Whitepaper

VOCs

Air quality management integrated with a home automation system

TELETASK

trendsetter in home automation

TABLE OF CONTENTS

1 INTRODUCTION

At the occasion of the introduction of a built-in VOC sensor in a TELETASK home automation touch panel (AURUS-6), we wanted to provide our professional customers, architects, system integrators and end-users with answers for the many questions which may arise around the subject of VOC management.

In this whitepaper, we don't offer you a scientific overview of chemical, biochemical and medical studies, but a readable document with the most relevant information from different sources.

We offer you basic information and answers on most VOCs and their Home automation-related questions:

What are (indoor) VOCs and where do they come from?
How harmful are they?
What can I do to avoid or minimise VOCs?
What are other important construction considerations, apart from the VOC health risks?
How can TELETASK help me with my project concept design?
What solution can a TELETASK system integrator offer me?

By reading the below information, we hope to enable you to make the right construction design decisions and selections.

2 WHAT ARE VOCS

During our investigation process, it quickly appeared, although the definition of VOCs may vary at some points, that everybody agrees upon the presence and risks generated by VOCs. It is also clear that VOCs are gases which appear at higher levels in the first year after a new building/renovation has been done.

2.1 LIST OF VOCS

Common VOCs include ethanol, formaldehyde, benzene, toluene, and xylene. VOCs are of concern to both indoor air quality and outdoor quality. Indoor VOCs are usually emitted from consumer products and building materials such as paints and carpets and may adversely impact the health of people who are exposed.

2.2 INTERNATIONAL DEFINITIONS OF INDOOR VOCS.

Source:
https://www.chemsafetypro.com/Topics/VOC/What_Are_Volatile_Organic_Compounds_(VOC)_and_Overview_of_Global_VOC_Regulations.html

International definitions of VOCs are similar but different. Each jurisdiction or country may have different official definitions for VOCs depending on whether the VOCs are indoor VOCs or outdoor VOCs. There is usually no detailed list of VOCs. However, some volatile organic substances may be excluded from the definition of VOCs due to their low concern.

EU definition of VOCs
Any organic compound having an initial boiling point less than or equal to 250°C measured at a standard pressure of 101,3 kPa.

USA definition of VOCs
Indoor VOCs: Organic chemical compounds whose composition makes it possible for them to evaporate under normal indoor atmospheric conditions of temperature and pressure.
Canada definition of VOCs
Any volatile organic compounds that participate in atmospheric photochemical reactions and that are not excluded compounds.

China definition of VOCs

Any volatile organic compounds that participate in atmospheric photochemical reactions, including non-methane hydrocarbons (alkanes, alkenes, alkynes, aromatic hydrocarbons, etc.), oxygenated organic compounds (aldehydes, ketones, alcohols, ethers, etc.), chlorine-containing organic compounds, nitrogen-containing organic compounds, sulphur-containing organic compounds and so on.

Japan definition of VOCs

VOCs are volatile organic compounds that are discharged into the air. Substances (Methane and Hydrochlorofluorocarbon) designated by government decree which do not cause suspended particulate matter and oxidants are excluded.

2.3 Measurement for VOC in Indoor Air

Source: https://www.epa.gov/indoor-air-quality-iaq/technical-overview-volatile-organic-compounds

Knowledge about the VOCs that are present at low concentrations normally found in indoor air, in any given situation is highly dependent on how they are measured. All available measurement methods are selective in what they can measure and quantify accurately, and none are capable of measuring all VOCs that are present. For example, benzene and toluene are measured by a different method than formaldehyde and other similar compounds. The range of measurement methods and analytical instruments is large and will determine the sensitivity of the measurements as well as their selectivity or biases. This is why any statement about VOCs that are present in a given environment needs to be accompanied by a description of how the VOCs were measured so that the results can be interpreted correctly by a professional. In the absence of such a description, the statement would have limited practical meaning.

3 Sources of VOCs

Building Materials	**Home & Personal Care Products**	**Activities**
Paint, varnishes, caulks, adhesives	Air fresheners, cleaning products	Smoking

Carpet, vinyl flooring	Cosmetics	Dry cleaning, photocopiers
Composite wood products	Fuel oil, gasoline	Cooking, hobbies
Upholstery and foam		Burning gas and wood

Products containing VOCs are commonly found in your kitchen (cleaning supplies, gas stoves, frying food), in your garage (vehicle exhaust, paints, solvents), office (printers, markers, correction fluid) and bathroom (air fresheners, hairspray, cosmetics), but you might be surprised to know that your closet, craft room and living room may also pose a threat.

3.1 WHAT IS THE MOST COMMON VOC?

Formaldehyde. This is by far one of the most common VOCs out there, largely because it's present in everyday products such as moulded plastics and lacquers. Avoid heating plastics, and limit plastic use in general to keep concentrations of formaldehyde low.

According to EPA (US Environmental Protection Agency):
Volatile organic compounds (VOCs) are emitted as gases from certain solids or liquids. VOCs include a variety of chemicals, some of which may have short- and long-term adverse health effects. Concentrations of many VOCs are consistently higher indoors (up to ten times higher) than outdoors. VOCs are emitted by a wide array of products numbering in the thousands.
Examples include paints and lacquers, paint strippers, cleaning supplies, pesticides, building materials and furnishings, office equipment such as copiers and printers, correction fluids and carbonless copy paper, graphics and craft materials including glues and adhesives, permanent markers, and photographic solutions.
Organic chemicals are widely used as ingredients in household products. Paints, varnishes, and wax all contain organic solvents, as do many cleaning, disinfecting, cosmetic, degreasing, and hobby products. Fuels are made up of organic chemicals. All of these products can release organic compounds while you are using them, and, to some degree, when they are stored.
EPA's Total Exposure Assessment Methodology (TEAM) studies found levels of about a dozen common organic pollutants to be 2 to 5 times higher inside homes than outside, regardless of whether the homes were located in rural or highly industrial areas. Additional TEAM studies indicate that while people are using

products containing organic chemicals, they can expose themselves and others to very high pollutant levels, and elevated concentrations can persist in the air long after the activity is completed.

3.2 WHERE ARE MOST VOCS FOUND IN THE HOUSE?

(according to the American Lung Association lung.org).

Products containing VOCs are commonly found in your kitchen (cleaning supplies, gas stoves, frying food), in your garage (vehicle exhaust, paints, solvents), office (printers, markers, correction fluid) and bathroom (air fresheners, hairspray, cosmetics), but you might be surprised to know that your closet, craft room and living room may also pose a threat.

Dry-cleaned clothing off-gases the chemical solvents used to clean the fabric long after you pick it up from the cleaners. Perchloroethylene, a suspected carcinogen, can still be found in high levels on fabrics weeks after cleaning. Even still in the bag, clothes can off-gas these chemicals into the air.

Art & craft supplies like glues, markers, aerosol spray paints and photographic solutions can contain high levels of VOCs. In fact, permanent and dry erase markers have been shown to have an average total VOC emission 400 times higher than washable markers and highlighters.

Home furnishings like draperies, upholstered furniture, carpets, and materials with flame retardants and stain repellents emit VOCs. VOCs are higher with new products and tend to dissipate over time. Composite wood products like pressed wood furniture also contain formaldehyde.

3.3 WHAT CAN YOU DO IF THE VOC AIR LEVEL IS TOO HIGH?

If the VOC level is too high in your house, there are several steps you can take to reduce exposure to harmful chemicals and improve indoor air quality:

3.3.1 INCREASE VENTILATION:

The TELETASK system will activate your ventilation system automatically for you. In emergency cases, you can also temporarily open windows and use the extra exhaust fan in the kitchen or bathrooms to improve air circulation and bring in fresh air. But as the TELETASK system accurately measures and reacts fast, manual actions are not necessary unless in exceptional cases of home 'accidents' (e.g. a broken bottle of ether or acetone or other solvents for home and hobby use).

3.3.2 AVOID USING PRODUCTS THAT CONTAIN VOCS:

Switch to natural or low-VOC products for cleaning, personal care, and home maintenance.

3.3.3 PROPERLY STORE AND DISPOSE OF HOUSEHOLD CHEMICALS:

Store household chemicals in a well-ventilated area and dispose of them properly according to local regulations.

3.3.4 MONITOR VOC LEVELS:

Continue to monitor VOC levels to ensure that they remain within
the recommended range.

3.3.5 5. SEEK PROFESSIONAL HELP:

If the VOC level remains high despite these measures, consider consulting a professional who can identify and address sources of VOCs in your home. By taking these steps, you can reduce exposure to harmful chemicals and improve indoor air quality in your home.

3.3.6 CAN AN AIR PURIFIER GET RID OF VOCS?

Unlike particulate substances, gaseous pollutants like VOCs cannot be captured by a regular HEPA filter. You need an activated carbon filter to remove these chemicals.

However, this may be good as a retrofit solution in a small room but not as a maintenance-free solution in the long run. Refreshing the room is often not good enough but needs a more general approach as VOCs are appearing in most of the rooms. But they can also move from one room to another because of open doors.
In a newly built or renovated state-of-the-art low-energy house, general centralised ventilation is recommended (also see the chapter on heat recovery ventilation).

3.3.7 DO AIR FRYERS RELEASE VOCS?

Volatile organic compounds are also generally higher for cooking with the air fryer compared with the pan: 2.5 times higher for French fries and 4.8 times higher for chicken breast. (ref. https://pubmed.ncbi.nlm.nih.gov/37927234/).

4 VOCS AT HOME

4.1 BENEFITS OF MEASURING VOC LEVELS

4.1.1 MEASURING VOC LEVELS AT HOME

Measuring the VOC level at home can provide several benefits.

1. Monitoring indoor air quality: Measuring VOC levels can help you determine the quality of indoor air in your home. VOCs are chemicals that can be emitted from household products, building materials, and furnishings. High levels of VOCs can cause a range of health problems, including headaches, dizziness, and respiratory issues.
2. Health benefits: By monitoring VOC levels, you can identify and reduce exposure to harmful chemicals, which can lead to improved health outcomes for you and your family.
3. Improved indoor air quality: By reducing the amount of VOCs in your home, you can improve the overall quality of indoor air, which can lead to better health and comfort for occupants.
4. Environmental benefits: Many VOCs are harmful to the environment and contribute to air pollution. By reducing the amount of VOCs in your home, you can help reduce your environmental impact.
5. Energy efficiency: Reducing the amount of VOCs in your home can also be an indicator of energy efficiency. Many VOCs are emitted from products and materials that are energy-intensive to produce. By choosing low-VOC products, you can reduce your energy consumption and save on energy bills. Overall, measuring VOC levels at home can help you create a healthier and more comfortable living environment, as well as reduce your environmental impact and energy bills.

4.2 BENEFITS OF MEASURING THE VOC LEVEL IN OFFICES.

Measuring the level of Volatile Organic Compounds (VOCs) in offices can provide several additional benefits:

4.2.1 PRODUCTIVITY BENEFITS

Poor indoor air quality can also affect employees' productivity, as it can cause symptoms that can affect their ability to focus on work or other tasks. By ensuring that VOC levels are within the recommended range, you can help employees stay alert and focused, which can lead to increased productivity.

4.2.2 COMPLIANCE:

Many countries have regulations for indoor air quality, including VOC levels. By measuring VOC levels, you can ensure that your office is compliant with local regulations.
Overall, measuring VOC levels in offices can help you create a healthier and more productive work environment, reduce your environmental impact, and ensure compliance with regulations.

5 HEALTH EFFECTS OF VOC EXPOSURE

The risk of health effects from inhaling any chemical depends on how much is in the air, how long and how often a person breathes it in.
Breathing in low levels of VOCs for long periods of time may increase some people's risk of health problems. Several studies suggest that exposure to VOCs may make symptoms worse for people with asthma or who are particularly sensitive to chemicals. These are much different exposures than occupational exposures.
It is important to remember that VOCs refer to a group of chemicals. Each chemical has its toxicity and potential to cause different health effects.

Common symptoms of exposure to HIGH levels of VOCs include:

Acute/short-term exposures (hours to days)	Chronic exposures (years to a lifetime)
Eye, nose & throat irritation	Cancer
Headaches	Liver & kidney damage

Nausea/vomiting	Central nervous system damage
Dizziness	
Worsening of asthma symptoms	

VOCs are manyfold. Therefore, TELETASK has provided in the measurement of the most common components. We then established different threshold values for controlling a ventilation system. This ventilation system must of course be connected (integrated) to the TELETASK home automation system as well, so that we can offer the residents a healthy environment without anyone having to worry about VOCs anymore.

6 WHAT IS A SAFE LEVEL OF VOCS

Because the toxicity of a VOC varies for each individual chemical, there is no such information as a safe level. A basic VOC sensor measures a mix of VOCs and gives a general level indication. TELETASK made this approach more intelligent. See more information in the chapter about the TELETASK VOC index.

6.1 ARE SOME PEOPLE AT GREATER RISK FROM VOC EXPOSURE?

People with respiratory problems such as asthma, young children, the elderly, and people with heightened sensitivity to chemicals may be more susceptible to irritation and illness from VOCs.

7 STANDARD QUANTIFICATION OF VOCS

7.1 THE STANDARD APPROACH TO QUANTIFY VOCS:

When measuring Volatile Organic Compounds (VOCs), several units are commonly used to quantify their concentrations. Let's explore these units:

Parts per Billion (ppb): This unit expresses the concentration of a substance in the air as the number of molecules per billion air molecules. For example, if there is 1 ppb of a specific VOC, it means there is one molecule of that VOC for every billion air molecules.

Parts per Million (ppm): Similar to ppb, ppm represents the concentration of a substance but on a larger scale. It indicates the number of molecules per million air molecules. For instance, 1 ppm corresponds to one molecule of the VOC for every million air molecules.
Micrograms per Cubic Meter (µg/m³): This unit measures the mass of a substance (in micrograms) present in one cubic meter of air. It provides a direct measure of the amount of VOCs in the air.
These units allow to compare VOC concentrations against established safety limits. For instance, the Threshold Limit Value (TLV) defines the maximum exposure level to a chemical that is considered safe for daily exposure without adverse effects. Remember that not all organic compounds are volatile chemicals, and some well-known VOCs include acetone, benzene, toluene, and formaldehyde.

8 How does TELETASK quantify VOCs and react on them?

The TELETASK VOC sensor employs a unique approach to quantify Volatile Organic Compounds (VOCs) using a system with a VOC Index. TELETASK decided not to work with a level indication but with an Index that indicates the VOC level, historically compared to the last 24-hour level. It has the advantage that whatever the VOC level, the given Index reflects the level of increase or decrease against the dynamic reference. This is an improved method to be used to control an integrated ventilation system that refreshes the air with outdoor air until the level is back to a lower level.

8.1.1 In detail

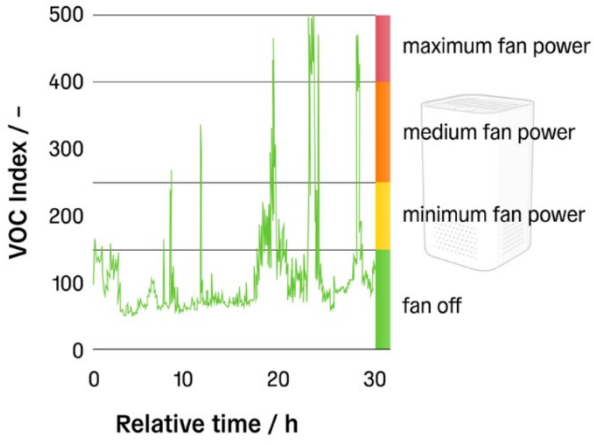
The used VOC Index is the optimal tool to monitor VOC conditions instead of a commonly used VOC concentration output, which cannot be properly provided under field conditions. The TELETASK VOC Index utilizes the measuring capabilities of the VOC sensor much more efficiently. To achieve this, the raw signal of the sensor is processed by a powerful Index Algorithm on the microcontroller of the concerned TELETASK sensor device (e.g. TDS12028 touch panel). The VOC Index describes the current VOC status in a room relative to the sensor's recent history. In this way, the TELETASK VOC Index behaves like a human nose. Assuming that we are entering a room from outside, our nose will use the air composition outside the room as an offset and provide us with feedback if it recognizes higher or lower

levels of VOCs when entering the room. The VOC Index performs a similar calculation by using a moving average learning time over the past 24 hours as an offset.

HUMAN NOSE	TELETASK VOC INDEX
Reference = past minutes/hours	Reference = past 24 hours
Relative intensity (weak, distinct, strong)	Relative intensity (VOC index 1-500)
Different odours - distinguishable	Different odours - not distinguishable
Sensitive to odours only	Sensitive to VOCs (incl. odourless)

The VOC Index mimics the human nose's perception of odours with a relative intensity compared to recent history. The TELETASK VOC Index is also sensitive to odourless VOCs, but it cannot discriminate between them.

This is a very helpful feature because the VOC Index thus works in any environment regardless of the different VOC backgrounds. Note that every indoor air environment contains a certain VOC background stemming from constantly off-gassing sources. On the VOC Index scale, this offset is always mapped to the value of 100, making the readout as easy as possible: a VOC Index above 100 means that there are more VOCs compared to the average (e.g., induced by a VOC event from cooking, cleaning, breathing, etc.) while a VOC Index below 100 means that there are fewer VOCs compared to the average (e.g., induced by fresh air from an open window, a ventilation system or air purifier, etc.). Also, our nose perceives odours on a scale of relative intensity (weak, distinct and strong), but it cannot tell us if the concentration of one odour is truly higher than the concentration of another. Therefore, the VOC Index adapts its gain according to the VOC events of the past 24-hours learning time, leading to different VOC conditions being quantified on the same limited scale: a VOC Index ranging from 1 to 500. In this way, one can use a fixed mapping of the VOC Index to an action the device should execute (for instance, triggering the ventilation system when the VOC Index is above 150). Let's assume that in one room a ventilation system is exposed to VOC events which the VOC sensor is not very sensitive towards, but it is still desired that the ventilation system automatically starts



cleaning the room. The gain adaption of the VOC Index helps to boost the signal so the TELETASK system can detect these events and take action.

9 VOC CONTROL

It has emerged that a higher concentration of VOCs is present in the first year after a new construction or renovation and this will decrease thereafter. However, when the ambient temperature starts to rise, for example when the heating is switched on (in autumn) but also when the outside temperatures rise (e.g. spring/summer), an increase in VOCs will occur again. You could conclude from this that permanent monitoring of VOCs, after one or two years, is no longer relevant, but nothing could be further from the truth. Many unhealthy sources require good ventilation in living, sleeping and working areas. After beautification work in a room, especially when new furniture, walls, layers of paint, varnishes, fabrics, etc. have been applied, we experience a similar phenomenon, at least in the rooms involved. On the other hand, VOCs are also released during the cooking and baking processes but also when smoking, receiving clothes from dry cleaning, and others.
In short, VOCs are not a problem with new constructions only, but an ever-present problem that needs to be avoided.
Therefore, proper measurement of VOCs in at least living- and bedrooms is recommended. When a minimum level is exceeded, ventilation is activated. Sometimes the level can be so high, that a higher ventilation volume is necessary.

9.1.1 VENTILATION CONCERNING ENERGY MANAGEMENT

The most obvious solution is simple permanent ventilation. However, this is not a good solution nowadays. In the context of sustainability, we cannot simply ventilate permanently because ventilation in a low-energy one-family home (according to a study by research group of VITO – Belgium in 2016) accounts for 5.8 or higher percentage of the total energy consumed by that reference home. Ventilation may also be necessary to manage parameters other than VOC, such as humidity and dust management. It is therefore important to have a system that can measure these parameters and realize the necessary control, with respect to the energy consumption parameters. Although, if there is any contamination, the ventilation must be active, whatever the energy cost, it is useless to keep

it on when the air quality is back to normal. The ventilation control system, therefore, must also be linked to the digital energy meter and know when 'free-of-charge - green' energy is available from solar panels and when the ventilation can be temporarily increased without environmental load (use of fossil fuels in the generation of the consumed electrical energy).

9.1.2 COMFORT:

In addition to health and sustainability, we also need to include the comfort parameter. One of the elements is acoustic comfort. Ventilation often comes together with noise generation. At the lowest ventilation speed, the system should be defined in a way that the residents do not experience any loss of comfort. But what if the residents and their children are asleep and the installation suddenly decides to extract air at a higher speed, thereby waking the residents? This parameter will also have to be taken into account by the system. It is therefore advisable to also ventilate preventively, at preset times, to avoid such situations as much as possible. Otherwise, there is a risk that residents want to deactivate the system during the night.

9.1.3 CONCLUSION:

Managing the air quality in our living environment is more than just measuring and ventilating. In new-built houses, it needs to be integrated with a comfort and energy management system. The TELETASK integrated smarthome system is designed for that. It can be integrated with all necessary parameters and systems.

E.g. the system knows whether the family is present or absent. When at home, it knows whether they are sleeping or not.

On the other hand, the digital energy meter continuously provides information about the available energy and its cost.
The TELETASK system also knows when there is an energy injection in the grid, allowing free-of-charge ventilation.
In short, a solution that ensures the greatest comfort with the highest sustainability, without any knowhow and involvement of the residents.

10 GENERAL SOLUTION BY TELETASK

10.1 MEASURING VOCS WITH A BUILT-IN – HIDDEN - SENSOR

Since the problem of VOC gases is not a clearly defined area, we will try to list the most important elements involved. On the one hand what VOCs are, on the other hand what the most important known risks are for humans and also how we can limit these risks in our home and work environment, so VOCs do not pose a safety risk.

With the TELETASK VOC sensor we have therefore provided for the measurement of the most common Volatile Organic Components and we have established different threshold values for controlling a solid ventilation system. This ventilation system must of course be connected to the TELETASK system, so it can offer the residents a healthy environment without anyone having to worry about VOCs.

It has clearly emerged that a higher concentration of VOCs is present in the first year after a new construction or renovation and that this will decrease thereafter. However, when the ambient temperature starts to rise, for example when the heating is switched on (in autumn) but also when the outside temperatures rise (e.g. spring/summer), an increase in VOCs can/will occur again. You could conclude from this that permanent monitoring of the VOCs (after a year) is no longer needed, but there are several other sources. After beautification work in a room, especially when new furniture, walls, layers of paint, varnishes, fabrics, etc. have been applied, a similar phenomenon will appear, at least in the rooms involved. On the other hand, VOCs are also released during cooking and baking processes, smoking, in clothes after dry cleaning, and others.

In short, VOCs are not only a problem with new construction, but an ever-present health risk that needs to be minimised.

Proper measurement of any VOCs present in at least one or more relevant rooms is recommended. When a minimum level is exceeded, ventilation is a must. Sometimes the level can be so high that maximum ventilation is necessary.

10.2 SUSTAINABILITY

The simplest solution to get rid of VOCs is permanent ventilation with one or more exhaust fans. However, this is not a good solution nowadays. In the context of sustainability, we cannot simply ventilate permanently. According to a study of the research institute VITO (Belgium; 2016), the energy consumption of heat-recovery ventilation in a medium-sized family home accounts for 5.8% of the total energy consumption. With smart control, PV panels and dynamic energy tariff, this can be further minimised by several percent.

Ventilation may also be necessary to manage parameters other than VOC, such as humidity and dust management. It is therefore important to have a system that can measure these parameters and realize the necessary control, including the energy parameters. The ventilation system or its control must therefore also be linked to the digital energy meter and know when 'free' - 'green' energy is available from solar panels where the ventilation can be temporarily increased without environmental damage (avoid the use of fossil fuels in the generation of the consumed electrical energy).

10.2.1 HEAT RECOVERY VENTILATION

TELETASK also strongly recommends the use of a heat-recovery ventilation system, rather than a basic exhaust ventilation system with no recovery at all. If you want to keep the air very clean and healthy, it is not only electrical ventilation motor consuming energy. You may lose even more energy which was put in the indoor air when you replace it by fresh outdoor air coming in. In winter periods (in some countries) 'expensive' warm air is blown out and replaced by cold air coming in, which is to be warmed up with expensive energy. In the summer, 'expensive' fresh indoor air is lost and replaced with hot air coming in, which is to be cooled down with a relatively-high energy-consuming AC system.

If you use a heat–recovery ventilation system instead, the energy loss will be limited to 10 to 20% instead of 100%. It not only results in a more sustainable solution but also in higher comfort and the HVAC system can be of a much lower capacity and will take a lower maintenance cost.

10.3 COMFORT

In addition to health and sustainability, we can certainly also include the comfort parameter. One of the elements is acoustic comfort. Ventilation often comes together with sound generation. At the lowest ventilation speed, the system should be set up in such a way that the residents do not experience any significant loss of comfort. But what if the residents and their children are asleep and the installation suddenly decides to extract air at a higher speed, thereby waking the residents. This parameter will also have to be taken into account by the system and it is therefore advisable to ventilate preventively to avoid such situations.

Otherwise, there is a risk that residents will switch off the system completely during the night, while this may be inadvisable.

11 AN INTELLIGENT - INTEGRATED - SOLUTION

Managing the air quality in our living environment is more than just measuring and ventilating. It is part of a wider comfort, safety (health protection) and energy management system. The TELETASK system is therefore equipped with all necessary input. The residents can indicate to the system whether they are present or absent, whether they are sleeping or not. On the other hand, the digital energy meter provides the necessary information about the current energy rate and the TELETASK system knows when there is an energy surplus, allowing free ventilation. However, by indicating priorities, the TELETASK system will give priority to heating water, electric cooking, and charging electric vehicles, before ventilation comes at a higher speed. In short, an event that will ensure the greatest comfort with the highest sustainability, without the involvement of the residents.

12 TELETASK TDS12027/12028 SENSOR DETAILS

- Measuring range: 0-1000ppm of ethanol equivalents
- Solid state - 2nd generation sensor
- On-chip humidity compensation
- Extreme small footprint
- Broadband sensor
- High sensitivity to most VOCs
- Power consumption: <10mW
- Start-up time: <60 seconds
- Response time: <10 seconds
- Lifetime of >10 years

13 LIST OF DOCUMENT SOURCES

What are VOCs international definition
https://www.chemsafetypro.com/Topics/VOC/What_Are_Volatile_Organic_Compounds_(VOC)_and_Overview_of_Global_VOC_Regulations.html
Volatile Organic Compounds in Your Home:
EPA (US Environmental Protection Agency):
https://www.health.state.mn.us/communities/environment/air/toxins/voc.htm
Identifying the relationship between VOCs emission and temperature/humidity changes in new apartments in the hot desert climate:
https://www.frontiersin.org/articles/10.3389/fbuil.2022.1018395/full
Definition of VOCs by country
https://www.chemsafetypro.com/Topics/VOC/What_Are_Volatile_Organic_Compounds_(VOC)_and_Overview_of_Global_VOC_Regulations.html
National USA library of medicine
https://pubmed.ncbi.nlm.nih.gov/37927234/
American Lung Association
https://www.lung.org/

14 DISCLAIMER

The information provided in this whitepaper is for informational purposes only. It does not constitute legal, financial, or professional advice. While we have made every effort to ensure the accuracy and reliability of the content, we do not assume any responsibility for errors, omissions, or consequences arising from its use. Readers should consult with qualified professionals before making any decisions based on the information presented here.

If you would like to have more information on how to use ventilation in your TELETASK system, please take a look at our website www.teletask.be or contact your local distributor.

TELETASK

trendsetter in home automation