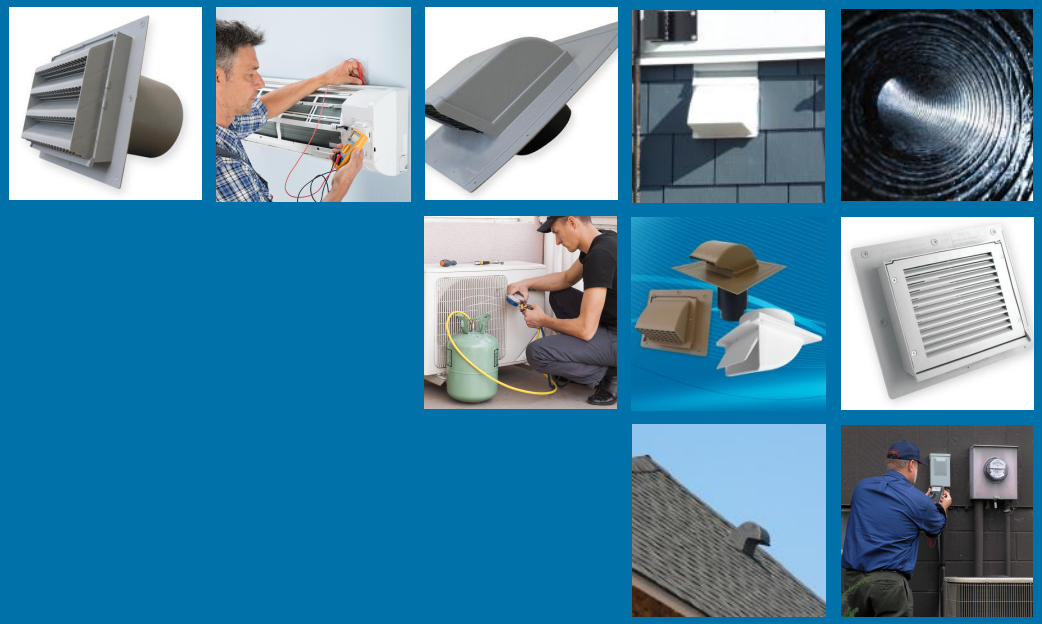
HVAC VENTING E-BOOK



HVAC IN THE SMART HOME

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Technologies in the HVAC industry are giving customers more control over their household temperature and their energy bill.

Learn how HVAC zoning, sensors, apps, big data, and the IoT are industry game changers!

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HVAC Zoning in the Smart Home

The next time your customers ask you about setting up smart technologies for their HVAC, tell them how HVAC zoning can make their smart home even smarter.

Zoned HVAC systems can – and should – work with smart thermostats. They are much more effective than a smart thermostat on its own. Zoned HVAC includes a main control, thermostats and motorized dampers that work together to deliver heating optimal control and energy efficiency.

Well-designed HVAC zones can reduce your customer's energy bills by as much as 30%, and the savings don't stop there. Zoning can also extend the life of your customer's equipment. With a zoned system, the equipment works less than a system that constantly delivers services to the entire building, which means less wear-and-tear.

Zoning Pros

- *Reduce your customer's energy bills by as much as 30%*
- *Extend the life of your customer's equipment*

HVAC Zoning in the Smart Home

Are your customers considering smart vents to get the control they crave? Smart vents control the delivery of heating or cooling by opening or closing the vents to each room.

This can be a good option for smaller homes, but for larger homes zoned HVAC is better.

With smart vents, there is no change to the output of the equipment, even if only one room is being heated, which means the equipment won't run at peak efficiency. With a zoned system, the thermostats communicate with the controls that send instructions to different parts of the system to ensure efficient operation.

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The closing of vents can result in air pressure build-up, which will lead to leaks in your customer's ducts. At the least, this means the equipment won't run at peak efficiency, and at its worst can cause major damage to equipment.

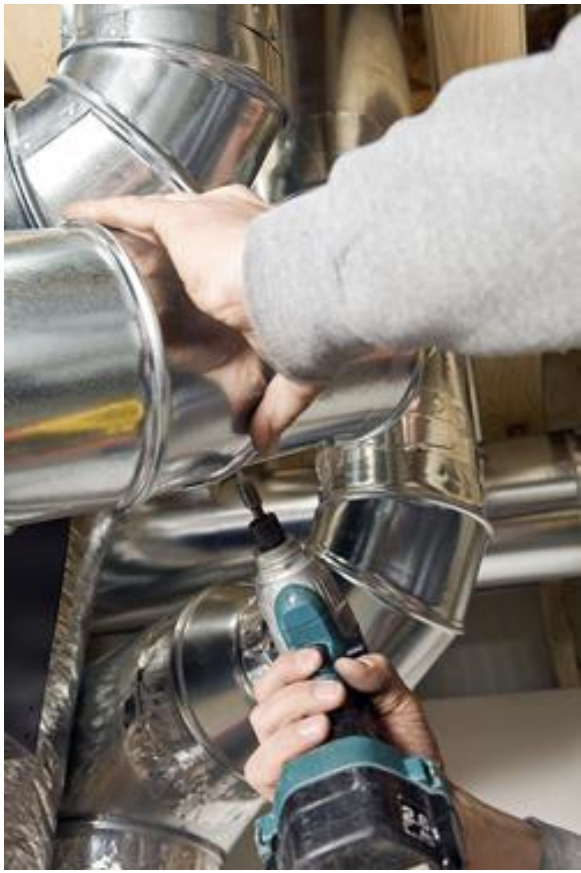
Balancing equipment costs with energy savings

When considering the design of zones, balance the cost of the equipment with energy bill savings. In a residential installation, this will likely mean installing only two to four distinct zones. For commercial jobs, the zones will depend on the use of the space. Large commercial spaces may require multiple heat pumps which each deliver to multiple zones.

All the ducts need to be the same size, because at any given time only a single zone may be receiving heating or cooling services. The ducts need to be both large enough to operate as the only duct in the system, and small enough to be efficient when the entire building needs HVAC.

In zoned HVAC systems, bypass dampers regulate airflow to ensure that the equipment isn't damaged.

A good rule is for the ducts to be sized at 2/3 of the total CFM (cubic foot per minute) required by the heating or cooling unit manufacturer. At this size, the air pressure would be high, but still acceptable, if only one zone is in operation and the air pressure would be sufficient when all zones are receiving heating or cooling.



How HVAC Sensors Improve Energy Efficiency

An HVAC installation has some hidden components tucked away in a basement or on a roof. Even more invisible are the sensors that make everything run smoothly.

With more customers opting for Internet of Things (IoT) capability, sensors are becoming a bigger part of HVAC. Some, like pressure sensors, are most useful to HVAC techs. Others, like occupancy sensors, will be used directly by your customers.

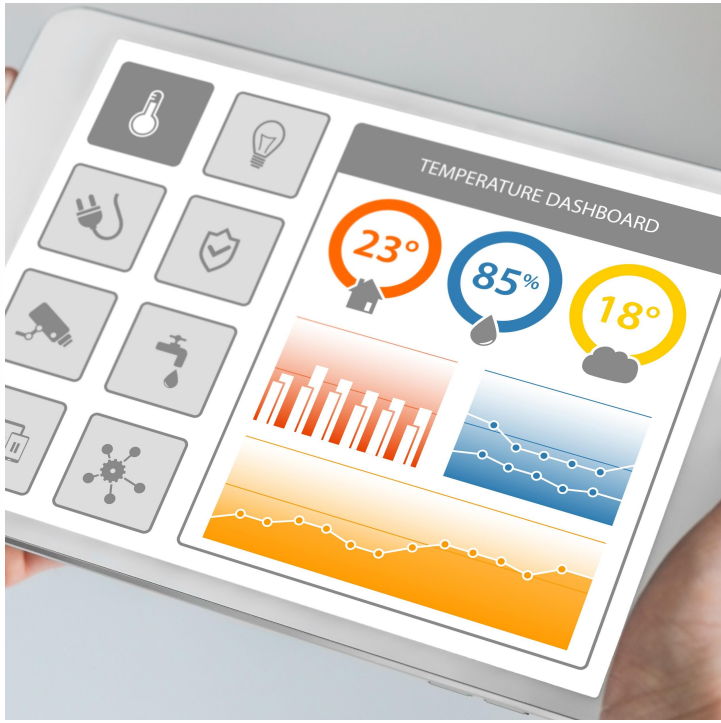
The most common sensor used in HVAC is, of course, the thermostat. Today, thermostats are usually digital and use semiconductor devices such as thermistors or resistance temperature detectors (RTDs).

Sensor Pros

- *Keep equipment running smoothly and safely*
- *Improve energy efficiency*
- *Maintains good health conditions*

Thermistors and RTDs both measure temperature based on resistance. A thermistor is typically made of a ceramic or polymer, whereas an RTD is made of pure metal.

The sensors available for HVAC today go far beyond the thermostat. Sensors are used to keep equipment running smoothly and safely, to improve energy efficiency and to maintain our health.



Pressure sensors

These are used in compressors, boilers, coolers, heat recovery systems, burner control, and variable air volume systems. They monitor rooms and filters for drops in pressure, which may indicate that the system needs maintenance. Monitoring pressure is also useful for optimizing air flow, heating and cooling.

Duct smoke detectors

Ducts can move toxic gases, smoke, and even flames from one area to another. Duct smoke detectors are most used to prevent the HVAC system from spreading smoke through a building. Duct smoke detectors may be required by regulations and building codes. For example, some call for smoke detectors to be installed in return ducts for air conditioning units over 2000 CFM.

Occupancy sensors

At their most basic, occupancy sensors identify the presence of a person in a room. Occupancy sensors can help your customers improve their energy efficiency, particularly when used in combination with zoned HVAC. **There are two main types of occupancy sensors: PIR and ultrasonic.**

1. **PIR** (also referred to as passive infrared) sensors measure heat and motion. They work via line of sight, so the sensors must be aimed at where people will be and are best used in open rooms.
2. **Ultrasonic sensors** send out a high-frequency sound wave. If it bounces back with a change, the system is triggered. Ultrasonic waves can pass through solid objects, so they can pick up smaller movements and are more sensitive than PIR sensors.

Sensors and indoor air quality

Sensors that measure indoor air quality (IAQ) are becoming an HVAC installer's best friend. The basic IAQ sensor is a carbon sensor, which detects carbon levels in the air. Carbon levels are an indicator of air circulation, and poor air circulation increases the chances that other contaminants could be present. Carbon dioxide sensors use either infrared light or a chemical process to measure levels of CO2.

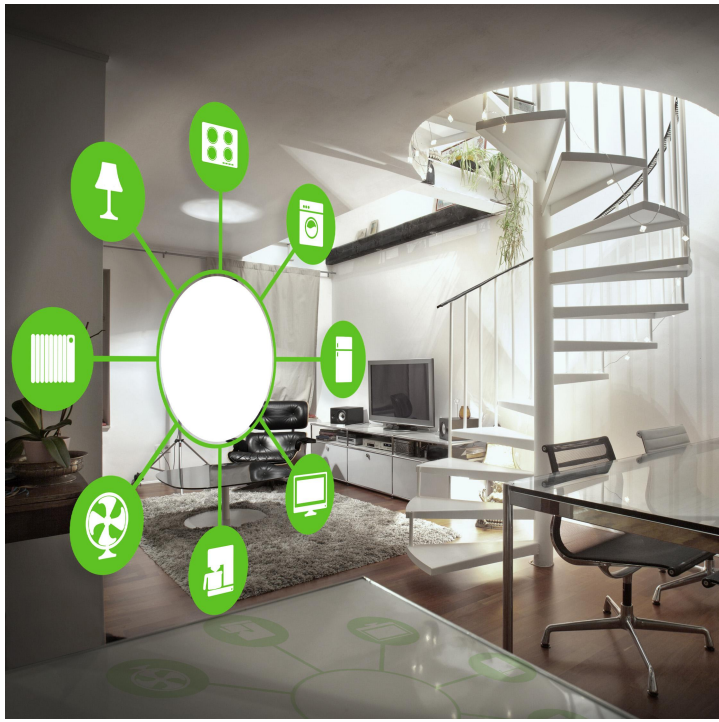
Sensors are also used to detect volatile organic compounds (VOCs). VOC sensors use a process called photoionization. Ionization is the changing of an atom's charge. VOC sensors can ionize particles with ultraviolet light and measure electron levels. These measures allow them to detect toxic or combustible gases.

Gateway technology and sensors

Many of your customers' legacy HVAC systems have a lot of life left in them. And while they would benefit from sensor technology that goes beyond the basic thermostat, they might be reluctant to replace a well-functioning system.

This is where gateway technology comes in. Think of it as a bridge between the legacy equipment and any other IoT device, allowing your customers to use sensors that were unavailable when their system was installed.

As sensor technology advances, you can expect to see more of them, embedded into HVAC system and offered as independent devices.



Why You Should Connect HVAC Equipment to the IoT

Are you hearing more and more about the IoT these days? Simply put, it means the Internet of Things and refers to the vast network of objects or “things” that are connected using the internet. Each “thing” is assigned an IP (Internet Protocol) address, a series of numbers divided by periods or dots that is (hopefully) unique.

There’s now a new Internet Protocol called IPv6. This features an extremely large address space that could potentially allow everything on the planet to have a unique ID. This, coupled with the expansion of broadband Internet and the drop-in price of smart devices has led to an explosion of devices being added to the IoT.

Who came up with IoT?

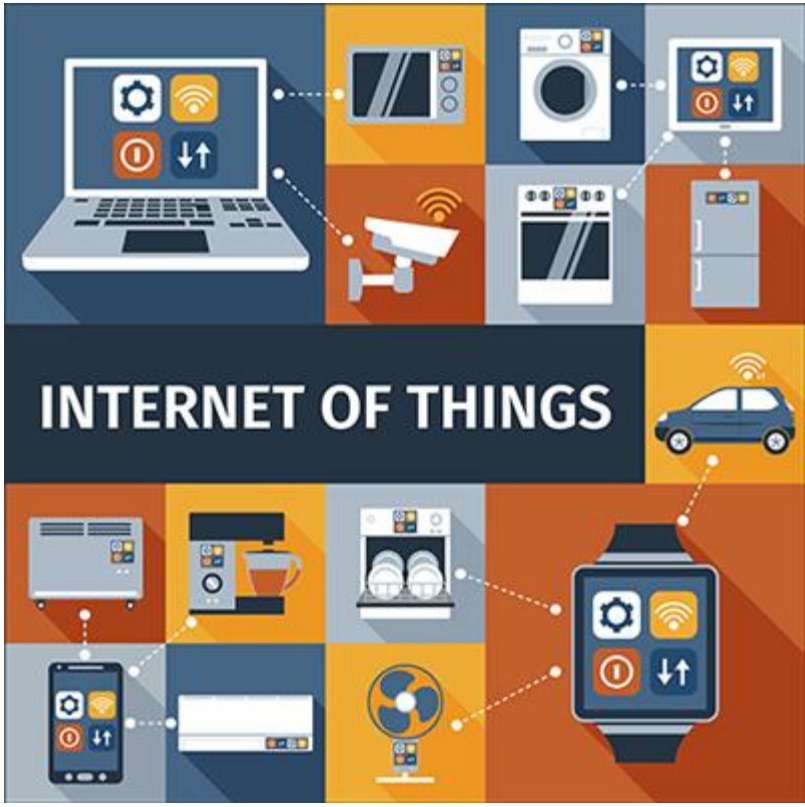
The term Internet of Things was first used in 1999 by Kevin Ashton at MIT. He was involved with installing chips into product packaging to improve tracking of inventory by communicating wirelessly with computers.

Smart company, smart home

One of the most successful companies in this field has been Nest Labs. In 2011, the small company introduced their Nest Thermostat. This attractive looking device was controlled wirelessly by a smart phone, and it learned what temperature settings and timing building occupants preferred.

It wasn't long before the company was gobbled up by Google and now all kinds of companies are jumping onto the IoT bandwagon.

The IoT lends itself well to the HVAC industry as for years now sensors have already been used in a lot of equipment.



Once the data enters the internet it can be stored in databases and monitored by applications.

Equipment maintenance has been an obvious area for IoT connection. An example is software from a new startup called Augury. According to their website: **"Every mechanical system can be characterized by the sound that it makes — machines 'talk' and we understand their language."**

Their system uses data from vibration and ultrasonic sensors in HVAC equipment. It compares current data with previous data from the same machine, as well as data collected from similar machines. Their platform can detect the slightest changes and warn of developing malfunctions. This analysis is done in real-time and the results can be displayed on a smartphone within seconds.

They also provide an online management platform accessible from any internet-connected computer that displays the status of all monitored equipment and assists in making informed, accurate and efficient maintenance decisions.

The next logical step was to connect these sensors to the internet either through wired connections or, more likely, wirelessly by WiFi to a central router or through mobility service.

Ductwork in HVAC needs monitoring too. Sensors can be placed in ducts to measure airflow, static pressure and temperatures.

In an article for Contracting Business, Rob Falke, president of the National Comfort Institute explains that static pressure allows installers to “see” the system in a new perspective. “Airflow becomes visible. The result of measuring static pressure is the ability to prescribe duct renovation work. You begin to see that the duct system is what controls comfort and efficiency. Only by getting the ducts operating properly can you assure the system as a whole is operating properly.”

Not only does this data prescribe the diameter of ducting but the best termination methods, such as which grille or diffuser to use.

What’s next?

New applications using IoT promise to improve the HVAC industry from preventive maintenance, responsiveness and increased energy efficiency to improving contractors’ work processes and the comfort of their customers.

5 Things to Know About HVAC Integration

Integration is a key trend in the HVAC industry. It refers to HVAC and other building systems like lighting and security that are part of a single automation system. Yes, we're talking about the smart home. Here are five things to understand about integration.

Improve efficiency

The potential to improve energy efficiency in an integrated home is exciting. Imagine a system where sensors determine whether a room is occupied and adjusts the HVAC and lighting accordingly. Sensors on windows could turn off air conditioning and alert residents when windows are left open.

Integration Tip

Always install a good HVAC monitoring system to keep you informed on the equipment diagnostics!

Monitoring equipment

The monitoring capabilities with HVAC integration provide immense benefits to building operators, homeowners and HVAC professionals. System diagnostics can be sent to the HVAC professional who could then contact the building owner or operator to schedule maintenance before any problems negatively impact the building.

Sensors can be placed in ductwork and vents to measure airflow, static pressure and temperatures. The maintenance savings and improvement in customer service puts more money in everyone's pockets.

HVAC installers lead the way

HVAC installers have been among the first trades to install smart home features. **Because HVAC systems consume 40% of a building's energy, operators and homeowners have been eager to improve HVAC efficiency through smart technology.** As well, HVAC systems were a natural choice for early adoption of smart technology, since they already used sensors. They only needed to add Wi-Fi capabilities, which are now a common feature in HVAC equipment.

Today, homeowners and building operators are looking to expand their smart building capabilities by integrating their HVAC with other building controls. They want to improve efficiencies in all building systems, but they don't want to have to keep track of their controls on multiple operating systems.

Integrated systems management

Integrated household controls are typically handled by a building automation system (BAS), also called building management system (BMS). These systems are made up of software and hardware and a user interface of some kind.

A BAS seems to solve most of the problems of a building operator, and in many ways, it does, but it's not quite that simple. The big issue, according to Robert McDowall, author of Fundamentals of HVAC Control Systems, is interoperability. Each BAS uses an Internet protocol to communicate with the equipment in the building, and vendors for equipment such as HVAC and lighting use different protocols as well.

Some protocols are proprietary, meaning that the owners share the protocol selectively. Proprietary protocols don't always play well with others. The other category is open protocols, which anyone can use. Many systems using proprietary protocols have a long list of compatible equipment, but as general rule, systems using open protocols are easier to integrate.

Perhaps the most well-known proprietary protocol is Nest Weave. Open protocols that work well with other systems and are commonly used in HVAC include Zigbee, BACnet, LonTalk.

Integrated installation

When you're doing an install, either a retrofit or a new build, know what other systems are in place. That way you can install equipment that uses a compatible protocol. Where there are no systems in place, install an HVAC system with a protocol that will integrate well with other systems. The day will come when your client tries to implement other smart technologies, and they will thank you for helping them make the right choice.

Big Data Equals Big Savings in HVAC

What if you could help your customers save 17% on their energy bill? Today's customer is concerned about energy savings, and you can give them all they need: vents that protect their building envelope, high-performance equipment, and better decisions thanks to Big Data.

The term Big Data refers to datasets that are so large and complex that they can't be analyzed by a human being. Big Data isn't just millions of instances of the same 5 indicators but often consists of hundreds, or even thousands, of data points. For example, a popular rooftop chiller on the market offers building managers access to 150 data points.

Big Data for Building Managers

Data from building control systems can:

- *monitor energy expenses*
- *info on occupancy*
- *monitor equipment performance*
- *track lighting history*

Big Data Equals Big Savings in HVAC

A chiller is only one component of a building control system. When you factor in other managed systems such as ventilation, heating, lighting and security, the data points that could be gathered gets into the thousands. This is data that can be collected in real time and stored, resulting in millions of data segments each year, which is more than any human can make sense of.

Data gathered from building control systems can be used by building managers to monitor energy expenses, data on occupancy, equipment performance, lighting history and any other feature that the control system interacts with. To achieve energy savings, your customers need to leverage all this data into better decision making. That's where software comes in.

Big Data requires specialized software, often referred to as analytics software or analytic tools, to organize and present it in a way that we humans can work with. Building controls systems can collect a whole lot of data, and many manufacturers now provide software that presents the data visually on the building operator's PC, tablet or smartphone.

Is Big Data affordable?

The data analytics tools that come with new building controls are great, but not all your customers will be able to install a new building control system for financial and logistic reasons. Fortunately, your customers can still harness the power of big data without a complete overhaul of equipment.

Case study 1

An example of a successful Big Data retrofit is the Washington Athletic Club in Seattle. Built in 1930, the skyscraper is a mix of hotel rooms, banquet halls and sports facilities including a full-size pool. Some of the HVAC equipment was decades old, but upgrading all of it at once was not a feasible option. Instead, building engineer Mike Young focused on gathering as much data as he could while replacing some of the older equipment.

The insights that came out of this $1 million project saved the Washington Athletic Club $630,000 in energy bills in the first three years.

Case study 2

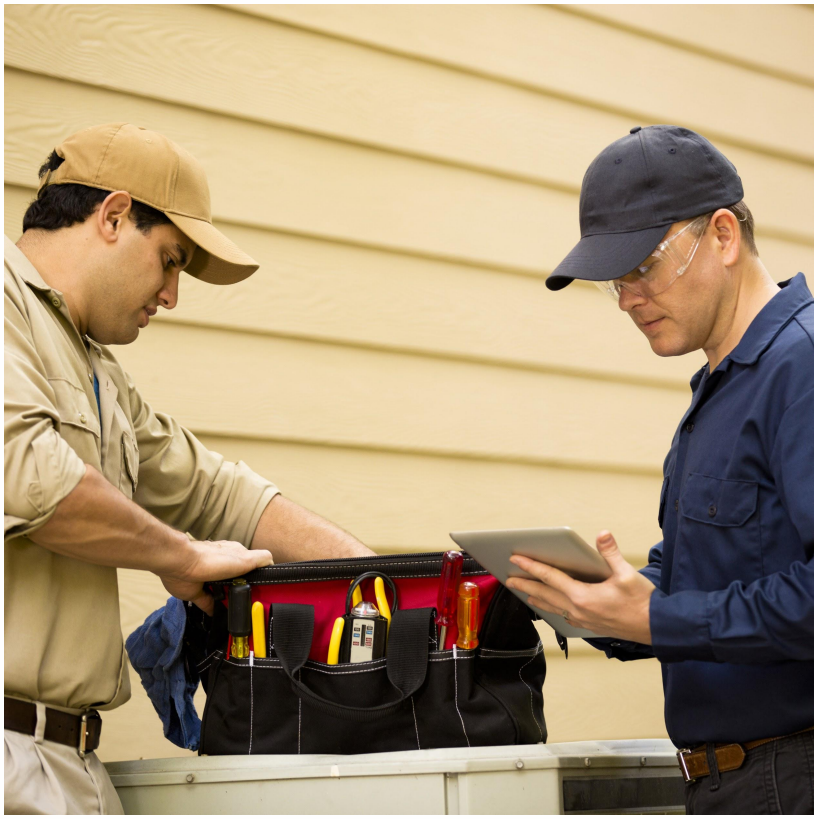
Another company that has leveraged Big Data for energy savings is Microsoft. Using big data to manage their 125-building headquarters in Redmond, Washington, the company saved $1.2 million energy costs in a single year.

Building automation has been around since the 1970s, so even older equipment has the capacity to provide data. The challenge with collecting Big Data from building control systems is dealing with the various protocols and languages. But this is bound to change as more building managers become aware of the benefits of Big Data.

Top 10 HVAC apps

Balancing a system? Charging a refrigerant? Sizing ducts? There's an app for that!

1. **Predictair**
   Works with the Dwyer SMART Air Hood® balancing instrument and has the potential to cut HVAC balancing time in half!
2. **Filterfetch**
   Helps HVAC professionals generate extra revenue
3. **Evergreen InTune Wi-Fi programmer**
   Adjust the motor speed in Evergreen electronically commutated motors (ECMs)
4. **HVAC Buddy**
   Assists with refrigerant diagnostics



Top 10 HVAC apps

5. **HVAC Tech Terminology**
   Industry dictionary

6. **Complete HVAC Dictionary**
   Industry dictionary for Androids only

7. **HVAC Toolkit**
   Includes a duct sizer, a PT calculator, a refrigerant charge calculator, and pipe sizers

8. **HVAC Check & Charge**
   Calculate the correct charge for R-22 or R-410A refrigerants

9. **ESC Mobile Tech**
   Service management to schedule appointments, create quotes and invoices

10. **iHandy level**
    A virtual level, combine it with a flashlight app to get a closer look at equipment in dark spaces

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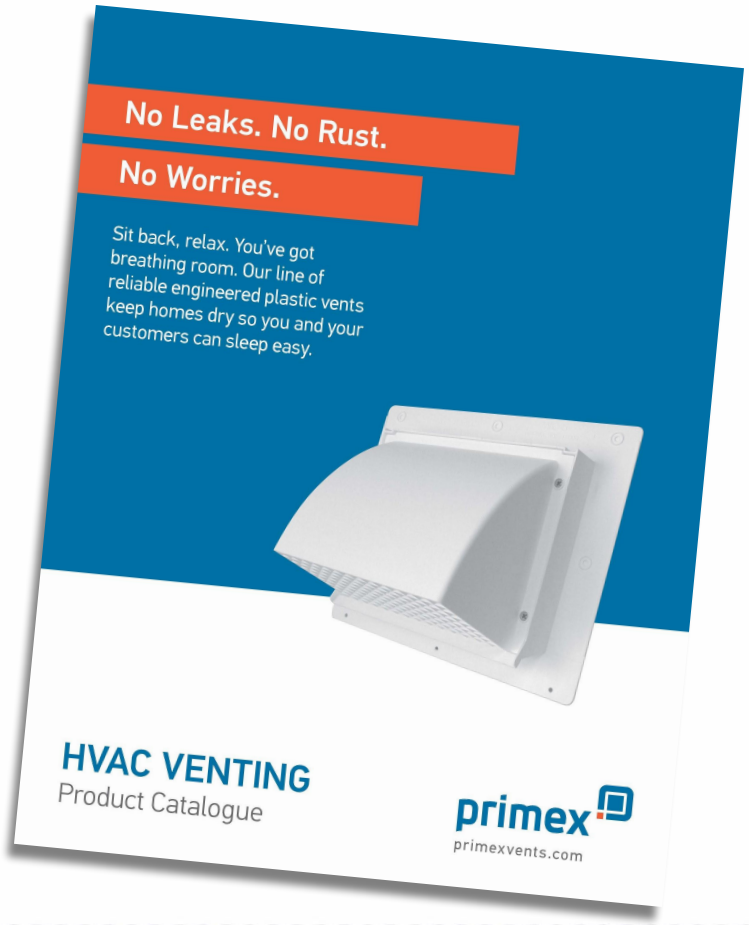

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