Every time the DISP switch is pressed, the display is changed between the sequence code and flame voltage alternately.

• Sequence codes

Code	Description
P1	Start check
P3	Ignition standby
P4	Lockout timing
P5	Main burner combustion standby
P8	RUN
--	Controlled shutdown

● When an error occurs

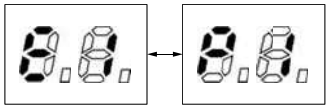
The 7-segment display shows an alarm code and the sequence code for which the alarm was issued alternately.

Every time the DISP switch is pressed, the display is changed between an alarm code and the sequence code for which the alarm was issued alternately as well as the flame voltage.

• Alarm codes

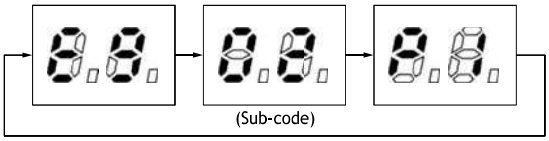
Alarm codes	Sub-code	Description
E1	None	False flame
E6		Ignition failure
E7		Flame failure
E9	02	Switch input
E9	03	Internal relay feedback (K1)
E9	05	Abnormal voltage on terminal 7 (PV)
E9	06	Abnormal voltage on terminal 8 (MV)
E9	07	Abnormal voltage on terminal 6 (IG)
E9	08	Alarm at power ON
E9	50 or more	Device error

Examples of sequence codes and alarm codes (Alarm code: When there is not a sub-code)



Switches every 0.8 s

Examples of sequence codes and alarm codes (Alarm code: When there is a sub-code)



Switches every 0.8 s

Chapter 4. Explanation of Operation

CAUTION

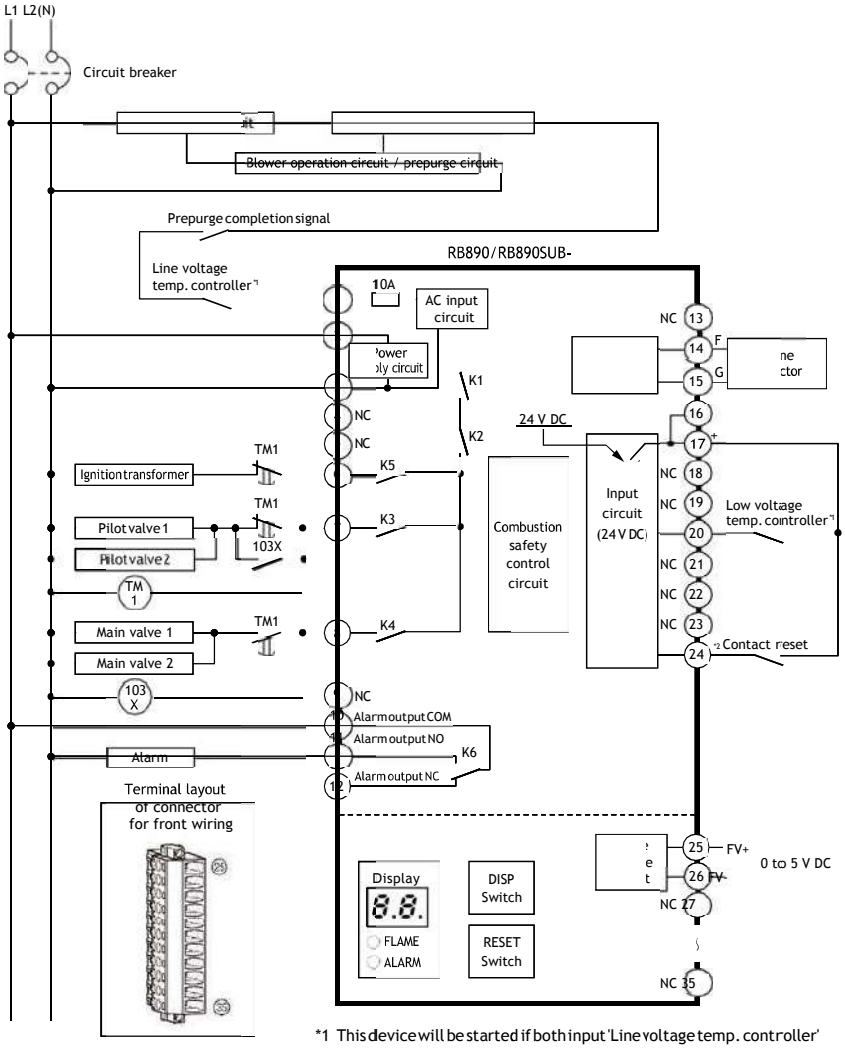
This device does not start operation until about 8 seconds after power-on.

The AC and DC input circuits use approximately 1 second for checking after the input signal turns ON.

■ Example of wiring connection with external device: Internal block diagram

● When the RB890 SUB-BASE sub-base is used (terminals 1–24 are on sub-base, 25–35 on front connector)

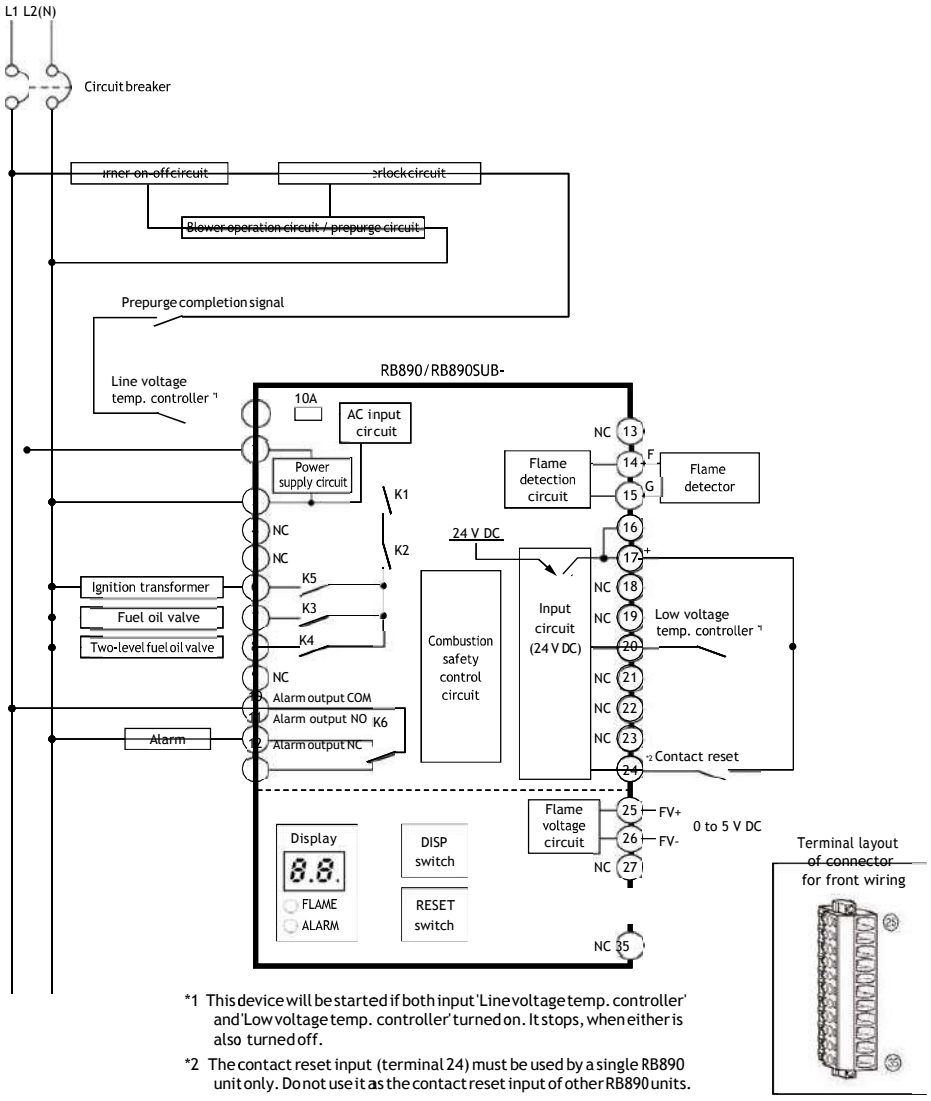
● Non-recycling gas-fired combustion



*1 This device will be started if both input 'Line voltage temp. controller' and 'Low voltage temp. controller' turned on. It stops, when either is also turned off.

*2 The contact reset input (terminal 24) must be used by a single RB890 unit only. Do not use it as the contact reset input of other RB890 units.

● Non-recycling oil-fired combustion (2-level combustion)

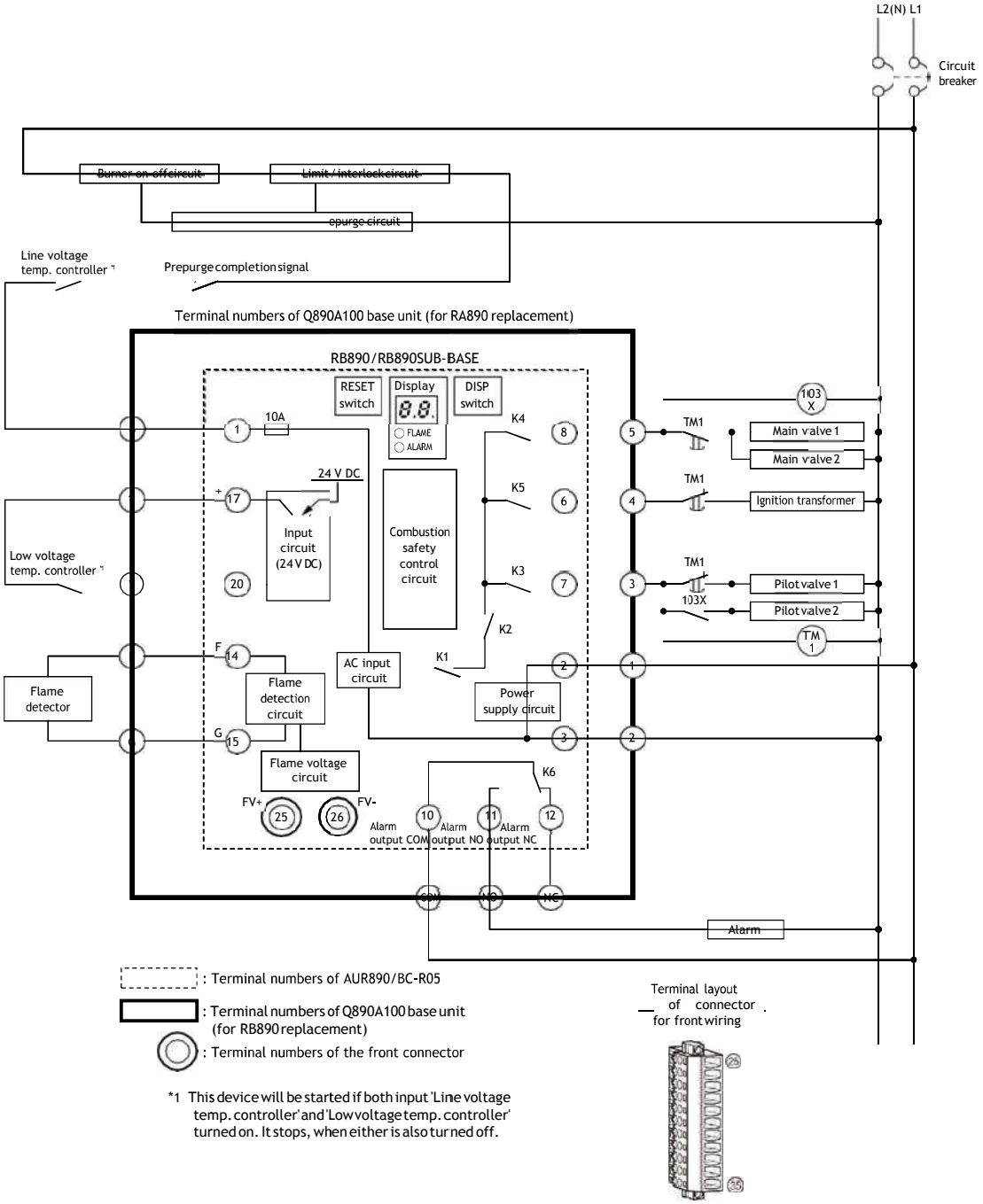


*1 This device will be started if both input 'Line voltage temp. controller' and 'Low voltage temp. controller' turned on. It stops, when either is also turned off.

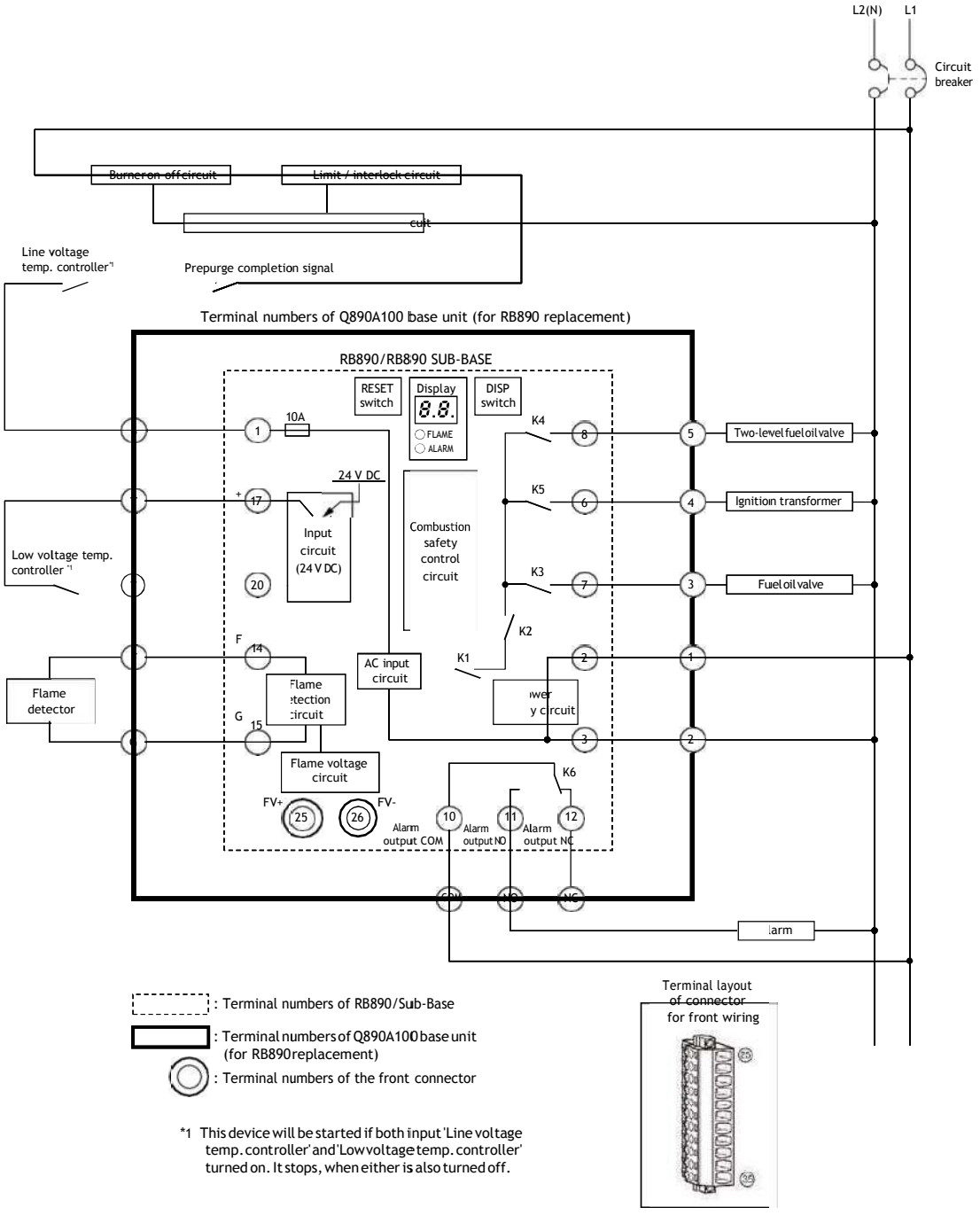
*2 The contact reset input (terminal 24) must be used by a single RB890 unit only. Do not use it as the contact reset input of other RB890 units.

● Q890A100 base unit for RB890-RB890 replacement

● Non-recycling gas-fired combustion

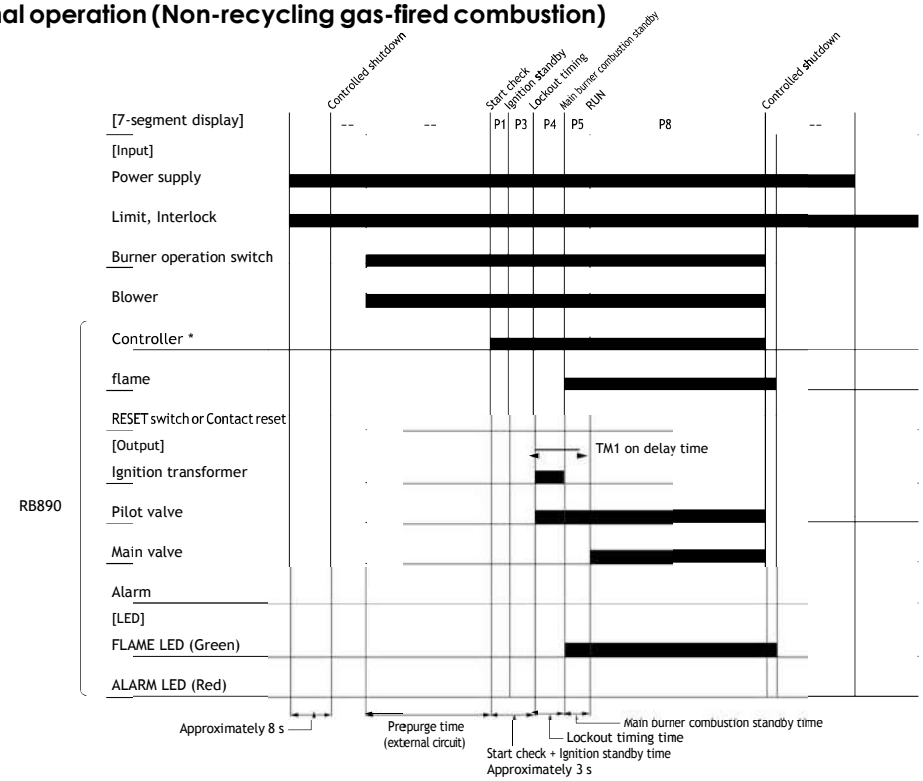


● Non-recycling oil-fired combustion (2-level combustion)



■ Example sequence

● Normal operation (Non-recycling gas-fired combustion)



Input	RB890 operation	Sequence codes	Operation of external devices
Power ON	When approximately 8 seconds have passed after the power has been turned on, the 7-segment LED display on the front panel of the RB890 shows the sequence code [- -].	- -	
Burner operation switch ON		- -	When the burner operation switch is turned on, the blower starts to operate, and if the limit and interlock conditions are normal, a prepurge is done. After the prepurge, the prepurge completion signal is turned ON. Blower: operating
Controller ON	If the prepurge completion signal is ON and the controller is ON, the internal circuits are checked during the start check.	P1	
	Afterward a false flame check is conducted during the ignition wait time.	P3	
	If the status is normal, the lockout time begins, relays K1, K2, K3 and K5 turn ON, the ignition transformer starts, the pilot valve begins to open, and external timer TM1 turns ON.	P4	Ignition transformer : start Pilot valve : open (TM1 starts)
	When the flame detector detects the pilot burner flame, relay K5 turns OFF to stop the ignition transformer.	P5	Ignition transformer : continues operation Pilot valve : remains open
	Relay K4 and external relay 103X turn ON. When the time set for timer TM1 has passed and TM1's contacts have turned ON, the main valve opens to begin normal combustion. The FLAME LED (green) on the front panel of the RB890 lights up.	P8	Ignition transformer : stop Main valve : open (103X : ON) (TM1's contacts : ON)
Burner operation switch OFF	When the burner operation switch is turned OFF, relays K1, K2, K3 and K4 turn off, and the pilot and main valves begin to close. The FLAME LED (green) on the front panel of the RB890 turns off.	- -	Fuel oil combustion valve : closed Main valve : closed Blower : stop
Power OFF	When the power is turned OFF, the 7-segment LED display on the front panel of the RB890 stops showing the sequence code [- -].		

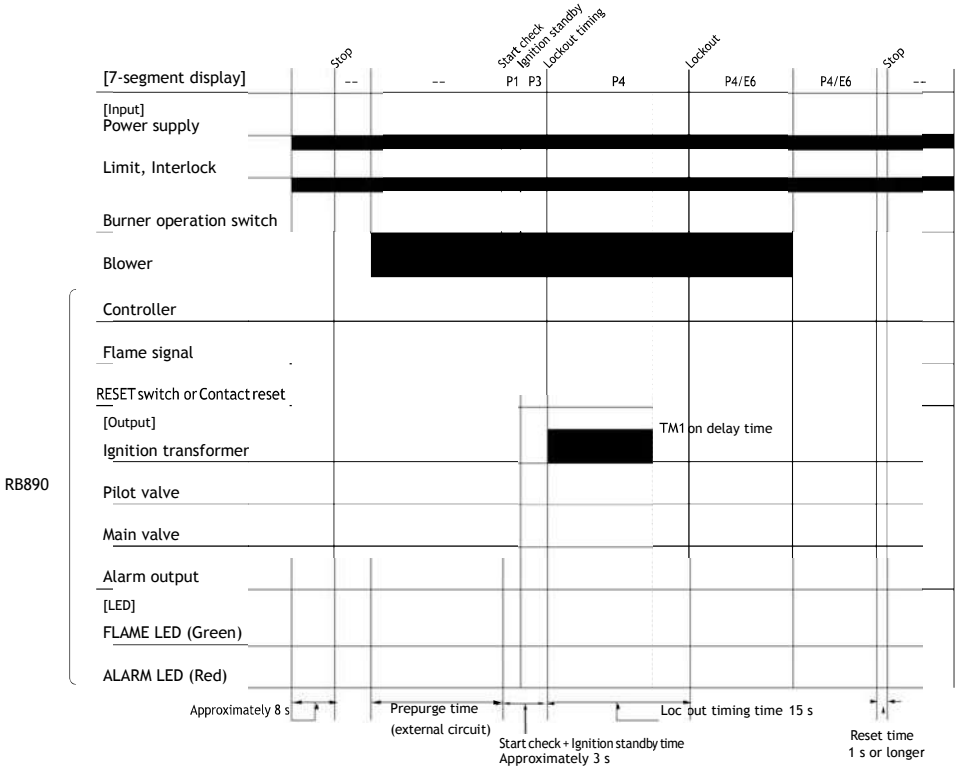
Note: The RB890 turns the main valve ON after the standby process for normal combustion. This feature does not allow the main valve to be turned on immediately after ignition in order to prevent the flame from being blown out. During the standby process for normal combustion, if the time set for external timer TM1 has passed and the contacts are reversed, the supply of power to the pilot valve and main valve may be interrupted for a moment.
Whenever a flame is detected just before completion of the time set for external timer TM1, ignition is delayed. Adjust the burner so that it ignites reliably at least one second before the time set for external timer TM1 passes.

* This device will be started if both input "External Controller(for power supply)" and "External Controller (for low voltage)" turned on. It stops, when either is also turned off. This explanation for Controller is the same also in subsequent pages.

⚠ WARNING

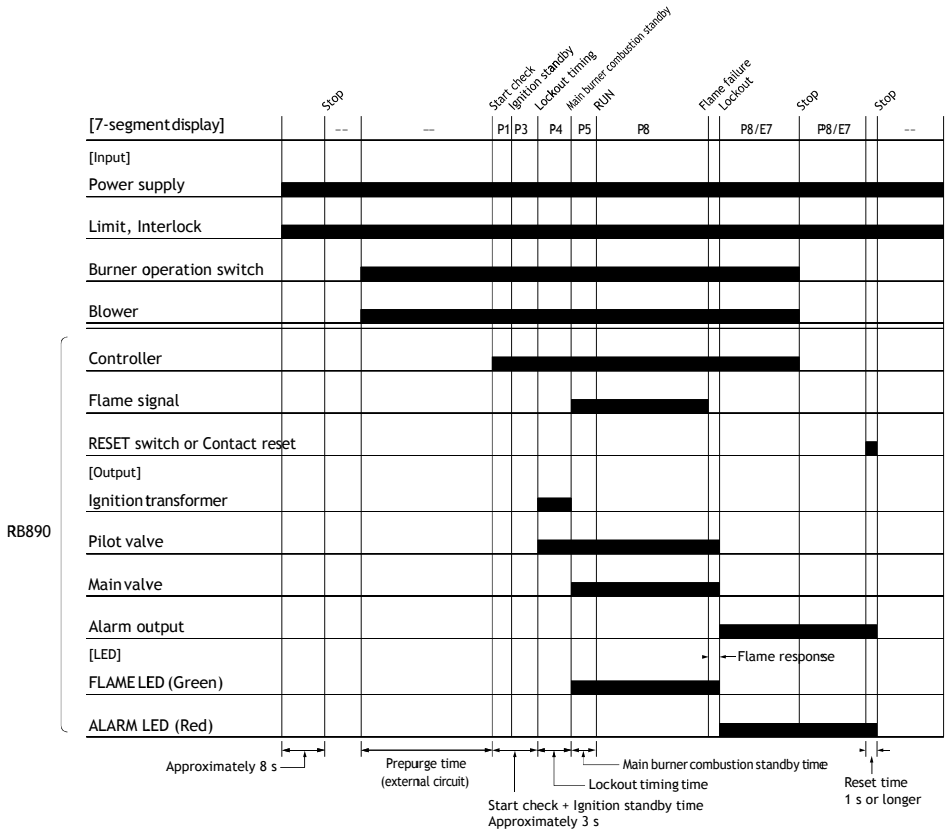
Be sure to do a prepurge before restarting the system when lockout occurs. If the combustion chamber and gas flue are not ventilated to remove any unburned gas, the ignition process may cause an explosion.

● Operation when an ignition failure occurs (Non-recycling gas-fired combustion)



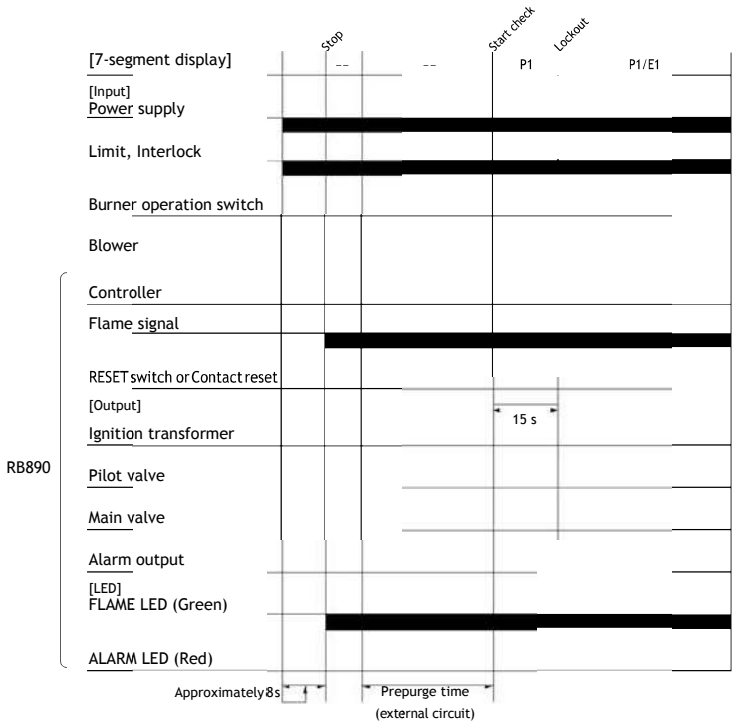
Input	RB890 operation	Sequence codes	Operation of external devices
Power ON	When approximately 8 seconds have passed after the power has been turned on, the 7-segment LED display on the front panel of the RB890 shows the sequence code [- -].	- -	
Burner operation switch ON		- -	When the burner operation switch is turned on, the blower starts to operate, and if the limit and interlock conditions are normal, a prepurge is done. After the prepurge, the prepurge completion signal is turned ON. Blower: operating
Controller ON	If the prepurge completion signal is ON and the controller is ON, the internal circuits are checked during the start check.	P 1	
	Afterward a false flame check is conducted during the ignition wait time.	P 3	
	If the status is normal, the lockout time begins, relays K1, K2, K3 and K5 turn ON, the ignition transformer starts, the pilot valve begins to open, and external timer TM1 turns ON.	P 4	Ignition transformer : start Pilot valve : open (TM1 starts)
	When the time set for TM1 has passed after the start of ignition transformer operation, TM1's contacts turn off, the ignition transformer ceases operation, and the pilot valve opens.	P 4	Ignition transformer : stop Pilot valve : closed Alarm output : OFF (TM1's contacts : OFF)
	If the flame detector does not detect a flame within the lockout time, relays K1, K2, K3 and K5 turn OFF, relay K6 turns ON, and the alarm output turns ON. The ALARM LED (red) on the front panel of the RB890 lights up.	P 4/E6	Ignition transformer : stop Pilot valve : closed Alarm output : ON (TM1 stop)
Burner operation switch OFF		P 4/E6	Blower : stop
Contact reset or main unit reset switch: ON	Relay K6 turns OFF to turn OFF the alarm output. The ALARM LED (red) on the front panel of the RB890 turns off.	- -	Alarm output : OFF

● Operation when a flame failure occurs (Non-recycling gas-fired combustion)



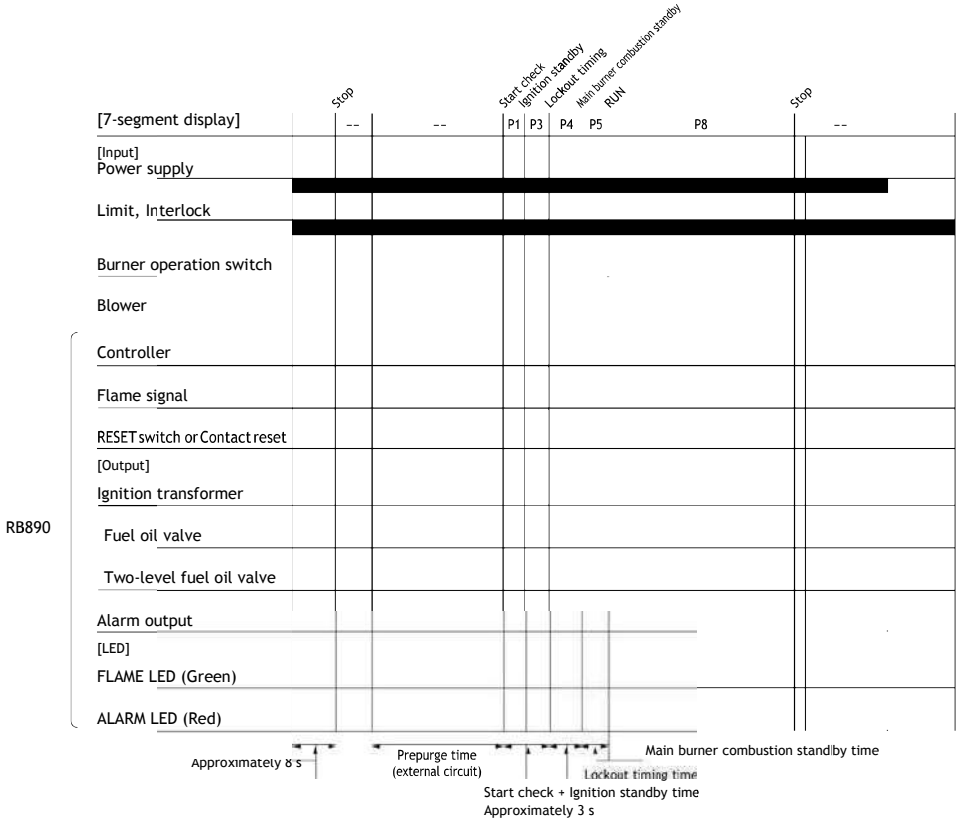
Input	RB890 operation	Sequence codes	Operation of external devices
Power ON	When approximately 8 seconds have passed after the power has been turned on, the 7-segment LED display on the front panel of the RB890 shows the sequence code [- -].	- -	
Burner operation switch ON		- -	When the burner operation switch is turned on, the blower starts to operate, and if the limit and interlock conditions are normal, a prepurge is done. After the prepurge, the prepurge completion signal is turned ON. Blower: operating
Controller ON	If the prepurge completion signal is ON and the controller turns ON, the sequence that follows is start check, ignition standby, lockout time, standby for normal combustion, and normal combustion. The FLAME LED (green) on the front panel of the RB890 lights up.	P8	Pilot valve : open Main valve : open
	During main burner combustion, if a flame failure of the burner occurs for some reason, after the flame failure response time has passed, the RB890 will be locked out so that relays K1, K2, K3, and K4 turn OFF, the pilot and main valves close, relay K6 turns ON, and the alarm output turns ON. FLAME LED (green) on the front panel of the RB890 turns off, and ALARM LED (red) turns on.	P8 /E7	Pilot valve : closed Main valve : closed Alarm output : ON
Burner operation switch OFF		P8 /E7	Blower : stop
Contact reset or main unit reset switch: ON	Relay K6 turns OFF to turn OFF the alarm output. The ALARM LED (red) on the front panel of the RB890 turns off.	- -	Alarm output : OFF

● Operation when there is a false flame before start input (Non-recycling gas-fired combustion)



Input	RB890 operation	Sequence codes	Operation of external devices
Power ON	When approximately 8 seconds have passed after the power has been turned on, the 7-segment LED display on the front panel of the RB890 shows the sequence code [- -]. Because there was a false flame signal, the FLAME LED (green) on the front panel of the RB890 lights up.	- -	
Burner operation switch ON		- -	When the burner operation switch is turned on, the blower starts to operate, and if the limit and interlock conditions are normal, a prepurge is done. After the prepurge, the prepurge completion signal is turned ON. Blower: operating
Controller ON	If there is a false flame signal before the controller turns ON, after the prepurge completion signal and then the external controller turn ON, a false flame check is executed during the start check.	P 1	
	If a false flame signal lasts for 15 seconds or longer, the RB890 will be locked out, and relay K6 and the alarm output turn ON. Also, the ALARM LED (red) on the front panel of the RB890 lights up.	P 1 / E1	Alarm output : ON

● Normal operation (Non-recycling oil-fired combustion (2-level combustion))

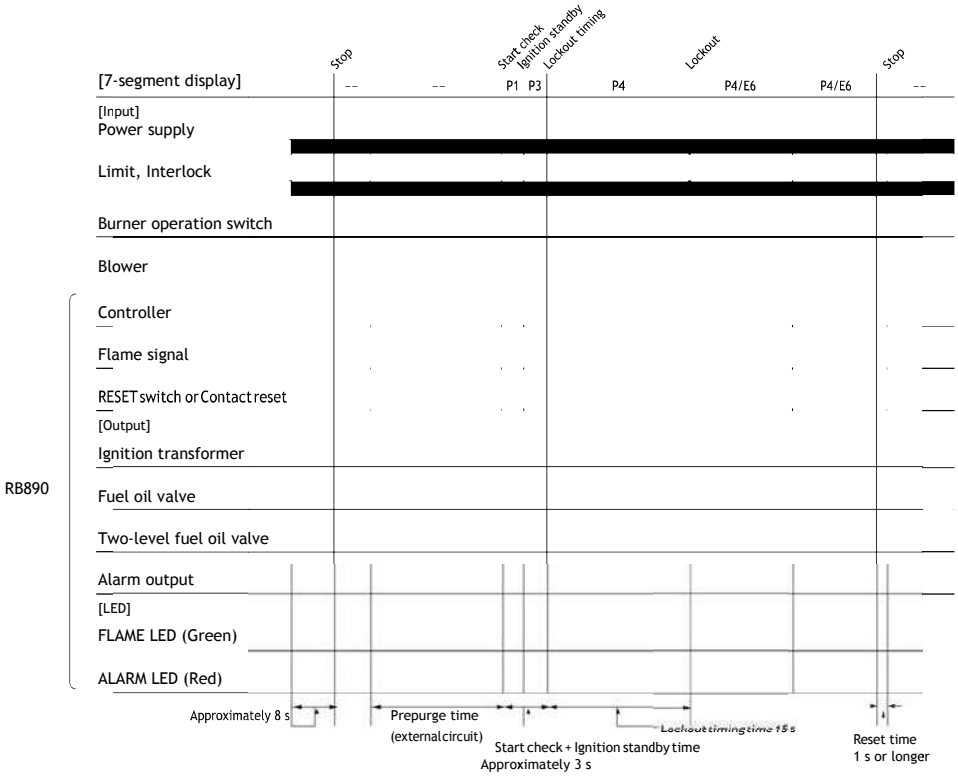


Input	RB890 operation	Sequence codes	Operation of external devices
Power ON	When approximately 8 seconds have passed after the power has been turned on, the 7-segment LED display on the front panel of the RB890 shows the sequence code [- -].	- -	
Burner operation switch ON		- -	When the burner operation switch is turned on, the blower starts to operate, and if the limit and interlock conditions are normal, a prepurge is done. After the prepurge, the prepurge completion signal is turned ON. Blower: operating
Controller ON	If the prepurge completion signal is ON and the controller is ON, the internal circuits are checked during the start check.	P1	
	Afterward a false flame check is conducted during the ignition wait time.	P3	
	If the status is normal, the safety lockout time begins, relays K1, K2, K3 and K5 turn ON, the ignition transformer starts, and the fuel oil valve opens.	P4	Ignition transformer : start Fuel oil valve : open
	After the lockout time has passed, if a flame signal is detected, the ignition transformer output is maintained until the standby time for normal combustion has passed.	P5	Ignition transformer : continues operation Fuel oil valve : remains open
	When the flame detector detects the flame from the fuel oil valve fuel, relay K5 turns OFF, the ignition transformer stops, relay K4 turns ON, the two-level fuel oil valve opens, and normal combustion begins. The FLAME LED (green) on the front panel of the RB890 lights up.	P8	Ignition transformer : stop Two-level fuel oil valve : open
Burner operation switch OFF	When the burner operation switch is turned OFF, relays K1, K2, K3 and K4 turn OFF, and the fuel oil valve and two-level fuel oil valve close. The FLAME LED (green) on the front panel of the RB890 turns off.	- -	Fuel oil valve : closed Two-level fuel oil valve : closed Blower : stop
Power OFF	When the power is turned OFF, the 7-segment LED display on the front panel of the RB890 stops showing the sequence code [- -].		

⚠ WARNING

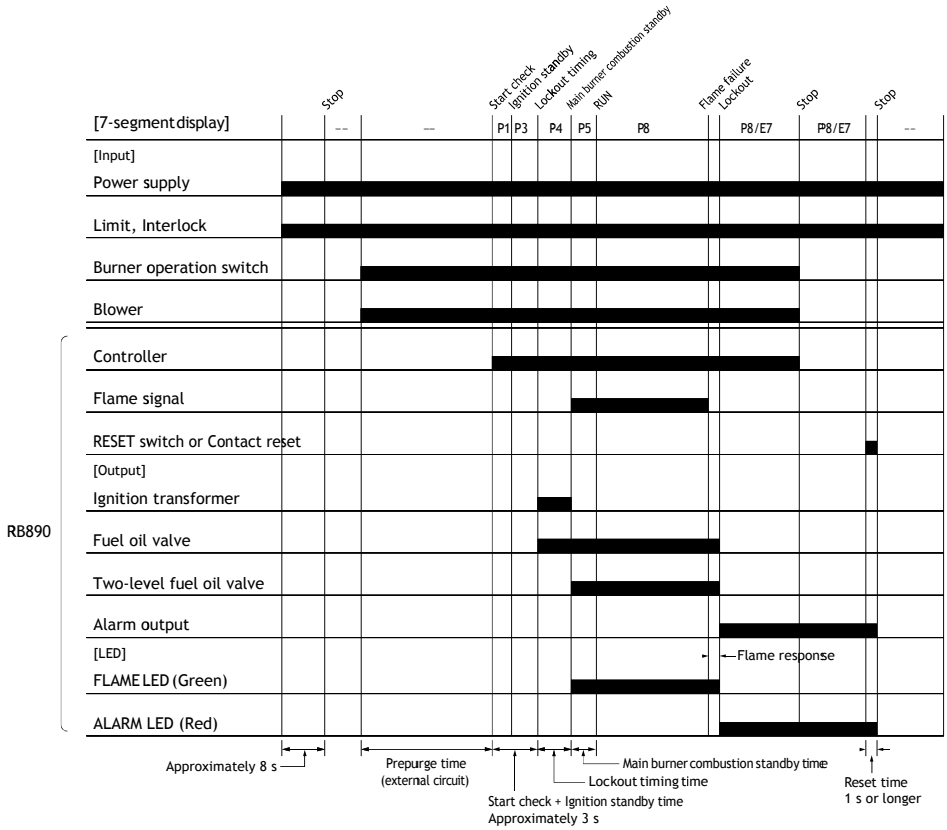
Be sure to do a prepurge before restarting the system when lockout occurs. If the combustion chamber and gas flue are not ventilated to remove any unburned gas, the ignition process may cause an explosion.

● **Operation when an ignition failure occurs (Non-recycling oil-fired combustion (2-level combustion))**



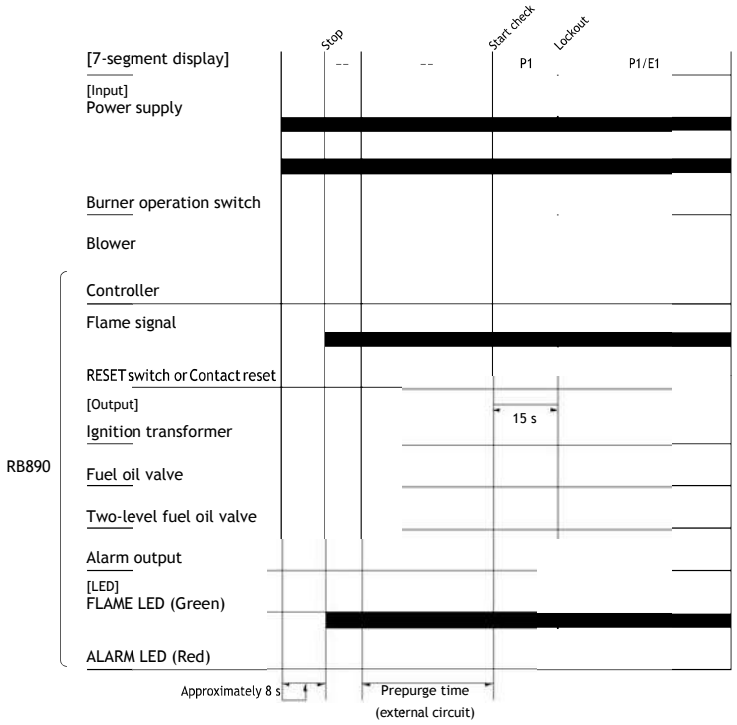
Input	RB890 operation	Sequence codes	Operation of external devices
Power ON	When approximately 8 seconds have passed after the power has been turned on, the 7-segment LED display on the front panel of the RB890 shows the sequence code [- -].	- -	
Burner operation switch ON		- -	When the burner operation switch is turned on, the blower starts to operate, and if the limit and interlock conditions are normal, a prepurge is done. After the prepurge, the prepurge completion signal is turned ON. Blower: operating
Controller ON	If the prepurge completion signal is ON and the controller is ON, the internal circuits are checked during the start check.	P 1	
	Afterward a false flame check is conducted during the ignition wait time.	P 3	
	If the status is normal, the lockout time begins, relays K1, K2, K3 and K5 turn ON, the ignition transformer starts, the pilot valve begins to open, and external timer TM1 turns ON.	P 4	Ignition transformer : start Fuel oil valve : open
	If the flame detector does not detect a flame within the 15 seconds of lockout time, the RB890 will be locked out so that relays K1, K2, K3, and K5 turn OFF, the ignition transformer stops operation, the fuel oil valve closes, relay K6 turns ON, and the alarm output turns ON. ALARM LED (red) on the front panel of the RB890 turns on.	P 4/E6	Ignition transformer : stop Fuel oil valve : closed Alarm output : ON
Burner operation switch OFF		P 4/E6	Blower : stop
Contact reset or main unit reset switch: ON	Relay K6 turns OFF to turn OFF the alarm output. The ALARM LED (red) on the front panel of the RB890 turns off.	- -	Alarm output : OFF

● Operation when a flame failure occurs (Non-recycling oil-fired combustion (2-level combustion))



Input	RB890 operation	Sequence codes	Operation of external devices
Power ON	When approximately 8 seconds have passed after the power has been turned on, the 7-segment LED display on the front panel of the RB890 shows the sequence code [- -].	- -	
Burner operation switch ON		- -	When the burner operation switch is turned on, the blower starts to operate, and if the limit and interlock conditions are normal, a prepurge is done. After the prepurge, the prepurge completion signal is turned ON. Blower: operating
Controller ON	If the prepurge completion signal is ON and the controller turns ON, the sequence that follows is start check, ignition standby, lockout time, standby for normal combustion, and normal combustion. The FLAME LED (green) on the front panel of the RB890 lights up.	P8	Fuel oil valve : open Two-level fuel oil valve : open
	During normal combustion, if a flame failure of the burner occurs for some reason, after the flame failure response time has passed, the RB890 will be locked out. At that time relays K1, K2, K3 and K4 turn OFF, the fuel oil valve and two-level fuel oil valve close, relay K6 turns ON, and the alarm output turns ON. The FLAME LED (green) on the front panel of the RB890 turns off, and the ALARM LED (red) lights up.	P8 /E7	Fuel oil valve : closed Two-level fuel oil valve : closed Alarm output : ON
Burner operation switch OFF		P8 /E7	Blower : stop
Contact reset or main unit reset switch: ON	Relay K6 turns OFF to turn OFF the alarm output. The ALARM LED (red) on the front panel of the RB890 turns off.	- -	Alarm output : OFF

● Operation when there is a false flame before start input (Non-recycling oil-fired combustion (2-level combustion))



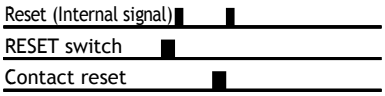
Input	RB890 operation	Sequence codes	Operation of external devices
Power ON	When approximately 8 seconds have passed after the power has been turned on, the 7-segment LED display on the front panel of the RB890 shows the sequence code [- -]. Because there was a false flame signal, the FLAME LED (green) on the front panel of the RB890 lights up.	- -	
Burner operation switch ON		- -	When the burner operation switch is turned on, the blower starts to operate, and if the limit and interlock conditions are normal, a prepurge is done. After the prepurge, the prepurge completion signal is turned ON. Blower: operating
Controller ON	If there is a false flame signal before the controller turns ON, after the prepurge completion signal and then the controller turn ON, a false flame check is executed during the start check.	P 1	
	If a false flame signal lasts for 15 seconds or longer, the RB890 will be locked out, and relay K6 and the alarm output turn ON. Also, the ALARM LED (red) on the front panel of the RB890 lights up.	P 1 E1	Alarm output : ON

■ Relation of START signal, External controllers (power supply and low voltage)

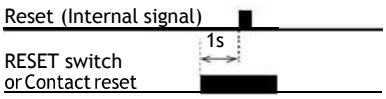
START signal = External controller (power supply Terminal ①) ∩ External controller (low voltage Terminal ⑳)

■ Relation of Reset signal, RESET switch and Contact reset

Reset signal = (Contact reset) ∪ (RESET switch)



Reset signal is generated when Reset switch (or Contact reset) is turned on and held for 1second.



Chapter 5. Trial Operation and Adjustment

⚠ WARNING

The ignition time for the pilot and main burners should not exceed the time defined by the burner or device manufacturer.

If it does, fuel will accumulate in the combustion chamber and form an explosive mixture, resulting in a very dangerous situation in which an explosion could occur.

Do not touch terminal 14 (F) after turning the power off. An electric charge may remain in the terminal 14 (F) and may cause an electric shock.

Do not operate this device without first completing adjustment, testing, and the combustion equipment manufacturer's tests.

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

⚠ WARNING

Installation, wiring, maintenance, inspection, and adjustment must be carried out by a professional with technical training in combustion equipment and combustion safety equipment.

The pilot turn-down test should be carried out only by an experienced specialist possessing knowledge and skills pertaining to combustion equipment and combustion safety.

■ Preliminary inspection

- The temperature and humidity are within the ranges specified for operating conditions.
- There are no errors in wiring and terminal screws are not loose.
- The flame detector is installed correctly. (For the installation location, orientation, and other details, see the user's manual for the flame detector.)
- The burner is adjusted correctly.
- There are no obstructions, covers, or other items in the combustion air intake or exhaust outlet.
- The power supply voltage and frequency are the same as those shown on the device.

■ Inspection procedure

For safe operation of the combustion equipment, inspect the following items carefully and make appropriate adjustments.

■ Ignition spark response (ultraviolet sensor)

⚠WARNING

Ensure that the ultraviolet sensor does not detect ultraviolet rays other than those from the burner.

If the sensor detects other ultraviolet rays, it will continue to send flame detection signals even if the burner flame goes out. Consequently, fuel will continue to be supplied, potentially resulting in an explosion.

Before doing the spark response test, make sure that all manual fuel valves are closed.

(1) Close the manual valves in the piping for the pilot and main burners.

(2) Begin operation and measure the flame voltage during the ignition trail sequence to check for any effect from the ignition spark.

(3) If the spark has an effect, such as causing the FLAME LED to light up, make adjustments using the following methods.

- Move the ultraviolet sensor or the ignition spark rod so that the spark does not affect the flame voltage.
- Attach a shield that prevents the spark's ultraviolet radiation from entering the optical path of the ultraviolet sensor. Adjust so that the spark's effect on the flame signal is 0.4 V DC or less.
- If the S7200A_ _ _GH_ or S720A_ _ _GH_ igniter is used, swap the polarity of the power to the igniter. When this device is used in combination with an igniter, changing the polarity of the power can prevent the ultraviolet sensor from detecting the spark.

Note: "_" represents a number.

Handling Precautions

- Ensure that the ultraviolet sensor does not detect ultraviolet rays other than those from the burner flame.

Sources of ultraviolet radiation (other than the burner flame) that can activate the ultraviolet sensor include the following.

Examples:

Ultraviolet ray sources	1371 °C or hotter red-hot furnace wall (within 50 cm from wall)
	Ignition transformer, welding arc spark
	Gas laser
	Sun lamp
	Germicidal lamp, ultraviolet lamp, fluorescent lamp
	Strong flashlight
Gamma ray and X-ray sources	X-ray analyzer, gamma ray analyzer/measurer
	Electron microscope
	X-ray machine
	High-voltage vacuum switch
	High-voltage capacitor
	Radioactive isotope
	Any other ultraviolet, gamma, or X-ray source

■ Measurement of flame voltage

This device shows the flame voltage on the 7-segment display. It can be checked by changing the display using the DISP switch on the front of the device.

Checking the flame voltage is the best way to determine whether or not the location of the flame detector is appropriate.

It should be checked during installation and servicing.

Checking it once per month or more can prevent shutdowns due to insufficient flame voltage.

Start the device and measure the voltage under various conditions, such as at startup and during normal operation.

Check to make sure that the flame voltage remains stable at 2.0 V DC or more. The recommended flame voltage is 2.0 V DC or more and it must be stable.

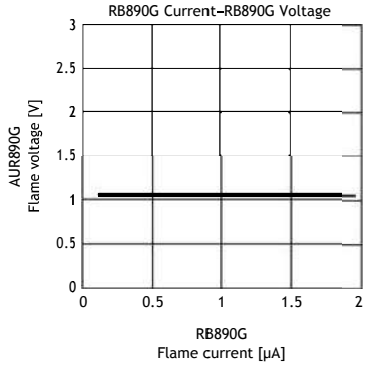
Note: If this stable voltage cannot be achieved, the problem may be caused by one or more of the following. In such a case, do a thorough inspection.

- The power supply voltage or frequency is not correct.
- The air supply pressure or air-fuel ratio is not correct.
- The flame detector is not correctly wired.
  - Open circuit
  - Short circuit
  - High-resistance short circuit of the lead wires due to the temperature or dirt
- Incorrect flame detector mounting angle (RB890G)
- Dirty flame detector sensing surface (RB890G).
- AUD15C tube unit deterioration (RB890G).
- Incorrect flame rod installation (RB890F).
  - Area in contact with flame is insufficient.
  - Position of flame rod in flame is incorrect.
  - The flame rod insulator is at a high temperature (315 °C).
  - Flame rod is affected by ignition transformer.

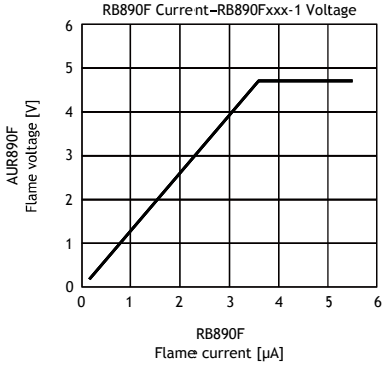
    If the ignition transformer is placed close to Terminal F of the flame rod, electrons in the flame are absorbed into the ignition transformer, and as a result, sufficient flame voltage cannot be achieved.

Correlation of flame output with that of older model

• RB890G (AUD100/110/120)



• RB890F (flame rod)

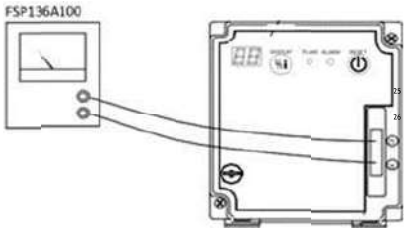


● Measurement method for flame voltage

The voltage can be checked on the 7-segment display or by connecting a flame meter to terminals 25 and 26 of the front connector.

Analog flame meter
FSP136A100

Flame voltage display



* Connector for front wiring (81447514-001/002) is required to connect FSP136A100 to RB890.

Handling Precautions

- For flame voltage output signal wires, use wire with indoor PVC insulation ("IV wire," JIS C3307) 0.75 mm^2. Wiring length cannot be more than 10 m.
- The input impedance of a measuring instrument used with this device must be 100 kΩ or more.

● Checking ignition time in a case where it is configured with an external timer

A flame failure can occur if an ignition attempt is made just before the ignition time expires.

This is because the supply of power to the pilot valve and main valve is interrupted for a moment if the time set for the external timer passes during the standby process for normal combustion and the external timer's contacts are reversed.

Whenever a flame is detected just before the ignition time has passed, ignition is delayed.

Adjust the burner so that it ignites reliably at least one second before the ignition time expires.

■ Pilot turn-down test

⚠ WARNING

- **Make sure that the pilot turn-down test is done properly.**
  If the flame detector is able to detect a pilot flame that is too small to ignite the main burner, and if there is a flame failure of the main burner, this device will not be able to recognize the flame failure.
  As a result, fuel will continue to be supplied, resulting in an explosion hazard.
- **Before doing the pilot turn-down test, always make sure that all manual fuel valves are closed.**
- **If the pilot turn-down test must be repeated, stop the combustion equipment completely each time and discharge all of the unburned gas and oil from the fuel chamber and flue. Failure to discharge unburned gas may result in an explosion hazard.**
- **After completing the pilot turn-down test, turn off the power switch to turn off the power supply. Make sure to return all test jumpers and limit or controller settings to their original values. Resuming normal operation without returning the settings to their original values, etc., may damage the equipment or cause a gas leak or explosion.**

⚠ CAUTION

- **The pilot turn-down test should be carried out only by an experienced specialist possessing knowledge and skills pertaining to combustion equipment and combustion safety.**

The purpose of this test is to determine the smallest possible pilot flame that will reliably ignite the main burner.

Before and after this test, make sure to measure the flame voltage and confirm that it is 2.0 V or more.

(1) Turn off the power to the combustion equipment to stop all devices.

(2) Close the main valve (by removing one side of the wiring to the main valve or by closing the manual cock) to cut off the gas to the main burner. Open the pilot valve to its normal position.

(3) Turn on the power switch. If the start input is on, the ignition sequence begins after the prepurge, as soon as the pilot valve is opened.

(4) After the pilot burner ignites, turn the pilot valve (manual cock) down until the burner controller extinguishes the flame. Mark the position of the manual cock at the time when the flame is extinguished. Then, press the reset switch to reset the error and restart the burner controller. Turn the manual cock back until just before the previously marked position (so that more gas is output).

(5) Turn off the power switch, return the main valve to the normal state (open the manual cock) and then turn on the power switch again. After the prepurge, pilot burner combustion begins, followed by main burner combustion.
If the main burner does not ignite, turn off the power switch immediately. In this case the pilot flame is too small, so it must be increased. After increasing the pilot flame, change the position of the flame detector so that its monitoring angle is slightly away from the pilot flame monitoring axis.

(6) Change the gas pressure from the minimum to the maximum and repeat steps (1) to (5) to check if the main burner ignites properly.

Handling Precautions

- If it is necessary to repeat the test, each time it is repeated be sure to stop all the equipment first to prevent an explosion and then discharge all unburned gas that has accumulated in the combustion chamber and exhaust flue.

■ Safety shutoff check

- Interlock check
  During burner combustion, simulate the operation of each type of interlock and check if this device is locked out or stops.
  Then, restart the burners and check for proper ignition.

- Ignition trail failure check
  Close the manual gas cock of the burners. Turn on the start input of the burners to begin operation. After the prepurge, pilot burner ignition is attempted. Since the manual cock is closed, however, the pilot burner does not ignite and lockout occurs.
  After confirming the above behavior, open the manual cock. Turn on the reset switch, restart the burner and check that they ignite properly.

- Flame failure check
  Close the manual gas cock while the burner is operating. After the flame failure response time elapses, the pilot valve and main valve close and lockout occurs.
  After confirming the above behavior, open the manual cock. Turn on the reset switch, to restart the burners and check that they ignite properly.

- Power loss (power failure) check
  Turn off the power switch during burner operation in order to stop combustion.
  After waiting for a while, turn on the power back on.
  Then, turn on the start input to restart the burners, and check that they ignite properly.

Chapter 6. Maintenance and Inspection

⚠ WARNING

Before mounting, removing, or wiring, be sure to turn off the power to this device and all connected devices. Failure to do so may result in an electric shock.

Do not touch terminal 14 (F) after turning the power off. An electric charge may remain in the terminal 14 (F) and may cause an electric shock.

⚠ CAUTION

- **Installation, wiring, maintenance, inspection, and adjustment must be carried out by a professional with technical training in combustion equipment and combustion safety equipment.**
- **If the combustion equipment is restarted as a result of a lockout, do all of the inspection steps described in chapter 5, "Trial Operation and Adjustment."**
- **When doing a maintenance inspection of the burner, be sure to do the pilot turn-down test. Inspection must be done at least once a year.**
- **Inspect the combustion equipment periodically in accordance with the instructions given in the manual provided by the equipment manufacturer.**
- **When cleaning the burner, clean the flame detector also.**

■ General maintenance and inspection

- When replacing this device, do all of the checks and adjustments, including those mentioned under CAUTION ☞ p. i.
- Do not lubricate any part of this device.
- Remove any products of combustion that are stuck to the burner or other equipment.

■ Maintenance and inspection cycle

The maintenance and inspection cycle should take into consideration the device type, ambient conditions of the installation location, the frequency of use, etc. The following are approximate guidelines.

- Cleaning the burner: once or more per year
  After cleaning, make sure to do the pilot turn-down test.
- Burner shutdown check: once or more per month
- Flame voltage check: once or more per month

■ Alarm codes and details

When lockout occurs, an alarm code is displayed automatically. When an alarm occurs, the sequence number and alarm code issued when the lockout."

Alarm code	Sub-code	Description	Status	Cancellation method
E1	None	False flame	The flame signal is detected for 15 s during prepurge	Reset
E6		Ignition failure	Ignition was not detected during the lockout time.	Reset
E7		Flame failure	The flame signal disappeared during standby for normal combustion or thereafter.	Reset
E9	02	Switch input error	The DISP switch, RESET switch or reset input stayed on for 60 seconds. Or, one minute passed with the contact reset input ON. Note: Monitoring is continuous while power is supplied.	Reset
E9	03	Internal relay feedback (K1)	Relay K1 failure (contact welding) Note: If this error recurs even after a manual reset, a device failure may have occurred.	Reset
E9	05	Terminal 7 voltage discrepancy (PV)	At terminal 7, while pilot valve or main valve output was OFF, voltage was detected for 30 seconds. Note: This error can occur because of a ground fault, voltage supply to terminal 7 from an external circuit (bypass circuit, etc.), or relay K3 failure (contact welding, etc.).	Reset
E9	06	Terminal 8 voltage discrepancy (MV)	At terminal 8, while main valve output was OFF, voltage was detected for 30 seconds. Note: This error can occur because of a ground fault, voltage supply to terminal 8 from an external circuit (bypass circuit, etc.), or relay K4 failure (contact welding, etc.).	Reset
E9	07	Terminal 6 voltage discrepancy (IG)	At terminal 6, while the ignition transformer output was OFF, voltage was detected for 30 seconds. Note: This error can occur because of a ground fault, voltage supply to terminal 6 from an external circuit (bypass circuit, etc.), or relay K5 failure (contact welding, etc.).	Reset
E9	08	Alarm generation when power is turned ON	When the cause of lockout cannot be identified • Power was turned off before CPU error judgment after lockout occurred • Latch relay was set to lockout due to vibration during transport or for other reasons This does not indicate a problem with the device. Reset the device to restore normal operation.	Reset
E9	10	ROM failure	ROM check code error	Reset
E9	11	Memory read error	Internal memory read error	Reset
E9	12	Memory write error	Internal memory write error	Reset
E9	13	Memory data error	Internal memory check code error	Reset
E9	14	CPU communication error	CPU communication error	Reset
E9	15	Diagnosis of the input circuit	Detection of part failure (voltage applied to the input terminal by wrong wiring) or strong inductive electrical noise to the signal wire	Reset
E9	16	Input safety pulse error	Internal clock error	Reset
E9	17	CPU diagnosis (EEPROM data error)	Error during CPU check • Because of EEPROM failure, EEPROM data differed	Reset
E9	18	CPU diagnosis (parameters)	Error during CPU check	Reset
E9	19	CPU diagnosis (timer)	Error during CPU check	Reset
E9	20	CPU diagnosis (process)	Error during CPU check	Reset
E9	21	CPU diagnosis (process synchronization)	Error during CPU check	Reset
E9	62	Alarm relay timeout	Internal feedback signal error of alarm output relay	Reset
E9	63	CPU diagnosis	Internal memory data error	Reset
E9	64	Flame circuit diagnosis	Error in the circuit for diagnosing the flame detector circuit	Reset
E9	65	Flame circuit diagnosis	Error in the interactive diagnosis of the flame detector circuit	Reset
E9	66	K1 relay circuit error	Internal fuse blown, or internal feedback signal error	Reset
E9	68	K3 relay circuit error (PV)	Internal feedback signal error	Reset
E9	69	K4 relay circuit error (MV)	Internal feedback signal error	Reset
E9	70	K5 relay circuit error (IG)	Internal feedback signal error	Reset
E9	71	POC (shutoff valve proof of closure) setting error or internal memory read error	Internal memory read error • Because of EEPROM failure, EEPROM data differed	Reset

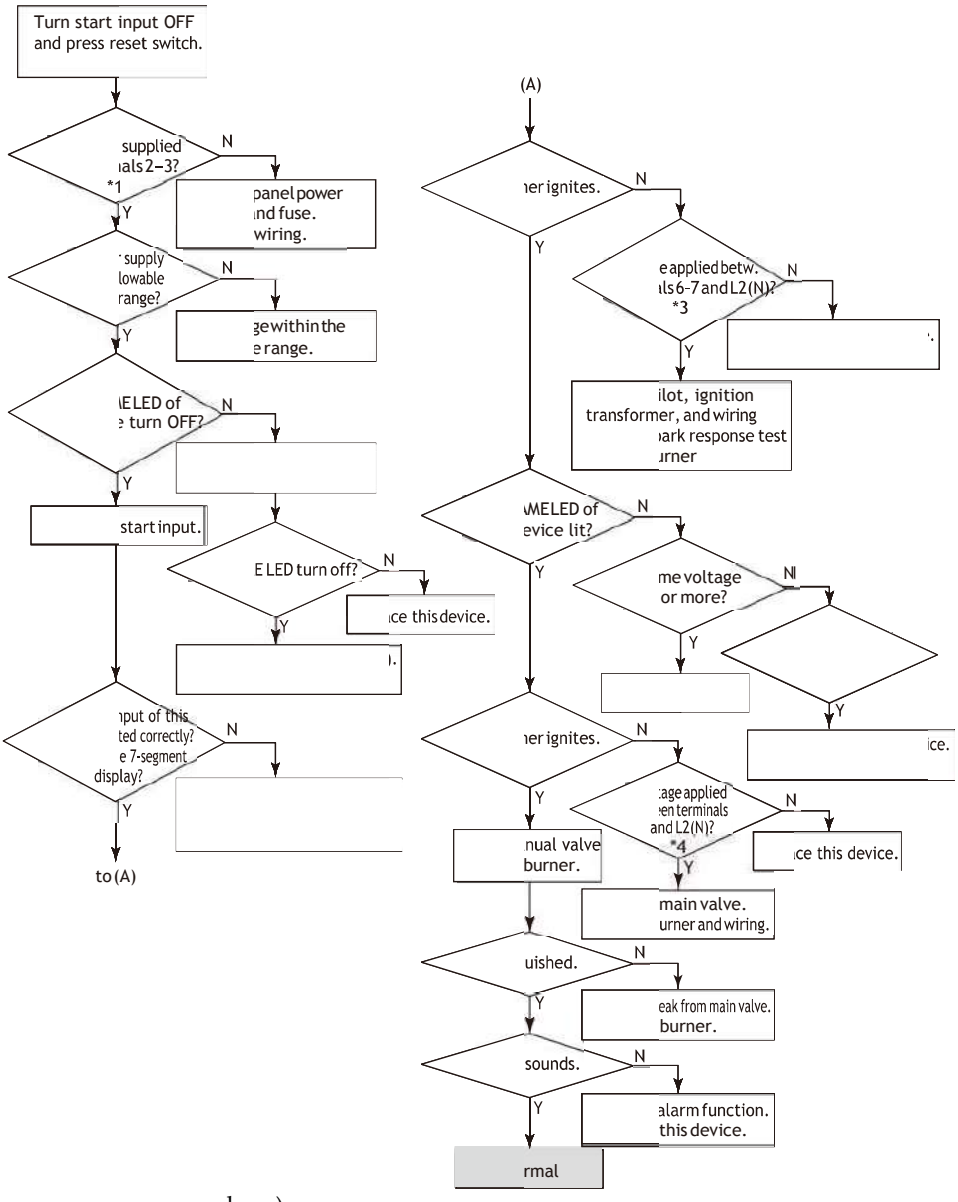
Note. If the sequence cannot be specified, the sequence code displayed when lockout occurred may be shown as [--] (stopped).
If lockout occurs even if reset is repeated, the device has failed.

■ Failure inspection flow

⚠ WARNING

Before mounting, removing, or wiring, be sure to turn off the power to this device and all connected devices. Failure to do so may result in an electric shock.

If there is any problem with the device, follow the inspection procedure below. (Note: The terminal numbers are applicable in the case of the RB890 SUB-BASE sub-base.)



	Terminal numbers for Q890A100 replacement base unit
*1	Terminals 1 - 2
*2	Between terminals T - T or terminal 6
*3	Between terminals 3, 4 - L2(N)
*4	Between terminals 5 - L2(N)

Chapter 7. Specifications

Item		Description			
Application		Batch-operated combustion systems burning gas, oil, or gas/oil mixture			
Compatible flame detector		AUD100/110/120 series ultraviolet sensor, flame rod			
Sequence	Lockout timing	13.5 ± 1.5 s			
	Main burner combustion standby	0.4 s			
	Flame failure response timing *1	AUD100/110/120 series ultraviolet sensor		Flame rod (Ionization)	
		3 ± 1 s (when flame voltage is 3 V)		1 s max (when flame voltage is 2 V)	
	Reset timing	1 s or longer (reset switch or contact reset input) *2			
	False flame detection time	15 s			
	Operation at ignition failure	Lockout			
	Operation at flame failure	Lockout			
Electrical specifications	Rated power supply	200/230V AC, 60Hz			
	Allowable power supply voltage	85-110 % of rated power supply			
	Power consumption	10 W or less			
	Dielectric strength	1500 V AC for 1 min, or 1800 V AC for 1 s Between each terminal and ground (the DIN rail clamp), except for combustion sensor connection terminals (terminals 14, 15)			
	Insulation resistance	50 MΩ min. with 500 V DC megger Between each terminal and ground (the DIN rail clamp), except for combustion sensor connection terminals (terminals 14, 15)			
	Contact rating	Ignition transformer	Pilot valve	Main valve	Alarm
		360 VA	200 VA	200 VA	75 VA
	Flame detection level	AUD100/110/120 series ultraviolet sensor		Flame rod (Ionization)	
		Flame establishment: 1.5-4.5VDC Flame-out detection: 0.2-0.6VDC		Flame establishment: 1.5-4.5VDC Flame-out detection: 0.0-0.1VDC	
	Flame voltage output	Recommended flame voltage: Must be stable at 2 V DC or above Flame voltage output range: 0.2-4.5VDC		Recommended flame voltage: Must be stable at 2 V DC or above Flame voltage output range: 0.0 - 4.5VDC	
	Input	Non-voltage contact input, allowable contact resistance 500 Ω max. Low voltage temp. controller, Contact reset			
	Life	10 years when used for 8 hours per day, or 100,000 start/stop cycles (at 25 °C, room humidity, rated voltage)			
Transportation and storage conditions	Ambient temperature	-20 to +70 °C			
	Ambient humidity	5-95 %RH (no condensation)			
	Vibration	0-9.8 m/s^2 (10-150 Hz, 1 octave/minute, 10 cycles, in each of XYZ directions)			
	Shock	0-300 m/s^2			
	Package drop test	Height 60 cm (free-fall test for 1 corner, 3 edges and six sides)			

Operating conditions	Ambient temperature	-20 to +60 °C
	Ambient humidity	10-90 %RH (no condensation)
	Vibration	0-3.2 m/s^2 (10-150 Hz, 1 octave/minute, 10 cycles, in each of XYZ directions)
	Shock	0-9.8 m/s^2
	Mounting angle	Reference plane ±10 °
	Dust	0.3 mg/m^3 or less
General specifications	Protection rating	IP40 (with sideboards (81447515-001) attached to the sub-base (BC-R05)) IP10 • When only the replacement base unit (Q890A100) is used • Sub-base (BC-R05) only
	Overvoltage category	II
	Pollution degree	PD2
	Case color	Black
	Case material	Denatured PPE resin (UL94-V0 PTI Material group IIIa)
General specifications	Structure	Structure of the replacement base unit or sub-base and main unit
	Mounted orientation	Vertical or horizontal However, for horizontal attachment, 7 segment display can only be mounted so that it faces directly overhead (DIN rail mounting or direct mounting through base screw holes)
	Dimensions	• When used in combination with the replacement base unit (Q890A100) : W126 × H136 × D155 mm • When used in combination with the sub-base (RB890 SUB-BASE) : W95 × H105 × D110 mm
	Weight	Approximately 1200 g (When used in combination with the replacement base unit), Approximately 600 g (incl. sub-base)
Wiring types and max. wiring length		• Low voltage temp. controller 600 V PVC-insulated copper wire cable ("IV wire," JIS C3307), 1.25 mm^2, recommended length 20 m or less, max. wiring length 100 m • Contact reset 600 V PVC-insulated copper wire cable ("IV wire," JIS C3307), 1.25 mm^2, max. wiring length 10 m • AUD100 Series (F, G) Copper IV wire with 600V vinyl insulation, 1.25 mm^2, maximum wiring length: 100 m or 2 mm^2, maximum wiring length: 200m • Flame rod (F, G) RG-11U (JAN standard: US DoD compliant specification) Or equivalent 5C2V, 7C2V (JIS standard) Recommended condition: 20 m or less, maximum wiring length: 30 m • Flame voltage output signal circuit IV wire 0.75 mm^2 or larger, max. wiring length 10 m

*1 Selected by model number.

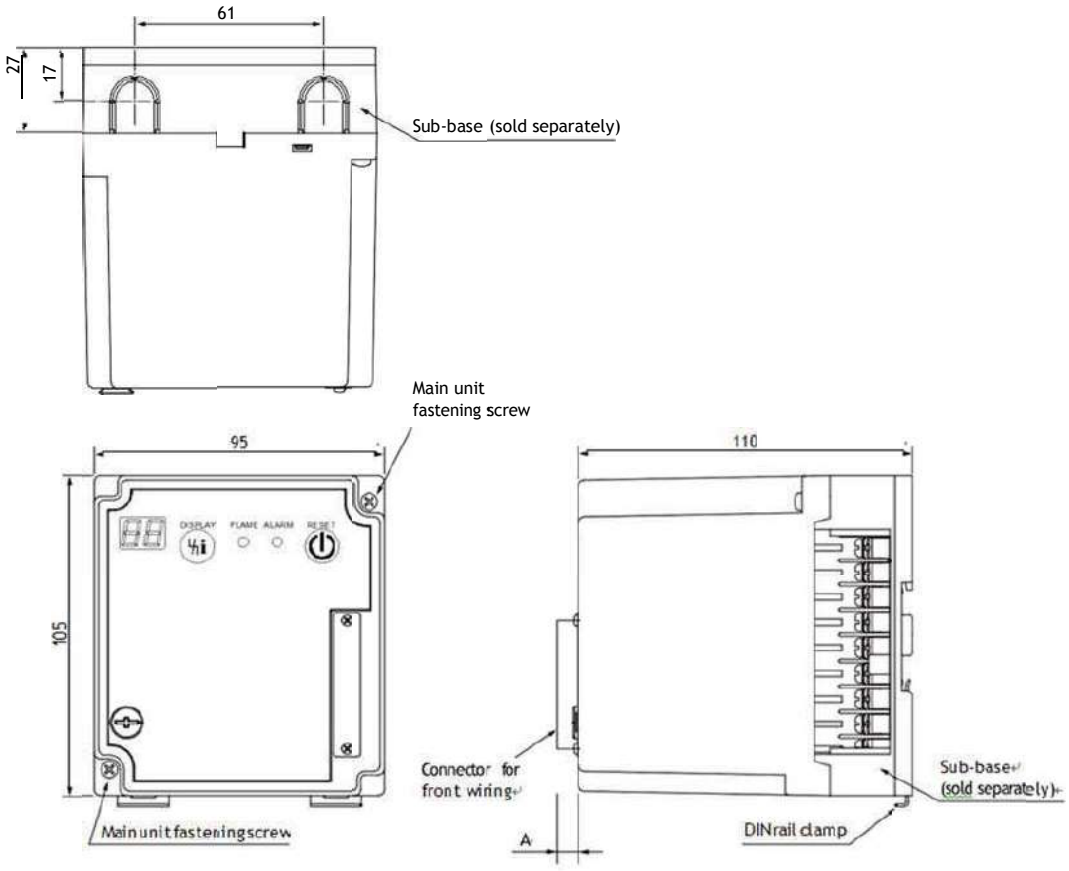
*2 If no alarm has occurred, input from the RESET switch and the contact reset terminal is not accepted.

■ External dimensions

● RB890 with the RB890 SUB-BASE sub-base

unit : mm

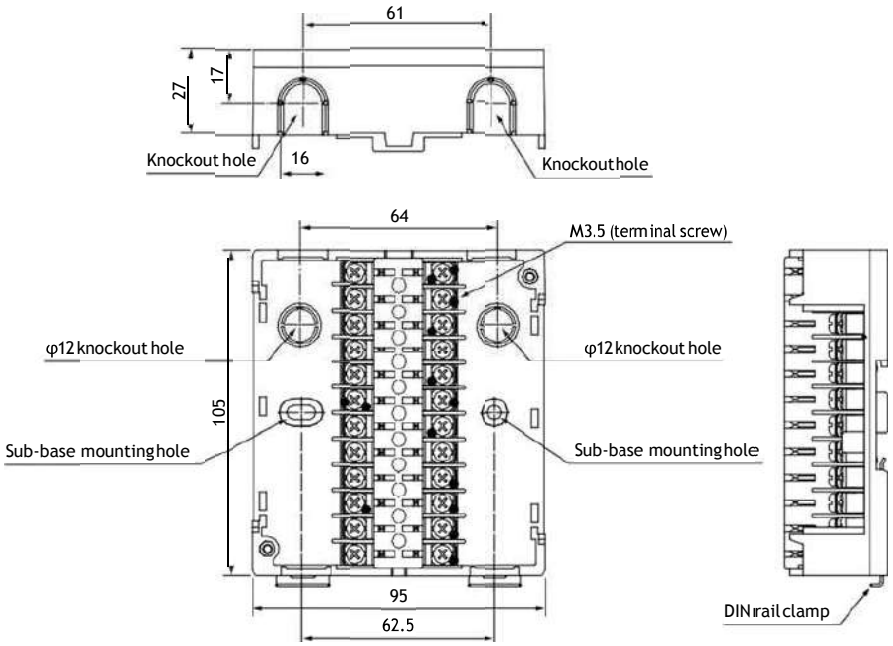
● **Body**



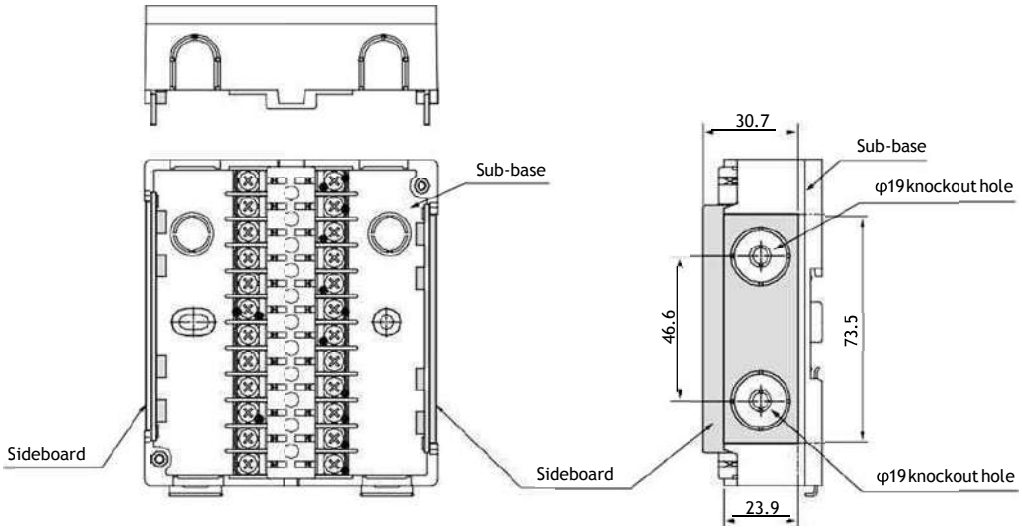
Model number	A
81447514-001	10.6
81447514-002	14.6

unit: mm

- **Sub-base RB890 SUB-BASE (sold separately)**

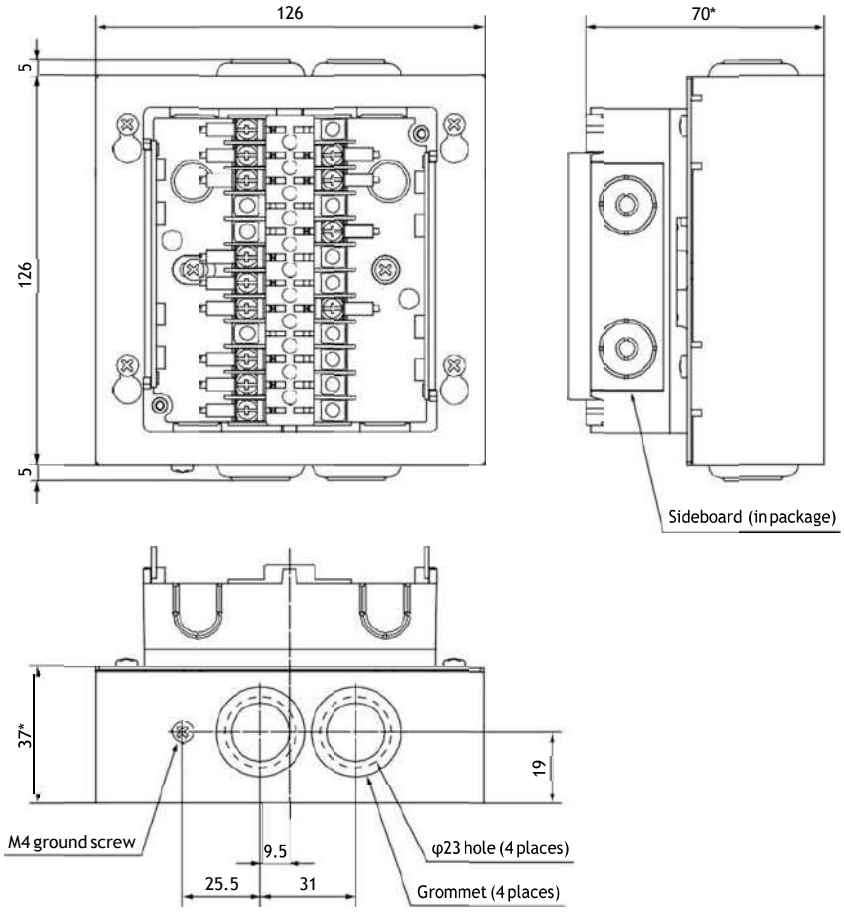


- **Sideboard 81447515-001 (sold separately)**



unit: mm

- **With the base unit (Q890A100) for RB890 replacement (purchased separately)**



* This dimension is for a product with a date code (D/C) of 1828 or later.
The height is 8 mm less than that of a product with an earlier date code.

-MEMO-

Revision History of RB890FU-E

Date	Rev.	(New) Page No.	Description
Dec. 2019	**1**		
Aug. 2020	**2**	Cover	The document number was changed.
Sep. 2020	**3**	iv, 5, 6	Warning and Caution were changed.
		3	Table was changed.
		15-18, 24-27,	This device will be started if both input 'Line voltage temp. controller' and 'Low voltage temp. controller' turned on. It stops, when either is also turned off.
		22	All the LEDs are lit for 4 seconds after the power is turned on, and then they are turned off, and the display of the sequence code begins were added.
		40	RB890F was changed.
		46	Rated power supply was changed.

Terms and Conditions

We would like to express our appreciation for your purchase and use of Yamataha Corporation's products.

You are required to acknowledge and agree upon the following terms and conditions for your purchase of Yamataha Corporation's products (system 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

Yamataha 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 Yamataha Corporation's product has any failure attributable to Yamataha during the aforementioned warranty period, Yamataha Corporation 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 Yamataha product (noncompliance with conditions, environment of use, precautions, etc. set forth in catalogs, specifications, instruction manuals, etc.);
(2) Failure caused for other reasons than Yamataha Corporation's product;
(3) Failure caused by any modification or repair made by any person other than Yamataha Corporation or Yamataha Corporation's subcontractors;
(4) Failure caused by your use of Yamataha Corporation's product in a manner not conforming to the intended usage of that product;
(5) Failure that the state-of-the-art at the time of Yamataha Corporation's shipment did not allow Yamataha Corporation to predict; or
(6) Failure that arose from any reason not attributable to Yamataha 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 Yamataha Corporation shall not be liable for any damages, including direct, indirect, special, incidental or consequential damages in connection with or arising out of Yamataha Corporation's products.

2. Ascertainment of suitability

You are required to ascertain the suitability of Yamataha Corporation's product 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 Yamataha 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 Yamataha is constantly making efforts to improve the quality and reliability of Yamataha Corporation's products, there exists a possibility that parts and machinery may break down. You are required to provide your Equipment with safety design such as fool-proof design,*1 and fail-safe design*2 (anti-flame propagation design, etc.), whereby preventing any occurrence of physical injuries, fires, significant damage, and so forth. Furthermore, fault avoidance,*3 fault tolerance,*4 or the like should be incorporated so that the said Equipment can satisfy the level of reliability and safety required for your use.

*1. A design that is safe even if the user makes an error.
*2. A design that is safe even if the device fails.
*3. Avoidance of device failure by using highly reliable components, etc.
*4. The use of redundancy.

3. Precautions and restrictions on application

3.1 Restrictions on application

Please follow the table below for use in nuclear power or radiation-related equipment.

	Nuclear power quality*5 required	Nuclear power quality*5 not required
Within a radiation controlled area*6	Cannot be used (except for limit switches for nuclear power*7)	Cannot be used (except for limit switches for nuclear power*7)
Outside a radiation controlled area*6	Cannot be used (except for limit switches for nuclear power*7)	Can be used

*5. Nuclear power quality: compliance with JEAG 4121 required
*6. Radiation controlled area: an area governed by the requirements of article 3 of "Rules on the Prevention of Harm from Ionizing Radiation," article 2 2 4 of "Regulations on Installation and Operation of Nuclear Reactors for Practical Power Generation," article 4 of "Determining the Quantity, etc., of Radiation-Emitting Isotopes," etc.
*7. Limit switch for nuclear power: a limit switch designed, manufactured and sold according to IEEE 382 and JEAG 4121.

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

The products are for industrial use. Do not allow general consumers to install or use any Yamataha Corporation's product. However, Yamataha products can be incorporated into products used by general consumers. If you intend to use a product for that purpose, please contact one of our sales representatives.

3.2 Precautions on application

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 Yamataha product 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, fault avoidance, fault tolerance, and other kinds of protection/safety circuit design on your own

responsibility to ensure 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
      [When used outside a radiation controlled area and where nuclear power quality is not required]
      [When the limit switch for nuclear power is used]
    * 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
    * Facilities/applications associated directly with billing
(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 Yamataha 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 Yamataha 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 Yamataha 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 Yamataha Corporation's products every 5 to 10 years unless otherwise specified in specifications or instruction manuals. System products, 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 Yamataha 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 Yamataha 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 Yamataha 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 Yamataha Corporation's product may be discontinued without notice. After manufacturing is discontinued, we may not be able to provide replacement products even within the warranty period.

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 system products, field instruments, we may not be able to undertake parts replacement for similar reasons.

9. Scope of services

Prices of Yamataha Corporation's products do not include any charges for services such as engineer dispatch service. Accordingly, a separate fee will be charged in any of the following cases:

(1) Installation, adjustment, guidance, and attendance at a test run
(2) Maintenance, inspection, adjustment, and repair
(3) Technical guidance and technical education
(4) Special test or special inspection of a product under the conditions specified by you

Please note that we cannot provide any services as set forth above in a nuclear energy controlled area (radiation controlled area) or at a place where the level of exposure to radiation is equivalent to that in a nuclear energy controlled area.

URL:
http://www.yamataha.com

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3rd edition: Sep. 2020 (T)