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# Crowcon Hydra

## Addressable Car Park System

# Introduction

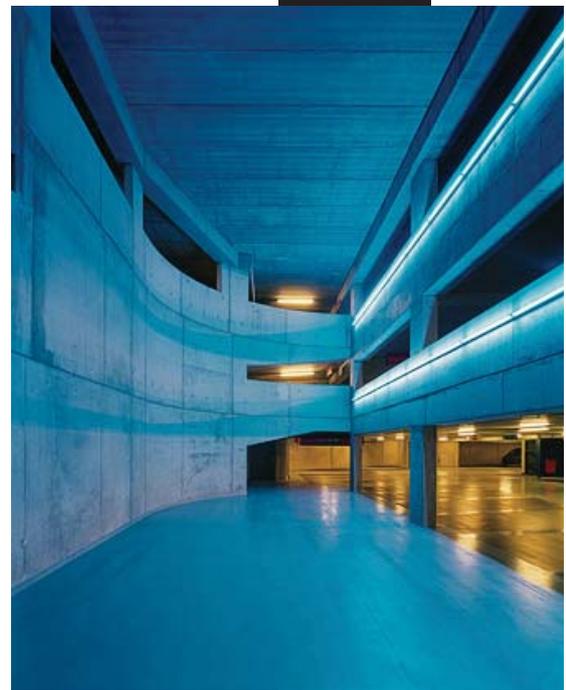
The new Crowcon Hydra addressable gas detection system provides a cost-effective solution for detecting toxic gases from vehicle exhausts, such as Carbon Monoxide (CO), oxides of Nitrogen (NO/NO<sub>2</sub>) plus explosive petrol vapours, in enclosed or underground car parks.

Many car parks run ventilation fans continuously, but this is very inefficient and energy intensive. The Crowcon Hydra offers an alternative method of controlling fans so they only need to run at full speed when required. Speed-controlled ventilation systems can be set to run slowly to keep the area ventilated, and speed up to clear detected gas accumulations.

The Crowcon Hydra addressable system also costs less to install than conventional point-to-point systems, and a single control unit can monitor up to 120 separate gas detector heads distributed throughout a car park.

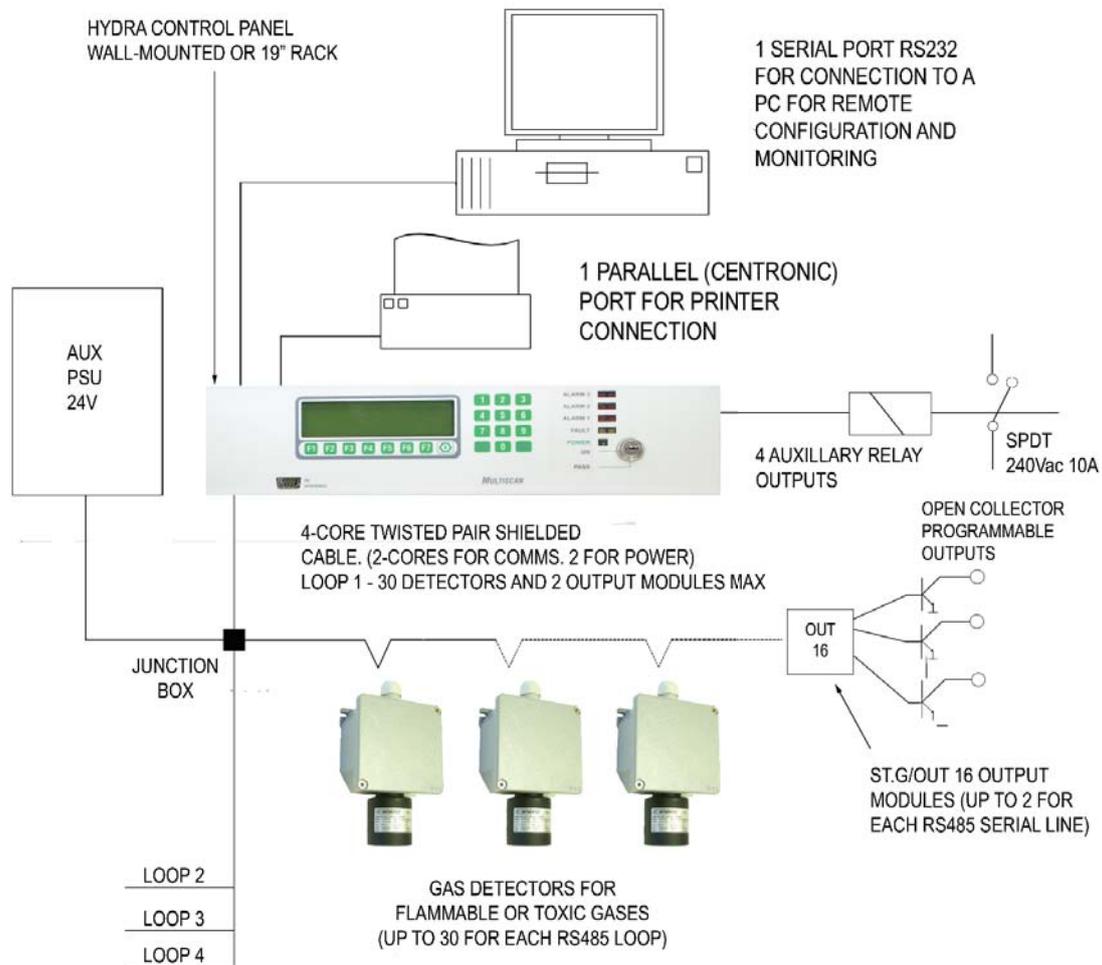
The detectors' electrochemical sensors provide superior performance compared with semiconductor detectors often used in car park gas detectors. Electrochemical sensors reduce incidences of false alarms. The system has four programmable relays for controlling fans and/or alarms, and a further 128 outputs can be added.

The control unit can be positioned anywhere – such as a plant room or office – and provides a continuous, easy to read backlit LCD display of all operating conditions and gas levels. It has an event-logging facility and a printer connector, so all alarm and fault events can be recorded and printed automatically. An RS-232 Modbus output also enables connection to BMS, DCS or SCADA systems.



# Product Description

Available in wall-mounted or 19" rack versions, the Crowcon Hydra control system can monitor up to 120 CO, NO<sub>2</sub> or petrol vapour detectors arranged on four RS-485 addressable loops.



A back-lit LCD displays gas levels, detector locations and system status, and four 10A programmable relays are fitted for controlling fans or signalling to BMS systems.

Addressable output modules can be fitted to the detector loops to extend the total output capability to 132 outputs. Outputs from the addressable modules are open-collector type, capable of driving a 24V relay which in-turn can be used to trigger alarm devices etc. Three independently programmable alarm levels are provided for each detector.

24Vdc power to the detector loops and output modules must be provided via a separate power supply (ie not from the control panel): only the 2-core twisted-pair communications cable is connected to the control panel.

Crowcon can provide an auxiliary PSU for the detector loops complete with battery back-up, or alternatively distributors/installers can provide the PSU.

The control panel logs all 'events' such as alarms, faults, key-presses etc, and the log file can be read direct from the LCD or up-loaded to a PC via the RS-232 communications port.

The RS-232 port can also be used for communicating directly with a site BMS (Building Management System) via the Modbus protocol to provide live data on gas levels and alarms. An RS-232 to RS-485 converter will be required if the length of the Modbus communications cable exceeds 3 metres. Crowcon can supply a suitable converter.

A 'parallel' type printer can be directly connected to the control panel to print-out alarms and faults (with time/date stamp) as they occur.

# Markets and Legislation

The Crowcon Hydra system is primarily targeted at the car park CO/NO<sub>2</sub> detection market.

## Car Parks

Vehicle exhaust gases contain significant quantities of highly toxic gases such as Carbon Monoxide (CO) and Oxides of Nitrogen (NO<sub>x</sub>). The main NO<sub>x</sub> emission is in the form of Nitric Oxide (NO), however NO combines with the oxygen in ambient air to create Nitrogen Dioxide (NO<sub>2</sub>).

These gases are toxic in very low concentrations: CO has a 15 minute exposure limit of only 30ppm (part per million) whilst NO<sub>2</sub> may be hazardous to health at 1ppm. The effects of the gas are cumulative, low concentrations over an extended period of time can be as dangerous as short-term exposure to high levels of gas. Car park users and workers are at risk from gas accumulations. 'Hot spots' for gas accumulation are where cars wait with engines running: pay-booths and exit ramps.

The most significant risk from petrol engine exhaust gases is from CO. Diesel (gasoil) engines emit significantly higher proportions of NO (which in turn forms NO<sub>2</sub>), although CO is also present in dangerous concentrations. CO detectors are generally installed in vehicle parks where either engine type may be present. Parking facilities reserved exclusively for diesel powered vehicles (such as military vehicles, bus depots) are usually protected by NO<sub>2</sub> detection systems.

Flammable vapours from fuels spills can also present an explosive risk in car parks with poor ventilation.

LPG powered vehicles may be restricted in parking facilities due to the risk of leaks of explosive vapours.

Requirements for determining the number of detectors fitted within a car park and the alarm levels vary according to national standards.

Area of coverage per-point for any fixed-point

detector to provide complete coverage is typically 100m<sup>2</sup>. Some car park standards however stipulate an area of 100-500m<sup>2</sup> per detector.

As a general guide, CO and NO<sub>2</sub> detectors should be installed approximately 1.5 - 1.8 metres from the ground, petrol vapour detectors should be installed 30-50cm from the ground. Detectors may need protecting with a guard-mesh in public areas to prevent damage from vandals.

### Car park standards:

Enclosed or underground car parks in all countries must have ventilation systems fitted to control the accumulation of exhaust gases. National standards stipulate the required air-change rate criteria, and in some cases also stipulate the gas detectors are fitted.

The following is a limited list: other countries may have their own standards.

**UK:** no legislation for CO detection systems, however guidance on ventilation and monitoring is given by CIBSE (Chartered Institute of Building Services Engineers).

**Australia:** Standards Association of Australia AS1668.2: The use of mechanical ventilation and air conditioning in buildings. Requires toxic gas monitoring combined with ventilation systems.

**USA:** ASHRAE (American Society of Heating, Ventilation and Air Conditioning Engineers) Standard 62 - 1989 - 2003 requires the ventilation of car parks, and stipulates minimum pollutant concentrations.

**Germany:** VDI: The Association of German Engineers guideline VDI 2053 defines requirements for exhaust gas control in car parks.

## Commercial Kitchens

Some cities in the Middle-East have no natural gas network; hotels and restaurants rely on LPG cylinders to provide gas for cooking. It is a requirement that detectors are installed to monitor for leaks of flammable gas from cylinders and pipe-lines. Addressable flammable gas detectors provide a significant installation cost saving over traditional point-to-point type systems.

# Sales Platform

The Crowcon Hydra system will initially be promoted in limited territories:

- UK
- Middle East
- Singapore

Restricting territories will enable Crowcon to gain experience of the product and market before expanding into other territories.



The key selling points for the product are:

- Installation cost savings over point-to-point systems: the cost of installing multi-point systems may be far higher than the equipment cost. Addressable systems enable many detectors to be connected to a common cable; thus cable and installation costs are dramatically reduced.
- Energy cost savings: building regulations in all countries stipulate that ventilation systems are fitted to enclosed car parks. The energy costs of running fans continuously can be considerable. Gas detection systems can be linked to HVAC controllers to start or speed-up fans only when gas accumulations are detected. This has the added benefit of reducing the noise from ventilation systems.
- Compliance with legislation: in some territories it is mandatory to install gas detection systems in enclosed car parks. The Crowcon Hydra can compete with competitors systems already established in the market-place.

## Features

- Up to 30 detectors on one cable: four inputs on the control panel means up to 120 CO, NO<sub>2</sub> and/or petrol vapour/LPG sensors can be connected.
- Simple operation and calibration: detector and system status is shown on an LCD. Calibration is performed at the detectors only; no control panel adjustments are required.
- Superior electrochemical sensors: provide fewer false alarms and more dependable operation than semi-conductor type sensors used on many competitors products.
- Choice of outputs: four programmable relays are fitted as standard for triggering alarms or fans. Up to 128 further outputs can be added on addressable modules which can be fitted to any detector cable.
- RS-232 Modbus communications: can be used to transfer gas level and alarm/fault data to building management systems (BMS).
- Event log function: the control panel logs all alarm and fault events so that on-site event history can be checked at any point. A printer can also be connected to print-out events as they occur.

# Cost Saving Analysis

The key selling points for addressable CO monitoring systems in car parks are:

- Installation cost savings compared to point-to-point systems
- Ventilation operating cost savings through reduced energy consumption

These points are especially important in markets where there is no legislation to force car park operators to install CO monitors.

The following case studies illustrate the significant savings addressable systems provide.

## Typical installation cost comparison

Figures shown are an estimate for a typical 30-point system.

System Type	Material costs (cable, tray, glands etc)	Labour Costs	Travel/ subsistence/ sundries	Total
Point to Point	£3000.00	£9000.00	£3000.00	£15000.00
Addressable	£2100.00	£6300.00	£2100.00	£10500.00
<b>Cost Saving</b>	£900.00	£2700.00	£900.00	<b>£4500.00</b>

Addressable systems typically provide a 30% installation cost saving due to:

- ~30% lower material costs (although cables, trays etc only represent approximately 20% of total costs)
- ~30% lower labour costs (less time on-site: fewer cables to run and the control panel is quicker to install due to fewer detector cable terminations)
- ~30% lower subsistence costs (less time on-site means lower hotel/food costs)

## Typical energy saving analysis

By connecting alarm outputs from the Crowcon Hydra system to building management systems (BMS), car park operators can start or speed-up ventilation fans only when gas accumulations are detected. Significant energy cost savings may be achieved by running fans more efficiently.

See page 7 for details

# Cost Saving Analysis

Data used is based on a typical commercial energy costs in the UK.  
Costs are estimated over a typical 1-year operating period:

Electricity rate: £0.07/Kilowatt per hour

Ventilation system power consumption for a medium size car park: 39kW (assumes 30 off 1.3kW fans)

Cost of running fans at full power for 24 hours a day for one year= **£23,914.08** (39kW x 8760hours x £0.07)

Cost of running two-speed fans at slow speed when no gas is detected and full speed on a low CO alarm:

System Status	Hours per day	Electricity Rate kWh	Fan Power Consumption kW	Fan Quantity	Total Power Consumption kW	Annual Electricity Costs
No alarm	19	£0.07	0.28	30	8.4	£4,077.78
Alarm 1	5	£0.07	1.3	30	39	£4,982.25
			<b>Total</b>			<b>£9,060.03</b>

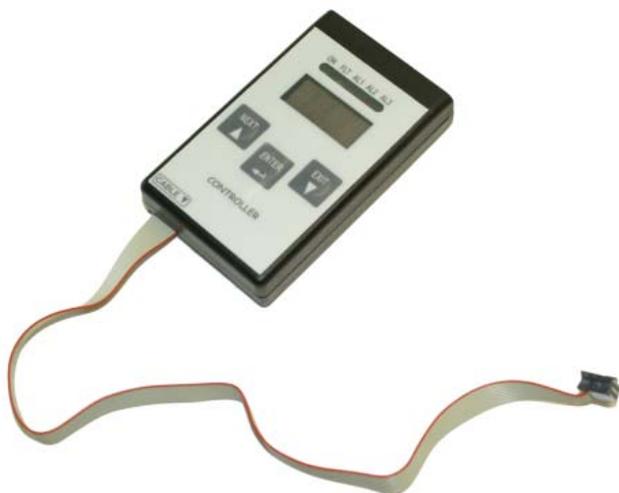
Therefore in this example a total energy cost saving of **£14854.05** is achieved **per year** by controlling fans using a CO detection system.

# Accessories

A Crowcon Hydra system will comprise as a minimum:

- a control panel
- detector heads
- detector power supply

The following accessories are available to complement the system:



### C02124 Calibration Keypad

Required for setting the address of detectors, plus performing zero and calibration.



### C02125 Calibration Adaptor

For applying calibration test gas to the sensor.



### C02120 Output Module

Provides 16 open-collector type outputs. Can be fitted within the wall-mount control panel or on detector loops.



### C01954 Auxiliary Power Supply

Provides 24Vdc power and battery-back-up for the detector loop(s).

# Technical Specification

## Addressable Control Panel Specification

<b>Size:</b>	440mm(w) x 420mm(h) x 140mm(d) wall mounted version 19" 3U rack version available
<b>Inputs:</b>	Maximum number of detectors: 120 arranged on 4 addressable RS-485 loops (30 detectors maximum per loop) 1 Km maximum cable length*
<b>Outputs:</b>	4 SPDT output relays rated 220Vac 10A Optional 16-way output modules (maximum of 8) Each module has 16 open-collector outputs each capable of sinking 50mA. RS-232 Modbus interface for data transfer to BMS/DCS/SCADA systems Parallel printer port for automatic event printing Event log function capable of storing up to 800 events
<b>Panel Indication:</b>	Back-lit LCD display Red LED's for Alarm 1, Alarm 2, Alarm 3 Yellow LED for Fault Panel sounder (can be de-activated) Green power LED
<b>Power:</b>	230V ac 50-60Hz (110Vac optional) or 12Vdc Battery back-up is available as an option
<b>Operating Temperature:</b>	0 to +50° C
<b>Humidity:</b>	15-85% non-condensing

## Detector Specification

<b>Construction:</b>	Alloy
<b>Size:</b>	96mm (w) x 152mm (h) x 60mm (d)
<b>Certification:</b>	Not hazardous area certified; safe area use only
<b>Operating Temperature:</b>	-10 to +55° C
<b>Humidity:</b>	20-90% RH non-condensing (@40°C)
<b>Ingress Protection:</b>	IP55
<b>Voltage:</b>	12-24V DC, 180mA max.
<b>Outputs:</b>	RS-485 addressable communications
<b>Calibration:</b>	Requires hand-held keypad
<b>Sensor:</b>	Gases and Ranges: 0-300ppm CO, 0- 20ppm NO <sub>2</sub> (electrochemical sensor) 0-100% l <sub>el</sub> LPG/Propane (catalytic bead)
<b>Sensor Life:</b>	> 3-years*
<b>T90 Response Times:</b>	<60 secs*
<b>Accuracy:</b>	5% of range or 10% of display*
<b>Accessories:</b>	Hand-held calibration keypad Auxillary 24V PSU for detector loops Calibration adaptor

\* specifications are typical and may vary dependant upon site conditions.

# Alternative CO Monitoring Solutions

The Crowcon Hydra provides an excellent and cost-effective method of monitoring toxic gases in car parks. Some customers however may prefer a sampling method of monitoring rather than employing point detection systems.

The advantages and disadvantages of each system type are illustrated in the following tables:

Point Type System (eg Crowcon Hydra)	
<b>Advantages</b> compared to sample systems	<b>Speed of response:</b> any gas alarm will be reported in ~30 seconds
	Provides ability to control fans individually linked to CO detectors in the same zone.
<b>Disadvantages</b> compared to sample systems	Higher installation costs: cables are more expensive to buy and install than nylon tubing.
	Higher maintenance costs: a 30-point sample system will only have one CO cell to replace.
	Sensors may require additional mechanical protection where vandalism is an issue

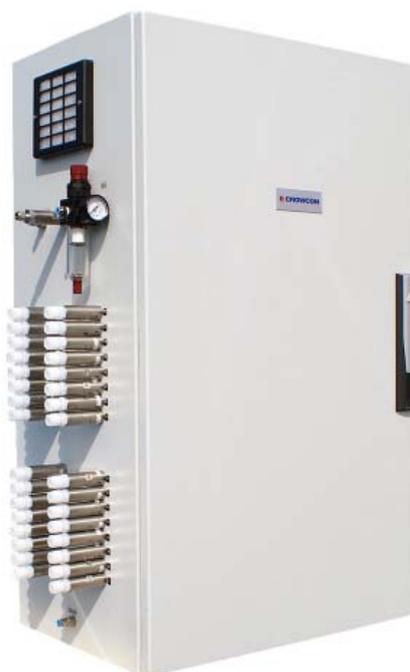
Sample System (eg Crowcon PGSi)	
<b>Advantages</b> compared to point-type systems	Lower installation costs: nylon tubing is less expensive to buy and install than cables.
	Lower maintenance costs: a 30-point sample system will only have one CO cell to replace; a point-type system will have 30 sensors to replace.
	Sample pipes are less prone to vandalism than sensors.
<b>Disadvantages</b> compared to point-type systems	<b>Speed of response:</b> each line must be sampled for 1 minute, therefore it may take 30 minutes+ (on a 32-point system) for a gas accumulation to be reported in an area.
	Lower number of points: a maximum of 32 sample points can be monitored; Crowcon Hydra can monitor 120 points.
	Size and noise: the sample system is much bulkier and noisier than Crowcon Hydra.

## Crowcon PGSi Programmable Sample System

The PGSi is a highly versatile system that can monitor up to 32 separate sample lines on a sequential basis. Operating from Windows XP™ based software, the PGSi system is the ideal solution for monitoring CO gas accumulations within car parks.

The sample times for each point are individually adjustable, and can be sequenced in any order. A dual-pump arrangement ensures that samples are presented to the gas sensors as quickly as possible.

Particle and water filters and flow-fail devices, are fitted to ensure safe and reliable operation at all times.



## PGSi Programmable Sample System (cont.)

The system is controlled by an industrial PC, which displays individual sample locations and gas levels, alarms, operates up to 16 relays and provides comprehensive data-logging facilities. Gas data can be displayed in tabular or graphical format. The system PC can be interrogated remotely via an optional modem to check status and upload datalog files. The system can be supplied complete with a PC fitted, or can operate from a PC supplied by the user.

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