DISCOVERY® CARBON MONOXIDE FIRE DETECTORS

CARBON MONOXIDE DETECTION OF FIRE

All carbon-based materials in the smouldering, red ember stage of a fire can produce significant and easily detectable levels of carbon monoxide (CO).

Carbon monoxide levels can, therefore, be monitored in order to give an early warning of fire.

Exposure to CO is potentially lethal at concentrations above 300 parts per million (ppm) and at higher concentrations can cause death within minutes. Lethal levels of CO are most likely to be produced when a fire starts in an enclosed space with limited ventilation. In such cases a fire in a late smouldering state will deplete the oxygen in the enclosure and produce very high CO levels in the range 10 000 to 50 000 parts per million (ppm).

DISCOVERY CARBON MONOXIDE DETECTORS

Apollo Fire Detectors has developed a carbon monoxide fire detector as part of the Discovery® range of analogue addressable fire detectors. The CO fire detector has the following features:

- Early warning of carbon based smouldering fires
- Resistance to false alarm in areas with high levels of steam and other airborne particles
- Ideal for protecting small volume sleeping risk areas
- Resistance to contamination in dirty and dusty conditions
- Excellent supplement to fire detection systems to improve detection of smouldering hydrocarbon fires

OPERATING PRINCIPLES

Discovery CO fire detectors contain a long-life electro-chemical carbon monoxide sensor which is tolerant of low levels of common vapours and household products. The sensing technology is fast, accurate and needs only very low power. These factors make the CO sensor suitable for fire detection applications.

The detection capabilities are enhanced by a rate-sensitive response. Fast rises in the carbon monoxide level are often associated with hot fires and the detector will respond earlier under these conditions. The analogue reply from the detector is rate limited to remove nuisance alarms resulting from short-term high levels caused by sources such as pipe smokers or gas flame ignition.

APPLICATION

CO detectors do not detect smoke particles or heat and are not universal replacements for smoke detectors.

apollo FIRE DETECTORS LIMITED

INVESTOR IN PEOPLE

LPCB

Quality Systems Certificate No 010
Assessed to ISO 9001

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Apollo **does not endorse** the use of CO detectors as the main method of fire detection if:

—the protected area is an escape route

—there is a requirement to detect overheating of electrical equipment or cables

—the protected area is exposed to sources of CO such as vehicle exhausts, or to hydrogen or to high levels of alcohol vapour as emitted by some cleaning agents

—there is a requirement to detect fires involving flammable liquids

CO fire detectors are particularly suitable for **supplementing** smoke detection when there is:

—a deep seated smouldering fire risk

—a risk of fire starting in an enclosed space

—a likelihood of stratification taking place

Carbon monoxide detectors may be used as the **primary** fire detector in areas where the following conditions exist:

—the main risk is smouldering fires

—optical smoke detectors are deemed unsuitable (see '**FALSE ALARMS**' below)

—the fire compartment is not greater than 50m²

Typical applications include hotel bedrooms, halls of residence, sheltered accommodation and hospital wards.

DETECTOR SITING

CO fire detectors should be sited using the recommendations for smoke detectors from BS5839: Part 1 (or other applicable code).

In the development of a fire, smoke and CO in the smoke plume spread by convection to a fire detector. As CO is a gas, it further spreads—like smells—by diffusion. For this reason CO *may* reach a detector faster than smoke would. This potential advantage can be exploited when designing a fire protection system and CO detectors may be used for supplementary detection. Equally, the opposite effect might occur, with CO moving *away* from a detector.

The behaviour of CO is therefore unpredictable and diffusion should not be relied on when designing a fire protection system.

FALSE ALARMS

Carbon monoxide detectors are less susceptible than smoke detectors to false alarms from sources such as toast, steam, cooking, plumbing work and hair spray. They may therefore be used in **some** applications in which smoke detectors would be susceptible to unwanted alarms.

Conversely, they may be more susceptible than smoke detectors to false alarms from fumes containing CO, such as vehicle exhausts, open fires and gas appliances.

LIMITATIONS

Carbon monoxide detectors also have important limitations. They are set to a higher sensitivity than the maximum allowed by the domestic CO alarm standard and will respond to CO from faulty gas appliances or vehicle exhausts. *These detectors **should not** be used in place of carbon monoxide alarms complying with BS7860 or UL2034.*

Carbon Monoxide Fire Detector Operating Modes

Mode	Alarm Threshold (ppm)	Minimum time to alarm (seconds)	Typical application
1	30	60	Sleeping risk with no ambient CO
2	45	30	General use fast response such as supplementary protection in atria
3	45	60	General use and sleeping risk with some low-level CO (such as from light smoking or an unventilated gas fire)
4	60	30	General smoking area and supplementary detection of deep seated fires such as laundry rooms
5	75	30	Supplementary use in kitchen or boiler room

OPERATING MODES

The Discovery CO detector has five operating modes, each having a set combination of sensitivity and response delay, which the user can select for any given application. See table opposite.

Note: a 30 second delay should be allowed after power-up in order to obtain valid data.

DRIFT COMPENSATION

In view of the inherent stability of CO cells, there is no need for Discovery CO detectors to compensate for drift. Discovery CO detectors are set to report a drift value of 16.

CELL TEST

The Discovery carbon monoxide fire detector has a remote test feature, which is used to verify that the electro-chemical cell is fitted and that it is active.

A test must be carried out at least *once a year* but preferably more frequently to ensure that the cell has not dried out. (Note that the cell will not be affected by the test, even if the remote test is carried out once a day.)

If the test indicates a sensor failure, ie, the detector returns a pre-set analogue value of 25, the detector should be sent to Apollo's Service Department for cell replacement and detector recalibration.

When carrying out the cell test, the 30 second delay referred to above *must* be observed.

PRECAUTIONS WHEN INVESTIGATING ALARMS

It is important to remember that CO is a colourless, odourless gas, which is not directly detectable by human senses. If a CO fire detector is in an alarm condition, it is possible that a dangerous level of CO exists around the detector. *Extreme care must be taken when investigating alarms from CO fire detectors even if no combustion products can be seen or smelled*.

Because of this danger, it is imperative that CO fire detectors are correctly identified at the control panel so that personnel investigating alarms may take the relevant precautions.

MAINTENANCE AND SERVICE

The electrochemical cell used in the Discovery CO fire detector has a more limited life than would normally be expected from a smoke detector. In a typical environment, the life of the cell is seven years.

High temperature or low relative humidity can, however, reduce the life significantly. The limits given in the section **'TECHNICAL DATA'** overleaf should be carefully observed.

It is essential that systems using CO fire detectors be correctly maintained and that the maintenance schedule include functional testing of the CO fire detectors.

CO fire detectors will not respond to the aerosol testers commonly used for the in-situ testing of smoke detectors. Apollo recommends that CO fire detectors be tested using a "hand warmer", burning compressed charcoal fuel rods. These hand warmers are available in camping and outdoor shops. The charcoal rod should be ignited at one end according to the instructions. To achieve a reliable test, the complete hand warmer should be placed inside a hood which fits over the detector, allowing CO to build up around the detector. The Apollo (No Climb) detector tester can be used for this purpose.

If there is any doubt over the sensitivity of a Discovery CO fire detector it should be returned to Apollo for servicing and calibration.

HEALTH AND SAFETY GUIDELINES

This product contains a sealed electro-chemical cell and in normal usage represents no chemical hazard in the sense of COSHH and the Health and Safety at Work Act 1974. Chemical hazard can, however, arise if the following notes on storage, handling and disposal are not observed.

For maximum life, the product should be stored before installation in clean dry conditions between 0°C and 20°C. It should not be exposed to temperatures outside the range –40°C to +60°C or to organic vapours.

The electrochemical cell contained in this product is fitted into sockets on the printed circuit board; to avoid damage to the cell do not remove it.

The electrochemical cell contains sulphuric acid in a relatively concentrated state. In the event of leakage (which may be caused by mechanical damage or use outside the operating specification for the cell) the cell should be removed from the detector using protective gloves. Avoid contact with any liquid. If skin or eye contact with the electrolyte occurs, wash immediately with plenty of water and obtain medical advice. All traces of electrolyte should be washed away with copious amounts of clean water. The cell should be disposed of according to local waste management requirements and environmental legislation. It should not be burnt since it may release toxic fumes.

TECHNICAL DATA

Discovery Carbon Monoxide Detector

Specifications are typical and apply at 24V, 23°C and 50% relative humidity unless otherwise stated.

Detector Part no:
58000-300

Base Part no:
45681-210

Detector principle:
Ambient carbon monoxide level

Type code:

Bits	2	1	0	4	3	7	6	5
	0	1	1	0	1	0	0	1

Supply wiring:
Two-wire supply, polarity sensitive

Terminal functions:
L2: positive supply in and out connections
L1: negative supply in and out connections
+R: remote indicator positive connection (internal 2.2kΩ resistance to positive)
–R: remote indicator negative connection (internal 2.2kΩ resistance to negative)

Operating voltage:
17–28V DC

Communication protocol:
Apollo Discovery 5-9V peak to peak

Note: a 30 second delay should be allowed after power-up in order to obtain valid data.

Quiescent current:
500µA average, 750µA peak

Power-up surge current:
1mA

Maximum power-up time:
10s

Alarm current, LED illuminated:
3.5mA

Remote output characteristics:
Connects to positive line through 4.5kΩ (5mA maximum)

Sampling frequency:
1 per second

Clean air analogue value:
25±2

Alarm level analogue value:
55

Alarm indicator:
2 red Light Emitting Diodes (LEDs);
Optional remote LED

Electro-magnetic compatibility:
CE marked

Storage Temperature:
Continuous: –10°C to +50°C
Transient: –40°C to +60°C

Storage Pressure:
If air freighted this product should be placed in a pressurised hold

Operating Pressure:
Suitable for installation up to 2,000m above sea level

Operating Temperature:
Continuous: 0°C to +40°C
Transient: –10°C to +50°C

Operating Humidity:
15 to 90% relative humidity

Cell Life:
7 Years (assumes regular checks are satisfactory)

Effect of temperature on detector:
Less than 15% change in sensitivity over rated range

Effect of wind:
None

Vibration, Impact and Shock:
To EN54-7

IP rating:
43

Dimensions:
100mm diameter
42mm height
50mm (height in base)

Weight:
Detector 105g
Detector in base 160g

Materials:
Housing: White polycarbonate , V-0 rated to UL94
Terminals: Nickel plated stainless steel