

RA890G PROTECTORELAY Burner Controller User's Manual



Thank you for purchasing the RA890G PROTECTORELAY Burner Controller.

This manual contains information for ensuring the correct use of the RA890G. It also provides necessary information for installation, maintenance, and troubleshooting.

This manual should be read by those who design and maintain equipment that uses the RA890G. Be sure to keep this manual nearby for handy reference.

Azbil Corporation

NOTICE

Be sure that the user receives this manual before the product is used.

Copying or duplicating this user's manual in part or in whole is forbidden. The information and specifications in this manual are subject to change without notice.

Considerable effort has been made to ensure that this manual is free from inaccuracies and omissions. If you should find an error or omission, please contact the azbil Group.

In no event is Azbil Corporation liable to anyone for any indirect, special or consequential damages as a result of using this product.

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Conventions Used in This Manual

- To prevent injury to the operator and others, and to prevent property damage, the following types of safety precautions are indicated:



Warnings are indicated when mishandling this product might result in death or serious injury.



Cautions are indicated when mishandling this product might result in minor injury to the user, or physical damage to the product.

- In describing the product, this manual uses the icons and conventions listed below.



Use caution when handling the product.



The indicated action is prohibited.



Be sure to follow the indicated instructions.

Handling Precautions:

Handling Precautions indicate items that the user should pay attention to when handling the RA890G.



Note:

Notes indicate information that might benefit the user.



This indicates the item or page that the user is requested to refer to.















(1), (2), (3): Numbers within parentheses indicate steps in a sequence or parts of an explanation.

Safety Precautions




Safety precautions are intended to ensure the safe and correct use of this product, to prevent injury to the operator and others, and to prevent damage to property. Be sure to observe these safety precautions. Please make sure you understand the safety guidelines before reading the rest of this manual.

The use of this product in a manner not specified by the manufacturer will impair its built-in safety features.













WARNING

	Use this device for batch operation of the burner (at least one start and stop in a 24-hour period). Do not use for continuous burner operation (nonstop combustion for 24h or longer).
	This device performs recycle operation during flame failure. Therefore, when it is to be used together with a gas-fired combustion system, operate it in non-recycle sequence by using an on-delay timer.
	This device does not have the prepurge functions required for burner ignition. Give careful consideration to various safety guidelines, etc., when setting timers and sequencing times.
	Wire terminals 1 and 2 so that they receive power continuously whenever the power switch is turned on. This is absolutely necessary to ensure operation of the self-check circuits at startup. Therefore, do not wire a thermostat between the power switch and terminal 1 or 2. Doing so might cause a serious combustion equipment accident.
	Connect loads (ignition transformer, solenoid valve, etc.) directly to the output terminals of this device. If they are not directly connected, combustion safety cannot be ensured.
	Do not allow the pilot or main burner ignition trial time to exceed the specifications of the burner or equipment manufacturer. If they do, fuel may accumulate in the combustion chamber and form an explosive air-fuel mixture, resulting in a serious explosion hazard.
	Before wiring, mounting, or removing this device, be sure to turn the power off. Wiring with the power on can result in an electric shock.
	Do not connect a solenoid valve to the high voltage side of the circuit. If a ground fault occurs, the ground fault current may energize and open the solenoid valve. This device will not be able to prevent the valve from opening and fuel from flowing out.
	Even after the power to this device is turned off, terminal F continues to hold an electrical charge. To avoid electrical shock, do not touch terminal F.
	Carry out the pilot turndown test. If the flame detector is set so that it detects a pilot flame that is too small to ignite the main burner, this device will not be able to detect a flame failure in the main burner. In that case, fuel will continue to be supplied, causing a serious explosion hazard.
	Before the pilot turndown test or ignition spark response test, make sure that all manual fuel valves are closed.
	If the pilot turndown test must be carried out repeatedly, completely shut down all equipment each time the test is finished, and completely discharge unburned gas or fuel that has accumulated in the ducts and combustion chamber. Failure to discharge unburned gas or fuel may result in an explosion.
	When the pilot turndown test is complete, turn OFF the power switch to shut down the power. Restore all test jumpers and limit interlock/regulator settings to their previous states. If operation begins without the above steps, damage to the equipment, gas leak or explosion may result.
	Do not start regular operation of the equipment without first completing the trial-run adjustments for this device, as well as the tests specified by the equipment manufacturer.















WARNING

	If lockout occurs, be sure to remove the cause of the lockout and reset it. Also, be sure to do a pre-purge before restarting the system. If the combustion chamber and gas flue are not ventilated to remove any unburned gas, the ignition process may cause an explosion.
	To prevent electric shock, turn the power off and discharge any remaining electrical charge before removing this device from the subbase. Use lead wires to connect terminals F and G of the flame simulator (FSP300C100) to terminals F and G of this device for 10 seconds or more.
	Do not touch this device's internal relay. Doing so might damage the relay or cause this device and/or the combustion equipment to malfunction.

CAUTION

	Use the RA890G for the oil-fired or gas-fired combustion equipment up to approx. 700 kW in combustion rate.
	Do not install where exposed to any of the following: <ul style="list-style-type: none">• Certain chemicals or corrosive gases (ammonia, sulfur, chlorine, ethylene compounds, acid, etc.)• Splashing water or excessive humidity• High temperatures• Prolonged vibration
	Make sure the load connected to each terminal does not exceed the rating indicated in the specifications.
	If timers and auxiliary relays are needed for additional functions, select ones with high reliability, and be sure to design the circuit correctly.
	When installing and wiring, be sure to follow the instructions in this manual and in the user's manual for the combustion equipment.
	Do not detect ultraviolet rays other than those of the burner flame. If the flame detector responds to other ultraviolet rays, it will report that there is a flame even if the burner flame goes out. As a result, fuel will continue to be discharged, causing a very serious explosion hazard.
	The ignition transformer ground lead should be connected directly to the burner body or to a metallic part electrically connected to the burner body.
	Connect the blue signal lead from the Minipeeper Ultraviolet Flame Detector to terminal F and the white lead to terminal G. Turning on the power while the flame detector is incorrectly wired could damage the UV tube.
	A thermostat for low-voltage use is usually put between terminals T1 and T2.
	Run the high-voltage ignition transformer cable separately and keep it at least 10 cm away from this device.
	Keep power lines and ignition transformer high-voltage cables separate from the flame detector wires.
	Make sure that ignition transformer high-voltage cables are properly connected to prevent faulty contact. Faulty contact might generate high-frequency radio waves which can cause malfunction.

CAUTION

	Always connect the power supply last. Otherwise, touching a terminal accidentally could result in electric shock or damage.
	Always supply electric power at the voltage and frequency stated on the model label of this device.
	In keeping with technical standards for electrical equipment, the burner body must have an earth ground connection with a resistance of less than 100 Ω .
	After the wiring is complete, be sure to check that it is correct. Incorrect wiring may cause damage or faulty operation.
	Make sure that the flame detector does not detect the ignition spark. If the flame detector can detect the spark, change the position of the detector or the ignition electrode.
	Only an experienced technician who has knowledge and technical skills related to combustion equipment and combustion safety should carry out the pilot turndown test.
	This product is equipped with functions that are extremely important for the safe operation of combustion equipment. Carefully follow the instructions for its use that are given in this user's manual.
	Do not use this device with the cover removed. Doing so might cause faulty operation.
	Check the flame current at least once per month. Doing so can prevent shutdowns caused by a weak flame current signal.
	This device has an operating life. Assuming that the operating life of the combustion equipment used with this device is longer, be sure to do periodic maintenance and replacement of this device.
	In the event that this device is replaced, do all of the checks listed in chapter 4, INSPECTION AND ADJUSTMENT.
	When doing a maintenance inspection of the burner, be sure to do the pilot turndown test. Inspection must be done at least once a year.
	Conduct periodic inspections in accordance with the user's manual of the equipment manufacturer.
	When cleaning the burner, clean the flame detector as well.

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Chapter 1. OVERVIEW

■ Overview

The RA890G is an electronic burner controller to be used for the automatic operation and safety operation of gas, oil or combination gas-oil combustion equipment, up to 700 kW in batch operation. And it is used combined with the AUD100 series advanced ultraviolet flame detector. For combustion equipment in continuous operation, use the AUR450C dynamic self-checking burner controller. This device can configure a prepurge function using external instrumentation, and automatically ignite pilot and main burners, and monitor the flame. The RA890G performs recycle operation during flame failure.

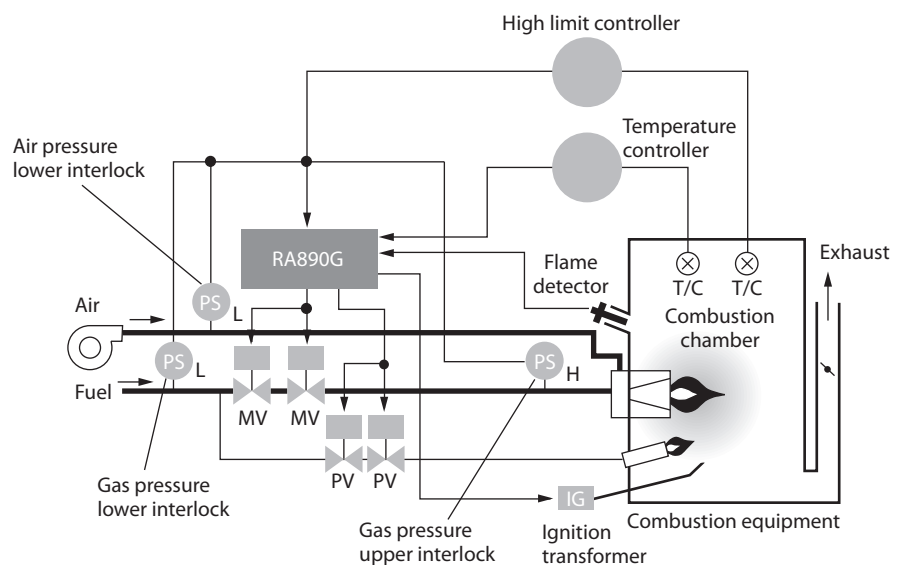
Compatible burner operation type	Purge function	Ignition function	Behavior if flame failure occurs	Compatible flame detector
Batch	No	Yes	Recycle	AUD 100 Series Advanced Ultraviolet Flame Detector

■ Features

- If the burner fails in ignition, the safety switch is operated to shut off fuel automatically.
- A safeguard circuit is incorporated to prevent the RA890G from being operated, when the flame detector detects a false flame.
- When connected to temperature controllers, etc., the RA890G can automatically start and stop combustion.
- A test jack is provided to permit the flame current to be read.
- Applicable to the intermittent pilot system.
- The RA890G is operated after mounted directly onto the Q270A subbase.

■ System configuration

In terms of the overall system, the RA890G serves as the ignition controller and the flame monitoring device. It is used as shown in the diagram below.



■ Security function and precautions for facility instrumentation

The RA890G is designed to ensure safety, and plays an important safety role by monitoring the burner operation and the flame.

(1) Combustion monitoring and safety shutoff

- Detects flame failure in the burner and quickly shuts off the fuel and shuts down the burner.
- When an ignition failure, flame failure or flame-out occurs, the RA890G follows a fixed sequence to stop each piece of equipment.

(2) Startup, operation, and shutoff of combustion equipment

- The RA890G operates each device according to the predetermined sequence and timing.

(3) Safe startup

- At every startup signal, the RA890G checks for false flame in the flame detector and flame detection circuit.
- If a problem is detected, the RA890G does not start the burner.

(4) Redundant design

- Maintains safety even if its own self-check circuit fails.
- Will not deviate from the proper ignition sequence.
- The sequence timing is designed so that it is failsafe.

In designing facilities that use combustion safety devices, be sure to give careful consideration to the safety guidelines listed below.

- For safety standards for industrial facilities using combustion equipment, see the technical guidelines published by the Ministry of Health, Labour and Welfare.
- For general safety rules for industrial combustion furnaces, see JIS B 8415.
- For technical safety guidelines for gas combustion furnaces in industrial use, see publications by the Japan Gas Association.

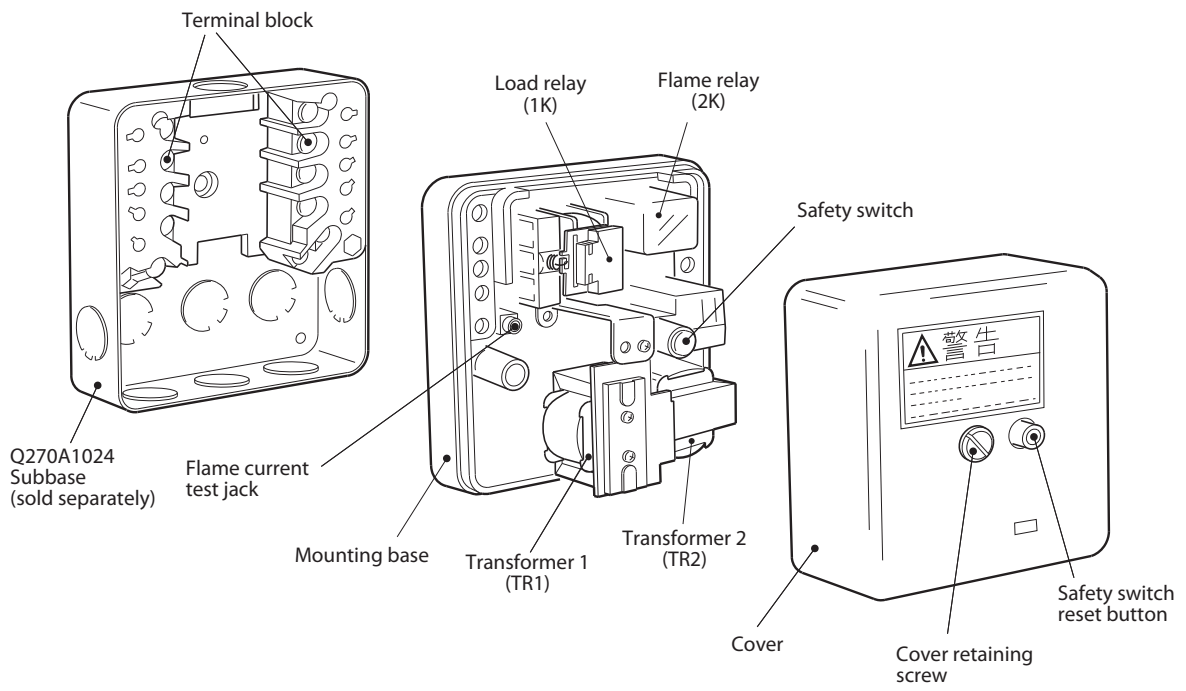
● Important points for ensuring safety

- (1) Connect the load directly to the RA890G.
- (2) Design the interlock so that it can directly cut off power to the load.
- (3) Be sure to use a safe startup circuit upon startup.
- (4) Do not set up a bypass, such as manual operation, for any load.
- (5) Have a redundant main valve and pilot valve.

● Precautions for system design

- Since the RA890G does not have purge and ignition functions, they must be provided externally.
- To stop the recycle at flame failure, provide a timer circuit externally.

■ Names of parts



Chapter 2. MOUNTING

! Handling Precautions

- Installation, wiring, inspection, adjustment, etc. should be carried out by a trained and experienced technician who has knowledge and technical skills related to combustion equipment and flame safeguard control devices.

■ Mounting the subbase

! CAUTION



Do not install where exposed to any of the following:

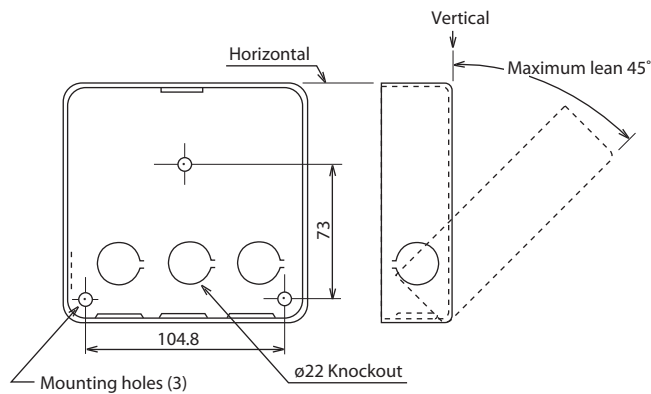
- Certain chemicals or corrosive gases (ammonia, sulfur, chlorine, ethylene compounds, acid, etc.)
- Splashing water or excessive humidity
- High temperatures
- Prolonged vibration



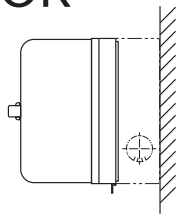
When installing and wiring, be sure to follow the instructions in this manual and in the user's manual for the combustion equipment.

● Mounting method

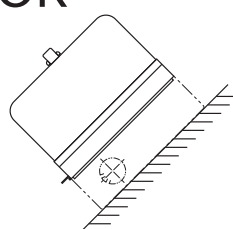
- (1) Mount the subbase as shown below, so that the three knockouts on the back are in the lower part of the back, the top edge is horizontal, and the back is vertical. The subbase may lean backward within 45 degrees if necessary.
- (2) Open knockout holes for conduits as required, and attach wiring conduits there.
- (3) Fix the subbase at the specified position with screws (3).



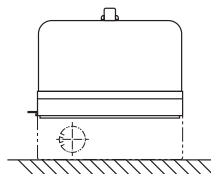
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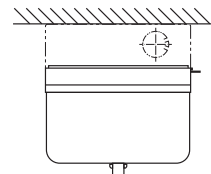
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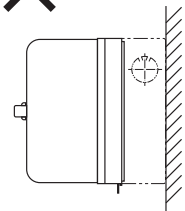
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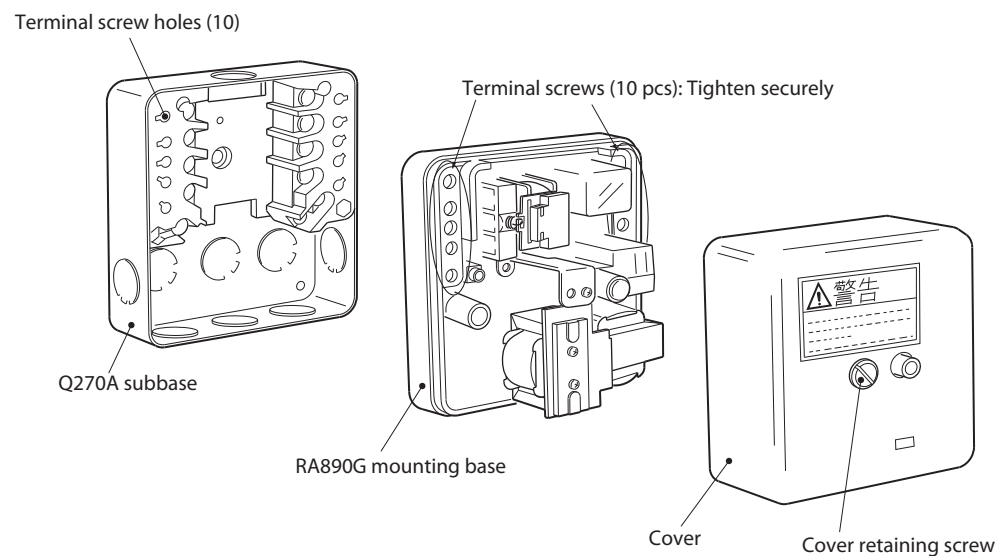
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■ Mounting the RA890G onto the subbase

Mount the RA890G onto the subbase after the completion of external wiring.

- (1) Loosen the cover retaining screws and remove the cover from the RA890G.
- (2) Set the position of the RA890G mounting base to that of the subbase.
- (3) Tighten the terminal screws (10 pcs) of the RA890G securely in the individual terminal thread holes in the subbase using 1 N·m tightening torque. (Electrical connection with the subbase is completed when the RA890G is mounted.)
- (4) Replace the cover to the RA890G.






⚠ Handling Precautions










- The RA890G is connected electrically with a subbase by terminal screws. A loose terminal screw makes the RA890G malfunction. Be sure that there is no loose terminal screw.

Chapter 3. WIRING

WARNING

-  The RA890G performs recycle operation during flame failure. Therefore, when it is to be used together with a gas-fired combustion system, operate it in non-recycle sequence by using an on-delay timer.
-  Wire terminals 1 and 2 so that they receive power continuously whenever the power switch is turned on. This is absolutely necessary to ensure operation of the self-check circuits at startup. Therefore, do not wire a thermostat between the power switch and terminal 1 or 2. Doing so might cause a serious combustion equipment accident.
-  Connect loads (ignition transformer, solenoid valve, etc.) directly to the output terminals of this device. If they are not directly connected, combustion safety cannot be ensured.

CAUTION

-  Connect the blue signal lead from the Minipeeper Ultraviolet Flame Detector to terminal F and the white lead to terminal G. Turning on the power when the flame detector is incorrectly wired could damage the UV tube.
-  When installing and wiring, be sure to follow the instructions in this manual and in the user's manual for the combustion equipment.
-  Make sure the load connected to each terminal does not exceed the rating indicated in the specifications.
-  Always supply electric power at the voltage and frequency stated on the model label of this device.
-  If timers and auxiliary relays are needed for additional functions, select ones with high reliability, and be sure to design the circuit correctly.
-  In keeping with technical standards for electrical equipment, the burner body must have an earth ground connection with a resistance of less than 100 Ω .
-  Keep power lines and ignition transformer high-voltage cables separate from the flame detector wires.
-  Run the ignition transformer high-voltage cable separately and keep it at least 10 cm away from this device.
-  Always connect the power supply last. Otherwise, touching a terminal accidentally could result in electric shock or damage.

Handling Precautions

- Use a PVC insulated wire (such as IV (2 mm²) wire) with 600 Vac voltage proof for each terminal.
- For the terminals F and G, the allowable wiring length shall be 200 m or less.

■ Non-recycling gas-fired combustion

⚠ WARNING



In the case of gas-fired combustion equipment, do not connect the main valves to terminal 3. If ignition failure occurs, the main valves would remain open and allow fuel to flow out until lockout occurs, causing a serious hazard.

⚠ CAUTION

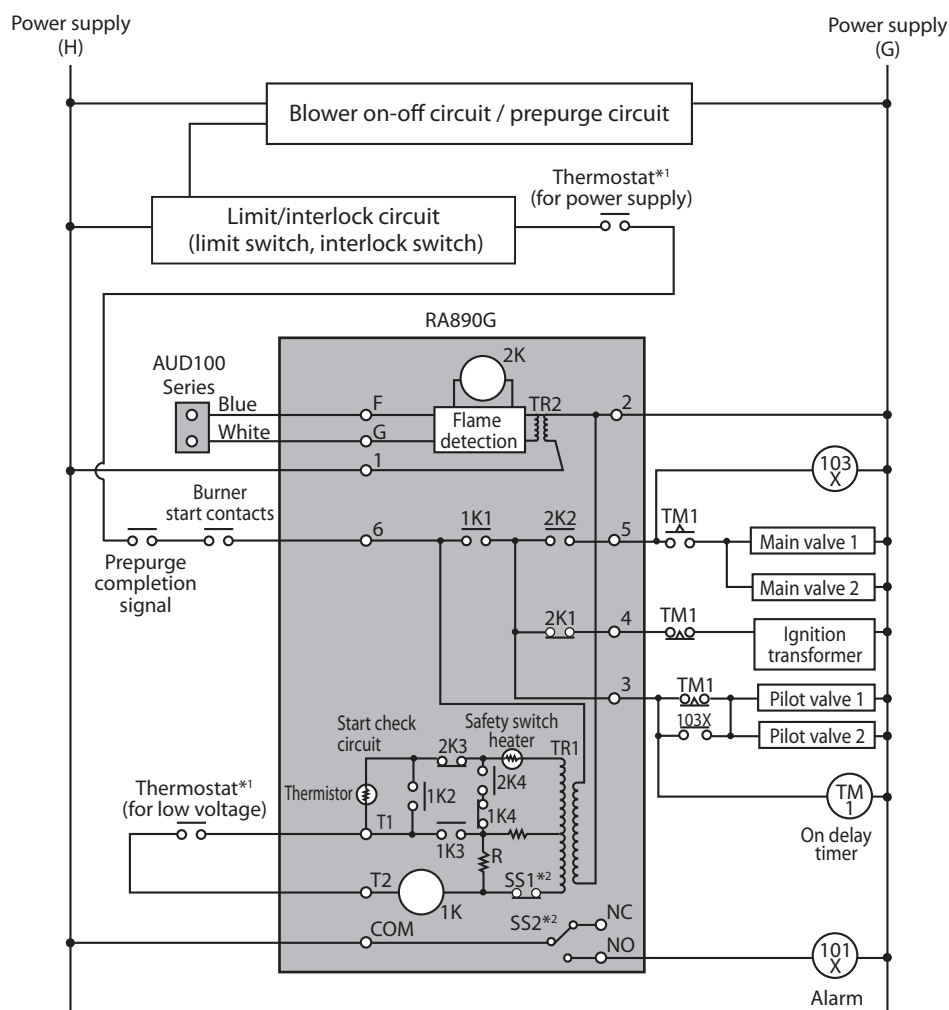


Give careful consideration to safety guidelines, etc., when setting timers.

! Handling Precautions

- Relay 1K has contacts 1K1 to 1K4 for the ignition transformer, pilot valves, and main valves. Relay 2K has contacts 2K1 to 2K4 for the flame detector.
- In the case of gas-fired combustion equipment, be sure to connect an on-delay timer and auxiliary relay to disable recycling.

● Wiring diagram

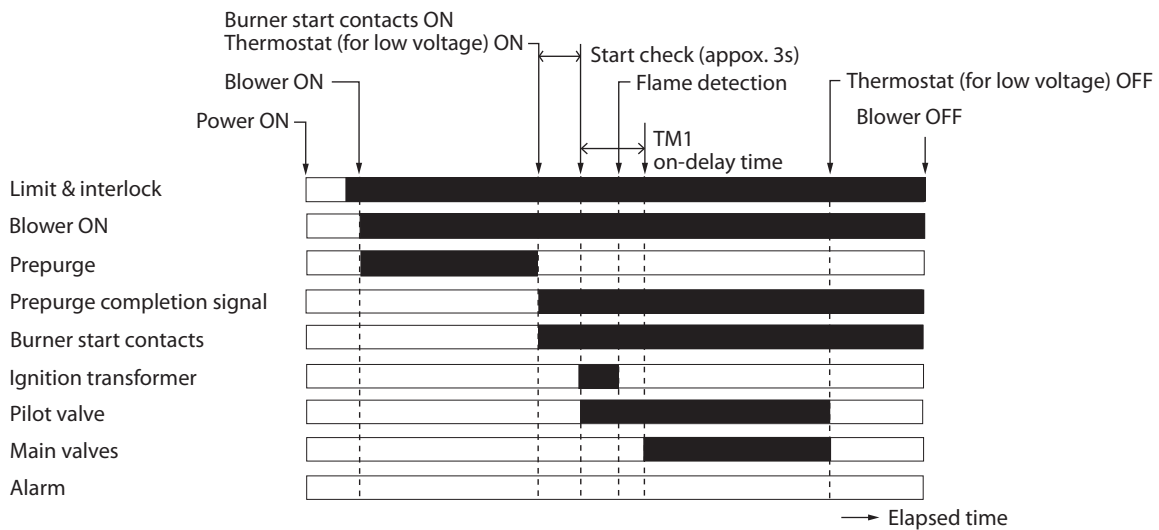


*1 Use the thermostat for either the power supply or for low voltage.

*2 SS1 and SS2 are contacts for the safety switch heater. Design the circuit so that the blower on-off circuit/prepurge circuit will always be reset if an alarm occurs (101X: ON).

● Normal operation

Input status	RA890G operation	Output status
Power ON	<ul style="list-style-type: none"> Power is supplied to terminals 1 and 2, and voltage is applied to transformers TR1 and TR2. 	
Blower ON	<ul style="list-style-type: none"> The blower turns on. When the prepurge ends, the prepurge completion signal is generated to make the next process possible. 	
Burner start contacts ON Thermostat (for low voltage) ON	<ul style="list-style-type: none"> If the limit and interlock conditions are normal (limit contacts are closed) and the burner start contacts are closed, power is supplied to terminals 6 and 2, and voltage is applied to transformer TR1. A start request from the thermostat closes the contacts between terminals T1 and T2, and current flows as follows: internal SS1 → relay 1K → terminal T2 → thermostat (for low voltage) → terminal 1 → thermistor → contacts 2K3 → safety switch heater. When current flows to the thermistor, the thermistor's resistance declines, and 3 seconds later, relay 1K is energized. When contacts 1K1 close, voltage is applied to terminal 4 to turn on the ignition transformer, and to terminal 3 so that the pilot valves are opened and external timer TM1 starts. Contacts 1K3 close and relay 1K forms a self-maintaining circuit. Since contacts 1K2 are closed, the thermistor stops heating, and the safety switch heater begins heating via contacts 2K3, 1K2, and 1K3. 	Ignition transformer starts Pilot valves open (TM1 starts)
The flame detector detects a flame	<ul style="list-style-type: none"> If the flame detector senses a flame within the safety switch's lock-out time (about 15 seconds), relay 2K is energized. When contacts 2K1 open, voltage to terminal 4 is cut off, and ignition transformer operation stops. When contacts 2K2 close, voltage is applied to terminal 5, and external relay 103X turns on. When the time set for TM1 operation has passed and contacts TM1 have turned on, the main valves open. Contacts 2K3 open, and the safety switch heater stops heating. 	Ignition transformer stops (103X: ON) (Contacts TM1: ON) Main valves open
Thermostat (for low voltage) OFF	<ul style="list-style-type: none"> When the thermostat ends its start request, the contacts between terminals T1 and T2 open, relay 1K turns off, contacts 1K1, 1K2, and 1K3 open, and contacts 1K4 close. Voltage to terminals 3, 4, and 5 stops, and all loads stop operation. The RA890G returns to the initial state and is ready for the next request from the thermostat (for low voltage). 	Pilot valves close (103X: OFF) Main valves close (TM1 stopped)



! WARNING

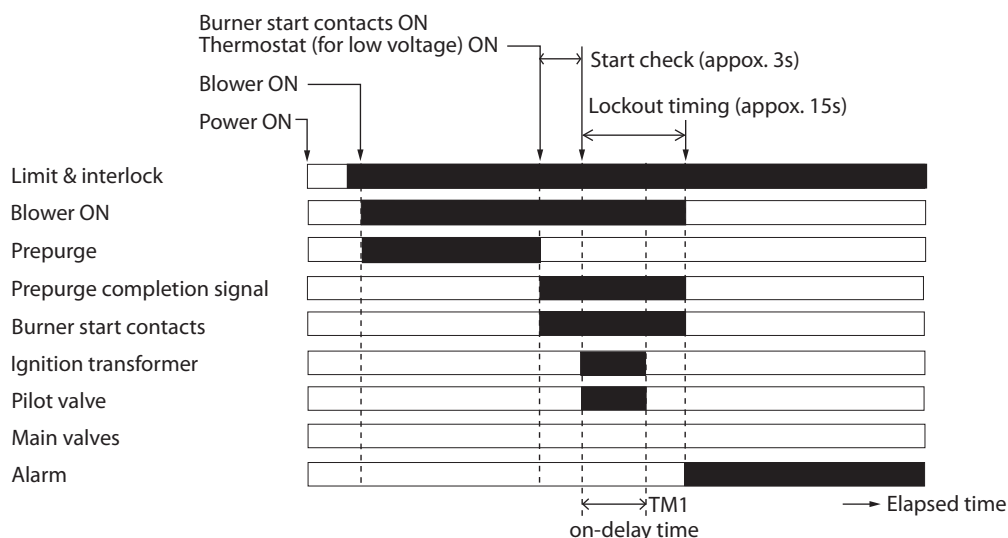
! If lockout occurs, be sure to do a prepurge before restarting the system. If the combustion chamber and flue are not ventilated to remove accumulated unburned gas, the ignition process may cause an explosion.

! Handling Precautions

- Even if the on-delay timer is set to more than 15 s, the ignition transformer stops after the lockout time of 15 s.

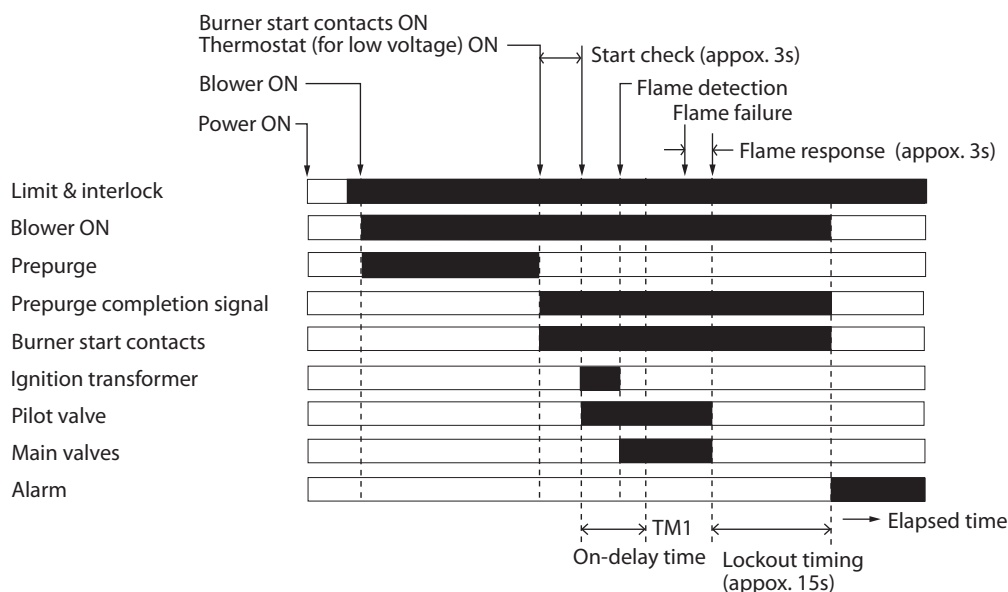
● **Ignition failure**

Input status	RA890G operation	Output status
Power ON	• Power is supplied to terminals 1 and 2, and voltage is applied to transformer TR2.	
Blower ON	• The blower turns on. When the prepurge ends, the prepurge completion signal is generated to make the next process possible.	
Burner start contacts ON Thermostat (for low voltage) ON	<ul style="list-style-type: none"> • If the limit and interlock conditions are normal (limit contacts are closed) and the burner start contacts are closed, power is supplied to terminals 6 and 2, and voltage is applied to transformer TR1. • A start request from the thermostat closes the contacts between terminals T1 and T2, and current flows as follows: internal SS1 → relay 1K → terminal T2 → thermostat (for low voltage) → terminal 1 → thermistor → contacts 2K3 → safety switch heater. • When current flows to the thermistor, the thermistor's resistance declines, and 3 seconds later, relay 1K is energized. • When contacts 1K1 close, voltage is applied to terminal 4 to turn on the ignition transformer, and to terminal 3 so that the pilot valves are opened and external timer TM1 starts. • Contacts 1K3 close and relay 1K forms a self-maintaining circuit. • Since contacts 1K2 are closed, the thermistor stops heating, and the safety switch heater begins heating via contacts 2K3, 1K2, and 1K3. 	Ignition transformer starts Pilot valves open (TM1 starts)
Flame detector does not detect a flame within the safety switch time	<ul style="list-style-type: none"> • When the time set for TM1 has passed after the start of ignition transformer operation, voltage to the transformer is cut off, the transformer ceases operation, and the pilot valves also close. • If the flame detector cannot detect a flame within the safety switch heater's lockout time (about 15 seconds), the heater is locked out, contacts SS1 open, relay 1K turns off, contacts 1K1, 1K2, and 1K3 open, and contacts 1K4 close. • Voltage to terminals 3, 4, and 5 stops, and all loads stop operation. Also, contacts SS2 close and activate an alarm. 	Ignition transformer stops Pilot valves close (Contacts TM1: OFF) (TM1 stopped) Alarm (101X: ON)



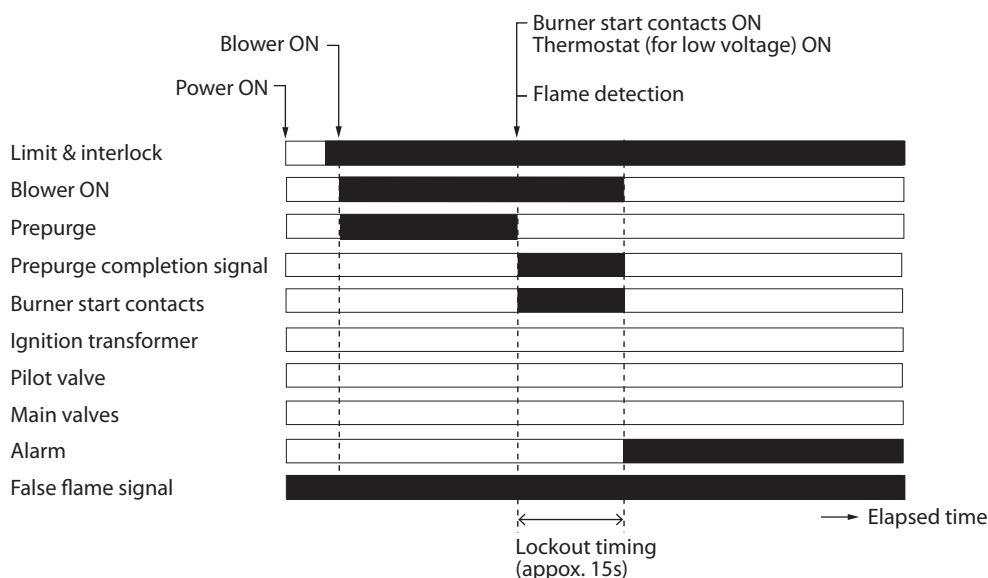
● Flame failure during combustion

Input status	RA890G operation	Output status
Power ON	<ul style="list-style-type: none"> Power is supplied to terminals 1 and 2, and voltage is applied to transformer TR2. 	
Blower ON	<ul style="list-style-type: none"> The blower turns on. When the prepurge ends, the prepurge completion signal is generated to make the next process possible. 	
Burner start contacts ON Thermostat (for low voltage) ON	<ul style="list-style-type: none"> If the limit and interlock conditions are normal (limit contacts are closed) and the burner start contacts are closed, power is supplied to terminals 6 and 2, and voltage is applied to transformer TR1. A start request from the thermostat closes the contacts between terminals T1 and T2, and current flows as follows: internal SS1 → relay 1K → terminal T2 → thermostat (for low voltage) → terminal 1 → thermistor → contacts 2K3 → safety switch heater. When current flows to the thermistor, the thermistor's resistance declines, and 3 seconds later, relay 1K is energized. When contacts 1K1 close, voltage is applied to terminal 4 to turn on the ignition transformer, and to terminal 3 so that the pilot valves are opened and external timer TM1 starts. Contacts 1K3 close and relay 1K forms a self-maintaining circuit. Since contacts 1K2 are closed, the thermistor stops heating, and the safety switch heater begins heating via contacts 2K3, 1K2, and 1K3. 	<p>Ignition transformer starts Pilot valves open (TM1 starts)</p>
The flame detector detects a flame	<ul style="list-style-type: none"> If the flame detector senses a flame within the safety switch's lockout time (about 15 seconds), relay 2K is energized. When contacts 2K1 open, voltage to terminal 4 is cut off, and ignition transformer operation stops. When contacts 2K2 close, voltage is applied to terminal 5, and external relay 103X turns on. When the time set for TM1 operation has passed and contacts TM1 have turned on, the main valves open. Contacts 2K3 open, and the safety switch heater stops heating. 	<p>Ignition transformer stops (103X: ON) (Contacts TM1: ON) Main valves open</p>
During combustion, flame detector can no longer detect a flame	<ul style="list-style-type: none"> During combustion, if the flame detector can no longer detect a flame, relay 2K turns off, contacts 2K2 open, voltage to terminal 5 is cut off, the main valves close, and external relay 103X also turns off. When contacts 103X open, the pilot valves close. Contacts 2K3 close and the safety switch heater starts heating. When relay 2K turns off, contacts 2K1 close. However, because TM1's time has expired, voltage is no longer reapplied to the ignition transformer. The safety switch heater continues operating, and when its lockout time (about 15 seconds) has passed the switch is locked out, contacts SS1 open, relay 1K turns off, contacts 1K1, 1K2, and 1K3 open, and contacts 1K4 close. Voltage to terminals 3, 4, and 5 stops, and all loads stop operation. Also, contacts SS2 close and activate an alarm. 	<p>Main valves close (103X: OFF) Pilot valves close (TM1 stopped) Alarm (101X: ON)</p>



● **False flame signal at startup**

Input status	RA890G operation	Output status
Power ON	<ul style="list-style-type: none"> Power is supplied to terminals 1 and 2, and voltage is applied to transformer TR2. 	
False flame signal is detected	<ul style="list-style-type: none"> If there is a false flame signal, relay 2K turns on. 	
Blower ON	<ul style="list-style-type: none"> The blower turns on. When the prepurge ends, the prepurge completion signal is generated to make the next process possible. 	
Burner start contacts ON Thermostat (for low voltage) ON	<ul style="list-style-type: none"> If the limit and interlock conditions are normal (limit contacts are closed) and the burner start contacts are closed, power is supplied to terminals 6 and 2, and voltage is applied to transformer TR1. Current flows as follows: SS1 → resistor R → contacts 1K4 → contacts 2K4 → safety switch heater. Next, the thermistor starts heating. When the lockout time (about 15 seconds) has passed, lockout occurs and contacts SS1 open. Also, contacts SS2 close and activate an alarm. 	Alarm (101X: ON)



■ Recycling oil-fired combustion (2-stage combustion)

⚠ CAUTION

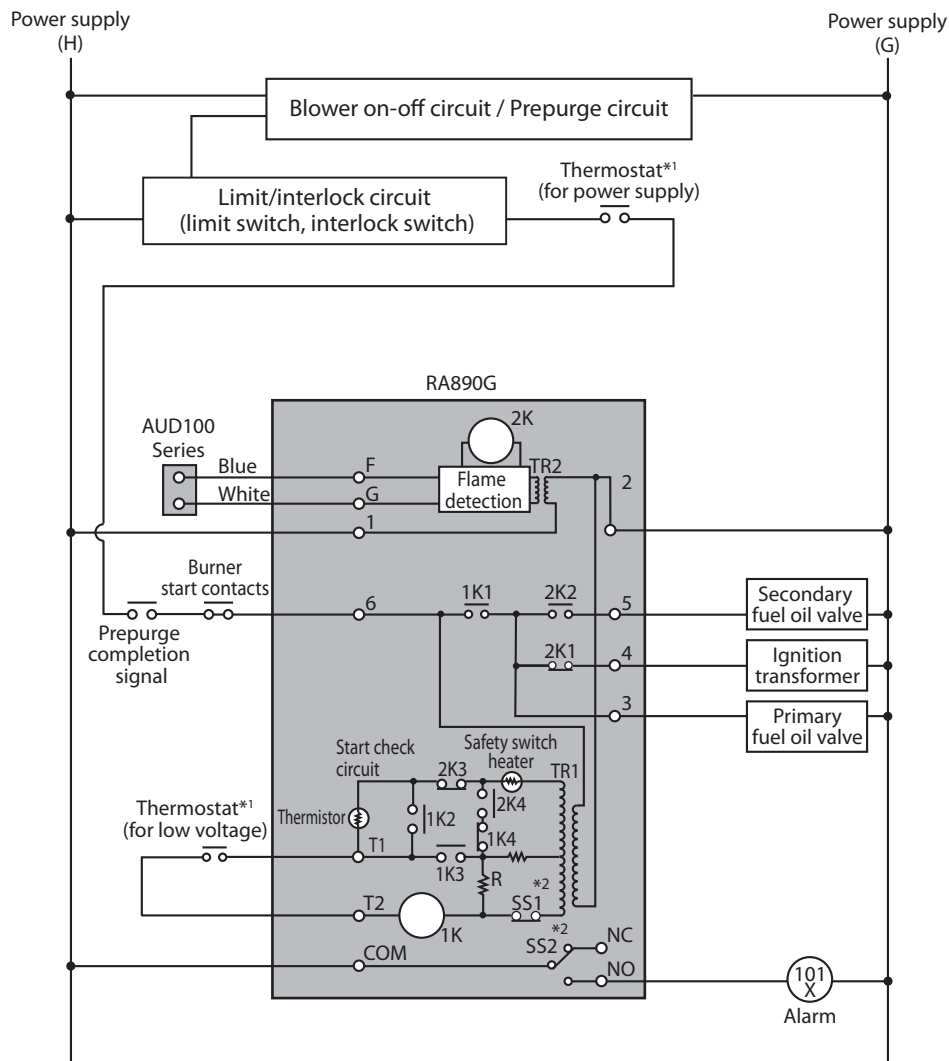


For oil-fired combustion equipment that must be operated on a non-recycling basis, use a timer and auxiliary relay in the same way as for gas-fired equipment.

! Handling Precautions

- Relay 1K has contacts 1K1 to 1K4 for the ignition transformer and fuel valves. Relay 2K has contacts 2K1 to 2K4 for the flame detector.

● **Wiring diagram**

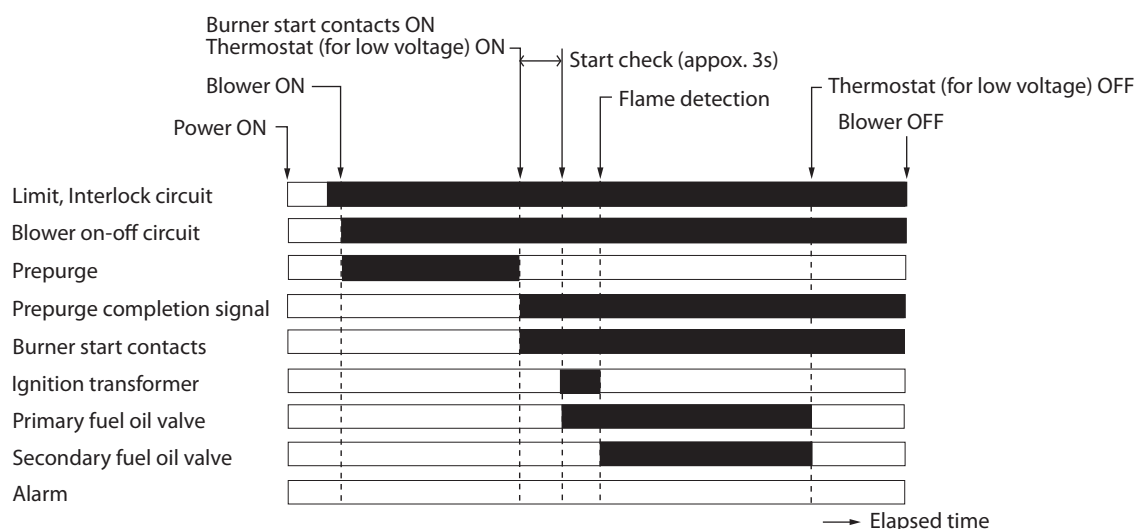


*1 Use the thermostat for either the power supply or for low voltage.

*2 SS1 and SS2 are contacts for the safety switch heater. Design the circuit so that the blower on-off circuit/prepurge circuit will always be reset if an alarm occurs (101X: ON).

● Normal operation

Input status	RA890G operation	Output status
Power ON	<ul style="list-style-type: none"> Power is supplied to terminals 1 and 2, and voltage is applied to transformers TR2. 	
Blower ON	<ul style="list-style-type: none"> The blower turns on. When the prepurge ends, the prepurge completion signal is generated to make the next process possible. 	
Burner start contacts ON Thermostat (for low voltage) ON	<ul style="list-style-type: none"> If the limit and interlock conditions are normal (limit contacts are closed) and the burner start contacts are closed, power is supplied to terminals 6 and 2, and voltage is applied to transformer TR1. A start request from the thermostat closes the contacts between terminals T1 and T2, and current flows as follows: internal SS1 → relay 1K → terminal T2 → thermostat (for low voltage) → terminal 1 → thermistor → contacts 2K3 → safety switch heater. When current flows to the thermistor, the thermistor's resistance declines, and 3 seconds later, relay 1K is energized. When contacts 1K1 close, voltage is applied to terminal 4 to turn on the ignition transformer, and to terminal 3 to open the primary fuel oil valve. Contacts 1K3 close and relay 1K forms a self-maintaining circuit. Since contacts 1K2 are closed, the thermistor stops heating, and the safety switch heater begins heating via contacts 2K3, 1K2, and 1K3. 	Ignition transformer starts Primary fuel oil valve opens
The flame detector detects a flame	<ul style="list-style-type: none"> If the flame detector senses a flame within the safety switch's lock-out time (about 15 seconds), relay 2K is energized. When contacts 2K1 open, voltage to terminal 4 is cut off, and ignition transformer operation stops. When contacts 2K2 close, voltage is applied to terminal 5 to open the secondary fuel oil valve. Contacts 2K3 open, and the safety switch heater stops heating. 	Ignition transformer stops Secondary fuel oil valve opens
Thermostat (for low voltage) OFF	<ul style="list-style-type: none"> When the thermostat ends its start request, the contacts between terminals T1 and T2 open, relay 1K turns off, contacts 1K1, 1K2, and 1K3 open, and contacts 1K4 close. Voltage to terminals 3, 4, and 5 stops, and all loads stop operation. The RA890G returns to its initial status and is ready for the next request from the thermostat (for low voltage). 	Primary fuel oil valve closes Secondary fuel oil valve closes



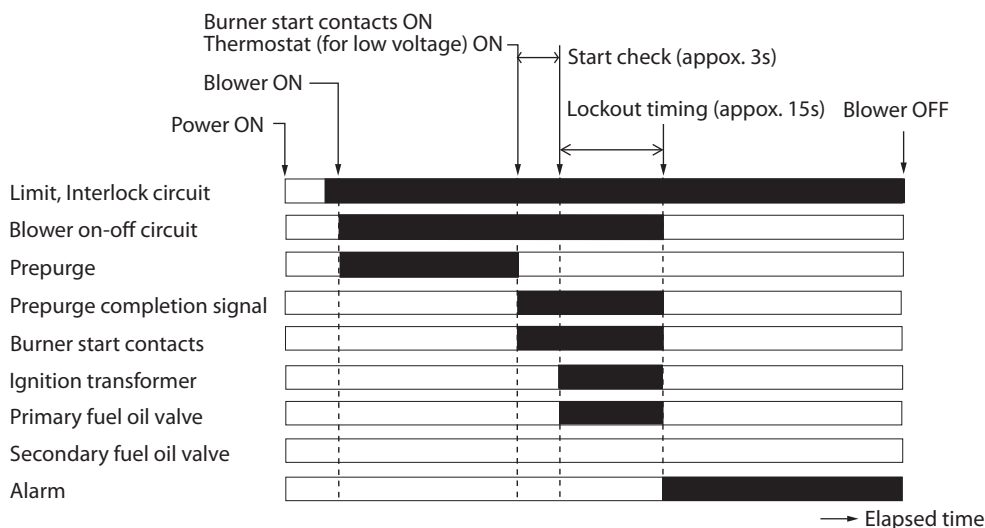
⚠ WARNING



If the system is locked out, do not reset it until the cause of the problem has been eliminated. Before restarting, be sure to do a prepurge. Failure to discharge unburned gas that has accumulated in the flue and combustion chamber may result in an explosion.

● **Ignition failure**

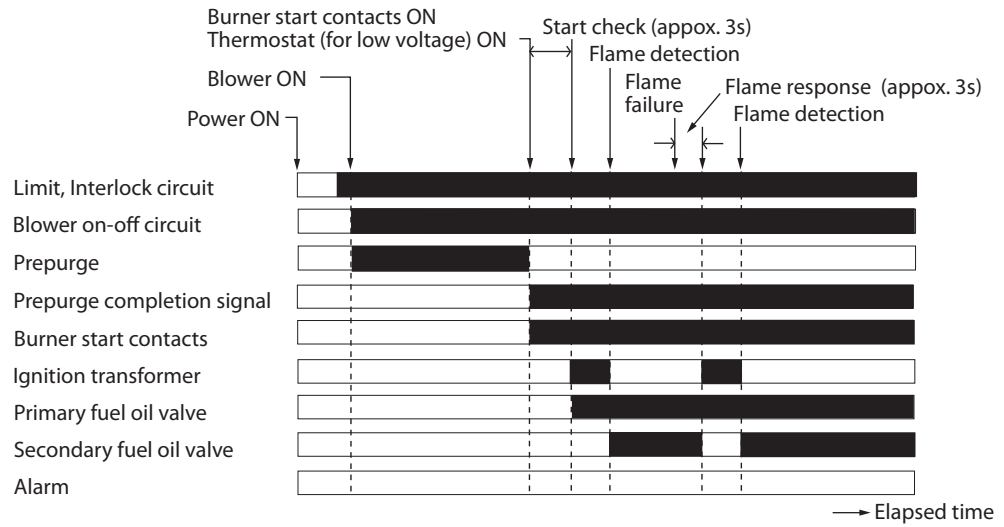
Input status	RA890G operation	Output status
Power ON	<ul style="list-style-type: none"> Power is supplied to terminals 1 and 2, and voltage is applied to transformer TR2. 	
Blower ON	<ul style="list-style-type: none"> The blower turns on. When the prepurge ends, the prepurge completion signal is generated to make the next process possible. 	
Burner start contacts ON Thermostat (for low voltage) ON	<ul style="list-style-type: none"> If the limit and interlock conditions are normal (limit contacts are closed) and the burner start contacts are closed, power is supplied to terminals 6 and 2, and voltage is applied to transformer TR1. A start request from the thermostat closes the contacts between terminals T1 and T2, and current flows as follows: internal SS1 → relay 1K → terminal T2 → thermostat (for low voltage) → terminal 1 → thermistor → contacts 2K3 → safety switch heater. When current flows to the thermistor, the thermistor's resistance declines, and 3 seconds later, relay 1K is energized. When contacts 1K1 close, voltage is applied to terminal 4 to turn on the ignition transformer, and to terminal 3 so that the primary fuel oil valve opens and external timer TM1 starts. Contacts 1K3 close and relay 1K forms a self-maintaining circuit. Since contacts 1K2 are closed, the thermistor stops heating, and the safety switch heater begins heating via contacts 2K3, 1K2, and 1K3. 	Ignition transformer starts Primary fuel oil valve opens
Flame detector does not detect a flame within the safety switch time	<ul style="list-style-type: none"> When the time set for TM1 has passed after the start of ignition transformer operation, voltage to the transformer is cut off, the transformer ceases operation, and the pilot valves also close. If the flame detector cannot detect a flame within the safety switch heater's lockout time (about 15 seconds), the heater is locked out, contacts SS1 open, relay 1K turns off, contacts 1K1, 1K2, and 1K3 open, and contacts 1K4 close. Voltage to terminals 3, 4, and 5 stops, and all loads stop operation. Also, contacts SS2 close and activate an alarm. 	Ignition transformer stops Primary fuel oil valve closes Alarm (101X: ON)



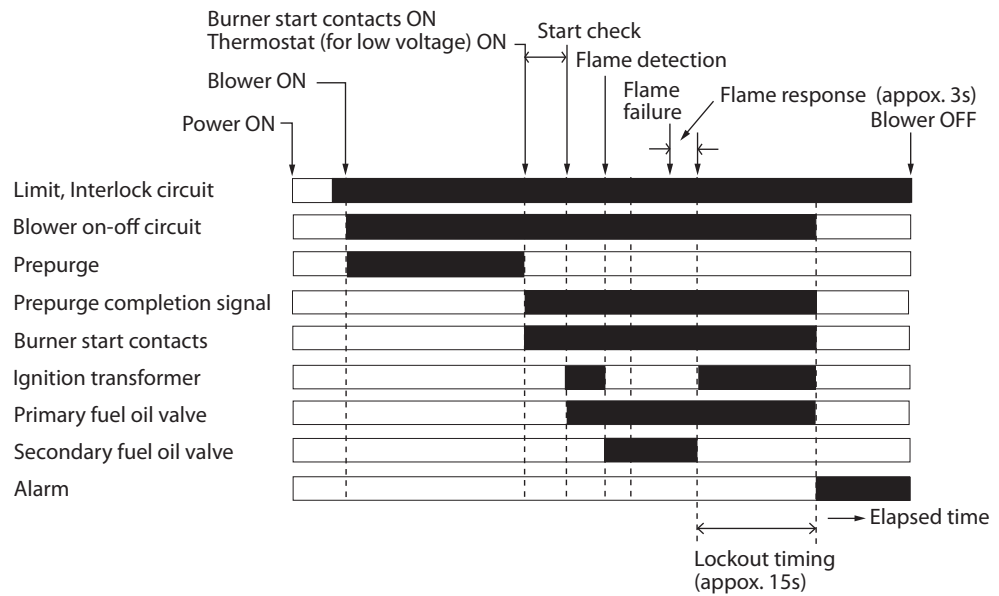
● Flame failure during RUN

Input status	RA890G operation	Output status
Power ON	<ul style="list-style-type: none"> Power is supplied to terminals 1 and 2, and voltage is applied to transformer TR2. 	
Blower ON	<ul style="list-style-type: none"> The blower turns on. When the prepurge ends, the prepurge completion signal is generated to make the next process possible. 	
Burner start contacts ON Thermostat (for low voltage) ON	<ul style="list-style-type: none"> If the limit and interlock conditions are normal (limit contacts are closed) and the burner start contacts are closed, power is supplied to terminals 6 and 2, and voltage is applied to transformer TR1. A start request from the thermostat closes the contacts between terminals T1 and T2, and current flows as follows: internal SS1 → relay 1K → terminal T2 → thermostat (for low voltage) → terminal 1 → thermistor → contacts 2K3 → safety switch heater. When current flows to the thermistor, the thermistor's resistance declines, and 3 seconds later, relay 1K is energized. When contacts 1K1 close, voltage is applied to terminal 4 to turn on the ignition transformer, and to terminal 3 so that the primary fuel oil valve opens and external timer TM1 starts. Contacts 1K3 close and relay 1K forms a self-maintaining circuit. Since contacts 1K2 are closed, the thermistor stops heating, and the safety switch heater begins heating via contacts 2K3, 1K2, and 1K3. 	Ignition transformer starts Primary fuel oil valve opens
The flame detector detects a flame	<ul style="list-style-type: none"> If the flame detector senses a flame within the safety switch's lockout time (about 15 seconds), relay 2K is energized. When contacts 2K1 open, voltage to terminal 4 is cut off, and ignition transformer operation stops. When contacts 2K2 close, voltage is applied to terminal 5, and secondary fuel oil valve opens. Contacts 2K3 open, and the safety switch heater stops heating. 	Ignition transformer stops Secondary fuel oil valve opens
During combustion, flame detector can no longer detect a flame	<ul style="list-style-type: none"> During combustion, if the flame detector can no longer detect a flame, relay 2K turns off, contacts 2K2 open, voltage to terminal 5 is cut off, and secondary oil fuel valve closes. Contacts 2K3 close and the safety switch heater starts heating. When relay 2K turns off, closing contacts 2K1, voltage is again applied to terminal 4 and the ignition transformer operation starts. 	Secondary fuel oil valve closes Ignition transformer starts
Recycle operation at flame failure	<ul style="list-style-type: none"> When the flame detector again detects a flame, relay 2K turns on, opening contacts 2K1. Contacts 2K2 close, voltage to terminal 4 is cut off, voltage is applied to terminal 5, and ignition transformer operation stops. Voltage is applied to terminal 5 and thereby to the secondary fuel oil valve, which opens. 	Ignition transformer stops Secondary fuel oil valve opens
	<ul style="list-style-type: none"> If no flame is detected during recycling, the safety switch heater continues heating and lockout occurs when the lockout time (about 15 seconds) has passed. Contacts SS1 open, relay 1K turns off, contacts 1K1, 1K2, and 1K3 open, and contacts 1K4 close. Voltage to terminals 3, 4, and 5 stops, and all loads stop operation. Also, contacts SS2 close and activate an alarm. 	If a flame is not detected again, an alarm occurs. (101X: ON)

• When the system restarts

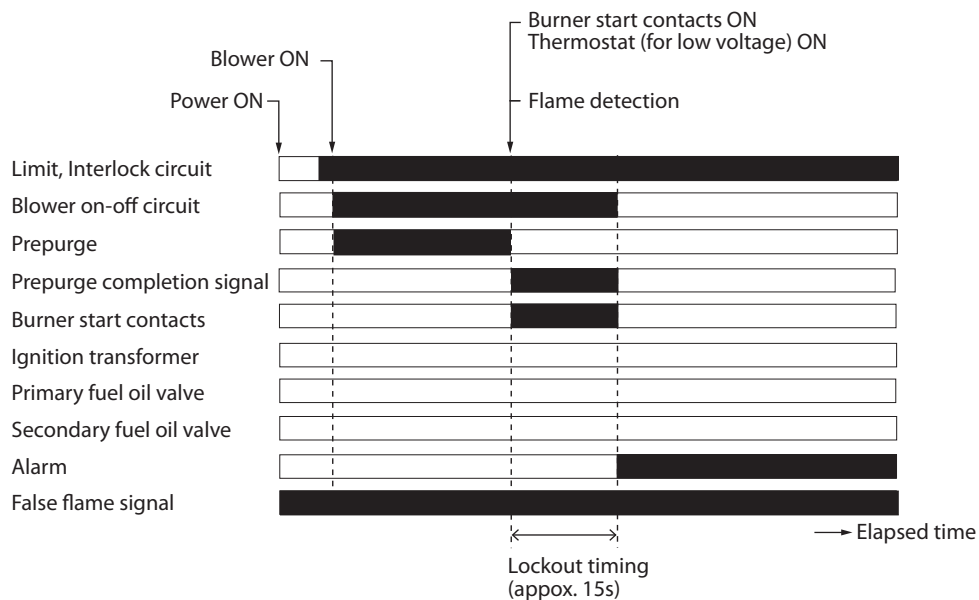


• When system restart fails



● False flame signal at the start of operation

Input status	RA890G operation	Output status
Power ON	• Power is supplied to terminals 1 and 2, and voltage is applied to transformer TR2.	
False flame signal is detected	• If there is a false flame signal, relay 2K turns on.	
Blower ON	• The blower turns on. When the prepurge ends, the prepurge completion signal is generated to make the next process possible.	
Burner start contacts ON Thermostat (for low voltage) ON	<ul style="list-style-type: none"> • If the limit and interlock conditions are normal (limit contacts are closed) and the burner start contacts are closed, power is supplied to terminals 6 and 2, and voltage is applied to transformer TR1. • Current flows as follows: SS1 → resistor R → contacts 1K4 → contacts 2K4 → safety switch heater. Next, the thermistor starts heating. When the lockout time (about 15 seconds) has passed, lockout occurs and contacts SS1 open. Also, contacts SS2 close and activate an alarm. 	Alarm (101X: ON)

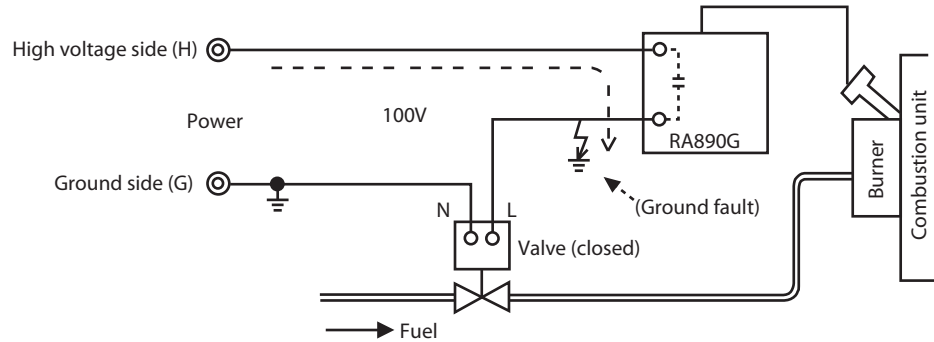


■ **Wiring the solenoid valve**

⚠ CAUTION

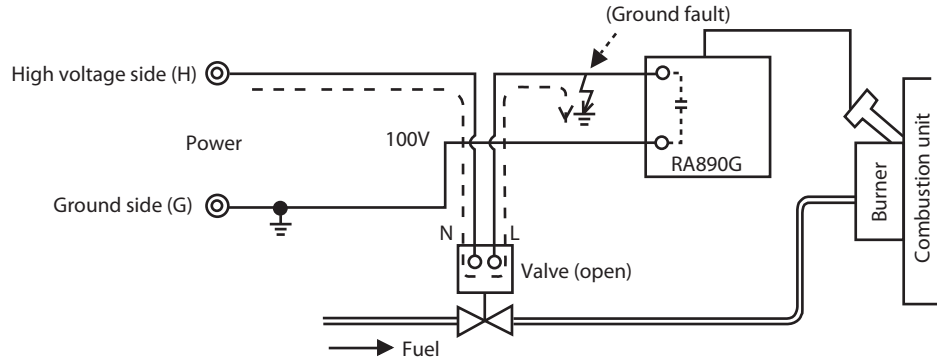
⊘ Do not connect a solenoid valve to the high voltage side of the circuit. If a ground fault occurs, the ground fault current may energize and open the solenoid valve, and fuel will flow out.

● **Correct connection**



Ground current will not flow to the solenoid valve with the valve wired as shown in the figure above, even if faulty insulation on the voltage side (H) causes a ground fault. Accordingly, the valve will not open, eliminating the risk of fuel discharge.

● **Wrong connection**

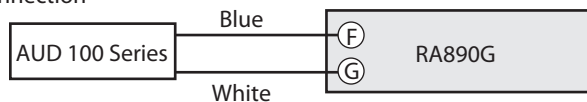


Ground current will flow to the solenoid valve with the valve wired as shown in the figure above. Accordingly, the solenoid valve will open regardless of the Protectorelay, causing fuel discharge.

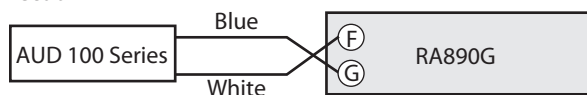
■ **Wiring the flame detector**

Connect the blue signal lead from the AUD 100 Series Advanced Ultraviolet Flame Detector to terminal F and the white lead to terminal G.

Correct connection



Wrong connection







Chapter 4. INSPECTION AND ADJUSTMENT



Handling Precautions

- A trained and experienced technician who has knowledge and technical skills related to combustion equipment and flame safeguard control devices should carry out inspection, adjustment, etc.

WARNING

-  Do not allow the pilot or main burner ignition trial time to exceed the specifications of the burner or equipment manufacturer. If they do, fuel may accumulate in the combustion chamber and form an explosive air-fuel mixture, resulting in a serious explosion hazard.
-  Even after the power to this device is turned off, terminal F continues to hold an electrical charge. To avoid electrical shock, do not touch terminal F.
-  Do not start regular operation of the equipment without first completing the trial-run adjustments for this device, as well as the tests specified by the equipment manufacturer.
-  Do not touch this device's internal relay. Doing so might damage the relay or cause this device and/or the combustion equipment to malfunction.

CAUTION

-  Check the flame current at least once per month. Doing so can prevent shutdowns caused by a weak flame current signal.
-  This device has an operating life. Assuming that the operating life of the combustion equipment used with this device is longer, be sure to do periodic maintenance and replacement of this device.

■ Inspection

To operate the system more safely, check for the items below satisfactorily.

● Required equipment

- Analog flame meter FSP136A100
- Manometer (pressure gauge)
- Digital voltmeter (tester)

● Checkout procedure

- (1) Preliminary check
- (2) Loosen the cover retaining screw, and then remove the cover.
- (3) Flame current check
- (4) Ignition spark response test
- (5) Pilot turndown test
- (6) Safety shutoff test
- (7) Mount the cover on the base with the cover retaining screw.

● **Preliminary check**

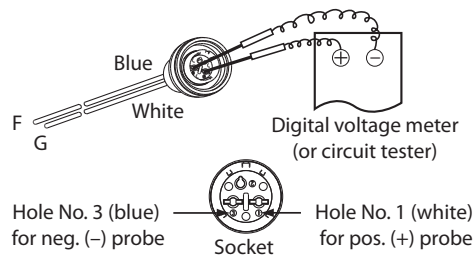
- (1) Check all the wiring points.
- (2) Make sure that the 10 terminal screws are tightened firmly.
- (3) Make sure that the RA890G is installed at a place within the allowable ambient temperature range.
- (4) Check if the flame detector is installed properly. (Refer to the instruction manual for the flame detector)
- (5) Check if the burner has been adjusted properly.
- (6) Check the exhaust mechanism in the flue.
- (7) Press the green pushbutton at the front of the RA890G to reset the safety switch.

● **Wiring check of the AUD 100 Series Advanced Ultraviolet Flame Detector**

Check that the wiring to the AUD 100 Series Advanced Ultraviolet Flame Detector is correct using the steps below.

• Procedure for the AUD 100C with the AUD 15C

- (1) Remove the AUD 15C tube unit from the AUD 100 socket.
- (2) Supply the power to the RA890G.
- (3) Measure the DC voltage in the socket with a digital voltmeter or tester.
 - Connect the plus probe to the No.1 pin on the socket (white wire).
 - Connect the minus probe to the No.3 pin on the socket (blue wire).



• Reference voltage (by TR6841 of ADVANTEST)

Hole No.	Tester probe	Voltage
3 (blue):F	-	160 to 220 Vdc
1 (white):G	+	

! Handling Precautions

- If the above measured voltage is negative, the wiring is reversed.
- Before mounting the AUD 15C tube unit, make sure that the wiring is correct.

● Flame current check

The flame current check is the best way to identify the proper flame detector installation. Set the range changeover switch of FSP136A100 Analog Flame Meter at 15 μ A, and insert the current measurement plug of an analog flame meter FSP136A100 into the flame current test jack of the RA890G. Then, operate the burner and read the flame current from the analog flame meter. If the flame current is abnormal, see the users' manual for the flame detector.

Checkpoints

- The flame current should be steady, without excessive fluctuation of the indicator.
- The flame current should be 1.5 microamperes or more.

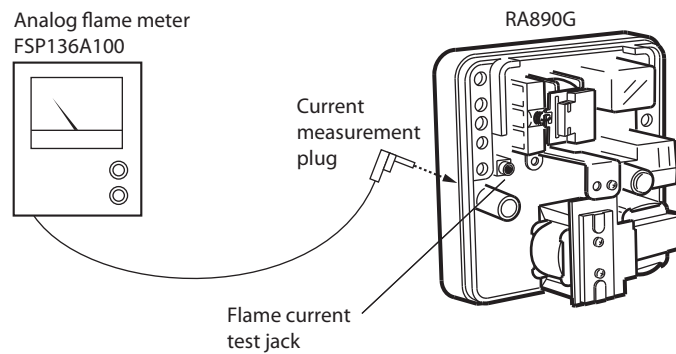
- AUD100 Series Advanced Ultraviolet Flame Detector

AUD100/100 Socket for the AUD15 Tube Unit User's Manual CP-UM-5640JE

- Advanced Ultraviolet Sensor AUD15 Tube Unit for the AUD100/110

CP-UM-5639JE

● How to measure the flame current



■ Ignition spark response test

CAUTION
<div style="display: flex; flex-direction: column; gap: 10px;"> <div style="display: flex; align-items: flex-start;"> <div> <p>Make sure that the flame detector does not detect the ignition spark. If the flame detector detects the spark, change the position of the detector or the ignition electrode.</p> </div> </div> <div style="display: flex; align-items: flex-start;"> <div> <p>Adjust the flame detector so that it detects only the ultraviolet rays of the burner flame. If the flame detector responds to other ultraviolet rays, it will report that there is a flame even if the burner flame goes out. As a result, fuel will continue to be discharged, causing a serious explosion hazard.</p> </div> </div> </div>

Make arrangement so that the flame relay 2K may not be excited by the sparks generated during the operation of the ignition transformer. Check the response of the flame detector to the ignition sparks in the following procedure, and check the mounting position.

- (1) Close the manual fuel valves for the pilot burner and main burner to shut off the fuel.
- (2) Start operation and make sure that relay 2K is not turned on during the pilot ignition sequence.
- (3) If relay 2K is energized, adjust as follows:
 - Change the location of the flame detector or ignition spark rod and check that the change does not affect its operation.
 - Install a shield plate or the like to prevent the ultraviolet rays of the spark from intruding into the flame detector's field of view, and adjust it so that relay 2K is not energized because of the spark.






● Cautions regarding UV sources other than flames

The table below shows various radiation sources other than the burner flame that may activate the flame detector. Make sure that the flame voltage is not affected by any of these sources under any operating conditions.

Ultraviolet ray sources	Red-hot chamber wall with temperature 1371 °C or more
	Sparks
	• Ignition transformer • Welding arc • Lightning
	Gas laser
	Sunlamp
	Germicidal lamp
Gamma ray and X-ray sources	Strong flashlight (toward UV sensor)
	X-ray diffraction equipment and gamma-ray analysis measurement equipment
	Electron microscope
	X-ray camera
	High-voltage vacuum switch
	High-voltage capacitor
	Radioactive isotope
	Other sources producing ultraviolet rays, gamma rays and X-rays

■ Pilot turndown test

WARNING

-  Do not allow the pilot or main burner ignition trial time to exceed the specifications of the burner or equipment manufacturer. If they do, fuel may accumulate in the combustion chamber and form an explosive air-fuel mixture, resulting in a serious explosion hazard.
-  Carry out the pilot turndown test carefully. If the flame detector is set so that it detects a pilot flame that is too small to ignite the main burner, this device will not be able to detect a flame failure in the main burner. In that case, fuel will continue to be supplied, causing a serious explosion hazard.
-  Before the pilot turndown test or ignition spark response test, make sure that all manual fuel valves are closed.
-  If the pilot turndown test must be carried out repeatedly, completely shut down all equipment each time the test is finished, and completely discharge unburned gas or fuel that has accumulated in the ducts and combustion chamber. Failure to discharge unburned gas or fuel may result in an explosion.
-  When the pilot turndown test is complete, turn OFF the power. Restore all test jumpers and limit interlock/regulator settings to their previous states. If the equipment is operated without restoring the previous settings, damage to the equipment, gas leak or explosion may result.

This test is intended to prove that even with a worst-case change of gas pressure and air pressure, if the flame detector detects a pilot flame, the main burner can be lighted without fail.

Check the following:

- Any pilot flame large enough to light the main burner can be detected without fail.
- No pilot flame that is too small to light the main burner can be detected.
- The ignition spark is not detected as a flame.

- (1) Close the manual fuel valves for the pilot burner and main burner to shut off the fuel.
- (2) Connect a manometer to the downstream side of the pilot valve.
- (3) Open the manual valve of the pilot burner.
- (4) Start the system by raising the set point of the thermostat. The relay 1K is excited and the pilot valve opens, and then ignition operation starts.
- (5) Gradually reduce the size of the pilot flame until the flame detector can detect no flame, by slowly closing the manual valve of the pilot burner. The flame relay (2K) and relay 1K become OFF and the pilot valve closes, and then the pressure of the manometer drops down suddenly. The safety switch heater starts heating and lockout occurs 15 seconds after. Take notes the pressure just before the pilot valve closes.
- (6) Reset the safety switch and restart the system.
- (7) Gradually open the manual valve of the pilot burner again and set it to the pressure just before the shutoff measured in step (5).
- (8) Check if the main burner is lighted smoothly within 1 second after the manual valve of the main gas line is opened.

- (9) While changing the gas pressure to minimum and maximum values, repeat ignition to the main burner 5 or 6 times. Then, check if ignition is performed smoothly within 1 second every time.
- (10) If the main burner cannot be lighted, it is necessary to enlarge the size of the pilot flame. After enlarging the pilot flame, make the adjustment to keep the viewing line of the AUD100 Series, C7027A or C7035A a little away from the axis of the pilot flame, or make correction with the flame size reduced.
- (11) After the adjustment, check if the main burner is lighted smoothly by repeating steps (5) to (9).
- (12) After the end of test, restore the manual valve on the pilot burner and the main burner to the fully open position and check if the flame current is proper.
- (13) Disconnect the manometer.

■ Safety shutdown checks

After the completion of all adjustment, perform safety shutdown checks.

(1) Limit action check

While the burner is operating, lower the high limit setting of boiler or furnace to simulate an overheated boiler or furnace, and normal shutdown will occur. When shutdown starts, restore the normal limit setting of the boiler or furnace, and the burner will restart.

(2) Flame failure check

While the burner is operating, close the manual fuel valves to simulate a flame failure, and the system will lock out in safety switch time (approx. 15 s). After the safety switch has cooled (3 minutes or more), open the manual fuel valves, reset the safety switch, and restart the burner.

(3) Power failure check





While the burner is operating, turn the power off temporarily to simulate a power failure. After some time, turn the power on again and make sure that the burner restarts and operates normally.

Chapter 5. MAINTENANCE




Handling Precautions

- The maintenance, inspection and adjustment shall be made by trained, experienced flame safeguard control technicians.

WARNING

-  Before wiring, mounting, or removing this device, be sure to turn the power on and then immediately off. Wiring with the power on can result in an electric shock.
-  Do not touch this device's internal relay. Doing so might damage the relay or cause this device and/or the combustion equipment to malfunction.
-  Even after the power to this device is turned off, terminal F continues to hold an electrical charge. To avoid electrical shock, do not touch terminal F.
-  To prevent electric shock, turn the power off and discharge terminals F and G before removing this device from the subbase. Use lead wires to connect terminals F and G of the flame simulator (FSP300C100) to terminals F and G of this device for 10 seconds or more.

CAUTION

-  In the event that this device is replaced, do all of the checks listed in chapter 4 INSPECTION AND ADJUSTMENT.
-  When doing a maintenance inspection of the burner, be sure to do the pilot turndown test. Inspection must be done at least once a year.
-  Conduct periodic inspections in accordance with the user's manual of the equipment manufacturer.

■ Maintenance and inspection intervals

Determine a specific maintenance schedule, taking into account the type of equipment controlled, operating conditions (dust, ambient temperature, etc.), the amount of damage in case of shutdown by some failure during operation, and so on.

- (1) Perform a safe shutdown check at least once a month, as described in Chapter 4, "Inspection and Adjustment".
- (2) Check a soot condition on the viewing window of the flame detector, and clean it periodically.
- (3) Check a flame current at least once a month.

■ Troubleshooting

⚠ WARNING



Use utmost care while troubleshooting the RA890G since the line voltage can be present on most terminals when power is on.



To prevent electric shock, turn the power off and discharge terminals F and G before removing this device from the subbase. Use lead wires to connect terminals F and G of the flame simulator (FSP300C100) to terminals F and G of the RA890G for 10 seconds or more.

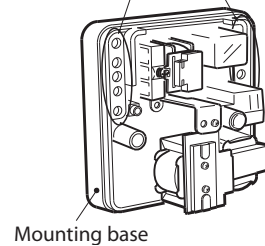
If trouble occurs in the heating system, check the following step-by-step procedure.

Step 1.

Initial check

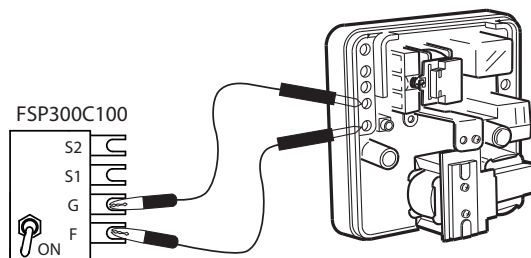
- (1) After remove the cover, check 10 terminal screws are tightened firmly.
- (2) Set the controller not to call for heat.
- (3) Reset the safety switch on the RA890G by pushing it.
- (4) Close the line switch.
- (5) Check for the line voltage between the terminals 2 and 6. (The voltage will be zero if a line voltage controller is used. Check for the line voltage when the controller is set to call for heat.)

Terminal screws (10): Tighten firmly



- The voltage must be within +10 to -15 % of the rated voltage.
- If the voltage is zero (with the thermostat connected to the terminals T1 and T2), check if the limit switch contacts are closed, and power is supplied. Check for blown fuses, open circuit or open disconnect switch.

When replacing the RA890G is required, before removing it from the subbase, turn on the FLAME MODE switch of the flame simulator, and connect terminals F and G to terminals F and G of the RA890G with lead wires.



Step 2.

Flame status check

- (1) If the flame relay is not excited, proceed to step 3.
- (2) If the flame relay is excited, check for a flame simulation condition. Disconnect the wiring to the flame detector.
 - If the flame relay is excited, replace the RA890G.
 - If the flame relay is not excited, the flame detector or external circuit is defective. Check them.

Step 3.

Set the controller to call for heat.

If the line voltage temperature controller is connected to the terminal 6, go back to steps 1 and 2.

Step 4.

Check if the load relay is excited.

- (1) When the load relay is excited to light the pilot and start the burners, proceed to step 8.
- (2) If the load relay is not excited, proceed to step 5.
- (3) If the load relay is excited, but the pilot does not light, or the burner does not start, proceed to step 7.

Step 5.

Check the line voltage controller and limit switch for proper operation if the line voltage controller is connected to the terminal 6. If the load relay is not excited, turn ON the controller and check the voltage between the terminals 2 and 6 again. Replace the RA890G if the load relay is not excited still, although the rated voltage is obtained there. If a low voltage thermostat is used, proceed to step 6.

Step 6.

Check the low voltage thermostat, if used, for proper operation.

- (1) When the load relay is excited with the terminals T1 and T2 short-circuited, check the low voltage thermostat and external connection circuit.
- (2) If the load relay is not excited with the terminals T1 and T2 short-circuited, replace the RA890G.

Step 7.

If the load relay is excited, but the pilot won't light or the burner won't start, check the voltage at the terminals 2-3 or 2-4.

- (1) If no voltage is obtained at the terminals 2-3 or 2-4, replace the RA890G.
- (2) If the normal line voltage is obtained at the terminals 2-3 or 2-4, check the external circuits of the burner, ignition transformer and fuel valve. Check the wiring, burner adjustment, ignition system including the electrode spacing and location, oil quality, character and efficiency of oil atomization, fuel supply pressure, flame pattern, flame character and quality, pilot burner location with respect to main burner, flame detector, or other conditions that may delay ignition.

Step 8.

Observe the flame relay (right-hand relay) for excitation when the burner is lighted.

- (1) When the flame relay is excited, proceed to step 10.
- (2) When the flame relay is not excited, proceed to step 9.

Step 9.

Check the flame relay with the FSP300C100 flame simulator, if available, or in the following procedure:

- (1) Check the flame current (see page 25)
- (2) If the flame current is satisfactory, replace the RA890G.
- (3) If the flame current is not satisfactory, one or more of the following items are considered:
 - The power supply is not suitable.
 - The connection of the flame detector is improper.
 - Open status
 - Short circuit status
 - Insulation breakdown of leads caused by moisture and contamination
 - Unsuitable viewing position and viewing window
 - Dirty light receiving face of the flame detector
 - Improper flame detector

Step 10.

Observation of sequencing operation

Observe the operation of the main fuel valve when the flame relay is excited. If the main fuel valve does not open, check the voltage at the terminals 2-5.

- (1) When the normal voltage is obtained, check the main fuel valve and valve circuit.
- (2) If the normal voltage is not obtained, replace the RA890G.

Step 11.

Check if sparks are cut off when the flame relay is excited, if the ignition transformer is connected to the terminal 4. Check if the wiring is proper. If sparks remain, replace the RA890G.

● **Other problems**

- Relay chattering

The relay 1K (load) chattering may result from the extreme low power supply voltage (check the power supply voltage) or from a loose terminal connection (retighten).

The relay 2K (flame) chattering may result from improper combustion (adjust the burner) or soot or carbon on the viewing part of the flame detector (clean).

- Loose terminal screw

If faulty operation has occurred, check if there is a loose terminal screw.

Chapter 6. SPECIFICATIONS

■ Specifications

Item	Specifications	
Model number	RA890G117_2	RA890G1278_2
Rated voltage	100 Vac	208 Vac
Allowable voltage	85 to 110 % of rated voltage	
Rated frequency	50/60 Hz	
Power consumption	10.5 W (18 VA) max. for 50 Hz 9.5 W (14 VA) max. for 60 Hz	
Target combustion equipment	700 kW or less in combustion rate	
Lockout time	Approx. 15 s	
Flame response period	3±1 s (at flame current of 2 µA)	
Operating point	1.2 µA max. for light-up 0.5 µA min. for flame-out	
Recommended flame current	1.5 µA	
Operation against flame failure	Recycle	
Self check time at startup	Approx. 3 at the rated voltage and in normal temperature	
Allowable operating temperature	-20 to +55 °C	
Allowable operating humidity	90 % RH at 40 °C (without condensation)	
Allowable vibration	4.9 m/s ² max. 55 Hz max.	
Dielectric strength	1500 Vac for 1 min. between terminals 2, 3, 4, 5 and case	
Life	100,000 cycle of relay contact	
Cover painting color	Gray enamel paint (Munsell scale 0.5PB 4.2/0.2)	
Mass	1.22 kg	
Applicable flame detector	AUD100 Series advanced ultraviolet flame detector Minipeeper ultraviolet flame detector C7027A*, C7035A*	
Subbase (sold separately)	Q270A1024	
Optional parts (sold separately)	Flame simulator: FSP300C100 Analog flame meter: FSP136A100	

* Discontinuation date: Dec. 2011.

● Contact ratings

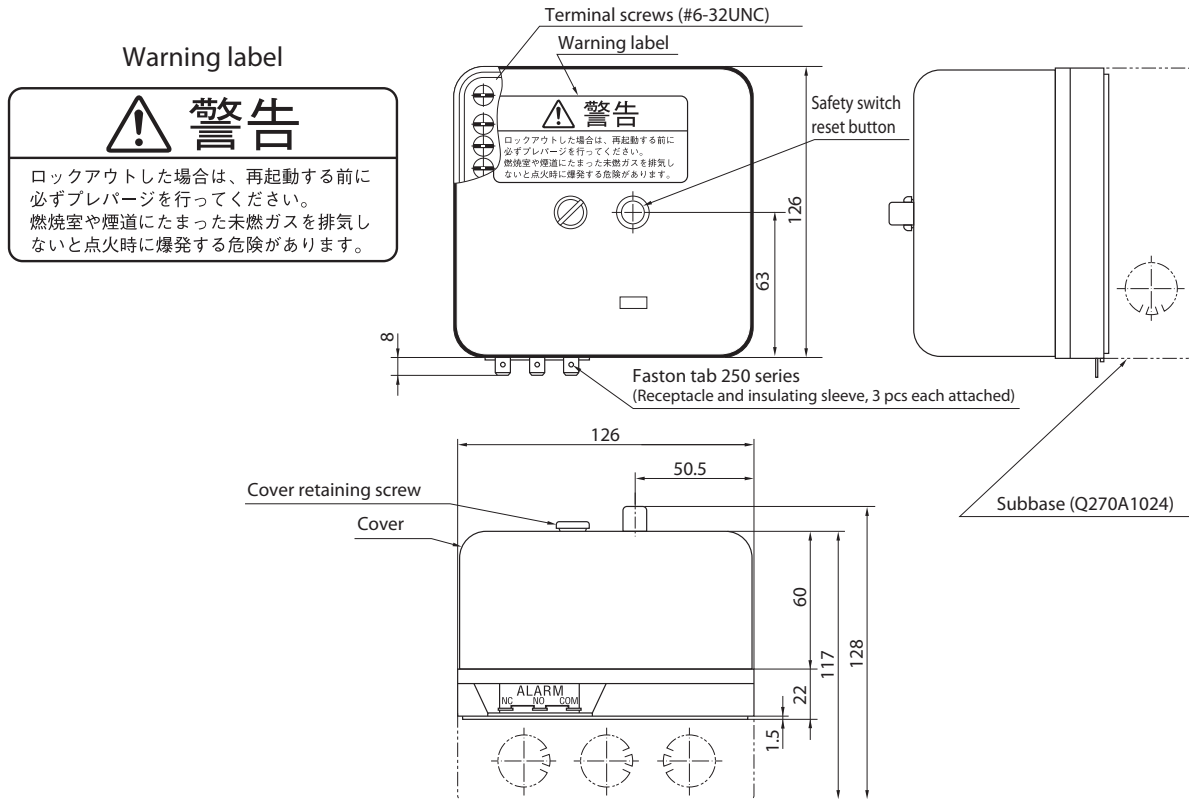
Terminal	Load	Contact rating
3 (note)	Pilot valve/Primary fuel oil valve	200 VA
4	Ignition transformer	300 VA
5	Main valve/Secondary oil fuel valve	200 VA
NC, NO, COM	Alarm	75 VA
T1, T2	Control circuit	0.17 A

For reference: If a burner motor and pilot valve are connected to terminal 3

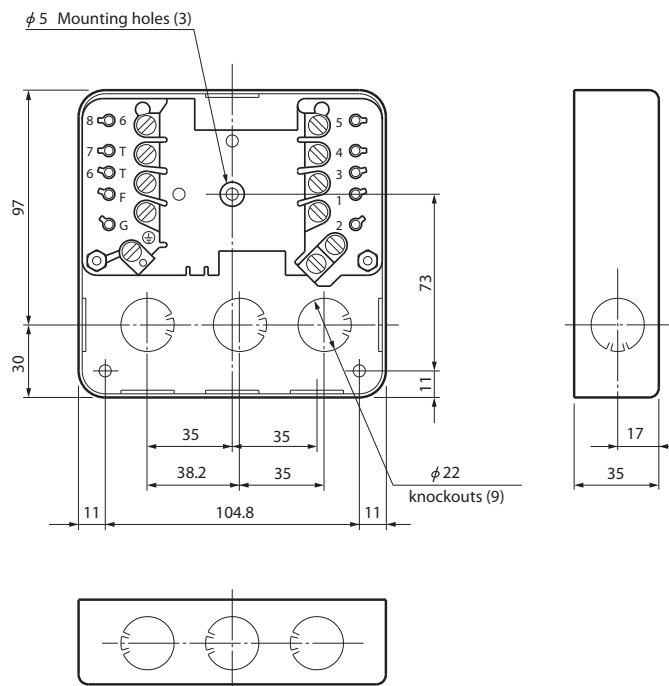
Terminal	Load		Contact rating	
			100 Vac	200 Vac
3	Burner motor	Normal	5.2 A	2.6 A
		Start	31.2A	15.6 A
	Pilot valve			25 VA

External dimensions

Main device



Q270A102A sub base (sold separately)



Revision History of CP-UM-1218E

Printed	Edn.	Revised pages	Description
Mar. 1984	1		
Nov. 2008	11		Overall revision. 11th ed = 16th Jp ed.
Nov. 2011	12		Overall revision due to discontinuation of 123514B flame simulator and introduction of AUD100 series advanced ultraviolet flame detector
Apr. 2012	13		Company name changed.
Apr. 2013	14		Overall revision. 14th ed = 21th Jp ed.

Terms and Conditions

We would like to express our appreciation for your purchase and use of Azbil Corporation's products. You are required to acknowledge and agree upon the following terms and conditions for your purchase of Azbil Corporation's products (field instruments, control valves, and control products), unless otherwise stated in any separate document, including, without limitation, estimation sheets, written agreements, catalogs, specifications and instruction manuals.

1. Warranty period and warranty scope

1.1 Warranty period

Azbil Corporation's products shall be warranted for one (1) year from the date of your purchase of the said products or the delivery of the said products to a place designated by you.

1.2 Warranty scope

In the event that Azbil Corporation's products has any failure attributable to azbil during the aforementioned warranty period, azbil shall, without charge, deliver a replacement for the said product to the place where you purchased, or repair the said product and deliver it to the aforementioned place.

Notwithstanding the foregoing, any failure falling under one of the following shall not be covered under this warranty:

- (1) Failure caused by your improper use of Azbil Corporation's products (noncompliance with conditions, environment of use, precautions, etc. set forth in catalogs, specifications, instruction manuals, etc.);
- (2) Failure caused for other reasons than Azbil Corporation's products;
- (3) Failure caused by any modification or repair made by any person other than azbil or azbil's subcontractors;
- (4) Failure caused by your use of Azbil Corporation's products in a manner not conforming to the intended usage of that product;
- (5) Failure that the state of the art at the time of Azbil Corporation's shipment did not allow us to predict; or
- (6) Failure that arose from any reason not attributable to Azbil Corporation, including, without limitation, acts of God, disasters, and actions taken by a third party.

Please note that the term "warranty" as used herein refers to equipment-only-warranty, and Azbil Corporation shall not be liable for any damages, including direct, indirect, special, incidental or consequential damages in connection with or arising out of Azbil Corporation's products.

2. Ascertainment of suitability

You are required to ascertain the suitability of Azbil Corporation's products in case of your use of the same with your machinery, equipment, etc. (hereinafter referred to as "Equipment") on your own responsibility, taking the following matters into consideration:

- (1) Regulations and standards or laws that your Equipment is to comply with.
- (2) Examples of application described in any documents provided by Azbil Corporation are for your reference purpose only, and you are required to check the functions and safety of your Equipment prior to your use.
- (3) Measures to be taken to secure the required level of the reliability and safety of your Equipment in your use. Although Azbil Corporation is constantly making efforts to improve the quality and reliability of Azbil Corporation's products, there exists a possibility that parts and machinery may break down.

You are required to provide your Equipment with fool-proof design, fail-safe design, anti-flame propagation design, safety design, or the like so that the said Equipment may satisfy the level of the reliability and safety required in your use, whereby preventing any occurrence of physical injuries, fires, significant damage, and so forth.

3. Precautions and restrictions on application

Azbil Corporation's products other than those explicitly specified as applicable (e.g. azbil limit switch for Nuclear Energy) shall not be used in a nuclear energy controlled area (radiation controlled area).

Any Azbil Corporation's products shall not be used for/with medical equipment.

In addition,

you are required to conduct a consultation with our sales representative and understand detail specifications, cautions for operation, and so forth by reference to catalogs, specifications, instruction manual, etc. in case that you intend to use Azbil Corporation's products for any purposes specified in (1) through (6) below.

Moreover, you are required to provide your Equipment with fool-proof design, fail-safe design, anti-flame propagation design and other designs of protection/safety circuit on your own responsibility to ensure the reliability and safety, whereby preventing problems caused by failure or nonconformity.

- (1) For use under such conditions or in such environments as not stated in technical documents, including catalogs, specification, and instruction manuals
- (2) For use of specific purposes, such as:
 - * Nuclear energy/radiation related facilities
[For use outside nuclear energy controlled areas] [For use of Azbil Corporation's limit switch for Nuclear Energy]
 - * Machinery or equipment for space/sea bottom
 - * Transportation equipment
[Railway, aircraft, vessels, vehicle equipment, etc.]
 - * Antidisaster/crime-prevention equipment
 - * Burning appliances
 - * Electrothermal equipment
 - * Amusement facilities
- (3) Supply systems such as electricity/gas/water supply systems, large-scale communication systems, and traffic/air traffic control systems requiring high reliability
- (4) Facilities that are to comply with regulations of governmental/public agencies or specific industries
- (5) Machinery or equipment that may affect human lives, human bodies or properties
- (6) Other machinery or equipment equivalent to those set forth in items (1) to (5) above which require high reliability and safety

4. Precautions against long-term use

Use of Azbil Corporation's products, including switches, which contain electronic components, over a prolonged period may degrade insulation or increase contact-resistance and may result in heat generation or any other similar problem causing such product or switch to develop safety hazards such as smoking, ignition, and electrification. Although acceleration of the above situation varies depending on the conditions or environment of use of the products, you are required not to use any Azbil Corporation's products for a period exceeding ten (10) years unless otherwise stated in specifications or instruction manuals.

5. Recommendation for renewal

Mechanical components, such as relays and switches, used for Azbil Corporation's products will reach the end of their life due to wear by repetitious open/close operations. In addition, electronic components such as electrolytic capacitors will reach the end of their life due to aged deterioration based on the conditions or environment in which such electronic components are used. Although acceleration of the above situation varies depending on the conditions or environment of use, the number of open/close operations of relays, etc. as prescribed in specifications or instruction manuals, or depending on the design margin of your machine or equipment, you are required to renew any Azbil Corporation's products every 5 to 10 years unless otherwise specified in specifications or instruction manuals. Field instruments (sensors such as pressure/flow/level sensors, regulating valves, etc.) will reach the end of their life due to aged deterioration of parts. For those parts that will reach the end of their life due to aged deterioration, recommended replacement cycles are prescribed. You are required to replace parts based on such recommended replacement cycles.

6. Other precautions

Prior to your use of Azbil Corporation's products, you are required to understand and comply with specifications (e.g., conditions and environment of use), precautions, warnings/cautions/notices as set forth in the technical documents prepared for individual Azbil Corporation's products, such as catalogs, specifications, and instruction manuals to ensure the quality, reliability, and safety of those products.

7. Changes to specifications

Please note that the descriptions contained in any documents provided by Azbil Corporation are subject to change without notice for improvement or for any other reason. For inquires or information on specifications as you may need to check, please contact our branch offices or sales offices, or your local sales agents.

8. Discontinuance of the supply of products/parts

Please note that the production of any Azbil Corporation's products may be discontinued without notice. For repairable products, we will, in principle, undertake repairs for five (5) years after the discontinuance of those products. In some cases, however, we cannot undertake such repairs for reasons, such as the absence of repair parts. For field instruments, we may not be able to undertake parts replacement for similar reasons.



Specifications are subject to change without notice. (09)

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