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MACURCO
GAS DETECTION

PARKING GARAGE GUIDE

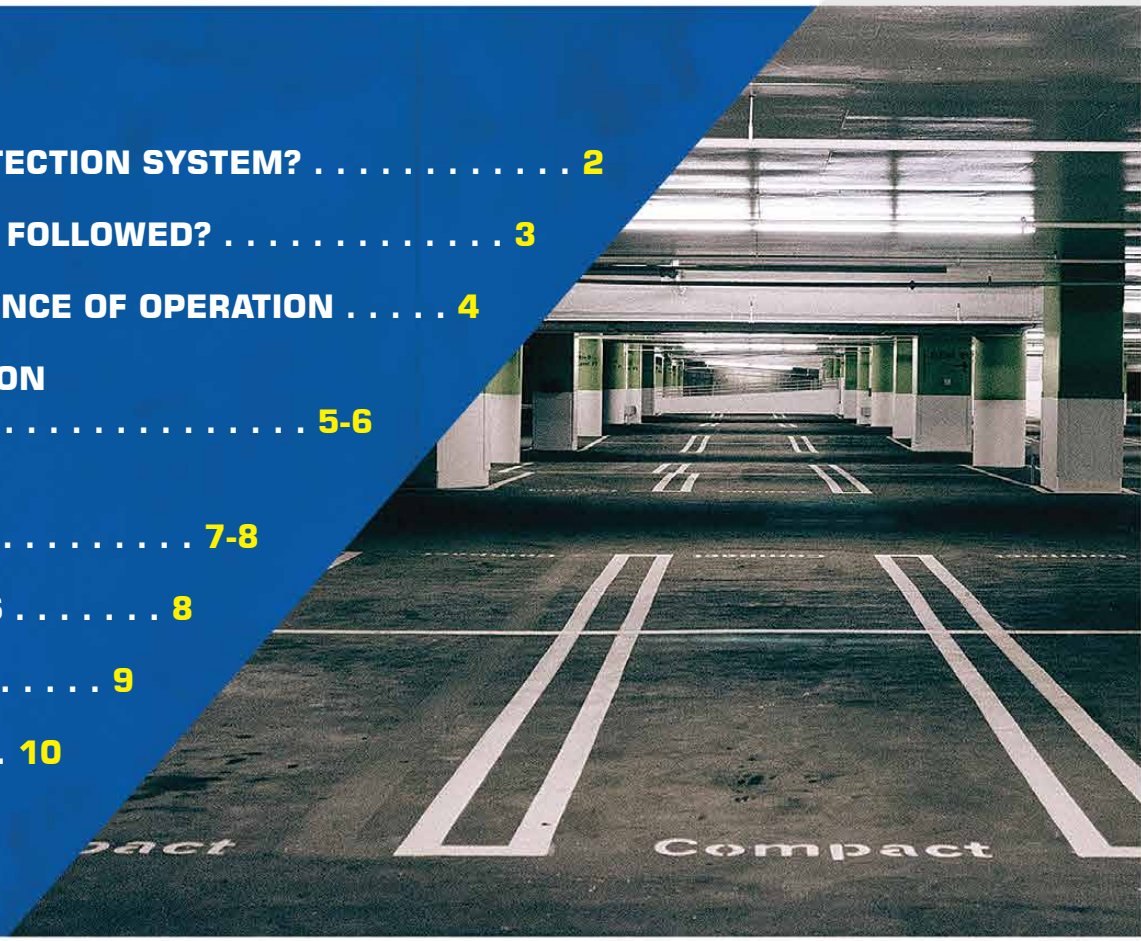
Building owners and facility managers want to provide safe and effective parking garages while minimizing the energy costs associated with heating, ventilation and air conditioning.

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 (NO2)** 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?

OSHA / NIOSH / ACGIH

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.

CARBON MONOXIDE

OSHA - Occupational Safety and Health Administration
TWA: 50 ppm 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 - Section 403.5 Public garages
Mechanical ventilation systems for public garages arranged to operate automatically upon detection of concentration of carbon monoxide of 25 ppm by approved detection devices.

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 maximum average concentration not greater than 200 ppm for a period not exceeding on hour. The uniform building code was replaced after 1997 by the International Building Code.

NITROGEN DIOXIDE

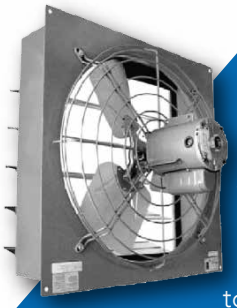
Current **OSHA** PEL: 5 ppm (9 mg/m3) CEILING - 1989 **OSHA** PEL: 1 ppm (1.8 mg/m3) STEL - NIOSH REL: 1 ppm (1.8 mg/m3) STEL - 1993-1994 ACGIH TLV: 3 ppm (5.6 mg/m3) TWA, 5 ppm (9.4 mg/m3) STEL

GAS LEVELS AND SEQUENCE OF OPERATION

VENTILATION, WARNING AND ALARM

In parking garages vehicle traffic is part of everyday operations. 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. 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 reduce 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 NO2. 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 NO2. 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 NO2. 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 NO2, 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.

Macurco Horn Strobe

Warning Level Set at a higher concentration usually 100ppm of CO and 3ppm for NO2. 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 educing 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 NO2. 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.

MECHANICAL VENTILATION CONSIDERATIONS

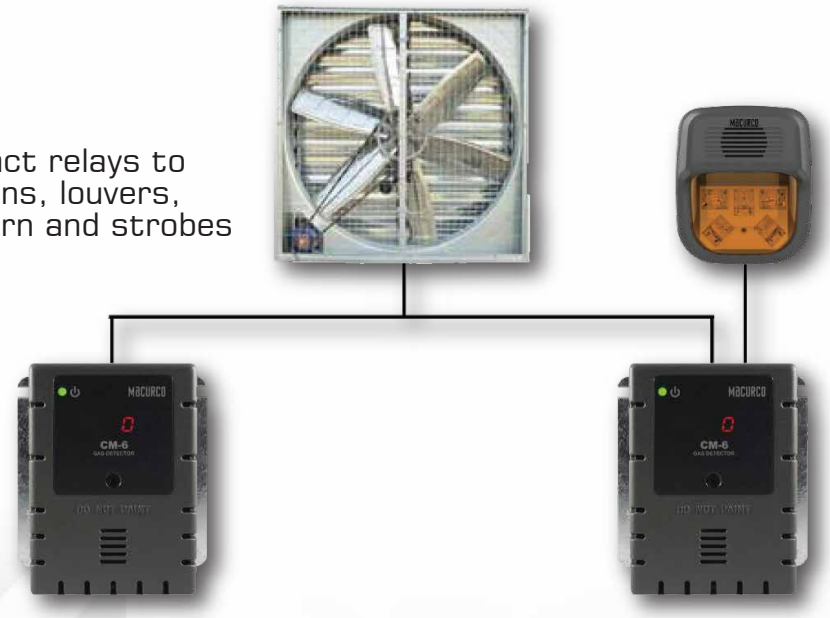
DEFINING THE VENTILATION SYSTEM

Two main factors are required to size the ventilation system are the number of cars in operation and the CO and NO2 emission quantities. 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).

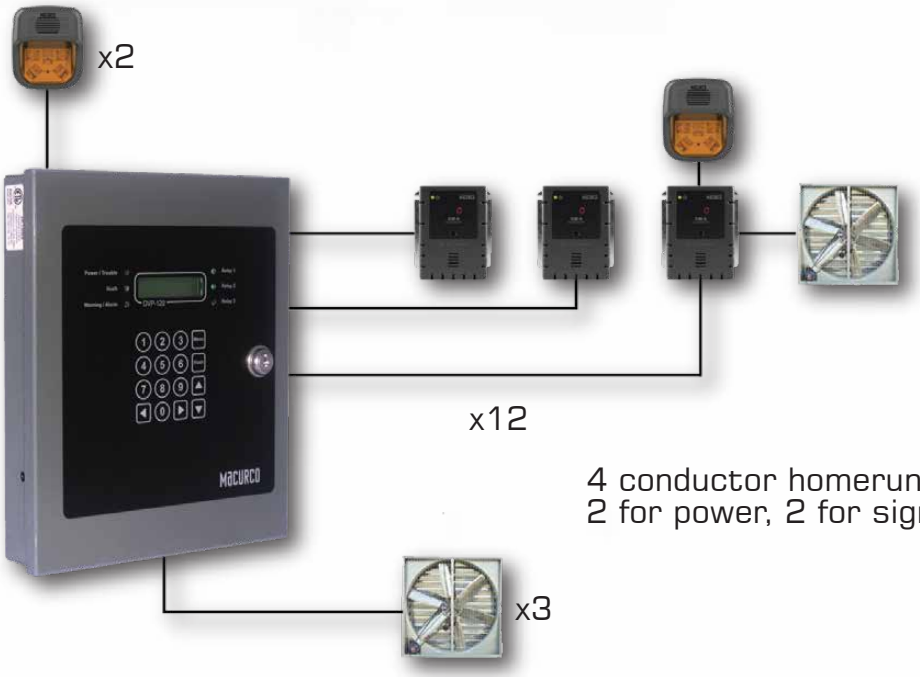
EQUIPMENT SELECTION AND LOCATION

STAND-ALONE DETECTORS

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

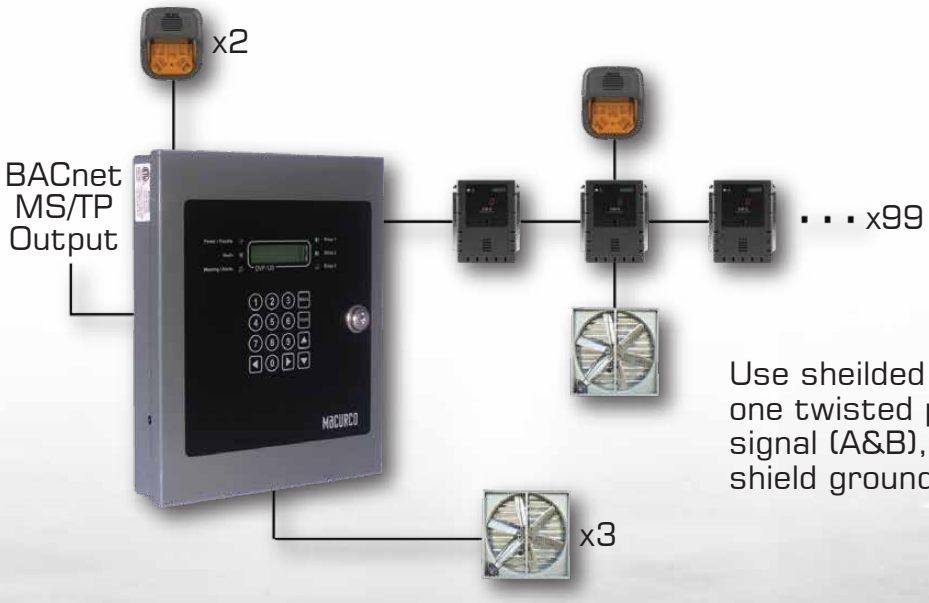


DETECTION AND VENTILATION CONTROL PANEL



4 conductor homerun
2 for power, 2 for signal

ADDRESSABLE GAS DETECTION AND CONTROL



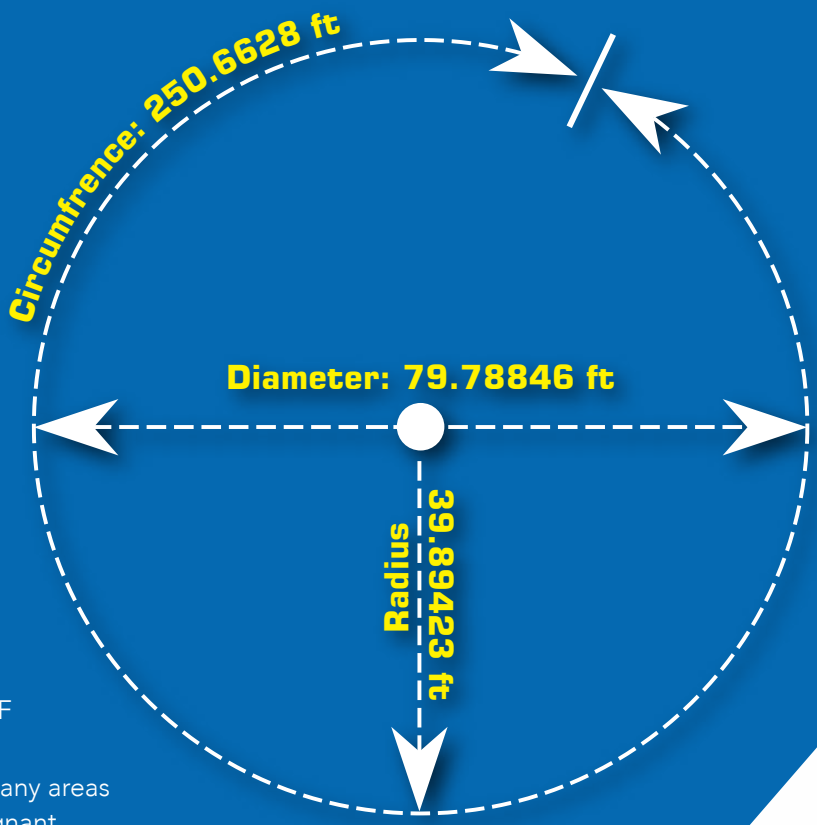
Use sheilded 3-conductor wire with one twisted pair providing a pair for signal (A&B), common (COM) and shield ground (SHD) connections.

EQUIPMENT LOCATION

Macurco CM-6 for Carbon Monoxide, TX-6-ND for Nitrogen Dioxide

These units typically cover about 5,000 sqft (465 square meters) in a parking garage or similar application. The radius of coverage is 40 ft (12.2 m) per detector.

- Mounted on a column the detector covers 5,000 sqft
- Mounted on a wall the detector covers 2,500 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 1.036 respectively (Air = 1). Carbon monoxide is just slightly lighter than air and nitrogen dioxide is slightly 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.

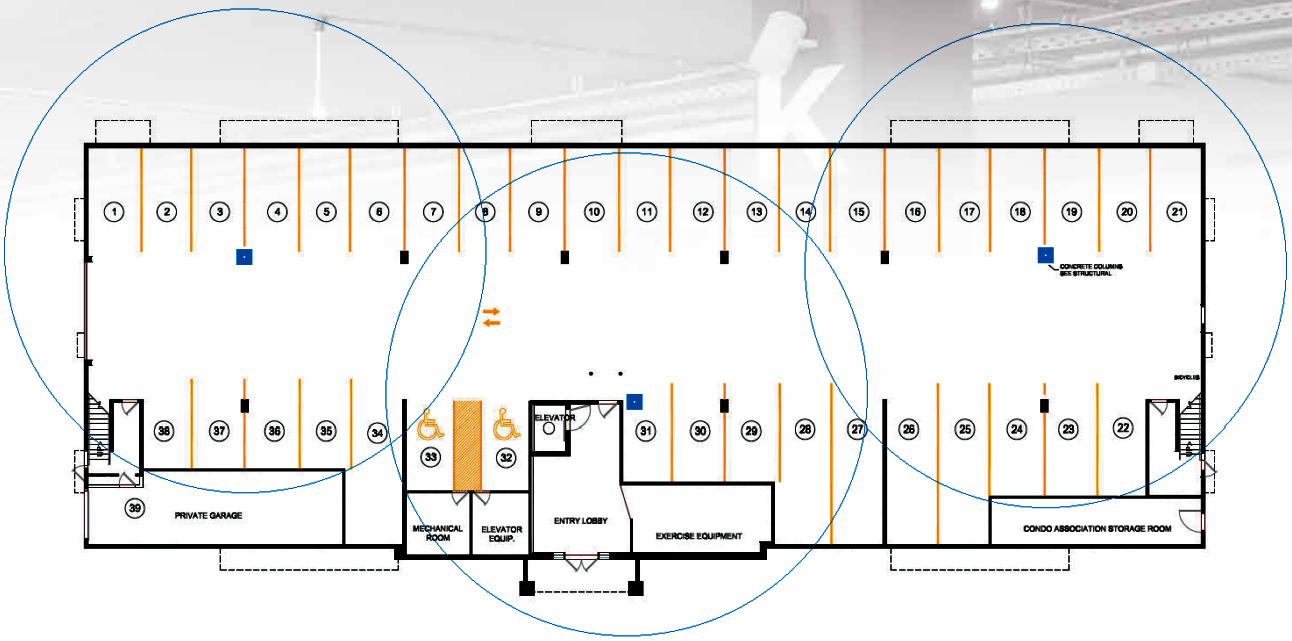
Macurco GD-6 for Combustible Gas

These units typically cover about 900 sqft (84 square meters). The radius of coverage is 17 feet (5.2 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 (H2), 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 without overlapping the coverage of the sensors.

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 without overlapping the coverage of the sensors.

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 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

DVP-120 Control Panel Output Options

	DVP-120	DVP-120M	DVP-120B	DVP-120C
Analog Connections	12	12	12	0
Digital Connections	0	87	87	99
10 AMP Relays	3	3	3	3
24VDC Output	2	2	2	2
BacNET	X	X	✓	✓
Title 24	X	X	X	✓

6-Series Detector Output Options

	CM-6 (CO)	TX-6-ND (NO_2)	GD-6 (LEL)
Display	LED (On/OFF)	LED (On/OFF)	LED (On/OFF)
Range	0-200 PPM	0-20 PPM	0-50% LEL
Low Level Relay	5 AMP	5 AMP	5 AMP
High Level Relay	1/2 AMP	1/2 AMP	1/2 AMP
Buzzer	✓	✓	✓
Sensor Life	7 Years	2 Years	5 Years
Coverage	5,000 sq. ft.	5,000 sq. ft.	900 sq. ft.
4-20mA	✓	✓	✓

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, trouble-shoot, calibrate and maintain the gas detection and ventilation control systems. Calibration and test kits should be provided with the gas detection system. Calibration and test intervals should comply with manufacturer's recommendations. If required, prepare a written report to record test procedures, test results and corrective actions. The report should also cover the requirements for accessories like acceptability of alarm types, signs and protective equipment. Any repair or replacement of malfunctioning units should be performed by Macurco.

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 Carbon Monoxide (CO), Combustible Gases and other Toxic Gas detection. The Macurco 6-Series and 12-Series detectors can be used stand-alone or can be integrated with the Macurco DVP-120 Control Panel or HVAC and Fire/Security Systems. For use in Parking Garages, Warehouses and other Commercial Buildings, these products are all ETL Listed. The DVP-120 and the CM-6 are also LADBS Approved for use in Los Angeles, CA.

Intertek

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DEPARTMENT OF BUILDING AND SAFETY

MACURCO
GAS DETECTION

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Celebrating over 45 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_2), hydrogen (H_2), propane (LP), methane (natural gas), hydrogen sulfide (H_2S), ammonia (NH_3), oxygen (O_2), carbon dioxide (CO_2) and refrigerants. Headquartered in Sioux Falls, South Dakota, Aerionics manufactures Macurco Gas Detection products. Aerionics 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.

Visit **www.macurco.com** for additional product information and training.

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