

ON DEMAND VENTILATION IN CAR PARKS

The demand for parking spaces is growing phenomenally in cities across the country. Car parks typically pose challenges in Indoor Air Quality and ventilation distinctly different from other interior spaces.

The main factors determining the characteristics of a parking ventilation system is the approximate number of cars serviced on a daily basis and the nature of construction of the facility that it caters to. As a rule, apartment buildings and shopping centers adopt the condition of constant and distributed car use, with the number of moving vehicles varying from 3% to 5% of the total number of cars. While in sports facilities, concert halls, airports etc. the number of vehicles in simultaneous motion equals 15-20% during peak hours or during the hours that coincide with the beginning or the end of the business day.

Hence the need for an intelligent system that can monitor and control ventilation is critical.

A. VENTILATION REQUIREMENTS FOR CAR PARKS

Open Sided Car Parks

These are completely above ground level with permanent wall openings on each level, equalling 5% of plan area, arranged to provide cross ventilation sufficient for both smoke and vehicle exhaust fumes.

Naturally Ventilated Car Parks

These have permanent wall openings on each level, which are equal to 2.5% of the plan area, arranged to provide cross ventilation. This is sufficient for smoke clearance, but in addition mechanical extract system of capacity 3 air changes per hour is needed to remove vehicle exhaust fumes

Mechanically Ventilated Car Parks

In absence of natural ventilation, a mechanical extract system is required. This needs to achieve 12 air changes per hour for vehicle exhaust fumes and 30 air changes per hour for smoke clearance.

B. HYGIENE LIMITS

CO levels typically should be maintained within 29 (25) mg/m^3 (ppm), with peak levels not to exceed 137 (115) mg/m^3 (ppm), as per NBC India.

NO_x should be maintained within 1 ppm, as per various building codes.

All other contaminants which are present in exhausts disappear with the carbon dioxide. It shall be maintained within 1300 ppm.

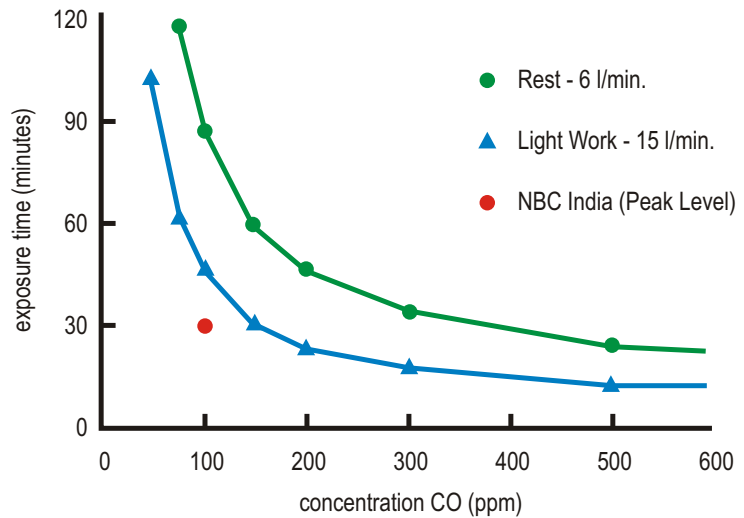
C. ADVERSE EFFECTS

The determination of hygienic limits is based on medical research, where the ability of human blood to absorb different gases has been studied, including the resulting symptoms and after-effects.

The risk factor increase with the concentration of gas, the time of exposure, and the individual heart/lung activity at the time of exposure.

CO-absorption in the blood occurs through the production of carboxyhaemoglobin (COHb), which can lead to oxygen deficiency (hypoxia).

CO Exposure Time
for the blood COHb level to reach 3.5%



HOW TO ACHIEVE OPTIMAL VENTILATION ?

Mechanical ventilation may not be required during all times, if the toxic and harmful gases are maintained within exposure limits.

An efficient solution would be to monitor the toxic gas levels and accordingly calibrate our ventilation.

Significant energy savings can be achieved by reducing ventilation rates during low movement of vehicles.

D. WHICH GASES ARE RELEVANT TO MEASURE?

Traditionally CO is considered to be biggest threat in car parks, and NOx where there are heavy loads of diesel vehicles. It present greatest danger to the human health.

In many contexts it is be better to measure CO2 (carbon dioxide), instead of measuring every toxic component which might occasionally occur. CO2 is always the dominating product of combustion. It therefore provides a good measure of the total amount of accumulated exhaust, and, consequently, of the ventilation requirements.

With rapid development of environment friendly modern cars with catalytic converters generate 100-900 times CO2 as much CO. Therefore CO2 itself is a greater threat to safety and health of people present in car parks. CO2 can be measure more precisely and reliably than any other detector of toxic gases

E. COVERAGE OF SENSORS

Next step would be to distribute CO2 measuring sensors in a manner that gives us the most accurate overall picture.

Maximum distance of any corner in the car park to the nearest sensor shall be less than 25m.

First 12m from fresh air opening are considered as natural ventilation (NV) zone.

Sensors are grouped according to the zones by the exhaust fans. It shall be located at 0.9m ~ 1.8m above floor level. However, for practical reasons (in order to avoid vandalism), the sensors can be installed just above 1.8m.

Number of sensors required

$$N = A \times \text{SQRT}(L/W) / 1000$$

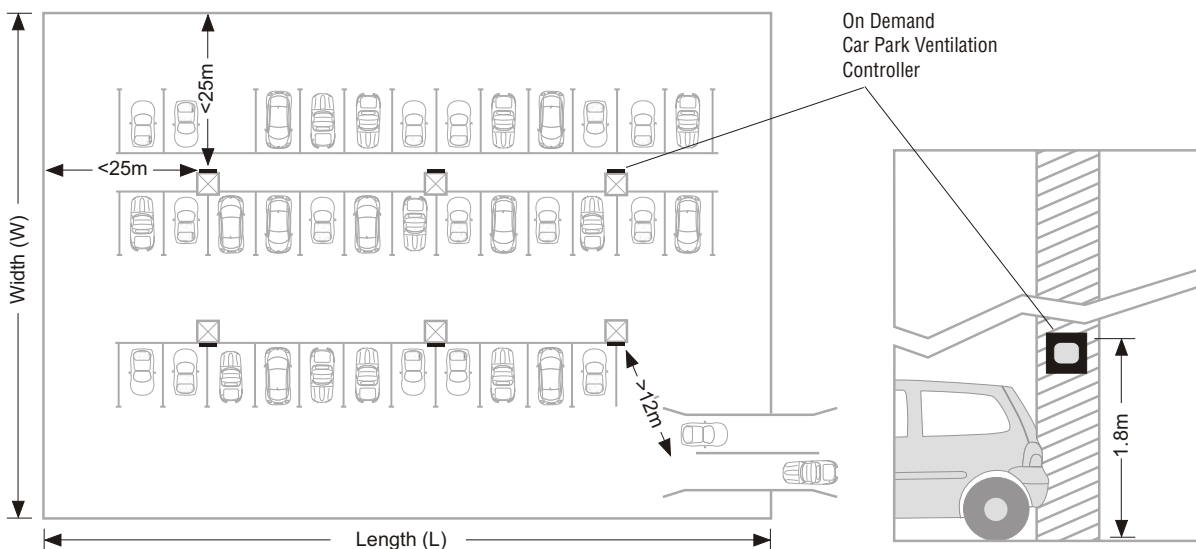
Where,

N : no. of sensing points

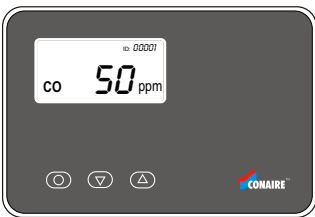
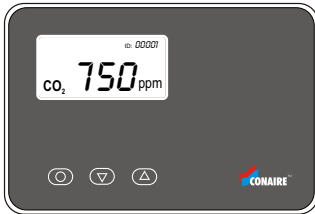
A : Area of car park in square meters

L : Length of car park in meters

W : Width of car park in meters



F. OUR SOLUTION

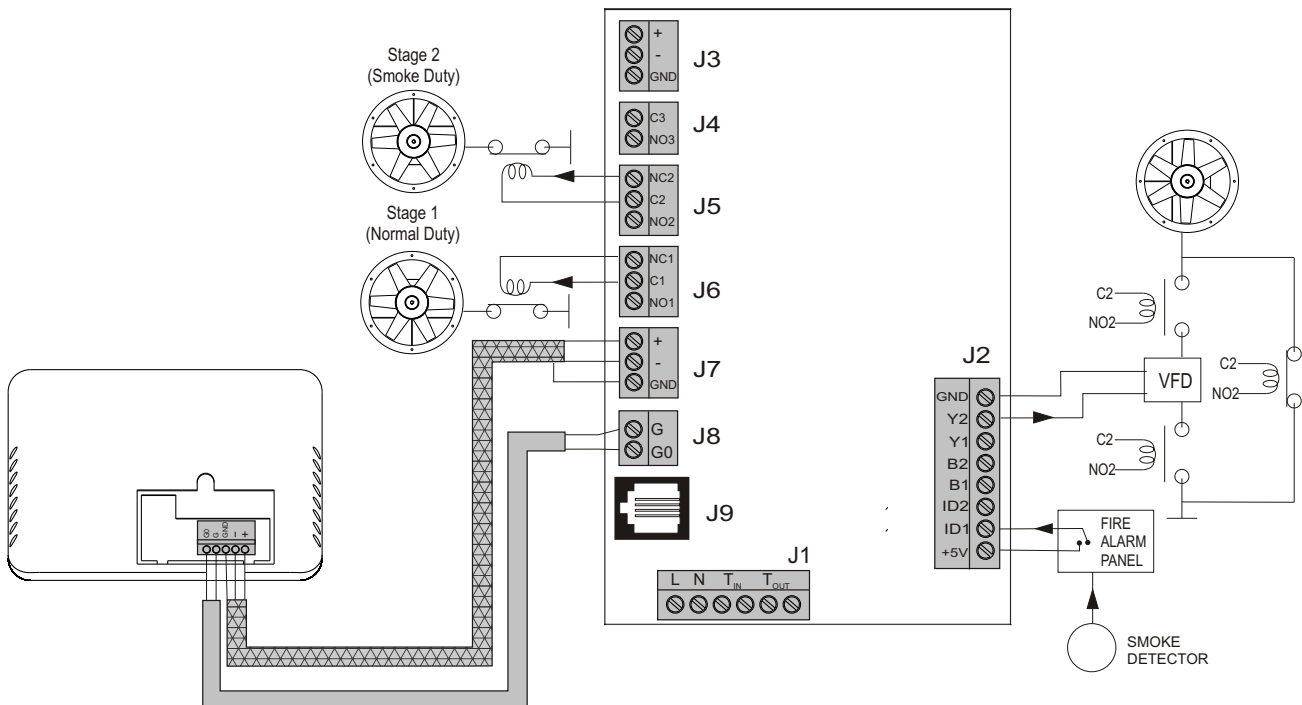


CONAIRE On-Demand Car Park Ventilation Controller, includes a CO & CO₂ sensor integrated with a controller to affect energy savings by reducing ventilation rates during low movement of vehicles and at the same time taking care of local building codes by maintaining CO levels within permissible limits.

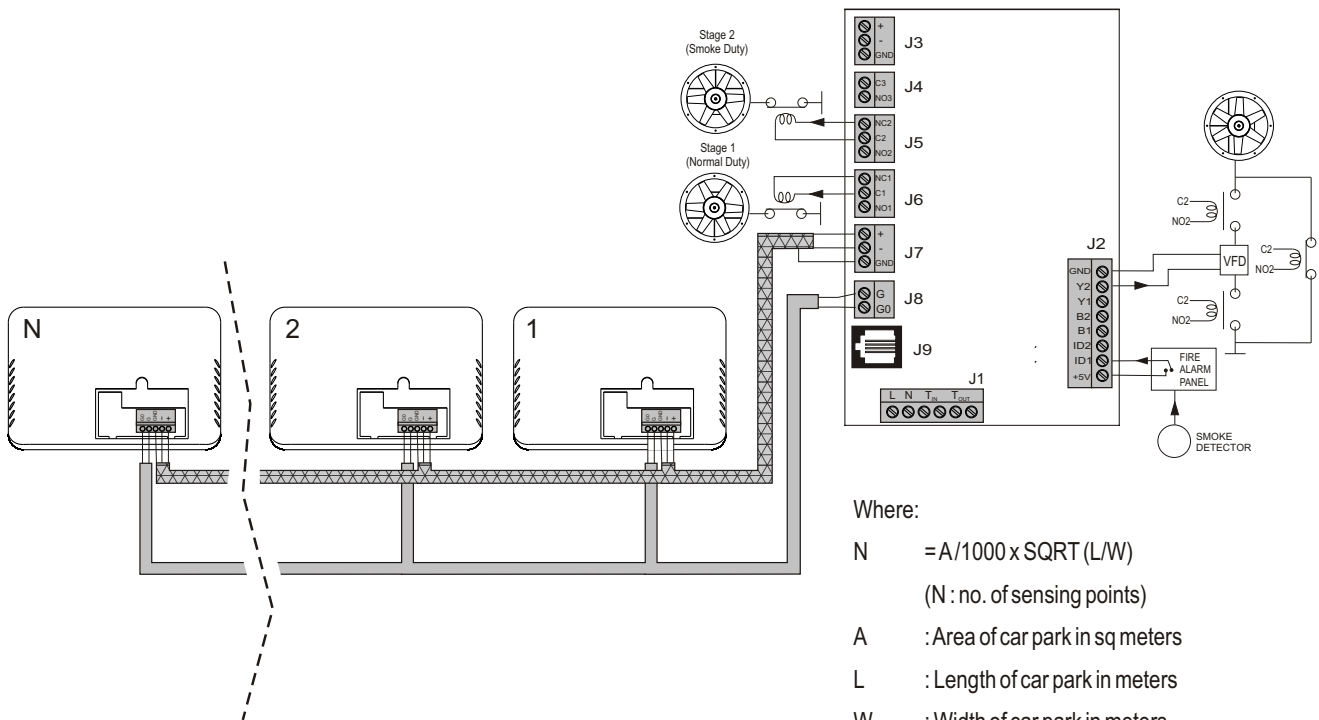
The system also provides a fail-safe smoke exhaust in case of fire and a manual override to override sensor and provide maximum ventilation.

Most importantly, multiple numbers of these units can be networked in a large space to give signal to the ventilation system.

SINGLE SENSOR



MULTIPLE SENSORS



Where:

$N = A/1000 \times \text{SQRT}(L/W)$
 (N : no. of sensing points)

A : Area of car park in sq meters
 L : Length of car park in meters
 W : Width of car park in meters
 SQRT : square root

Key features of CONAIRE On-Demand Car Park Ventilation Unit

- Integrated with more reliable CO2 sensor.
- Advanced application controller with plug and play operation for easy site installations.
- Manual override option available to provide maximum ventilation during predetermined peak loads.
- Smoke override option available to provide maximum ventilation upon receiving signal from smoke detector or central fire alarm panel.
- Several slave sensor connected with master module to provide accurate results in sensing.
- Both On/Off and VFD control strategy available.

We look forward to your feedback on this series of knowledge papers from Conaire. Whether you found this paper useful and informative or you require any further information.

Please write in with your suggestions and queries at:

feedback@conaire.in



An ISO 9001:2008 Company

B-23A, Udyog Kendra Extn. - 1, Greater Noida (U.P.) - 201 308
 Phone: +91 120 - 3144807, 9990484500, 9310048450
www.conaire.in