%
sensors eliminated

80%
savings compared to
maintaining wall sensors





1300 Michigan St. NE
Suite 102
Grand Rapids, MI 49503
Phone: 616.214.3155
antrum.com

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