

Oxygen Detector

KS-70

Instruction Manual

- Keep this manual for easy reference.
- Carefully read this manual prior to use.
- This manual describes the standard model. If your unit has end-user-specific options, this manual will be superseded by your delivery specifications.



NEW COSMOS ELECTRIC CO., LTD.

Instruction Manual No.
GAE-052-06
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1. Introduction

Thank you for purchasing the New Cosmos KS-7O oxygen detector.


To ensure safe and reliable operation, please read this instruction manual prior to use.


This unit detects oxygen leakage/deficiency in working environments, e.g., semiconductor manufacturing plants and laboratories, and relays the oxygen concentration value as an analog signal (4-20mADC) to external devices while simultaneously displaying the concentration value on its display.


Oxygen levels are monitored, and if the concentration reaches a preset level, the unit will produce audio/visual alarms and activate relay contacts.

SYMBOLS

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

 **DANGER** : Indicates an imminently hazardous situation that can result in death or serious injury.

 **WARNING** : Indicates a potentially hazardous situation that may result in death or serious injury.

 **CAUTION** : 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.
- Follow the precautions below to ensure safe operation.
- Only use this product in accordance with the applicable laws and regulations.
- Only a qualified electrician with knowledge of wiring and installation procedures should perform wiring and installation.

WARNING

- In the event of a gas alarm, follow the safety procedures in accordance with your company's regulations.
- This product is not explosion-proof and should not be installed in a hazardous area.
- Secure the cover by tightening the two fastening screws. Proper gas detection is not possible if the cover is not tightly closed.

CAUTION

- Do not disassemble, modify, or alter the structure of this unit or its electrical circuits. Doing so may compromise the performance of the product.
- This product is not drip-proof and should be kept away from water.
- When using the detector's analog output to display gas concentrations using high-layer monitoring software, perform a 21% suppression setting using the high-layer monitoring software.
- The detector's analog output resolution ranges from 250 to 500 (contingent on full scale setting). Because of the difference in resolution or number of displayed gas concentration digits between this product and high-layer monitoring software, or connected impedance, some errors in displayed gas concentration value may be observed.
If the fault threshold needs to be set via analog output, set it to 1.0 mA.
- To comply with JIS T 8201:2010 (Japanese Industrial Standard), your unit should be configured for manual-resetting. Specify manual-resetting type at time of order. If a self-resetting type is chosen and manual-resetting is maintained using a high-layer system, a self-resetting type of detector can be used to comply with this standard.

NOTE

Operation during power outage

- In the event of a power outage during operation, the detector will cease operation if the backup battery is not installed. The detector will automatically resume operation once power is restored, as long as the main power switch, under the cover, is in the on (up) position. A backup battery is included in the package (not pre-installed) when delivered. Install it into the detector if the detector needs to continue running during a power outage.
- If the backup battery level becomes very low while the detector operates on the backup battery, "E-B" (Backup battery is Empty) will be displayed on the LCD. If the detector continues operating while "E-B" is displayed, it will cease operation automatically to prevent over-discharge. In this case, the detector will not automatically resume operation even if power is restored.
- Remove the backup battery from the detector before a planned power outage etc., if the detector is expected to operate on the backup battery for an extended period of time.
- Refer to 8-2. "Backup/Clock Battery Replacement" for battery installation/removal/replacement. Under normal condition, the detector's operation will not be affected whether the backup battery installed or removed.

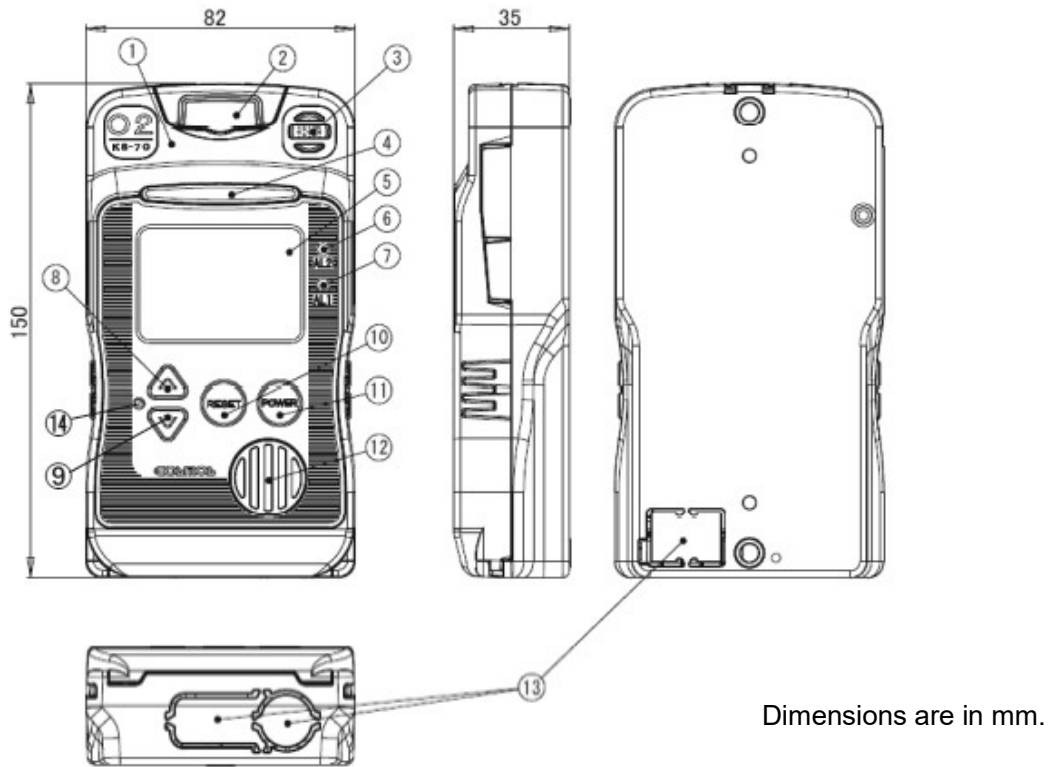
3. Package Contents

The following items are included in a standard package. If any items are missing or damaged, please contact New Cosmos or its authorized representative for replacement.

| Item | Quantity | Description |
|------------------------------|----------|--|
| Oxygen detector | 1 | KS-7O |
| Mounting screw | 2 | M5x12 with spring washer (wall mounting) |
| Cable tie | 1 | To be used to bundle electric cables |
| Pin terminal | 9 | To be crimped to cables and inserted into the terminal block |
| Insulating sleeve | 9 | To be installed in a crimped pin terminal to provide insulation |
| Instruction manual | 1 | This manual |
| Inspection certificate | 1 | |
| Backup battery | 1 | CR2 lithium battery |
| AC power cable (Optional) | 1 | 100 VAC power cable with 2-pin power plug at one end and two pin terminals at the other end Length: 2.5 m Note: AC power cable is not included unless specified at the time of order, even though your unit has AC power option. |

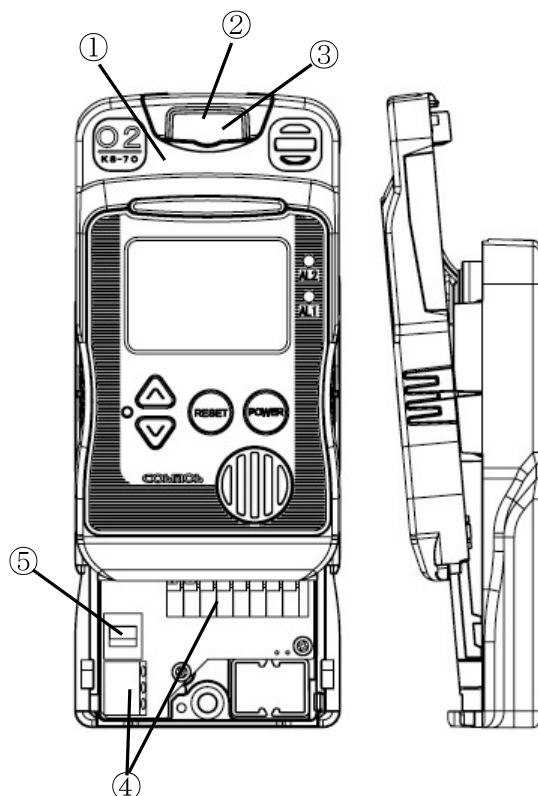
4. Unit Dimensions and Components

4-1. Outer Appearance



| Item | Component | Description/Function |
|------|------------------------------------|---|
| 1 | Cover | Slide up and lift the cover to access to the main power switch and to wire external cables. This cover is normally closed. |
| 2 | Screw cover | Houses one mounting screw, and two fastening screws that attach the cover to the unit. This cover is normally closed. |
| 3 | Gas detection port | Gas inlet to the oxygen sensor. |
| 4 | Status indicator (red/amber/green) | During normal operation all three green internal LEDs are lit. In the event of an 1st/2nd stage gas alarm, four internal amber/red LEDs light sequentially. |
| 5 | LCD | Displays oxygen concentration, parameter values, error code, and status icons. |
| 6 | AL2 alarm LED (red) | Flashes red in the event of a 2nd stage gas alarm. The LED will become solid if reset by pressing the RESET button. |
| 7 | AL1 alarm LED (amber) | Flashes amber in the event of a 1st stage gas alarm. The LED will become solid if reset by pressing the RESET button. |
| 8 | ▲ (Up) button | During normal operation, press to display the highest peak value of oxygen concentration after powering-up on the LCD. Used for making settings in combination with other button operation. |
| 9 | ▼ (Down) button | During normal operation, press to display the lowest peak value of oxygen concentration after powering-up on the LCD. Used for making settings in combination with other button operation. |
| 10 | RESET button | During normal operation, press to display the full scale and alarm set values. Used for muting an on-going audio alarm. |
| 11 | POWER button | Press and hold for 3 seconds to turn on/off the detector. |
| 12 | Speaker opening | Opening for audio. |
| 13 | Cable entry (3 places) | Make a cutout (cable entry) with a nipper to connect external cables to the terminals. |
| 14 | Maintenance button | Recessed button used for making settings. |

4-2. Inner Components



| Item | Component | Description/Function |
|------|----------------------------|--|
| 1 | Cover | Slide up and lift the cover to access to the main power switch and to wire external cables. This cover is normally closed. |
| 2 | Screw cover | Houses one mounting screw, and two fastening screws that attach the cover to the unit. This cover is normally closed. |
| 3 | Fastening screw (2 places) | Located under the screw cover. Screws that attach the screw cover to the unit. |
| 4 | Terminal block | Connect to external wiring. |
| 5 | Main power switch | Turns on/off the main power. |

5. Installation

WARNING

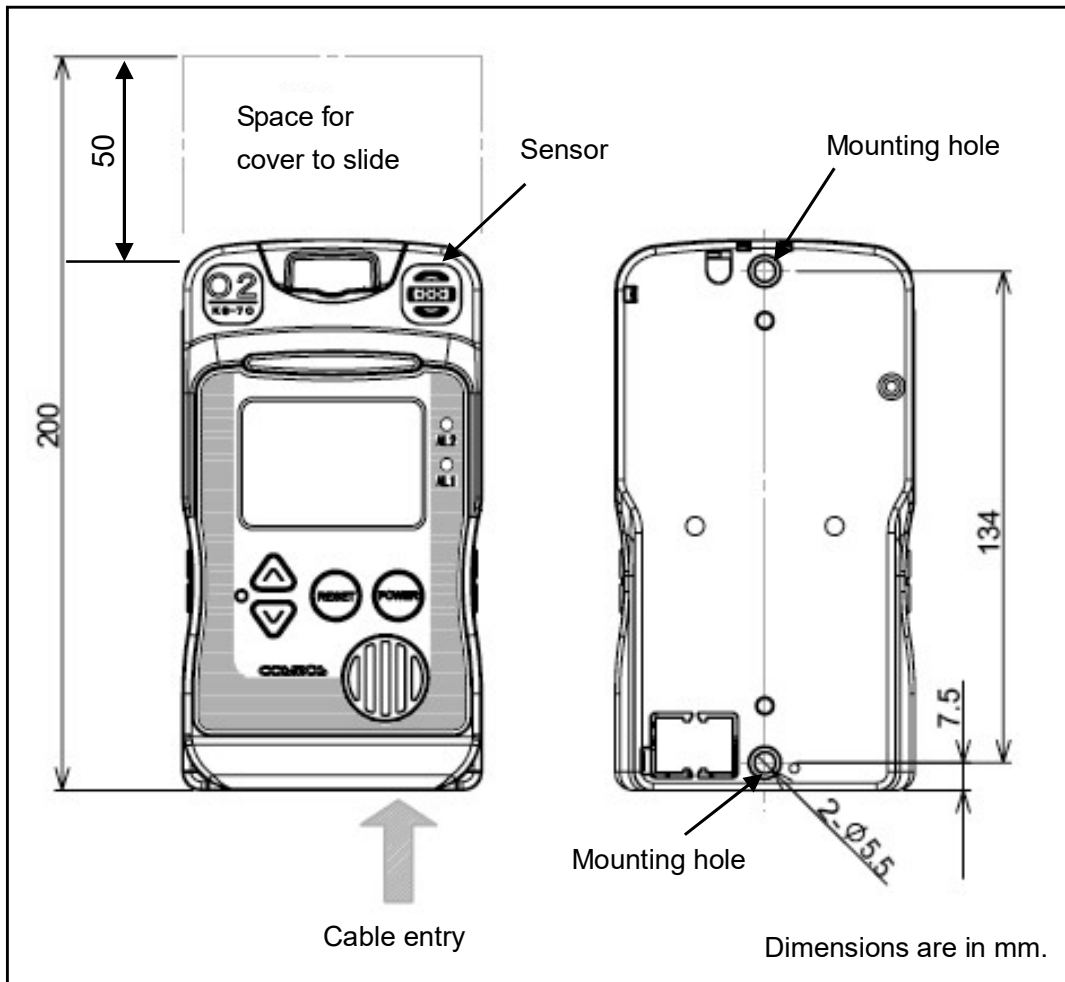
This product is not explosion-proof and should not be installed in a hazardous area.

CAUTION

- Avoid strong mechanical shock, impact or vibration to the detector by dropping or bumping. Failure to do so may impair the performance of the detector.
- Do not install the detector in the following conditions.
 - Outdoors
 - Exposure to water spray
 - Outside the following operating temperature/humidity
 - 10 to +40 °C (no rapid temperature change)
 - 30 to 85% RH (no condensation)
 - Presence of corrosive gas
 - Exposure to impact or vibration
 - Presence of high frequencies or a magnetic field
 - Exposure to electrical noise
- Install the detector in a location that ensures easy access for maintenance.
- For detecting oxygen deficiency, the detector should be installed at head height in a place free from obstruction to the gas detection port.
- When used in a measurement environment where the atmospheric pressure is different from the standard atmospheric pressure, e.g., at a high altitude, the measurement value should be adjusted to compensate for the oxygen sensor's pressure dependence.
- Secure the cover by tightening the two fastening screws. Proper gas detection is not possible if the cover is not tightly closed.

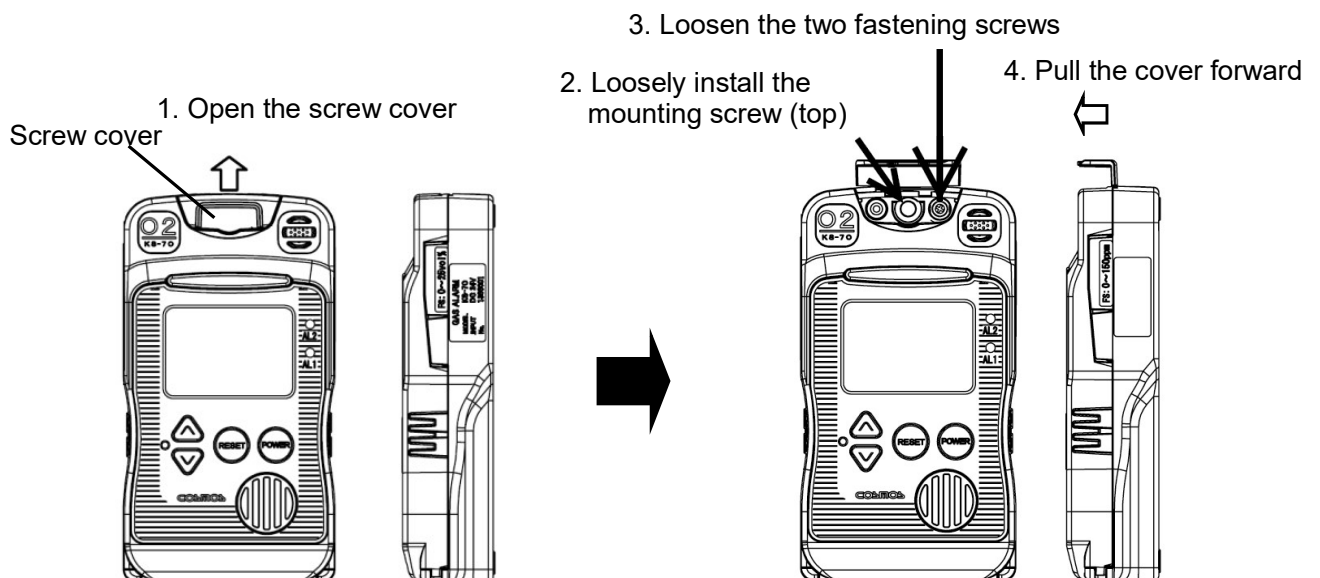
NOTE

- Leave a distance of more than 30mm from each side of the detector for removal purpose.
- Leave a distance of more than 50mm from the top of the detector to allow the cover to slide open.
- Leave enough space for cable wiring below the detector.

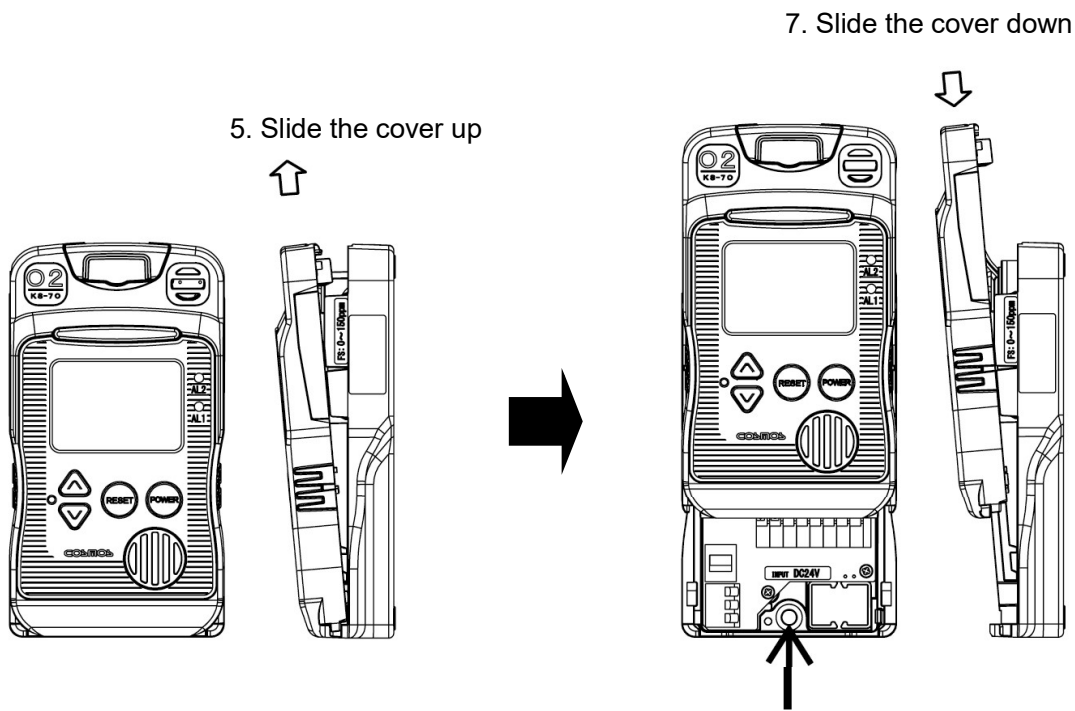


Wall-mount the detector using two M5 mounting screws (pitch: 134) according to the following procedure.

1. Open the screw cover.
2. Loosely install the mounting screw (top).
3. Loosen the two fastening screws.
4. Slightly pull the cover forward.



5. Slide the cover up (cover is open).
6. Firmly tighten the mounting screw (bottom) to secure the detector to the wall.
7. Slide the cover down (cover is closed).



7. Slide the cover down

6. Tighten the mounting screw (bottom)

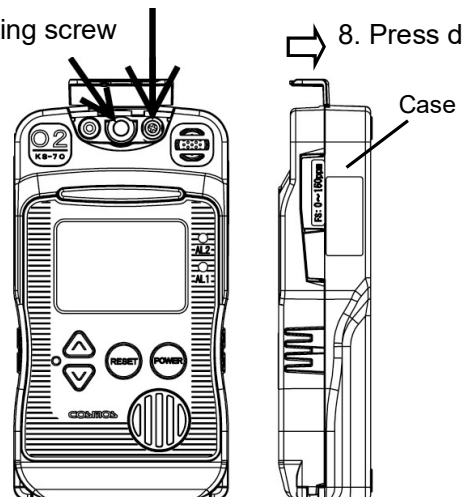
8. While pressing down the cover toward the case,
9. tighten the mounting screw (top).
10. Secure the screw cover to the case with the two fastening screws.
11. Close the screw cover.

CAUTION
Secure the cover by tightening the two fastening screws. Proper gas detection is not possible if the cover is not tightly closed.

10. Tighten the two fastening screws

9. Tighten the mounting screw

8. Press down the cover



6. Wiring

⚠ WARNING

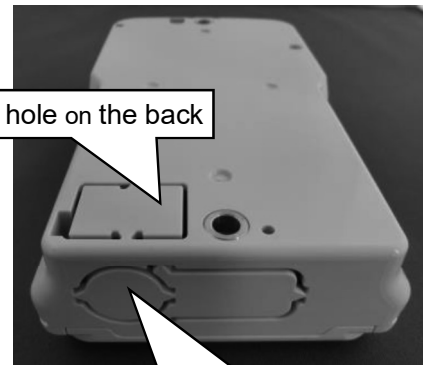
- Remove any power source during wiring work to prevent electric shocks.
- After wiring is completed, close the detector's cover to prevent electric shocks.

⚠ CAUTION

- New Cosmos is not responsible for the cost or any damage resulting from controlling external equipment (e.g., interlock) by using the oxygen concentration outputs (e.g., analog output, alarm relay contact output) from this product.
- Connect wires to their corresponding terminals by referring to the marking on the terminal block.
- Keep the connection cable away from the electrical power line.
- When using with external devices, isolate the product's 4-20mA analog output from power lines of external devices in order to prevent inflow current and noise.

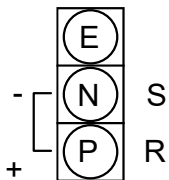
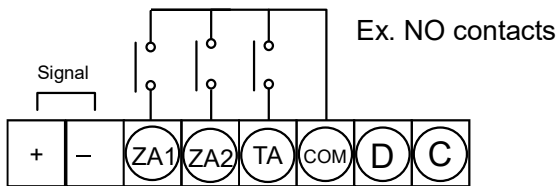
The knockout holes for cable entry are provided on the back and bottom of the unit, and can be removed using a nipper.

Use a shielded cable (with 0.5 to 1.25 mm² wires) up to 500 m in length with an outside diameter of 10.5 mm or less.



NOTE

- Refer to page 12 for the wiring procedure for the optional AC power cable.
- Refer to 7-3-2 "Normal Operation Status" on page 15 for the operation of the backup battery.



| | | | |
|--------|----|---|-----------------------------------|
| AC | DC | | Power supply 24 VDC or 100 VAC |
| R | P | + | |
| S | N | - | |
| E | | Earth terminal for grounding the detector | |
| Signal | | + | Analog output |
| | | - | 4-20mADC |
| ZA1 | | 1st stage alarm relay contact (Dry NO or NC) | |
| ZA2 | | 2nd stage alarm relay contact (Dry NO or NC) | |
| TA | | Fault alarm relay contact (Dry NO or NC) | |
| COM | | Common | |
| D | | Not used | |
| C | | | |

NO: Normally Open NC: Normally Closed

6-1. Pin Terminal/Insulating Sleeve Installation

Recommended parts/tools

| Part | Model (Manufacturer) | Description |
|-------------------|----------------------|---|
| Electric cable | | Shielded cable (with 0.5-1.25 mm ² wires) Outer diameter: 10.5 mm or less |
| Pin terminal | TC1.25-16 (Nichifu) | (Included in package) Used for 0.25-1.65 mm ² twisted wire |
| Insulating sleeve | VC1.25 (Nichifu) | (Included in package) |
| Crimping tool | NH1 (Nichifu) | 1.25 |

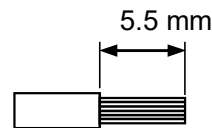
Terminal block (reference)

| Part | Model (Manufacturer) | Description |
|--------------------------------|---|------------------|
| Power terminal block | ML-1400-S1L-3P (Sato Parts) | Dia. 0.65-1.6 mm |
| External output terminal block | FFKDSA1/H1-5, 08-8 (Phoenix Contact) | Dia. 0.2-1.5 mm |

1. Wire stripping

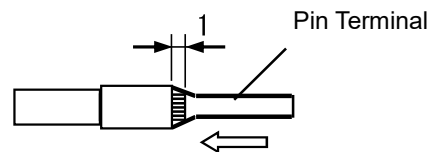
Strip the wire.

Recommended stripped wire length: 5.5 mm



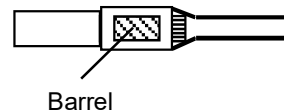
2. Pin terminal installation

Insert the stripped wire into a pin terminal until 1 mm of stripped wire can be seen from the end of the pin terminal's barrel.



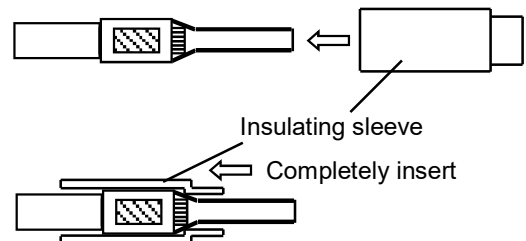
3. Terminal crimping

Crimp the center of the barrel.



4. Insulating sleeve installation

Attach an Insulating sleeve to the crimped pin terminal.



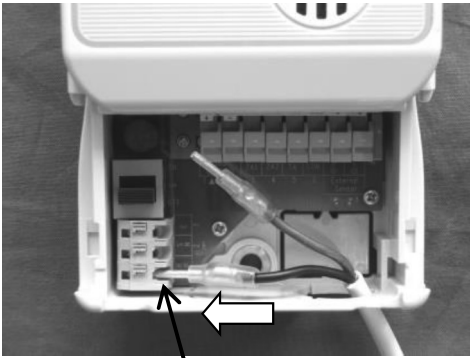
NOTE

Completely insert the pin terminal into the insulating sleeve. Not doing so may cause an insufficient pin length when wired to the terminal block, which may result in a poor connection.

6-2. Wire Connection/Disconnection to/from Terminal Block

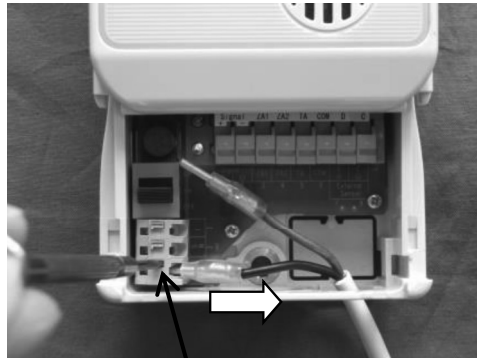
6-2-1. Power Terminal Block

(Connection)



Insert each pin terminal to its corresponding slot on the terminal block.

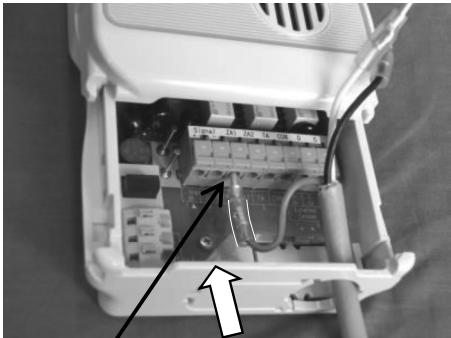
(Disconnection)



While pressing the release button with a precision screwdriver (recommended tip thickness: 2.6 mm), lift the pin terminal.

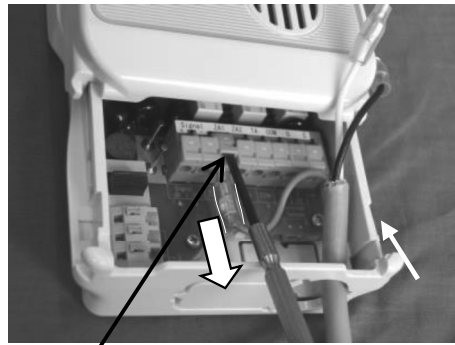
6-2-2. External Output Terminal Block

(Connection)



Insert each pin terminal to its corresponding slot on the terminal block.

(Disconnection)

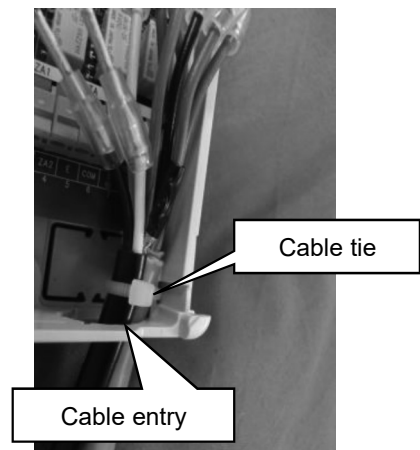


While pressing the release button with a precision screwdriver (recommended tip thickness: 3.0 mm), lift the pin terminal.

6-3. Cable Tie Installation

Use a cable tie for bundling the in-coming cables through the cable entry and secure them to the unit's wall.

The unit has a cable tie holder inside its case near the bottom. Pre-install a cable tie by feeding it through the tie holder and make a loop. To easily bundle the wiring of in-coming cables to the terminal block, feed these cables through this loop and secure to the case wall.



6-4. AC Power Cable (PC0125) Wiring Procedure

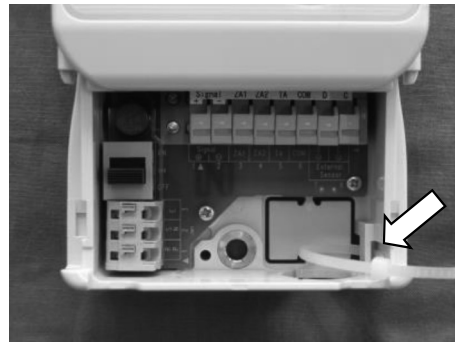
1. Make a cutout (cable entry) on the bottom of the unit with a nipper.

Note: The knockout holes for cable entry are provided on the back and bottom of the unit, and either can be used as cable entry.

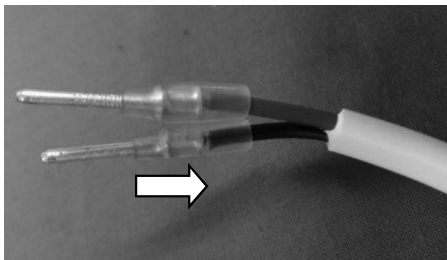


Cut here (2 places)

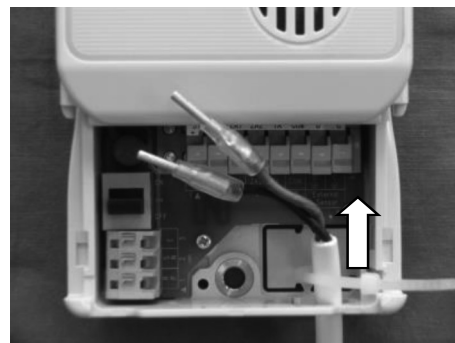
2. Install a cable tie by feeding it through the tie holder and make a loop.



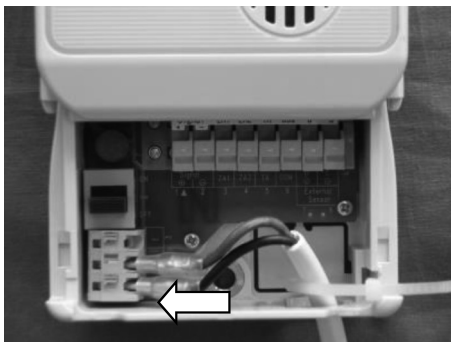
3. Ensure that the insulating sleeves are completely installed to the pin terminals of the AC power cable.



4. Feed the AC power cable through the cable entry and the loop of the cable tie.



5. Insert the pin terminals into the slots (Nos. R and S) on the terminal block.
Note: Either pin terminal can be connected to either slot.



6. Pull the cable tie to secure the AC power cable to the case wall. Cut off the excess strap with a nipper.



7. Operation

7-1. Precautions before Use

⚠ WARNING

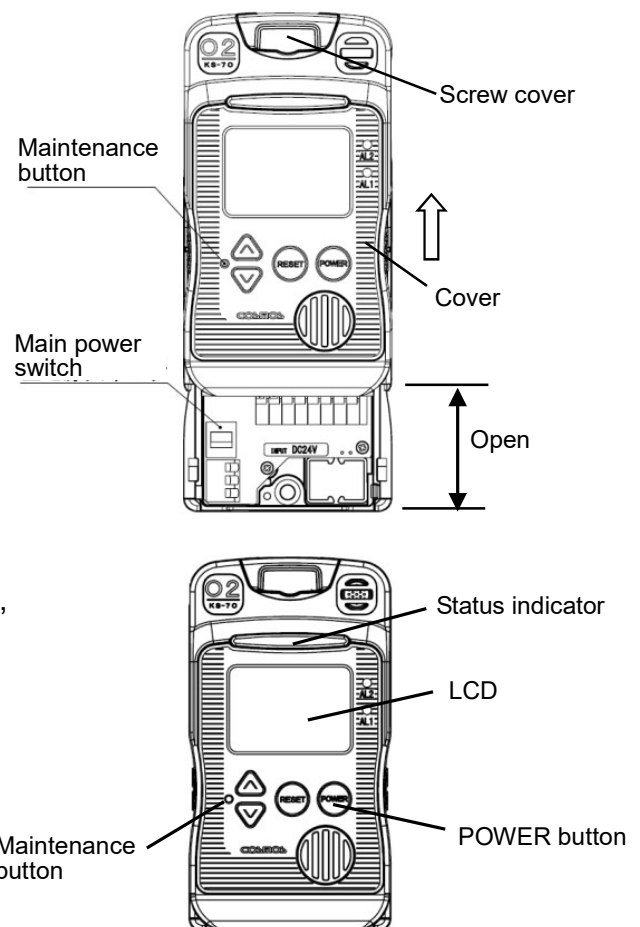
- Before tuning on the unit, confirm that the power supply is:
24 VDC±10% when DC power is used.
100 VAC±10% and 50/60Hz±10% when AC power is used.

⚠ CAUTION

- Before turning on the unit, check that all wiring is correct. (Refer to 6. "Wiring" or delivery specifications if provided.)
- Turn on the unit in clean air.
- When the sensor output is not stable, the external relay contact may possibly activate after the warm-up. To prevent possible activation of the external relay contact after the warm-up is completed, release the interlocks of the external devices, as needed.
- During the warm-up, the analog signal is output and the external relay contacts are disabled.

7-2. Operating Procedure

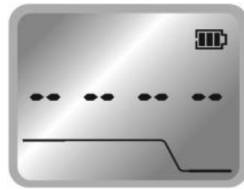
- 1) Follow Steps 1, 3, 4, and 5 of 5. "Installation" to slide up and open the cover (cover is not fully opened).
 1. Open the screw cover.
 3. Loosen the two fastening screws.
 4. Slightly pull the cover forward.
 5. Slide the cover up (cover is open).
- 2) Set the main power switch to the on (up) position.
- 3) Follow Steps 7, 8, and 10 of 5. "Installation" to close the cover and tighten the screws.
 7. Slide the cover down (cover is closed).
 8. While pressing down the cover toward the case,
 10. secure the screw cover to the case with the two fastening screws.



⚠ CAUTION

Secure the cover by tightening the two fastening screws. Proper gas detection is not possible if the cover is not tightly closed.

- 4) Press and hold the POWER button for 3 seconds to turn on the detector (two beeps). The three green LEDs inside the status indicator start flashing and "-- -- -- --" is displayed on the LCD. The warm-up cycle lasts 30 seconds.



Warm-up cycle



Normal operation

- 5) When the warm-up cycle is completed, the three green flashing LEDs inside the status indicator become solid, the gas concentration is displayed on the LCD, and normal operation starts.
- 6) Perform a span adjustment (21.0 vol%).

⚠ CAUTION

- To prevent a possible activation of alarm or external alarm relay contact, switch to the Maintenance mode to ON before performing a span adjustment. (Refer to 7-4-2. "Switching Maintenance Mode On/Off".)
- Check that there is no gas present before span adjustment. Proper gas detection is not possible if a span adjustment is performed in a gas atmosphere.
- When a span adjustment is completed, switch the Maintenance mode to OFF. External alarm relay contacts or audio alarm are not active while the unit is in the Maintenance mode.

NOTE

Use a rounded pin (e.g., precision screwdriver) for pressing the maintenance button.

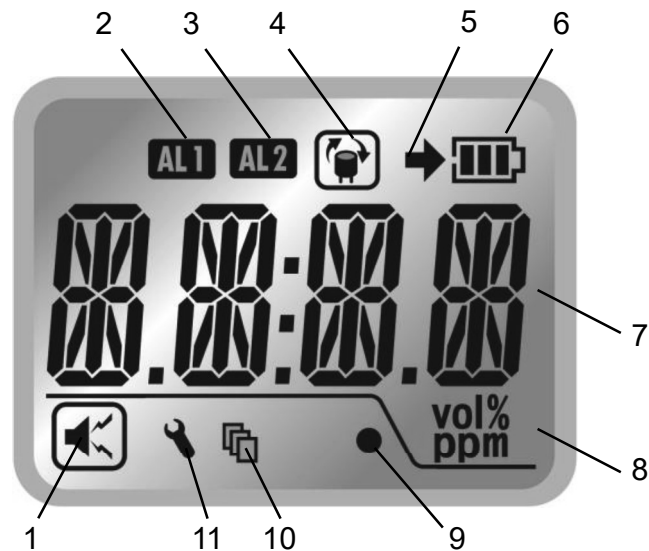
1. Enter the User mode. (Refer to 7-4-1. "User Mode Operation")
 2. Switch the Maintenance mode to ON. (Refer to 7-4-2. "Switching Maintenance Mode On/Off")
 3. Perform a span adjustment. (Refer to 7-4-4. "Span Adjustment")
 4. Switch the Maintenance mode to OFF.
- 7) Perform an alarm test by referring to 7-4-5. "Alarm Test".
Confirm that an alarm activates.
- 8) To turn off the detector, press and hold the POWER button for 3 seconds to stop the operation, then set the main power switch to the off (down) position.

NOTE

Once the POWER button is turned off, the backup power is not available. The backup power is activated if the main power switch is turned off, as long as the POWER button is in the on position.

7-3. LCD Operation

7-3-1. LCD



| Item | Icon/Display | Description/Function |
|------|-------------------------------------|--|
| 1 | Audio alarm icon | Always present |
| 2 | AL1 icon | 1st stage gas alarm notification |
| 3 | AL2 icon | 2nd stage gas alarm notification |
| 4 | Sensor replacement icon | Sensor needs to be replaced |
| 5 | Backup battery icon | Unit is operating on the backup battery |
| 6 | Backup battery level indicator | Battery level of the backup battery used during power outage |
| 7 | Concentration value and information | Oxygen concentration value, parameter values, error code, etc. |
| 8 | Unit of measurement | A unit of gas concentration |
| 9 | Clock battery level indicator | Clock battery level is low |
| 10 | Alarm history icon | Alarm history is being accessed |
| 11 | Maintenance mode icon | Maintenance mode is active |

7-3-2. Normal Operation Status

During normal operation the green status indicator is fully lit, the gas concentration value is displayed on the LCD, and the AL1 and AL2 alarm LEDs are off.

NOTE

When the detector operates on the backup battery, unlike when it is driven by 24 VDC or 100 VAC power supply,

- The status indicator is not lit during normal operation and it sequentially flashes in the event of a 1st/2nd stage gas alarm.
- The analog output is 0 mA (no output).
- The external relay contacts are disabled.
- The audio volume is lower.

Operation buttons

| | |
|--|--------------------|
| | POWER button |
| | RESET button |
| | ▲ (UP) button |
| | ▼ (DOWN) button |
| | Maintenance button |

7-3-3. Full Scale and Alarm Set Values Display

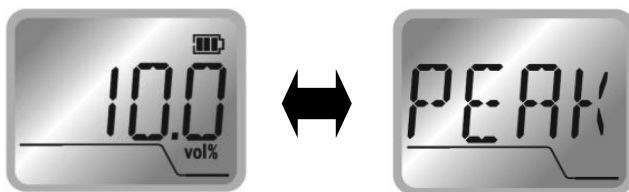
Press the RESET button (one beep) to display the “full scale concentration”, “1st stage gas alarm set value”, and “2nd stage gas alarm set value” in sequence.



Full scale: 25.0 vol% 1st stage gas alarm set value: 19.0 vol% 2nd stage gas alarm set value: 18.0 vol%

7-3-4. Peak Value Display and Reset

Press the ▼ button (one beep). The “lowest peak value after powering-up” and “PEAK” will be displayed alternately.



NOTE Press the ▲ button to display the highest peak value after powering-up.

(Ex. lowest peak value is 10vol%)

To return to the normal gas concentration display, press the RESET button (one beep).

The display will show the full scale value and alarm set value, then return to the normal gas concentration display.

To reset the peak value, press the ▲/▼ button at the same time (two beeps).

The peak value is reset then the display returns to the normal gas concentration display.

7-3-5. Operation during Gas Alarm

When the oxygen concentration reaches the alarm set value, the alarm LED flashes, the status indicator sequentially-flashes and an audio alarm sounds.

NOTE

Audio alarm mute: If the RESET button is pressed during a gas alarm, the audio alarm will be muted and the flashing alarm LED(s) will become solid. If the RESET button is pressed and held, the alarm will not be muted.

- There are two options to clear a gas alarm, manual-resetting and self-resetting. By default, the detector is set to manual-resetting mode. Please specify the alarm clearance option at the time of order, if necessary.
- The alarm hysteresis range is 0.2vol%. The alarm will not be cleared until the oxygen concentration exceeds the alarm set value by more than the hysteresis value. E.g., when the alarm set value is 18.0vol% and an alarm is activated, the alarm will not be cleared until the concentration reaches 18.3vol% or higher.

NOTE

Alarm relay contact reset: If the RESET button is pressed while the concentration is outside the alarm set value, the alarm relay contact will return to its normal position and the alarm LED will turn off.

< 1st stage alarm >

- Amber AL1 alarm LED flashes and the status indicator sequentially-flashes amber.
- Audio alarm beep: Fast, high and low beep tones.
- ZA1 alarm relay contact is closed. (When normally open contacts are used)

< 2nd stage alarm >

- Red AL2 and A1 alarm LEDs flash and the status indicator sequentially-flashes red.
- Audio alarm beep pattern: Very fast high and low beep tones.
- ZA2 alarm relay contact closes and ZA1 alarm remains closed. (When normally open contacts are used)

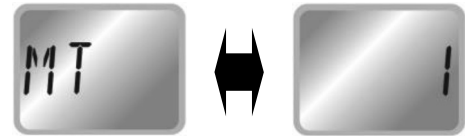
7-4. User Mode

NOTE

- During the User mode, gas detection, alarm operation, analog output, and contact output activation are active as during normal operation mode. However, audio alarm mute and alarm clearance are not active and cannot be used.
- Return to normal operation mode after using the User mode.

7-4-1. User Mode Operation

To enter the User mode, press the maintenance button while the unit is on. After one beep, “1” and its abbreviated mode name “MT” will be alternately displayed.



NOTE

Use a rounded pin (e.g., precision screwdriver) for pressing the maintenance button.

- To select the mode options, use the ▲ and ▼ buttons.
- To confirm your selection, press the maintenance button. To return to the previous step, press the RESET button.
- To execute the selected mode, press and hold the maintenance button for 3 seconds.
- To return to the normal operation mode, press and hold the RESET button for 5 seconds.

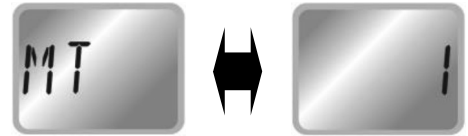
| Mode | Mode name | Abbreviated mode name |
|------|-----------------------------------|-----------------------|
| 1 | Switching maintenance mode on/off | MT |
| 2 | Zero adjustment | 0.0 vol% |
| 3 | Span adjustment | 21.0 vol% |
| 4 | Alarm test | AL T |
| 5 | Alarm history | AL H |
| 6 | Clock setting | DATE |

7-4-2. Switching Maintenance Mode On/Off [Mode1]

WARNING

During the Maintenance mode, the external relay contacts and audio alarm are disabled. Turn off the Maintenance mode during normal operation.

- 1) Enter the User mode. Press the ▲/▼ button to select "1". "MT" and "1" will be alternately displayed.



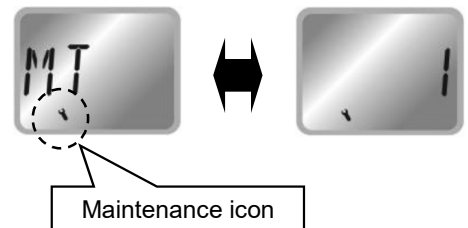
- 2) Press the maintenance button (one beep). "OFF" will flash.



- 3) Press the ▲ button (one beep). "ON" will flash.



- 4) Press and hold the maintenance button for 3 seconds (beep pattern: short-long-short-short) to confirm the selection. The maintenance icon is displayed, and "1" and "MT" will be alternately displayed, indicating that the unit is in the Maintenance mode.



NOTE

If the unit is returned to normal operation mode while in the Maintenance mode, the "concentration value" and "_ _ _ _" will be alternately displayed and the maintenance icon will remain displayed.



- 5) To exit the Maintenance mode, take Steps 1) to 4) above to switch the mode from "ON" to "OFF". Confirm the maintenance icon has turned off.



7-4-3. Zero Adjustment [Mode 2]

 **CAUTION**

On-site zero adjustment is not necessary as units have been zeroed when shipped out.

7-4-4. Span Adjustment (21.0vol% Adjustment) [Mode 3]

 **CAUTION**

Perform a span adjustment in clean air.

- 1) Press the ▲/▼ button to select “3” (each press of the button is followed by one beep). “21.0vol%” (span adjustment concentration) and “3” will be alternately displayed.
- 2) Press the maintenance button (one beep). The measured oxygen concentration (vol%) will be displayed.
- 3) Check that there is no gas present. Press and hold the maintenance button for 3 seconds to start a span adjustment (beep pattern: short-long-short-short). “21.0vol%” and “3” will be alternately displayed, indicating that span adjustment is complete.



(Span adjustment value is 21.0vol%)



(Ex. Current concentration is 20.8vol%)



7-4-5. Alarm Test [Mode 4]

When an alarm test is executed, the alarm test value (concentration) will be displayed on the LCD, and corresponding analog output and alarm outputs (external relay contacts, audio alarm, alarm LEDs) will activate. This will allow the user to test the alarm operation.

NOTE

If the unit is in the Maintenance mode, the external relay contacts and audio alarm are disabled (alarm LEDs and analog outputs are active).

CAUTION

An alarm test activates the external relay contacts of the detector. If the detector's external relay contacts are used to operate the interlocks, etc., of the external devices, release the interlocks beforehand, as needed to prevent a possible activation of the interlocks. Notify those concerned before starting an alarm test or inspection.

- 1) Enter the User mode. Press the ▲/▼ button to select "4" (each press of the button is followed by one beep). "AL T" and "4" will be alternately displayed.



- 2) Press the maintenance button (one beep). The current alarm test value (vol%) will be displayed.



(Ex. Test value is currently set to 18vol%)

- 3) To change the alarm test value (vol%), press the ▲/▼ button.



(Ex. Test value is changed to 10vol%)

NOTE

To increase/decrease the test value, press the ▲/▼ button. Holding the button will continuously increase/decrease the value.

- 4) Press and hold the maintenance button for 3 seconds to start an alarm test (two beeps).

- 5) To cancel the ongoing alarm test, press the RESET button (one beep). The current alarm test value (vol%) will be displayed.

(Note: If the RESET button is pressed and held, the alarm will not be cancelled and the unit will return to normal operation mode.)



(Ex. Test value is currently set to 10vol%)

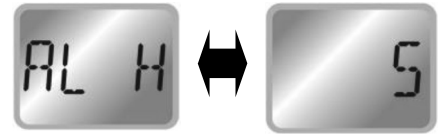
- 6) To change the test value, repeat Steps 3) to 5).

- 7) Press and hold the RESET button for 5 seconds to return to normal operation mode.

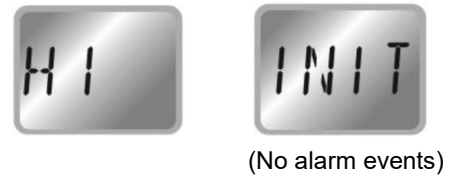
7-4-6. Alarm History [Mode 5]

- Up to the 10 most recent alarm events can be displayed (automatically updated).
- For each alarm event, the following sequence of information is displayed: peak value (vol%) during the alarm, starting and ending times (year/month/day/time) of the alarm.
- Press the RESET button to return to the previous screen.

1) Enter the User mode. Press the ▲/▼ button to select “5” (each press of the button is followed by one beep). “AL H” and “5” will be alternately displayed.



2) Press the maintenance button (one beep) to display the alarm history. The most recent alarm event number “H1” will be displayed. If there is no alarm history event, “INIT” will be displayed.



3) Use the ▲ button (each press of the button is followed by one beep) to select (display) the desired alarm event from H1 to H10.



NOTE

Each press of the ▲ button cycles through alarm events. The sequence is H1, H2, through H10, and INIT. To delete the alarm history, select “INIT”, then press and hold the maintenance button for 3 seconds. (beep pattern: short-long-short-short)

4) Press the maintenance button (one beep). “AL” with history icon and the “peak value vol% during alarm” of the selected alarm event are alternately displayed.



5) Each press of the ▼ button cycles through the details of the selected alarm event. The sequence is: starting year, date, and time and ending year, date, and time of the event.



- 6) Press the RESET button (one beep) to display the selected alarm event number "H *".
To display other alarm event, repeat Steps 3) to 5).



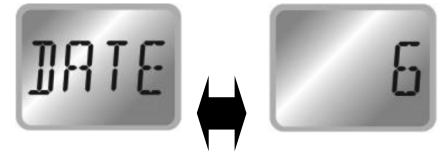
To delete the alarm history, select "INIT" in Step 3), then press and hold the maintenance button for 3 seconds (beep pattern: short-long-short-short). The deletion is complete.



7-4-7. Clock Setting [Mode 6]

Clock is used when recording the alarm history.

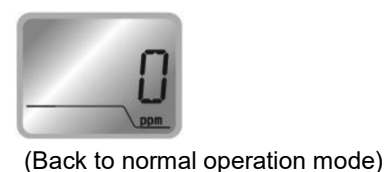
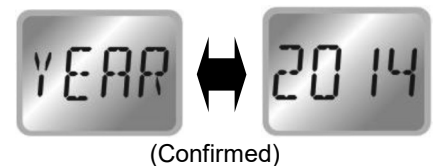
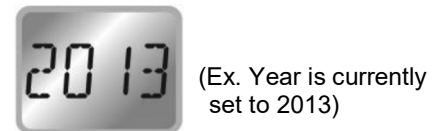
- 1) Enter the User mode. Press the ▲/▼ button to select "6" (each press of the button is followed by one beep). "DATE" and "6" will be alternately displayed.
- 2) Press the maintenance button (one beep). "YEAR" and "**** (year)" will be alternately displayed.
- 3) Select the item to change with the ▲/▼ button. The item and its currently set value will be displayed.



NOTE Each press of the ▲ button cycles through: "YEAR", "MON" (month), "DAY", "HOURL" and "MIN" (minute).

When selecting "YEAR", for example,

- 4) Press the maintenance button (one beep). The currently set year will be displayed.
- 5) Change the set value by using the ▲/▼ button.
- 6) Press and hold the maintenance button for 3 seconds to confirm the change (beep pattern: short-long-short-short). "YEAR" and the set year will be alternately displayed.
- 7) To change the other items, repeat Steps 3) to 6).
- 8) Press and hold the RESET button for 5 seconds (two beeps) to return to normal operation mode.



7-5. Maker Mode

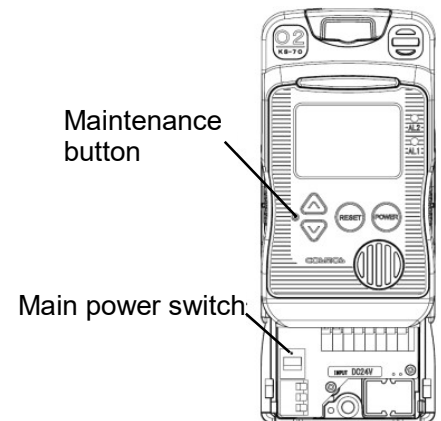
All the items set in the Maker mode (e.g., alarm set value) are password-protected.

WARNING

- Incorrect settings in the Maker mode may change the detector's specifications. Never operate in a way other than as described in this instruction manual.
- Only a selected administrator should have the authority to make changes in the Maker mode.
- Gas detection is not possible during the Maker mode. To exit the Maker mode and return to normal operation, power cycle the unit before use.

7-5-1. Maker Mode Activation

First, turn off the detector. Simultaneously press and hold down the ▲ and ▼ and POWER buttons for 3 seconds (two beeps) to activate the Maker mode. The software version is displayed then all the LCD segments turn on, and finally "775" starts flashing. Now the Maker mode is active.



7-5-2. Operating Time Refresh

This detector is designed to notify when a sensor needs replacement (refer to 8-1.5) "Sensor Replacement"). Reset the operating time to zero after battery replacement.

- 1) Read 7-5. "Maker Mode" including the WARNING beforehand. Enter the Maker mode. Now "775" is flashing.
- 2) Press the ▲ button twice (two beeps) to change the password from 775 to 777. Now "777" is flashing.



WARNING

Before moving to the next step, "777" must be displayed. If this step is not taken, it may change the detector's specifications.



- 3) Press the maintenance button (one beep). “4mA” will be displayed.

NOTE Use a rounded pin (e.g., precision screwdriver) for pressing the maintenance button.






- 4) Press the ▲ button (one beep).
The total operating time will be displayed in hex notation.

WARNING
Before moving to the next step, “total operating time” must be displayed. If this step is not taken, it may change the detector’s specifications.



(Ex. Total operating time is 2239 or 1 year)

NOTE Each press of the ▲ button cycles through the details of total operating time. The sequence is shown below.

Total operating time

- 5) Press and hold the maintenance button for more than 3 seconds (beep pattern: short-long-short-short).
The “operating time” will be reset to “0”.

NOTE If the operating time refresh is not successful, two beeps are heard and the value does not become “0”. In this case, press and hold the POWER button for 3 seconds to turn off the unit, then repeat the procedure. If the unit still fails to refresh, contact your New Cosmos representative for repair.



(Total operating time is reset)

- 6) To end the refresh, press and hold the POWER button for 3 seconds to turn off the unit.

7-5-3. Alarm Set Value Change

- 1) Read 7-5. “Maker Mode” including the WARNING beforehand. Enter the Maker mode. Now “775” is flashing
- 2) Press the maintenance button (one beep).
“AL 1” will be displayed and the AL1 alarm LED will turn on.



“775” flashes

NOTE When the alarm stage displayed is the upper limit, its corresponding alarm light flashes at a one-second interval.



- 1) Use the ▲/▼ button (one beep) to select the alarm stage.

NOTE

Each press of the ▲ / ▼ button alternates between “AL 1” and “AL 2”.



(1st stage alarm)



(2nd stage alarm)

- 2) Press the maintenance button (one beep) to confirm the selection. The current alarm set value for the selected alarm stage will be displayed.



(Ex. AL1 alarm set value is currently set to 19.0vol%)

- 3) Change the alarm set value by using the ▲/▼ button.



(Ex. Changed to 19.5vol%)

- 4) Press and hold the maintenance button for more than 3 seconds (beep pattern: short - long - short - short) for confirmation. The new alarm set value has been set and “AL1” or “AL2” is displayed.

NOTE

If the alarm set value change is not successful, two beeps are heard and the previous set value remains displayed. In this case, press and hold the POWER button for 3 seconds to turn off the unit, then repeat the procedure. If the unit still fails to change the alarm set value, contact your New Cosmos representative for repair.



- 5) To change another alarm set value, repeat Steps 3) to 6).
- 6) To end the procedure, press and hold the POWER button for 3 seconds to turn off the unit.
- 7) Press and hold the POWER button for 3 seconds to restart the unit in normal operation mode. Check the alarm set values. (Refer to 7-3-3. “Full Scale and Alarm Set Value Display”.)

8. Maintenance

Daily checks are carried out by the user, while monthly and annual inspections are performed by the user, New Cosmos or its authorized representative.

Important Notice for Maintenance

In order to ensure the reliability of the gas detector, it is vital to perform periodic sensor replacement. While it is possible for the user to perform the replacement, it is highly recommended that a maintenance contract with a local New Cosmos representative be made for the performance of scheduled sensor adjustment and replacement.

8-1. Inspection Contents and Frequency

| Check items | Start-up | Expansion or relocation | Periodic Inspection | | Daily check |
|----------------------------|----------|-------------------------|---------------------|--------|-------------|
| | | | Monthly | Annual | |
| 1) Concentration display | √ | √ | | | √ |
| 2) Backup battery level | √ | √ | | √*1 | √ |
| 3) Alarm test | √ | √ | √ | | |
| 4) 21.0 vol% adjustment *2 | | | √ | | |
| 5) Sensor replacement | | | | √*3 | |

*1. Regardless of the battery level, the first battery replacement should be done within 3 years from the purchase date. Succeeding replacements should be done every 3 years.


*2. Perform a 21.0vol% adjustment in clean air.

*3. The first sensor replacement should be done within 1 year from the purchase date. Succeeding replacements should be done every year.


1) Concentration Display

Check that the oxygen concentration is displayed on the LCD and that the detector operates properly.

2) Backup Battery Level

- Check the backup battery level on the LCD. If the low battery icon  appears (indicating 70 hours or less of operation), then battery replacement is recommended.
- The unit can continuously operate for about 350 hours with a new backup battery (at 20°C, with no alarm activation and backlight being off).

NOTE

- Backup powering is not possible while the empty battery alert icon  is flashing. A low battery does not affect the detector's operation, but replace the battery or remove it from the unit in order to prevent possible battery leakage.
- If a gas alarm occurred while the backup battery was being used, a significant amount of battery was consumed. Battery replacement is recommended.
- Even though the backup battery was unused, replace it every 3 years to prevent possible battery leakage. (Replace the clock battery every 10 years regardless of its battery level.)
- Refer to 8-2. "Sensor/Backup Battery/Clock Battery Replacement" for battery replacement procedure.

3) Alarm Test

Check that an alarm activates correctly by referring to 7-4-5. "Alarm Test".

CAUTION

- Perform an alarm test in accordance with the applicable local laws and regulations. For example, the applicable law in Japan specifies that alarm activation must be checked by performing a circuit check once every month.
- An alarm test activates the external relay contacts of the detector. If the detector's external relay contacts are used to operate the interlocks, etc., of the external devices, release the interlocks beforehand, as needed to prevent a possible activation of the interlocks. Notify those concerned before starting an alarm test or inspection.

4) 21.0 vol% Adjustment

- Check that the displayed concentration is 21.0% while in clean air. If not, perform a span adjustment by referring to 7-4-4. "Span Adjustment".
- If the indication differs greatly from 21.0vol% or other error is found, the sensor needs to be replaced.

NOTE

The output of a galvanic cell sensor is commensurate with oxygen partial pressure in the atmosphere. Therefore, the concentration indication may be affected by an atmospheric pressure change even though the oxygen concentration itself is unchanged.

CAUTION

- Perform 21.0 vol% and span adjustments in clean air.
- Proper gas detection is not possible if 21.0 vol% and span adjustments are incorrectly performed.

5) Sensor Replacement

Even if the detector is unused for a long period of time, replace the sensor one year from the purchase date. (Refer to 8-2. "Sensor/Backup Battery/Clock Battery Replacement.")

NOTE

This detector counts each hour while it is on. When the total operating time reaches one year, sensor replacement alert will be notified by audio alarm and onscreen indication. The audio alarm sounds at a one-minute interval. To mute the audio alarm, press the RESET button. The muted audio alarm will become audible, once the detector is power cycled. To mute the resumed audio alarm, press the RESET button.

* The sensor replacement alert is set to on by default when shipped out, and it can be muted if specified. Please specify the mute option at the time of order, if necessary. Onscreen sensor replacement alert is always set to on regardless of the audio setting.

CAUTION

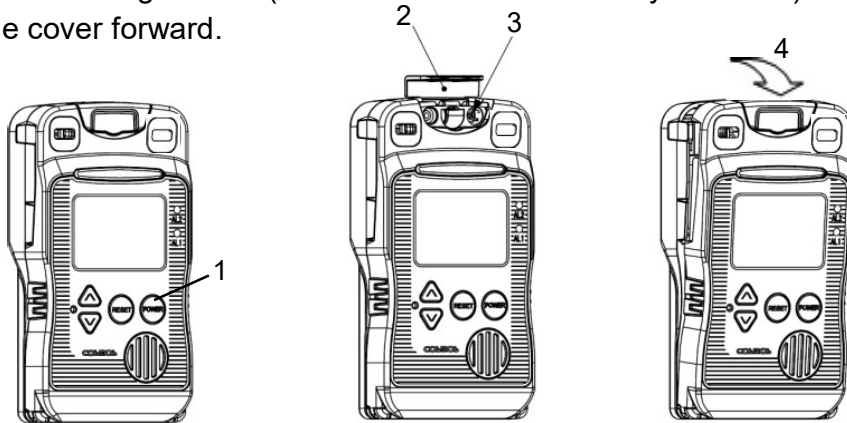
- Replace the oxygen sensor (Part No. OS-3M-K) with a new one once every year.
- Install a new sensor into the detector before its shelf life expires. The shelf life is one year from the production date indicated on the sensor package.
- For sensor replacement, the detector needs to be turned off. When detector's outputs are used to control the interlocks, etc. of the external devices, release the interlocks as needed.
- Perform a span adjustment of the newly installed oxygen sensor after more than 30 minutes from removing the sensor from its shipping package.

8-2. Sensor/Backup Battery/Clock Battery Replacement

⚠ CAUTION

- Use a “CR2 lithium battery, cylindrical type” for backup battery.
- Use a “CR2032 lithium battery, coin type” for clock battery.

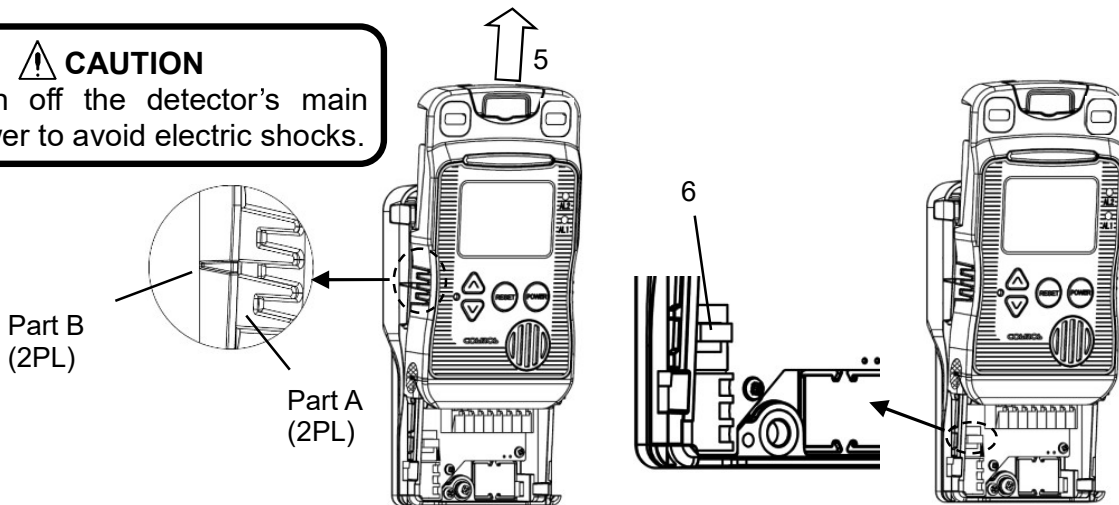
1. Press and hold the POWER button for 3 seconds to turn off the detector.
2. Open the screw cover.
3. Loosen the two fastening screws (these screws cannot be fully removed).
4. Slightly pull the cover forward.



5. Slide the cover up by holding Part A (2 places, each side of the cover) until the middle alignment markings on Part A and the alignment markings on Part B match.
6. Turn off the main power by setting the main power switch to the off (down) position.

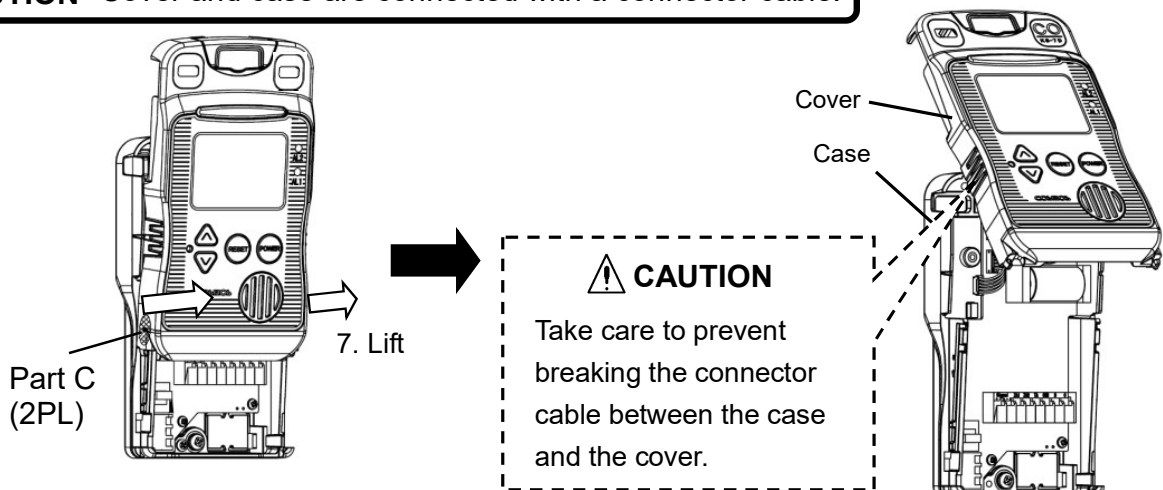
⚠ CAUTION

Turn off the detector's main power to avoid electric shocks.

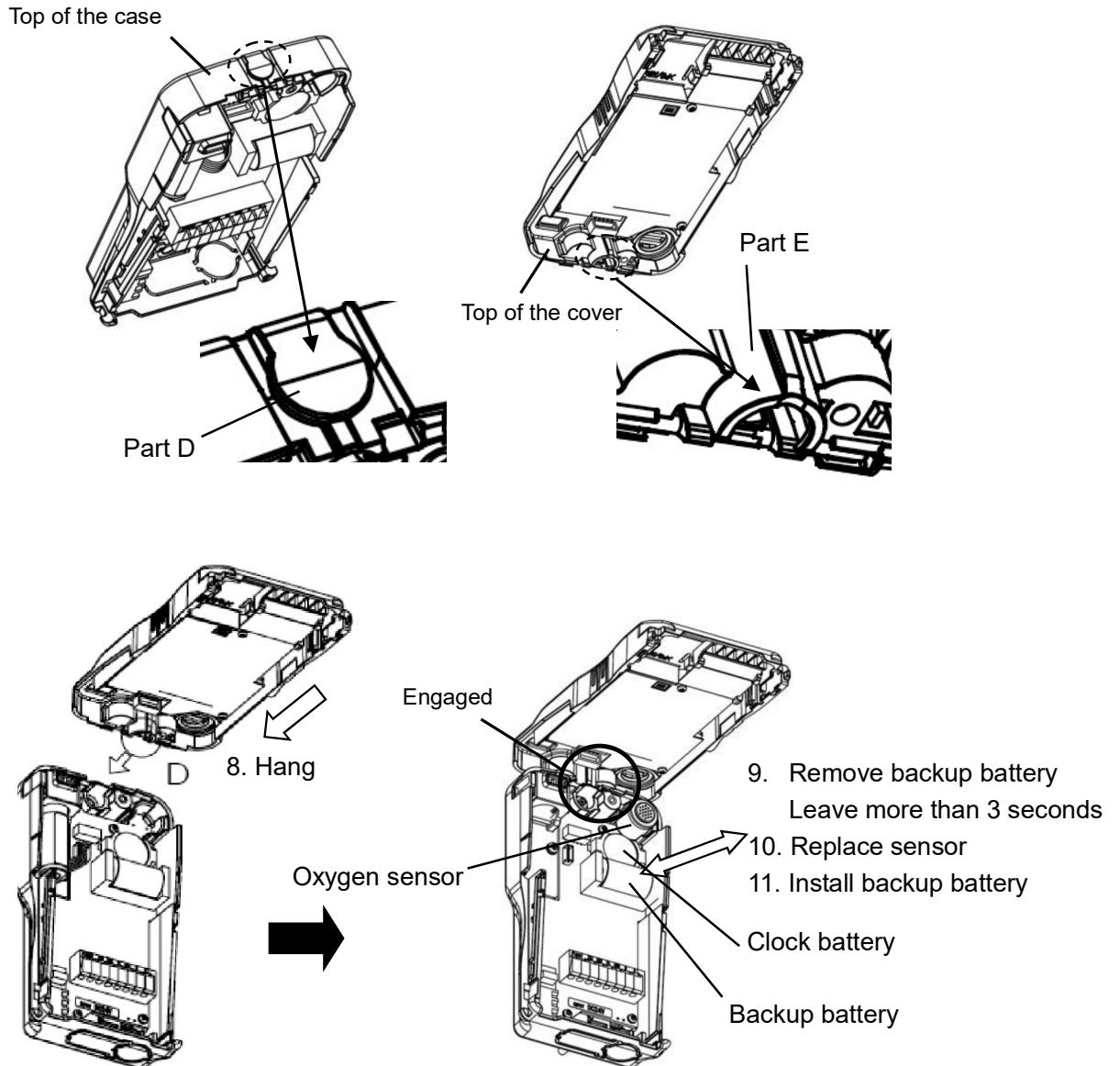


7. Pull and detach the cover from the case by holding Part C (2 places, each side of the cover).

⚠ CAUTION Cover and case are connected with a connector cable.



- Temporarily hang the cover on the top of the case by engaging the cover's Part E into the case's Part D.



- Remove the backup battery from the case. Wait more than 3 seconds before installing a new one.

⚠ CAUTION
Backup battery should be CR2, cylindrical cell not coin cell.

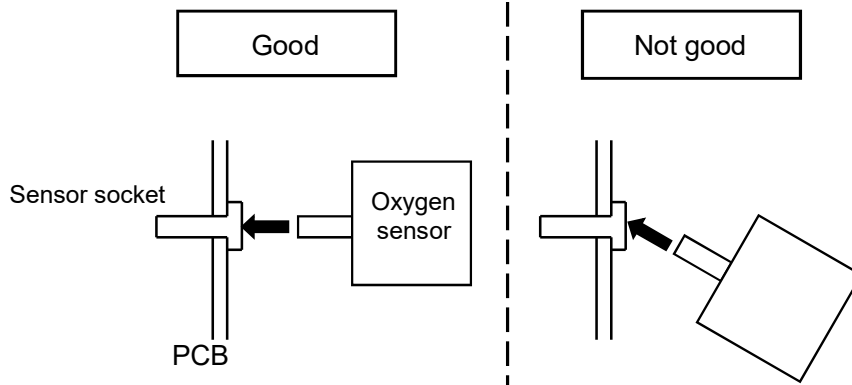
- Replace the oxygen sensor with a new one.

⚠ CAUTION

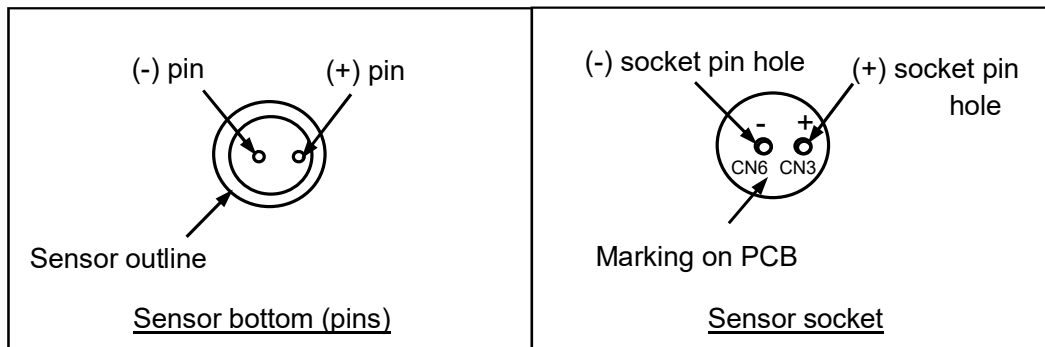
- Pinch the head of the oxygen sensor (plug-in type) and pull out horizontally to remove it from the printed circuit board.
- Correctly install a battery by checking the polarity marking on the battery holder.

⚠ CAUTION

Horizontally install the oxygen sensor so that its connector pins are horizontally inserted into the sensor socket's pin holes. Forced insertion from the side may damage the socket, which will cause a poor connection.



Place the sensor in place so that its connector pins (+) (-) and the socket's pin holes (+) (-) on the printed circuit board match, then gently push it into place.



11. Install a new backup battery (CR2, cylindrical) in the battery holder.
12. (Reverse Step 8) Pull and detach the case from the top of the case by holing the Part C (2 places, each side of the cover). Align Part A to Part B (2 places, each side of the cover) to engage the cover into the case.
13. Turn on the main power by setting the main power switch to the on (up) position
14. (Reverse Step 5) By holding Part A (2 places, each side of the cover), match the middle alignment markings on Part A and the alignment markings on Part B, slide down and close the cover.
15. Press up and open the screw cover. Tighten the two fastening screws.

⚠ CAUTION

Secure the cover by tightening the two fastening screws. Proper gas detection is not possible if the cover is not tightly closed.

16. Close the screw cover.
17. If the oxygen sensor is replaced, perform the following adjustments.
 - Perform a span adjustment. (Refer to 7-4-4. "Span Adjustment")
 - Reset the total operating time to zero. (Refer to 7-5-2. "Operating Time Refresh")

⚠ CAUTION

If the oxygen sensor is replaced, span adjustment is necessary. Proper gas detection is not possible without a span adjustment. Sensor replacement notification will not be reset without an operating time refresh.

9. Troubleshooting

Before requesting repair, please refer to the table below. If the detector does not return to normal operation 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.

| Problem | Probable cause | Solution | Reference section |
|--|---|--|---|
| Green status indicator not lit | Main power switch or POWER button is off | Set the main power switch to on position or press and hold the POWER button for 3 seconds. | 7-2. Operating Procedure |
| | Incorrect wiring or loose connection | Check and rewire/reconnect. | 6. Wiring |
| | No power supplied | Supply correct power. | 7-1. Precautions before Use |
| Maintenance icon displayed on LCD, and gas concentration value and “_ _ _ _” displayed alternately | Product is in Maintenance mode | Switch the Maintenance mode to OFF. | 7-4-2. Switching Maintenance Mode On/Off |
| No audio alarm | Product is in Maintenance mode | Switch the Maintenance mode to OFF. | 7-4-2. Switching Maintenance Mode On/Off |
| | Incorrect alarm set value | Check the alarm set value. | 7-3-3. Full Scale and Alarm Set Value Display |
| | None-audio unit selected at time of order | Consult your New Cosmos representative. | |
| Alarm relay contacts do not activate | Product is in Maintenance mode | Switch the Maintenance mode to OFF. | 7-4-2. Switching Maintenance Mode On/Off |
| | Incorrect wiring or loose connection | Check and rewire/reconnect. | 6. Wiring |
| | Incorrect alarm set value | Check the alarm set value. | 7-3-3. Full Scale and Alarm Set Value Display |
| | Detector operates on the backup battery | This is not a failure and the detector operates normally. | 7-3-2. Normal Operation Status |

| Problem | Probable cause | Solution | Reference section |
|---|---|--|---|
| <ul style="list-style-type: none"> ▪ Sensor replacement icon displayed on LCD ▪ Once a minute sensor replacement audio alarm | Total operating time has reached one year, and the sensor replacement alert is activated. | <p>Replace the sensor with a new one.</p> <p>To mute the audio alarm, press the RESET button.</p> <p>The muted audio alarm will become audible, once the detector is power cycled.</p> <p>To mute the resumed audio alarm, press the RESET button.</p> | <p>8-1. 5) Sensor Replacement</p> <p>8-2. Sensor/Backup Battery/Clock Battery Replacement</p> |
| <ul style="list-style-type: none"> ▪ Status indicator flashing between green and red ▪ “E-E1”, “E-E2” or “E-E3” displayed on LCD ▪ Audio alarm sounds ▪ Fault alarm relay contact activates ▪ Analog output is lower than 0.9 mA | Internal error | Press and hold the POWER button for 3 seconds to turn off the detector. After a few minutes, turn the detector on again. If the product does not return to normal operation, contact your New Cosmos representative for repair. | 7-2. Operating Procedure |
| <ul style="list-style-type: none"> ▪ “E-A” displayed on LCD ▪ Audio alarm sounds ▪ Analog output is lower than 0.9 mA | Sensor error (Incorrect zero adjustment or sensor abnormality) | Press and hold the POWER button for 3 seconds to turn off the detector. Turn on the detector in clean air. If the product does not return to normal operation, contact your New Cosmos representative for repair. | 7-2. Operating Procedure |
| <ul style="list-style-type: none"> ▪ “E-B” displayed on LCD ▪ Audio alarm sounds | Backup battery is empty | <p>Replace the backup battery with a new one.</p> <p>Pressing the RESET button can mute the audio alarm for one hour.</p> | 8-2. Sensor/Backup Battery/Clock Battery Replacement |
| Other than the above | Microcomputer may malfunction due to noise. | <p>Turn off the detector and remove the backup battery from the unit, then reinstall.</p> <p>Turn on the detector. If the product does not return to normal operation, contact your New Cosmos representative for repair.</p> | <p>7-2. Operating Procedure</p> <p>8-2. Sensor/Backup Battery/Clock Battery Replacement</p> |

10. Specifications

| | |
|------------------------------------|--|
| Detection principle | Galvanic cell sensor |
| Sampling method | Diffusion type |
| Target gas | Oxygen |
| Detection range | 0-25.0vol% or 0-50.0vol% |
| Display | Four-digit LCD with backlight, resolution 0.1vol% |
| Alarm set value | F.S.25vol%: 19vol% (AL1, lower limit) and 18vol% (AL2, lower limit) F.S.50vol%: 18vol% (AL1, lower limit) and 25vol% (AL2, upper limit) |
| Indication accuracy *1 | +/- 0.7vol% (when indication is 25vol% and lower) +/- 3.0vol% (when indication is 25.1vol% and higher) |
| Alarm accuracy | Displayed value is equal to the alarm set value in the event of alarm |
| Alarm delay | Less than 5 seconds to reach 18vol% (alarm is triggered) after exposure to 10vol% gas concentration at 20+/-2°C |
| Alarm | <ul style="list-style-type: none"> ▪ Gas alarm (in two stages) 1st stage gas alarm: AL1 alarm LED flashes (lit if the audio alarm is muted), amber status indicator sequentially-flashes, audio alarm sounds, and AL1 icon is displayed on LCD. 2nd stage gas alarm: AL1 and AL2 alarm LEDs flash (lit if the audio alarm is muted), red status indicator sequentially-flashes, audio alarm sounds, and AL1 and AL2 icons are displayed on LCD. ▪ Alarm clearance method: Manual-resetting (standard) or self-resetting *3 |
| External output *4 | <ul style="list-style-type: none"> ▪ Gas concentration analog output *2: 4-20mADC (common negative with power supply) (Current sensing resistor must be 300Ω or less including a wiring resistance) ▪ Gas alarm relay contacts (in two stages): Dry NO (standard) or NC contacts, manual-resetting (standard) or self-resetting *3 (Max load: 0.5 A at 125 VAC or 2 A at 30 VDC (resistance load)) ▪ Fault alarm relay contact: Dry NO (standard) or NC contact, manual-resetting (standard) or self-resetting *3 (Max load: 0.5 A at 125 VAC or 2 A at 30 VDC (resistance load)) |
| Explosion-proof | Not explosion-proof |
| Compliance *5 | EMC:2014/30/EU/SI 2016 No.1091 RoHS:2011/65/EU+(EU)2015/863/SI 2012 No.3032 |
| Other features | Maintenance mode used to disable gas alarm relay contacts, audio alarm mute, and backup battery used in the event of power outage |
| Applicable cable | 0.5-1.25 mm ² shielded cable. Outer diameter: less than 10.5 mm |
| Cable length | Up to 500 m |
| Operating temperature and humidity | -10 to +40°C, 30 to 85%RH (No rapid temperature/humidity changes. No condensation) |
| Operating pressure | 80 to 110 kPa |
| Power supply | 24 VDC±10% or 100 VAC±10% 50/60 Hz±10% |
| Power consumption | 24 VDC: 1 W during normal operation, 3W during alarm, or 100 VAC: 2 VA during normal operation, 6VA during alarm |
| Dimensions | W82 x H150 xD35 mm (excluding protruding parts) |
| Mass | Approx. 300 g |
| Mounting method | Wall mounting, indoors |

*1. Checked after gas calibration following a 30-minute warm-up cycle from powering-up.

*2. Output concentration value is within the detection range.

*3. Manual-resetting or self-resetting; NO (normally open) or NC (normally closed) are specified at the time of order.

*4. When the detector operates on the backup battery, the analog output is 0mA (no output) and the gas/fault alarm relay contacts are all disabled.

*5. CE marking specification applies to KS-70 which uses 24 VDC power. Refer to the "EU Declaration of Conformity" (separate document) for information on the CE marking unit.

11. 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.

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 or repair service. This warranty covers the New Cosmos product/parts only and not third party product/parts.

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.

12. Expected Sensor Life

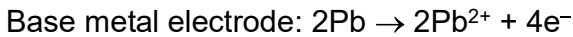
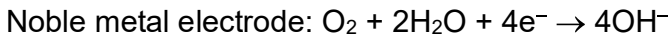
The estimated service life of the sensor is shown in the table below. The sensor may fail to provide correct detection after its service life expires. Replace the sensor before its expiration. This expected service life assumes that maintenance is done properly and periodically and that the sensor is 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.

| Detection principle | Expected sensor life |
|----------------------|----------------------|
| Galvanic cell sensor | 1 year |

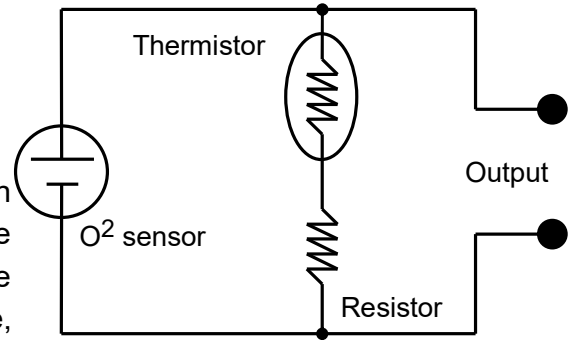
13. Detection Principle

Galvanic Cell Sensor

The sensor consists of two electrodes, a membrane and an electrolyte. To accelerate reactions of gas in the atmosphere on the electrodes, the membrane is designed to adhere tightly to the electrodes. The electrodes are two different metals, noble metal (Pt, Ag) and base metal (Pb). The noble metal electrode has contact with air via a Teflon membrane. Connecting load resistance to both electrodes generates a potential difference, which speeds up the following reactions:



As a result, the current proportional to the oxygen concentration in the air flows from the noble metal electrode to the base metal electrode via the external circuit. Since the electromotive force changes depending on the temperature, a thermistor is added to compensate for the ambient temperature variations.



14. Glossary

| Term | Definition |
|---|--|
| Clean air or normal air | Standard atmosphere which contains 20.9 to 21.0% oxygen in dry condition or atmosphere without target gas or interference gases. |
| 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. |
| 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. |
| Service range | A range of target gas concentrations the detector is able to indicate, which are usually outside the Detection Range and used only as reference. |
| Alarm set value | Preset gas concentration level at which an alarm is triggered. |
| Alarm accuracy | Difference between the alarm set value and gas concentration value at which an alarm is actually triggered, or percentage of the difference compared to the alarm set value. |
| Alarm delay | Time required for an alarm to trigger after the detector is exposed to a gas concentration level, higher or lower than the alarm set value. |
| 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. |
| Self-resetting | Gas alarm clearance method. When the gas concentration falls below (or above when the alarm set value is the lower limit) the gas alarm set value after an alarm has been signaled, relevant alarm lights, gas alarm icon and alarm relay contacts will automatically return to their normal positions/statuses. |
| Manual-resetting | Gas alarm clearance method. Even if the gas concentration falls below (or above when the alarm set value is the lower limit) the gas alarm set value after an alarm has been signaled, relevant alarm lights, gas alarm icon, and alarm relay contacts will not automatically return to their normal positions/statuses. Manual operation is only possible when the gas concentration is below (or above) the gas alarm set value. |
| 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. |
| Explosive atmosphere | Mixture of air and flammable substances in the form of dust or vapor which are within their explosive limits. |
| Sequentially-flash | There are several LEDs inside the status indicator. In the event of a gas alarm, one LED lights at a time and the lit LED moves from left to right. |

15. Proper Product Disposal at End of Life



The Waste Electrical and Electronic Equipment (WEEE) directive (2012/19/EU) is intended to promote recycling of electrical and electronic equipment and their components at end of life. This symbol (crossed-out wheeled bin) indicates separate collection of waste electrical and electronic equipment in the EU countries. This product contains two Lithium batteries. Specific battery information is given in this instruction manual. Batteries must be recycled or disposed of properly.

At the end of its life, this product must undergo separate collection and recycling from general or household waste. Please use the return and collection system available in your country for the disposal of this product.

Revision History

| Document No. | Date | Revision |
|--------------|----------------|----------|
| GAE-052-00 | June 2014 | 0 |
| GAE-052-01 | May 2016 | 1 |
| GAE-052-02 | October 2018 | 2 |
| GAE-052-03 | June 2019 | 3 |
| GAE-052-04 | December 2020 | 4 |
| GAE-052-05 | September 2022 | 5 |
| GAE-052-06 | June 2023 | 6 |

Additional copies of this instruction manual may be purchased.
Contact New Cosmos or its authorized representative for ordering.

Authorized representative:

Manufacturer:

NEW COSMOS ELECTRIC CO., LTD.

2-5-4 Mitsuya-naka, Yodogawa-ku,
Osaka 532-0036, Japan

www.newcosmos-global.com

NEW COSMOS ELECTRIC CO., LTD.