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An article from Heating and Ventilation:

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It is known that a balanced climate is necessary for a good performance of the employee and to prevent absence due to sickness. This awareness caused to laws and procedures for this subject. At least men should take care for the needed ventilation with fresh air, whereby it is necessary to watch the thermal comfort. Beside the needed ventilation with fresh air and thermal comfort there are also situations where unwished parts in the air get released. For example VOC's (Volatile Organic Compounds) or harmful pieces like house dust, welding smoke and wood dust. Those can be harmful for people or for the production process. Only ventilation is not the best solution when we watch at the thermal comfort of the energy usage. Intelligent sensors can make the different, not only by measuring the concentrations, but just by leading the ventilation system based on actual measurements. With this it is possible to create a safe environment to work, with an energy usage which is as low as possible.

# Intelligent sensors watch to the quality of the air at a workplace

Maybe you know them or at least you heard of them, the factory's of the first half of the last century, mostly dusty, dirty, wet, bad light, and depending of the work process and seasons is to hot or to cold. In this environment, where men not do well, getting illnesses and unsatisfied. In short a firebox of social commotion.

In our days we cannot imagine it, it is so short ago, these worse work environments were normal.

Heating, air-conditioning and ventilation are now almost a common property. The modern employee has it, almost in collaboration with the works council, fine settled. At least, we think it. If we look better, we can see a lot of places to improve the comfort. The quality of the air in the environment is commonly defined at feeling. A thermometer is almost available humidity meters are more scarce. Measure instruments for determining harmful dust in the air are only available in environments where a direct risk for health is present, or when there is a fire or explosion risk. When men ask a common manufacturer of air-cleaning and ventilation systems, how he guaranteed values of volatile organic compound and/ or dust measured in for example the

Figure 1. The sensors Of the MACView® can be used to measure the temperature, humidity and concentration. It is possible to use a computer for saving the data.



returning air, then they say we don't do that". Even so they produce in common good and adequate developed installations. The starting point of the device is mostly based on the number of refreshments of the room and not on real concentrations of not wanted gasses or dust.

Through extracting a lot of air from the room, brings the concentration to an acceptable level, but not in all cases. In addition it could be necessary to replace the extracted air with air from the outside of the building. This brings risks with it and costs. The air from the outside of the building has to be heated or cooled, some production processes can be disturbed by strong air streams, vulnerable products (food and farm industry) can be infected, etc.

## Rules

The (European) lawmakers make rules for companies about the air in the work environment. Those rules are not made by accident, but they are made after careful discussions between communities. Like branch department employees and trade(s)-union.

A part of the rules are rather recent, this gives the companies the feeling it is not necessary to meet the rules at all, or a part of them. With two important industries are appointments made, these are the wood processing and the construction industry which affect the welding part of it. It is necessary for all the companies to meet all the rules according the MAC-values. (Maximum Allowable Concentration for human during 8





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Figure 2. Governments give rules for emissions. Sensors could be an important part in the process

hours.) Also important are the design and functionality of the air extraction system are carefully checked by users. In the past, only the lowest prize was important when it was needed to buy an air extraction system, now it is (because the tightened laws and rules) an integral part of the production process, besides this, the customers demand for more functionality.

#### Intelligent sensors

In the HVAC (heating, ventilation, air-conditioning) market it became a trend to use intelligent sensors, which react at temperature and/or humidity, to control the air treatment system. If working in offices, factories or other public opportunities, a healthy environment is not only depending on temperature and/or humidity. The sick building-syndrome can also be caused by the presence of a large quantity of dust, pollen or volatile organic compounds, like carbon monoxide and carbon dioxide, or a shortcoming of oxygen. The above-mentioned sensors are not capable to measure all the factors and are not useful to control the ventilation systems. With the use of intelligent sensors it is possible to detect or to measure the concentrations of these pollutions. An example are the MAC View® devices.

#### MAC View®

The MAC View®-devices can be equipped with a solvent-sensor or a particles-sensor. The particles-version is a certified instrument; this sensor can measure parts of dust per amount of space with a defined accuracy. This is the successor of the classic method to measure dust that was not real time and requires a lot of work. This particles-version is useful to measure parts of dust, like house dust, welding smoke or wood dust. For almost any kind of dust counts, they can be harmful when they have a specific size. The sizes are from 800 nanometre to 10 or 20 micron. Through measuring in this domain and controlling the air cleaning installations, a better work environment is created. Besides the particles-sensor there are several solvent-sensors, whereby the user can choose between general; sensors, who can measure several VOC's (Volatile Organic Compounds), or specific sensors, who are made to measure one specific gas, like carbon monoxide, carbon dioxide, ethanol, methane or white spirit.

#### Possibilities

A MAC View® can be applied in several ways. The sensors can be used to measure temperature, humidity and gas or dust concentrations and record them at a computer. With this application it is possible to create reports and register in which environment the employees do their jobs. A second important application is to use the MAC View® as a control unit. By using the available relays that are controlled by real-time MAC-values, it is possible to control an air ventilation system. So the ventilation system starts or stops on the previously given set points or an extra ventilator starts, or only clean air is imported. At the same time it is possible to start an alarm, so the employees know when it is needed to pay attention to the air cleaning system, or when a possible dangerous situation arises. You can think at situations like strong increasing concentrations of dust or solvents, for example in a polyester manufacturing industry. By making use of time delays the system prevents from starting and stopping continuously when short-living peak values are measured.

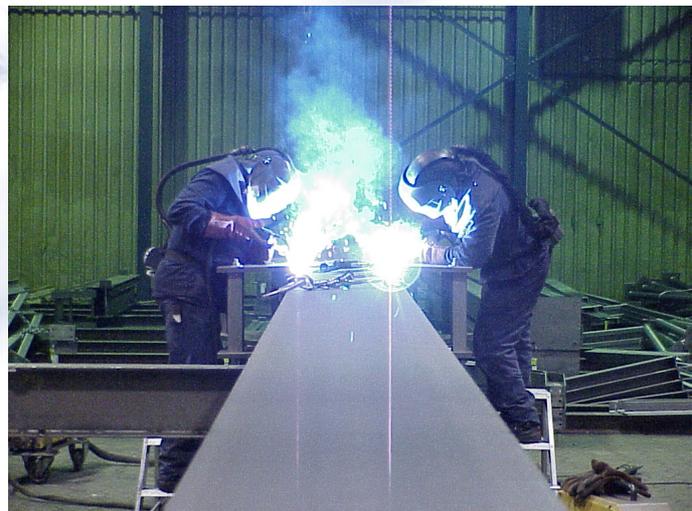


Figure 3. Intelligent sensors can, for example regulate the ventilation; at welding smoke emissions based on the real measured values.



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A third application is a full automatically climate management system, which is leaded up by the concentrations of the MACView®. By making use of the 4-20 mA or 0-10 volt output, it is possible to modulate the ventilation system with frequency-regulated ventilators. When the MACView® is connected to a PC it is possible to record all the data in a database and show a chart of the data. The climate at a work spot is regulated by real-time measured concentrations. For the employee it is an attractive advantage. By this kind of controlling, the system ventilates, besides the base capacity, on demand. In this case it is not needed to extract more than is necessary. This saves the energy costs of the ventilation system and the heating or cooling of the room.

### Very good applicable

At this moment the technique is frequently used in the welding industry, in which the particles-sensors are very suitable to measure the welding smoke emissions. Some companies use them only to monitor the concentrations, but in other companies are savings of 50% on energy costs. In these cases the particles-sensor controls the installation automatically. The solvent-sensors are frequently used in painting cabins and paint mix rooms, polyester manufacturing industry, petrochemical industrie, in gas cylinder storage rooms, fire departments and industrial companies. Another application is the air extraction in garages. In the meantime the MACView® is used in printing companies and in environments where diesel or oil vapour exists. Other possibilities are the measuring of narcosis gas in operating rooms, volatile gasses in the pharmaceutical industry, rubbish industry and recycling companies. In the industry the intelligent sensors of the MACView® are an added value in the food-sector, the polyester manufacturing branches, the bio-industry, laboratory, glue industry and cool /freeze companies.

### Product development

The MACView® is a product line of products which via several parameters the working of air treatment installations continuously can be monitored and corrected. With the recently introduced IP-version it is possible to control through the Internet from one location several offices, production halls or watch installations at worldwide spread plants. The advantages are indefinitely. A Quality Assurance-department can see in one look the performance of the air cleaning system, or a Quality Control-department who checks the dust level in a packing room for baby food can watch continuously. Thus it is possible for international operating companies to watch the performance of the

production real-time, it does not matter in witch country, only Internet is needed. The most recent development in Internet monitoring is the MaxXS, the first industrial GPRS-application in Europe and a succession of the MACView®-IP. The MaxXS® is build around a mobile Internet server. This server is small and can be accessed from anywhere around the world. In the embedded web server are HTML-pages that can be opened by using the right IP address, like a real web server. The difference is, the MaxXS® is wireless and mobile and it can serve dynamical data like temperature, pressure and humidity. All possible sensors can be connected to the MaxXS® and the data can be shown in the web pages. Because of this, the MaxXS® is more applicable. A few examples of applications are: monitoring of tank lorries with hazardous goods, tank installations, cool / freeze transport, emission measurement around airfields, industrial areas, but also climate control in several buildings. Because the infrastructure already exists (the GSM-network) the devices can be used everywhere in the world where GPRS is in the air.

### Summary

In principle it can be supposed that the MACView® applicable is in every kind of public building, office or factory to guarantee the quality of the present air by monitoring. The objective is to protect the most expensive asset, the employees, to guarantee and to reduce the absence due to sickness. A saving that could be much bigger then the cost of an energy bill.