

Gas Detector

TP-70DGII

Operating Manual

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1. Outline of the Product

1-1. Preface




Thank you for choosing the TP-70DGII. Please check that the model number of the product you purchased is included in the specifications on this manual.

Non-compliance with safety precautions may lead to fire or bodily injury. This manual explains how to use the gas detector and its specifications. It contains information required for using the gas detector properly. Read the manual before using the gas detector.

1-2. Purpose of Use

- This is a fixed-type gas detector that detects gases used in semiconductor factories, etc. The gas detector is a safety unit, not an analyzer or densitometer. Please fully understand the features and proper use of the gas detector before using it.
- The gas detector's built in gas sensor unit detects the presence of gases. The gas concentration displays on the LCD.
- The gas detector's built-in pump draws gas to perform gas detection.
- The gas detector has a two-step gas alarm contact and a fault alarm contact.
- The gas detector outputs the gas concentration in 4 - 20 mA or in digital data (Ethernet).

1-3. Definition of DANGER, WARNING, CAUTION and NOTE

 DANGER	This message indicates that improper handling may cause serious damage to life, health or property.
 WARNING	This message indicates that improper handling may cause serious damage to health or property.
 CAUTION	This message indicates that improper handling may cause minor damage to health or property.
NOTE	This message indicates handling advice.

2. Important Safety Notices

2-1. Danger Statements



DANGER

This is not an explosion-proof unit. Do not use this unit in the presence of combustible gases.

2-2. Warning Statements



WARNING

Power supply

Before turning on the gas detector, always check that the voltage is properly applied and that the power supply is stable.

Grounding circuit

Do not cut the grounding circuit or disconnect the grounding terminal wire.

Defects in protective functions

Before turning on the gas detector, check the protective functions for defects. If protective function (such as protective grounding) defects are found, do not turn on the gas detector.

External connection

Before connecting the gas detector to a detection target or external control circuit, securely connect it to a protective grounding circuit.

Tube

The gas detector is designed to draw gases under normal atmospheric pressure. If excessive pressure is applied to the detector's sampling inlet and outlet (GAS IN, GAS OUT), detected gases may leak from the flow system and pose dangers. Be sure that excessive pressure is not applied to the gas detector during use. Detected gases must be exhausted from the outlet (GAS OUT) on the back of the gas detector to a safe place using an exhaust tube.



WARNING

Handling the sensor unit

Do not disassemble the electrochemical type sensor unit (ESU) because it contains electrolyte. Electrolyte may cause severe skin burns and may cause blindness if contact occurs. It may discolor or damage clothing. If contact occurs, rinse the area immediately with a large quantity of water.

Zero adjustment in the atmosphere

Before performing a zero adjustment, confirm that the area is a fresh air environment. If interference gases exist, the zero adjustment will be inaccurate and the detector will not properly detect gas.

Operation in a gas

Do not operate the gas detector in a place where combustible/explosive gases or vapors are present. Operating the gas detector in such an environment will lead to extreme dangers.

Response to gas alarm

A gas alarm indicates that there are extreme dangers. Take proper actions based on your judgment.

Fuse

To prevent fire, use a fuse with the specified ratings (current, voltage and type) for the gas detector. Turn the POWER switch OFF and disconnect the power plug from the outlet before replacing a fuse. Do not use an unspecified fuse or short-circuit the fuse holder.

Power cable

To power the gas detector with 200 VAC, use a power cable that supports 200 VAC. The provided power cable only supports 100 VAC.

Do not touch the pyrolyzer.

The inside of the pyrolyzer is hot and can stay hot even after power-off. Do not touch the inside of the pyrolyzer unless the unit has been off for a long time.

2-3. Caution Statements



CAUTION

Do not use a transceiver (walkie-talkie) near the gas detector.

Radio waves from a transceiver near the gas detector or its cables may disrupt detector operation. Do not use a transceiver near the detector.

Do not turn the detector on less than 5 seconds after turning it off.

Restarting the gas detector less than 5 seconds after turning it off may cause errors.

Verify that the reading on the flow rate indicator corresponds to the specified flow rate before using the gas detector.

If it does not correspond to the specified flow rate, gas detection cannot be performed properly. Be sure the flow rate is stable.

Attach the provided filter before using the gas detector.

Before using the gas detector, attach the specified filter to prevent disturbances by possible gas absorption or air dust.

The filter used varies depending on the gas being detected. For more information on filters, please contact RKI.

The gas detector itself is not dust-proof. Cover the detector if using it in a dusty environment.

Observe the operating restrictions to prevent condensation inside the tube.

Condensation can cause inaccurate gas readings. Carefully monitor the temperature/humidity of the sampling point and the installation environment to prevent condensation inside the tubing. In particular, when detecting a corrosive, water-soluble gas, such as a strong acid gas, the gas is undetectable and furthermore may corrode internal parts. Please observe the operating restrictions.

Do not use the external output of the gas detector to control other units.

This is not a control unit. Do not use the external output to control other units.

Do not disassemble/modify the gas detector or change the settings unless necessary.

Disassembling/modifying the gas detector will invalidate the warranty. Changing the settings without understanding the specifications may cause alarm malfunctions. Please use the gas detector properly in accordance with the operating manual.

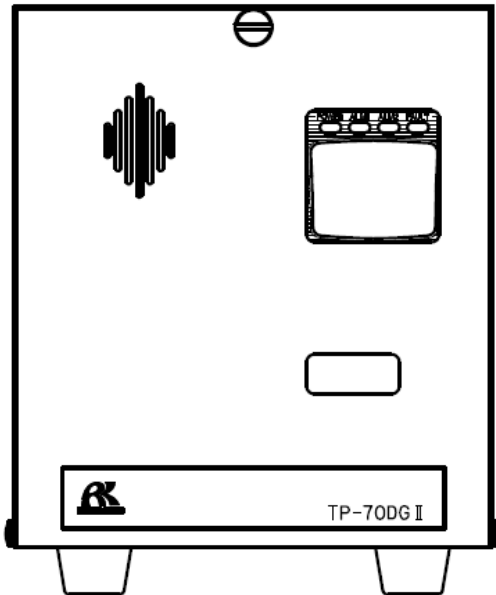
Perform regular maintenance.

Regular maintenance must be performed to ensure safety. Continuing to use the gas detector without maintaining it compromises the sensor sensitivity which causes inaccurate gas readings.

3. Product Components

3-1. Main Unit and Standard Accessories

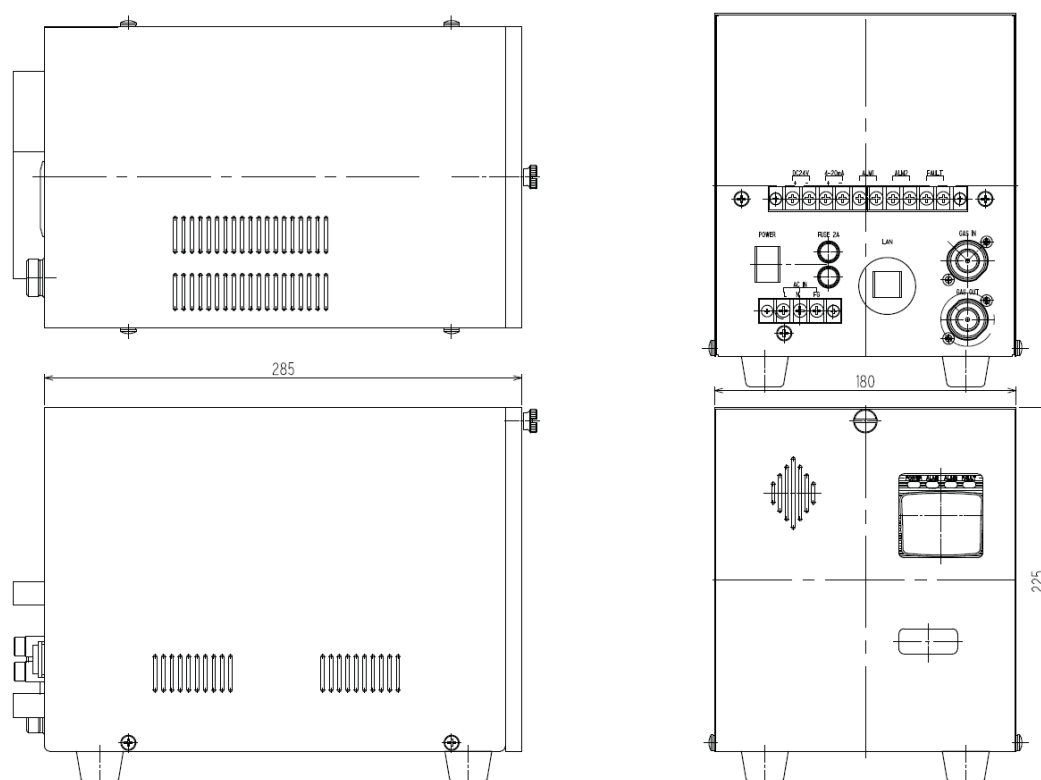
<Main Unit>



<Standard Accessories>

- Operating Manual
- Protective rubber cap on GAS IN and GAS OUT fittings (to be removed when using the gas detector)
- Dust filter
- Silica gel filter (for C4F6/C5F8 detection only)

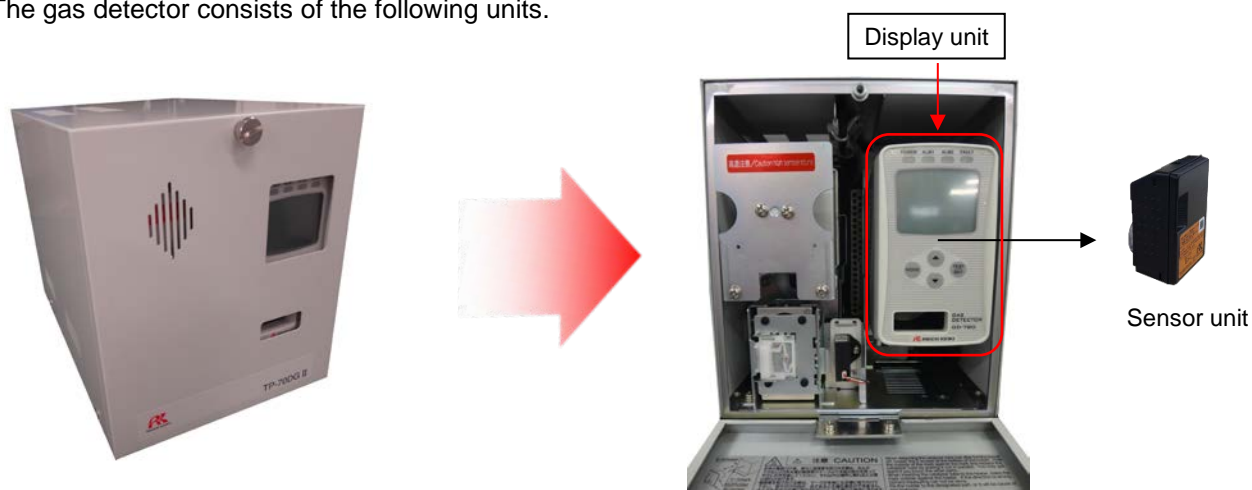
3-2. Outline Drawing



3-3. Names and Functions for Each Part

<Components of the Gas Detector>

The gas detector consists of the following units.



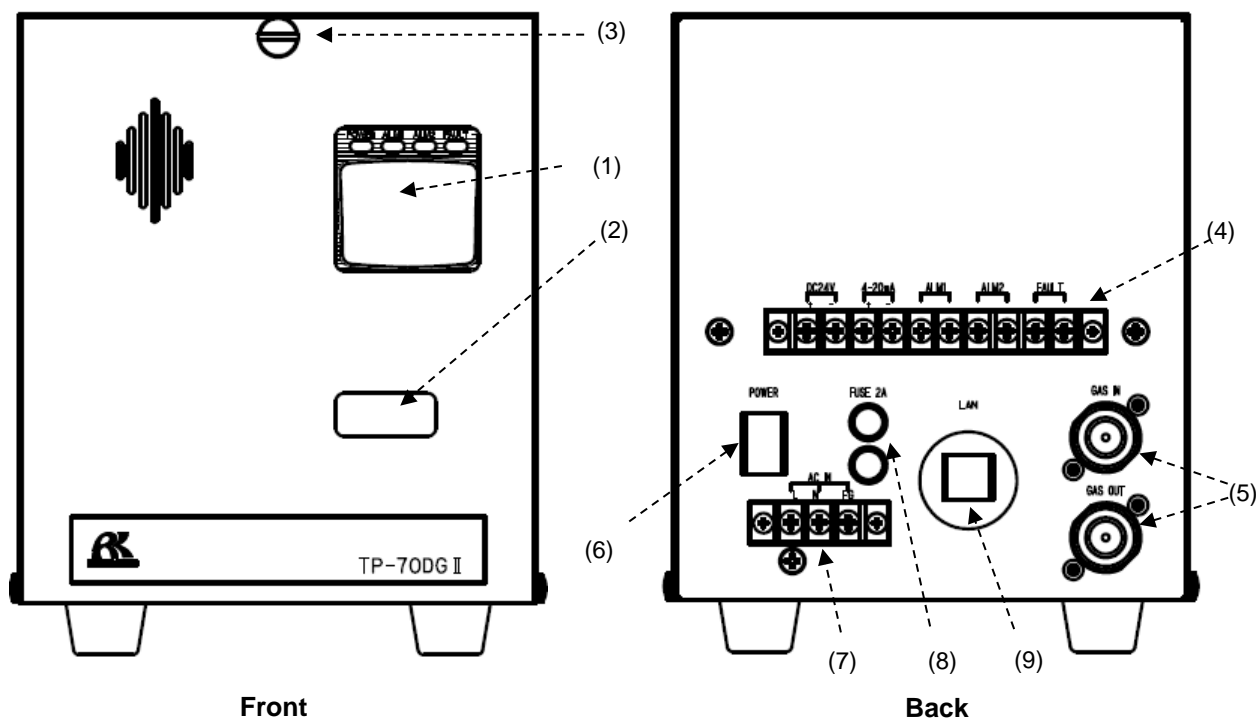
CAUTION

Each unit consists of precision parts. When a unit is detached, be careful not to drop it. Dropping the unit compromises its original performance or causes malfunctions.

NOTE

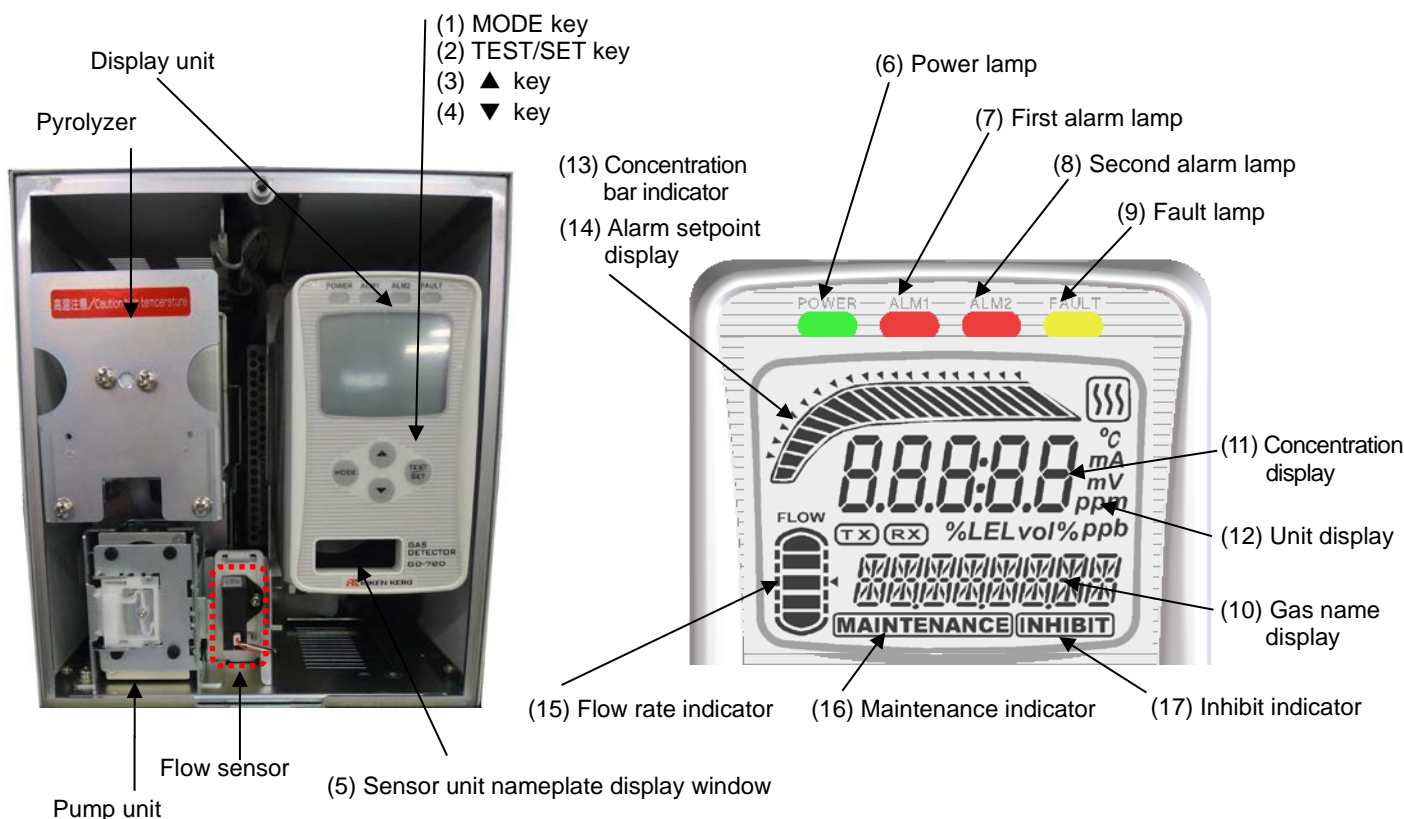
The display unit is designed specifically for the gas detector. Do not use a similar product. It will not function correctly.

<Exterior of Main Unit>



(1)	Display	Display the gas concentration.
(2)	Sensor unit nameplate display window	View the currently installed sensor unit nameplate.
(3)	Knurled screw	Keeps front cover in place.
(4)	External terminal plate	Connection point for external signals (4 - 20 mA) and contacts.
(5)	Sample gas inlet/outlet	GAS IN: Connect sample gas tubing. GAS OUT: Connect exhaust tubing.
(6)	Power switch	Turn the AC power ON/OFF.
(7)	Power terminal plate	Power connections.
(8)	Fuse	Main fuse.
(9)	LAN connector	Connect a LAN cable.

<Interior of Main Unit>



(1)	MODE key	Enter the maintenance mode. Cancel or skip an item in each mode. Reset an alarm in the alarm test mode.
(2)	TEST/SET key	Enter the test mode. Confirm a setting in each mode.
(3)	▲ key	Change screens or adjust a value (UP).
(4)	▼ key	Change screens or adjust a value (DOWN). Reset an alarm in detection mode.
(5)	Sensor unit nameplate display window	View the currently installed sensor unit nameplate.
(6)	Power lamp (POWER)	Turns green when the power is on.
(7)	First alarm lamp (ALM1)	Flashes or turns solid red when the first alarm is reached.
(8)	Second alarm lamp (ALM2)	Flashes or turns solid red when the second alarm is reached.
(9)	Fault lamp (FAULT)	Flashes yellow when gas detector abnormality is detected.
(10)	Gas name display	Displays target gas' chemical formula. (e.g. Silane = SiH_4)
(11)	Concentration value display	Displays the gas concentration.
(12)	Unit display	Displays the gas concentration unit. (ppm, ppb, vol%, %LEL)
(13)	Concentration bar indicator	Full scale is split into 20 bars. The current gas concentration is shown as a graph.
(14)	Alarm setpoint display	The alarm setpoints (AL1 and AL2) are shown on the concentration bar.
(15)	Flow rate indicator	Displays the flow rate. When the line is in the middle of the indicator, the flow rate is normal (0.5 L/min).
(16)	Maintenance display	Displayed during the maintenance mode. When this indicator is on, the alarm contact is disconnected and there are no alarms.
(17)	Inhibit display	Displayed when the inhibition (point skip) is set.

<How to Use Sensor Unit>



CAUTION

- The sensor unit must be handled carefully to ensure quality as a safety unit. When the sensor unit is stored, a dedicated container and power equipment for the sensor unit are needed. In principal, the sensor unit must not be detached from the gas detector when it is handled or stored.
- Be sure that the sensor unit is not installed improperly.
If the wrong type of sensor unit is installed, a "C-02" message appears on the LCD. Check the sensor unit's specifications.
- After the sensor unit is replaced, always perform a calibration (zero adjustment and span adjustment).

Electrochemical Type (ESU)

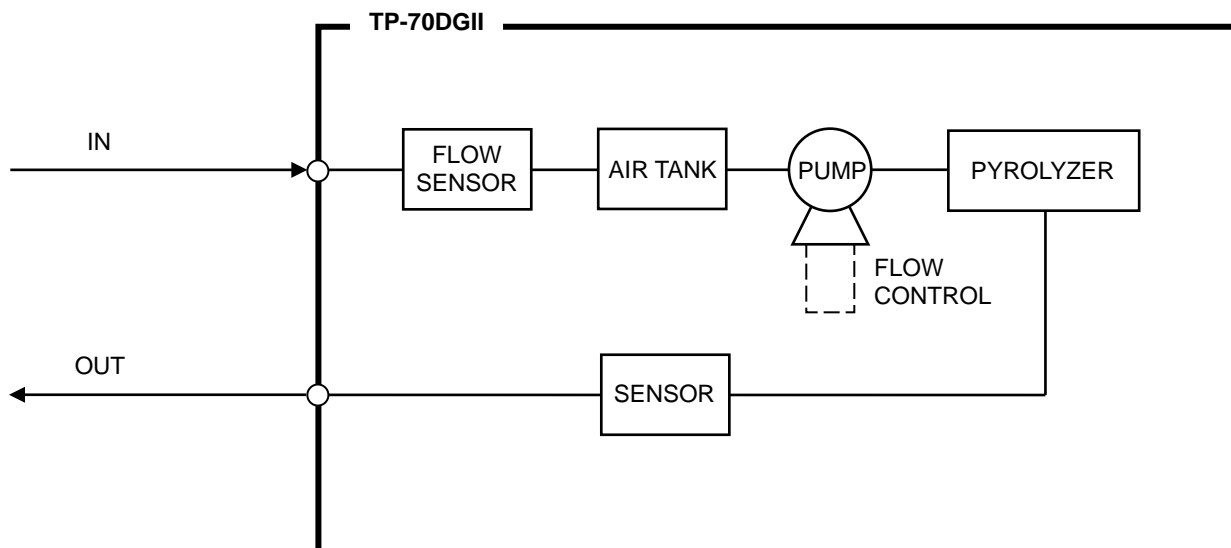


- Do not disassemble the sensor unit because it contains electrolyte. If contact occurs, rinse the area immediately with a large quantity of water.
- The sensor unit indicates the storage direction. Put the sensor unit in the dedicated case while handling it. Do not place it on its side or upside-down.
- When a new sensor unit is installed, it must be warmed up.
The warm-up time is at least 3 hours but varies depending on the sensor.
- The sensor unit must be stored in a clean, cool, and dark place away from direct sunlight. Some types of the sensor units cannot be stored with other types of sensor units. Please contact RKI for more information.

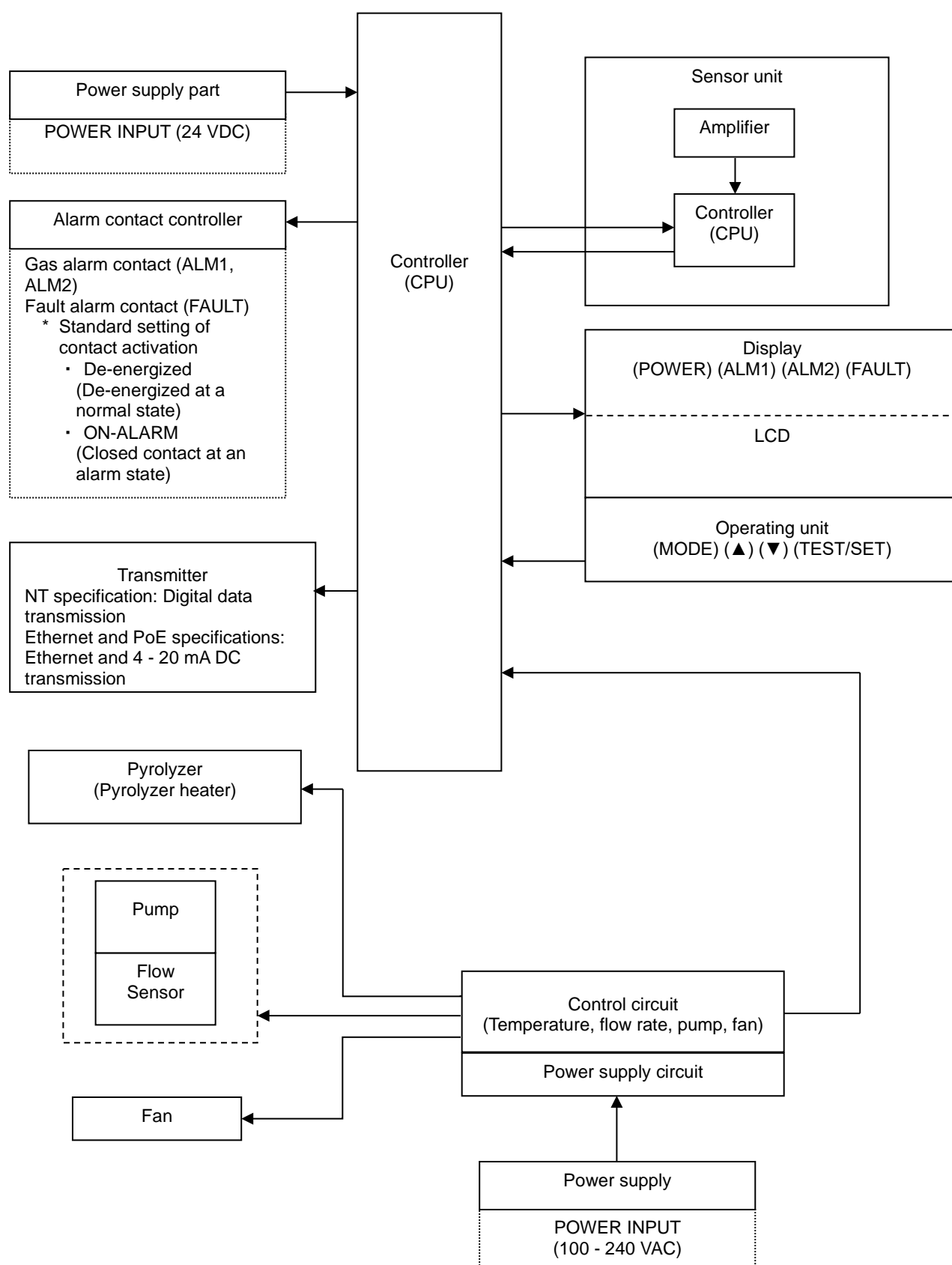


3-4. Block Diagrams

<Flow Diagram>



<Electric Diagram>



4. How to Use

4-1. Requirements

Follow the operating precautions. Ignoring the precautions may damage the gas detector, resulting in inaccurate gas detection.



CAUTION

After receiving the gas detector, start using it within the specified operation start limit of the sensor unit.

4-2. Installation Precautions

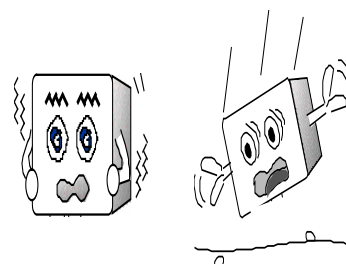


CAUTION

This is a precision device. The gas detector may not function in all environments. If necessary, make the installation site environment appropriate for the gas detector. Choose installation site(s) where the detected gas is most likely to appear. Install enough detectors to monitor your area.

Do not install the gas detector in a place with vibrations or shocks.

The gas detector consists of sensitive electronic parts. The gas detector must be installed in a stable place without vibrations or shocks and where it will not fall.



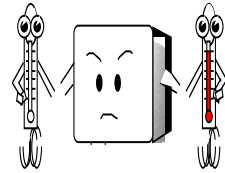
Do not install the gas detector in a place exposed to water, oil or chemicals.

Avoid installing the gas detector in a place where it is exposed to water, oil, or chemicals.



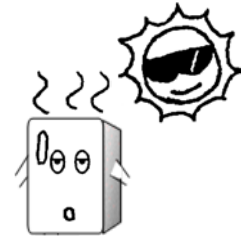
Do not install the gas detector in a place where the temperature drops below 20°C or rises above 40°C.

The operating temperature of the gas detector is 20 to 40°C. The gas detector must be installed in a stable place where the operating temperatures are maintained and do not change suddenly.



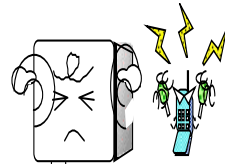
Do not install the gas detector in a place exposed to direct sunlight or sudden changes in the temperature.

Do not install the gas detector where it is exposed to direct sunlight or radiant heat (infrared rays emitted from a high-temperature object), and where the unit temperature changes suddenly. Condensation may form inside the gas detector and the gas detector cannot adjust to sudden temperature changes.



Keep the gas detector (and its cables) away from noise sources.

When selecting installation points, avoid a place where high-frequency/high-voltage devices exist.



Do not install the gas detector in a place where maintenance of the gas detector cannot be performed or where handling the detector involves dangers.

Regular maintenance of the gas detector must be performed.

Do not install the gas detector in a place where the machinery must be stopped during maintenance, where machinery parts must be removed during maintenance, or where the gas detector cannot be removed. Do not install the gas detector in a place where maintenance involves dangers (such as near a high-voltage cable).

Do not install the gas detector in machinery that is not properly grounded.

Before installing the gas detector in machinery, the machinery must be grounded properly.

Do not install the gas detector in a place where interference gases exist.

The gas detector must not be installed in a place where interference gases exist.

4-3. Precautions for System Designing



CAUTION

- An unstable power supply and noise may cause malfunctions or false alarms. Follow the instructions in this section when designing your system.
- Instrumentation must still be safe even if a power/signal cable comes loose or the instrument experiences a malfunction or failure.

Using a Stable Power Supply

Power turn on, detector warmup, or a momentary power blackout can activate external and alarm contacts. Use a UPS (uninterruptible power system) and take appropriate action on the receiving side of the contacts.

The gas detector must be provided with the following power supply.

Power supply voltage	100 - 240 VAC $\pm 10\%$ (terminal voltage of the gas detector) 50/60 Hz	
Allowed time of momentary blackout	Up to 500 milliseconds (To recover from a blackout longer than 500 milliseconds, restart the gas detector.)	<u>Example of actions</u> To ensure continuous operation and alarm contact activation, install a UPS (uninterruptible power system) outside the gas detector.
Others	Do not use a power supply that has a large power load or high-frequency noise.	<u>Example of actions</u> Use a line filter to avoid the noise source.

Heat Radiation Designing

If the gas detector is installed on a closed instrumentation panel, attach ventilation fans above and below the panel.



CAUTION

When the internal temperature of the gas detector reaches about 60°C, the power is shut off. Take care not to let the ambient temperature exceed 30°C. Provide a clearance of 30 mm or more above the gas detector to allow for heat dissipation.

Protecting Against Lightning

If cables are installed outside the factory/plant, or if internal cables are installed in the same duct as the cables coming from outside the factory/plant, devices connected to the cables may be damaged during a lightning strike. The risk of damage from a lightning strike cannot be completely eliminated but the following protective measures can be taken.

Protection against lightning	<u>Take appropriate measures in accordance with the importance of the facilities and the environment.</u> <ul style="list-style-type: none">• Connect the transmission signal route by using optical fiber.• Provide protection by a lightning arrester (cable arrester).
Grounding	Ground the gas detector to protect it from surge noise.

Proper Use of Alarm Contact

The gas detector's alarm contact is used to transmit signals to activate an alarm lamp or buzzer. Do not use the alarm contact for controlling purpose (e.g. controlling the shutdown valve).



CAUTION

The "b" contact (break contact) under de-energized state may be opened momentarily by a physical shock.

When the "b" contact is selected for the alarm contact, prepare for a momentary activation by adding a signal delay (approximately one second) to the receiving side of the "b" contact.

The specifications for the gas detector's alarm contact are based on the resistance load conditions. If inductive load is used at the alarm contact, the following errors can easily occur because of counter electromotive force generated at the contact.

- Deposition, defective insulation or defective contact at the relay contact
- Damage of any electric parts due to high-voltage generated inside the gas detector.
- Abnormal operations by an out-of-control CPU



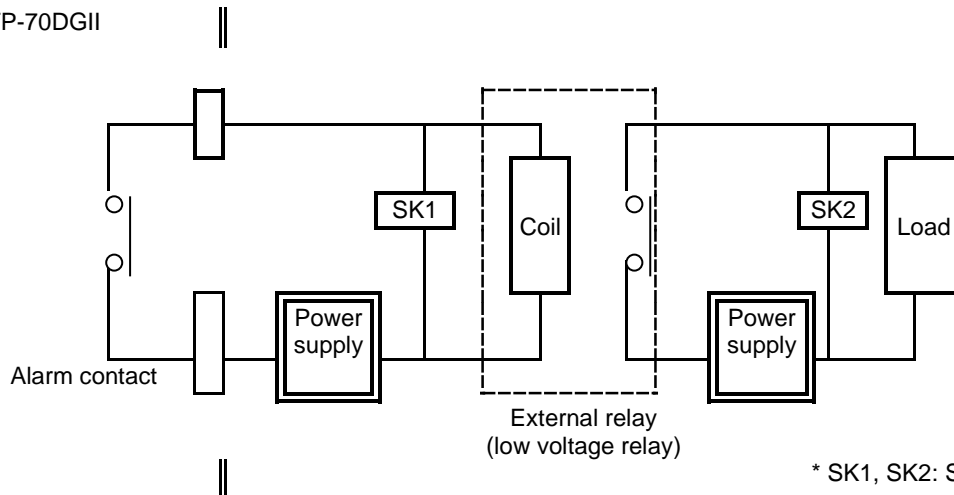
CAUTION

- In principle, do not activate an inductive load at the gas detector's alarm contact. (In particular, never use the inductive load to activate a fluorescent lamp, motor, etc.)
- If an inductive load is activated, relay it with an external relay (contact amplification). However, because the coil of an external relay also involves inductive load, select a relay at a lower voltage (100 VAC or below), and then protect the gas detector's contact with an appropriate surge absorbing part, such as a CR circuit.

If load is to be activated, appropriate measures must be taken to stabilize the operation of the gas detector and protect the alarm contact referring to the following information.

- Relay it with an external relay at a lower voltage of 100 VAC or below (contact amplification). At the same time, the surge absorbing part SK1 suitable for the specifications must be attached to the external relay.
- In addition, the surge absorbing part SK2 must be attached to the loaded side of the external relay if necessary.
- It may be recommended that the surge absorbing part be attached to the contact for certain load conditions. It must be attached to an appropriate position by checking how the load is activated.

TP-70DGII



* SK1, SK2: Surge absorbing parts

4-4. Wiring the Detector



CAUTION

- Be careful not to damage the internal electronic circuit when wiring. In addition, be careful not to apply stresses to the gas detector when (overweight) cables are installed.
- The power cables and signal cables must not be installed together with the motor power cables. When these cables must be installed together for unavoidable reasons, put the power cables and signal cables in a metal conduit. The conduit must be connected to a grounding circuit.

<Recommended Cables>

4 - 20 mA transmission	Shielded cable of CVVS, etc. (1.25 sq) - 2-core
Contact output	Cable of CVV, etc. (1.25sq) - max. 6-core
2-wire type DC power-line communication system	Shielded twisted-pair cable of KPEV-S, etc. (1.25 sq) - 1P
LAN (for Ethernet and PoE)	Ethernet cable (category 5 or higher) UTP (unshielded twisted-pair cable) Supported medium type: 100BASE-T or higher Cable specification: Single wire (5 m maximum for a stranded wire) Modular plug: RJ-45 Number of cores: 8-core Wire connection: Straight

<Specifications of Terminal Plate>

- Rated voltage: 250 VAC
- Rated current: 20 A
- Terminal size: M4



CAUTION

These terminal plate specifications are not the connectable load capacity.

<Grounding>

Connect the gas detector to your grounding terminal.

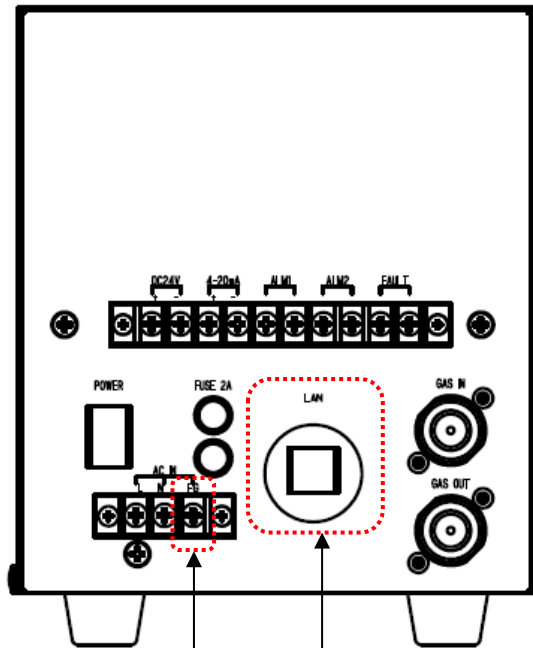


WARNING

Before turning on the gas detector, never fail to connect it to a grounding terminal. Do not connect the grounding wire to a gas pipe. The grounding must be made as D type grounding (below 100 Ω of grounding resistance).

<How to Use Communication Connectors>

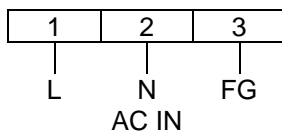
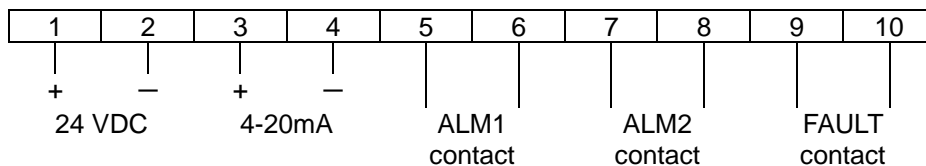
To use Ethernet or PoE connection, insert a LAN cable to the communication connector (RJ45) at the back of the main unit.



Main unit grounding terminal: Make sure to ground the gas detector using 3P power cable.

Communication connector: Connect a LAN cable.
* A dust-proof cap is attached prior to shipment.

<Wiring to the Terminal Plate>



NOTE

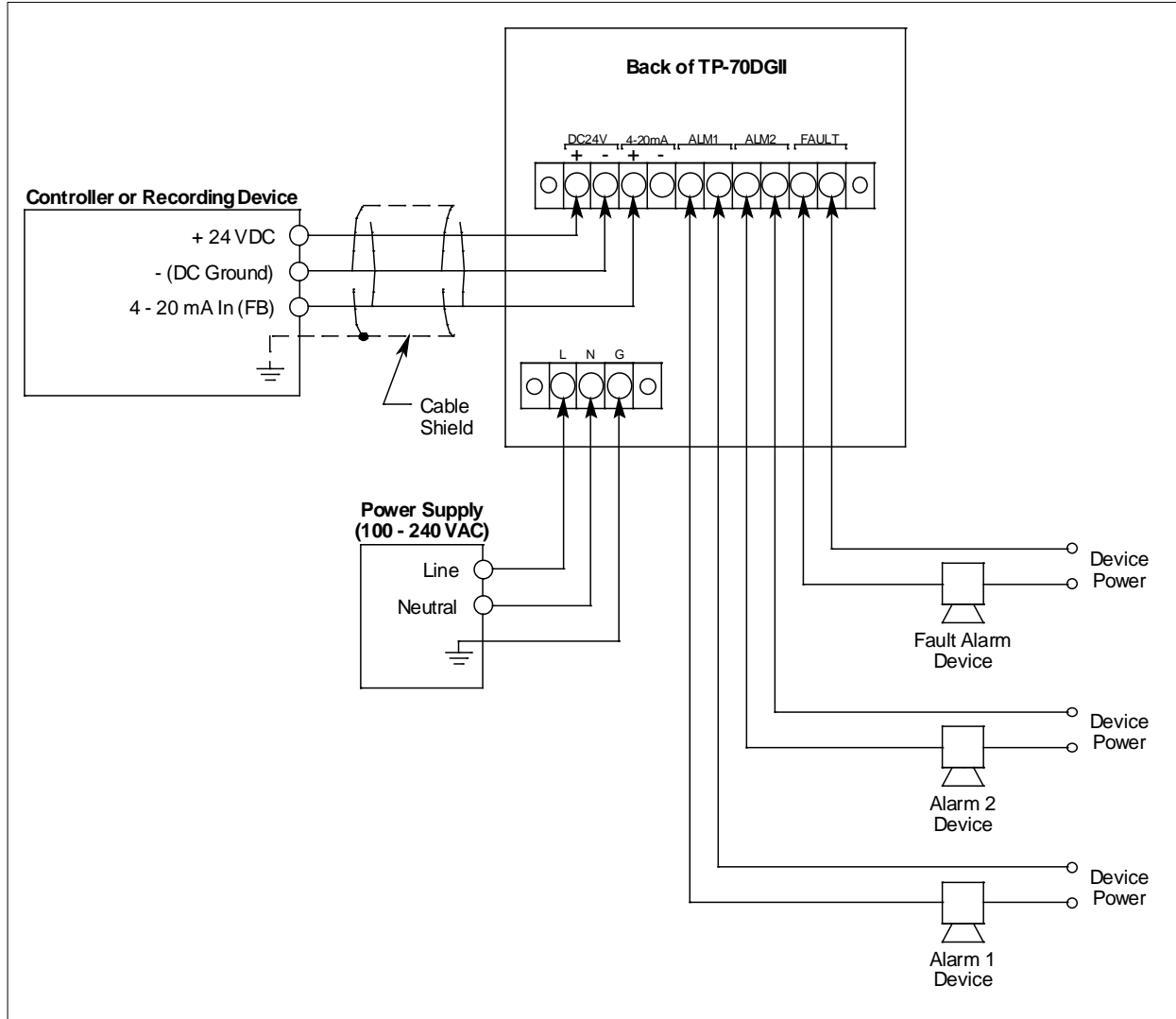
- The 24 VDC terminals 1 and 2 are unavailable for the Ethernet and PoE specifications. (Connection prohibited)
- The 4 - 20 mA terminals 3 and 4 are unavailable for the 2-wire type DC power-line communication system (NT) specification. (Connection prohibited)



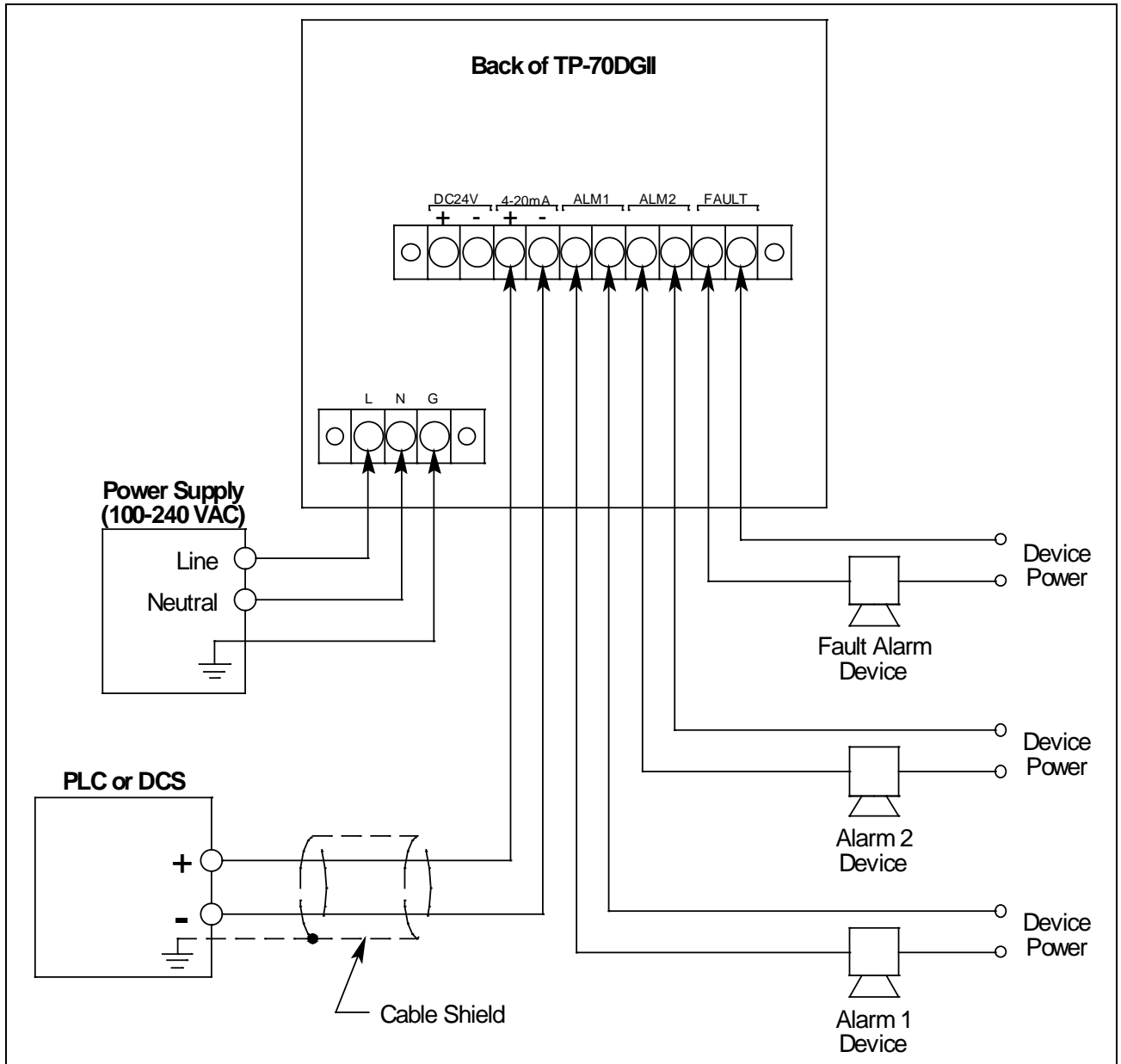
WARNING

To operate the gas detector on 200 VAC system, use a 200 VAC power cable.
The provided power cable is only for 100 VAC.

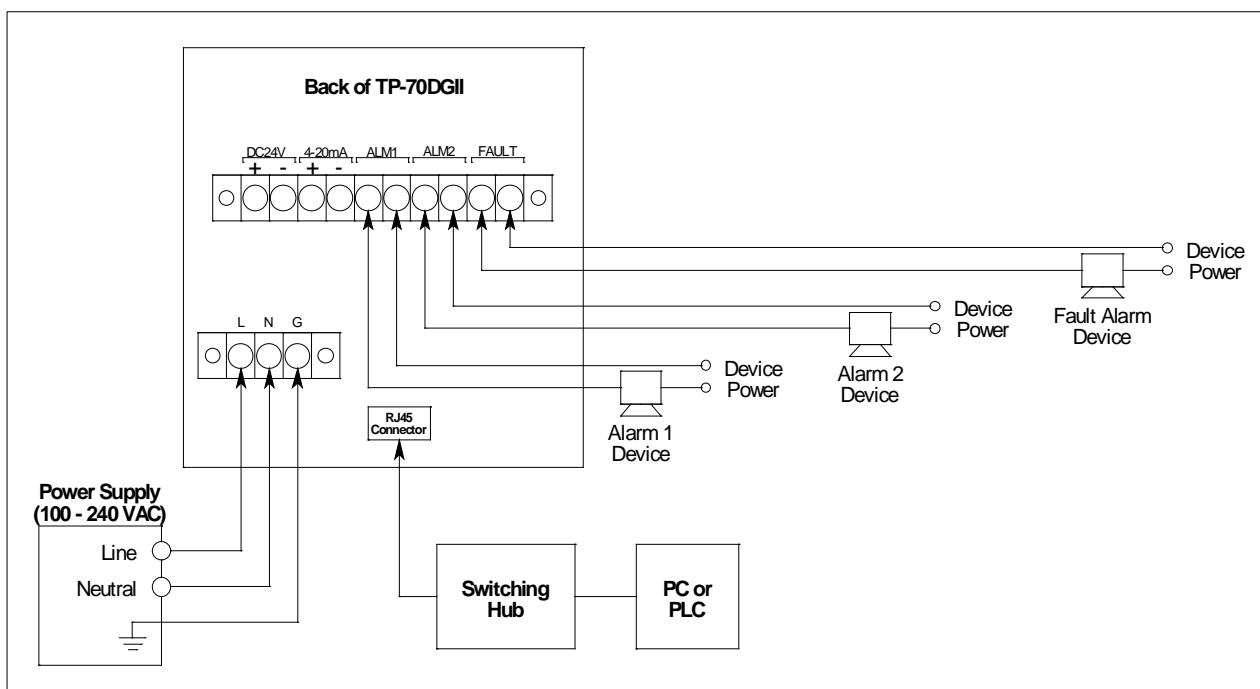
Generic Controller Wiring



PLC or DCS Wiring (EA specification, 2-wire type/4-20 mA)



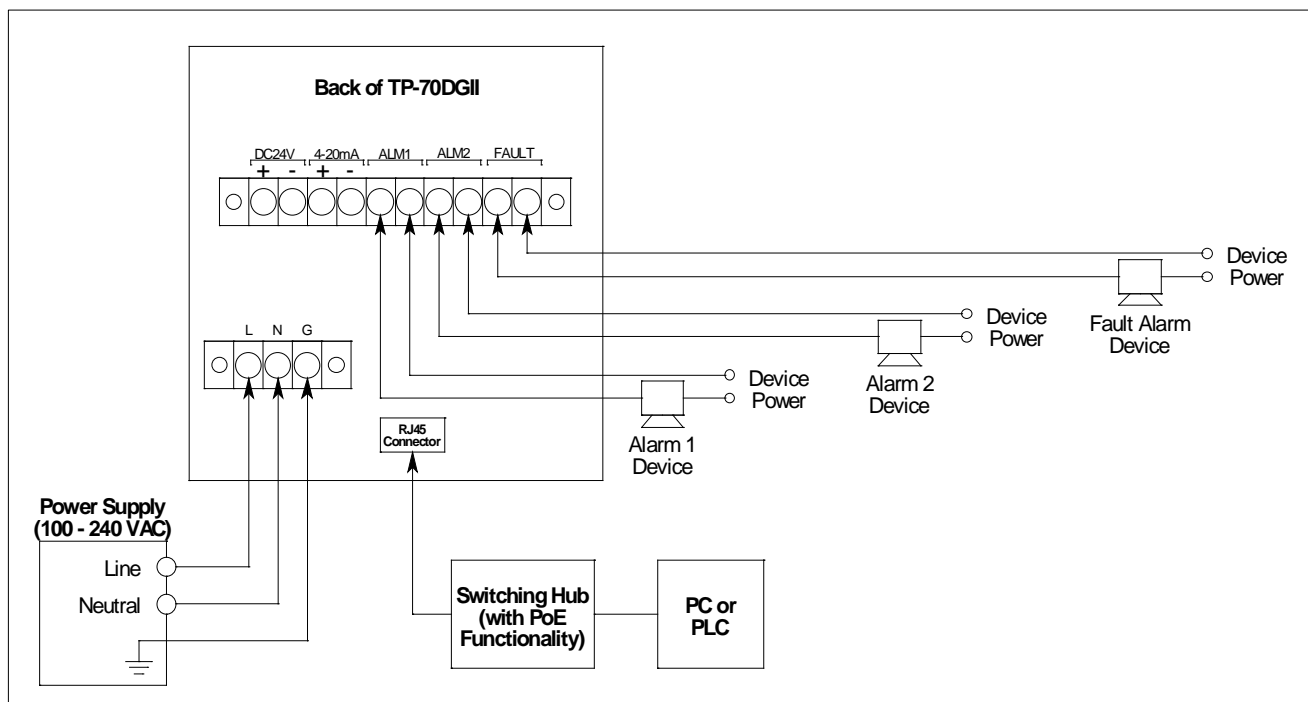
Ethernet Wiring (EA specification with Ethernet)



CAUTION

Do not use a switching hub equipped with PoE function with the Ethernet specification. Using it causes the PoE power and 24 V power to be supplied at the same time, which may cause a failure.

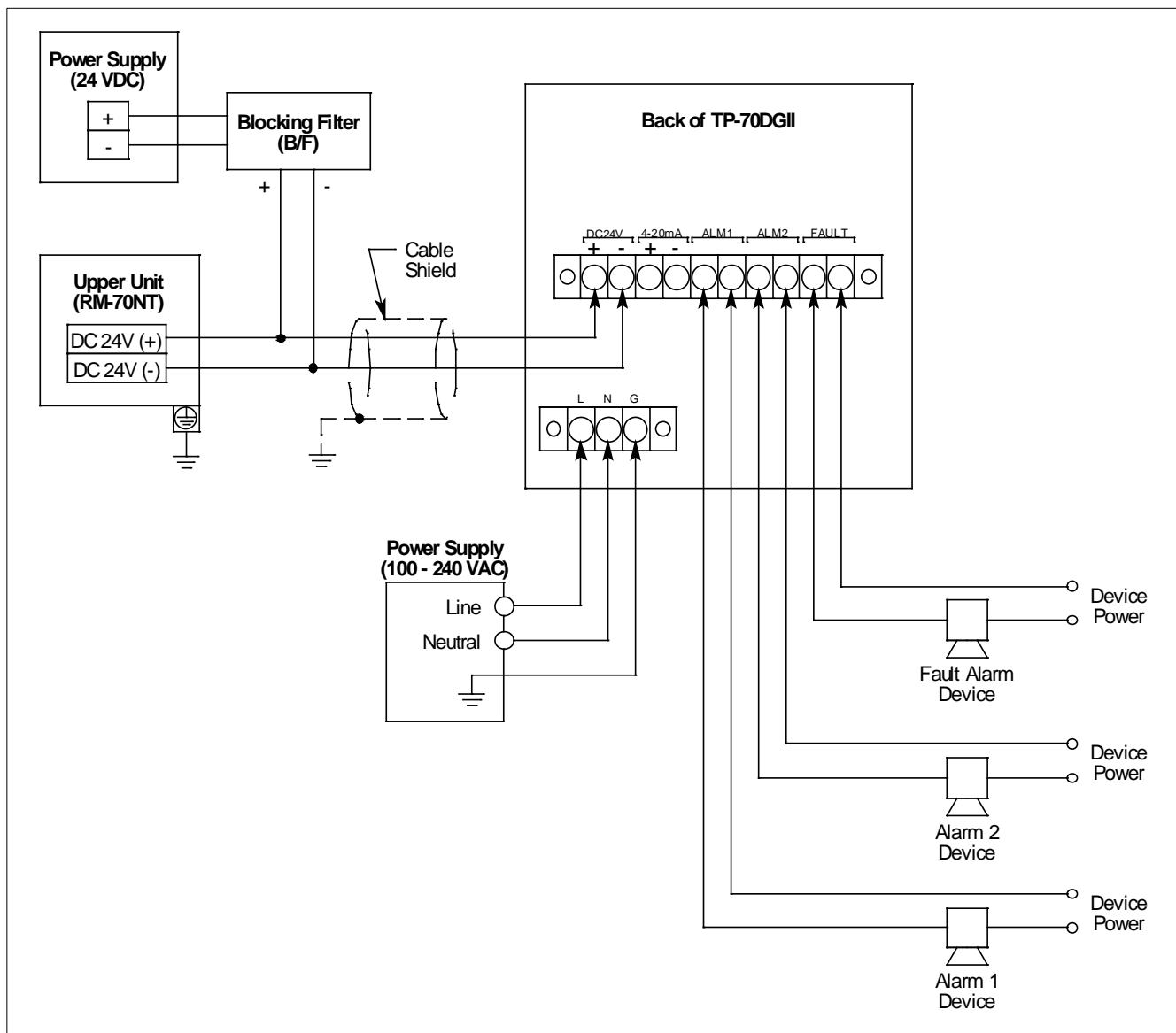
PoE Wiring (EA specification with PoE)



CAUTION

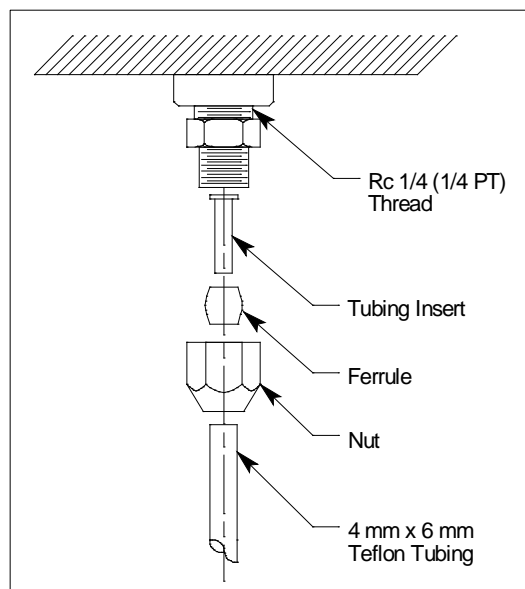
Be sure to use a switching hub equipped with PoE function with the PoE specification.
If the PoE function is unavailable, the power will not be supplied to the display unit.

RM-70NT Wiring (for NT specification)



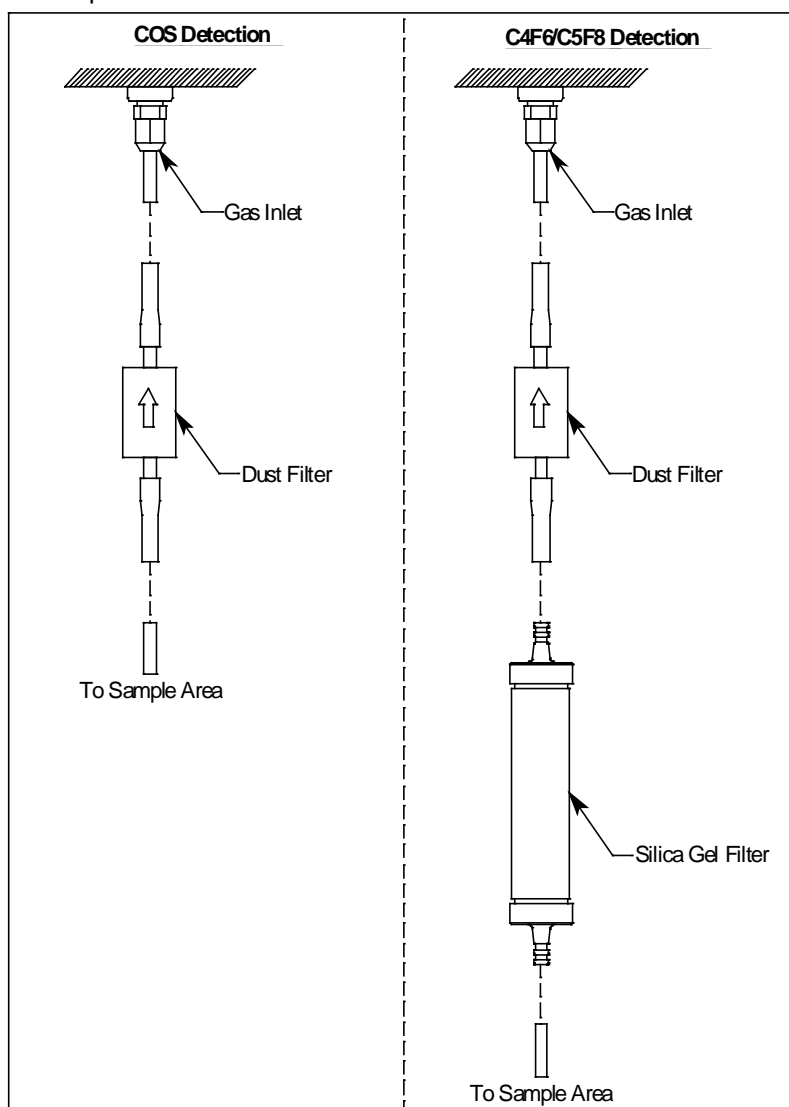
4-5. Making Tubing Connections

1. The tube nut, ferrule, and tubing insert are shipped uninstalled and the open GAS IN and GAS OUT fittings are covered with protective rubber caps. Remove the rubber caps from the GAS IN and GAS OUT fittings.
2. Install a short piece of 4 mm x 6 mm Teflon tubing to the GAS IN fitting as shown below. Be sure the tubing insert, ferrule, and nut are installed properly.



3. Connect the dust filter to the tubing. The dust filter has an arrow on it to indicate flow direction. Be sure the arrow is pointing toward the GAS IN fitting.
4. For C4F6/C5F8 versions ONLY: Connect the silica gel filter to the dust filter.

5. Install another piece of 4 mm x 6 mm Teflon tubing to the other end of the dust filter (or silica gel filter) and route it to the sample area.



6. Attach 4 mm x 6 mm Teflon tubing to the GAS OUT fitting and route it to a safe area. Be sure to use the tubing insert, ferrule, and nut as shown above.



WARNING

- The gas detector is designed to draw gases under atmospheric pressure. If excessive pressure is applied to the detector's sampling inlet and outlet (GAS IN, GAS OUT), gas may leak from the flow system. Be sure that excessive pressure is not applied to the gas detector while used.
- Detected gases must be exhausted from the exhaust port (GAS OUT) to a safe area.



CAUTION

- Be sure your inlet line is drawing from a place most likely to see the target gas. Keep the inlet line as short as possible and use a material appropriate for the detected gas.
- Condensation can affect gas detection and corrode parts. Take all reasonable action to prevent condensation from forming.
- Be sure the included filter(s) is used in the inlet line.

5. How to Operate

5-1. Preparing for Start-Up

Before connecting a power supply, read and understand the following precautions. Ignoring these precautions may cause an electric shock or damage the unit.

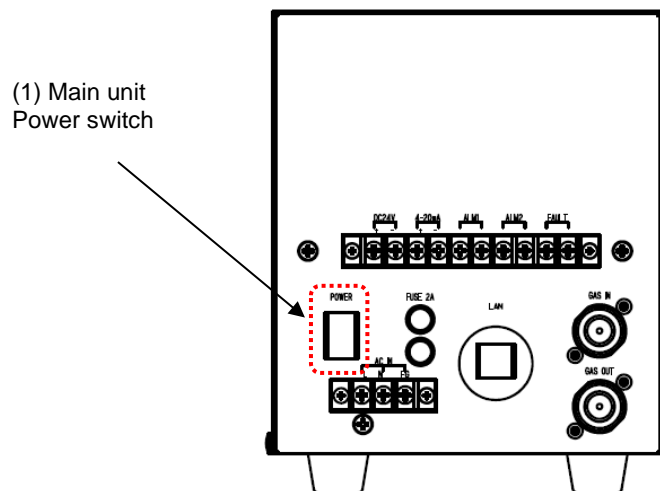
- Connect the gas detector to a grounding circuit.
- Check that the external wiring is correct.
- Check that the power voltage is compliant with the specification.
- Because the external contact may be activated during warmup, take measures to prevent an activated contact from having influences on external circuits.
- Check that there is no clogging or leak in the connected tube. (If the connected tube is clogged, pressure is applied to the sensor unit, causing errors and malfunctions.)
- Check that the filter is attached properly. (The filter is specified based on the gas to be detected.)
- Make sure to use a fuse with the specified ratings to prevent fire.
- Check that the gas detector is level. The gas detector must be installed in the correct orientation to ensure its performance. (* The detector must be moved and stored in the correct orientation.)

5-2. Turning On the Gas Detector

- Before turning on the power switch, check that the gas detector is installed properly.
- Turn on the power switch located at the back of the main unit.
- The gas detector contains a catalyst and requires warm-up to deliver adequate performance. Warm up the gas detector for a specified period to obtain accurate detection of gases. (After the power switch is turned on, the gas detector enters the detection mode immediately after the start-up flow.)

<All Specification Besides PoE>

1. Turn on the power switch at the back of the gas detector.



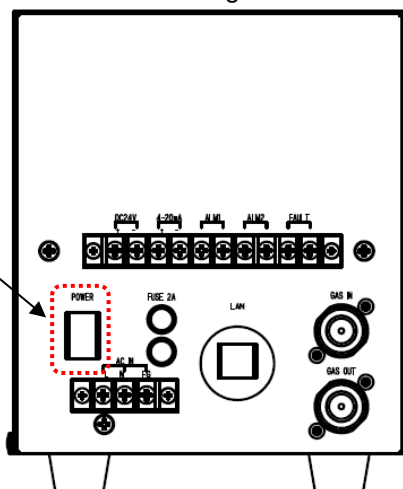
2. Allow the gas detector to warm up for the appropriate amount of time based on the unpowered time.

Unpowered Time	Warmup Time
> 1 week	24 hours (Warmup time can be reduced by using "2-13. PL AGING" in Regular maintenance mode. See page 62.)
< 1 week	2 hours

<PoE Specification>

1. Turn on the main unit's power switch at the back of the gas detector.

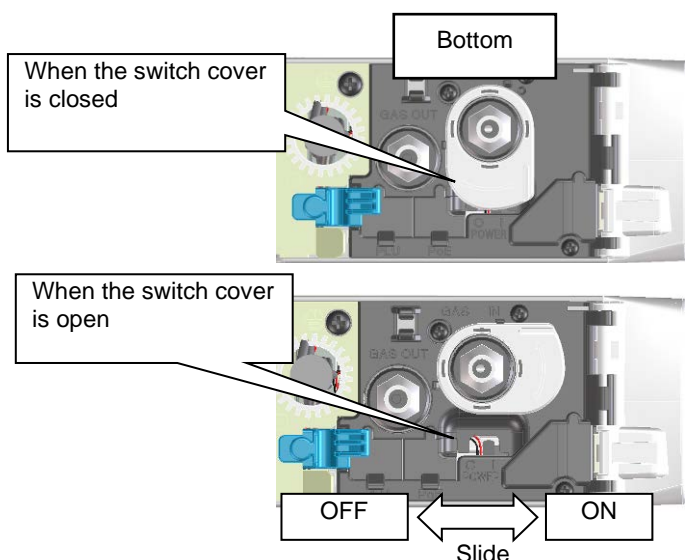
(1) Main unit
Power switch



2. Turn on the display unit's power. The power switch is protected by a cover. Rotate the switch cover to access the power switch. (Return the switch cover to the original position after the switching is completed.)



Display unit
power switch



3. Allow the gas detector to warm up for the appropriate amount of time based on the unpowered time.

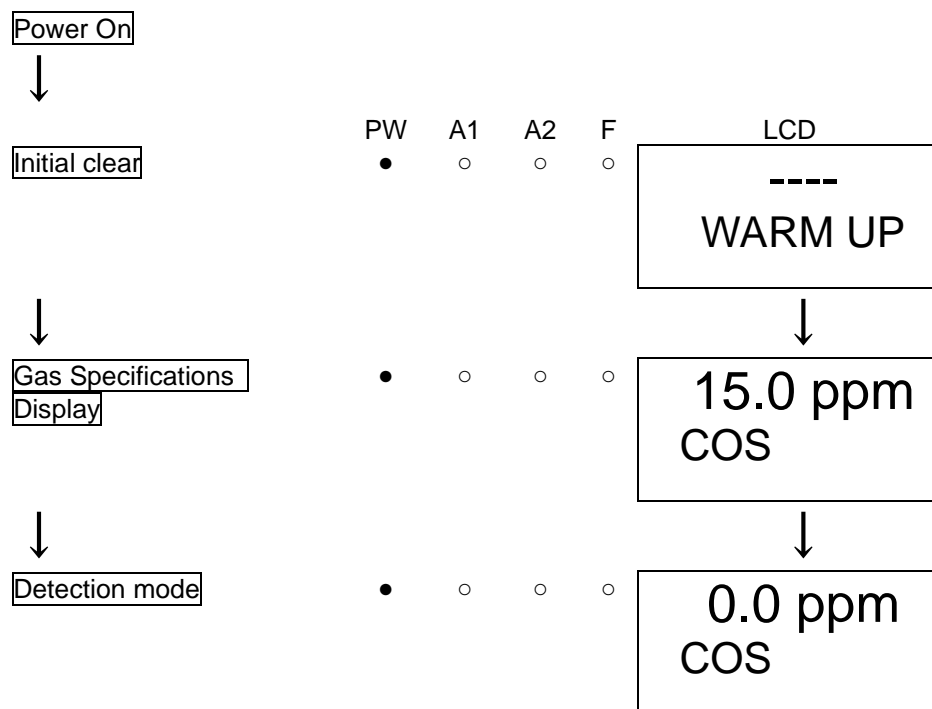
Unpowered Time	Warmup Time
> 1 week	24 hours (Warmup time can be reduced by using "2-13. PL AGING" in Regular maintenance mode. See page 62.)
< 1 week	2 hours



CAUTION

- If the display unit's power switch is turned on first, the pyrolyzer may malfunction and an error "E-7 PL UNIT" may occur. If the error is displayed, turn on the power again in the correct order.

<Startup Sequence>

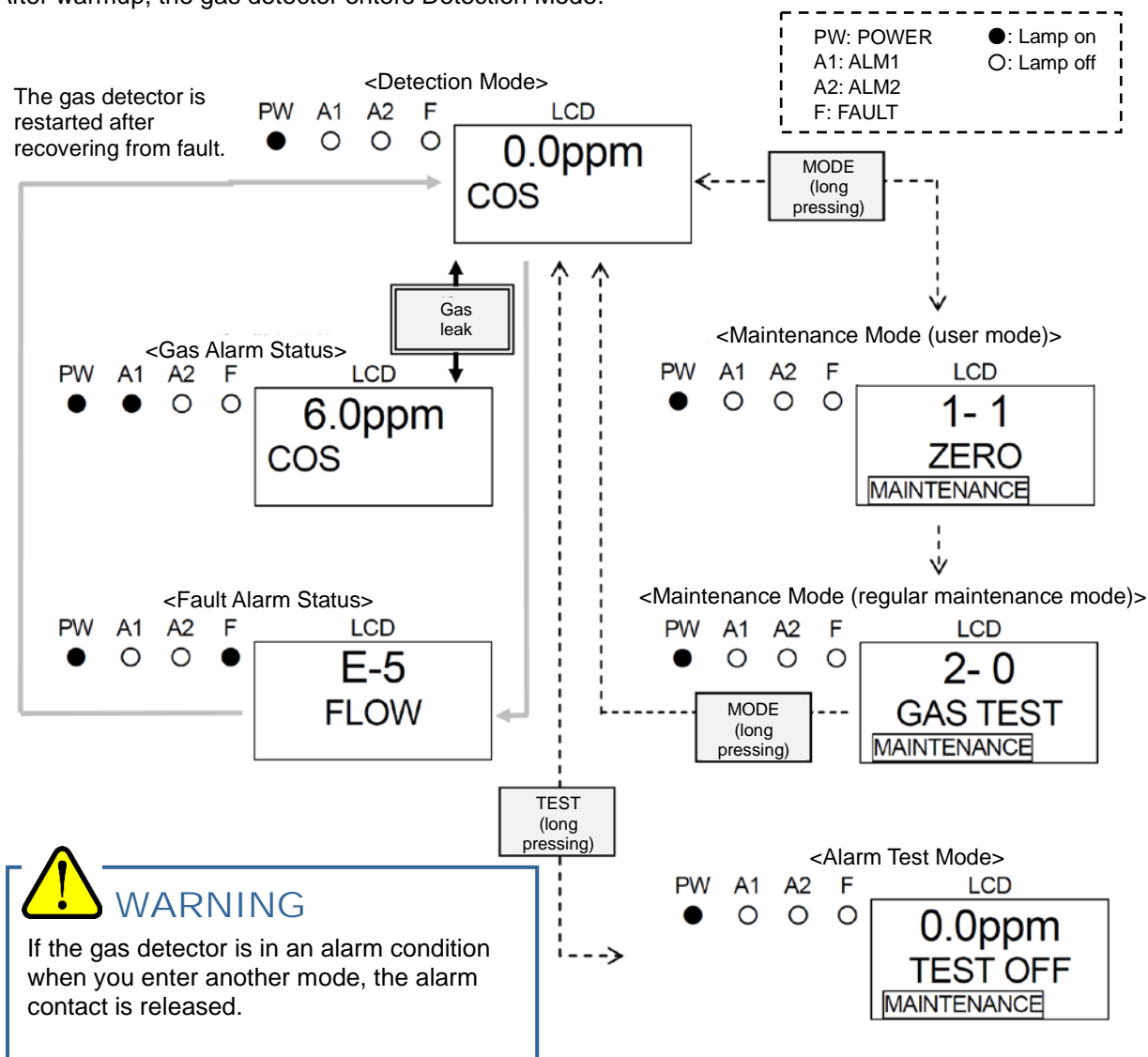


CAUTION

- Do not turn off the gas detector during the initial clear. The gas detector is reading the sensor memory during the initial clear.
- When the power is turned off to perform replacement or maintenance of parts, the gas detector needs to be warmed up for a specified period which is determined depending on the length of unpowered time.
- During the warm-up, the alarm activation and output signals are unstable. Notify the related sections so that they can prepare for false alarms.
- After the instrument has warmed up for the appropriate amount of time, be sure the flow rate indicator matches the specified flow rate, and then perform a calibration.

5-3. Basic Operation

After warmup, the gas detector enters Detection Mode.



5-4. Modes

Details on each mode are provided as follows. (* Operations are slightly different depending on the sensor unit.)

Mode	Item	LCD display	Details
Detection mode	—	Gas concentration Gas name	Normal state
Alarm test mode	—	Gas concentration	Perform the alarm test.
Maintenance Mode (User)	Zero Adjustment (span adjustment)	1-1 ZERO (1-1 SPAN)	Perform zero adjustment. (In case of oxygen 0 - 25 vol%, perform span adjustment.) => <u>Span adjustment is not used on the gas detector.</u>
	Setting Display	1-2 CONFIRM	Display the typical settings. <ul style="list-style-type: none"> • First alarm setpoint (AL1) • Second alarm setpoint (AL2) • Alarm delay time • Zero suppression value • Zero follower ON/OFF • Sensitivity correction ON/OFF
	Flow Rate Indicator	1-3 FLOW	Display the current flow rate.
	Address Display	1-4 ADDRESS	Display the address.
	Main Unit Version Display	1-5 70D VER	Display the program version of the main unit.
	Unit Version Display	1-6 UNIT VER	Display the program version of the sensor unit.
	Net Version Display	1-7 NET VER	Display the program version of the communication function.
	Communication output setting	1-8 COM SET	Set communication output.
	Regular maintenance mode switching	1-9 M MODE	Switch to the regular maintenance mode.
Maintenance mode (Regular maintenance)	See page 44.		

5-5. Turning Off the Detector

To turn off the gas detector, turn "OFF" the power switch located on the rear side of the main unit. Then, turn off the power supply to the gas detector.



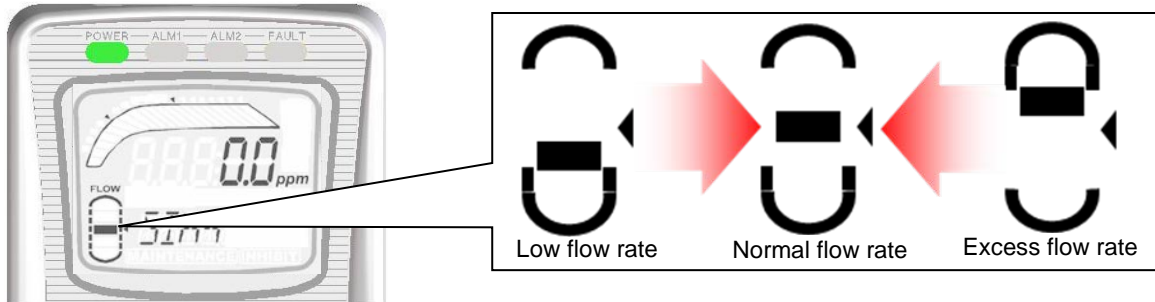
WARNING

- When the gas detector is turned off, an alarm may be triggered on the upper (central) system. Before turning off the gas detector, the inhibit (point skip) on the upper (central) system must be activated.
Decide whether the power can be turned off by checking the operation of the devices connected to the external output or external contact output terminal of the gas detector.
- If the alarm contact is energized (option), it is activated when the gas detector is turned "OFF".
- If the gas to be detected has an adsorptive property, the gas detector must be cleaned thoroughly with fresh air before turning "OFF" the gas detector.

6. Detection Mode

<Flow Rate Indicator>

Because the flow rate of the gas detector is automatically adjusted by the flow rate control function, the flow rate, in principal, does not need to be controlled. As shown on the figure below, when the flow rate does not correspond to the specified flow rate for some reasons, it is adjusted automatically.



CAUTION

If the automatic flow rate adjustment does not work (due to clogged tube or leak), messages such as "FLOW" for an unstable flow rate or "E-05" for flow rate abnormalities are displayed. In this case, you must identify the causes and take appropriate actions.

6-1. Gas Alarm Activation

Gas alarm: Triggered when the concentration of detected gas reaches or exceeds the alarm setpoint value.

NOTE

The alarm setpoint (first alarm and second alarm) is factory-set. Although the alarm delay time (standard: two seconds) works in the gas detector to prevent a false activation, it can be canceled if not needed.

<Visual Indications During Alarm Condition>

Gas Concentration Display

If the gas concentration rises above the detection range (Over Scale), "∞ ∞ ∞ ∞" appears on the LCD.

Power Indicator Lamp (POWER: Green)

Continuously on while power is applied.

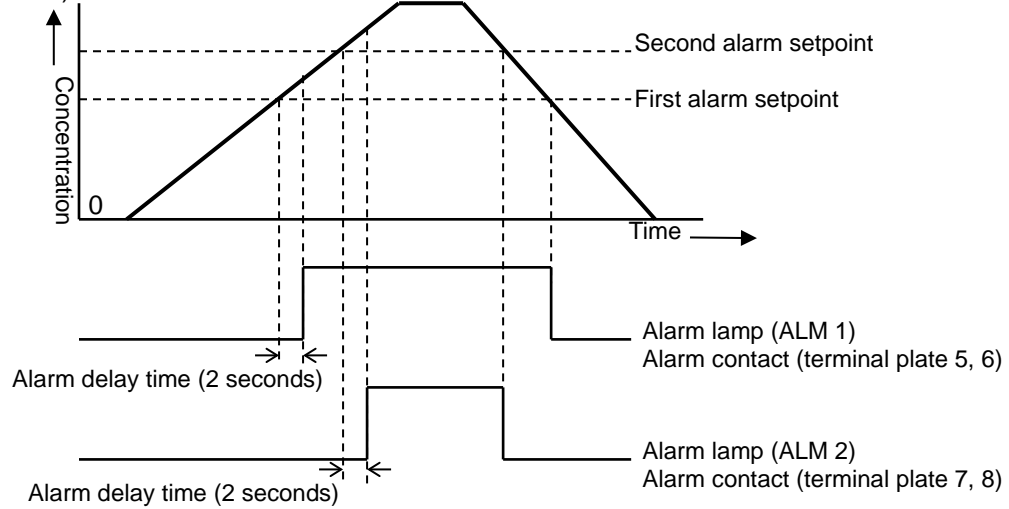
Alarm Indicator Lamp (ALM1: Red), (ALM2: Red)

Each alarm lamp lights up when its alarm setpoint value is reached or exceeded.

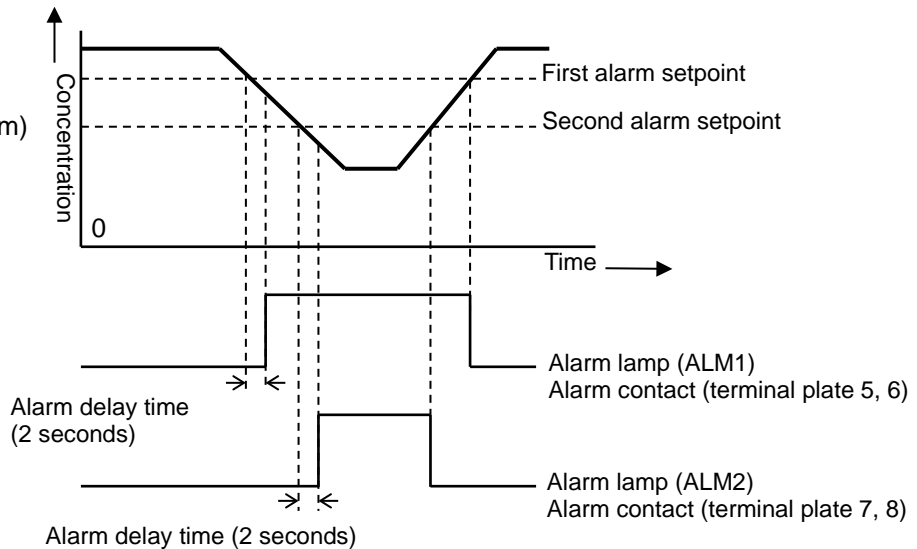
<Contact Activation>

The contact is activated when the gas concentration reaches or exceeds the alarm setpoint value. The contact activation is reset automatically when the gas concentration drops below the alarm setpoint value.

"Alarm Pattern (H-HH)"



"Alarm Pattern (L-LL)"
(* oxygen deficiency alarm)



<Responding to a Gas Alarm>

- Check the reading of the gas detector.

NOTE

If a gas leak was momentary or if the alarm was triggered by noise, the reading may already be back to a fresh air reading.

- To ensure safety, no one should be allowed access to the monitored area.
- If gas continues to be present, close the main gas valve, and then check the gas reading.
- If gas continues to be present, using a portable gas detector to check the leak point.
- If you can determine that the point is free from dangers, take actions to fix the gas leak.

6-2. Fault Alarm Activation

A fault alarm is triggered when the gas detector detects abnormalities. After a fault alarm is triggered, the FAULT lamp (yellow) lights up and an error message displays on the LCD. Determine the causes and take appropriate actions.

After the gas detector recovers from a fault, it restarts and follows the same startup procedure as a regular startup.

If the gas detector repeatedly malfunctions, contact RKI immediately.



* E-5 FLOW
(flow rate abnormalities)

NOTE

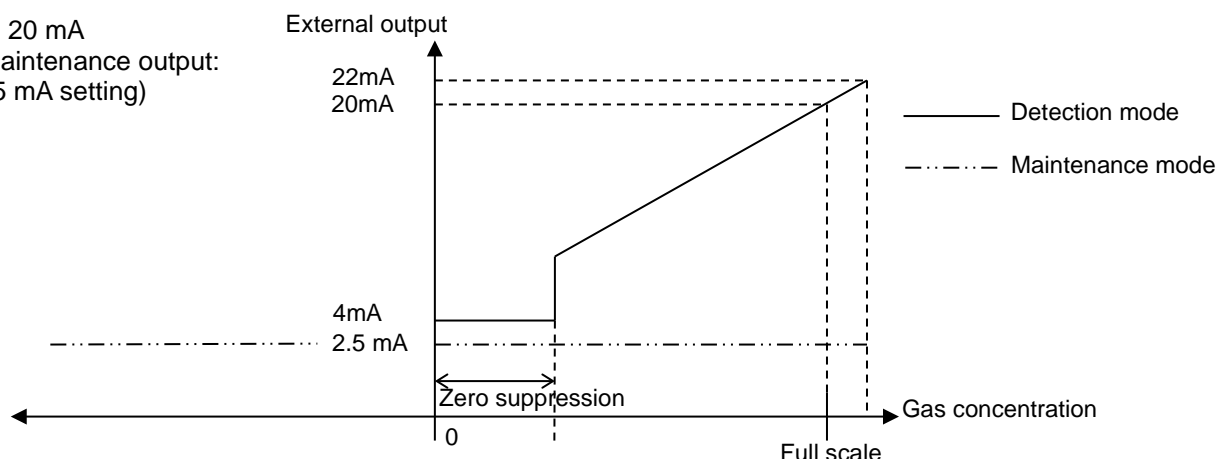
For information on error messages, see "Troubleshooting" on page 79.

6-3. External Output Operation

Specifications		4 - 20 mA	Power-line communication system	Ethernet
Signal Transmission System		Analog transmission (non-isolated)	2-wire type DC power-line communication	Ethernet (10BASE-T/100BASE-TX)
Transmission Path		CVVS	KPEV-S	Ethernet cable
Transmission distance		Below 1 km	Below 300m (depending on the system conditions)	Below 100m (depending on the system conditions)
Connection Load Resistance		Below 300 Ω	—	
(1)	Detection mode (no alarm)	4 - 20 mA (concentration output)	Concentration data	
(2)	Detection mode (gas alarm)	4 - 20 mA (concentration output)	Concentration data, Alarm bits	
(3)	Initial Clear	Depending on the setting of (4) 2.5 mA setting: 2.5 mA 4 mA, HOLD, 4 - 20 mA setting: 4 mA	Initial bit	
(4)	Maintenance Mode	2.5 mA setting: 2.5 mA 4 mA setting: 4 mA HOLD setting: The previous value retained 4-20 mA setting: 4 - 20 mA (concentration output)	Concentration data, Adjustment bit	
(5)	Alarm Test	Output ON setting: 4 - 20 mA (concentration output) Output OFF setting: The previous value retained	Concentration data, Adjustment bit, Test bit	
(6)	Fault Alarm	0.5 mA (Fixed)	Fault bits	
(7)	Inhibit	Depending on the setting of (4) 2.5 mA setting: 2.5 mA 4 mA, HOLD, 4 - 20 mA setting: 4 mA	Concentration data, Adjustment bit, Inhibit bit	
(8)	Power interruption	0mA	Signal OFF	

Example of Gas Concentration and External Output

4 - 20 mA
(Maintenance output:
2.5 mA setting)



CAUTION

<Analog Transmission (4 - 20 mA)>

- The 4 - 20 mA output is already adjusted. In case of an over scale reading, the output will not exceed 22 mA.
- Output during inhibit or initial clear is based on 4 - 20 mA output setting in the maintenance mode. The output during an OSU sensor's initial clear may drop as low as 2.5 mA during initial clear. In particular, this occurs when the gas detector is started or if the specification is changed. Prevent false alarms, as necessary (e.g. making an inhibit status).

<Communication Specifications>

Power-line communication system	The gas detector is used in a local network formed with a multi-display unit (RM-70NT) as the base unit. For more information, see the operating manual of the multi-display unit.
Ethernet	<p>The gas detector offers functions that work with external software using a standard network protocol. For details, see the separate manual for communication function.</p> <p><u>Web function (HTTP), mail send function (SMTP), and time synchronization function (SNTP)</u></p> <p>Use a Web browser of an upper-unit PC to view and change setting values and perform calibration and test on a graphical user interface.</p> <p>SMTP, when receiving a gas alarm or fault alarm from an external mail server, can send a notification mail to a registered address.</p> <p>SNTP, receiving time information from a time server, can correct the clock at regular intervals.</p> <p><u>Modbus slave function (Modbus/TCP)</u></p> <p>Works as a Modbus slave and feeds back a setting value in response to a read request or changes a setting value in response to a write request.</p> <p><u>PLC linkage function (FINS·MC)</u></p> <p>Sends a setting value to PLC to provide information to be processed by PLC in a ladder program. Reading from PLC is also available to change a setting value or perform calibration and test.</p>

6-4. Other Functions

<Suppression Function>

Some types of sensors are affected by environmental changes (temperature, humidity, etc) or interference gases, which affects the reading.

Therefore, the reading might fluctuate around zero even in a fresh air environment with no gas leak.

The suppression function hides (suppresses) the fluctuations around the zero reading up to a certain point. Once the gas reading is outside of that suppression range, a reading appears on the display.

<Example: COS 0 - 15 ppm rated range>

0.5 ppm
COS

Suppression Function Disabled

A fluctuation around zero is displayed as the reading.



0.0 ppm
COS

Suppression Function Enabled

A fluctuation under the standard setting value = 6% FS (0.9 ppm) is hidden with zero.
(Zero suppression)

NOTE

- In the maintenance mode, this function is disabled and all fluctuations around the zero reading are displayed.



CAUTION

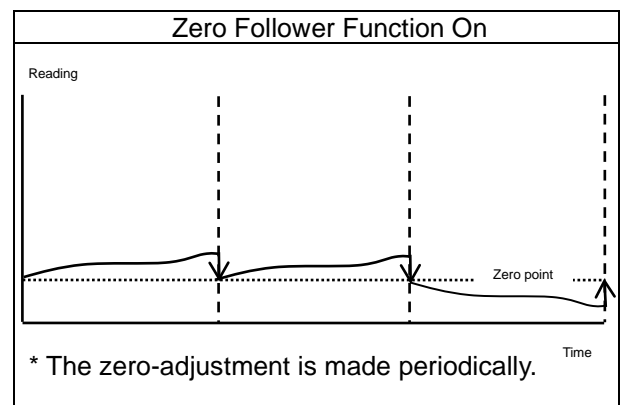
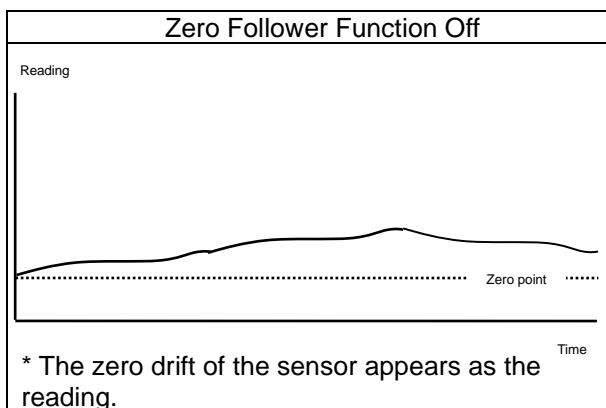
A reading below zero is suppressed with the 10% FS suppression.

A reading that gets 10% FS or more below zero is displayed as "-0.0", which prevents an accurate gas detection and requires a zero adjustment.

<Zero Follower Function>

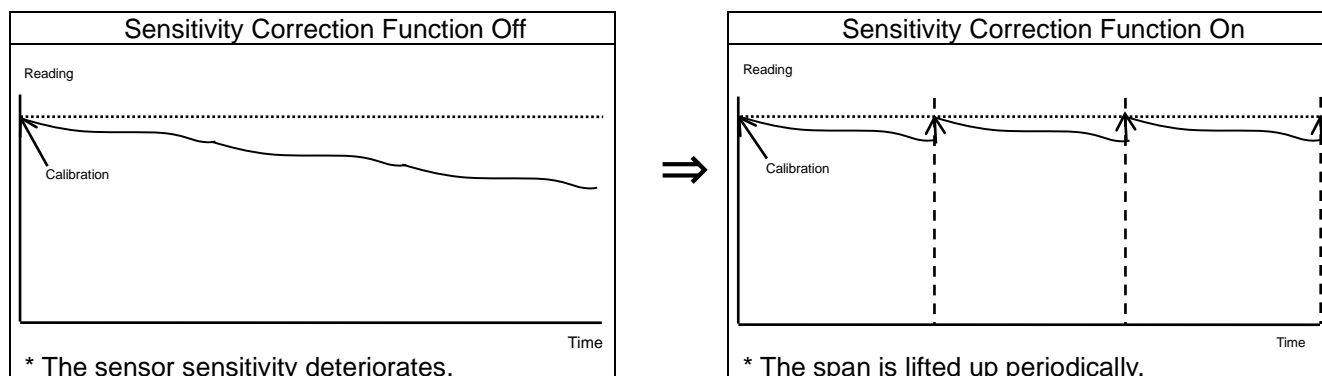
Electrochemical (ESU) and pyrolysis-particle (SSU) sensors have sensitivity variations after being used for a long period.

The zero follower function corrects the zero point (zero drift) for sensitivity variations over time using program manipulation to stabilize the zero point.



<Sensitivity Correction Function>

Electrochemical (ESU) sensors may have sensitivity variations after being used for a long period. The sensitivity function compensates for the deterioration in gas sensitivity over time. It makes a span adjustment based on the principled deterioration pattern.



CAUTION

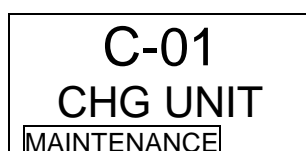
The sensitivity correction function is just an auxiliary function. It uniformly lifts the span up based on the principled deterioration pattern only and cannot consider the sensitivity variation of an individual sensor.

<Calibration History/Alarm Trend History/Event History Functions>

The gas detector and the sensor unit have their own history functions. To use these functions, please contact RKI.

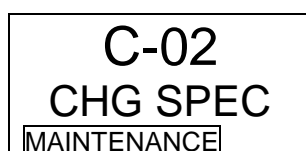
<Sensor Unit Automatic Recognition Function>

The gas detector automatically recognizes when a new/different sensor unit is installed. One of the two screens shown below appears.



Unit Replacement

Displayed when a new sensor of the same type is installed (ie. sensor replacement). Press the MODE key to acknowledge the message and start the gas detector. "CHG UNIT" and "USED SEN" alternate if the replacement sensor's manufacture date is older than the previous sensor. Confirm that the correct sensor was installed and that an old sensor was not installed by mistake.



Specification Change

Displayed when a different type of sensor is installed. If you intended to install a different type of sensor, press the MODE key to acknowledge the message and start the gas detector. If you did not intend to install a different type of sensor, check the sensor.



CAUTION

Acknowledging a "C-02" message changes the detector specification and sets everything to standard settings. If you want to use nonstandard setting values, set them in the maintenance mode. Data from the new sensor is already output to digital data before the "C-02" message is acknowledged.

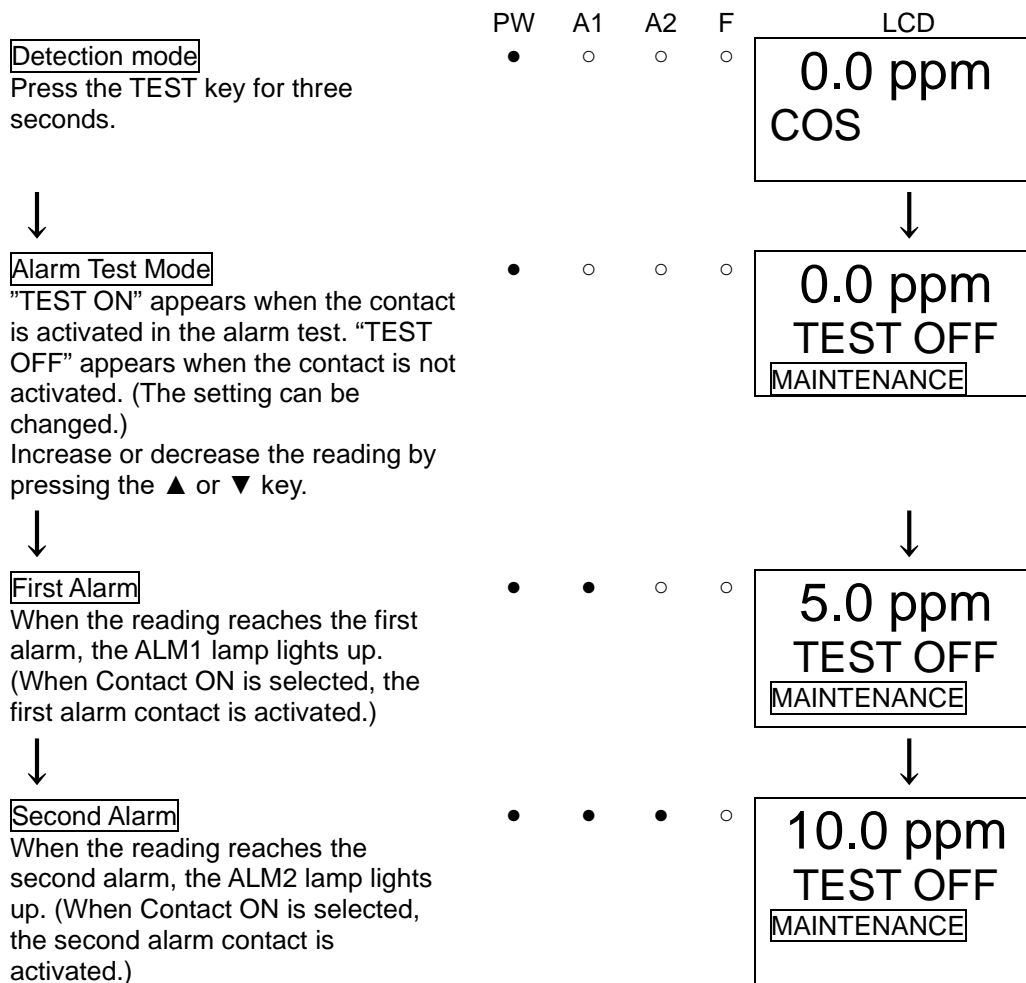
7. Alarm Test Mode

Alarm Test Mode generates dummy signals that mimic gas concentrations in order to check alarm lamp activation and the transmission to external circuits.



WARNING

Before starting the alarm test (transmission test), inform affected areas about a false alarm. After the test is completed, be sure to press the TEST key to return to the detection mode.
(The gas detector will automatically return to detection mode after 10 hours.)

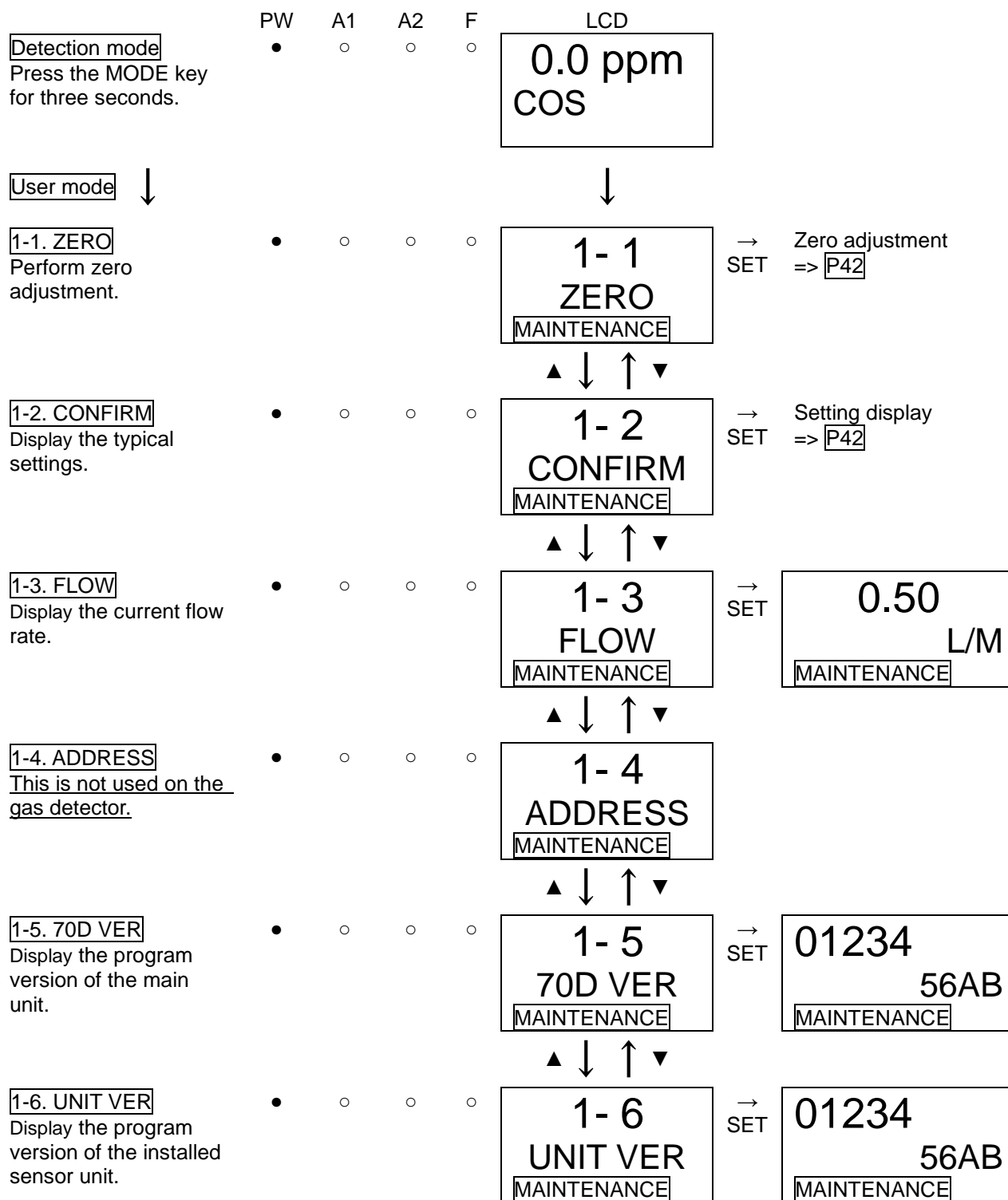


8. User Mode



WARNING

After the adjustment is completed, press the MODE key to return to detection mode.
(The detector will automatically return to detection mode after 10 hours.)



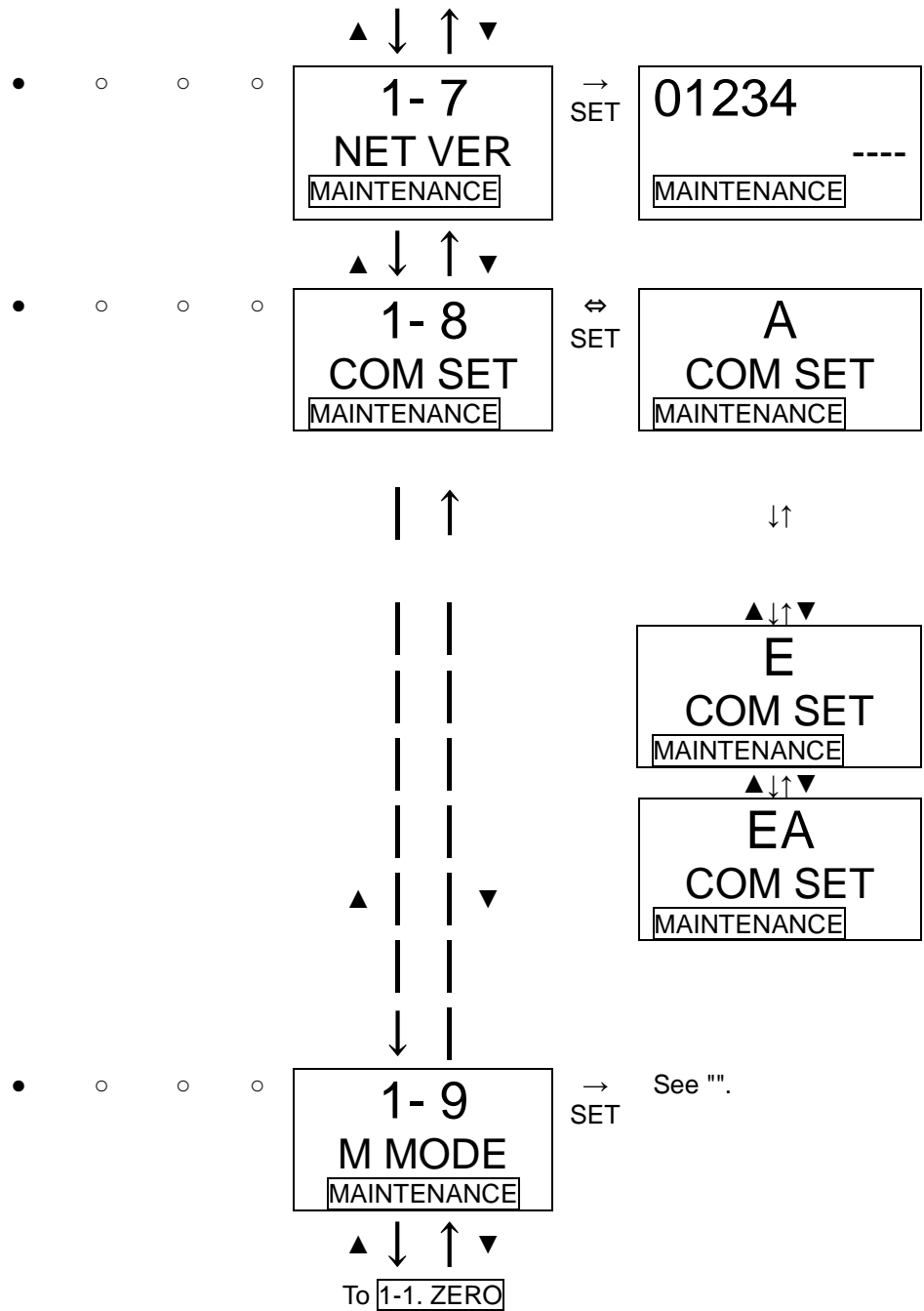
Display the program version of the communication function.

Set communication output.

Press the ▲ or ▼ key to select the communication output, and then press the SET key to confirm the value.

A: Analog transmission
E: Ethernet
EA: Ethernet and
analog transmission

Switch to the regular maintenance mode.

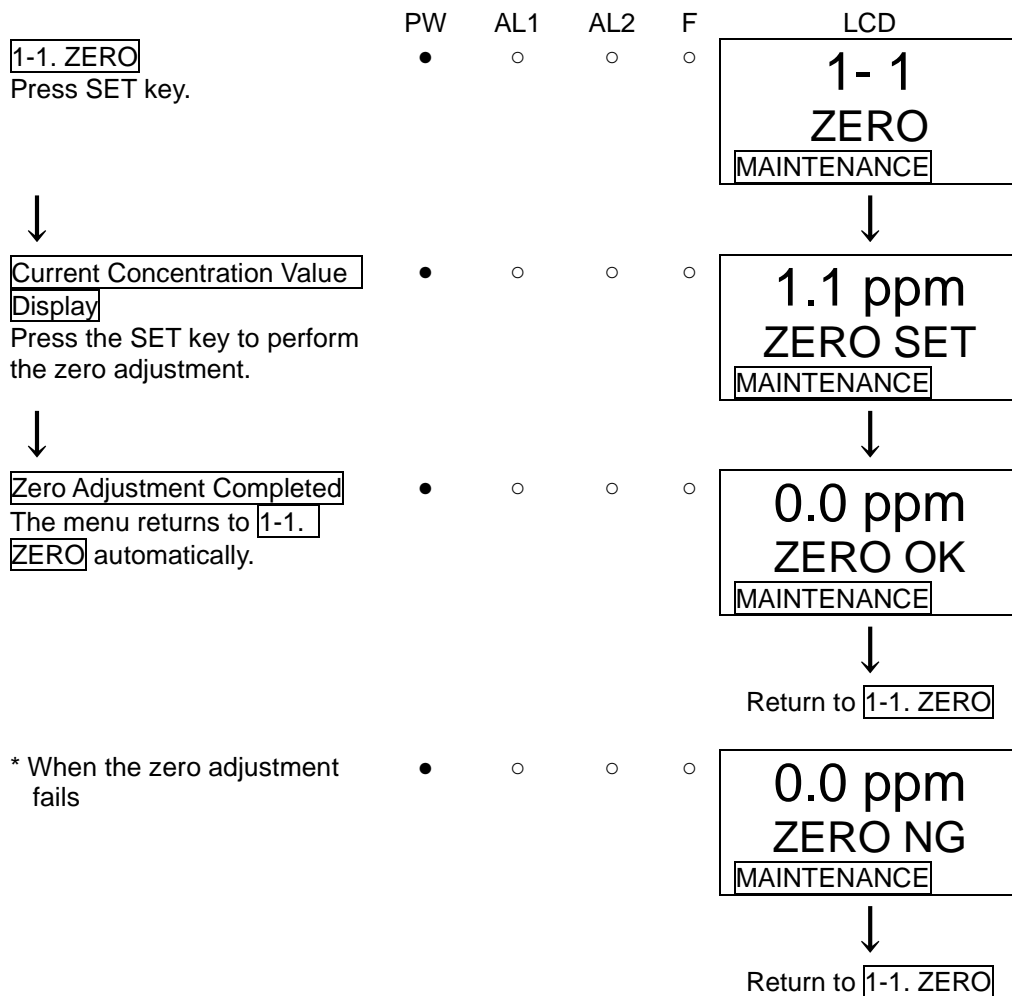


NOTE

- For the case of using analog transmission only (Ethernet is not used), when the communication output is set to A, Communication Abnormalities **E-6** does not occur even if an Ethernet cable is not connected.

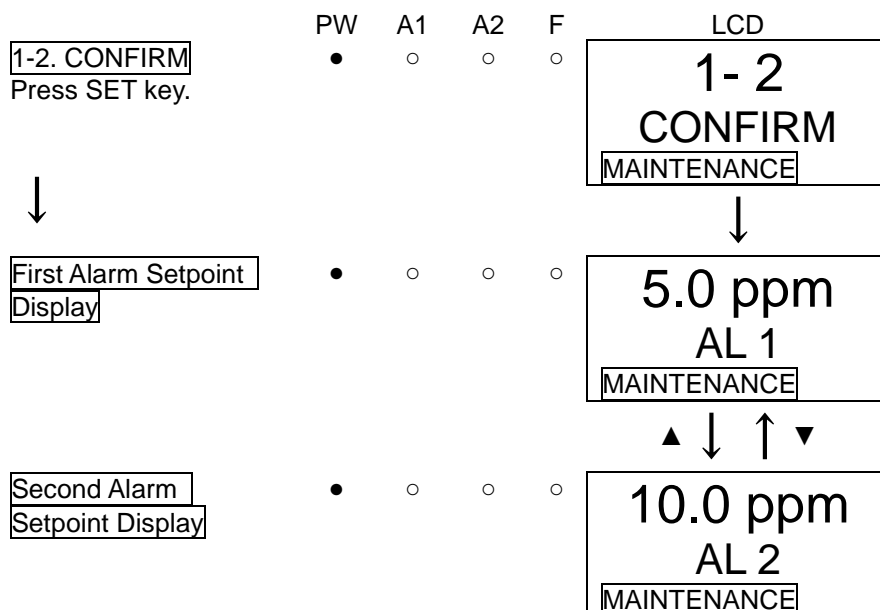
<Zero Adjustment "1-1">

This is used to perform the zero adjustment. Before starting the zero adjustment, let the gas detector draw the zero adjustment gas and wait until the reading is stabilized.



<Setting Display "1-2">

This is used to check the setting of typical menus.



Alarm Delay Time Display (seconds)	•	○	○	○	<div>▲ ↓ ↑ ▼</div> <div>2</div> <div>ALM DLY</div> <div>MAINTENANCE</div>
Zero suppression value display	•	○	○	○	<div>▲ ↓ ↑ ▼</div> <div>0.9 ppm</div> <div>SUPPRESS</div> <div>MAINTENANCE</div>
Zero follower ON/OFF display (If ESU or SSU is installed)	•	○	○	○	<div>▲ ↓ ↑ ▼</div> <div>ON</div> <div>ZERO F</div> <div>MAINTENANCE</div>
Sensitivity Correction ON/OFF Display (If ESU installed)	•	○	○	○	<div>▲ ↓ ↑ ▼</div> <div>OFF</div> <div>S ASSIST</div> <div>MAINTENANCE</div>
					<div>▲ ↓ ↑ ▼</div> <div>To First Alarm Setpoint Display</div>

9. Maintenance Mode



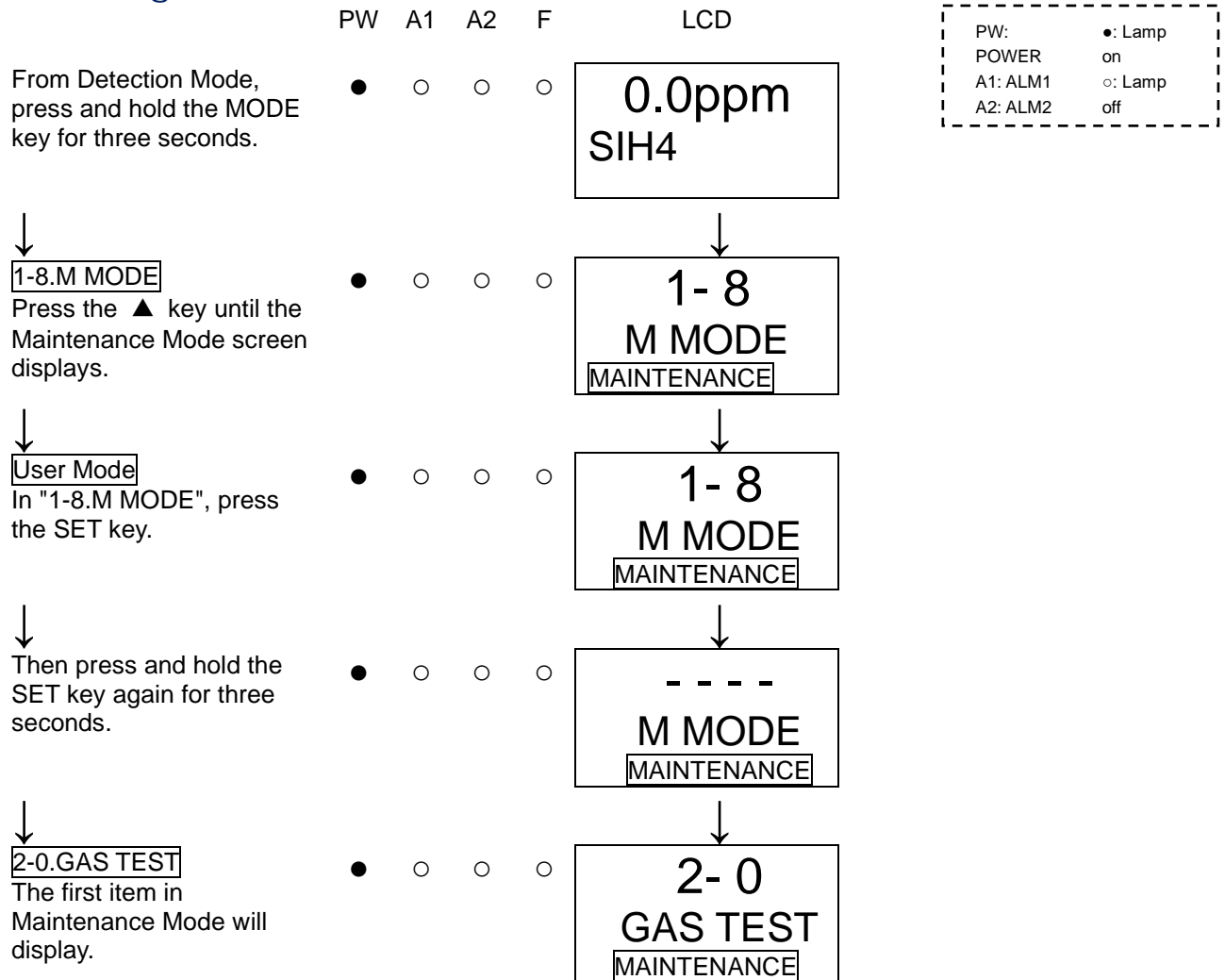
WARNING

After the adjustment is completed, press the MODE key to return to detection mode.
(The detector automatically returns to detection mode in 10 hours.)

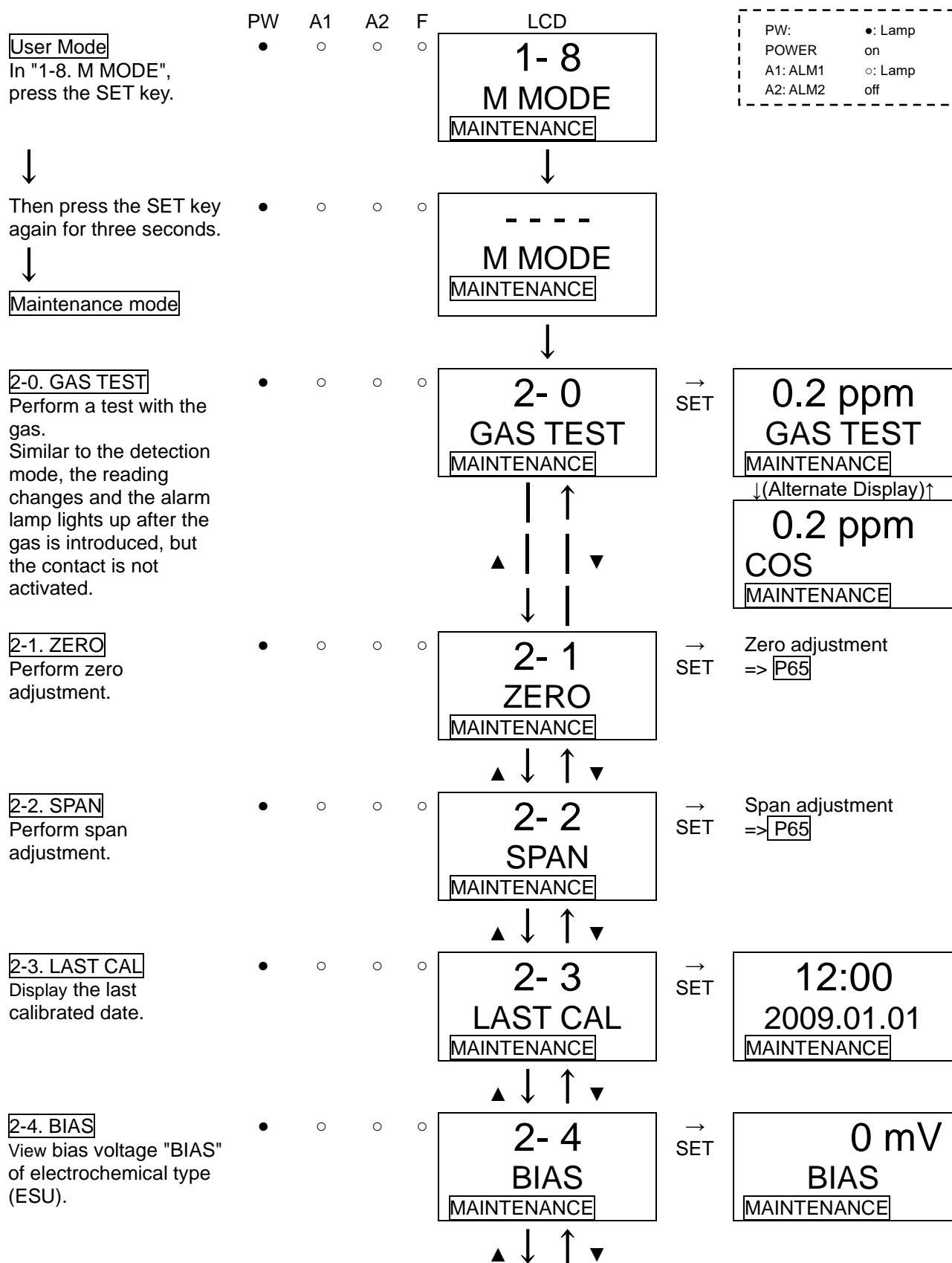
Mode	Item	LCD display	Details
Maintenance mode (Regular maintenance)	Gas introduction display	2-0 GAS TEST	Perform the gas introduction test in the regular maintenance mode.
	Zero adjustment => P65	2-1 ZERO	Perform zero adjustment.
	Span Adjustment => P65	2-2 SPAN	Perform span adjustment.
	Last Calibrated Date	2-3 LAST CAL	Display the last calibrated date.
	Bias voltage (element voltage)	2-4 BIAS (2-4 E VOLT)	Display the bias voltage. (Display the element voltage.) => <u>Element voltage is not used on the gas detector.</u>
	Flow Rate Setting (adjusted to 0.5 L/min)	2-5 DEF FLOW	Not used.
	Flow rate manual adjustment	2-6 FLOW	Display the output and flow rate of the current pump.
	Detector temperature	2-7 TEMP	Display the current environment temperature.
	Expected warm-up completion date/time	2-8 WARMTIME	Display the expected warm-up completion for semiconductor type (SGU). => <u>This is not used on the gas detector.</u>
	Environmental setting 1 => P48	2-9 SETTING1	Operation setting SET 0. INHIBIT: INHIBIT setting SET 1. ALMP: Alarm value setting => P49 SET 2. ALM DLY: Alarm delay time setting SET 3. MAINT: Regular replacement operation (pump stop) => <u>This is not used on the gas detector.</u> SET 4. F TEST: Fault alarm test => P50
	Environmental setting 2 => P51	2-10 SETTING2	Functions setting SET 0. ADDRESS: Address setting SET 1. DAY TIME: Date and time setting => P56 SET 2. SUPPRESS: Zero suppression value setting SET 3. SUP TYPE: Zero suppression type setting SET 4. TEST RLY: Contact setting for alarm test SET 5. TEST4-20: External output setting for alarm test SET 6. RLY PTRN: Energized/De-energized setting => P57 SET 7. ALM TYP: Alarm type setting => <u>Not used on the gas detector.</u> SET 8. ALM PTRN: Alarm pattern setting SET 9. AL LIMIT: Alarm value limiter setting SET 10. FLT PTRN: Fault activation setting SET 11. AT FLOW: Flow rate auto-adjustment setting SET 12. ZERO F: Zero follower ON/OFF setting SET 13. ZERO 24F: 24 hours zero follower ON/OFF setting SET 14. S ASSIST: Sensitivity correction ON/OFF setting SET 15. MNT OUT: Set maintenance mode's external output SET 16. MA 4-20: External output adjustment SET 17. BK LIGHT: Backlight setting SET 18. ETHERNET: Ethernet setting => P58 SET 19. PUMP CK: Pump drive level diagnosis ON/OFF setting
	Pyrolyzer data display	2-11 PL DATA	Display various pyrolyzer data.

Mode	Item	LCD display	Details
	=> P60		
	Fault investigation	2-12 FAULT	Not used.
	Catalyst aging function => P62	2-13 PL AGING	Perform aging of catalyst.
	Factory mode	2-14 F MODE	Not used.

<Entering Maintenance Mode>



<Brief Overview of Maintenance Mode Screens>



2-5. DEF FLOW

This is not used on the gas detector.

• ○ ○ ○ ○

▲ ↓ ↑ ▼

2- 5

DEF FLOW

MAINTENANCE

▲ | | ▼

⇔
SET

1000

DEF FLOW

MAINTENANCE

2-6. FLOW

Display the output and flow rate of the current pump.

• ○ ○ ○ ○

2- 6

FLOW

MAINTENANCE

⇔
SET

50%

0.50 L/M

MAINTENANCE

2-7. TEMP

Display the temperature of the gas detector.

• ○ ○ ○ ○

2- 7

TEMP

MAINTENANCE

→
SET

25.0°C

TEMP

MAINTENANCE

2-8. WARMTIME

Display the suggested warm-up completion date/time for semiconductor type (SGU), which requires a long warm-up time.
* This is not used on the gas detector.

• ○ ○ ○ ○

2- 8

WARMTIME

MAINTENANCE

→
SET

12:00

2009.01.01

MAINTENANCE

2-9. SETTING1

Specify the environmental setting 1.

• ○ ○ ○ ○

2- 9

SETTING1

MAINTENANCE

→
SET

Environmental Setting
1 => P48

2-10. SETTING2

Specify the environmental setting 2.

• ○ ○ ○ ○

2-10

SETTING2

MAINTENANCE

→
SET

Environmental setting
2 => P51

2-11. PL DATA

Display the pyrolyzer data.

• ○ ○ ○ ○

2-11

PL DATA

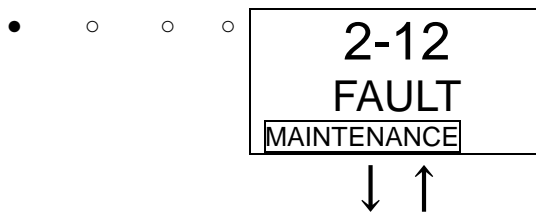
MAINTENANCE

→
SET

Pyrolyzer data display
=> P60

2-12. FAULT

This is used (by the manufacturer) to investigate and analyze the causes of faults. This is not used by the user.



2-13. PL AGING

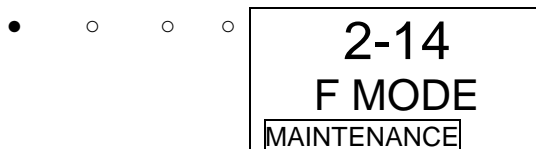
Used to perform aging of catalyst.



→ SET
Catalyst aging function
=> P62

2-14. F MODE

Enter the factory mode. This is not used by the user.



To 2-0. GAS TEST

<Environmental Setting 1 "2-9">

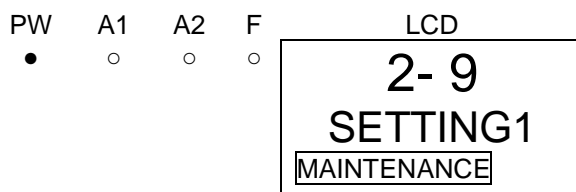
Maintenance Mode

Access Maintenance Mode as described on page 45.

2-9. SETTING1

Press the ▲ key until the "2-9 SETTING1" screen displays.

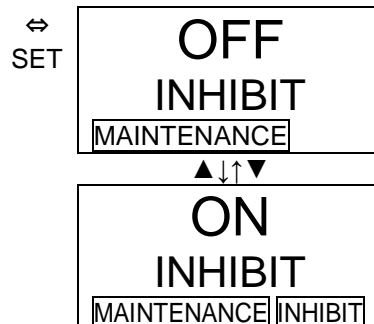
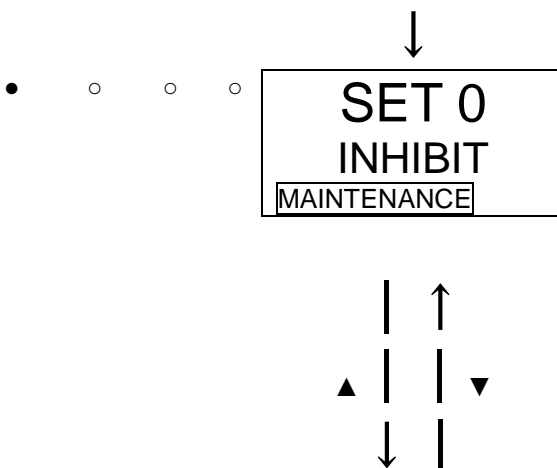
Press the SET key.



SET 0. INHIBIT

Set the inhibit. Select either ON/OFF, and then press the SET key to confirm the selection.

When ON is selected, the message INHIBIT is displayed on the LCD. As a result, an alarm is not triggered to external circuits even though the gas detector is in the detection mode.



SET 1. ALM P
Set the alarm value.

• ○ ○ ○

SET 1
ALM P
MAINTENANCE

⇔ Alarm value setting
SET => P49

▲ ↓ ↑ ▼

SET 2. ALM DLY
Set the alarm delay time.
Change the value (second) by pressing the ▲ or ▼ key, and then press the SET key to confirm the value.

• ○ ○ ○

SET 2
ALM DLY
MAINTENANCE

⇔ SET 2
ALM DLY
MAINTENANCE

▲ ↓ ↑ ▼

SET 3. MAINT E

• ○ ○ ○

SET 3
MAINT E
MAINTENANCE

* This is not used on the gas detector.

▲ ↓ | ▼

SET 4. F TEST
Perform a fault alarm test.

• ○ ○ ○

SET 4
F TEST
MAINTENANCE

⇔ Fault Alarm Test
SET => P50

▲ ↓ ↑ ▼

To SET 0. INHIBIT
Setting

<Alarm Value Setting "2-9" - "SET 1">

Maintenance Mode

PW A1 A2 F LCD

Access Maintenance Mode as described on page 45.

2-9. SETTING1

• ○ ○ ○

Press the ▲ key until the "2-9 SETTING1" screen displays.

2- 9
SETTING1
MAINTENANCE

Press the SET key.

SET 1. ALM P

• ○ ○ ○

Press the ▲ key until the "SET 1 ALM P" screen displays.

SET 1
ALM P
MAINTENANCE

Press the SET key.

↓

First alarm value setting

• ○ ○ ○

Change the value by pressing the ▲ or ▼ key, and then press the SET key to confirm the value. (Press the MODE key to skip this menu.)

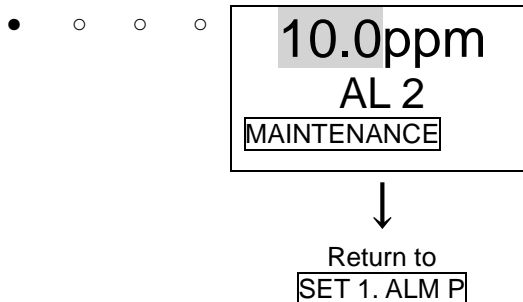
↓

5.0ppm
AL 1
MAINTENANCE

↓

Second alarm value setting

Change the value by pressing the ▲ or ▼ key, and then press the SET key to confirm the value. (Press the MODE key to skip this menu.)



<Fault Alarm Test "2-9" - "SET 4">

Maintenance Mode

Access Maintenance Mode as described on page 45.

2-9. SETTING1

Press the ▲ key until the "2-9 SETTING1" screen displays.

PW A1 A2 F LCD



Press the SET key.

SET 4. F TEST

Press the ▲ key until the "SET 4 F TEST" screen displays.



Press the SET key.



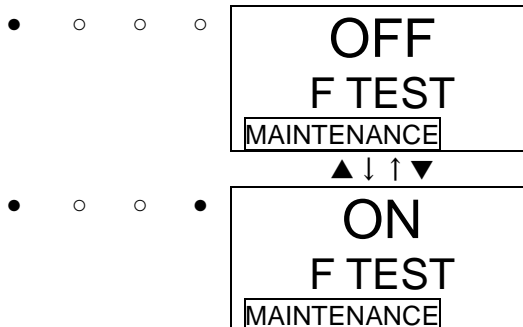
Fault Alarm Test ON/OFF

Select either ON/OFF.

Switch ON and press the SET key to trigger the fault alarm.

Return to OFF and press the SET key to cancel the test.

(Pressing the MODE key also enables to cancel this menu and to go back to the original state.)

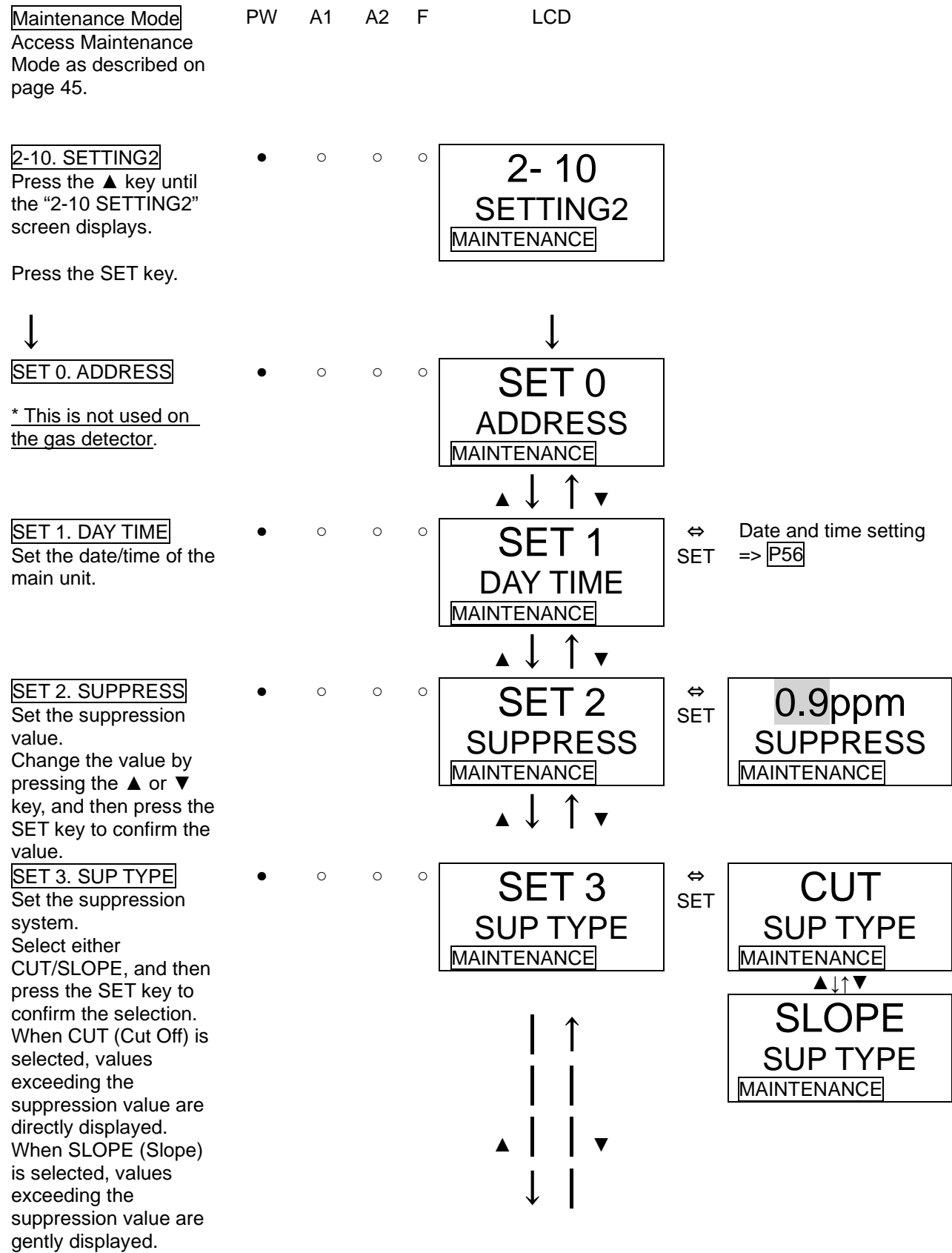


WARNING

Be careful to perform the fault alarm test, because it is the only way that the contact (fault) may be activated even in the maintenance mode. The fault alarm test cannot be performed during inhibit.

<Environmental Setting 2 "2-10">

The Environmental Setting 2 menu includes items that don't normally need adjustment. Be careful not to change these settings by mistake. If you do change these settings, RKI recommends recording the settings in a log.



SET 4. TEST RLY

Set the contact activation for an alarm test.

Select either ON/OFF, and then press the SET key to confirm the selection.

When ON is selected, the contact can be activated even during an alarm test.

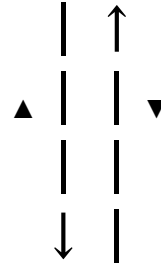
• ○ ○ ○ ○

▲ ↓ ↑ ▼
SET 4
TEST RLY
MAINTENANCE

⇔
SET

OFF
TEST RLY
MAINTENANCE

▲ ↓ ↑ ▼
ON
TEST RLY
MAINTENANCE



SET 5. TEST4-20

Set the external output for an alarm test.

Select either ON/OFF, and then press the SET key to confirm the selection.

When ON is selected, the external output (4 - 20 mA) is output even during an alarm test.

When OFF is selected, the output is kept at the one just before the alarm test mode is entered (HOLD).

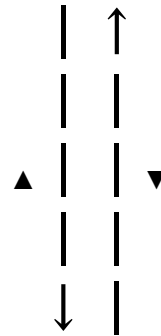
• ○ ○ ○ ○

▲ ↓ ↑ ▼
SET 5
TEST4-20
MAINTENANCE

⇔
SET

ON
TEST4-20
MAINTENANCE

▲ ↓ ↑ ▼
OFF
TEST4-20
MAINTENANCE



SET 6. RLY PTRN

Select either energized/de-energized for the contact.

• ○ ○ ○ ○

▲ ↓ ↑ ▼
SET 6
RLY PTRN
MAINTENANCE

⇔
SET

Energized/De-energized Contact Setting
=> **P57**



SET 7. ALM TYPE

Set the alarm type.

* This is not used on the gas detector.

• ○ ○ ○ ○

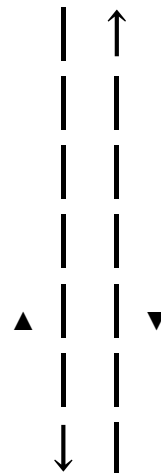
▲ ↓ ↑ ▼
SET 7
ALM TYPE
MAINTENANCE

⇔
SET

L-LL
ALM TYPE
MAINTENANCE

▲ ↓ ↑ ▼
L-H
ALM TYPE
MAINTENANCE

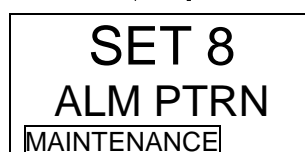
▲ ↓ ↑ ▼
H-HH
ALM TYPE
MAINTENANCE



SET 8. ALM PTRN

This is a setting screen of the gas alarm pattern. Do not change the setting when the gas detector is used in a normal way, because it determines how the gas detector functions. (Auto-reset setting: "nL")

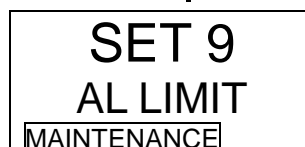
• ○ ○ ○ ○



SET 9. AL LIMIT

This is a setting screen of the alarm value limiter. Do not change the setting when the gas detector is used in a normal way. (ON setting)

• ○ ○ ○ ○



SET 10. FLT PTRN

This is a setting screen of the fault alarm pattern. Do not change the setting when the gas detector is used in a normal way, because it determines how the gas detector functions. (Auto-reset setting: "nL")

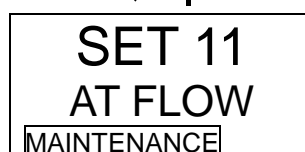
• ○ ○ ○ ○



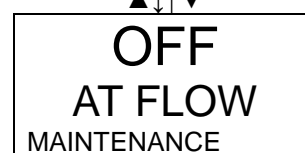
SET 11. AT FLOW

Set the flow rate auto-adjustment. Select either ON/OFF, and then press the SET key to confirm the selection. When ON is selected, the flow rate auto-adjustment is activated.

• ○ ○ ○ ○



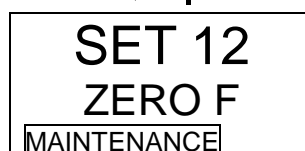
⇔
SET



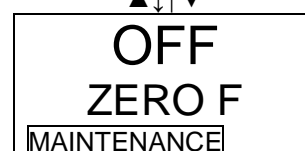
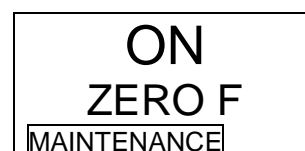
SET 12. ZERO F

Set the zero follower when the electrochemical type (ESU) or the pyrolysis-particle type (SSU) is installed. Select either ON/OFF, and then press the SET key to confirm the selection. When ON is selected, the zero follower function is activated.

• ○ ○ ○ ○



⇔
SET



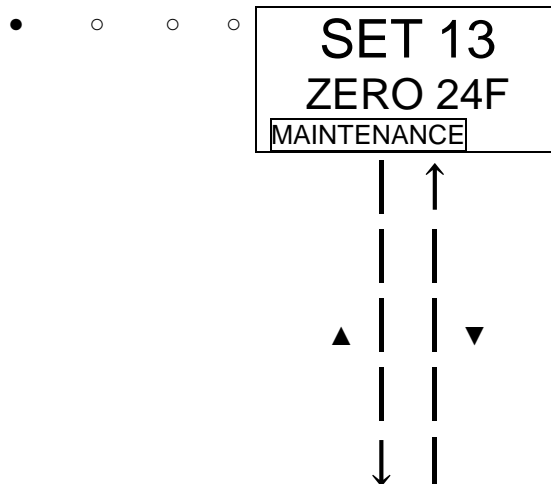
* When SSU is installed, it must always be set to ON.

SET 13. ZERO 24F

This is a supplemental setting screen for the above zero follower function. (A setting to determine whether the first-24-hour zero follower will be performed after the power is turned on.)

Do not change the setting when the gas detector is used in a normal way.

(ON setting)

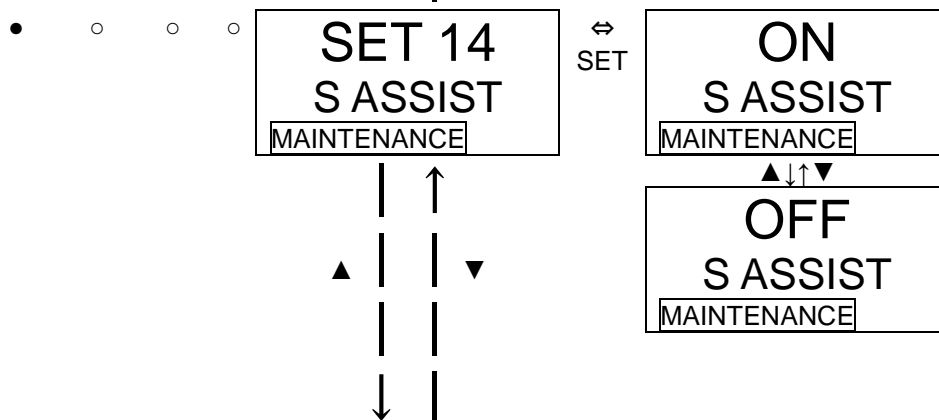


SET 14. S ASSIST

Set the sensitivity correction when the electrochemical type (ESU) is installed.

Select either ON/OFF, and then press the SET key to confirm the selection.

When ON is selected, the sensitivity correction function is activated.

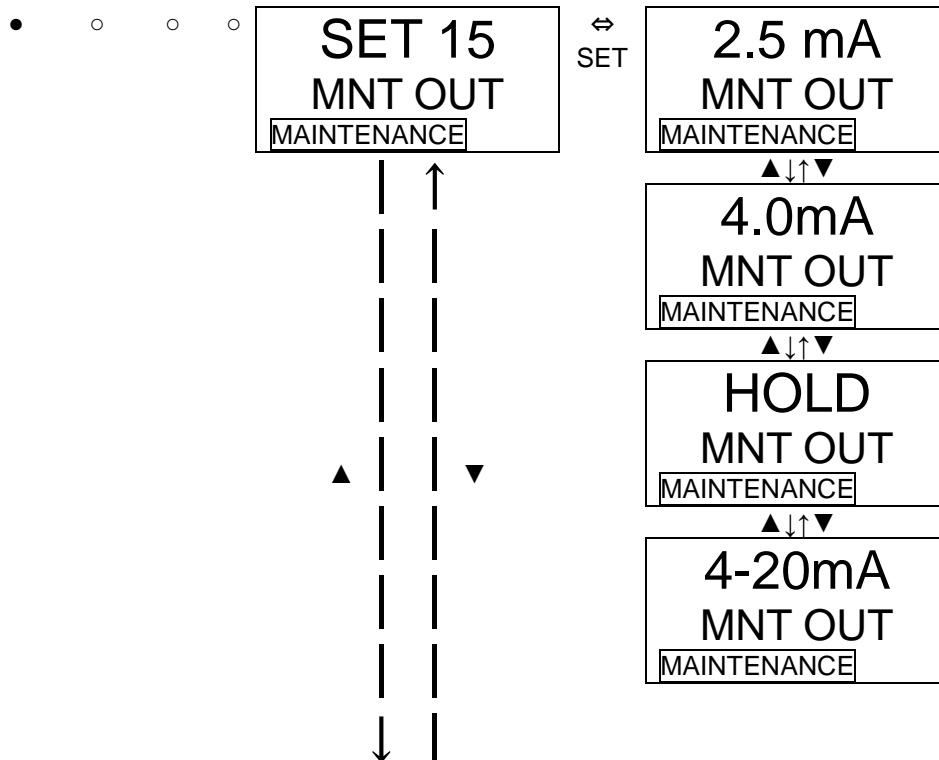


SET 15. MNT OUT

Set the external output for the maintenance mode.

Select either 2.5 mA/4.0 mA/HOLD (previous value)/4 - 20 mA (linked to display value), and then press the SET key to confirm the selection.

(4 - 20 mA specification)



SET 16. MA 4-20

Adjust the external output (4 - 20 mA).
Adjust the output (%) by pressing the ▲ or ▼ key, and then press the SET key to confirm the value.

(It must be adjusted to the upper unit or the ammeter.)

After adjustment of 4 mA is completed, perform the adjustment of 20 mA.

(Press the MODE key to skip this menu.)

(4 - 20 mA specification)

SET 17. BK LIGHT

Set the backlight.
Select either ON/SAVE, and then press the SET key to confirm the selection.

When ON is selected, the backlight lights up continuously.

When SAVE is selected, the backlight is usually turned off, but lights up only during an operation or event.

SET 18. ETHERNET

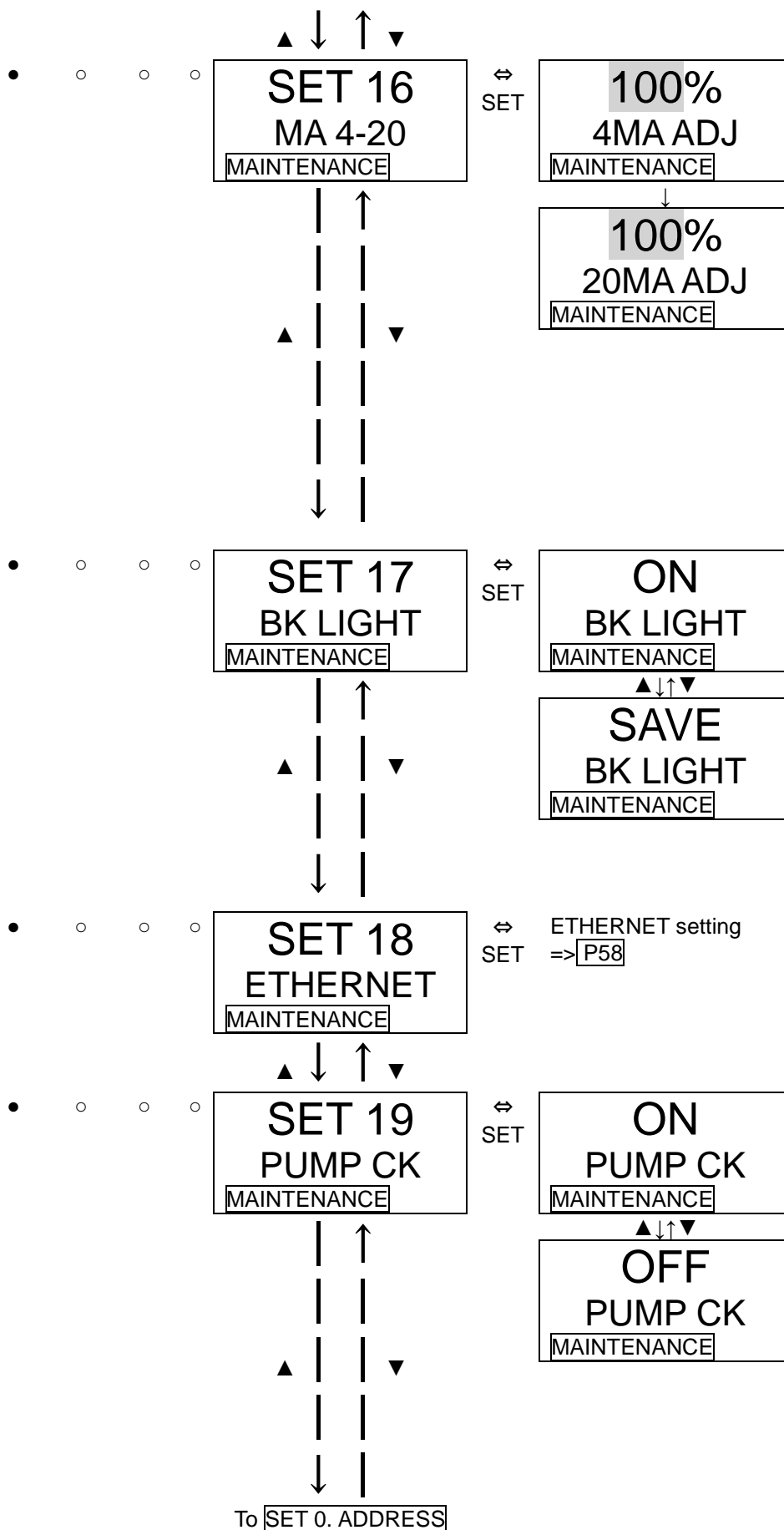
Set Ethernet.

SET 19. PUMP CK

Set the pump drive level diagnosis.

Select either ON/OFF, and then press the SET key to confirm the selection.

When ON is selected, the message "FLOW" is displayed if the flow rate is sufficient even though the pump drive level is low. (A function to check the conditions for applying pressure, etc.)

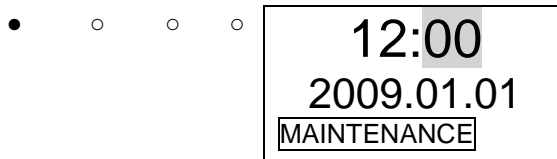


<Date/Time Setting "2-10" - "SET 1">

Maintenance Mode	PW	A1	A2	F	LCD
Access Maintenance Mode as described on page 45.					
2-10. SETTING2 Press the ▲ key until the "2-10 SETTING2" screen displays.	•	○	○	○	2- 10 SETTING2 MAINTENANCE
Press the SET key.					
SET 1. DAY TIME Press the ▲ key until the "SET 1 DAY TIME" screen displays.	•	○	○	○	SET 1 DAY TIME MAINTENANCE
Press the SET key.					
↓					↓
Date/time setting display Press SET key.	•	○	○	○	12:00 2009.01.01 MAINTENANCE
					↓
Year Setting Change the value by pressing the ▲ or ▼ key, and then press the SET key to confirm the value.	•	○	○	○	12:00 2009.01.01 MAINTENANCE
					↓
Month Setting Change the value by pressing the ▲ or ▼ key, and then press the SET key to confirm the value.	•	○	○	○	12:00 2009.01.01 MAINTENANCE
					↓
Date Setting Change the value by pressing the ▲ or ▼ key, and then press the SET key to confirm the value.	•	○	○	○	12:00 2009.01.01 MAINTENANCE
					↓
Hour Setting Change the value by pressing the ▲ or ▼ key, and then press the SET key to confirm the value.	•	○	○	○	12:00 2009.01.01 MAINTENANCE
					↓

Minute Setting

Change the value by pressing the ▲ or ▼ key, and then press the SET key to confirm the value.



Return to

SET 1. DAY TIME

* In the Date/Time Setting mode, press the MODE key to cancel this menu and go back to the previous setting.

<Energized/De-Energized Setting "2-10" - "SET 6">

Maintenance Mode

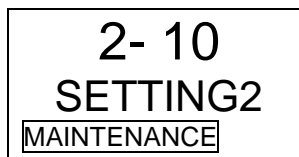
Access Maintenance Mode as described on page 45.

2-10. SETTING2

Press the ▲ key until the "2-10 SETTING2" screen displays.

PW A1 A2 F LCD

• ○ ○ ○



Press the SET key.

SET 6. RLY PTRN

Press the ▲ key until the "SET 6 RLY PTRN" screen displays.

• ○ ○ ○



Press the SET key.

First Alarm Contact Setting

Select either nd (de-energized)/nE (energized), and then press the SET key to confirm the selection. (Press the MODE key to skip this menu.)

• ○ ○ ○



Second Alarm Contact Setting

Select either nd (de-energized)/nE (energized), and then press the SET key to confirm the selection. (Press the MODE key to skip this menu.)

• ○ ○ ○



Fault Alarm Contact Setting

Select either nd (de-energized)/nE (energized), and then press the SET key to confirm the selection. (Press the MODE key to skip this menu.)



Return to
SET 6. RLY PTRN

NOTE

When de-energized is selected, the relay is energized and activated during an alarm state (de-energized during a normal state).

- When the "a" contact is used, it is open during a normal state and closed during an alarm state.
- When the "b" contact is used, it is activated conversely.

When energized is selected, the relay is energized during a normal state (de-energized during an alarm state).

- When the "a" contact is used, it is closed during a normal state and open during an alarm state. In addition, it is closed when the power is OFF.
- When the "b" contact is used, it is activated conversely.

<ETHERNET Setting "2-10" - "SET 18">

Maintenance Mode

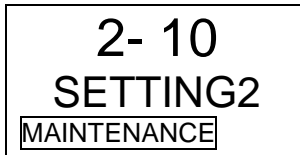
PW A1 A2 F LCD

Access Maintenance Mode as described on page 45.

2-10. SETTING2



Press the ▲ key until the "2-10 SETTING2" screen displays.



Press the SET key.

SET 18. ETHERNET



Press the ▲ key until the "SET 18 ETHERNET" screen displays.

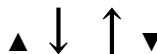
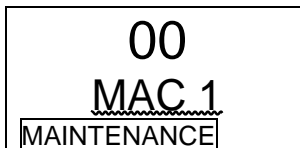


Press the SET key.

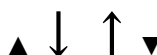


MAC Address Check

There are MAC addresses from MAC1 to MAC6. Select one using ▲ and ▼ keys and display them one by one in the same way. * MAC addresses are fixed values unique to the unit.



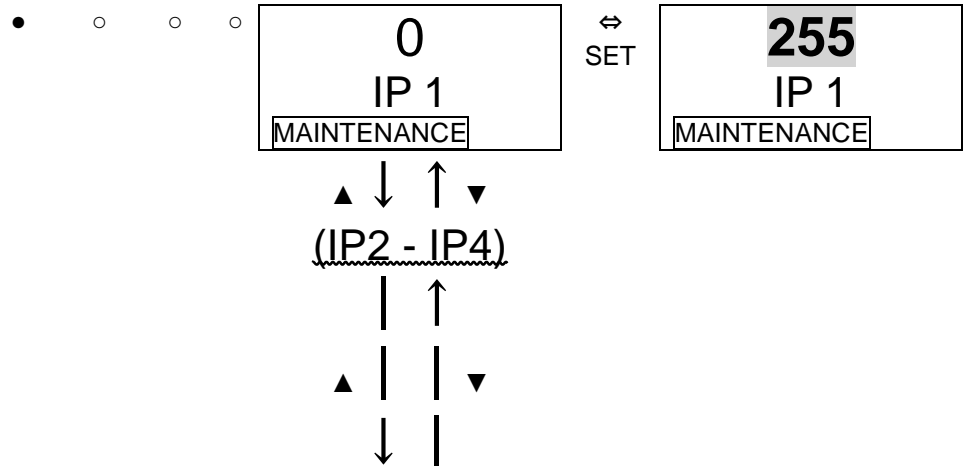
(MAC2 - MAC6)



IP Address Setting

Change the value by pressing the ▲ or ▼ key, and then press the SET key to confirm the value.

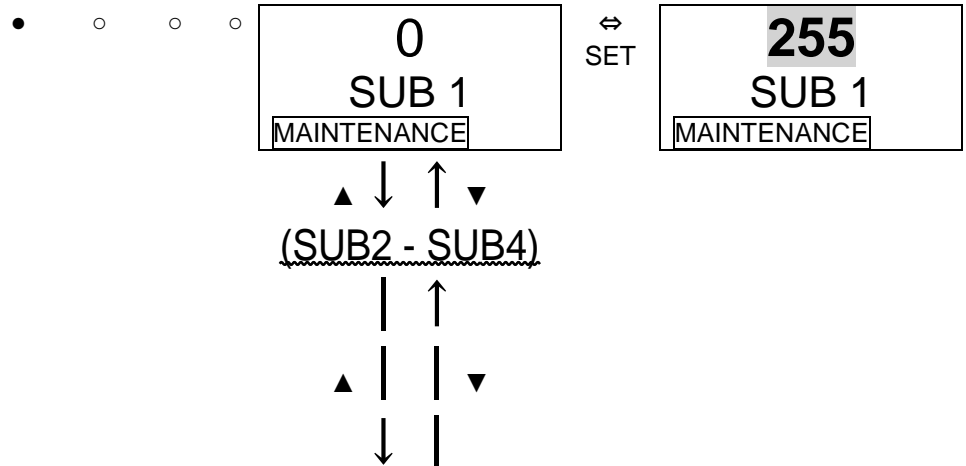
There are IP addresses from IP1 to IP4. Select one using ▲ and ▼ keys and set them one by one in the same way.



Subnet Mask Setting

Change the value by pressing the ▲ or ▼ key, and then press the SET key to confirm the value.

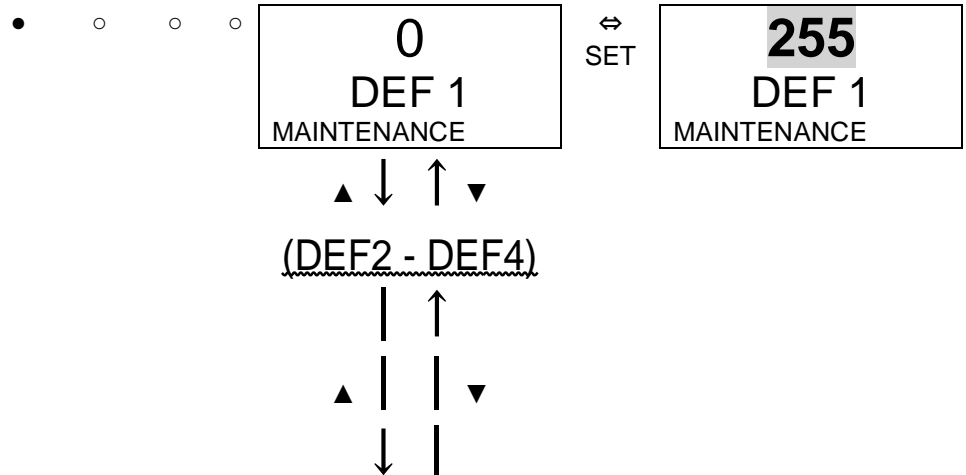
There are subnet masks from SUB1 to SUB4. Select one using ▲ and ▼ keys and set them one by one in the same way.



Default Gateway Setting

Change the value by pressing the ▲ or ▼ key, and then press the SET key to confirm the value.

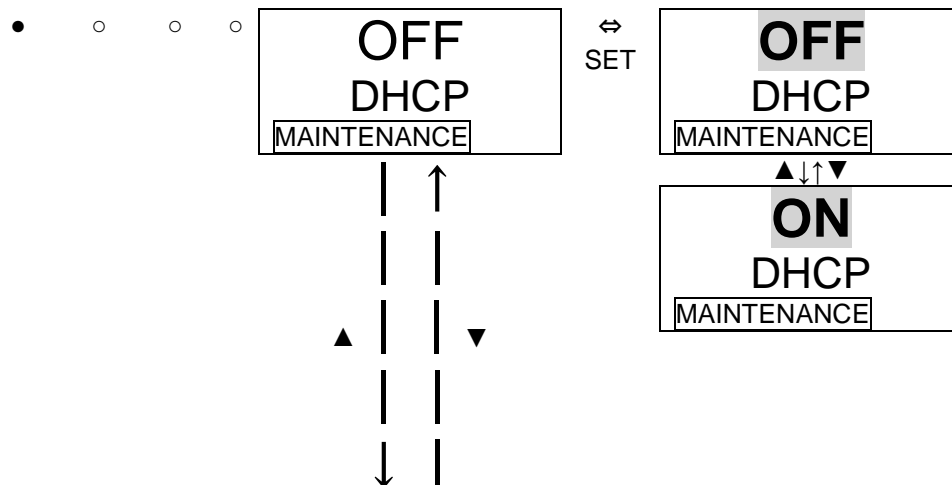
There are default gateways from DEF1 to DEF4. Select one using ▲ and ▼ keys and set them one by one in the same way.



DHCP Setting

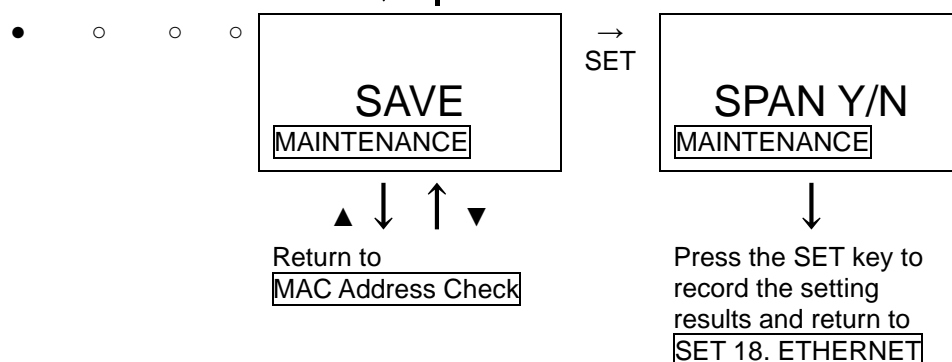
Select either ON/OFF, and then press the SET key to confirm the selection.

When ON is selected, an IP address is automatically obtained from the DHCP server. In this case, the IP1 to IP4, SUB1 to SUB4, and DEF1 to DEF4 settings are disabled.



Setting result record

To record the results of the settings made in the above, press the SET key.



* In ETHERNET mode, it is necessary to record setting results after all the settings have been selected. Press the MODE key before completion to undo all the changes that have been made.

NOTE

It takes 10 seconds or more for the address settings to be recorded and for the settings to take effect on the system. (Particularly for DHCP, the time it takes depends on the environment.) While the settings being put into effect, "0" is displayed for all of MAC1 - 6, IP1 - 4, SUB1 - 4 and DEF1 - 4, and none of the Ethernet functions are available.

<Pyrolyzer Heater Data Display "2-11">

Maintenance Mode

Access Maintenance Mode as described on page 45.

2-11. PL DATA

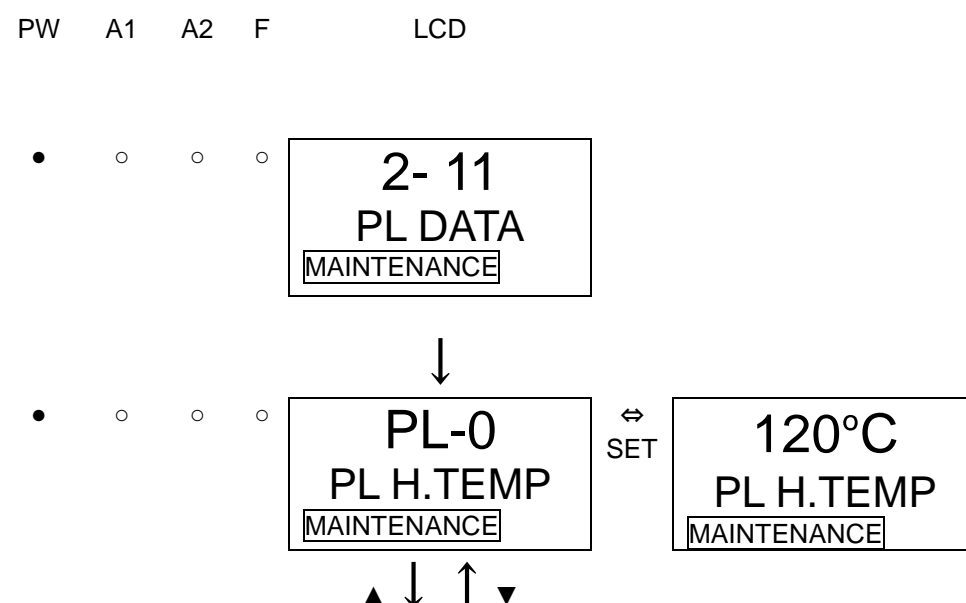
Press the ▲ key until the "2-11 PL DATA" screen displays.

Press the SET key.



PL-0 .PL H.TEMP

Display the pyrolyzer heater temperature.



PL-1 .PL FLOW

Display the pyrolyzer flow rate.

• ○ ○ ○

PL-1
PL FLOW
MAINTENANCE

⇔
SET

0.500
L/M
MAINTENANCE

▲ ↓ ↑ ▼

PL-2 .PL SET

Press the ▲ or ▼ key to change the setting of pyrolyzer heater temperature, and then press the SET key to confirm the value.

• ○ ○ ○

PL-2
PL SET
MAINTENANCE

⇔
SET

120°C
PL SET
MAINTENANCE

▲ ↓ ↑ ▼

PL-3 .PL AMP1

Display the voltage of pyrolyzer thermistor output 1.

• ○ ○ ○

PL-3
PL AMP1
MAINTENANCE

⇔
SET

0123 mv
PL AMP1
MAINTENANCE

▲ ↓ ↑ ▼

PL-4 .PL AMP2

Display the voltage of pyrolyzer thermistor output 2.

• ○ ○ ○

PL-4
PL AMP2
MAINTENANCE

⇔
SET

0123 mv
PL AMP2
MAINTENANCE

▲ ↓ ↑ ▼

PL-5 .PL AMP3

Display the voltage of pyrolyzer thermistor output 3.

• ○ ○ ○

PL-5
PL AMP3
MAINTENANCE

⇔
SET

0123 mv
PL AMP3
MAINTENANCE

▲ ↓ ↑ ▼

PL-6 .PL 3.3V

Display the pyrolyzer 3.3 V output.

• ○ ○ ○

PL-6
PL 3.3V
MAINTENANCE

⇔
SET

3300 mv
PL 3.3V
MAINTENANCE

▲ ↓ ↑ ▼

PL-7 .PL 5.0V

Display the pyrolyzer 5.0 V output.

• ○ ○ ○

PL-7
PL 5.0V
MAINTENANCE

⇔
SET

5000 mv
PL 5.0V
MAINTENANCE

▲ ↓ ↑ ▼

PL-8 .PL VER

Display the pyrolyzer version.

• ○ ○ ○

PL-8
PL VER
MAINTENANCE

⇔
SET

01234
ABCD
MAINTENANCE

▲ ↓ ↑ ▼

PL-9 .PL F AD

Display the voltage output of pyrolyzer flow rate.

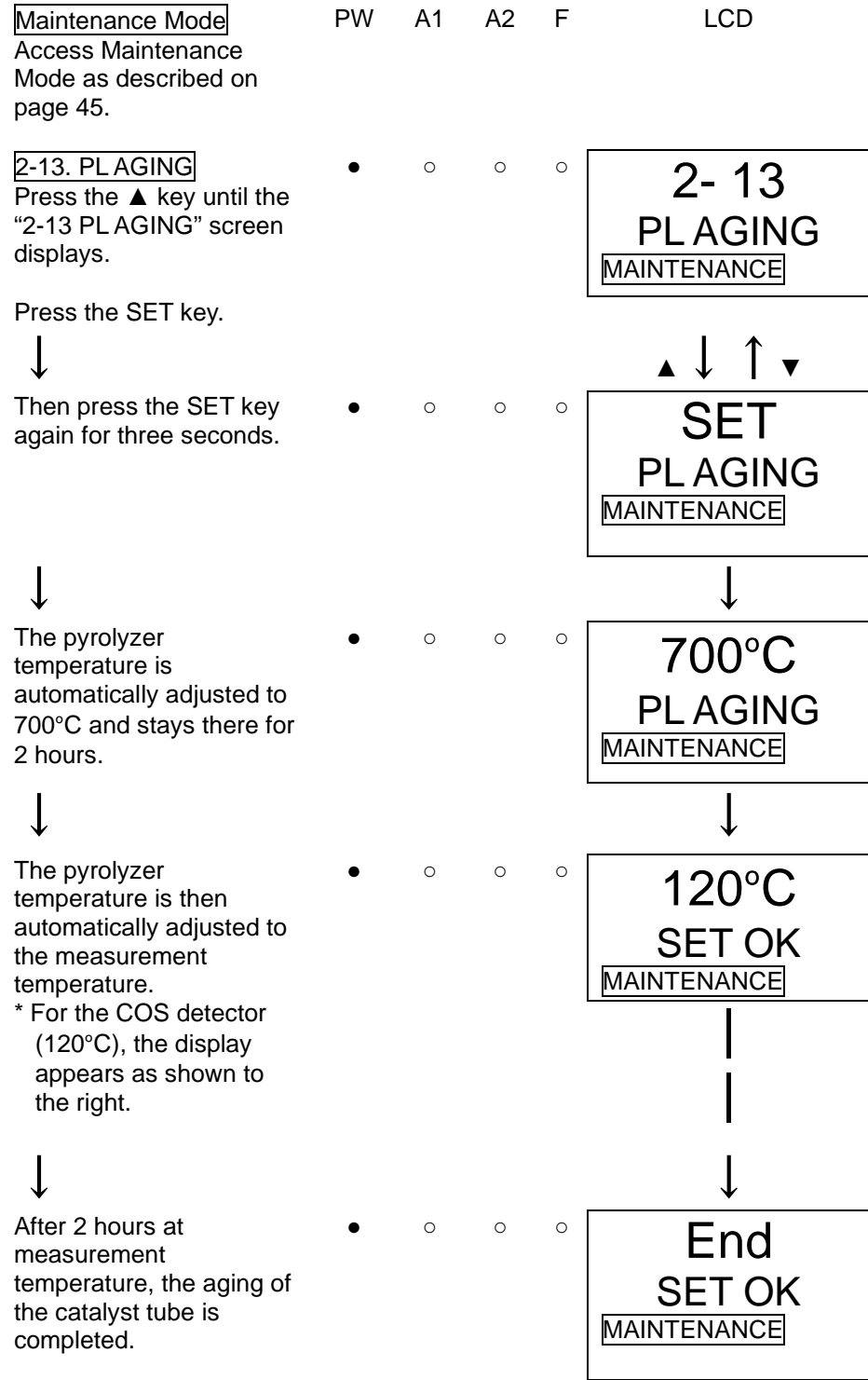
• ○ ○ ○

PL-9
PL F AD
MAINTENANCE

⇔
SET

01234
PL F AD
MAINTENANCE

<Catalyst Tube Aging Function "2-13">



10. Maintenance

The gas detector is an important safety instrument. To maintain the performance of the gas detector, perform regular maintenance.

10-1. Maintenance Intervals and Items

- Daily: Perform maintenance before beginning to work.
- Monthly: Perform maintenance once a month.
- Regular: Perform maintenance once or more for every six months.

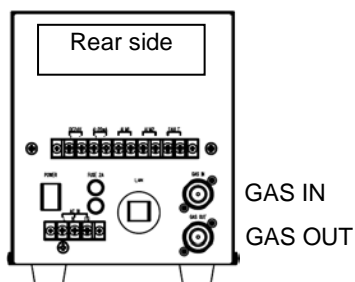
Maintenance item	Description	Daily	Monthly	Regular
Power supply check	Check that the power lamp lights up.	○	○	○
Concentration display check	Check that the concentration display value is zero. When the reading is incorrect, perform the zero adjustment after ensuring that no other gases exist around it.	○	○	○
Flow rate check	See the flow rate indicator to check for abnormalities.	○	○	○
Filter check	Check the dust filter for dust or clogging.	○	○	○
Alarm test	Inspect the alarm circuit by using the alarm test function.		○	○
Span adjustment	Perform the span adjustment by using the calibration gas.			○
Gas alarm check	Check the gas alarm by using the calibration gas.			○

10-2. Calibration Instructions

<Calibration Equipment>

- Demand flow regulator
- Cylinder of zero air calibration gas
- Cylinder of calibration gas

Target Gas	Calibration Gas Concentration
COS	10 ppm COS in air
C4F6/C5F8	2 ppm C4F6 in air



<Preparing for Calibration>

GAS IN Fitting

Remove the dust filter, silica gel filter (for C4F6/C5F8 detection only), and the sample line from the GAS IN fitting's tubing stub.

Regulator

Screw the demand flow regulator onto the calibration cylinder.

Accessing Maintenance Mode

From Detection Mode, press and hold the MODE key for three seconds.

↓

1-8.M MODE

Press the ▲ key until the “1-8 M MODE” screen displays.

↓

User Mode

Press the SET key.

↓

Then press and hold the SET key again for three seconds.



**0.0ppm
SIH4**

↓

**1- 8
M MODE
MAINTENANCE**

↓

**1- 8
M MODE
MAINTENANCE**

↓

**- - - -
M MODE
MAINTENANCE**



2-0.GAS TEST

The first item in Maintenance Mode will display.



<Zero Adjustment "2-1">

This is used to perform the zero adjustment.



WARNING

If the sampling environment is not a fresh air area, you must use a zero air calibration cylinder to perform the zero adjustment.

2-1. ZERO

Press the ▲ key until the **ZERO** screen displays.

Press the SET key.

Current Concentration Value Display

Press the SET key to perform the zero adjustment.

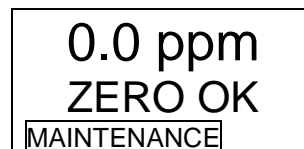
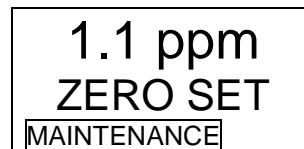
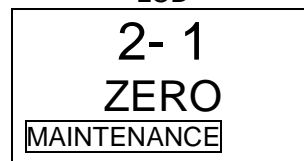
Zero Adjustment Completed

The menu returns to 2-1. ZERO automatically.

PW A1 A2 F

• ○ ○ ○

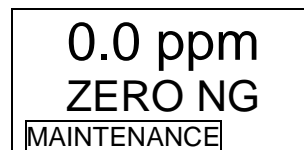
LCD



Return to 2-1. ZERO

* When the zero adjustment fails

• ○ ○ ○



Return to 2-1. ZERO

This is used to perform the span adjustment.

2-2. SPAN

Press the ▲ key until the **SPAN** screen displays.

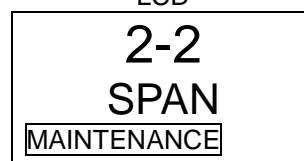
Press the SET key.



PW A1 A2 F

• ○ ○ ○

LCD



Connect Gas

Use the calibration tubing to connect the demand flow regulator to the tubing stub on the GAS IN fitting. Gas will begin to flow.

For COS: Allow gas to flow for 2 minutes.

For C4F6: Allow gas to flow for 90 seconds.

Accept Reading

Press the SET key when the reading has stabilized.

* The reading must be above 10% of the full scale value in order to continue.



CAUTION

Do not press the SET key before the reading stabilizes.

Disconnect Gas

Disconnect the calibration tubing from the tubing stub on the GAS IN fitting.



Span Adjustment

Using the ▲ or ▼ keys, adjust the reading to match the concentration listed on your calibration cylinder.

Press the SET key.



Span Adjustment Completed



Save Adjustment

To save the adjustment result, press the SET key.
(Press the MODE key to cancel this menu.)



2.0 ppm
SPAN GAS

MAINTENANCE



8.0 ppm
SPAN VAL

MAINTENANCE



8.0 ppm
SPAN OK

MAINTENANCE



8.0 ppm
SPAN Y/N

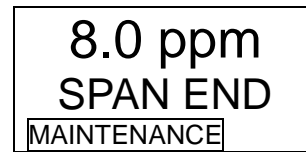
MAINTENANCE



Adjustment Completed

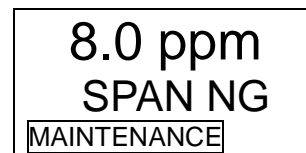
After the adjustment is saved, the instrument automatically returns to **2-2. SPAN**.

• ○ ○ ○



* When the span adjustment fails

• ○ ○ ○



<Returning to Detection Mode>

1. Store the components of the calibration kit in a safe place.
2. Reconnect the filter(s) and inlet line to the GAS IN fitting.
3. Press and hold the MODE key to return to Detection Mode.

10-3. Adjusting the Flow Rate

<Flow Rate Manual Adjustment “2-6”>

The flow rate of the gas detector is automatically adjusted to 0.5 L/min. Turning off the auto-adjustment function enables the manual adjustment. (See “2-10” - “SET 11”)

The manual flow rate adjustment can be performed in the regular maintenance mode “2-6. FLOW”.

2-6. FLOW

Press SET key.

PW A1 A2 F
● ○ ○ ○

LCD

**2-6
FLOW**
MAINTENANCE



Flow Rate Adjustment

As you increase or decrease the output by pressing the ▲ or ▼ key, the flow rate changes accordingly. Adjust the flow rate to 0.5 L/min, and then press the SET key.

(Press the MODE key to cancel this menu.)

● ○ ○ ○

50%
0.50 L/M
MAINTENANCE



WARNING

After the adjustment is completed, press the MODE key to return to the detection mode.

10-4. Replacing Parts

Item	Replacement Interval
Dust filter	When dirty or clogged
Silica gel filter (for C4F6/C5F8 detection)	2 years
Sensor unit	1 year
Catalyst tube	1 year
Pump unit	1 – 2 years
Flow sensor	5 years

<Replacing the Dust Filter>

Because the external dust filter may gradually get dirty or clogged over time, it must be replaced. Check the external dust filter, and then replace it as necessary. Frequency of replacement will depend on the operating conditions.

1. Turn off the power switch at the back of the unit.
2. Remove the sample line (and the silica gel filter, if used) from the dust filter.
3. Remove the dust filter from the tubing stub on the GAS IN fitting.
4. Install a new dust filter to the tubing stub on the GAS IN fitting.
5. Reconnect the sample line (and the silica gel filter, if used) to the new dust filter.
6. Turn on the power switch.
7. Allow the gas detector to warm up for the appropriate amount of time based on the unpowered time.

Unpowered Time	Warmup Time
> 1 week	24 hours (Warmup time can be reduced by using "2-13. PL AGING" in Regular maintenance mode. See page 62.)
< 1 week	2 hours

<Replacing the Silica Gel Filter (For C4F6/C5F8 Detection)>

Replace the silica gel filter every 2 years, if you notice particulate contamination or moisture, or if you notice a drop in your sample flow that changing the dust filter does not correct. The filter may discolor over time but discoloration is not an indication that the filter needs to be replaced.

1. Turn off the power switch at the back of the unit.
2. Remove the sample line from the silica gel filter.
3. Remove the silica gel filter from the tubing stub going to the dust filter.
4. Install a new silica gel filter on the tubing stub going to the dust filter.
5. Reconnect the sample line to the new silica gel filter.
6. Turn on the power switch.
7. Allow the gas detector to warm up for the appropriate amount of time based on the unpowered time.

Unpowered Time	Warmup Time
> 1 week	24 hours (Warmup time can be reduced by using "2-13. PL AGING" in Regular maintenance mode. See page 62.)
< 1 week	2 hours

<Replacing the Sensor Unit>

1. Turn off the power switch at the back of the unit.

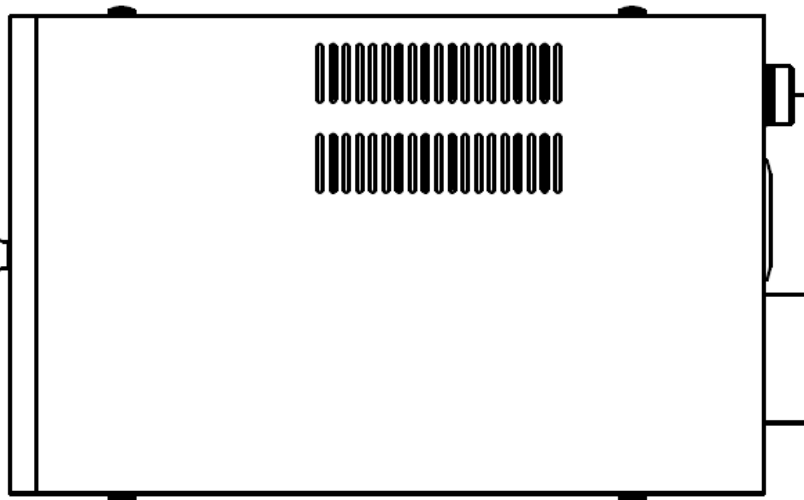
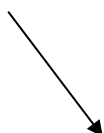


CAUTION

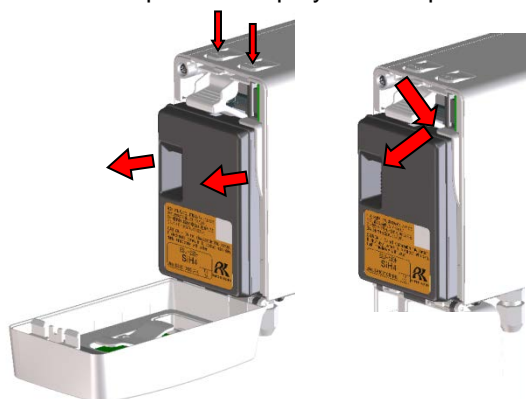
Turn the power off before detaching or attaching the sensor unit.

2. Loosen the front cover's knurled screw and open the cover.

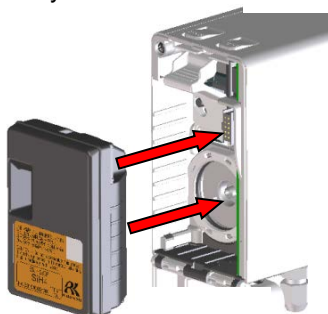
Knurled screw



3. Push the two buttons at the top of the display unit to open the front cover.



4. Grab the sides of the sensor unit and pull it out.
If the sensor unit is hard to remove, grab the top right corner and pull it out.
5. Push the new sensor unit firmly into the main unit.



6. Close the front cover of the display unit. Be sure it clicks into place.
7. Close the front cover of the main unit and tighten the knurled screw.
8. Turn the power switch on.
9. Replace the catalyst tube as described below if you have not already.

10. Allow the gas detector to warm up for the appropriate amount of time based on the unpowered time.

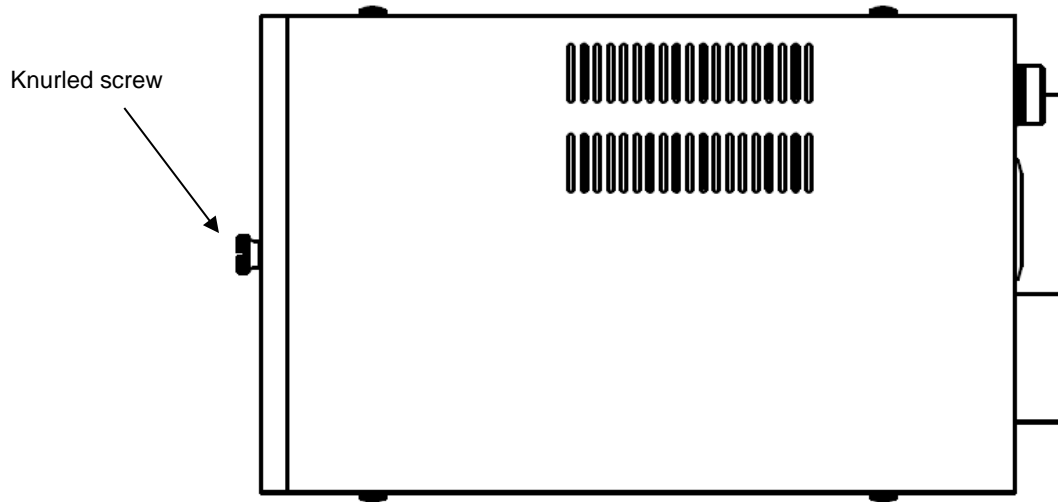
Unpowered Time	Warmup Time
> 1 week	24 hours (Warmup time can be reduced by using "2-13. PL AGING" in Regular maintenance mode. See page 62.)
< 1 week	2 hours

11. Perform a calibration as described on page 64.

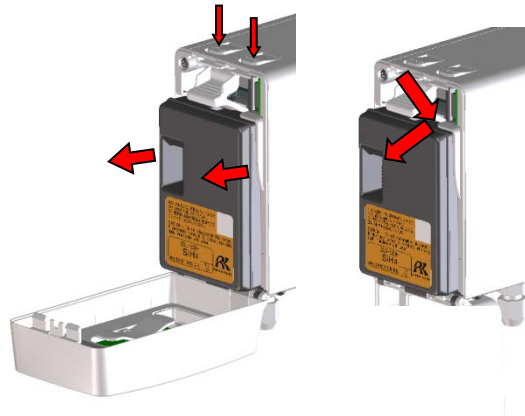
<Replacing the Sensor Battery>

If you get an E-1 error message for an ESU type sensor, try replacing the battery before replacing the entire sensor.

1. Turn off the power switch at the back of the unit.
2. Loosen the front cover's knurled screw and open the cover.



3. Push the two buttons at the top of the display unit to open the front cover.

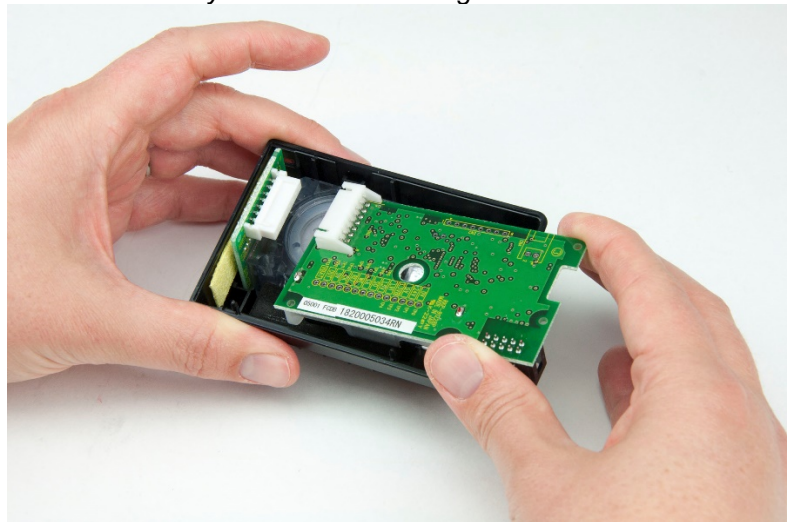


4. Push the two buttons at the top of the display unit to open the front cover. Grab the sides of the sensor unit and pull it out.
If the sensor unit is hard to remove, grab the top right corner and pull it out.

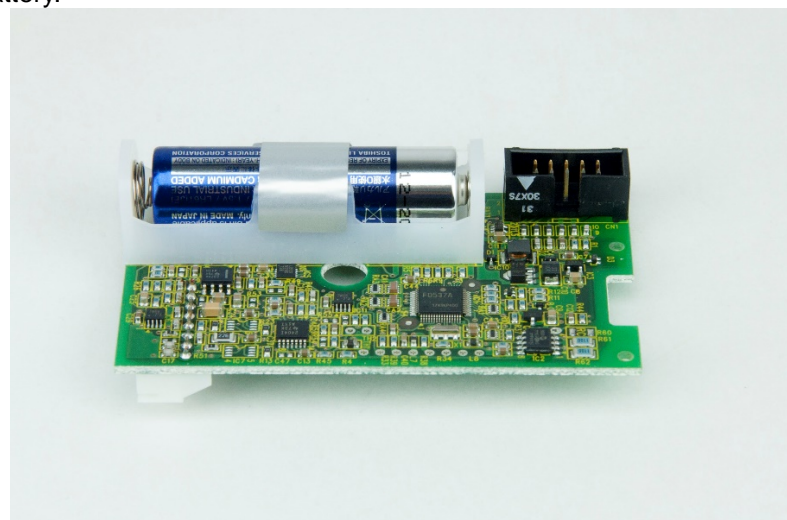
5. Pry the sensor unit lid off of the sensor unit body.



6. Remove the circuit board. *Be very careful not to damage the white connector.*



7. Remove the old battery.
8. Install a new battery.



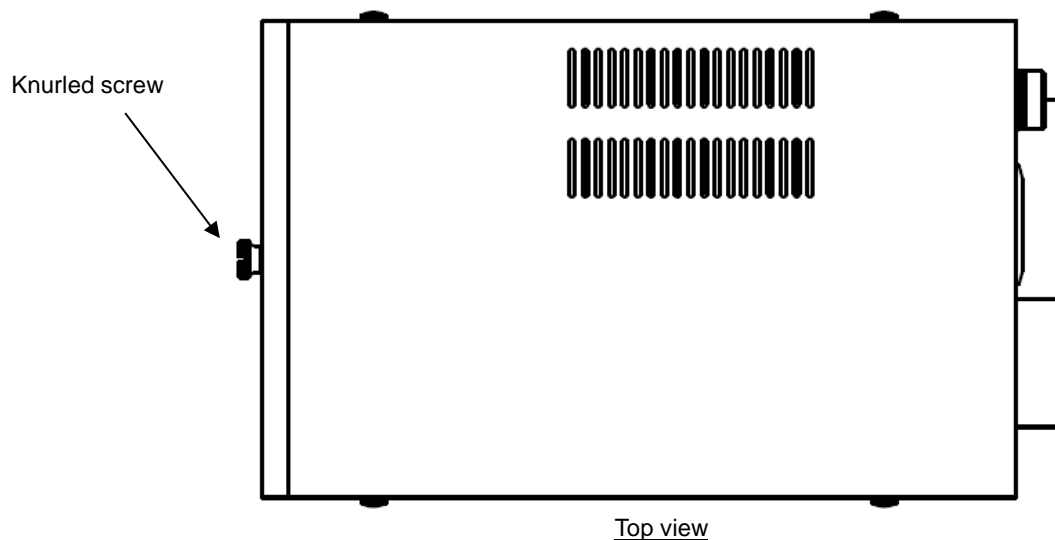
9. Reinstall the circuit board being careful not to damage the white connector.
10. Reinstall the sensor unit lid to the sensor unit body.
11. Insert the sensor unit into the main unit and make sure that the sensor unit is secured.
12. Close the front cover. Be sure the front cover clicks into place.
13. Turn the power switch on.

14. Allow the gas detector to warm up for the appropriate amount of time based on the unpowered time.

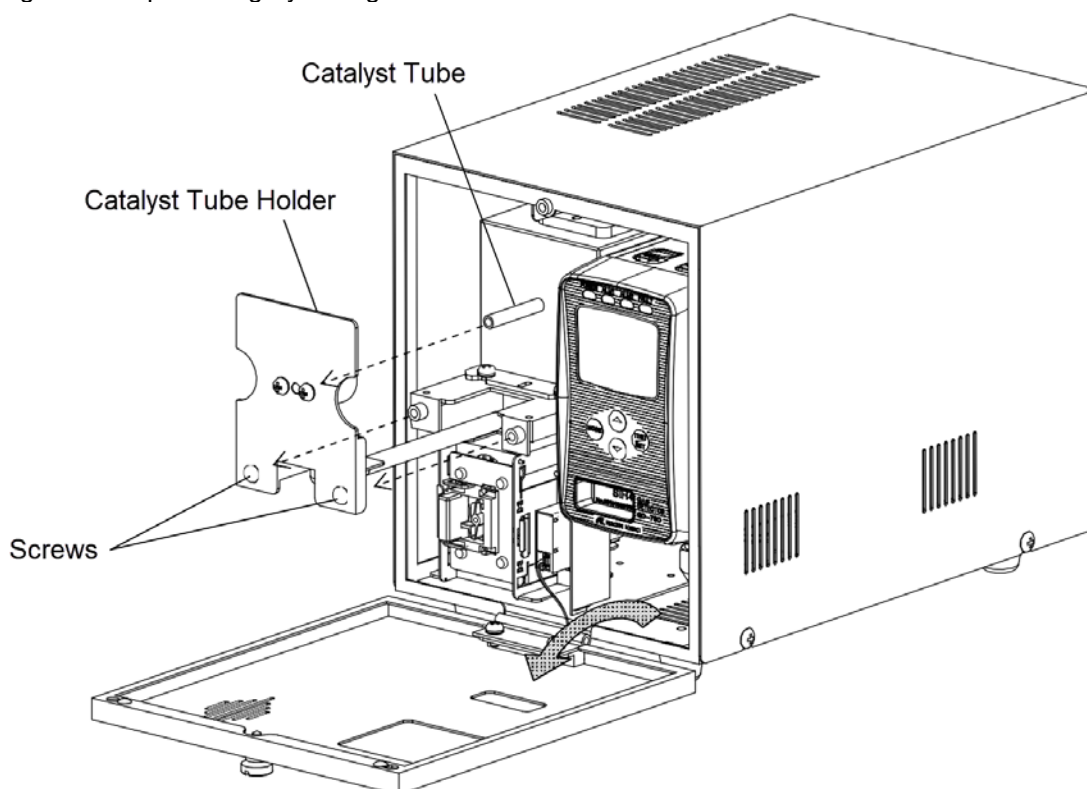
Unpowered Time	Warmup Time
> 1 week	24 hours (Warmup time can be reduced by using "2-13. PL AGING" in Regular maintenance mode. See page 62.)
< 1 week	2 hours

<Replacing the Catalyst Tube>

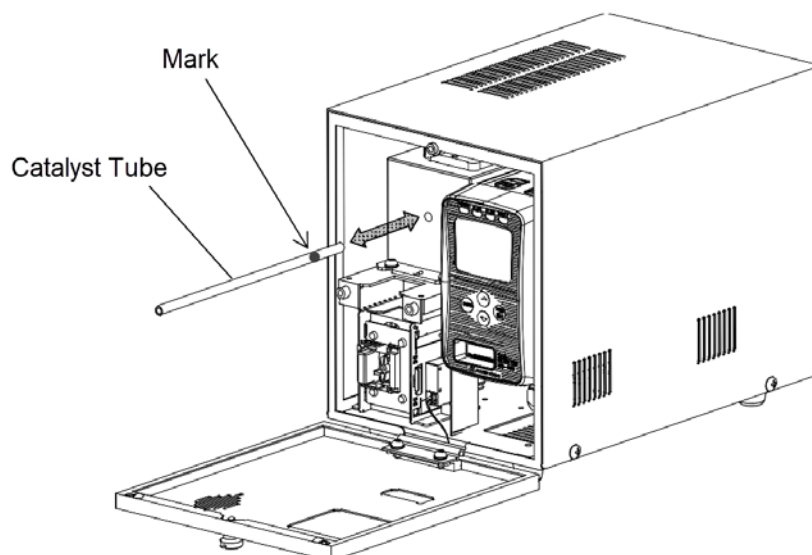
1. Turn off the power switch at the back of the unit.
2. Loosen the front cover's knurled screw and open the cover.



3. Unscrew the 2 screws at the bottom of the catalyst tube holder and pull the holder out. Let the holder hang from the piece of grey tubing.



4. Remove the old catalyst tube. If the instrument was running prior to tube replacement, handle the tube by the exposed end ONLY. The tube may be hot.
5. Be sure you are using the correct catalyst tube for your detection gas.
6. The new catalyst tube has a label on it with the detection gas and tube serial number. Remove that label and put it on the front of the catalyst tube holder.
7. Install the new catalyst tube. The end of the tube with the mark on it needs to get inserted first.



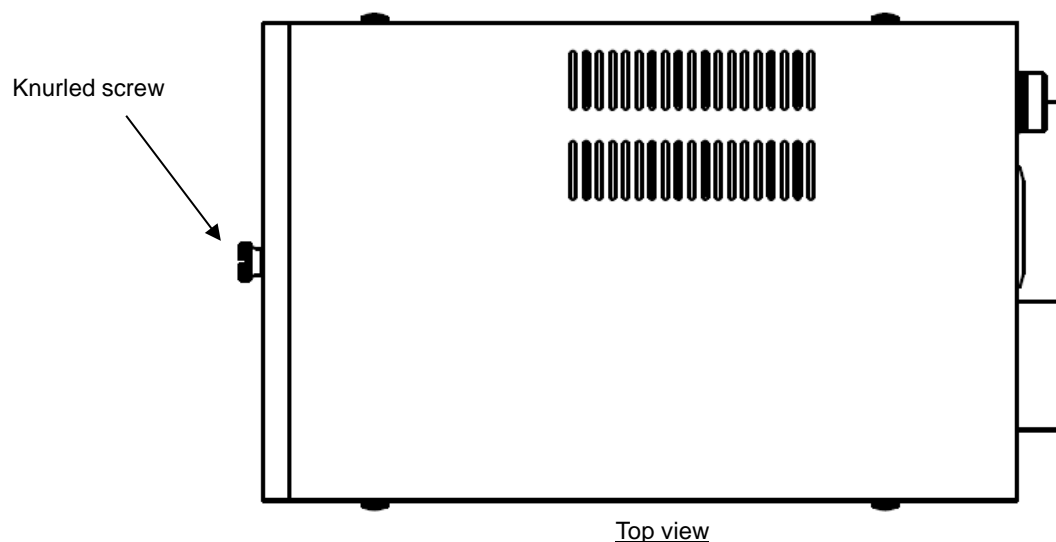
8. Push the catalyst tube holder onto the new catalyst tube and secure it with the 2 screws on the bottom.
9. Replace the sensor, as described above, if you haven't already.
10. Turn the power switch on.
11. Allow the gas detector to warm up for the appropriate amount of time based on the unpowered time.

Unpowered Time	Warmup Time
> 1 week	24 hours (Warmup time can be reduced by using "2-13. PL AGING" in Regular maintenance mode. See page 62.)
< 1 week	2 hours

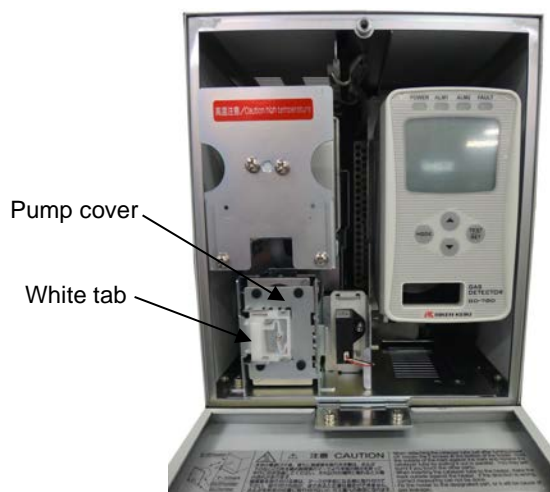
12. Perform a calibration as described on page 64.

<Replacing the Pump>

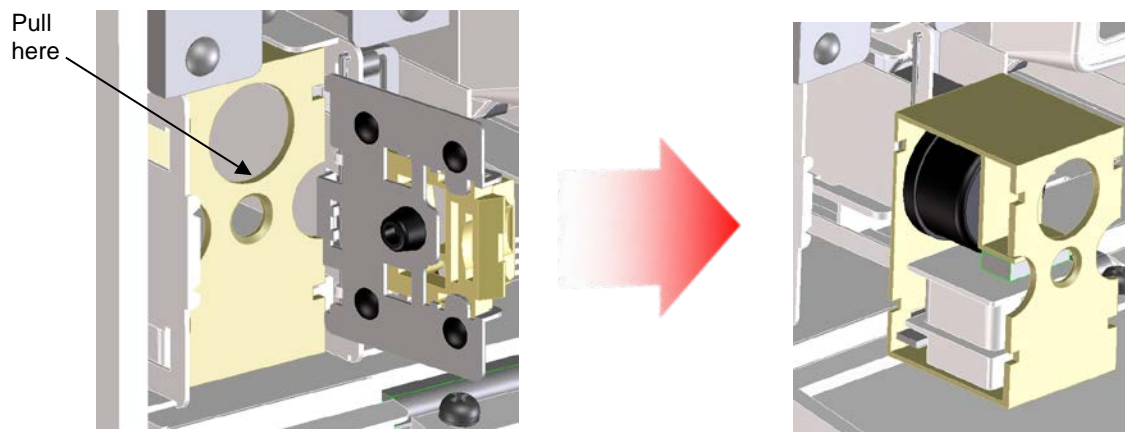
1. Turn off the power switch at the back of the unit.
2. Loosen the front cover's knurled screw and open the cover.



- The pump cover is latched. Push the white tab to the right and pull to open the pump cover. Slide the tab in the direction of the arrow (toward the inside of the main unit) to open/close the pump unit cover.



- Put your finger through the hole at the top of the pump unit and pull the pump unit out.



- Install the new pump in the same orientation.
- Slide the pump cover's white tab to the right and push the cover closed.
- Turn the power switch back on.
- Allow the gas detector to warm up for the appropriate amount of time based on the unpowered time.

Unpowered Time	Warmup Time
> 1 week	24 hours (Warmup time can be reduced by using "2-13. PL AGING" in Regular maintenance mode. See page 62.)
< 1 week	2 hours

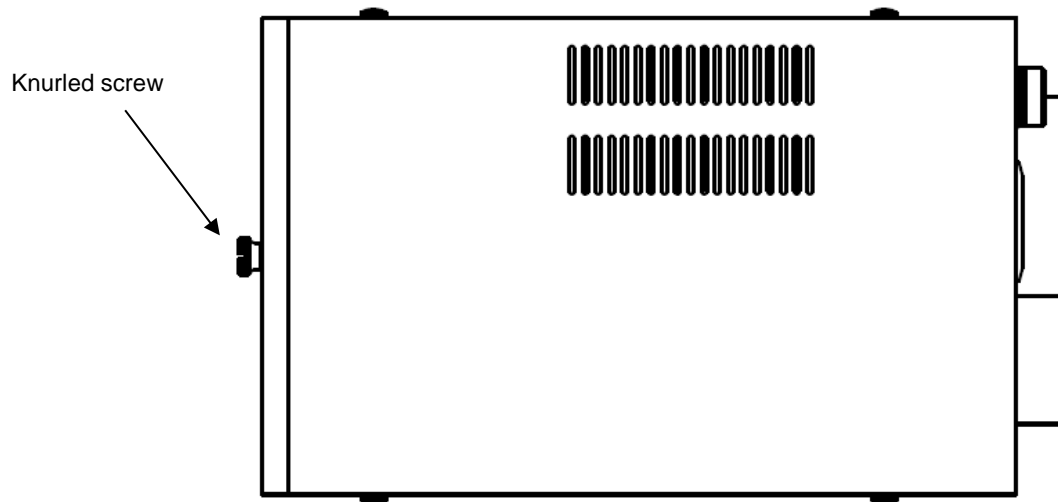


CAUTION

If the pump and pump unit cover are not attached properly, the pump may malfunction.

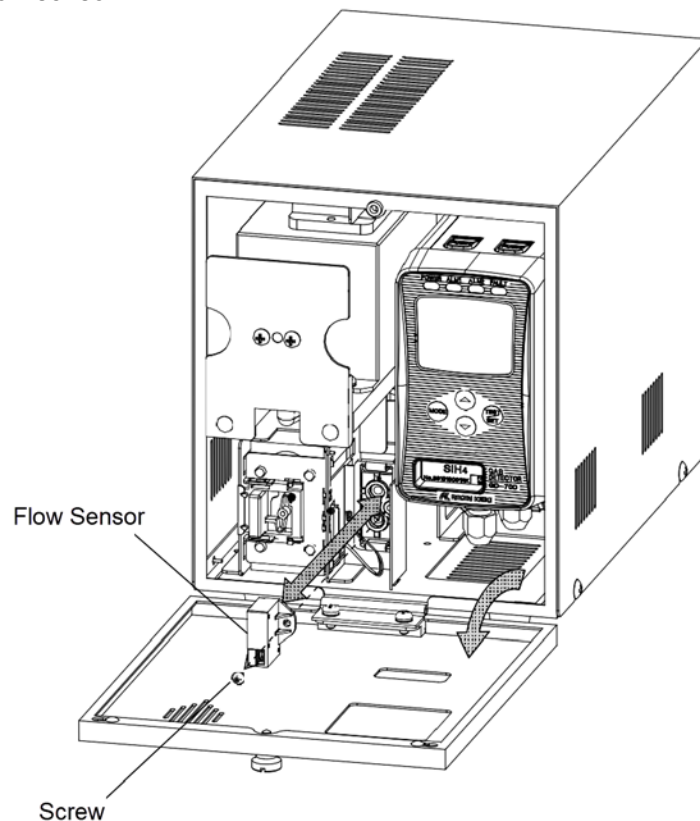
<Replacing the Flow Sensor>

1. Loosen the front cover's knurled screw and open the cover.



Top view

2. Press and hold MODE for 3 seconds.
3. Press the ▲ key until the "1-8 M MODE" screen displays.
4. Press and release SET.
5. Press and hold SET for 3 seconds.
6. Press the ▲ key until the "2-10 SETTING2" screen displays.
7. Press and release SET.
8. Press the ▲ key until the "SET 11 AT FLOW" screen displays.
9. Press the ▲ key to show "OFF".
10. Press and release SET.
11. Unscrew the screw holding the flow sensor in its slot. The screw is not captive and will fall out.
12. Remove the old flow sensor.

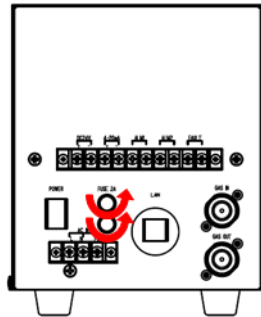


13. Gently pull on the wires coming from the flow sensor to remove the plug from the flow sensor.
14. Insert the plug into the new flow sensor.
15. Install the new flow sensor and tighten the screw.
16. Press the ▲ key to show "ON".
17. Press and release SET.
18. Press and release MODE to return to normal operation.??? Confirm whole flow
19. Reconnect the power source.
20. Turn on the power switch.

<Replacing the Fuses>

The fuses are 5 mm x 20 mm, 3.15A 250V, slow blow fuses. Be sure to use a replacement fuse with the same specifications.

1. Turn off the power switch at the back of the main unit.
2. Disconnect the power source.
3. The fuses are located at the back of the main unit, to the right of the power switch.
4. Push the fuse holder and turn it 90 degrees counterclockwise.



5. Remove the fuse holder and the old fuse.
6. Push the new fuse into the fuse holder.
7. Reinstall the fuse holder by pushing it and turning it 90 degrees clockwise.
8. Reconnect the power source.
9. Turn on the power switch.
10. Allow the gas detector to warm up for the appropriate amount of time based on the unpowered time.

Unpowered Time	Warmup Time
> 1 week	24 hours (Warmup time can be reduced by using "2-13. PL AGING" in Regular maintenance mode. See page 62.)
< 1 week	2 hours



WARNING

To prevent fire, use a fuse with the specified ratings (current, voltage and type) for the gas detector. Do not use an unspecified fuse or short-circuit the fuse holder.

11. Storage, Relocation, and Disposal

11-1. Procedures to store the gas detector or leave it for a long time

The gas detector must be stored under the following environmental conditions.

- In a place with normal temperature and humidity, away from direct sunlight
- In a place where gases, solvents or vapors are not present

11-2. Procedures to relocate the gas detector or use it again

When the gas detector is relocated, select a new place in accordance with "4-2. Installation Precautions". For information on wiring and tubing, see "4-4. Wiring the Detector" on page 17 and "4-5. Making Tubing Connections" on page 24. The unpowered time must be minimized when the gas detector is relocated.



CAUTION

When using a relocated or stopped/stored detector again, you must perform a calibration.

11-3. Disposal of products

- A used sensor unit must be treated as hazardous waste. Follow local regulations for disposal.
- If liquid is leaked from the electrochemical type sensor unit (ESU), do not touch the liquid. The sensor unit must be put into a plastic bag to prevent leaking.
- The gas detector (without sensor unit) must be treated as industrial waste. Follow local regulations for disposal.

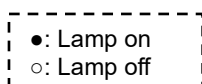


WARNING

- Do not disassemble the electrochemical type sensor unit (ESU) because it contains electrolyte. Electrolyte may cause severe skin burns if it contacts skin, while it may cause blindness if it contacts eyes. If electrolyte is adhered on your clothes, that part on your clothes is discolored or its material is decomposed. If contact occurs, rinse the area immediately with a large quantity of water.

12. Troubleshooting

This troubleshooting section explains common problems but does not explain the causes of all detector malfunctions. If the detector has a symptom that is not explained in this manual or if the actions described in this section do not solve your problem(s), please contact RKI.



<Device Abnormalities>

Symptom/Display	FAULT	Causes	Actions
<u>The detector cannot be turned on.</u>	—	The power switch is turned off.	Turn ON the power switch.
		Abnormalities/momentary blackout of power supply system	Provide the rated voltage. Take measures such as checking or adding the UPS, power supply line filter, and insulation transformer.
		Cable abnormalities (open circuit/not connected/short circuit)	Check the detector wiring and the wiring on connected devices.
		Fuse disconnection	Find out why the fuse has blown and take appropriate actions before replacing it. If the power still cannot be turned on after replacement, the inside temperature fuse needs to be replaced. Please contact RKI.
<u>Abnormal operations</u>	○	Disturbances by sudden surge noise.	Turn off and restart the gas detector. If the symptom occurs regularly, take appropriate action to eliminate the noise.
<u>Incorrect flow rate indicator</u> (Specified Value Display does not correspond to 0.5 L/min.)	○	Improper flow rate default set	The flow rate default may have been done incorrectly and the flow rate is not actually 0.5 L/min. Use a different flowmeter to perform another flow rate default. <u>If the symptom occurs regularly, replace the flow sensor.</u>

Symptom/Display	FAULT	Causes	Actions
<u>Sensor unit abnormalities</u> E-1 SENSOR	•	The unit is not connected or is improperly connected.	Check that the sensor unit is securely installed.
		Communication errors.	Replace the sensor unit (see page 70).
		Zero drift caused by environmental changes or aging deterioration that cannot be corrected by zero follower.	Perform a zero adjustment. If the symptom persists after the zero adjustment, replace the sensor unit (see page 70).
		Faults in the unit itself	Replace the sensor unit. If the sensor unit is damaged, do not touch it with bare hands and handle it carefully.
<u>Flow rate warning</u> FLOW	○	Deteriorated pump performance	Although gas detection can be performed with a deteriorated pump unit, replace the pump unit as soon as possible (see page 74).
		Clogged dust filter	Replace the dust filter (see page 69).
		Bent or clogged inlet or exhaust tubing.	Fix the defective parts.
		Pressure difference is present in the sampling condition. (The flow rate is ensured even though the pump drive level is low.)	In some sampling conditions (presence of pressure difference between IN and OUT), the flow rate is ensured even though the pump drive level is low. Although the gas detector can be used in such a situation, the diagnosis function of its pump drive level issues this message. The message can be eliminated by disabling this function (see page 46). Check the operating conditions before taking actions. * If the flow rate indicator is incorrect, the message may be displayed even though pressure difference is not present.
		Flow sensor is not performing correctly.	Although gas detection can be performed, provided that flow loss (fault alarm) does not occur, replace the flow sensor as soon as possible (see page 76) .

Symptom/Display	FAULT	Causes	Actions
<u>Flow rate abnormalities</u> E-5 FLOW	•	Protective rubber cap is not removed.	Remove the protective rubber cap from GAS IN and GAS OUT.
		Broken pump	Replace the pump unit (see page 74).
		Clogged dust filter	Replace the dust filter (see page 69).
		Bent or clogged inlet or exhaust tubing	Fix the defective parts.
		The flow sensor is disconnected or improperly connected.	Check the connection of the flow sensor.
<u>Communication abnormalities</u> E-6 (ETHERNET)	○	Communication cable abnormalities	Check the detector wiring and the wiring on connected devices.
		Disturbance by external noise	Turn off and restart the gas detector. If the symptom occurs regularly, take appropriate action to eliminate the noise.
<u>Clock abnormalities</u> E-9	○	Detector clock abnormalities	Set the Date/Time. Note that when the ESU sensitivity correction function is used, correction may not be made properly. If the symptom occurs regularly, the built-in clock may be malfunctioning and need replacement. Please contact RKL.
<u>System abnormalities</u> E-9 SYSTEM	•	The rated voltage is not supplied to the gas detector.	Check the power supply and supply the rated voltage.
		ROM, RAM or display unit EEPROM abnormalities	Please contact RKL.
<u>Pyrolyzer abnormalities</u> E-7 PL UNIT	○	Pyrolyzer failure	Restart the gas detector. If the symptom does not improve, please contact RKL.
		Cable abnormalities (open circuit/not connected/short circuit)	
		ROM, RAM or pyrolyzer controller EEPROM abnormalities	
		Disturbance by external noise	Restart the gas detector. If the symptom occurs regularly, take appropriate action to eliminate the noise.

<Reading Abnormalities>

Symptoms	Causes	Actions
<u>The reading rises (drops) and stays there.</u>	Sensor output drift	Perform a zero adjustment.
	Presence of interference gas	Interference gases, such as solvents, cannot be eliminated completely. For information on actions, such as removal filter installation, please contact RKL.
	Slow leak	A very small amount of the sample gas may be leaking (slow leak). Take a remedial action similar to a gas alarm action.
	Environmental changes	Perform a zero adjustment.

<u>A gas alarm is triggered without gas being present.</u>	Presence of interference gas	Interference gases, such as solvents, cannot be eliminated completely. For information on actions, such as removal filter installation, please contact RKL.
	Disturbance by noise	Restart the gas detector. If the symptom occurs regularly, take appropriate actions to eliminate the noise.
	Sudden change in the environment	When the environment (temperature, etc.) changes suddenly, the gas detector cannot adjust to it and is affected by it. In some cases, the gas detector triggers an indication alarm. Because the gas detector cannot be used under sudden and frequent environmental changes, you must take any preventive actions to eliminate them.
<u>Slow response</u>	Clogged dust filter	Replace the dust filter (see page 69).
	Bent or clogged inlet or exhaust tubing	Fix the defective parts.
	Inlet tubing has condensation	Fix the defective parts.
	Deteriorated sensor sensitivity	Replace the sensor unit (see page 70).
<u>Cannot perform a span adjustment</u>	Improper calibration gas concentration	Use the proper calibration gas.
	Deteriorated sensor sensitivity	Replace the sensor unit (see page 70).

13. Product Specifications

13-1. List of Specifications

<Product Specifications>

Model	TP-70DG II
Detection principle	Catalyst + electrochemical type
Gas to be detected	C4F6/C5F8 COS
Concentration display	Character LCD (Digital and Bar Meter Display)
Detection range	C4F6/C5F8: 0 - 5 ppm COS: 0 - 15 ppm
Detection method	Pump suction type/pyrolysis type
Flow rate	0.5 L/min \pm 10%
Alarm setpoint value	C4F6/C5F8: 1st: 2 ppm, 2nd: 4 ppm COS: 1st: 5 ppm, 2nd: 10 ppm
Power display	POWER lamp on (green)
Displays	Gas name display/flow rate indicator/mode display/communication status display/pyrolyzer connection display
External output	Gas concentration signal/gas alarm contact/fault alarm contact
Alarm accuracy (under the same conditions)	\pm 30% to the alarm setpoint value
Alarm delay time (under the same conditions)	Within 60 seconds after providing the gas 1.6 times the alarm setpoint (excluding delay in the tube)
Gas alarm type	Two-step alarm (H-HH)
Gas alarm display	First: ALM1 lamp blinks or lights up (Red) Second: ALM2 lamp blinks or lights up (Red)
Gas alarm pattern	Auto-reset or self-latching
Gas alarm contact	No-voltage contact 1a or 1b (2 step independent) De-energized in a normal state (energized at an alarm state) or energized in a normal state (de-energized at an alarm state)
Fault alarm/self diagnosis	System abnormalities/sensor abnormalities/flow rate abnormalities/communication abnormalities/pyrolyzer abnormalities
Fault alarm display	FAULT lamp on (yellow)/detail display
Fault alarm pattern	Non latching (Auto-reset)
Fault alarm contact	No-voltage contact 1a or 1b De-energized in a normal state (energized at an alarm state) or energized in a normal state (de-energized at an alarm state)
Contact capacity	125 VAC, 0.25 A/24 VDC, 0.5 A (resistance load)
Contact cable	Cable of CVV, etc. (1.25sq) - max. 6-core
Functions	White backlight/alarm delay/suppression/zero follower/sensitivity correction/flow control Calibration history/alarm trend history/event history
Initial clear	Approx. 25 seconds
Tube connecting port	Rc1/4 (O.D 6-1t, half-union for Teflon tube <PP> supplied)
Operating temperature range	20 - 40°C
Operating humidities	40 - 70%RH (non-condensing)
Power consumption	150 VA or less
Structure	Tabletop type
External dimensions	Approx. 180 (W) x 225 (H) x 285 (D) mm (projection portions excluded)
Weight	Approx. 6.0 kg

<Specifications by Communication>

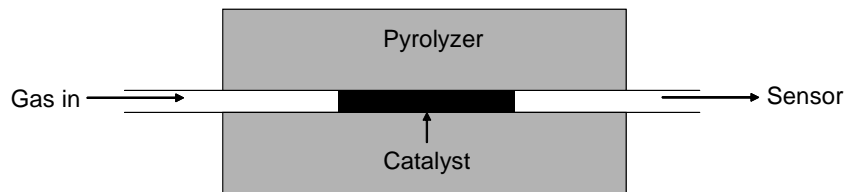
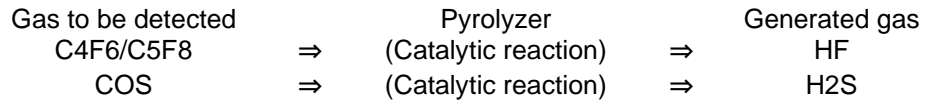
Model	(NT specification)	(EA specification) (EA (PoE) specification)
Transmission method	2-wire type DC power-line communication	Digital transmission: Ethernet (10BASE-T/100BASE-TX) Analog transmission: 3-wire type analog transmission (common cable for power and signal <power, signal, common>) or 2-wire type analog transmission
Transmission specification		Digital transmission: Ethernet Analog transmission: 4 - 20 mA DC (no-insulation/load resistance under 300 Ω)
Transmission cable	Shielded twisted-pair cable (1.25 sq) of KPEV-S, etc. - 1P	Digital transmission: Ethernet cable (category 5 or higher) Analog transmission: Shielded cable of CVVS, etc. (1.25 sq) - 3-core or 2-core
Power supply	100 - 240 VAC $\pm 10\%$ 24 VDC $\pm 10\%$ (Common with the transmission cable) (Dedicated line by blocking filter)	100 - 240 VAC $\pm 10\%$ or PoE connection (Common with the digital transmission cable for PoE connection)

13-2. List of Accessories

- Operating Manual
- Protective rubber cap
- Dust filter
- Silica gel filter (for C4F6/C5F8 detection only)

13-3. Detection Principle

Sample gas passes through the pyrolyzer. The pyrolyzer's catalyst breaks the gas into a substance (HF or H₂S) which reacts well to the electrochemical type sensor. The sensor's response to HF or H₂S is proportional to the target gas.

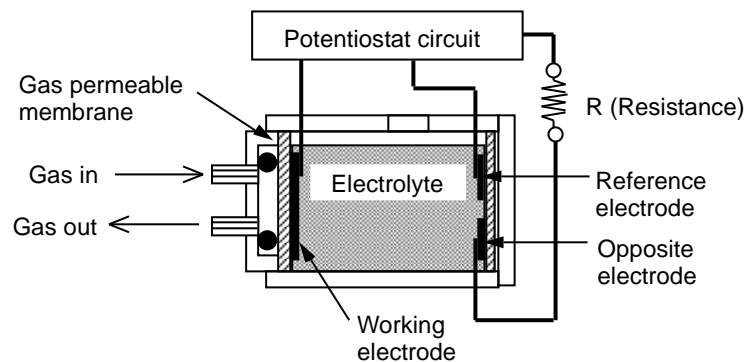


Pyrolyzer Structure Diagram

[Principle of electrochemical type sensor]

The electric potential between the working electrode and reference electrode is kept at a certain level by a potentiostat circuit.

The sample gas is electrolyzed directly at the working electrode. Because the electric current generated is proportional to the gas concentration, the gas concentration can be determined by measuring the electric current flow between the working electrode and the opposite electrode.



Sensor Structure Diagram

Special precautions for this principle

1. The gas detector is susceptible to interference gases. The alarm may be triggered by interference. The reading may also fluctuate based on environmental changes in the installation site.
2. The alarm must be set within a range where the performance of the gas detector can be ensured. In facilities compliant with the High Pressure Gas Safety Act, an alarm setting below our standard alarm setpoint (threshold limit value) may trigger a false alarm.
3. This is a safety unit, not a control unit.
The alarm contact output of the gas detector must be used for an external alarm lamp, while the analog signal output must be used for an indicator or external recorder. If these outputs are used to control other units, we shall not be responsible for any malfunctions.
4. Solvents can weaken the sensor unit's porous polymeric membrane and cause an electrolyte leak. Do not use solvents near the gas detector. If a solvent is used for unavoidable reasons, attach the recommended filter to the gas detector inlet while using the solvent and for one hour after that.
5. The gas detector must be regularly maintained as described in this manual. RKI also recommends that the gas detector be calibrated every 6 months.

14. Definition of Terms

External dust filter	When the gas detector is used in a dusty environment, it is recommended that a dust filter be attached to the inlet line.
vol%	Gas concentration indicated in the unit of one-hundredth of the volume
ppm	Gas concentration indicated in the unit of one-millionth of the volume
ppb	Gas concentration indicated in the unit of one-billionth of the volume
Calibration	Find relationship of the readings, display values or setting values with the actual values by using the calibration gas.
Maintenance mode	When maintenance is performed on the gas detector, the alarm contact is disconnected, and a signal to indicate the maintenance mode status is sent out to the external output signal.
Initial clear	The reading is unstable for several seconds after the power is turned on. To prevent false alarms during that period, the alarm contact is deactivated. In addition, a signal to indicate the initial clear status is sent out to the external output.
Zero suppression	A function to cut off the influences of environmental changes, interference gases, etc.
Alarm delay time	A function which temporarily suspends activation to prevent a false alarm caused by noise.
Inhibit	The gas detection function is temporarily suspended during maintenance of the gas detector. This is also called "point skip".
Pyrolyzer	A unit to break down gases under high temperatures to make them detectable.

15. Parts List

Replacement Part Description	Part Number
Catalyst tube, COS	56-0215
Catalyst tube, C4F6	56-0216
Filter, dust (CF-8369) for COS and for C4F6/C5F8 versions	33-0167RK
Filter, silica gel (CF-8364TP) for C4F6/C5F8 version only	33-2120
Flow sensor	31-2032
Fuse, 5mm x 20mm, slow blow, 3.15A, 250V	43-4164
Pump	30-0038
Sensor, COS	ESU-237IF-COS
Sensor, C4F6	ESU-K235L-C4F6
Tubing nut, ferrule and post, 4 x 6 mm	17-2500RK-01
Tubing nut, ferrule and post, 1/4 x 5/32"	17-2503RK-01

Calibration Part Description	Part Number
COS, 10 ppm in air, 58 liter calibration cylinder	81-0189RK-02
C4F6, 2 ppm in air, 58 liter calibration cylinder	81-9030RK-02
Zero air, 34 liter steel calibration cylinder	81-0076RK-01
Zero air, 103 liter calibration cylinder	81-0076RK-03
Regulator, demand flow type, for 34 liter aluminum, 58 liter, and 103 liter calibration cylinders (cylinders with internal threads)	81-1054RK
Regulator, demand flow type, for 17 liter and 34 liter steel calibration cylinders (cylinders with external threads)	81-1055RK