acme

DG

DIESEL FUMES
DETECTION SYSTEMS

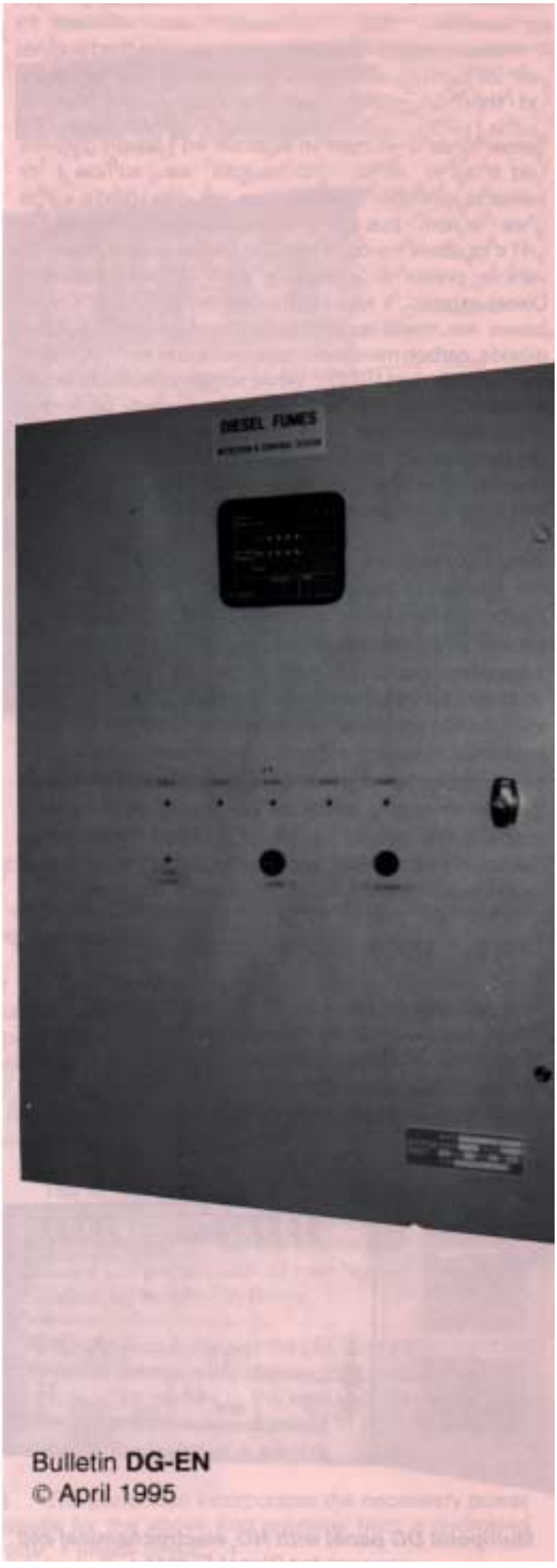
ENVINRONMENTAL CONTROL SYSTEM

Features and Advantages

- Simple to operate and maintain by facility and building personnel.
- Uses CO_2 as a surrogate or NO_2 as an alternative sensor for total air quality control.
- Suitable for both existing and new systems in buildings.
- Infrared CO_2 or electrochemical cell NO_2 detection incorporating the latest microprocessor technology.
- Saves money by operating the ventilation system only when required.
- Protection for personnel working in vehicular spaces.
- Rugged construction suitable for garages, tunnels, public spaces, etc.

Applications

- Parking garages where Diesel vehicles are the majority.
- Parking and service garages for buses, trucks, and road maintenance equipment.
- Platforms in bus, truck and railway terminals.
- Control of ventilation in vehicular tunnels.



Bulletin **DG-EN**

The history of Diesel fumes detection

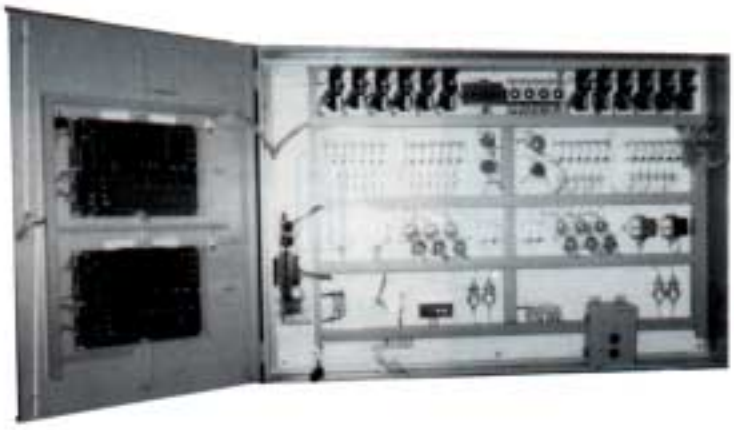
In the early 1970's, consulting engineers began specifying carbon monoxide (CO) detection and control systems for demand-based ventilation in enclosed parking garages and facilities. While CO detection was sufficient for ventilation control in locations where gasoline-fired engines were the norm, bus garages, fire stations, loading docks and other facilities dominated by Diesel engine powered vehicles presented a problem. While CO was present in Diesel exhaust, it was not the primary pollutant. Diesel fumes are made up of the oxides of nitrogen, sulphur dioxide, carbon monoxide, carbon dioxide and respirable combustible dust (RCD). While some consultants would specify CO-based detection systems anyway, personnel in Diesel-dominated facilities would complain about the air long before the carbon monoxide would rise to unacceptable levels. A new method of ventilation control had to be developed for these facilities.

In the early 1980's, the United States Bureau of Mines and the Canadian Department of Energy, Mines and Resources conducted a study into the nature of Diesel exhaust and determined that carbon dioxide (CO_2) already a major component of Diesel fumes, was an acceptable surrogate for ventilation control in facilities where Diesel vehicles were present. The relationship curves from the published research indicated that maintaining a CO_2 concentration between 1300 and 2500 PPM would ensure that the air quality would be maintained at acceptable levels. Acme offered its first CO_2-based Diesel fumes detection unit in 1982 and has produced hundreds of single and multipoint installations since that time.

Diesel fumes detection and sensor selection

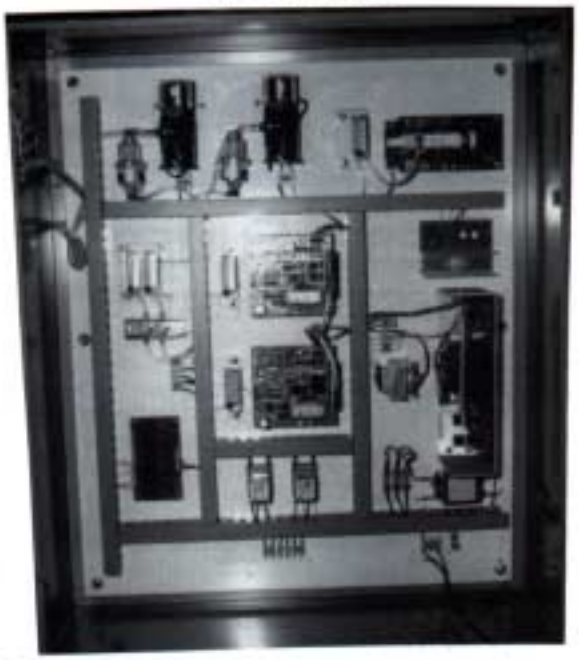
New technology has permitted Acme to offer Diesel fumes detection and control systems based on a variety of sensors. These include:

- Infrared CO_2 analyzers, and;
- Electrochemical cell NO_2 sensors.



Multipoint DG panel with NO_2 electrochemical cell sensors for Diesel Fumes.

2 point dual gas panel with optional CO sensor boards and infrared CO_2 analyzer for Diesel Fumes.



CO_2-based systems are acceptable in locations where direct-fired heating will not be used, as direct-fired systems create additional CO_2 emissions and render accurate Diesel fumes detection impossible. Systems with NO_2 sensors can be used in all locations regardless of the heating method employed. When specifying a detection system, engineers should note that infrared analyzers have a long life, while electrochemical cells need to be changed every 18-24 months. It is advantageous, therefore, to opt for a CO_2 infrared analyzer when conditions permit.

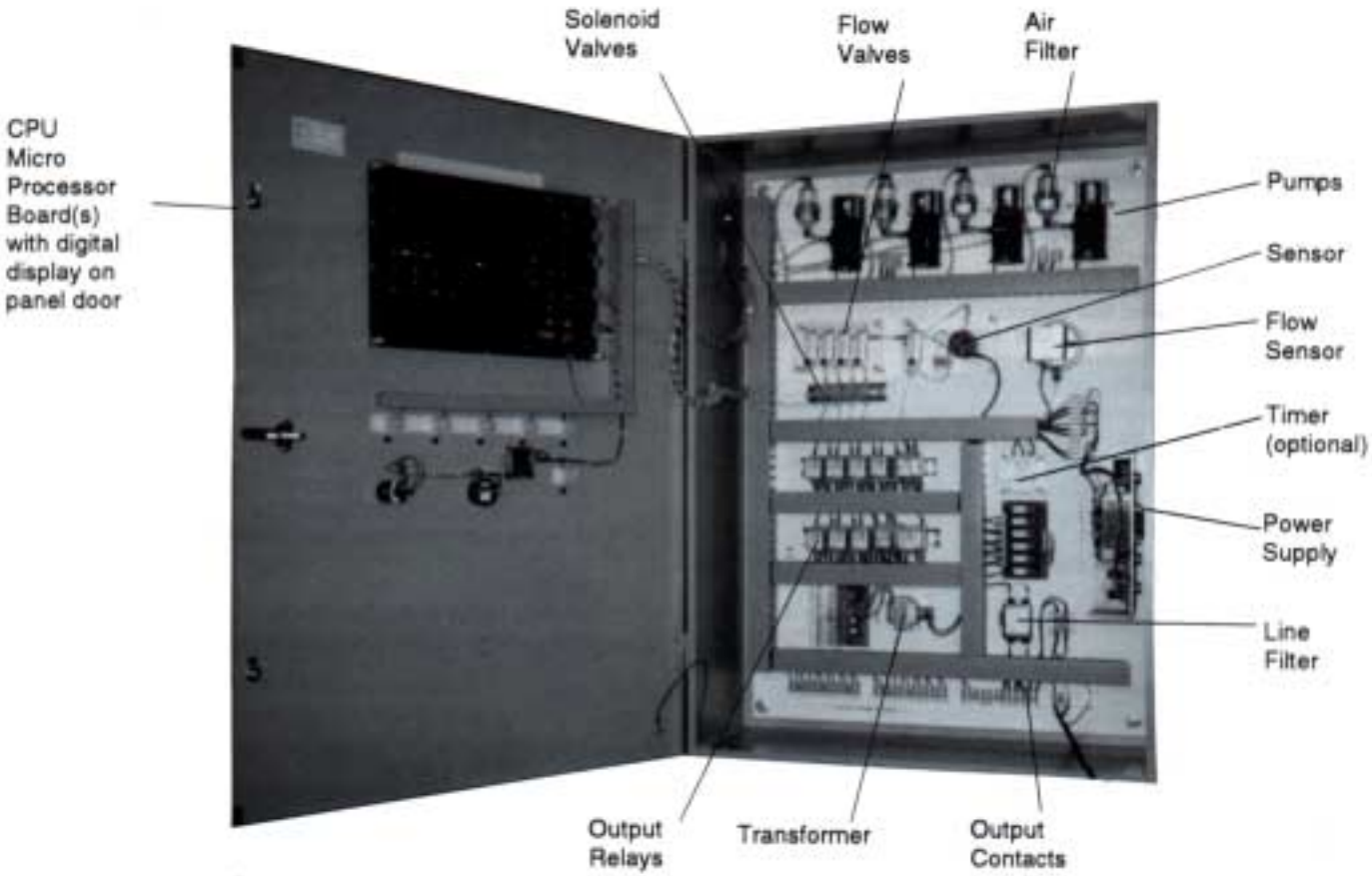
ACME's system design philosophy

Our systems are designed to be operated and maintained in a building environment where highly-trained instrumentation and laboratory personnel are unavailable or can only be obtained at high cost. We design components to be easily replaceable with commonly available tools by personnel with typical maintenance skills. Our panels are laid out with maximum accessibility in mind and often provide room for future expansion. Full documentation is provided with each system in order to facilitate installation and simplify maintenance. While many systems offered on the market are derivatives of instrumentation equipment, ours are specifically designed to meet the needs of the HVAC environment.

Updating existing detection systems

Acme Diesel fumes detection and control systems can be added to existing CO-based ventilation control systems as required. The logic of both systems can be matched or combined to meet the revised needs of the facility.

TYPICAL INTERNAL LAYOUT OF A
DG-EN CONTROL PANEL



DESCRIPTION OF OPERATION

A. The air sub-assembly has small independent pumps for each sampling point. The sampling pumps work continuously bringing current air samples from each point.

B. The DG-EN system measures carbon dioxide by means of an infrared gas analyzer that uses the unique NDIR (non-dispersive infrared) absorption spectrum for carbon dioxide. Air samples from each point are sequentially pumped into the analyzer's sample cell. A beam of infrared energy is generated by the infrared light source and passes through the sample cell. The energy absorbed (at the specific wave length) as a function of CO_2 concentration in the sample air is determined after the beam exits the sample cell, passes through an optical filter and lastly impinges on a detector located at the other end of the sample cell. The analyzer's electronics produce an output signal proportional to the CO_2 concentration (The NO_2 process is similar, but using an electrochemical cell).

C. The CPU board can be programmed to sample up to eight points. The CPU board sequences the 3-way solenoid valves that divert the sampled air into the analyzer sample cell. Dwell time for each point is 60-90 sec. The CPU stores the CO_2/NO_2 concentration of each point in memory, displays the concentration on a 4 digit 7-segment LED display and provides a set of analog and digital outputs for each point.

D. The CO_2/NO_2 output relay boards combine their outputs to produce a logic of operation as required for specific applications. There can be one or more zones per panel. The system operation can be single step, multiple step or proportional to the demand of the space. The proportional signal can be voltage, 4-20mA or pneumatic 3-15 PSI.

E. The ACME DG-EN Series panel outputs are used to control fans, dampers, make-up air units, VAV systems, plus local and optional remote alarms and supervision. Panels are compatible with all new or existing building automation and control systems.

F. The indicating lights and the LED display on the door of the panel continuously display the condition of each individual point relative to the operating levels and the alarm level. It is therefore possible to see the complete condition in the space at a glance.

G. The panel also incorporates the necessary power circuits for the above and operates from a dedicated 120V, 1 phase circuit.

TYPICAL SPECIFICATIONS FOR ACME's DG-EN SERIES EQUIPMENT

1.0 GENERAL

1.1 Supply, install and connect a DG-EN Series Environmental Control System to Monitor and Control Diesel Fumes as manufactured by ACME Engineering Products. Equipment shall include the following basic features:

1.2 Remote sampling heads with high capacity cartridge filters for space mounting or duct in duct installation, as shown on drawings.

1.3 Sampling pumps assembly. There shall be one pump and one adjustable flow indicator for each sampling point.

1.4 3-way solenoid valves assembly diverting selected sampled air to the infrared CO_2 analyzer (or NO_2 electro-chemical cell) according to the CPU program.

1.5 Non-dispersive infra-red CO_2 analyzer (or NO_2 electro-chemical cell) with filter and flow indicator.

1.6 CPU Central Processor Unit with memory for programming, value storage, display and outputs.

1.7 Output relay boards with two operating and one alarm output for each sampling point.

1.8 Enclosure shall be locking type with no adjustments accessible from the outside. Indicating lights display condition at each point.

1.9 Monitoring capability of up to 8 sampling locations.

2.0 OPERATION

2.1 Individual sampling pumps to run continuously bringing updated air to control panel from each location.

2.2 Each location shall be sampled in sequence according to CPU programming. At the end of each respective point sampling time, the CPU acquires the CO_2/NO_2 value as furnished by the CO_2 analyzer or NO_2 electro-chemical cell.

3.0 PROPORTIONAL (ANALOG) OUTPUTS

3.1 Each output shall be according to the CO_2/NO_2 concentration at the respective location over the detection range of the sensor.

4.0 SETTINGS AVAILABLE PER SET OF OUTPUTS

4.1 Three "ON-OFF" levels of operation.

4.2 Flow adjustment on indicating flow meter.

5.0 DISPLAY

Unit shall display the following:

5.1 Sensor flow indicator confirms air is flowing from sensor.

5.2 "LED" display shall indicate location in sampling stage.

5.3 LEDs for "ON-OFF" light up when relays are energized.

5.4 Fast sequence digital display indicates continuously location number and CO_2/NO_2 value of all points sampled.

6.0 NIGHT OR WEEKEND OVERRIDE (INTERLOCK) - OPTIONAL

6.1 Unit shall be programmed for this type of operation through contact opening. All outputs shall go to "Zero", there shall be no sampling or display but unit circuitry shall be on "stand-by" for immediate operation on contact closure.

7.0 PNEUMATIC OUTPUTS (OPTIONAL)

(SPECIFY APPLICABLE PARAGRAPHS)

7.1 Provide main air (20 PSI) connection and gauge.

7.2 Provide 3-15 PSI proportional output from each (or selected) locations.

7.3 Provide 3-15 PSI proportional operating outputs. Signal value to be based on percentage of points in a zone demanding ventilation.

8.0 SYSTEMS OPERATIONAL CONTROL

8.1 DESCRIBE HERE FOR EACH HVAC OR SIMILAR SYSTEM WHAT THE OUTPUTS OF THE AIR QUALITY MONITOR SHOULD ACHIEVE, SUCH AS:
CONTROL OF FANS
CONTROL OF SPEED OF FANS
CONTROL OF FAN CAPACITY
CONTROL OF ON-OFF DAMPERS
CONTROL OF MODULATING DAMPERS
INFORMATION TO COMPUTERIZED BUILDING CONTROL SYSTEMS
ACTIVATION OF ALARM CIRCUITS
PROVIDING RECORD OF AIR QUALITY IN SPACES
PROVIDING RECORD OF ENERGY SAVINGS OBTAINED
ETC.

9.0 FACTORY TESTING & LISTING

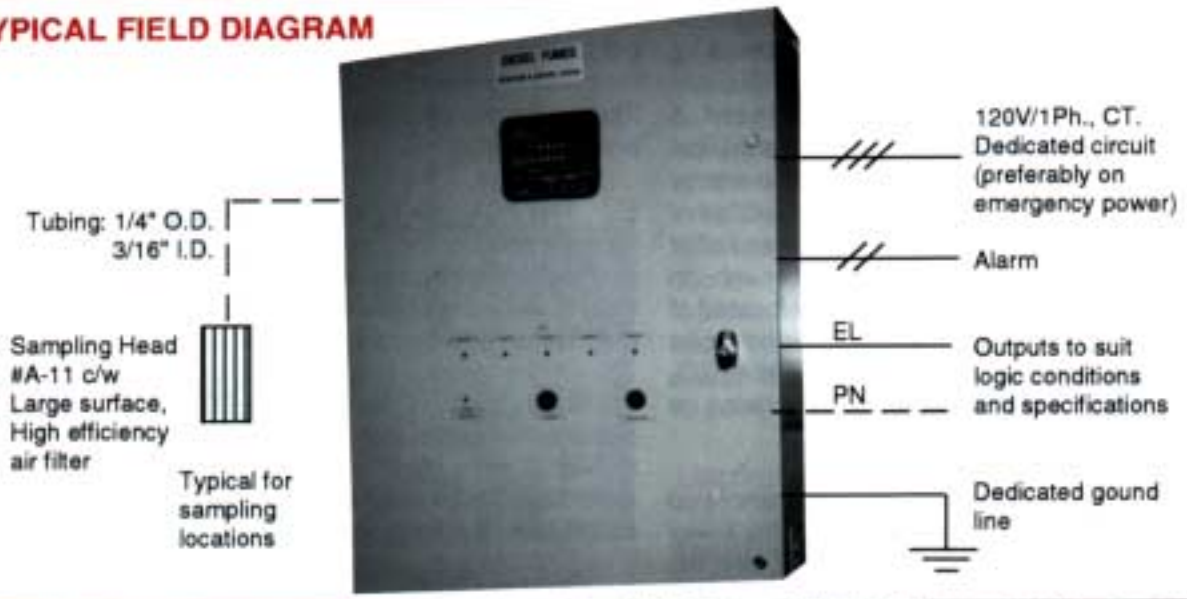
9.1 EQUIPMENT shall be run for one week at the factory fully operational on simulator prior to shipment to the field. Records of testing shall be submitted to the engineers.

9.2 EQUIPMENT shall be ETL listed.

10.0 FIELD VERIFICATION

10.1 After the equipment has been put into operation, the owner-operator shall select the worst condition time for verification. The ACME representative shall come to the site at the specified time to verify the installation and system operation and readjust the operating set points up or down according to conditions specific to the area served by the system. A report shall be given to the engineers.

TYPICAL FIELD DIAGRAM



The information provided by this bulletin is a general description of ACME systems. All specifications are subject to change without notice. Installation, Maintenance and other instructions provided with the equipment shall be closely followed by installers, owners and users.