Diffusion Type Gas Detector

KD-12 HART Series

Instruction Manual



- Keep this manual for easy reference.
- Carefully read this manual prior to use.
- This manual describes the standard model. If your unit contains customer-specific options, the delivery specifications will supersede this manual.



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1. Introduction

- Thank you for purchasing the New Cosmos KD-12 HART series Diffusion Type Gas Detector.
- Please read the enclosed instruction to ensure safe and reliable operation.
- This gas detection unit detects various gas types including combustible gases. This unit is
 intended for use in industrial facilities (e.g. gas production plants and depots, chemical plants,
 paint factories, and power plants) for the early detection of a gas leak and relaying the gas
 concentration value as an analog signal to an external device while simultaneously displaying
 the gas concentration value on its display.

If gas concentrations reach a preset level, the red ALARM LED will start flashing and activate an external relay contact, thus helping prevent incidents such as fires, and explosions.

• Periodic maintenance is essential to maintain the reliability of your detection system. Perform periodic maintenance in accordance with the instructions given in this manual.

Symbols Used in this Instruction Manual

This manual uses Danger, Warning, Caution and Note symbols to draw attention to procedures, materials, methods, and processes, which require particular attention.

A DANGER	Indicates an imminently hazardous situation that can result in death or serious injury.
A WARNING	Indicates a potentially hazardous situation that may result in death or serious injury.
	Indicates a hazardous situation that may result in minor injury or property damage.
NOTE	Provides information on product handling.

2. General Precautions

- Carefully read this manual prior to use.
- To ensure safe operation, follow the precautions below.

- Be sure to ground the detector to prevent electric shocks.
- In the event of a gas leak alarm, follow safety procedures in accordance with your company's regulations.
- The cable gland and blanking elements shall be ATEX/UKEx/IECEx-certified as "Flameproof Enclosure 'db'", and shall meet the special conditions below for safe use. Installation in strict accordance to the Section 5.1 "Procedure" is required.

Special Conditions for Safe Use

- If used in an ATEX hazardous area, an ATEX-certified cable gland must be used according to EN IEC 60079-0:2018 and EN 60079-1:2014. (Not included)
- If used in an UKEx hazardous area, it must be used a suitably certified cable gland for UKEx requirements. (Not included)
- If used in an IECEx hazardous area, an IECEx-certified cable gland must be used according to IEC 60079-0:2017 Edition 7.0 and IEC 60079-1:2014 Edition 7.0. (Not included)
- Fasteners (M5x16 hexagonal head screws) shall have yield stress of at least 450 N/mm².
- Cable entry requirements for cable gland:

Thread size..... G3/4 or PF3/4

Minimum depth of engagement 10.86mm

Minimum thread engagement...... 6 threads

• The dimensions of a flameproof joint between the case and the case cover of the KD-12 flameproof housing must meet the minimum requirements specified in EN/IEC60079-1. Please contact the manufacturer for inspection, repair or adjustment of the flameproof joint.

- Wiring and installation should only be performed by a qualified electrician with knowledge of explosion proof components/installation.
- Do not disassemble, modify, or alter the structure of this unit or its electrical circuits. Doing so may compromise the explosion-proof nature of the product.
- Do not use the product in a place or near a place where silicone sealant/vapor may be present. Doing so may compromise the performance of the product.
- Avoid using the product in an environment where it will be exposed to organic solvents such as aromatic hydrocarbon or halogen hydrocarbon for extended periods.
- Use a protective cover (sold separately) when installing outdoors.
- Only use this product in accordance with applicable laws and regulations.

3. Package Contents

This product is packed and shipped with the utmost care. If any items are missing or damaged, please contact New Cosmos or its distributor for replacement.

Package Contents			Optional Items	
Gas detector			Protective cover Horizontal type (KW-41A)	*2
Accessory kit			Vertical type (KW-42A)	
M5x15 screws for wall-mounting:	2 pcs		2B pole mounting bracket (PB-1)	*2
M4x4 hexagonal set screw:	1 pc		Sensor replacement jig (SK-1)	*2
			Calibration cap (GCP-09)	*2
Hex wrench (4 mm) : 1 pc			Gas calibration kit (Z-001K)	
Instruction manual		*1	2-bulb hand pump	
Magnetic stick (MJ-1): 1 pc			Capillary for 2-bulb hand pump	

*1. One set per order: instruction manual.

*2. KD-12 optional items.

- Do not use the magnetic stick for any purposes other than its intended use.
- Keep in mind that when the magnetic stick attracts magnetic objects, tools, iron pieces, etc., your hands may be pinched and injured.
- For those allergic to metals, skin may become chapped or irritated if the magnet comes in contact with bare skin. If symptoms appear, do not touch the magnet.
- Magnets easily fracture and corrosion may form from the fractured surfaces. Particles/chips may enter the eye and cause injury. Do not drop the magnetic stick or bump it against a hard surface.
- The components of the magnet may dissolve in water. Do not drink water exposed to the magnetic stick.
- Keep the magnetic stick away from electronic medical devices such as cardiac pacemakers. Failure to do so may impair the normal operation of such devices.

- Keep the magnetic stick away from magnetic tapes, floppy disks, and bank/credit cards. Failure to do so may magnetize them, making them unusable.
- Keep the magnetic stick away from high-precision devices such as personal computers and watches. Failure to do so may cause a device failure.

4. Unit Dimensions and Components

4.1 Exterior Appearance



(Dimensions are in mm)

ltem	Component	Description/Function	
(1)	Case cover		
(2)	Case		
(3)	Sensor unit	Incorporates a built-in gas sensor.	
(4)	Sensor guard	Protects the sensor unit.	
(5)	Earth terminal (external)	Used for grounding the frame.	
(6)	Status LEDs (3 places)	Indicate the status of the unit: power (green), alarm (red), and fault (amber)	
(7)	Magnetic switches (4 places)	Insert the magnetic stick into each magnetic switch opening to operate.	
(8)	Display	Displays the gas concentration, parameter value and status message.	
(9)	Cable entry	Thread size: G3/4 or PF3/4. Pitch=1.81mm. Depth of engagement: 10.86mm. Minimum engaged threads: 6 threads. Applicable cable gland ^{*1} must be provided by end user.	
(10)	M4x4 Hexagonal set	To secure the cable gland (cable fitting) and the sensor	
,	screw (2 places)	unit. Use 2mm hex key wrench (not included).	
(11)	M5x16 Hexagonal head	To secure the case cover.	
(11)	screws (4 places)	Use 4mm hex key wrench (included).	

*1: Cable gland should be ATEX/UKEx-certified according to EN IEC 60079-0:2018 for use in an ATEX/UKEx hazardous area, and EN 60079-1:2014, and IECEx-certified according to IEC 60079-0:2017 Edition 7.0 and IEC 60079-1:2014 Edition 7.0 for use in an IECEx hazardous area.

4.2 Display and Controls



Magnetic Switches Use the magnetic stick (MJ-1) to operate the magnetic switches.						
Item Component Description/Function						
(1)	[MODE] switch	Changes the operation mode or cancels the current operation.				
(2)	[ENTER] switch Confirms a setting or executes an operation.					
(3) [UP] switch Increases the parameter value.		Increases the parameter value.				
(4)	[DOWN] switch	Decreases the parameter value.				

ltem	Component	Description/Function
(5)	Display	Displays gas concentration, parameter value and status message.

Status LEDs					
ltem	Component	Description/Function			
(6)	[POWER] LED (green)	When lit, the unit is on.			
(7) [ALARM] LED (red) When lit, alarm notification.		When lit, alarm notification.			
(8)	[TROUBLE] LED (amber)	When lit, fault (device error) detected.			

4.3 Terminal Block



ltem	Name	Description/Function	
1	24 V (+)	Power supply voltage (positive)	
2	GND	Power supply voltage (-) and analog signal (-) common	
3	Signals	4-20mA analog and HART signals	
4	ZA		
5	ZC	External relay contact	
(-)	Earth terminal (Internal)	Used for grounding the frame.	

5. Installation

5.1 Procedure



Note: The head of each screw shall be flush with the surface of the fitting.

- Be careful not to damage the gas detector during installation. Keep joint surfaces clean and free from any damage. Contaminates such as scratches, fingerprints, dirt and oil may adversely affect the explosion-proof characteristics of the device.
- Do not install the gas detector in the following conditions
 - Ambient temperature is outside of the specified operating temperature range $(-10^{\circ}C \text{ to } 50^{\circ}C)$.
 - Condensation prone areas.
 - Exposure to water spray.
 - Presence of acetylene gas
 - In the vicinity of equipment which can generate high frequencies or a magnetic field.
 - In environments where silicone sealant/gas is or may be used.
- Install the gas detector in a place where it can be easily accessed for maintenance or inspection.
- Install the gas detector in a place free from vibration.
- Install the gas detector in a place free from sudden temperature changes.
- Avoid impacts to the gas detector.
- Attach the optional protective cover to the gas detector when installed outdoors.
- The installing height of the gas detector corresponds to the specific gravity of the target gas. Install the gas detector in accordance with required regulations.
- Install the gas detector in an environment where there is no power outage including short interruptions.
- The contact uses a mechanical relay, which can activate if exposed to excessive shock or vibration. Install the gas detector in a place free from shock and vibration. Set a delay time greater than one second for the external device connected to the gas detector.

Gas type	Installing height	Remarks	
Gas heavier than air (e.g. LPG)	Maximum of 10cm above the floor (height to the sensor guard tip)	Keep a space of approx. 7 cm from the sensor guard tip for easy maintenance and inspection.	
Gas near the specific gravity as air (e.g. Carbon monoxide)	75 to 150 cm above the floor (height to the sensor guard tip)	Determine the height by considering the specific gravity of the target gas and mounting environment.	
Gas lighter than air (e.g. Natural gas and hydrogen)	On or near the ceiling	Determine the height by considering layout (e.g. scaffold) for easy maintenance.	

Installing Height Regulation

• Secure the gas detector to the wall by tightening the two M5 screws (included) through the mounting holes. Attach the protective cover (not included) when installing the detector outdoors. Mount the detector with a 2B pole mounting bracket (not included) when mounting the detector to a 2B pole. Refer to 5.3 "Installation of Optional Parts" for more information.



⁽Dimensions are in mm)

• The case cover of the detector needs be able to open during installation, wiring, or sensor replacement. Make sure to keep sufficient space so that the cover can be opened to 90° or more.



• Maintain a distance of 50cm or more between the front of the detector and any other object during installation and operation.



• When installing this diffusion-type gas detector in a high location, or on a ceiling, make sure to leave enough space below the detector to allow for inspection or maintenance activities. When installing the detector at a height more than 3m from the floor, we recommend using a suction-type gas detector with a sampling tube up to the ceiling.



Leave space below the gas detector for inspection and maintenance.

- When installing the detector in a high location, or on a ceiling, the sensor guard is not necessary, but when installing the detector in a low location such as on a floor, make sure to install the sensor guard to protect it from splashing water.
- Consider the directions of the gas flow and the hole of the sensor guard when installing the detector.



Rotate the sensor guard to change its direction so that the openings are in line with gas flow.

5.2 Typical Installation Locations

• Install the gas detector in a place where gas is expected to accumulate.



Outdoor Installation

5.3 Installation of Optional Parts



- Secure the protective cover with M3 screw (1 place) when installing the gas detector in a place subject to strong winds.
- 2B Pole Mounting Bracket



(Dimensions are in mm)

6. Wiring

6.1 Guideline

• Use explosion-proof wiring when installing the detector in a hazardous area.

🖄 WARNING

• The cable gland and blanking elements shall be ATEX/UKEx/IECEx-certified as "Flameproof Enclosure 'db'", and shall meet the special conditions for safe use. Installation in strict accordance to the Section 5.1 "Procedure" is required.

- Wiring and installation should only be performed by a qualified electrician with knowledge of explosion proof components/installation.
- Do not connect the power supply to the gas detector until wiring is completed and the case cover is closed.
- Do not touch or let any tool (e.g. screwdriver, wrench) touch the inside surface of the case or case cover, keep joint surfaces clean and free from any damage. Contaminates such as scratches, fingerprints, dirt and oil may adversely affect the explosion-proof characteristics of the device.

Cable Work

- Use a shielded twisted pair cable with 0.75 to 2.00 mm² wires. Sheath all cables in a protective tube, such as a metal conduit or carbon steel pipes, or other protective structure, such as a metal or concrete duct.
- When using the external relay contact function of the product, a five-conductor cable, with a maximum cable conductor diameter of 1.25 mm² is required. If only the analog signal function is used without the external relay contact function, then a three-conductor cable, with a maximum cable conductor diameter of 2.00 mm², is required.

6.2 Wiring/Connection

🖄 WARNING

- Before opening the case cover of the gas detector, be sure to eliminate possible source of ignition. Disconnect the power supply to the detector and all devices connected to it (e.g. indicator unit and signal converter).
- Be sure to ground the gas detector to prevent an electric shock.
- Use a conductor with a cross-sectional area of at least 4mm² for external grounding.
- Place a plain flat washer between the case and the terminal.



- Connect wires to their corresponding terminals.
- Keep the connection cable (power and signal lines from the detector) away from other power lines.
- When closing the case cover, make sure that it does not catch on the gasket or any loose cables and that the cables are not overly stressed.
- Wire a current loop between Signal and Ground. If the wiring is open, normal gas detection is impossible because a trouble alarm will be triggered.

Connecting Power and Signal Lines

- If needed, use dedicated breakers for power lines going to devices connected to the detector, such as an indicator unit or a signal converter.
- Use a twisted pair cable that has 0.75 to 2.00 mm² wires.
- Ensure that the power voltage supplied to the gas detector is within the specifications.
- Ensure that the load resistance of the signal line, including the resistance of the wire, is not less than 120 ohm and not more than 500 ohm.

- The specifications for single wires/twisted wires/pins to be connected to the terminal block are given below. Prepare wires/pins that comply with these specifications.
 - Single wire outer diameter: 0.2 mm2 to 4 mm²
 Twisted wire outer diameter: 0.2 mm² to 2.5 mm²
 - Pin outer diameter without plastic sleeve
 - : 0.25 mm² to 2.5 mm²
 - Pin outer diameter with plastic sleeve
 - : 0.25 mm² to 1.5 mm²
 - Stripped wire length (L) : 7 mm
 - Total wire length from casing interior to terminal block (S)

: 40mm



NOTE

• Single-point grounding (grounding at a single point) is mandatory. Grounding on the power supply side (right side of the drawing) is recommended as shown in the drawing below.

[Typical Wiring Connection when Gas Detector is Grounded on Power Supply Side]



[Typical System Configuration]



• Refer to the instruction manual of each device for full information.

6.3 Terminal Block Wiring Procedure

- Do not apply the power supply to the gas detector until wiring is completed and the case cover is closed.
- Do not touch or let any tool (e.g. screwdriver, wrench) touch the inside surface of the case or case cover, keep joint surfaces clean and free from any damage. Contaminates such as scratches, fingerprints, dirt and oil may adversely affect the explosion-proof characteristics of the device.
- (1) Ensure that 24V power supply is used.
- (2) To open the case cover, loosen the four hexagonal head screws located at the four corners of the case cover using the 4mm hex wrench (included).
- (3) Secure an appropriate cable gland (not included) to the gas detector with a hex key wrench (not included). Feed the 3-wire cable (PWR+, GND, Analog 4-20mA) through the cable gland.



(4) Insert a flat-head screwdriver ("Phoenix Contact ST-BW" flat-head screwdriver or equivalent is recommended for user-friendliness) into the slot in the upper row of the terminal block, and lift up the screwdriver. Next, push the screwdriver further into the slot to lock the corresponding slot on the lower row in the open position. Now the screwdriver is locked in place and does not need to be held. While the screwdriver is in this position, the corresponding slot is open.



(5) Insert the tip of each wire into its corresponding slot.

Connect the (PWR+) wire to the slot marked "24V(+)". Connect the (GND) wire to the slot marked "GND". Connect the (Analog 4-20mA) wire to the slot marked "Signal".



- (6) Remove the screwdriver from the slot to close it. This will securely connect the wire to the terminal.
- (7) Check that these three wires are secure in their corresponding terminals.
- (8) Additional wiring for the external relay contact can use the slots marked "ZA" and "ZC".
- (9) Close the case cover. Attach the case cover to the case by tightening the four hexagonal head screws at the four corners of the case cover with the hex wrench (yield stress of at least 450 N/mm²).



7. Precautions before Use

• Before turning on any of the devices connected to this product (e.g. indicator unit, signal converter), check that all wiring is correct, particularly the gas detector and indicator unit or signal converter.

• In Case of Gas Leakage

\land DANGER

 Remain calm and check that there is no fire present. Do not touch any electric switches under any conditions. Sparks caused by turning on or off electric switches may cause an ignition.

- If there is a gas leak alarm, take the necessary measures specified by your company.
- If a gas leak occurs indoors, open the windows and doors to ventilate the room.
- Identify the location of the gas leak, and promptly take the necessary measures.
- Measure the gas concentration with a portable gas detector, and confirm the detection site is safe before entering.

8. Display at Power-up (Warm-up)

- Check that there is no gas present before turning on the product
- When the sensor output is not stable, the external relay contact may possibly activate. To prevent possible activation of the external relay contact during the warm-up, release the interlocks of the external devices, if needed.
- During the warm-up, the analog signal is fixed at 2.0 mA (default).

NOTE

- The magnetic stick is not usable during the warm-up.
- The warm-up cycle lasts approx. 30 seconds once the unit is powered.
- (1) Once the unit is powered, the warm up process will begin. All the status LEDs (green, amber and red) and the display will be lit.



(2) While the status LEDs (green, red, and amber) are lit, the display shows the following messages for one second each in the order below.

Software version number (installed in this gas detector)			
Full scale value	Example: [2000] ppm is displayed when the full-scale value is 2000 ppm.		
\downarrow Alarm set value	Example: [500] ppm is displayed when the alarm set value is 500 ppm.		

- (3) The POWER LED (green) flashes for approx. 25 seconds.
- (4) When the flashing POWER LED (green) becomes solid, the warm-up cycle of the detector is completed and the detector is now in gas monitoring mode.



- If the sensor unit has not been energized for a long time of period (e.g. from factory to initial power-up), it may take some time for the sensor output to stabilize.
- If needed, energize the gas detector for approx. one week, and perform the zero and span adjustments before use. Refer to 12.3 "Calibration" for adjustments.

9. Display and Operation Modes

		When the alarm set value is exceeded				
				Maintenance mode		
	Power-up (Warm-up)	Gas monitoring mode	Test mode	Gas monitoring mode	Test mode	
	Green LED flashing	Green LED LED is on 50	Red LED Green flashing LED is on	Green LED is on	Red LED lashing	
Display	Gas concentration value is displayed.	Gas concentration is displayed.	[Set concentration] Test from –10% to 110% of full scale is possible.	[Gas concentration] Displayed alternately	[— — —] [Test value] Displayed alternately	
Analog signal 4-20 mA	Fixed at 2.0mA or 4.0mA	Gas concentration value is output.	Test value is output	Gas concentration value or fixed value (1.6 mA) is a selectable output.	Test value or fixed value (1.6 mA) is a selectable output.	
Relay Contact operation (Normally Open)	Not activated. (Open)	Activated (Closed)	Activated (Closed)	Not activated. (Open)	Not activated. (Open)	
HART signal	Enable	Enable	Enable	Enable	Enable	

10. HART Communication

10.1 Overview

- This gas detector can superimpose a low-level digital signal over a 4-20mA analog signal and transmit these signals simultaneously over the same wiring to the host system.
- This gas detector does not support a burst mode. For this reason, the gas detector sends a ٠ signal only when it receives a command from the host system.
- Install the latest version of the DD file into the host system. Note: The DD file is not included in this package. The latest version is available from the FieldComm Group website at:

(http://www.hartcommproduct.com/inventory2/index.php?action=memberdirectory&num=463).

10.2 HART Communication Commands

There are three classes of commands for the HART communication, universal commands, common practice commands and Device Specific commands.

Command class	Description	Remarks	
Universal	All devices using the HART	Refer to the Universal Command	
	protocol must recognize and	Specification, which is available from	
	support the universal	the FieldComm Group website.	
	commands.		
Common Practice	Common Practice commands	The commands (Nos.38, 40, 42, 45,	
	provide functions implemented	46 and 59) are implemented.	
	by many, but not necessarily all,	Refer to the Common Practice	
	HART Communication devices.	Command Specification, which is	
		available from the FieldComm Group	
		website.	
Device Specific	Device Specific commands	Refer to the table below.	
	represent functions that are		
	unique to each field device.		

In addition to the requisite HART communication commands, device-specific commands are also available. Refer to the table below.

No.	Command	Function
128	Set write protection	Set the software write protection to prevent
		unexpected writing to the detector by the host.
129	Read dynamic variable	Read the dynamic variable used by the detector.
130	Read ADC value	Read the Analog-to-Digital Converter value.
131	Read gas concentration	Read the gas concentration value.
132	Read peak values	Read the lowest and highest values of measured
		gas concentration.
133	Reset peak values	Reset the lowest and highest values of measured
		gas concentration.
134	Read 4-20mA compensation values	Read the slope and intercept coefficients for
		4-20mA compensation.

List of Device-specific Commands

No.	Command	Function
135	Write 4-20mA compensation value A	Write the slope coefficient for 4-20mA
		compensation.
136	Write 4-20mA compensation value B	Write the intercept coefficient for 4-20mA
		compensation.
137	Read calibration parameters	Read the calibration parameter values.
138	Write potentiometer value	Write the digital potentiometer value. The range is
		0 to 127.
139	Write rough adjustment offset	Write the rough zero adjustment offset value. The
140	Write ener exefficient	range is 0 to 254.
140	white span coefficient	1/28
1/1	Write virtual zero point	Write the virtual zero point value. The range is 150
141		to 450
142	Read test value	Read the test value for use in the test mode.
143	Write test value	Write the test value for use in the test mode.
144	Read alarm and trouble	Read the set parameters for alarm and trouble
	configuration	(fault).
145	Write alarm value	Write the alarm set value.
146	Write alarm delay	Write the alarm delay time.
147	Read trouble value	Read the trouble (fault) set value.
148	Write trouble delay time Write the trouble (fault) delay time.	
149	Write alarm hysteresis	Write the alarm hysteresis range.
150	Read alarm mode and special mode.	Read the alarm mode. Read "0" for the special
		mode. "0" is normally unused.
151	Write alarm mode	Turn on the alarm mode.
152	Write special mode	Turn on the special mode (Write "0" for the special
		mode, which is normally unused.)
153	Read linear code	Read the linear code from ROM.
154	Write linear code	Write the linear code to ROM. The range is 0 to 40
455	Deed lineer data tabla	and 255.
155		Read the linear data table of ROM.
150	Virite linear data table	While linear data to the linear data table of ROM.
157		
158	Read full scale	Read the full scale value
150	Write full scale	Write the full scale value. The range is 10 to
100		9999.
160	Write decimal point	Specify the decimal point to display. The range is
		0, 1, 2, 3 or 4.
161	Read power-up (warm-up) time	Read the power-up time and the power-up current
		(2.0mA or 4.0mA).
162	Write power-up time	Set the power-up time.
163	Write power-up current	Write the current code at power-up. (0: 4.0 mA, 1:
		2.0 mA)
164	Read zero suppression	Read the zero suppression values, both positive
		and negative.

No.	Command	Function
165	Write zero suppression	Write the zero suppression values, both positive
		and negative.
166	Read sensor voltage	Read the voltage applied to the sensor.
167	Write sensor voltage	Write the voltage applied to the sensor.
168	Read maintenance mode	Read the maintenance mode status.
169	Write maintenance mode	Turn on or off the maintenance mode.
170	Read unit code	Read the unit code (0: %LEL, 1: ppm).
171	Write unit code	Write the unit code (0: %LEL, 1: ppm).
172	Read other parameters	Read other parameters.
180	Read adjustment status	Read whether a gas adjustment was normally
		completed.
181	Execute adjustment	Execute zero adjustment or span adjustment.
185	Read firmware version	Read the firmware version of main and HSM
		boards.
249	Write monitor command	Send monitor command used for serial
		communication and execute.
250	Write device ID No.	Write the device Identification number.

10.3 HART Communication Process

- In HART communication, the 4-20mA signal line (twisted pair cable) is connected to the master device (host system).
- It is possible to use up to two master devices (primary and secondary). Typically, a Distributed Control System (DCS) is used as a primary master and a hand-held communicator is used as a secondary master.
- This gas detector does not support a burst mode, and will not respond unless it receives a command from a master device.
- A slave device (gas detector) will respond to the corresponding command from the master device (host system) with the DD file installed.

11. Trouble Alarms

- This product has a self-diagnosis function, and a trouble (fault) alarm will activate if a problem is found.
- This product alerts the user of a problem by showing the corresponding error code on the display when a trouble alarm activates. The error codes are listed in the table below.
- When a trouble alarm activates, the 4-20mA analog signal is fixed at 1.6mA.

Error code on display	amber TROUBLE LED	Problem	Probable cause	Solution
E-24	Flashing	Power supply voltage drop	Insufficient power supply voltage	Check the power supply voltage.
E- 8 E- 9	Flashing	Sensor error	Sensor connector disconnected or damaged sensor wire	Check that the sensor connector is securely connected. If the sensor connector is defective or if the wire is damaged, contact New Cosmos or its authorized representative for repair.
E- 6 E- 7	Off	Zero point adjustment error	Gas is present in the ambient air	Perform zero adjustment in clean air.
E- 4 E- 5	Off	Span adjustment error	Incorrect gas type and/or concentration	Check the gas type and concentration of calibration gas. If they are incorrect, replace the gas with correct one. Perform fine span adjustment with the correct calibration gas.
				Check the gas type and concentration of calibration gas. If they are correct, perform coarse span adjustment.
E - 70	Flashing	Internal circuit error	Internal failure	Contact New Cosmos or its authorized representative for repair.
E-7/	Flashing	Internal circuit error	Internal failure	Contact New Cosmos or its authorized representative for repair.

Error code on display	amber TROUBLE LED	Problem	Probable cause	Solution
E - 72	Flashing	Analog output error	Damaged wire or internal failure	Check the wires for correct connection. If wires are correctly connected, there may be a damaged wire or component failure. In that case, contact New Cosmos or its authorized representative for repair.
E-73	Flashing	Internal circuit error	Internal failure	Contact New Cosmos or its authorized representative for repair.
E - 74	Flashing	Internal circuit error	Internal failure	Contact New Cosmos or its authorized representative for repair.
E - 75	Flashing	Maintenance mode recovery error	Gas detector remains in maintenance mode.	Power-cycle the gas detector by turning the power off, and waiting a few seconds then turning back on.

- If a code other than the ones listed is displayed, refer to 13 "Troubleshooting". If the product does not reset to normal operation after taking the steps shown in the table or if your problem is not listed in the table, please contact New Cosmos or its authorized representative.
- If the detector goes into any unintended mode during adjustment or setting, cease using the detector and consult with your system administrator.

12. Maintenance, and Operational Checks/ Procedures

12.1 Routine Checks and Annual Inspection

• Routine checks are carried out by the user, while annual inspections are performed by New Cosmos or its authorized representative.

	Frequency	Item	Procedure
	Min.1 per month	Visual check	 Check that POWER LED (green) is lit. Check that gas concentration value is displayed. Check wire element (mesh) of sensor unit for clogging or corrosion. Check gas detector for corrosion. Check mounting screws for corrosion. Replace any worn or damaged parts.
Routine check	Every two months	Check Alarm operation by using actual gas sample	 Apply the calibration gas to the gas detector and check the operation of the alarm. Attach the calibration cap to the detector, apply calibration gas, and check the operation of the alarm. Image: Calibration cap
		Detector vicinity	Check that the detector is free from objects that may interfere with the gas diffusion.
Annual inspection	Min.1 per year	Contact New Cosmos or its authorized representative for inspection.	

• Use optional items (e.g. calibration cap, gas calibration kit) when actual gas is used for check.

Important Notice for Annual Inspection

In order to ensure the reliability of this gas detection and alarm system, it is vital to perform periodic maintenance and inspections. Further, it is necessary to carefully perform inspection and calibrations by using actual gas (combustible or poisonous gas). It is highly recommended that a maintenance contract with a New Cosmos local representative be made for the performance of annual inspections.

Installation, inspection, maintenance, calibration and proof testing shall only be performed by trained personnel.

12.2 Calibration Gas Preparation

- Prepare calibration gas (actual gas) for inspection or maintenance use.
- Typical method to prepare calibration gas, 0.72 vol% (40%LEL) isobutane, is given below as an example.

When a commercially prepared gas cylinder is available,

Completely remove air from a gasbag, because if residual air remains inside the bag before filling, it will cause an incorrect measurement. Fill the prepared gas into the gasbag as shown in the drawing below.



NOTE Use a urethane gasbag. Leave the gas inside the bag for approx. 30 minutes before use, allowing the humidity of the gas inside to become close to the ambient humidity.

When a commercially prepared gas cylinder is not available,

Use a gas calibration kit (not included) and a pure gas cylinder (isobutane at 99 vol% or more). Dilute pure isobutane with air to produce 0.72 vol% (40%LEL) calibration gas.

NOTE Inexact calibration gas can be used for checking the alarm operation. When calibrating the detector, the gas concentration must be checked with a calibrated gas detector (e.g. New Cosmos portable gas detector, Model: XP-3110) before the calibration.



Ensure that there is no open flame or source of ignition when handling a flammable gas whose concentration exceeds its lower explosive limit (LEL).

- (1) Connect a gasbag to a pure gas cylinder. Draw the needed amount of gas from the cylinder into the gasbag. Bend the tube of the bag and pinch it using a pinchcock to ensure a leak-proof seal.
- (2) Connect a 10ml syringe to the gasbag. Collect 7.2ml of pure gas into the syringe. (You can collect a little more than needed, then discharge the excess to obtain 7.2ml.)
- (3) Connect the syringe to the inlet port of a measuring pump. Pull the plunger of the pump drawing the gas into the pump. Remove the syringe from the inlet port. Pull the plunger of the pump to the limit (100ml).
- (4) Connect an empty gasbag to the outlet port of the pump. Push the plunger of the pump. Cycle the plunger of the pump nine times to inflate the bag with the diluted gas.

For example, collect 7.2ml of pure isobutane gas, then cycle the plunger 10 times. (100ml per push), yielding a 0.72 vol% gas or 40%LEL gas:

7.2ml / (100ml×10) =0.0072 (0.72vol % diluted gas).

The LEL of isobutane is 1.8vol%.

0.72/1.8×100=40 (40%LEL diluted gas)



12.3 Calibration

Maintenance Mode

During the maintenance mode, the external relay contact does not operate even if gas concentrations reach or exceed the alarm set value. The detector in the maintenance mode maintains this status and the display shows [- - -]. The maintenance mode is canceled by turning off the detector after taking the steps (1) to (4) below, or automatically cancelled after an 8 hours waiting period. Ensure that the detector is not left in the maintenance mode as gas detection will not be possible for 8 hours when it will automatically reset.

NOTE

- Use the magnetic stick for the switch operation.
- Carefully handle the magnetic stick during operation or setting, because it has a strong attractive force. Refer to 3 "Package Contents" for full information.
- (1) While in the gas monitoring mode, press the MODE switch, then press the UP switch within approx. 2 seconds.
- (2) The detector displays *LAL* first, followed by a number.
 E.g. *i* is displayed when the power-up operation has been completed and no further operation has been done.



- (4) Press the ENTER switch.
- (5) If _ _ _ _ and the gas concentration value are alternately displayed, the detector is now in maintenance mode.
- (6) While **___** is displayed, the maintenance mode is still ongoing.
- (7) The maintenance mode can be canceled by performing the steps (1) to (4) above then turning off the detector, or by waiting for 8 hours.

Zero Adjustment

NOTE

- To prevent possible activation of the external relay contact during the zero adjustment, set the detector to maintenance mode, if needed.
- Perform the zero adjustment in a place where there is no target or interfering gas in the ambient atmosphere.
- Use the magnetic stick for the switch operation.
- Carefully handle the magnetic stick during operation or setting, because it has a strong attractive force. Refer to 3 "Package Contents" for full information.
- (1) While in the gas monitoring mode, press the MODE switch, then press the UP switch within approx. 2 seconds.
- (2) The detector displays *LRL*. first, followed by a number.
- (3) If the number . . . is not displayed, press the UP or DOWN switch to set the value to



- (4) Press the ENTER switch.
- (5) When the following messages are displayed, the zero adjustment is complete.

(6) Upon completion of the zero adjustment, the detector will automatically return to the gas monitoring mode.

NOTE

• If an error code is displayed, refer to 11 "Trouble Alarms".

Fine Span Adjustment

- To prevent possible activation of the external relay contact during the fine span adjustment, set the detector to maintenance mode or release the interlocks of the external devices, if needed.
- Only New Cosmos technician or personnel who have completed a maintenance seminar can perform a span adjustment.

NOTE

- Make sure to complete a zero adjustment before performing fine span adjustment.
- Use the magnetic stick for the switch operation.
- Carefully handle the magnetic stick during operation or setting, because it has a strong attractive force. Refer to 3 "Package Contents" for full information.
- (1) Attach a gasbag with the corresponding calibration gas to the gas detector. Apply gas at an even flow using 2-bulb pump and capillary (not included) or equivalent.



- (2) Allow time for the sensor to become exposed to the gas.
- (3) While in the gas monitoring mode, press the MODE switch, then press the UP switch within approx. 2 seconds.
- (4) The detector displays *L.***RL** first, followed by a number.
- (6) Press the ENTER switch.
- (7) The detector displays **5***F*. first, followed by the present gas concentration.
- (8) Press the UP or DOWN switch of the detector to adjust the display of the detector to the actual calibration gas concentration.
- (9) Press the ENTER switch.
- (10) Fine span adjustment is complete when **Lood** is displayed.
- (11) Upon completion of the fine span adjustment, the detector will automatically return to the gas monitoring mode.
- (12) Remove the gasbag.

NOTE

- Perform coarse span adjustment if *E Y* or *E* **5** is displayed.
- If an error code is displayed, refer to 11 "Trouble Alarms".

• Coarse span adjustment

Perform coarse span adjustment, if $\boldsymbol{\xi} - \boldsymbol{4}$ or $\boldsymbol{\xi} - \boldsymbol{5}$ is displayed.

- To prevent possible activation of the external relay contact during the coarse span adjustment, set the detector to maintenance mode or release the interlocks of the external devices, if needed.
- Only New Cosmos technician or personnel who have completed a maintenance seminar can perform a span adjustment.

NOTE

- Use the magnetic stick for the switch operation.
- Carefully handle the magnetic stick during operation or setting, because it has a strong attractive force. Refer to 3 "Package Contents" for full information.
- (1) Attach a gasbag with the corresponding calibration gas to the gas detector. Apply gas at an even flow using 2-bulb pump and capillary (not included) or equivalent.
- (2) Allow time for the sensor to become exposed to the gas.
- (3) While in the gas monitoring mode, press the MODE switch, then press the UP switch within approx. 2 seconds.
- (4) The detector displays **[RL**] first, followed by a number.
- (6) Press the ENTER switch.
- (7) The detector displays **5**, . . first, followed by the present gas concentration.
- (8) Press the UP or DOWN switch to set the displayed value closest to the actual calibration gas concentration.
- (9) Press the ENTER switch.
- (10) Coarse span adjustment is complete when *Lood* is displayed.
- (11) On completion of the coarse span adjustment, the detector will automatically return to the gas monitoring mode.
- (12) Remove the gasbag.

NOTE

- Precise adjustment is not possible using coarse span adjustment only. Perform a fine span adjustment once the coarse span adjustment is complete.
- If an error code is displayed, refer to 11 "Trouble Alarms".

• Full-scale and Alarm Set Values Display

NOTE

- The full-scale and alarm set values are only displayed and cannot be changed by the user.
- Use the magnetic stick for the switch operation.
- Carefully handle the magnetic stick during operation or setting, because it has a strong attractive force. Refer to 3 "Package Contents" for full information.
- (1) While in the gas monitoring mode, press the MODE switch, then press the UP switch within approx. 2 seconds.
- (2) The detector displays *L***.** first, followed by a number.
- (4) Press the ENTER switch.



(5) The following messages are displayed in the order below so that the user can check the full-scale and alarm set values.



(6) After the full-scale and alarm set values are displayed, the detector will automatically return to the gas monitoring mode.

• Test Mode

• Test mode is used to set the test value.

• To prevent possible activation of the external relay contact during the test mode, set the detector to maintenance mode or release the interlocks of the external devices, if needed.

NOTE

- Use the magnetic stick for the switch operation.
- Carefully handle the magnetic stick during operation or setting, because it has a strong attractive force. Refer to 3 "Package Contents" for full information.
- (1) While in the gas monitoring mode, press the MODE switch, then press the UP switch within approx. 2 seconds.
- (2) The detector displays **[.AL**]. first, followed by a number.



- (4) Press the ENTER switch.
- (5) The following messages are displayed in the order below.

Test value

Tests are possible with a concentration range from -10% to 110% of the full-scale value. For example, if the full scale is 2000 ppm, the test is possible using a range from -200 to 2200 ppm. If the full scale is 100%LEL, the test is possible using a range from -10%LEL to 110%LEL.

- Press the UP or DOWN switch to set the value to your desired calibration gas concentration. The test will automatically start once the value is set.
 If the set value is outside the operating range, LLLL or HHHH will be displayed.
- (2) To end the test mode, press the ENTER or MODE switch.
- (3) Ending the test with the ENTER switch will save the tested value.Ending the test with the MODE switch, will save the previously saved value.

13. Sensor Unit Replacement

- Disconnect the power supply to the gas detector before replacing the sensor unit. Failure to do so may cause a source of ignition.
- Before turning on the detector, ensure that the sensor and the sensor connector are firmly connected to the detector. Proper gas detection is not possible if the sensor and the detector are incorrectly connected.
- The dimensions of a flameproof joint between the case and the case cover of the KD-12 flameproof housing must meet the minimum requirements specified in EN/IEC60079-1.
 Please contact the manufacturer for inspection, repair or adjustment of the flameproof joint.

- Only New Cosmos technician or personnel who have completed a maintenance seminar can replace the sensor unit.
- Handle the sensor unit with care. Failure to do so may result in broken components such as the sensor wire or in a failure of the sensor.
- When the sensor output becomes unstable while replacing the sensor unit, the external relay contact may possibly activate. To prevent possible activation of the external relay contact during the replacement, release the interlocks of the external devices, if needed.
- When removing or installing the sensor unit, take care not to twist the harness of the sensor connector.
- When closing the case cover, make sure it does not catch on the gasket or any loose cables.



- (1) Disconnect the power supply to the gas detector.
- (2) Loosen the four hexagonal head screws at the four corners of the case cover with the 4mm hex wrench (included), and open the case cover of the detector.
- (3) Pull and disconnect the sensor connector.
- (4) Remove the sensor guard.
- (5) Use the sensor replacement jig to turn and pull out the sensor unit.
- (6) Insert a new sensor unit and tighten the sensor unit with the sensor replacement jig.
- (7) Connect the sensor connector.
- (8) Check that the sensor connector is securely connected.
- (9) Attach the sensor guard.
- (10) Close the case cover and tighten the four hexagonal head screws at the four corners of the case cover with the 4mm hex wrench.
- (11) Connect the power supply to the gas detector.
- (12) After sensor unit replacement, it is necessary to keep the detector energized for approx.. 1 week for sensor stabilization, then perform zero and span adjustments.
- (13) Prior to a span adjustment, make sure to complete a zero adjustment
- (14) If an error code is displayed, refer to 11 "Trouble Alarms".

NOTE

• The sensor replacement jig is optional.

14. Troubleshooting

- Before requesting repair, please refer to the table below. If the detector does not return to normal after performing the corresponding steps in the table, or if your issue is not found in the table, consult New Cosmos or its authorized representative.
- If the gas detector goes into any unintended mode during adjustment or setting, cease using the detector and consult with your system administrator.

Problem	Probable cause	Steps	Reference page
POWER LED(green) does not turn on.	Incorrect wiring	Check and rewire.	Page14 Wiring/Connection
	E - 24 Low voltage state	Check the power supply voltage.	
TROUBLE LED (amber) is flashing and error code is	E- 8 E- 9	Check that the sensor connector is securely connected.	
displayed.	Defective sensor unit, disconnected connector, or damaged sensor wire.	If there is a possibility of a defective sensor or damaged sensor wire, contact New Cosmos or its authorized representative.	Page14 Wiring/Connection
Gas concentration value and are flashing alternately.	Product is in maintenance mode.	Set the product to gas monitoring mode.	Page 28 Maintenance Mode
	Product is in maintenance mode.	Set the product to gas monitoring mode.	Page 28 Maintenance Mode
External relay contact does not function (no alarm signal to external	Incorrect wiring	Check and rewire	Page14 Wiring/Connection
equipment)	Incorrect alarm point setting.	Check the alarm setting.	Page 32 Full-scale and Alarm Set Values Display
Analog signal does not change.	Product is in test mode.	Set the product to gas monitoring mode.	Page 33 Test Mode
Value and HHHH are flashing alternately.	Sensor output is too high.	Gas concentration exceeds the full scale value. Check the ambient environment.	
Value and LLLL are flashing alternately.	Sensor output is too low.	Perform zero adjustment in clean air.	Page 29 Zero Adjustment
Cannot make or adjust setting.	Product is in warm-up cycle.	Operate the product after the 30-second warm-up cycle is completed.	Page 18 Display at Power-up (Warm-up)

Problem	Probable cause	Steps	Reference page
	Incorrect wiring	Check and rewire.	Page14
	Cable used is not a twisted pair cable.	Use twisted pair cable.	wiring/Connection
Product does not respond	Load resistance is too high or too low.	Set the load resistance of the signal line, including the resistance of the wire, to between 120 and 500 ohm, inclusive.	
to a HART command sent from host system.	Noise is present in the lines.	Remove noise from the power and signal lines.	
	Line length is too long.	Keep the line length within 1 km.	
	Mode is set between 21 to 23.	Change the mode to the gas monitoring mode with magnetic stick.	
	Combination of items above.	Clear faults one by one, then restart the communication.	
PV does not change.			
Note: Primary Variable (PV) is the first or only analog channel supported by a field device.	Product is in test mode.	Cancel the test mode by operating the product with magnetic stick or by host system.	

15. Specifications

Model	KD-12 (Type: HART)
Detection principle	【KD-12AH】Hot-wiresemiconductor sensor 【KD-12BH】Catalytic sensor
Sampling method	Diffusion type
Target gas	As per delivery specifications.
Detection range	As per delivery specifications.
Gas concentration display	Four-digit seven-segment LED display
Alarm set value	As per delivery specifications.
Alarm accuracy	 Combustible gas: ±25% of alarm set value under identical conditions. Toxic gas: ±30% of alarm set value under identical conditions.
Alarm delay	 Combustible gas: Less than 30 seconds with a gas concentration that is 1.6 times higher than the alarm set concentration. Toxic gas: Less than 60 seconds with a gas concentration that is 1.6 times higher than the alarm set concentration.
Alarms	 During gas alarm (single stage only), the red ALARM LED blinks. During trouble alarm in the event of sensor disconnection, zero drift, power supply voltage error, internal EEPROM communication error, internal voltage error, sensor signal amplifier circuit error, gas concentration analog signal error*, or microcomputer error, the amber TROUBLE LED blinks.
External output	 <gas analog="" and="" concentration="" hart="" signal=""></gas> 4-20 mA DC (common negative with power supply) 1.6 mA in the event of trouble alarm. 2.0 mA during the warm-up period. Wired HART signal (superimposed over 4-20mA signal), Protocol Rev.7.5 Load resistance of the analog signal line, including the resistance of the wire, is not less than 120 ohm and not more than 500 ohm. <gas (single="" alarm="" contact="" only)="" stage=""></gas> Dry contact. Normally open or normally closed (selectable). Normally energized or normally non-energized. Automatic resetting. Max. load: 3.0 A resistive at 250 VAC or 3.0 A resistive at 30 VDC
Equipment or Protective System intended for use in Potentially Explosive Atmospheres	Directive 2014/34/EU SI 2016 No.1107
Explosion-proof	 (x) II 2 G Ex db IIC T5 Gb (ATEX) (x) II 2 G Ex db IIC T5 Gb (UKEx) Ex db IIC T5 Gb (IECEx)
Approvals	EU-Type Examination Certificate Number: DEMKO 08 ATEX 143870 X (CE 2776 (Ex) II 2 G Ex db IIC T5 Gb) UKEx Examination certificate: CML 21UKEX11353X (UKCA 2503 (Ex) II 2 G Ex db IIC T5 Gb) EMC: EN61000-6-4:2007+A1:2011, EN50270:2015 - Type 2 <u>Performance testing</u> : The measuring function of the KD-12 gas detector for explosion protection in accordance with Annex II clauses 1.5.5, 1.5.6 and 1.5.7 of the Directive 2014/34/EU, is not covered in this certificate. IECEx: ULD 13.0001X (Ex db IIC T5 Gb)
Harmonised/Designated standards	EN IEC 60079-0:2018, EN 60079-1:2014 IEC 60079-0:2017 Edition 7.0, IEC 60079-1:2014 Edition 7.0
Degree of protection	IP65 (inside the device)

Applicable cable	Cable outer diameter: 10 to 14.5 mm • 3-wire twisted pair cable (Power, Analog and HART) with 0.75 to 2.00mm ² wires.
Operating temperature and humidity	 Temperature: -10°C to 50°C Humidity 10% to 90% (at 0 to 50°C) No sudden temperature or humidity changes. No condensation
Power supply	24 VDC (18 to 30 VDC) (terminal voltage)
Power consumption	3 W maximum
Dimensions	128 (W) x 116 (H) x 68 (D) mm (Excluding protruding parts)
Weight	Approx. 1.2 kg
Mounting method	Wall mounting

- The above specifications are subject to change without notice.

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- If your specifications are nonstandard, refer to the delivery specifications.

External markings (for explosion-proof model)



Harmonised/Designated standards EN IEC 60079-0:2018 EN 60079-1:2014 IEC 60079-0:2017 Edition 7.0 IEC 60079-1:2014 Edition 7.0

16. Warranty

The warranty period is one (1) year from the date of purchase.

You are entitled to the limited warranty, if the product malfunctions due to a manufacturing defect during normal use in accordance with the instruction manual, specifications and labels.

1. Warranty Scope

If the product fails or is found to be damaged due to a manufacturing defect during the warranty period, and used in accordance with the instruction manual and specifications, we will provide a free replacement and repair service. This warranty covers the New Cosmos product/parts only and not third party product/parts.

- 2. Warranty Exclusions (The following will be repaired at the cost of customer even during the warranty period.)
- (1) Failures and damages incurred by incorrect use, deliberate acts or negligence of the user.
- (2) Failures and damages caused by disaster, earthquake, storm and flood, lightning, extreme climate, abnormal power supply voltage, excessive electromagnetic interferences, or other acts of God.
- (3) Failures and damages resulting from repair and/or modification by non-New Cosmos certified technicians.
- (4) Consumables and failures and damages resulting from improper consumable replacement.
- (5) Other failures and damages not attributable to the manufacturer.

17. Life Expectancy of Sensor

The estimated service life of the sensor is shown in the table below. The sensor may fail to provide correct detection after its service life expires. Replace the sensor before the expiration. This service life assumes that maintenance is done properly and periodically and that the sensor is not exposed to high concentration gas or gas that may cause sensor poisoning. This does not imply that the sensor will provide correct detection values up to the end of the service life. Thus, no warranty will be given after the one-year period is over.

Model	Detection Principle	Life Expectancy
	(Sensor Type)	(from the date of purchase)
KD-12 AH	Hot-wire semiconductor	Approx. 5 years
KD-12 BH	Catalytic	Approx. 3 years

18. Service Life of Detector

The service life of this product is 10 years. The unit can operate for up to 10 years with a standard installation and used in accordance with the instruction manual. When the service life has expired, replacement is needed for continued reliable performance and other purposes.

19. Detection Principles

Hot-wire Semiconductor Sensor

A small amount of metal oxide semiconductor is deposited on a platinum coil, then the platinum coil is heated to a high temperature. When combustible gases react with oxygen absorbed on the surface of the semiconductor, free electrons increase in the semiconductor. As a result, the resistance of the semiconductor decreases. This resistance change is read as differential voltage using a bridge circuit for gas detection purpose. This type of sensor is very sensitive and thus suitable for low concentration gas detection.

Catalytic Sensor

Catalytic combustion occurs on the catalytic layer applied on a platinum coil even if the gas concentration is well below the lower combustion limit. This causes a rise in temperature of the platinum coil and increases its electrical resistance. This change is read as a differential voltage using a bridge circuit. This process enables detection of combustible gases in air up to the lower explosive limit (LEL).

Term	Definition
Gas detector	Device used to detect the presence of a target gas and to give its concentration in the form of an electrical signal.
Diffusion type	Sampling method using convective diffusion while placing a gas detector at a detection point.
Flameproof enclosure (explosion-proof enclosure)	Enclosure in which the parts which can ignite an explosive atmosphere are placed. This enclosure can withstand the pressure created during an internal explosion of an explosive mixture, and prevent the ignition of an explosive atmosphere outside the enclosure.
Target gas	Specific gas to be detected, concentration displayed, and used to trigger alarms.
Detection range	A range of target gas concentrations that can be displayed and trigger alarms.
Operating temperature and humidity ranges	Ambient temperature and humidity ranges in which the gas detection and alarm system can operate normally.
Maintenance and inspection	Tasks performed to ensure that equipment operates normally and correctly.
Calibration gas (test gas)	Gas specifically prepared to calibrate/adjust the gas detection and alarm system.
Hazardous area	An area in which an explosive atmosphere is present, or may be expected to be present, in quantities such as to require special precautions for the construction, installation and use of electrical apparatus.
Non-hazardous area	An area in which an explosive atmosphere is not expected to be present in quantities such as to require special precautions for the construction, installation and use of electrical apparatus.

20. Glossary

Term	Definition
Explosive atmosphere	Mixture of air and flammable substances in the form of dust or vapor which are within their explosive limits.
LEL	Lower Explosive Limit. Lowest concentration (percentage) of a gas or vapor in air capable of producing a flash fire, or explosion in the presence of an ignition source like arc, flame or heat.

(Partially quoted from the terms and definitions for gas detector/detector tube by the Industrial Gas Detectors & Monitors Association of Japan and IEC 60079-0:2017 Edition 7.0.)

Revision History

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GAE-119-00	June 2016	(Initial issue)
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