RIKEN KEIKI

M210-17012

# Applications in Fumigation Market and Introduction to Gas Detectors and Alarms for Safety and Security

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# Document contents

- About Riken Keiki
- Why do we need gas detectors?
  Risks associated with toxic gases
- Applications in fumigation market
- Major examples of accidents
- Product information
- International agents

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# About Riken Keiki

# About Riken Keiki

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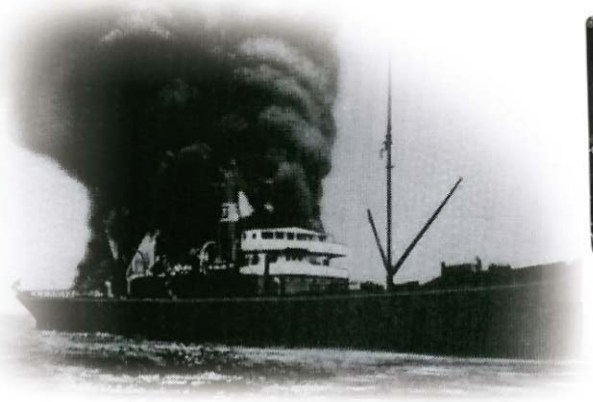
## RIKEN

1939

## Riken Keiki

Headquarters
To be completed in September 2018 (conceptual drawing)

**Riken Keiki was originally established to commercialize and sell detectors for preventing explosions in coal mines and on oil tankers.**



# About Riken Keiki

Methane gas measurements in coal mine

Optical Gas Indicator Model 3 (1939)

**Certification**

National heritage of analytical and scientific instruments
2014

# Company profile

| | | |
|---|---|---|
| Company name | Riken Keiki Co., Ltd. | |
| Established | March 15, 1939 | |
| Location | Headquarters:<br>Development Center: | 2-7-6 Azusawa Itabashi-Ku, Tokyo<br>2-3 Minamisakae-cho, Kasukabe-shi, Saitama |
| Factories | Hakodate-shi, Hokkaido; Sakurai-shi, Nara (affiliated company) | |

**Headquarters**

**To be completed in September 2018 (conceptual drawing)**

**Development Center**

# About Riken Keiki

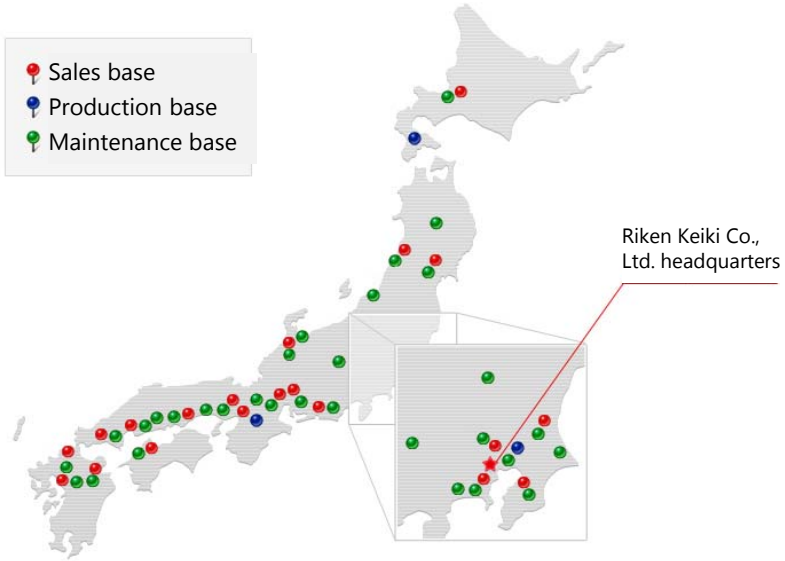
## Headquarters
(Itabashi-Ku, Tokyo)

To be completed in September 2018
(conceptual drawing)

## Development Center
(Kasukabe-shi, Saitama)

## Locations of sales offices

### ◆Domestic◆




### ◆Global◆

# Company profile

| | |
|---|---|
| Various bases | Domestic sales and branch offices: 20 locations<br>Service stations: 32 locations<br>Global bases: 7 locations |
| Major sales items | Combustible gas detectors and alarms<br>Gas detectors and alarms designed to prevent oxygen deficiency accidents<br>Toxic gas detectors and alarms<br>Combined gas detectors and alarms<br>Various measuring instruments for environmental measurements and other instruments |
| Capital | 2,565.5 million yen |
| Number of employees | 965 (non-consolidated), 1,127 (consolidated)<br>* As of September 30, 2017 |

**Hakodate Factory**
**(Hakodate-shi, Hokkaido)**

**Nara Factory**
**(Sakurai-shi, Nara)**

# Company history

| | |
|---|---|
| **1939** | Riken Keiki Co., Ltd. established to produce and sell optical gas detectors, photo-elasticity apparatuses, and other precision instruments invented and developed by RIKEN |
| **1959** | Start production and sale of combustible gas alarms and detectors (catalytic combustion type). |
| **1967** | Start production and sale of oxygen measuring instruments (OX-1). |
| **1970** | Start production and sale of monitoring tape type measuring instruments (FP-200). |
| **1972** | Start production and sale of non-dispersive infrared measuring instruments (RI-550). |
| **1975** | Start production and sale of electrochemical type measuring instruments (EC-231). |
| **1986** | Start production and sale of photoemission yield spectrometers (AC-1). |
| **2009** | 70th anniversary of founding |
| **2014** | Start production and sale of portable X-ray diffractometers equipped with XRF (DF-01). |
| **2015** | Start production and sale of portable multi gas detectors (GX-6000), first product of its kind in Japan capable of housing photoionization detectors (PID). |

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# Why Do We Need Gas Detectors?
# Risks Associated with Toxic Gases

# Need for gas detectors (combustible gases)

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## Criteria set by United Nations' Globally Harmonized System of Classification and Labelling of Chemicals (GHS)

According to the United Nations' Globally Harmonized System of Classification and Labelling of Chemicals (GHS), a combustible gas (or flammable gas) is defined as follows:

**A combustible or flammable gas is a gas having an explosive (flammable) range when mixed with air under atmospheric conditions of 20°C and standard pressure of 101.3 kPa.**

Gases falling under this definition are further subdivided into the following two categories based on the severity of the associated risk:

**Category 1 (Danger: Extremely flammable gas)**

Gases capable of igniting at 20°C and standard pressure of 101.3 kPa when occurring in a mixture of 13% or less by volume with air or having an explosive (flammable) range of at least 12% when mixed with air regardless of the lower explosion (flammable) limit

**Category 2 (Warning: Flammable gas)**

Gases, other than those in Category 1, which are gaseous at 20°C and a standard pressure of 101.3 kPa and have an explosive (flammable) range when mixed with air

**We need gas detectors because flammable gas leaks can lead to explosions.**

# Need for gas detectors (definition of permissible concentration)

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## Definition of permissible concentration

Even when workers are exposed to hazardous substances at work sites, no adverse health effects should emerge as long as the airborne concentration of the **hazardous** substance remains below the permissible concentration.

Recommended permissible concentrations have been set by the American Conference of Governmental Industrial Hygienists (ACGIH) and the Japan Society for Occupational Health. We use the **ACGIH** permissible concentrations.

## Types of permissible concentrations

- **TWA (Time Weighted Average)**
  Time Weighted Average refers to time-weighted average concentrations over an 8-hour workday and 40-hour workweek of routine work to which workers may be repeatedly exposed without adverse health effects.

- **STEL (Short Term Exposure Limit)**
  Short Term Exposure Limit refers to exposure that does not lead to adverse health effects if each exposure does not exceed 15 minutes, the number of daily exposures does not exceed four, and the exposures are separated by at least one hour.

- **C (Ceiling value)**
  Ceiling Value refers to the upper limit that can never be exceeded.

**We need gas detectors because leaks exceeding permissible concentrations can lead to accidents.**

# How human body reacts to oxygen-deficiency

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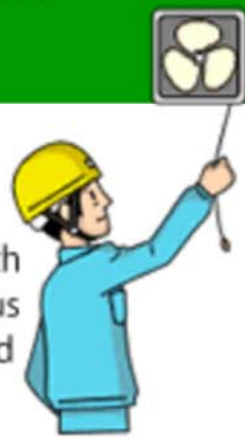
## O2 Concentration 21%

**Symptoms**

Natural air

## O2 Concentration 18%



**Symptoms**

Limit level for not causing serious health problems. Continuous ventilation is required

## O2 Concentration 16%-12%

**Symptoms**

Rapid breathing, Increase in pulse rate, Loss of concentration, Headache, Nausea, Ear ringing

## O2 Concentration 14%-9%

**Symptoms**

Stupor, Headache, Nausea, Cyanosis, Faintness on the entire body

## O2 Concentration 10%-6%

**Symptoms**

Comatose, Loss of consciousness, Muscle spasm on the entire body

## O2 Concentration 6% or less

**Symptoms**

Unconsciousness, Comatose, Cessation of breathing, Cardiac arrest, Die in 6 minutes

# Effects of hydrogen sulfide ($H_2S$) on human body

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| Concentration (ppm) | Effects and Toxicity |
|---|---|
| 0.025 | Smell vaguely. (It varies according to the individual.) |
| 0.3 | Smell clearly. |
| 3 - 5 | Smell moderate degree of objectionable odor. |
| 10 | Lower-level to irritate eyes' mucus membranes. |
| 20 - 40 | A strong odor. Lower-level to irritate lungs' mucous membranes. |
| 100 | Sense of smell is impaired in 2 - 15 minutes. Eyes and respiratory tract are irritated in 1 hour. 8 - 48 hours continuous exposure can lead to death. |
| 170 - 300 | 1 hour exposure is the limit for not causing serious health problems. |
| 400 - 700 | Life-threatening exposure in 0.5 - 1 hour. |
| 800 - 900 | Bring on loss of consciousness, cessation of breathing and death. |
| 1000 | Bring on immediate loss of consciousness and death. |

# Effects of carbon monoxide (CO) on human body

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| Concentration (ppm) | Effects and Toxicity |
|---|---|
| 100 | No noticeable effects even after breathing for a few hours. |
| 200 | A mild headache in around 1.5 hours. |
| 400 - 500 | Headache, nausea and ear ringing in around 1 hour. |
| 600 - 1000 | Loss of consciousness in around 1 - 1.5 hours. |
| 1500 - 2000 | Headache, vertigo and disabling nausea in around 0.5 - 1 hour, and losing consciousness. |
| 3000 - 6000 | Headache, vertigo, disabling nausea...etc. in a few minutes. 10 - 30 minutes exposure can lead to death. |
| 10000 | Bring on immediate loss of consciousness and death. |

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# Applications in Fumigation Market

# Applications in fumigation market

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1. Major chemical substances used for fumigation

2. Major applications

   2-1: Fumigating agricultural products (1)

   2-2: Fumigating agricultural products (2)

   2-3: Fumigating agricultural products (3)

   2-4: Fumigating farmland soil

   2-5: Fumigating wood, packaging materials, and building materials

   2-6: Fumigating cultural assets and art objects

   2-7: Fumigation for medical applications

# 1. Major chemical substances used for fumigation

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The table below indicates whether the chemical substances used in fumigation are detectable by PID. Other substances used include $CO_2$ and $N_2$.
(The substances in red are subject to mandatory risk assessment.)

| Chemical substance | Major applications | Acceptable concentration (ppm) | Products [Detection range] |
|---|---|---|---|
| Phosphine (Hydrogen phosphide) | ・Fumigating agricultural products (silos, warehouses, freight containers) | 0.3(*1) | FI-8000 [0 to 50 g/m³], FP-300 [0 to 500/900 ppb], GD-70D [0 to 1 ppm], GX-6000 [0 to 50,000 ppb/6,000 ppm], SC-01 [0 to 1.00 ppm], SC-8000 [0 to 1.00 ppm], SP-220 (TYPE FUM), etc. |
| Dichloropropene (1,3-dichloropropene) | ・Soil fumigation | 1(*1) | - |
| Chloropicrin | ・Soil fumigation | 0.1(*2) | - |
| MITC (methyl isocyanate) | ・Soil fumigation | 0.02(*1) | GX-6000 [0 to 50,000 ppb/6,000 ppm] |
| Hydrogen cyanide | ・Fumigating agricultural products (silos, warehouses, freight containers) | 5(*1) | FI-8000 [0 to 200 g/m³], GD-70 D [0.9 to 15/30 ppm], GX-6000 [0 to 15.0 ppm], SC-01 [0 to 15.0 ppm], SC-8000 [0 to 15.0 ppm] |
| Sulfuryl fluoride | ・Fumigating agricultural products (silos, warehouses, freight containers)<br>・Fumigating farmland soil<br>・Fumigating wood (used in Japan) | 5(*1) | FI-8000 [0 to 200 g/m³] |
| Formaldehyde | ・Fumigation for medical applications | 0.1(*2) | FP-31 [0 to 0.4/1 ppm], FP-330 [0 to 0.5/1/5 ppm], etc. |
| Iodoform (methyl iodide) | ・Fumigating fresh chestnuts<br>・Soil fumigation | 2 (*1) | GX-6000 [0 to 50,000 ppb/6,000 ppm] |
| Ethylene oxide | ・Fumigation for medical applications<br>・Fumigating cultural assets and art objects | 1 (*1) | GD-A80V, GX-6000 [0 to 50,000 ppb/6,000 ppm], etc. |
| Propylene oxide | ・Fumigating cultural assets and art objects | 2 (*1) | FI-8000 [0 to 10 vol%], GD-A80V, GX-6000 [0 to 50,000 ppb/ 6,000 ppm], etc. |
| Aluminum phosphide | ・Fumigating agricultural products (silos, warehouses, freight containers) | - | - |
| Methyl bromide (*3) | ・Fumigating farmland soil<br>・Fumigating wood, packaging materials, and building materials | 1 (*1) | GD-A80V, GX-6000 [0 to 50,000 ppb/6,000 ppm], SP-220 (TYPE FUM), etc. |
| Ethyl formate | ・Fumigating fruits and vegetables (used in Korea) | 100(*1) | GX-6000 [0 to 50,000 ppb/6,000 ppm] |

*1 TWA or STEL value recommended by ACGIH (American Industrial Hygienist Conference)
*2 Value recommended by the Japan Society for Occupational Health
*3 The Montreal Protocol provides for the phase-out of all use except in cases where no replacement is available.

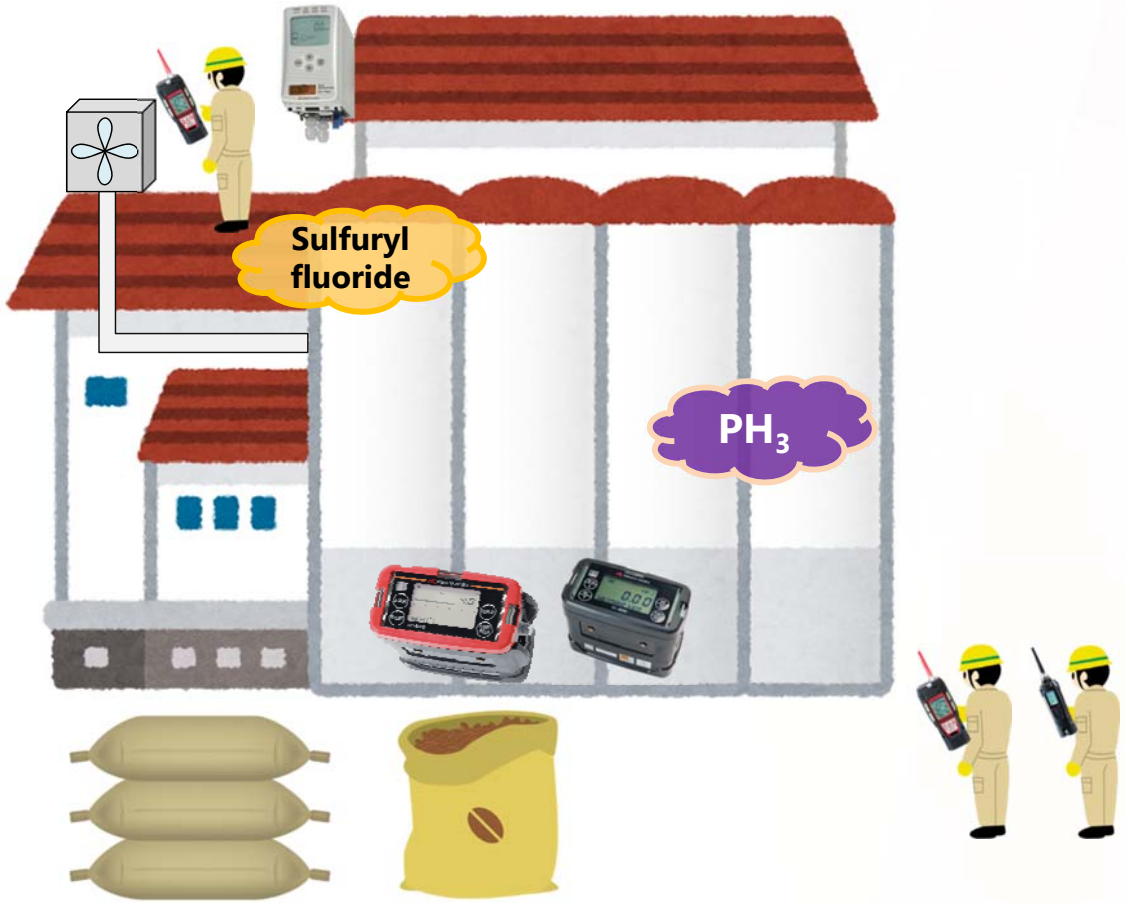
# 2-1: Fumigating agricultural products (1)

**Description**: Living creatures in bagged or bulked agricultural products (e.g., grain, coffee, and pulses) stored in silos or warehouses damage the quality of agricultural products. Thus, these products are fumigated using substances such as hydrogen phosphide (PH3: produced by the reaction of aluminum phosphide and airborne moisture) and sulfuryl fluoride. The airtightness of silos is checked by filling with $CO_2$.
* Use of methyl iodide and methyl formate is also being considered for the fumigation of silos and warehouses in the future.

**Hazardous risks:**

**$PH_3$ and sulfuryl fluoride may cause poisoning.** ⇒ **Detecting $PH_3$ and sulfuryl fluoride to prevent poisoning**

**Leaks of $CO_2$ used to check the airtightness of silos may cause poisoning.** ⇒ **Detecting $CO_2$ to prevent poisoning**




**To check for leaks in pipelines**

Smart Transmitter/ Gas Detector
**Model: GD-70D**

**To check for leaks of residual gases**

Portable Gas Leak Checker
**Model: SP-220 TYPE FUM**

**To check for leaks of exhaust ducts and residual gases**

Personal Four Gas Monitor
**Model: GX-6000**

**To control concentrations**

Optical Gas Indicator
**Model: FI-8000**

**To measure residual gases**

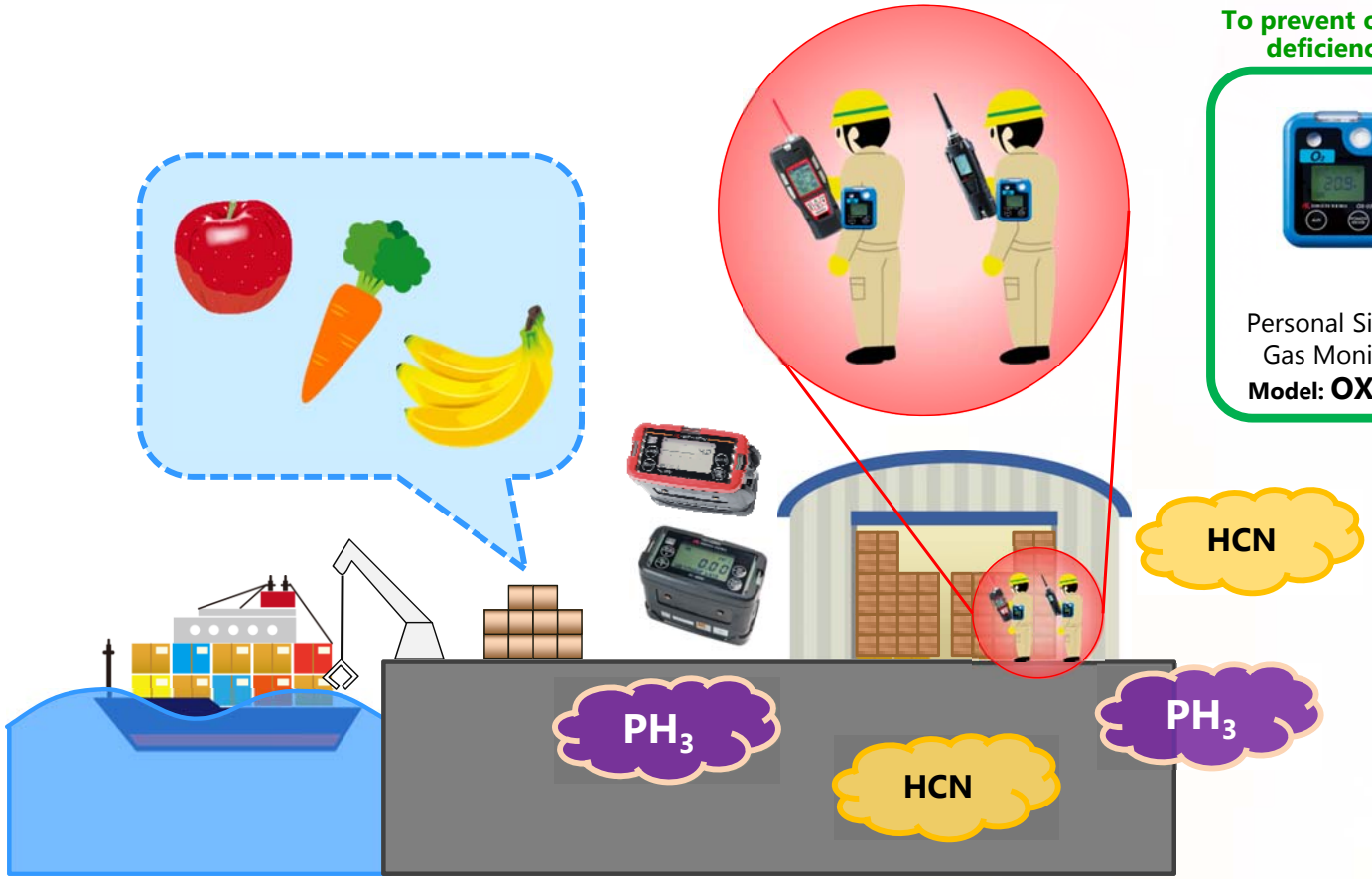
Portable Toxic Gas Monitor
**Model: SC-8000**

# 2-2: Fumigating agricultural products (2)

**Description**: Food (fruits and vegetables), grain, and similar goods transported as cargo (e.g., freight containers) on board cargo ships are quarantined when they are landed. If the quarantine identifies the presence of pest organisms, the cargo is disinfected by fumigating the landed cargo in warehouses, silos, or freight containers. Typically, HCN is used to fumigate fruits and vegetables in warehouses, while hydrogen phosphide ($PH_3$: generated by the reaction of aluminum phosphide and airborne moisture) is used to fumigate grain on board cargo ships.

**Hazardous risks:**

- **$PH_3$ remaining in freight containers or silos may cause poisoning.** ⇒ **Checking residual concentrations of $PH_3$ in freight containers or silos to prevent $PH_3$ poisoning**
- **HCN remaining in warehouses may cause poisoning.** ⇒ **Checking residual concentrations of HCN in warehouses to prevent HCN poisoning**
- **Rotting grain may cause oxygen deficiencies.** ⇒ **Measuring oxygen concentrations to prevent oxygen deficiencies**




**To prevent oxygen deficiencies**

Personal Single Gas Monitor
**Model: OX-03**

**To check for leaks of residual gases**

Portable Gas Leak Checker
**Model: SP-220 TYPE FUM**

Personal Four Gas Monitor
**Model: GX-6000**

**To control concentrations**

Optical Gas Indicator
**Model: FI-8000**

**To measure residual gases**

Portable Toxic Gas Monitor
**Model: SC-8000**

# 2-3: Fumigating agricultural products (3)

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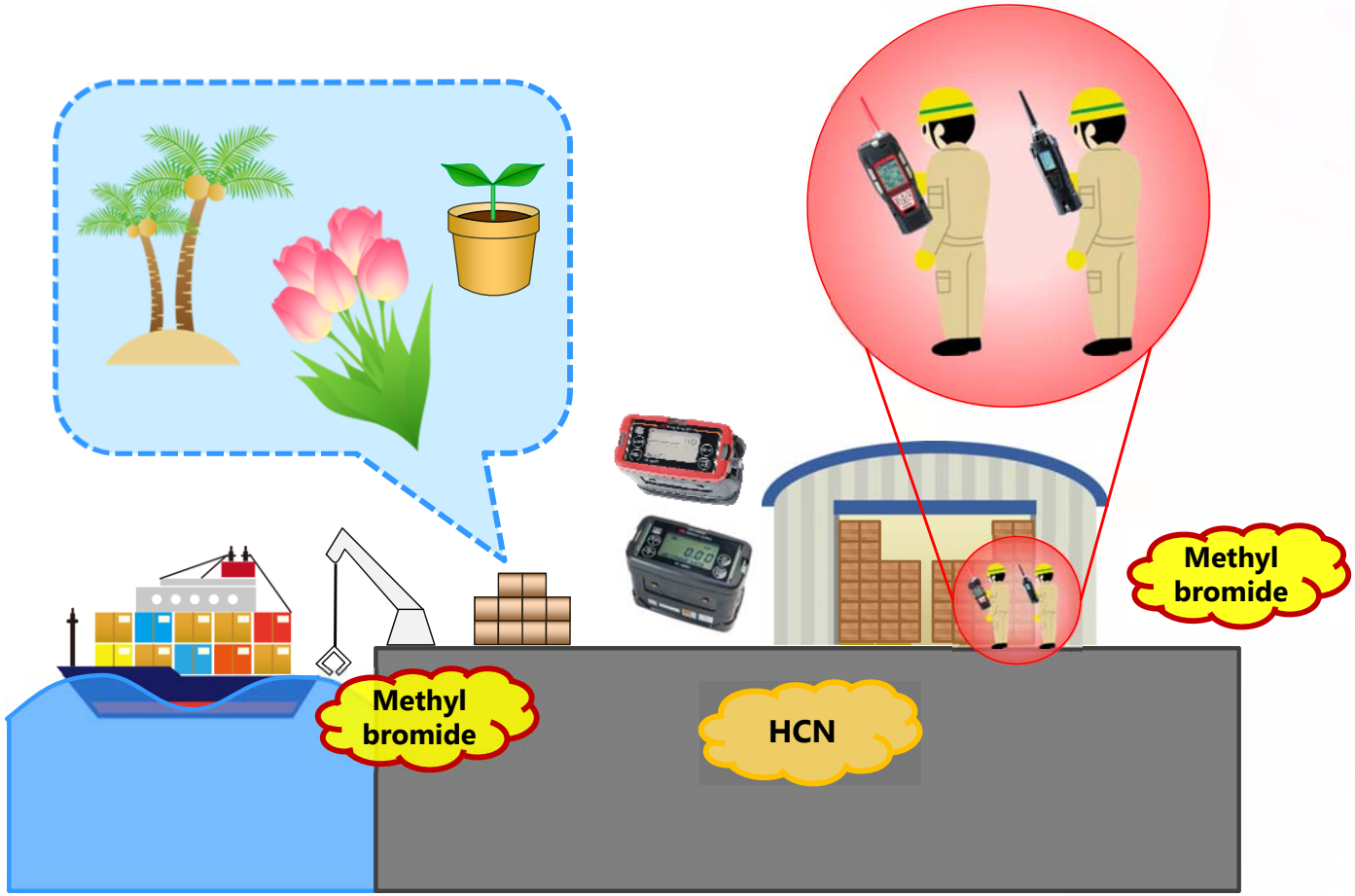
**Description**: Plants (trees, flowers, and seedlings), fruits, vegetables, and similar goods in cargo holds (e.g., freight containers) on board cargo ships are quarantined when they are landed. If pest organisms are found during the quarantine period, they are typically disinfected by fumigating the landed cargo in warehouses, silos, or freight containers. Typically, hydrogen cyanide (HCN) and methyl bromide ($CH_3Br$) are used to fumigate such agricultural products.
* Wood is fumigated with methyl bromide while on board the cargo ship with the hatch closed.

**Hazardous risks:** **HCN and $CH_3Br$ may cause poisoning.** ⇒ **Detecting HCN and $CH_3Br$ to prevent poisoning**




**To check for leaks of residual gases**

Portable Gas Leak Checker
**Model: SP-220 TYPE FUM**

Personal Four Gas Monitor
**Model: GX-6000**

**To control concentrations**

Optical Gas Indicator
**Model: FI-8000**

**To measure residual gases**

Portable Toxic Gas Monitor
**Model: SC-8000**

# 2-4: Fumigating farmland soil

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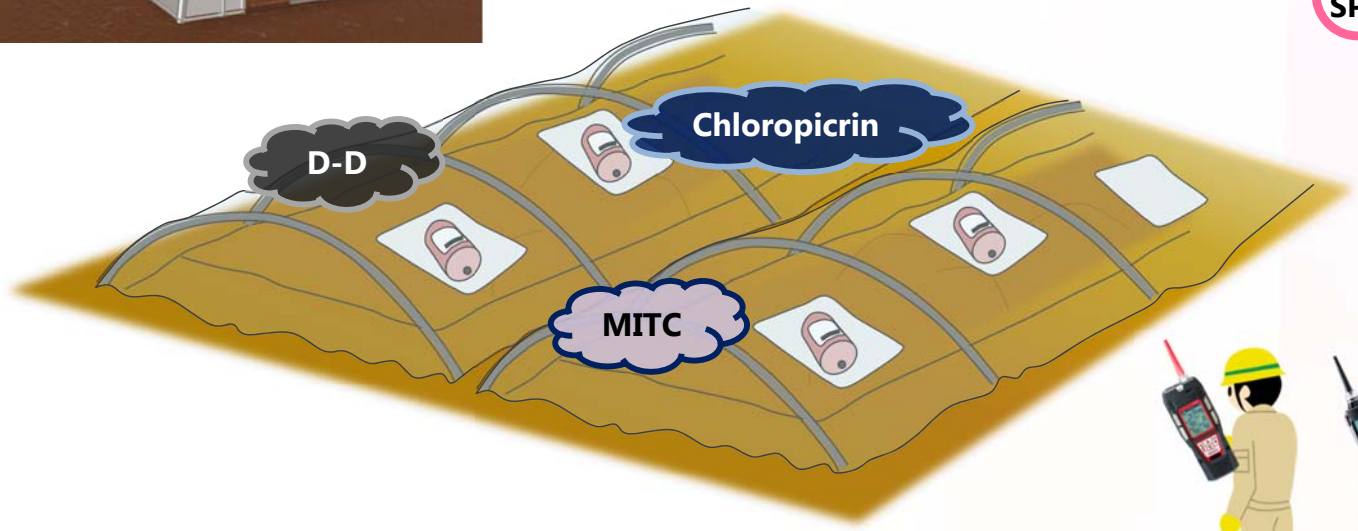
**Description**: Continuous cropping of the same farmland enhances the propagation of pathogenic bacteria, nematodes, and viruses that can damage crops. The land needs to be treated by fumigation. Chloropicrin, dichloropropene (D-D), and MITC (methyl isocyanate) are typically used for soil fumigation.

**Hazardous risks: Chloropicrin, D-D, and MITC may cause poisoning.** ⇒ **Detecting chloropicrin, D-D, and MITC to prevent poisoning**




**To check for leaks of residual gases**

Portable Gas Leak Checker
**Model:**
**SP-220 TYPE FUM**

Personal Four Gas Monitor
**Model: GX-6000**

# 2-5: Fumigating wood, packaging materials, and building materials

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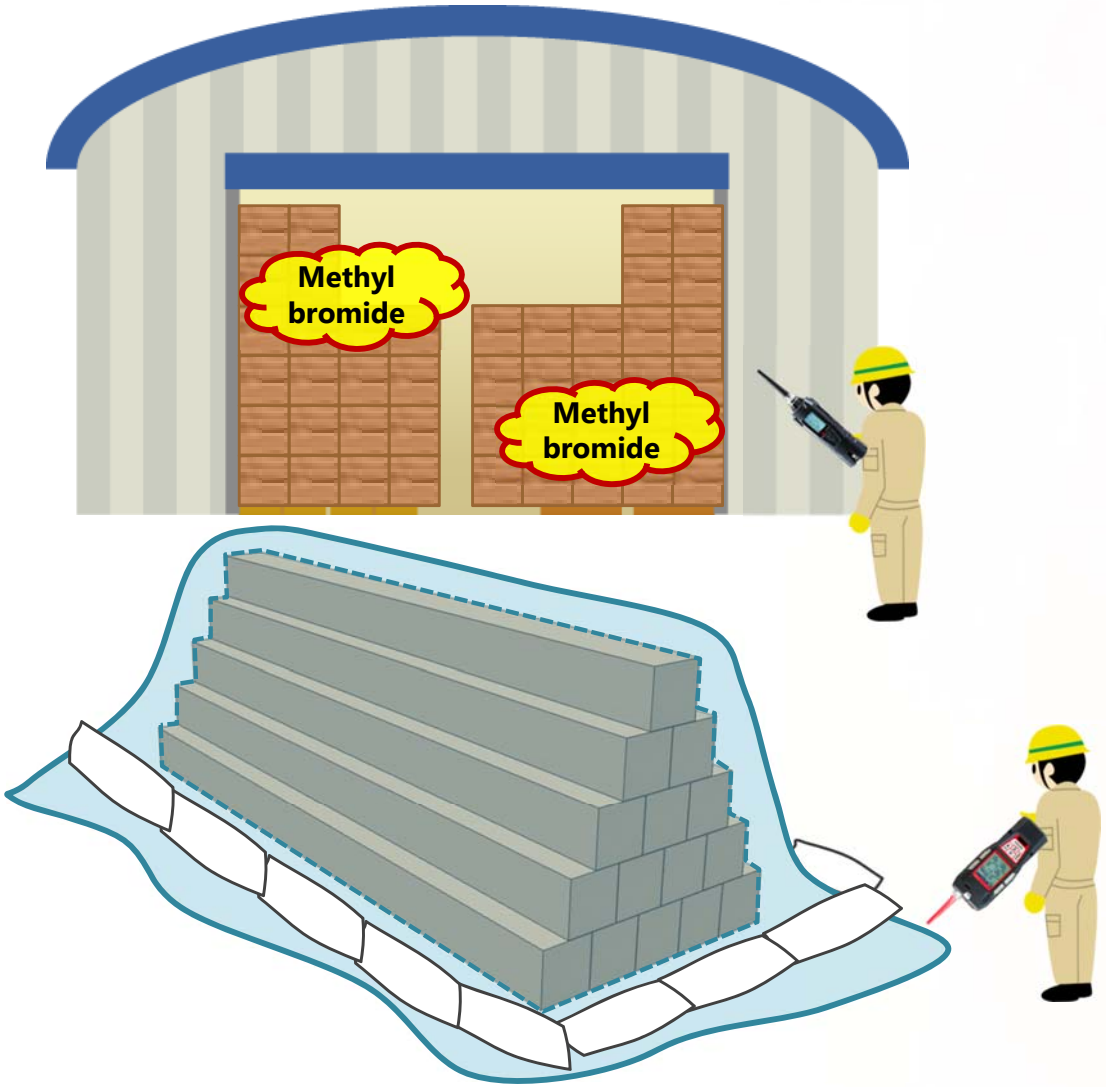
**Description**: Widely used as packaging or building materials, unprocessed wood can be infected by pest organisms. Any pest organisms found during the plant quarantine period are treated, typically by fumigation. Methyl bromide is often used for wood fumigation.
* Use of methyl bromide is prohibited for wood produced, distributed, or used in Japan.

**Hazardous risks: Methyl bromide may cause poisoning. ⇒ Detecting methyl bromide to prevent poisoning**




**To check for leaks of residual gases**

Portable Gas Leak Checker
**Model: SP-220 TYPE FUM**

Personal Four Gas Monitor
**Model: GX-6000**

**To control concentrations**

Optical Gas Indicator
**Model: FI-8000**

# 2-6: Fumigating cultural assets and art objects

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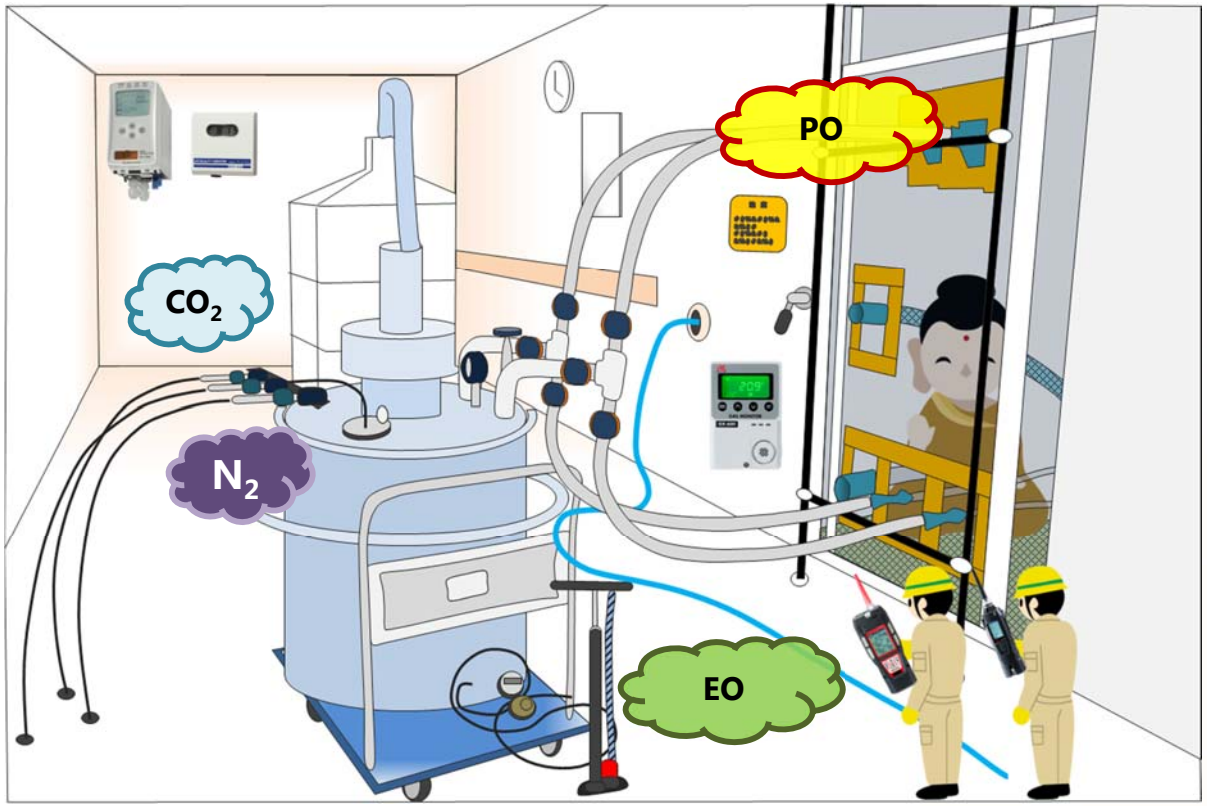
**Description**: Cultural assets and art objects are often exposed to daily changes in the environment and can degrade or sustain damage due to mold or pest organisms. As a countermeasure, they are often subjected to fumigation with propylene oxide (PO) or ethylene oxide (EO). In growing numbers of cases, fumigation with carbon dioxide or nitrogen is replacing fumigation with chemicals.

**Hazardous risks:** **PO and EO may cause poisoning. Carbon dioxide and nitrogen may cause poisoning or oxygen deficiencies.** ⇒ **Detecting PO, EO, and carbon dioxide to prevent poisoning Measuring oxygen concentrations to prevent oxygen deficiencies**




**To check for leaks**

Smart Transmitter/ Gas Detector
**Model: GD-70D**

$CO_2$ Monitor
**Model: RI-600**

Infrared $CO_2$ Gas Monitor
**Model: RI-215A**

**To prevent oxygen deficiencies**

Indoor Oxygen Monitor
**Model: OX-600**

**For portable personal protection**

Four Gas Personal Monitor
**Model: GX-2009**

Personal Single Gas Monitors
**Model: 03 series**

**To check for leaks of residual gases**

Portable Gas Leak Checker
**Model: SP-220 TYPE FUM**

Personal Four Gas Monitor
**Model: GX-6000**

# 2-7: Fumigation for medical applications

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**Description**: In facilities used to breed laboratory animals, biotechnology clean rooms, and laboratories that handle pathogens and pathogenic microorganisms, indoor sterilization is generally performed by formaldehyde (HCHO) fumigation.

**Hazardous risks**: **Formaldehyde may cause poisoning.** ⇒ **Detecting formaldehyde to prevent poisoning**


**To control concentrations**

Highly Sensitive Toxic Gas Monitor
**Model: FP-330**

**To control concentrations**

Formaldehyde Gas Detector
**Model: FP-31**

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# Major Examples of Accidents

Prepared by extracting and processing materials from the Safety at Work Site (Ministry of Health, Labour and Welfare: http://anzeninfo.mhlw.go.jp/index.html)

# Oxygen deficiency resulted in a death when hatches were opened following wood fumigation of cargo holds.

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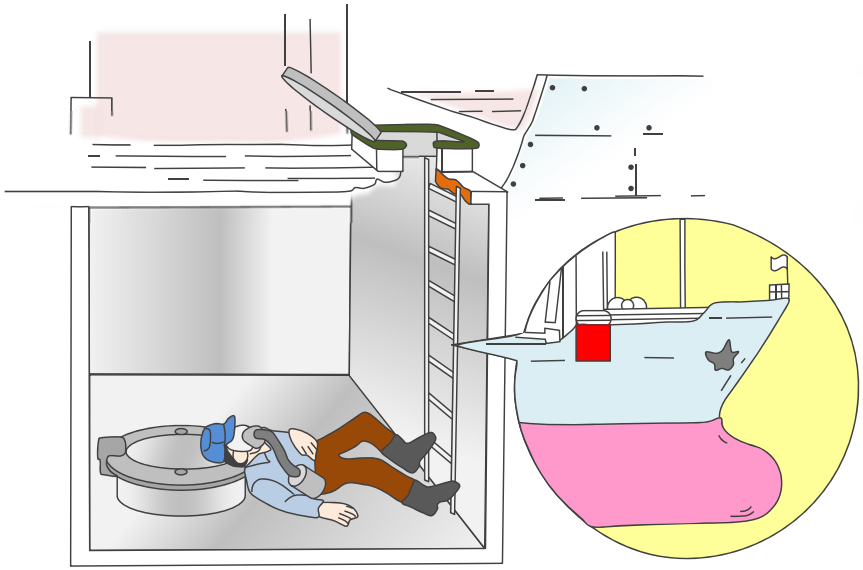

## [Location of accident]

While exhausting fumigant gas after wood fumigation on board a vessel

## [Cause of accident]

Gas concentrations in holds in which fumigation had been carried out the previous day were measured in the presence of a quarantine officer and the effects of fumigation confirmed. At that point, workers began opening the hatches and other openings for each hold. Workers began searching when one individual failed to return; they eventually found a companionway with the hatch open on the deck. Peering down into the companionway, they found the victim on his back, wearing a gas mask. While the fumigant gas had been measured, oxygen concentrations had not been checked, and the worker had fallen victim to an oxygen deficiency.

## [Damage/injuries]

The victim died due to oxygen deficiency.

It is important to recognize the risk of oxygen deficiencies as well as the risk of highly toxic fumigant gases. Wearing detectors that can measure both toxic gases and oxygen deficiencies ensures work safety.

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# Product Information

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## Features

- Adopts universal design independent of detection principle to allow shared use of the main unit.
- Reusable parts
- Allows recycling of constituent materials to reduce environmental impact.
- Design complies with various international regulations.
- Complies with CE requirements under RoHS Directive.
- Supports a range of communication methods.

DC method using analog 4 mA to 20 mA general instrumentation signal
(Detector head used: GD-70D)

DC power line carrier method using the same line for power supply and communication
(Detector head used: GD-70D-NT)

Ethernet method using PoE HUB
(Detector head used: GD-70D-EA)

Smart Transmitter/Gas Detector

# Model: GD-70D

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## Features

- Explosion-proof rating Exd II CT4 allows use in hydrogen and acetylene atmospheres.
- Provides support for suction and aspirator suction operations.
  (* Requires a separate pump unit and power supply.)

Combustible/Toxic Gas Detector Head

# Model: GD-A80V

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## Features

- Excellent selectivity for resistance to interference from other gases
- Rapid detection of slight environmental changes (Detectable at ppb level)
- Cassette insertion method for easy tape replacement (Using microcassette)

Highly Sensitive Toxic Gas Monitor
(Gas to be detected: Phosphine)

# Model: FP-300

Highly Sensitive Toxic Gas Monitor
(Gas to be detected: Formaldehyde)

# Model: FP-330

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## Features

- Formaldehyde detector designated by the Ministry of Health, Labour and Welfare [Designation number: 2701]
- Simply set the detection TAB on the main unit to begin measurement.
- Distinctive, large, easy-to-read digital display allows direct reading of concentrations.
- Incorporates reliable self-diagnosis function that indicates when the battery needs to be replaced or poor pump connections via buzzer and visual display.
- Precise and highly resistant to electromagnetic interference

Formaldehyde Gas Detector

# Model: FP-31

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Portable Gas Leak Checker

# Model: SP-220 TYPE FUM

## Features

- Tough, stylish, compact, lightweight unit
- Rapidly and reliably detects low concentrations of semiconductor material gases.
- Direct reading of concentrations and 40 types of gases selectable by button operation
- Features data logger function (logs up to 256 datum points for date, time, gas detected, and gas concentrations.)
- Incorporates LED lighting for accurate measurements even in dark places.

## Gases supported by TYPE FUM

| Gas to be detected | Display | Concentration display 1 (ppm) | Concentration display 2 (ppm) | Concentration display 3 (ppm) |
|---|---|---|---|---|
| Phosphine | PH3 | 0.1 | 2 | 4.5 |
| Methyl bromide | CH3Br | 1 | 20 | 100 |
| Carbon disulfide* | CS2 | 0.1 | - | - |
| Methyl iodide | CH3I | 1 | 10 | 30 |
| Hydrogen cyanide | HCN | 1 | - | - |
| Sulfuryl fluoride | SO2F2 | - | - | 800 |
| Ethylene dibromide* | C2H4Br2 | 1 | 10 | 30 |

* Gases whose use is prohibited in Japan

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Portable
Multi Gas Detector

# Model:
# GX-6000


## Features

- A single unit can simultaneously display up to six types of gases, including VOCs. This is the first product of its kind from a Japanese manufacturer.
- The PID sensor enables measurements of more than 200 types of chemical substances subject to regulation.
- Ideal for checking the risks and hazards of chemical substances as required under the Industrial Safety and Health Act
- Support for multilingual display (Japanese, English, French, Spanish, etc.)
- Equipped with convenient new functions, including panic alarm and LED flashlight

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## Features

- Intrinsically safe explosion-proof enclosure
- Product line supporting diverse gases
- Dustproof, waterproof enclosure for use in any environment
- Adjustable buzzer volume
- Two types of easy to read displays (digital/analog)
- Allows switching of target gas.

Portable Toxic
Gas Monitor

# Model: SC-8000

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Optical
Gas Indicator

# Model: FI-8000

## Features

- A single unit measures up to eight types of gases.
- Two types of suction methods are selectable.
  Automatic suction with built-in pump or manual suction with a hand aspirator
- Equipped with intermittent measurement mode (automatic suction only)
  Records concentration and time; allows confirmation of changes in gas concentrations on main unit.
- Large, easy to read LCD screen
  The display clearly shows measured gas type, gas concentrations, unit of measurement, and remaining battery capacity.

## Gases supported as part of standard fumigation gas specifications

| Gas to be detected | Base gas | Measurement range |
|---|---|---|
| Sulfuryl fluoride | Air | 0 to 200 g/m$^3$ |
| Propylene oxide | Air | 0 to 10 vol% |
| Methyl bromide | Air | 0 to 200 g/m$^3$ |
| | Air | 0 to 5 vol% |
| Methyl iodide | Air | 0 to 200 g/m$^3$ |
| Phosphine | Air | 0 to 50 g/m$^3$ |
| Hydrogen cyanide | Air | 0 to 200 g/m$^3$ |

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## Features

- Suitable for use as an explosion-proof product, even in a hydrogen/acetylene atmosphere
- IP 67 equivalent protection for safe use in outdoor work
- Three-direction alarm lamps and two-direction alarm buzzers to alert both the carrier and those in surrounding areas
- Buzzer volume of 95 dB or more can be heard even in noisy factory environments.
- Simultaneous display of gas concentrations of four components on large LCD screen
- Also equipped with clock display and data logger functions

Four Gas Personal Monitor

# Model: GX-2009

RIKEN KEIKI


**GP-03** (For combustible gases)

**OX-03** (For oxygen)

**HS-03** (For hydrogen sulfide)

**CO-03** (For carbon monoxide)

Personal Single Gas Monitors

# Model: 03 series

## Features

- Models for use with rechargeable batteries have been added to the product line.
- Standard protective covers protect the main unit from scratches, dirt, and shock.
- Compact, lightweight design doesn't interfere with work.
- Inherently safe and explosion-proof enclosure is ideal for use in hazardous locations.

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## Features

- Large, easy-to-read three-color LCD screen display
- Equipped with pressure correction function to prevent fluctuating readings due to atmospheric pressure
- The product line offers three types of power supply specifications (AC power supply, DC power supply, and dry battery) to suit the power supply available at the installation location.
- Continuous operation for approximately one year on two AA alkaline batteries
  * No alarm; backlight switched off
- Remote measurement at distances of up to 20 m with the remote sensor (sold separately)

Indoor Oxygen Monitor

# Model: OX-600

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## Features

- For $CO_2$ measurements required under the Act on Maintenance of Sanitation in Buildings and Ordinance on Health Standards in the Office
- For monitoring air in locations where people gather, such as offices, classrooms, and conference rooms
- For air conditioning in buildings and for air supply and exhaust control in underground parking lots
- For monitoring carbon dioxide concentration in plant cultivation factories and facilities

$CO_2$ Monitor

# Model: RI-600

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## Features

- Compact, lightweight, easy to install
- Equipped with an external output (4-20 mA) and control contact output

Infrared $CO_2$ Gas Monitor

# Model: RI-215A

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# International Agents

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# International Agents

| | | | |
|---|---|---|---|
| North America | South America | Asia and Pacific | Russia and Central Asia |
| Europe | Middle East | Africa | |

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# International agents (table of contents)

| | | | | | |
|---|---|---|---|---|---|
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| South America | Brazil | Argentina | Peru | Chile | Uruguay |
| Asia and Pacific | China | South Korea | Taiwan | Singapore | Malaysia |
| | Indonesia | Thailand | India | Vietnam | Philippines |
| | Australia | | | | |
| Europe | Germany | Greece | THE NETHERLANDS | Norway | Turkey |
| | U.K. | | | | |
| Middle East | U.A.E. | Israel | | | |
| Africa | South Africa | | | | |
| Russia and Central Asia | Russia | | | | |

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## International agents（U.S.A.）

# RKI INSTRUMENTS, INC.


| | |
|---|---|
| ADDRESS : | 33248 CENTRAL AVENUE, UNION CITY, CA94587-2010 U.S.A. |
| TEL : | +1-510-441-5656 |
| FAX : | +1-510-441-5650 |
| E-MAIL : | bob@rkiinstruments.com, sandra@rkiinstruments.com |
| PERSON : | MR. BOB PELLISSIER (PRESIDENT)<br>MRS. SANDRA GALLAGHER (VICE PRESIDENT) |
| WEBSITE : | http://www.rkiinstruments.com/ |

RIKEN KEIKI

# International agents（BRAZIL）

## HIDEO NAKAYAMA IMP. EXP. COM. E INDUSTRIA LTDA

| | |
|---|---|
| ADDRESS : | RUA SANTA AMÉLIA, 33 PRACA DA BANDEIRA<br>RIO DE JANEIRO RJ CEP: 20.260-030 BRAZIL |
| TEL : | +55-21-2590-3496 |
| FAX : | +55-21-2270-6390 |
| E-MAIL : | hideko@nakayama.com.br |
| PERSON : | MR. HIDEO NAKAYAMA (PRESIDENT)<br>MS. HIDEKO NAKAYAMA |
| WEBSITE : | http://www.nakayama.com.br/ |

RIKEN KEIKI

# International agents（ARGENTINA）

## Prevent Gas SA

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TEL : +54-11-4925-6342
FAX : +54-11-4925-6342
E-MAIL : ventas@preventgas.com.ar
PERSON : Mr. German Rosas
WEBSITE : http://preventgas.com.ar/

## HUBERG SUDAMÉRICA S.A.

ADDRESS : ERASMO (CALLE 79) 1047 (B1650HOE) VILLA PIAGGIO SAN MARTÍN, BUENOS AIRES, ARGENTINA
TEL : +54-11-4713-6068
FAX : +54-11-4713-6072
E-MAIL : arguello.juan@huberg.com
PERSON : MR. JUAN IGNACIO ARGUELLO
WEBSITE : http://www.huberg.com.ar

RIKEN KEIKI

# International agents（PERU）

## RESET ELECTRONICA Y SISTEMAS S.R.L.


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| ADDRESS : | Calle Martin de Murua 150 Of. 1004 - 1005<br>Edificio Plexus San Miguel Business Center<br>San Miguel - Lima 32, PERU |
| TEL : | +51-1-6367303 |
| FAX : | |
| E-MAIL : | enquiries@resetnaval.com |
| PERSON : | Mr. Max Muñoz Moran |
| WEBSITE : | http://www.resetnaval.com/ |

RIKEN KEIKI

## International agents（CHILE）

# Electronic Marine Ltd


ADDRESS : Uruguay 556 of 404 Valparaiso, CHILE
TEL : 56-32-2220050
FAX : 56-32-2593135
E-MAIL : marketing@electronicmarine.cl
PERSON : Alejandra Palominos (Marketing Manager)
WEBSITE : http://www.electronicmarine.cl

RIKEN KEIKI

# International agents（URUGUAY）

## microsur

ADDRESS : Carlos María Morales 934, 11200 Montevideo, Uruguay
TEL : 598-2410-1128
FAX : 598-2410-1128
E-MAIL : microsur@microsur.org
PERSON : Dra.Nermys Hernandez
WEBSITE : http://www.microsur.org

RIKEN KEIKI

# International agents（CHINA）

## RIKEN KEIKI COMMERCIAL(SHANGHAI）CO., LTD.


| | |
|---|---|
| ADDRESS : | HEAD OFFICE : ROOM4A SHANGHAI WATANABE INTERNATIONAL COMMERCIAL BUILDING NO.55, LINPING N.ROAD, HONGKOU DISTRICT, SHANGHAI, 200086 CHINA<br>SALES DEPARTMENT OFFICE : ROOM1106 DALIAN LEE WAN HOTEL NO.8, MINZHU SQUARE, ZHONGSHAN DISTRICT, DALIAN, LIAONING, 116001 CHINA |
| TEL : | 86-411-8212-3832 |
| FAX : | 86-411-8212-3833 |
| E-MAIL : | dl@rkkc.net (Ms. Sun Jun)<br>dl101@rkkc.net (Ms. Qu shuai)<br>dl102@rkkc.net (Ms. Xu fei) |
| WEBSITE : | http://www.rikenkeiki.asia |

RIKEN KEIKI

# International agents（KOREA）

## RIKEN KEIKI KOREA CO., LTD.


ADDRESS : 23, HWAJEONSANDAN 2-RO 134,
GANGSEO-GU, BUSAN, 46741 KOREA

TEL : 82-51-712-9900 FAX : 82-51-518-7736

E-MAIL : master@rikenkeiki.co.kr PERSON : MR.SUN-GU,LEE

WEBSITE :

(KOREAN) http://rikenkeiki.co.kr/bn/

(ENGLISH) http://rikenkeiki.co.kr/bn/english/

## HIGH INTEGRATED TECHNOLOGY, INC.

ADDRESS : 72, SEGYOSANDAN-RO, PYEONGTAEK-SI,
GYEONGGI-DO, 17843, KOREA

TEL : 82-31-650-7000 FAX : 82-31-650-7007

E-MAIL : info@hitinc.co.kr PERSON : MR.HYUNG-SIL, KIM

WEBSITE :

(KOREAN) http://www.hitinc.co.kr/

(ENGLISH) http://www.hitinc.co.kr/?strMode=company_e/company

RIKEN KEIKI

# International agents（TAIWAN）

## RIKEN KEIKI TAIWAN CO., LTD. HEAD OFFICE

ADDRESS : NO.87, YANGMING RD., SHANHUA JEN, TAINAN, 741, TAIWAN

TEL : 886-6-581-1224

FAX : 886-6-581-1250

E-MAIL : episys@ms22.hinet.net

PERSON : MR. SEITARO TAKAHASHI (PRESIDENT)

WEBSITE : http://www.rikenkeiki.com.tw/admin/news/front/news.php

## RIKEN KEIKI TAIWAN CO., LTD. TAICHUNG BRANCH

ADDRESS : NO.2, ALY.14, LN.150-30, SEC.3, XITUN RD., XITUN DIST., TAICHUNG CITY 407, TAIWAN

TEL : 886-4-2462-5386

FAX : 886-4-2462-5508

E-MAIL : johnny@rikenkeiki.com.tw

PERSON : MR. WU WEN CHENG

RIKEN KEIKI

# International agents（SINGAPORE）

## R K INSTRUMENTS (S) PTE LTD

| | |
|---|---|
| ADDRESS : | 102F PASIR PANJANG ROAD #03-11, CITILINK WAREHOUSE COMPLEX<br>SINGAPORE 118530 |
| TEL : | 65-6275-3398 |
| FAX : | 65-6275-3387 |
| E-MAIL : | rk@rkinstruments.com.sg |
| PERSON : | MR. BERNARD QUEK (PRESIDENT) |
| WEBSITE : | http://www.rkinstruments.com.sg/ |

RIKEN KEIKI

# International agents（MALAYSIA）

## KINETICS SYSTEMS MALAYSIA SDN. BHD.

| | |
|---|---|
| ADDRESS : | 12A, JALAN RINGGIT 23/11 , SECTION 23, 40300 SHAH ALAM, SELANGOR DARUL EHSAN MALAYSIA |
| TEL : | 603-5542-2288 |
| FAX : | 603-5542-2289 |
| E-MAIL : | ck.chooi@kinetics.net |
| PERSON : | MR. CHOOI CHOON KEET (GENERAL MANAGER) |
| WEBSITE : | http://www.kinetics.net/ |

RIKEN KEIKI

# International agents（INDONESIA）

## PT. PRATAMA GRAHA SEMESTA

ADDRESS : KOMPLEKS LODAN CENTER BLOK H-11 JL. LODAN RAYA NO.2 ANCOL - PADEMANGAN JAKARTA UTARA 14430 INDONESIA

TEL : 62-21-6900656

FAX : 62-21-6900657

E-MAIL : sales@ptpgs.co.id

PERSON : MR. FRENGKY TOMBOKAN

## PT. CENTRADINDO UNITRAS (FOR PERTAMINA & MARINE SECTOR)

ADDRESS : COMPLEX PERKANTORAN DUTA HARAPAN INDAH JL. KAPUK MUARA RAYA BLOK SS NO.3 JAKARTA UTARA 14460 INDONESIA

TEL : 62-21-6624347

FAX : 62-21-6623594

E-MAIL : centradindo.unitras@gmail.com

PERSON : MR. DJOHAN DAHLIAN (MANAGING DIRECTOR)

RIKEN KEIKI

# International agents（THAILAND）

## TAIYO GASES CO., LTD.


| | |
|---|---|
| ADDRESS : | 17TH FLOOR SERM-MIT TOWER, 159 SUKHUMVIT 21 ROAD, NORTH KLONGTOEY, WATTANA, BANGKOK 10110 THAILAND |
| TEL : | 66-2-260-2691 |
| FAX : | 66-2-260-2690 |
| E-MAIL : | hato@taiyogases.th.com |
| PERSON : | MR. KAZUNARI HATO |
| WEBSITE : | http://www.taiyogases.th.com/ |

RIKEN KEIKI

# International agents（INDIA）

## TRITECH

| | |
|---|---|
| ADDRESS : | 121,VEENA INDUSTRIAL ESTATE, OPP.FITWELL HOUSE, L.B.S.MARG, VIKHROLI(W) MUMBAI-400 083 INDIA |
| TEL : | 91-22-2577-7288, 6796-9990 |
| FAX : | 91-22-6796-9991 |
| E-MAIL : | tritec@vsnl.com |
| PERSON : | MR. NARESH SHARMA MR. JIGNESH SHAH |
| WEBSITE : | http://www.tritech.in/ |

RIKEN KEIKI

# International agents（VIETNAM）

## VIETNAM GAS DETECTOR ONE MEMBER CO., LTD.


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TEL : +84-(0)28-35262986 / 35262987

FAX : +84-(0)28-35262980

E-MAIL : info@vina-gasdetector.vn

PERSON : MR. CAO MINH LOI (Director)

WEBSITE : http://vina-gasdetector.vn/


RIKEN KEIKI

# International agents（PHILIPPINES）

## PILIPINAS TRADE GAS, INC. (PTGI)

| | |
|---|---|
| ADDRESS : | 23RD FLOOR ONE CORPORATE CENTER DONA JULIA VARGAS AVE., CORNER MERALCO AVENUE, ORTIGAS CENTER PASING CITY, PHILIPPINES |
| TEL : | 632-635-7320 |
| FAX : | 632-635-7322 |
| E-MAIL : | gerry.gueco@yahoo.com.ph |
| PERSON : | MR. S. HARA (PRESIDENT)<br>MR. GERRY C. GUECO (IN CHARGE) |

RIKEN KEIKI

# International agents（AUSTRALIA）

## CONTROL EQUIPMENT PTY. LTD.


ADDRESS : UNIT 1/3 DEAKIN STREET, BRENDALE QLD 4500, AUSTRALIA

TEL : 61-7-3481-9000

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E-MAIL : sales@controlequipment.com.au

PERSON : MR. GREG LOVE (GENERAL MANAGER)

WEBSITE : http://www.controlequipment.com.au/


RIKEN KEIKI

# International agents（GERMANY）

## RIKEN KEIKI GmbH

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E-MAIL : s-ono@rikenkeikigmbh.de

PERSON : MR. SHINTARO ONO(Managing Director)

WEBSITE : http://www.rikenkeiki.com/de/

RIKEN KEIKI

# International agents（GREECE）

## ZERVOUDAKIS MARINE SUPPLIES LTD.

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FAX : +30-210-4627900

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E-MAIL : sales@gms-instruments.nl

PERSON : MR. SEBASTIAN KELDERMAN AND MR. MARKUS FRANK

WEBSITE : http://gms-instruments.nl/

RIKEN KEIKI

# International agents（NORWAY）

## MARTIN BRUUSGAARD & CO. AS.

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| ADDRESS : | LOKKETANGEN 20A, 1337 SANDVIKA NORWAY<br>P.O. BOX 3, 1301 SANDVIKA NORWAY |
| TEL : | +47-6754-9330 |
| FAX : | +47-6754-9331 |
| E-MAIL : | dag@bruusgaard.no |
| PERSON : | MR. DAG MAARTMANN |
| WEBSITE : | http://www.bruusgaard.no/ |

RIKEN KEIKI

# International agents（TURKEY）

## DOGANAK COLL. CO.


| | |
|---|---|
| ADDRESS : | KARAKOY, OKCUMUSA CADDESI, IPEK CIKMAZI,<br>BOGAZICI HAN NO:6 KAT:2<br>34420 ISTANBUL, TURKEY |
| TEL : | +90-212-244-5318 / 245-2512 |
| FAX : | +90-212-243-5704 |
| E-MAIL : | doganak@doganak.com |
| PERSON : | MR. MEHMET ALI AKYUZ |
| WEBSITE : | http://www.doganak.com/ |


RIKEN KEIKI

# International agents（U.K.）

## WEATHERALL EQUIPMENT & INSTRUMENTS LTD.


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TEL : +44 1296 622180

FAX : +44 1296 624955

E-MAIL : sales@weatherall-uk.com

PERSON : MR. R.H.C. WORTHINGTON

WEBSITE : http://weatherall-uk.com/


RIKEN KEIKI

# International agents（U.A.E.）

## METRO　MAC

| | |
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| ADDRESS : | WS 104, DUBAI MARITIME CITY (DMC), DUBAI, U.A.E.<br>P.O.BOX: 13485 DUBAI U.A.E. |
| TEL : | +971-4-5636100 |
| FAX : | +971-4-5519973 |
| E-MAIL : | sales@metromac.com |
| PERSON : | MR. K.K. KUTTY<br>(MANAGING DIRECTOR) |
| WEBSITE : | http://www.metromac.com/ |

RIKEN KEIKI

# International agents（ISRAEL）

## MODCON SYSTEMS LTD.


ADDRESS : MODCON HOUSE M. BORNSHTEIN ST.,
SOUTH AKKO INDUSTRIAL PARK, 24222 ISRAEL

TEL : +972-4-9553955

FAX : +972-4-9553956

E-MAIL : gregorys@modcon.co.il

PERSON : MR. GREGORY SHAHNOVSKY

WEBSITE : http://www.modcon-systems.com/


RIKEN KEIKI

# International agents（SOUTH AFRICA）

## I.S.L. ENTERPRISES (PTY) LTD.


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| ADDRESS : | 29 KLOSSER STREET PAROW 7500 SOUTH AFRICA<br>P.O.BOX 72 PAROW 7499 SOUTH AFRICA |
| TEL : | +27-21-930-2354 |
| FAX : | +27-21-930-2043 |
| E-MAIL : | istvanisl@xsinet.co.za |
| PERSON : | MR. I.S. LADANYI |


RIKEN KEIKI

# International agents（RUSSIA）

## TAIRIKU TRADING CO., LTD.

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| ADDRESS : | Head office in Tokyo, Japan KAJITANI DAIICHI BUILDING, 21-10, SHINKAWA 2-CHOME, CHUO-KU, TOKYO 104-0033, JAPAN |
| TEL : | +81-3-6222-0194 FAX: +81-3-6222-0201 |
| E-MAIL : | tairiku@tairiku-trading.co.jp |
| PERSON : | MR. MORITA |
| WEBSITE : | http://www.tairiku-trading.co.jp/?lang=en |

## OOO"TAIRIKU MOSCOW LTD."

| | |
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| ADDRESS : | RUSSIAN FEDERATION, 119049, MOSCOW, KOROVY VAL STREET,7, BUILDING 1, FLOOR 2,OFFICE 12 |
| TEL : | +7-495-237-18-82 +7-495-237-19-26 |
| FAX : | +7-495-931-99-47 |
| E-MAIL : | tairiku.alpeev@co.ru, ofistrk@online.ru |
| PERSON : | MR. ALPEEV M.A., (MANAGER) |


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