

# MACURCO

GAS DETECTION



## PARKING GARAGE GUIDE

This application guide helps engineers, installers and integrators provide suitable gas detection systems for enclosed parking garages.

This publication is intended to serve as a guideline for the use of the Macurco products. It is not to be considered all-inclusive, nor is it intended to replace the policy and procedures for any facility. If there are any doubts about the applicability of the equipment to your situation, consult an industrial hygienist or call Macurco Technical Service at 1-877-367-7891



Made in the USA

# MACURCO

GAS DETECTION

## WHY INSTALL A GAS DETECTION SYSTEM?

### SAFETY

The solution to pollution is dilution. The solution to vehicle exhaust in parking garages is dilution with "fresh" air drawn in by fans, louvers and doors until reaching an acceptable gas concentration. Macurco gas detectors provide automatic exhaust fan control to help maintain acceptable levels of **Carbon Monoxide (CO), Combustible Gases (EX) or Nitrogen Dioxide (NO<sub>2</sub>)** in parking garages. Consult local codes for the specific requirements.



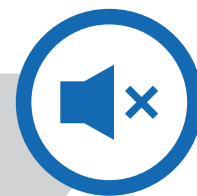
### SAVINGS

When people think about sustainability and saving energy, the temptation is to think first of inhabited spaces like offices and residences, but **one of the most important areas is in reducing energy consumption in enclosed parking garages.** Installing ventilation controllers based on gas concentrations can substantially reduce consumption of both electricity and natural gas and pay for itself in less than one year.



### SILENCE

In residential facilities like condominiums with enclosed parking, the noise from exhaust fans can negatively impact tenant satisfaction. Noise pollution adversely affects the lives of millions of people. Studies have shown that there are direct links between noise and health. **Problems related to noise include stress related illnesses, high blood pressure, speech interference, hearing loss, sleep disruption, and lost productivity.**



## WHICH STANDARDS ARE FOLLOWED?



## BUILDING CODES AND STANDARDS

Most states and local municipalities have building codes that recognize and recommend carbon monoxide detection and ventilation in enclosed parking garages. If local building code does not have any requirements for Carbon Monoxide or Combustible Gases and Nitrogen Dioxide detection in parking garages, it is still a good idea to educate the facility manager or design engineer that mitigation of these gases is a very important component of environmental health and safety in a parking garage. Consult local codes for the specific requirements.

### UL 2075

UL 2075 is a standard developed by Underwriters Laboratories (UL) that focuses on the safety and performance of gas detectors. UL 2075 and the International Mechanical Code work together to create a comprehensive framework for gas detection and ventilation systems, enhancing safety, compliance, and operational efficiency in environments where hazardous gases may be present.

## CARBON MONOXIDE

### OSHA - Occupational Safety and Health Administration

TWA: 50 ppm is the maximum allowable concentration for a worker's continuous exposure in any eight hour period.

### NIOSH - National Institute for Occupational Safety & Health

PEL - TWA: 35 ppm is the maximum allowable concentration for a worker to be exposed to in any eight hour period.

### ACGIH - American Conference of Governmental Industrial Hygienists

TLV - TWA: 25 ppm is the maximum allowable concentration for a worker's continuous exposure in any eight hour period.

### International Mechanical Code (IMC) - Section 404.1 - Enclosed parking garages

Mechanical ventilation systems for enclosed parking garages shall operate continuously or shall be automatically operated by means of carbon monoxide detectors applied in conjunction with nitrogen dioxide detectors. Such detectors shall be listed in accordance with UL 2075 and installed in accordance with their listing and the manufacturer's instructions.

### Uniform Building Code - Section 705 - In all parking garages

Automatic CO sensing devices may be employed to modulate the ventilation system to maintain a maximum average of CO of 50 ppm during any eight-hour period, with the maximum average concentration not greater than 200 ppm for a period not exceeding one hour. The Uniform Building Code was replaced after 1997 by the International Building Code.

## NITROGEN DIOXIDE

Current **OSHA** PEL: 5 ppm (9 mg/m<sup>3</sup>) CEILING - 1989 **OSHA** PEL: 1 ppm (1.8 mg/m<sup>3</sup>) STEL

**NIOSH** REL: 1 ppm (1.8 mg/m<sup>3</sup>) STEL - 1993-1994

**ACGIH** TLV: 3 ppm (5.6 mg/m<sup>3</sup>) TWA, 5 ppm (9.4 mg/m<sup>3</sup>) STEL

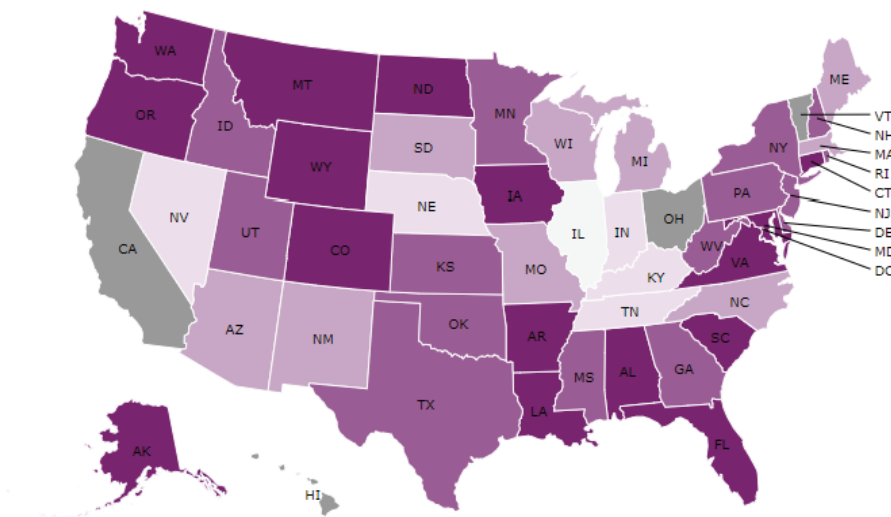
# INTERNATIONAL MECHANICAL CODE (IMC)

This code provides regulations for the installation and maintenance of mechanical systems, including HVAC. It aims to ensure safety, efficiency, and proper functioning of mechanical systems in buildings.

## ADOPTION MAP

### INTERNATIONAL MECHANICAL CODE® (IMC®)

#### ADOPTION MAP



#### MAP KEY

Edition of code currently in effect by state:

2021 IMC®

2018 IMC®

2015 IMC®

2012 IMC®

2009 IMC®

Local Adoptions

No state-wide IMC adoption

Adoption information is provided for states where the IMC is adopted statewide, adopted statewide for certain categories of buildings, or adopted by a state body to guide local code adoption.

Macurco CX-6 CO/NO2 Detector ETL Listed to UL 2075

## IMC & UL 2075

HVAC systems utilizing gas detection devices must comply with both the International Mechanical Code (IMC) and UL 2075. The IMC offers general guidelines for mechanical systems, while UL 2075 ensures that gas detection devices meet rigorous safety standards. Adhering to the IMC guarantees proper installation of these systems, whereas UL 2075 certifies their effectiveness in detecting hazardous gases, thus helping to mitigate risks. Furthermore, the IMC may reference UL standards, including UL 2075, to specify that gas detection systems in certain applications must meet established safety criteria. In summary, the IMC lays the groundwork for mechanical system installation, while UL 2075 ensures the safety and reliability of gas detection devices within those systems.

# GAS LEVELS AND SEQUENCE OF OPERATION

## VENTILATION, WARNING AND ALARM

Vehicle traffic is part of everyday operations in parking garages. Consequently, exhaust gases containing carbon monoxide and nitrogen dioxide will be released into the air under normal conditions. A gas detection system in a parking garage should not go directly into alarm upon detection of carbon monoxide as this would be considered a nuisance. Instead when low levels of carbon monoxide or nitrogen dioxide are detected, then the ventilation system should be engaged at the Rising Trip Point to draw in fresh air and lower those gas concentrations to acceptable levels.

If the ventilation system is incapable of reducing the gas concentration and it continues to rise, the Warning signal may be activated indicating that there is an issue with the amount of exhaust accumulating in the space. If the ventilation system continues to be incapable of reducing the gas concentration and it continues to rise even higher, the Alarm signal may be activated indicating there is a serious amount of exhaust accumulating in the space. The Warning and Alarm signal may be associated with buzzers, horns or strobes and activation of the fire or security system. Consult local codes for the specific requirements.



**Rising Trip Point** Set at a low concentration usually 35ppm of CO and 2.5ppm of NO<sub>2</sub>. Engages the ventilation system, drawing down the gas concentration until it reaches the Falling Trip Point.

**Falling Trip Point** Usually set to 15ppm for CO and 1.2ppm for NO<sub>2</sub>. Disengages the ventilation system.

**Multiple Fans** If the ventilation system is incapable of reducing the gas concentration and it continues to rise, that system remains operational and a 2nd ventilation system or fan is activated.

**2nd Rising Trip Point** Set at a higher concentration usually 75ppm of CO and 2.8ppm for NO<sub>2</sub>. Engages the 2nd ventilation system, drawing down the concentration until it reaches the 2nd Falling Trip Point.

**2nd Falling Trip Point** Usually set to 35ppm of CO and 2.5ppm for NO<sub>2</sub>, disengages the 2nd ventilation system. If the ventilation system is still incapable of reducing the gas concentration and it continues to rise, the ventilation systems remain operational and a warning condition activated.

**Warning Level** Set at a higher concentration usually 100ppm of CO and 3ppm for NO<sub>2</sub>. Engages the internal buzzer, horn or strobe drivers. Indication that there is a significant amount of exhaust accumulating in the space. If the ventilation system is still incapable of reducing the gas concentration and it continues to rise, the ventilation systems remain operational and an alarm condition activated.

**Alarm Level** Set at an even higher concentration usually 200ppm of CO and 5ppm for NO<sub>2</sub>. Engages the internal buzzer, horn or strobe drivers, indicating that there is a serious amount of vehicle exhaust accumulating in the space. If the ventilation system is still incapable of reducing the gas concentration and it continues to rise, the ventilation systems remain operational and an alarm condition activated. The Alarm signal may be associated with activation of a dialer or fire/security system.



**Macurco Horn Strobe**

# MECHANICAL VENTILATION CONSIDERATIONS

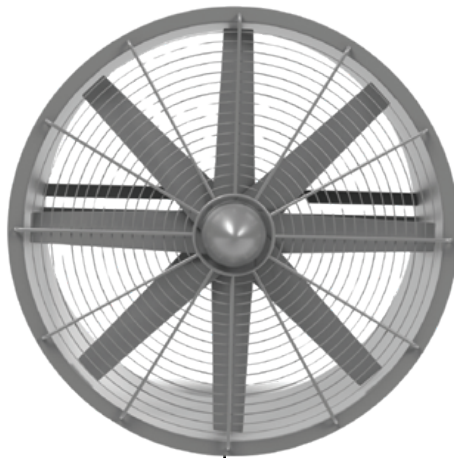
There are two main factors to consider when determining the ventilation system - the number of cars in operation and the emission concentrations of CO and NO<sub>2</sub>. Most codes simplify this estimate by requiring four to six air changes per hour for fully enclosed garages. Consult local codes for the specific requirements. The carbon monoxide monitoring system must be capable of activating both the exhaust fans and the air intake devices such as outside air louvers/dampers and make up air units. As per the Uniform Mechanical Code: Connecting offices (to parking garage), waiting rooms, ticket booths, etc., shall be supplied with conditioned air under positive pressure. The gas detection system activates the mechanical ventilation by using either dry contacts through magnetic starters, dry contacts through motor control center (MCC), dry contracts and/or analog outputs (4-20 mA) through the Building Automation System (BAS) or analog outputs (4-20 mA) modulating the speed of the fans through variable frequency drives (VFD).

## EQUIPMENT SELECTION AND LOCATION

### STAND-ALONE DETECTORS

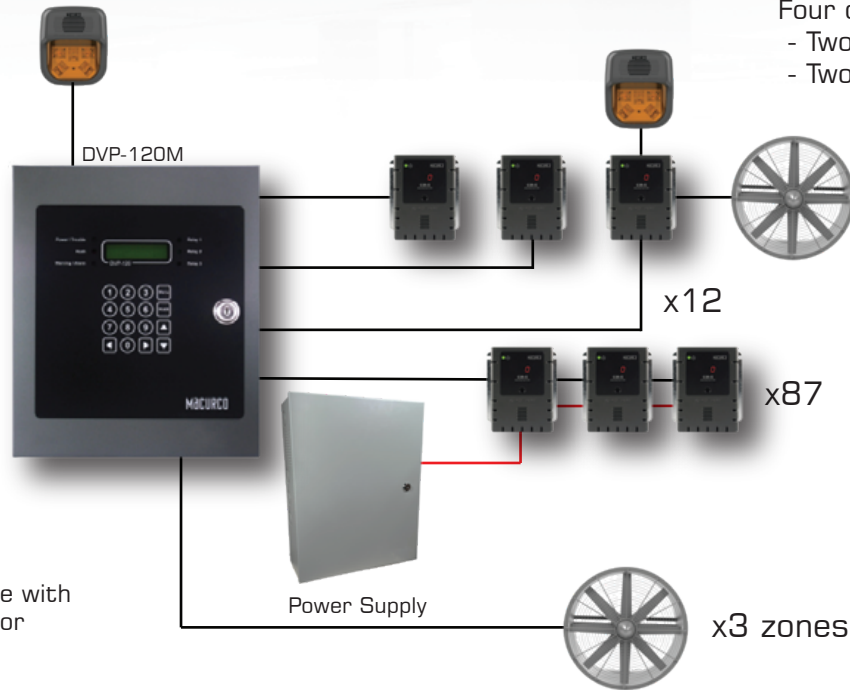


Dry contact relays to control fans, louvers, valves, horn and strobes



Benefits: Standalone / Small Jobs

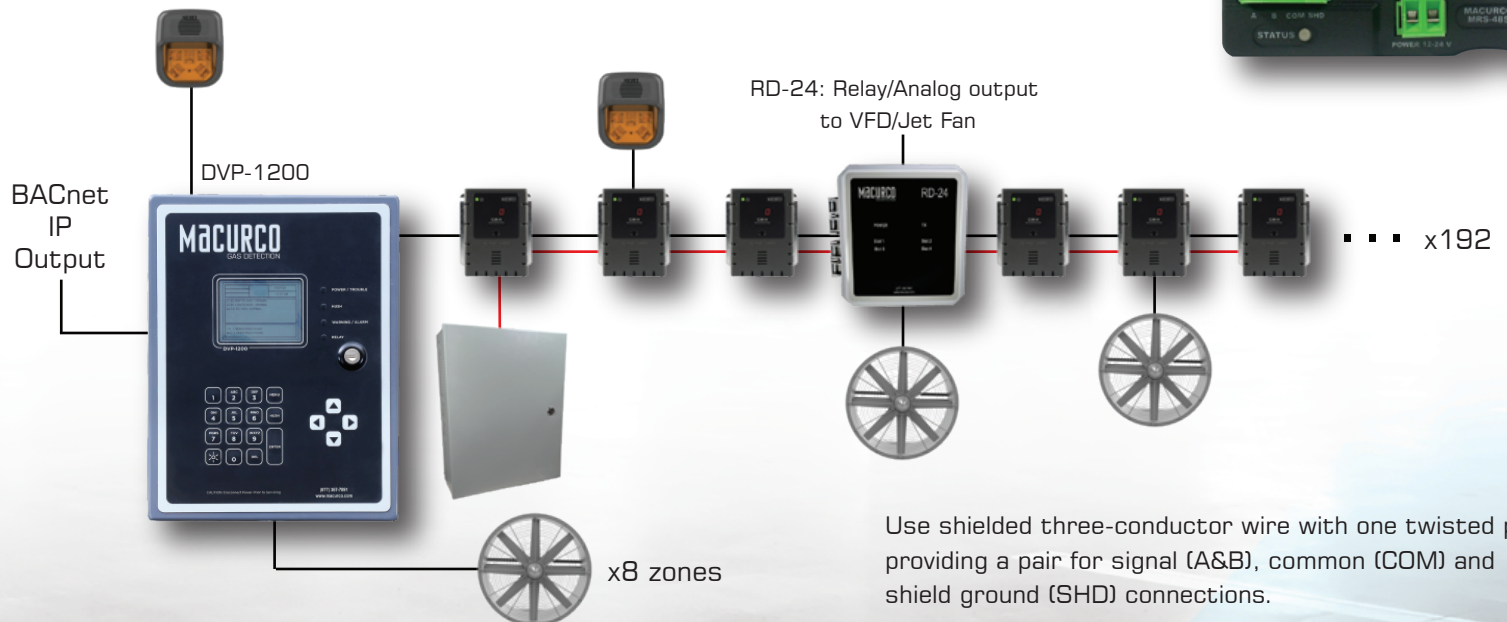
## DETECTION AND VENTILATION CONTROL PANEL



Use shielded three-conductor wire with one twisted pair providing a pair for signal (A&B), common (COM) and shield ground (SHD) connections.

Benefits: Medium Jobs

## ADDRESSABLE GAS DETECTION AND CONTROL



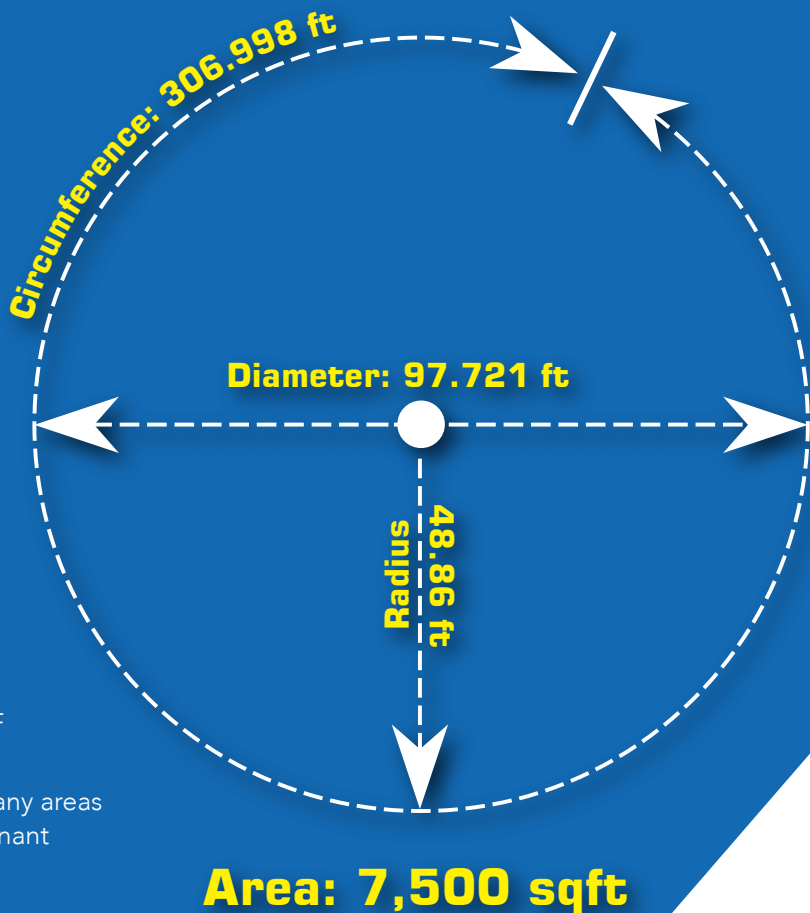
Benefits: Medium / Large Jobs, Less Wiring, Saves Time

## EQUIPMENT LOCATION

**Macurco CX-6 Combo CO/NO<sub>2</sub> Detector, CX-6-CO (CO Only), CX-6-NO<sub>2</sub> (NO<sub>2</sub> Only), & CM-6 Carbon Monoxide Detector.**

These units can cover up to 7,500 sqft (697 square meters) in a parking garage or similar application. The radius of coverage is up to 48 ft (14.63 m) per detector.

- Mounted on a column the detector can cover up to 7,500 sqft
- Mounted on a wall the detector can cover up to 3,750 sqft
- Do not mount the detector in a corner
- Do not mount where the normal ambient temperature is below 0°F or exceeds 125°F (-18°C to 52°C)
- Additional detectors may be needed near any areas where people work or where the air is stagnant



The relative densities of carbon monoxide and nitrogen dioxide compared to air are 0.967 and 2.174 respectively (Air=1). Carbon monoxide is just slightly lighter than air and nitrogen dioxide is heavier. Both of these gases tend to mix uniformly in the environment depending on air movement within the room or facility. Normally, the unit is mounted about 5 feet (1.5 m) above the floor (in the normal breathing zone), in a central area where air movement is generally good.

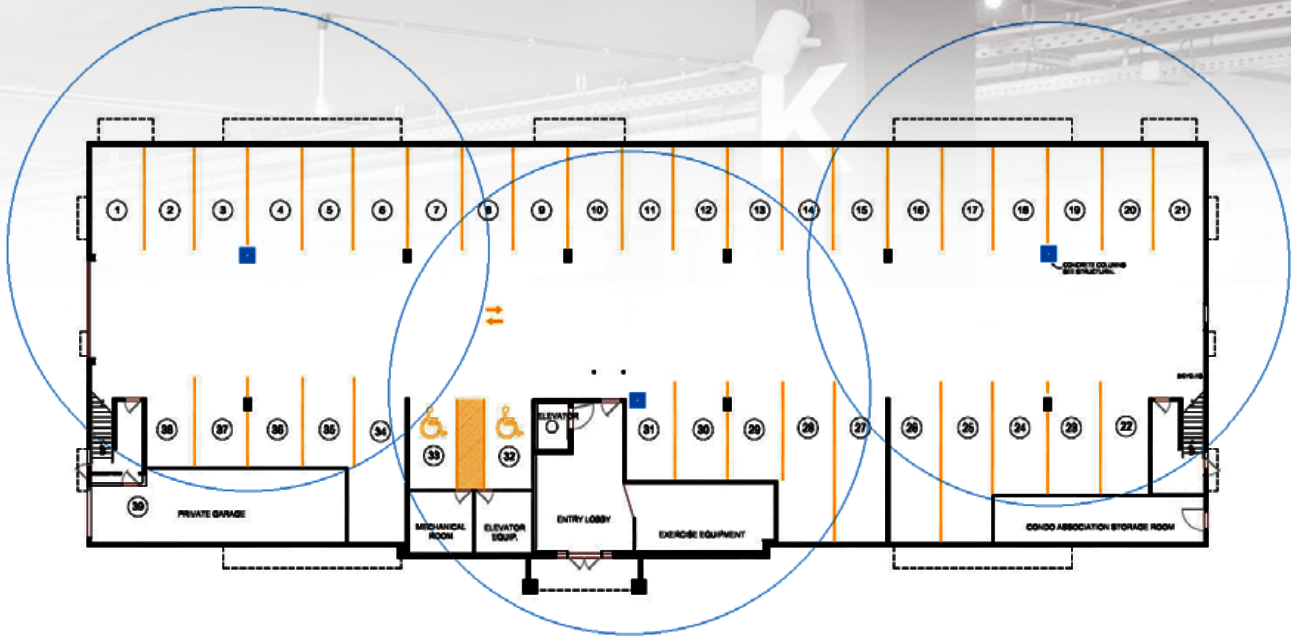
### Macurco GD-6 for Combustible Gas

These units can cover up to 1,257sqft (117 square meters). The radius of coverage is up to 20 feet (6.1 m) per detector. A GD-6 mounting height is dependent upon the target gas. If the target gas is lighter than air; methane (NG) or hydrogen (H<sub>2</sub>), mount the GD-6 high on a wall or column (about one foot down from the ceiling) in a central area where air movement is generally good. If the target gas is heavier than air, like propane (LP), mount the GD-6 low on a wall or column (about one foot above the floor) in a central area where air movement is generally good.

The detectors must be located as specified by regional building code. Use open interior support columns as much as possible to maximize the radius of coverage, not walls. Each level of the parking structure must be covered appropriately and some areas might need additional sensors based on the design of the parking structure.

## Detection and Ventilation Panel

Usually located out of reach of the general public. Preferably located close to or in the control center or office.



Use open interior support columns as much as possible to maximize the radius of coverage, not walls. Each level of the parking structure must be covered appropriately and some areas might need additional sensors based on the design of the parking structure.

## ON-BOARD DIAGNOSTICS TROUBLE CONDITIONS

- The Alarm relay will be activated
- The unit will display the error code
- The green status indicator LED light will flash
- The buzzer will chirp intermittently
- The 4-20 mA current loop will go to 24 mA

The Fan relay will also engage if the Trouble Fan Setting Option is set to "ON". To clear this mode, simply turn off power to the unit for a few seconds, or push the ENTER/TEST switch (inside the unit). This will cause the unit to restart the 1 minute self-test cycle.

### DVP-120 Family Trouble Status Display

The display will cycle through all trouble indications, at five seconds per display. Pressing any key (except HUSH) will advance the display to the next trouble indicator. If an external horn and/or strobe are connected and configured to signal a trouble condition, they will also sound when a trouble condition occurs, after a delay, if that configuration option is selected.

- Any configured channel has less than 4 mA in the current loop
- A sensor is reporting a trouble condition
- Any configured channel wiring is open
- Internal controller board problems are detected

# OUTPUT SIGNALS

## VISABLE, AUDIBLE AND MECHANICAL

### Control Panel Options

|                     | DVP-120M | DVP-120B | DVP-120C | DVP-1200 |
|---------------------|----------|----------|----------|----------|
| Analog Connections  | 12       | 0        | 0        | 0        |
| Digital Connections | 87       | 99       | 99       | 192      |
| 10 AMP Relays       | 3        | 3        | 3        | 8*       |
| 24VDC Output        | 2        | 2        | 2        | 4        |
| BACnet              | N/A      | MS/TP ✓  | MS/TP ✓  | IP ✓     |
| Title 24            | N/A      | N/A      | ✓        | ✓        |

\*The DVP-1200 supports up to 8 onboard relays, and an additional 32 remote relays when utilizing RD-24 devices.

### 6-Series Detector Options

|                  | CX-6 (CO/NO <sub>2</sub> )                    | CX-6-CO (CO Only)                     | CX-6-NO <sub>2</sub> (NO <sub>2</sub> Only) | CM-6 (CO)           | GD-6 (LEL)          |
|------------------|-----------------------------------------------|---------------------------------------|---------------------------------------------|---------------------|---------------------|
| Display          | LED (On/OFF)                                  | LED (On/OFF)                          | LED (On/OFF)                                | LED (On/OFF)        | LED (On/OFF)        |
| Range            | 0-200 PPM (CO)<br>0-20 PPM (NO <sub>2</sub> ) | 0-200 PPM (CO)                        | 0-20 PPM (NO <sub>2</sub> )                 | 0-200 PPM           | 0-50% LEL           |
| Low Level Relay  | 5 AMP                                         | 5 AMP                                 | 5 AMP                                       | 5 AMP               | 5 AMP               |
| High Level Relay | 1/2 AMP                                       | 1/2 AMP                               | 1/2 AMP                                     | 1/2 AMP             | 1/2 AMP             |
| Buzzer           | ✓                                             | ✓                                     | ✓                                           | ✓                   | ✓                   |
| Sensor Life      | 4-5 Year Sensor,<br>Field Replaceable         | 4-5 Year Sensor,<br>Field Replaceable | 4-5 Year Sensor,<br>Field Replaceable       | 10 Years            | 5 Years             |
| Coverage         | Up to 7,500 sq. ft.                           | Up to 7,500 sq. ft.                   | Up to 7,500 sq. ft.                         | Up to 7,500 sq. ft. | Up to 1,257 sq. ft. |
| 4-20mA           | ✓                                             | ✓                                     | ✓                                           | ✓                   | ✓                   |
| UL Listing       | ✓                                             | ✓                                     | ✓                                           | ✓                   | ✓                   |

\*Line voltage monitors are also available upon request.

## MAINTENANCE

### DEMONSTRATION AND TRAINING

Inspect the components, equipment installation and electrical connections for compliance with requirements. Test the alarm set points of the gas detection system with calibration and test gases and verify sequence of operation. Perform demonstrations and train maintenance personnel to adjust, operate, troubleshoot, calibrate and maintain the gas detection and ventilation control systems. Scan the QR codes below to watch YouTube videos on the calibration process.

#### CALIBRATION VIDEO



#### SENSOR REPLACEMENT



## PRODUCTS FOR VENTILATION CONTROL AND FOR USE WITH HVAC SYSTEMS

Macurco commercial products are designed to help meet OSHA and IBC standards as well as other local codes for detection of Carbon Monoxide (CO), Combustible Gases and other Toxic Gases. The Macurco 6-Series and 12-Series detectors can be used stand-alone or can be integrated with the Macurco Control Panel Family or other HVAC and Fire/Security Systems. For use in Parking Garages, Warehouses and other Commercial Buildings, these products are all ETL Listed. The DVP-120 / DVP-1200 control panel families and the Macurco CM-6 and CX-6 controllers are also LADBS Approved for use in Los Angeles, CA.



# MACURCO

GAS DETECTION

# MACURCO

## GAS DETECTION



Celebrating 50 years of gas detection, the Macurco product line offers equipment for residential, commercial and industrial applications. Since 1972 Macurco has been providing detection options for a number of different gases including carbon monoxide (CO), nitrogen dioxide (NO<sub>2</sub>), hydrogen (H<sub>2</sub>), propane (LP), methane (natural gas), hydrogen sulfide (H<sub>2</sub>S), ammonia (NH<sub>3</sub>), oxygen (O<sub>2</sub>), carbon dioxide (CO<sub>2</sub>) and refrigerants.

Headquartered in Sioux Falls, South Dakota, Macurco strives to provide the highest quality detection, safety and security solutions to customers worldwide. Whether you are looking for gas detection for a security system, building automation or HVAC system, for personal safety or for monitoring specific gases in potentially hazardous environments, Macurco has a gas detector to meet your needs.

### **GAS DETECTION IS ALL WE DO, AND WE DO IT BEST.**

Visit [www.macurco.com](http://www.macurco.com) for additional product information and training.



Macurco Inc. Sioux Falls, SD  
Phone: 1- 877-367-7891 - Email: [info@macurco.com](mailto:info@macurco.com) - [www.macurco.com](http://www.macurco.com)