Based on its core principle of *human-centered automation*, Azbil Corporation offers combustion equipment that provides safety and peace of mind.
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Overview

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Introduction to Flame Safeguard System

Flame Safeguard System

**Basic structure of flame safeguard system**

The flame safeguard system limits the operation to within safe operational ranges using limits and interlocks, and always monitors combustion conditions by means of a flame detector. The signal from the flame detector is converted by burner controller into the signal required for actuators to operate safety shutoff valves.

If some failure has occurred in the combustion equipment resulting in an ignition failure or other burner flame failure, the flame detector detects the abnormal condition of combustion flame, transmits the signal to the burner controller to close the safety shutoff valves, and prevents the flow of fuel into the combustion chamber.

If the flame detector or burner controller has caused a failure, the system has a safety circuit function to operate the fuel shutoff valves or not to start the burner.

- Stops the burner by automatic or manual operation.
- Starts the burner in correct sequence and monitors the combustion flame during operation.
- Protects against abnormal temperatures or pressures.
- Controls the combustion quantity of the burner.
- Maintains the operation start standby state during burner stop.

**Functions of the Flame Safeguard System**

- Stops the burner by automatic or manual operation.
- Starts the burner in correct sequence and monitors the combustion flame during operation.
- Protects against abnormal temperatures or pressures.
- Controls the combustion quantity of the burner.
- Maintains the operation start standby state during burner stop.

**The purpose of the FSG is to prevent an explosion.**

**For this purpose,**

**the FSG does not allow fuel to accumulate in the furnace (combustion chamber).**

The FSG controls the fuel to keep the density below the explosion limit.

**Cases of fuel accumulation in the furnace and corrective measures to them**

- **Residual gas remains in furnace.**
  - Ventilation must be made until fuel density is decreased to the level below the explosion limit. The ventilation time length must not be shortened even if a failure occurs.
  - Burner controller, safety shutoff valve (periodical maintenance)

- **Safety shutoff valve is opened before the ignition source is activated at the time of burner ignition.**
  - Ignition must be made in the correct sequence. Operation will not occur if there is an abnormality. The sequence must not be changed even in the event of a failure.
  - Burner controller (start check, ignition sequence)

- **Burner is not ignited even though ignition operation is tried.**
  - Shutoff must be made before the density increases to the explosion limit. Ignition time length must not become longer even in the event of a failure.
  - Flame detector, burner controller (ignition sequence)

- **Burner has suddenly experienced a flame failure due to some cause during operation.**
  - Flame failure must be reliably detected, and the fuel must be shut off before its density increases to the explosion limit.
  - Flame detector, burner controller (flame response), safety shutoff valve

- **Burner is experiencing incomplete combustion due to an inappropriate fuel/air ratio.**
  - Combustion conditions must be continuously secured by limits.
  - Gas pressure switch / air switch (periodical maintenance)
Introduction to Flame Safeguard System

Component Devices

Limit

1. Has the function of limiting operation so that it is within the safe operational ranges. Even when a control is out of order due to the malfunction of a controller, resulting in a continuing uncontrolled operational state, the limit controller can function to limit operation to within the safe ranges, ensuring safety. The limit controllers provided for safety must not be used mistakenly with other controllers. They must be clearly distinguished, selected and independently installed to ensure safety. The limit controllers are selected for reliable operation rather than for high accuracy. The extent to which combustion equipment can be controlled is dependent upon the safety provided by the limit controllers.

2. Responds to the temperatures, liquid levels and pressures. Industrial furnaces may have the problem of abnormally high temperature while boilers may have the problem of low water level or abnormally high pressure.

Interlock

1. Checks that the conditions are right to start combustion.

2. Checks that the conditions are right to continue combustion.

3. A start interlock is used to check the damper or burner position (high or low fire), fuel pressure, oil pre-heating temperature, and fuel shutoff valve closure.

4. A running interlock is used for fuel pressure, combustion air pressure, or draft. When the interlock for fuel pressure or combustion air pressure is operated, the safety shutoff is operated for lockout.

Flame detector

1. Detects the flame and sends a converted electric signal to the burner controller.

2. Flame detectors for industrial furnaces use the light (ultraviolet rays, etc.) emitted from the burner flame.

Burner controller

Burner controller has very important functions for the safety of burner operation and flame monitoring, and is designed as a failsafe system.

1. Detects that stable flame exists.

2. Starts the motor, fan, ignition and fuel valve in the correct sequence and at the correct time to ensure safe operation.

   (1) Supplies power to the devices in the correct sequence and at the correct time.

   (2) Shuts off the power supply given to the devices in a pre-determined sequence upon ignition failure, flame failure, or cessation of combustion.

3. Checks itself.

   (1) Checks its component parts every time an operation starts or power is applied.

   (2) Prevents burner ignition when a false flame signal exists.

   (3) Checks itself every time an operation starts or power is applied.

   (4) Prevents burner ignition when a false flame signal exists.

   (5) Checks itself every time an operation starts or power is applied.

   (6) Prevents burner ignition when a false flame signal exists.

   (7) Checks itself every time an operation starts or power is applied.

   (8) Prevents burner ignition when a false flame signal exists.

4. Failsafe design is incorporated.

   (1) Failsafe design is incorporated in the start check circuit ensuring no occurrence of checking error.

   (2) Ignition sequence is never performed out of order.

   (3) There is no occurrence of a timing error that would result in a dangerous instruction. For example, the required period for purging gas from the furnace before ignition does not become shorter. The ignition spark timing does not become longer.

Safety shutoff valve

1. There are ON/OFF, high/low and proportional types.

2. Delayed operation is available for oil, and slow-opening operation is available for gas.

Temperature and Pressure Controllers

1. Operates to keep the control at a set point.

2. Includes the temperature controllers, and pressure controllers or start/stop switches.
In the Flame Safeguard System, the detection of combustion flame has a very important role. The accurate detection of a flame is accomplished by fully utilizing the physical properties of flame.

For the detection of a combustion flame, a flame detector that effectively utilizes the nature of the flame is necessary. When utilizing any flame detector, it is essential to select a detector which is appropriate for the nature of the flame.

### Types of flame detectors

The detection methods of combustion flames are categorized into two types: optical and insertion.

The optical type consists of a sensor element that indirectly detects the brightness in the furnace and flame color or its wavelength, and the electronic circuits for signal conversion and amplifier. Since the detection is indirect, care must be taken so as not to receive any influence of external light.

Since the insertion type is used by directly inserting the sensor element into the flame, the flame temperature, length, and state can be detected, and therefore the detection is highly reliable. However, care must be taken with regard to sensor responsiveness and mounting position.

### Selection of a flame detector

For the detection of a combustion flame, a flame detector that effectively utilizes the nature of the flame is necessary. When utilizing any flame detector, it is essential to select a detector which is appropriate for the nature of the flame.

- **Ultraviolet flame detector**
  
  Since there are few restrictions in its mounting location, this detector is widely used for various applications. Care must be taken in its use so as not to mistakenly detect the spark of an igniter.

  In the case of a continuously operating burner in which the flame does not stop for more than 24 hours, the use of a continuously self-checking type of flame detector is required to ensure failsafe operation.

- **Visible light flame detector**
  
  This detector is used for a compact oil-fired burner. The gas blue flame cannot be detected. When a boiler or agricultural drying furnace is installed outdoors, special care must be taken so as not to mistakenly detect sunlight.

- **Flame rod**
  
  A flame rod utilizes the electrical conductivity of flame. In order to avoid a detection error in the event of a short-circuit between the sensor signal and the ground, the rectification function is utilized to ensure safety.
## Flame Detector Types and Features

<table>
<thead>
<tr>
<th>Detectors</th>
<th>Model/appearance</th>
<th>Flame property</th>
<th>Applicable combustion</th>
<th>Main uses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ultraviolet phototubes (UV sensors)</td>
<td>AUD300C1000 Series</td>
<td>Ultraviolet light 185–245 nm</td>
<td>Gas, Oil</td>
<td>Batch operation or continuous operation Pilot burner monitoring Main burner monitoring Industrial furnaces Plants Boilers</td>
</tr>
<tr>
<td></td>
<td>AUD500C11000 Series</td>
<td>Ultraviolet light 185–270 nm</td>
<td>Gas, Oil</td>
<td>Batch operation or continuous operation Pilot burner monitoring Main burner monitoring Industrial furnaces Plants Boilers</td>
</tr>
<tr>
<td></td>
<td>C7076A</td>
<td>Ultraviolet light 185–245 nm</td>
<td>Gas, Oil</td>
<td>Batch operation or continuous operation Pilot burner monitoring Main burner monitoring Industrial furnaces Plants Boilers</td>
</tr>
<tr>
<td></td>
<td>C7076D</td>
<td>Ultraviolet light 185–245 nm</td>
<td>Gas, Oil</td>
<td>Batch operation or continuous operation Pilot burner monitoring Main burner monitoring Industrial furnaces Plants Boilers</td>
</tr>
<tr>
<td></td>
<td>AUD100+AUD15</td>
<td>Ultraviolet light 185–245 nm</td>
<td>Gas, Oil</td>
<td>Batch operation or continuous operation Pilot burner monitoring Main burner monitoring Industrial furnaces Plants Boilers</td>
</tr>
<tr>
<td>Photo diodes (Visible light flame detectors)</td>
<td>AFD100</td>
<td>Light 400–800 nm</td>
<td>Oil</td>
<td>For batch operation Small oil-fired boilers</td>
</tr>
<tr>
<td></td>
<td>AFD110</td>
<td>Light 400–800 nm</td>
<td>Oil</td>
<td>For batch operation Small oil-fired boilers</td>
</tr>
</tbody>
</table>

### Reference
- **Continuous operation equipment means:** Combustion continues for at least 24 hours
- **Batch operation equipment means:** Combustion starts and stops at least once every 24 hours

Note: Flame detectors designed for continuous operation can also be used for batch operation.
Introduction to Flame Safeguard System

Safety Shutoff Valves

Safety technology related to safety shutoff valves


The basis of gas combustion equipment safety is the ability to shut off the gas supply immediately when an abnormal or dangerous state occurs. The safety shutoff valve is the key safety device for immediate shutoff of the gas supply to the overall equipment or to an independent zone when a hazardous state arises, such as a combustion issue like ignition failure or flame failure, or an abnormal rise in the temperature of the heating unit, or when the gas or air pressure falls outside the preset range. As a rule, two safety shutoff valves are installed in series in the event that one valve is not able to completely shut off the gas due to some problem with the valve.

Conditions requiring installation

Safety shutoff valves must be installed where they can immediately shut off the gas supply to the overall equipment or to an independent combustion zone when a hazardous state arises, with the exception of cases where the operator is able to continuously monitor the heating unit and immediately shut off the gas in the event of danger, such as when workmen are using hand-held acetylene torches near the gas pipeline.

Safety shutoff valve

Safety shutoff valves must be able to shut completely and automatically within 1 second after the supply of electricity or air pressure stops, must be able to sufficiently withstand the usage pressure, and also must comply with the relevant standards. Specifically, JIS B 8415 (General Safety Code for Industrial Combustion Furnaces) states that it is preferable for a fuel switch valve for a regenerative burner, such as a high-performance industrial furnace, that is being used as a shutoff valve to be given a minimum of two million operation test cycles as a durability test using the method prescribed in ISO 23550.

Leakage Standards for Safety Shutoff Valves: List of Safety Shutoff Valve Leakage Standards

<table>
<thead>
<tr>
<th>Standard</th>
<th>External leakage</th>
<th>Test methods</th>
<th>Internal leakage</th>
<th>Test methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>EN161</td>
<td>Standard bore: DN = 10 20 cm³/h or less 10 ≤ DN &lt; 25 40 cm³/h or less 25 ≤ DN &lt; 80 60 cm³/h or less 80 ≤ DN &lt; 150 80 cm³/h or less 150 ≤ DN</td>
<td>Measure at the burette or water column gauge after applying 60 mm of H₂O and a pressure of 1.5 times the maximum usage pressure from the inlet and outlet.</td>
<td>Standard bore: DN = 10 20 cm³/h or less 10 ≤ DN &lt; 25 40 cm³/h or less 25 ≤ DN &lt; 80 60 cm³/h or less 80 ≤ DN &lt; 150 80 cm³/h or less 150 ≤ DN</td>
<td>Measure at the burette or water column gauge after applying 60 mm of H₂O and a pressure of 1.5 times the maximum usage pressure from the inlet and outlet.</td>
</tr>
<tr>
<td>UL429</td>
<td>USA 200 cm³/h or less</td>
<td>1.5 times the maximum usage pressure for those with 360 cm³/h of H₂O or greater.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>JIS B 2151</td>
<td>Japan 3</td>
<td>30 cm³/h or less</td>
<td>Measure with the leakage detector at 4.2 kPa as well as 0.5 kPa of air pressure from the inlet.</td>
<td>• Must be within 95 % of specification. Converted to 15 °C atmospheric pressure.</td>
</tr>
<tr>
<td>ISO 23551</td>
<td>Standard bore: DN = 10 20 cm³/h or less 10 ≤ DN &lt; 25 40 cm³/h or less 25 ≤ DN &lt; 80 60 cm³/h or less 80 ≤ DN &lt; 150 80 cm³/h or less 150 ≤ DN</td>
<td>After carrying out an internal leakage test at 0.6 kPa, repeat the test using pressures of either 15 times the maximum usage pressure or 15 kPa, whichever is higher.</td>
<td>Standard bore: DN = 10 20 cm³/h or less 10 ≤ DN &lt; 25 40 cm³/h or less 25 ≤ DN &lt; 80 60 cm³/h or less 80 ≤ DN &lt; 150 80 cm³/h or less 150 ≤ DN</td>
<td>After carrying out an internal leakage test at 0.6 kPa, repeat the test using pressures of either 15 times the maximum usage pressure or 15 kPa, whichever is higher.</td>
</tr>
<tr>
<td>*1 For cases of connection to a gas pipe with an outer diameter of 35 mm or less, for gas burning appliance automatic valves used in combustion equipment that uses city gas or liquefied petroleum gas at a gas pressure of 3.3 kPa or less.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**European Safety Shutoff Valve Standard (EN161 Group 2): Excerpted summary by Azbil Corp.**

<table>
<thead>
<tr>
<th>Item</th>
<th>Performance</th>
<th>Test methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leakage</td>
<td></td>
<td>Measure internal leakage after applying pressure from the inlet, and external leakage from the inlet and outlet, using 60 mm of H₂O and a pressure of 1.5 times the maximum usage pressure.</td>
</tr>
<tr>
<td>Valve closure ability</td>
<td></td>
<td>Applied pressure Class A: 1500 mm — H₂O Class B: 500 mm — H₂O Class C: 100 mm — H₂O</td>
</tr>
<tr>
<td>Durability</td>
<td></td>
<td>Done with the pressure at the maximum allowable pressure, the flow rate at 10 % or less of the rating, the voltage at 85 % at 15 °C, 85 % and 90 % (half each) at 20 °C, and 70 % at 60 °C.</td>
</tr>
<tr>
<td>Flow</td>
<td></td>
<td>Converted to 15 °C atmospheric pressure.</td>
</tr>
<tr>
<td>Resistance to gas</td>
<td></td>
<td>Measure at 40°C after sleeping in 23 °C n-pentane for 72 hours and then air-drying for 72 hours.</td>
</tr>
<tr>
<td>Open time (slow open)</td>
<td></td>
<td>Measure the time taken to reach 80 % of the specification flow rate at 110 % of rated voltage at 60 °C and 85 % of rated voltage at 15 °C.</td>
</tr>
<tr>
<td>Strength (torque: kgf·cm)</td>
<td></td>
<td>For each, apply torque for 10 seconds and check for internal and external leakage.</td>
</tr>
</tbody>
</table>

| Group division | | Group 1: Shipped in the bracket, no force applied during piping work. Group 2: Installed inside or outside the bracket, supported only by the pipe. |

* *
• Position during automatic ignition

Normally two safety shutoff valves should be installed separately in series on the fuel supply pipes for the pilot burner and the main burner.

During synchronous ignition or extinguishing, as shown below, the safety shutoff valves for each burner form one layer, and by adding another safety shutoff valve in the zone, it is possible to have a double valve structure. However, this does not allow ignition or extinction of one burner only.

• Pipe Layout for Double Shutoff Valves

In addition, for non-synchronous ignition and extinction, two safety shutoff valves need to be installed for each burner, using double shutoff. Unlike synchronous ignition, this configuration allows ignition and extinction of each burner separately.

• Closed position indicator switch

In ISO 23551-1 (Safety and control for gas burner and gas burning appliances – Particular requirements – Part 1: Automatic valves), the closed position indicator switch is defined as the switch attached to the valve that indicates that the closing part is in the closed position. The following are specifically required.

Structure
• Must not interfere with normal valve operation
• The adjustment mechanism must seal it so that it can be seen that no adjustments have been made that the manufacturer did not intend.
• No amount of drift in the adjustment switches or driving mechanism may interfere with normal valve operation.

Performance
The switch is required to indicate the closed position in both of the following situations.
• When the flow is 10 % or less of the fully open flow at the same differential pressure.
• When the closing part is positioned within 1 mm of the closed position.

• Usage by class (following EN 746-2)

<table>
<thead>
<tr>
<th>Combustion capacity</th>
<th>When monitored by operator</th>
<th>When not monitored by operator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 120 kW (100,000 kcal/h)</td>
<td>Class A: 1 valve</td>
<td>Class B: 2 valves</td>
</tr>
<tr>
<td>Less than 120–600 kW (100,000–500,000 kcal/h)</td>
<td>Class B: 2 valves</td>
<td>Class A: 2 valves</td>
</tr>
<tr>
<td>Less than 600–1,200 kW (500,000–1,000,000 kcal/h)</td>
<td>Class A: 2 valves</td>
<td>Class A: 2 valves</td>
</tr>
<tr>
<td>1,200 kW (1,000,000 kcal/h) or above</td>
<td>Class A: 1 valve</td>
<td>Class A: 2 valves</td>
</tr>
</tbody>
</table>
**Introduction to Flame Safeguard System**

**Gas Safety Shutoff Valve Flow Calculation**

$C_v$ is normally used as a coefficient for showing the valve flow-through rate (capacity), but safety shutoff valves often show the flow rate and $C_v$ at a specific differential pressure or specific gravity determined by the gas.

Example:
The following table shows the $C_v$ and flow rates for a GV-A high-performance industrial-use gas double electromagnetic valve (with two connected in series). The flow rate values are at 15 °C and 101.325 kPa.

<table>
<thead>
<tr>
<th>Model</th>
<th>Connection bore</th>
<th>Flow rate m³/h</th>
<th>$C_v$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>differential pressure 250 Pa</td>
<td>Specific gravity 0.65</td>
<td>Specific gravity 1.53</td>
</tr>
<tr>
<td>GV-A100</td>
<td>10A (Rp 1/8)</td>
<td>8.5</td>
<td>5.6</td>
</tr>
<tr>
<td></td>
<td>15A (Rp 1/4)</td>
<td>10.9</td>
<td>7.1</td>
</tr>
<tr>
<td></td>
<td>20A (Rp 3/8)</td>
<td>16.4</td>
<td>10.7</td>
</tr>
<tr>
<td></td>
<td>25A (Rp 1)</td>
<td>18.6</td>
<td>12.1</td>
</tr>
<tr>
<td>GV-A200</td>
<td>25A (Rp 1)</td>
<td>32.8</td>
<td>21.4</td>
</tr>
<tr>
<td></td>
<td>32A (Rp 1 1/4)</td>
<td>41.1</td>
<td>26.8</td>
</tr>
<tr>
<td></td>
<td>40A (Rp 1 1/2)</td>
<td>45.6</td>
<td>29.7</td>
</tr>
<tr>
<td></td>
<td>50A (Rp 2)</td>
<td>46.4</td>
<td>30.3</td>
</tr>
<tr>
<td>GV-A300</td>
<td>40A (Rp 1 1/2)</td>
<td>65.9</td>
<td>43.0</td>
</tr>
<tr>
<td></td>
<td>50A (Rp 2)</td>
<td>71.4</td>
<td>46.5</td>
</tr>
<tr>
<td></td>
<td>65A (Rp 2 1/2)</td>
<td>74.3</td>
<td>48.4</td>
</tr>
</tbody>
</table>

$C_v$ and flow rate can be read from this table only if the differential pressure is 250 Pa and the gas type is natural gas 13A (specific gravity: 0.65) or propane gas (specific gravity: 1.53).

The following graph shows the relationship between flow rate and differential pressure when natural gas 13A is flowing through a GV-A. The flow rate values are at 15 °C and 101.325 kPa.

![Graph showing the relationship between flow rate and differential pressure](Image)

This graph makes it possible to find the flow rate for any given differential pressure, for natural gas 13A only.
The preceding table had a limited range of differential pressures and gas types, but it is possible to find the flow rate under other conditions by using the following calculation.

\[ Q = K \times \sqrt{\left(\frac{\Delta P}{\rho}\right)} \]  

Q : Flow rate (m³/h)  
K : Proportional constant  
\Delta P : Differential pressure (Pa)  
\rho : Specific gravity

A. When the differential pressure is 250 Pa or greater, use the following modification of formula (1) to find the flow rate:

\[ Q = \text{(Flow rate table value)} \times \sqrt{\left(\frac{\text{differential pressure}}{250}\right)} \]

Ex.: Find the flow rate for GV-A200 (bore: 1½), with a differential pressure of 980 Pa and natural gas 13A. According to the above table, the flow rate is 34.7 m³/h when the differential pressure is 250 Pa, so the flow rate is:

\[ Q = 34.7 \times \sqrt{\left(\frac{980}{250}\right)} = 68.7 \text{ m}^3/\text{h} \]

B. When the specific gravity is not 0.65, use the following modification of formula (1) to find the flow rate.

\[ Q = \text{(Flow rate table value)} \times \sqrt{\left(\frac{0.65}{\text{specific gravity}}\right)} \]

Ex.: Find the flow rate for GV-A200 (bore: 1½), with a differential pressure of 250 Pa and 6C gas (manufactured gas B). If the specific gravity of 6C is 0.55, the flow rate is:

\[ Q = 34.7 \times \sqrt{\left(\frac{0.65}{0.55}\right)} = 37.7 \text{ m}^3/\text{h} \]

C. When the differential pressure \( \Delta P \neq 250 \text{ Pa} \) and the specific gravity \( \rho \neq 0.65 \), use the following modification of formula (1) to find the flow rate.

Flow rate \( Q = \text{Flow rate table value} \times \sqrt{\left(\frac{\text{differential pressure}}{250}\times 0.65}{\text{specific gravity}}\right)} \)
Ideas in Support of Industrial Furnace Safety

For a wide range of operation configurations and ignition methods, we provide total solutions, from flame safeguard control and flame monitoring to fuel shutoff, in support of safe combustion in industrial incinerators.

Flame safeguard controls
Our new flame safeguard control system, consisting of burner interlock modules and burner control modules, uses a new architecture to allow safety, ease of use, and ease of adjustment when installing equipment and responding to problems.

Flame monitoring
Our compact flame detectors for continuous operation combustion equipment can be used without problems even for burners having many restrictions, such as tight installation space or temperature requirements.

Fuel shutoff
The advanced-function double-seated gas shutoff valve made by Elster Kromschröder, a company with a proven track record with European industrial burners, uses a modular structure that allows for installation in tight spaces around fuel pipes or burners where there are space or other restrictions.

Flame detector
AUD Series
- Limit/interlock
- Safety shutoff valve
- Burner control module
- Burner interlock module

For fuel-safe construction…
- Look for intrinsic safety
  - Carry out safety measures based on risk assessment
  - Mechanical safety/comprehensive safety indices (JIS B 9700-2/JIS B 9702)
- Separation of safety functions and control functions
  - Review software interlocks by means of control PLC
- Complexity of safety instrumentation circuits
  - Complexity increases due to redundancy and diagnostic circuits.

For safety shutoff valve installation…
- Two valves installed in series
  - Installation space is often restricted
  - Installation and replacement of shutoff valves
  - Removing surrounding piping is bothersome
  - Compliance with international standards

For flame detector selection…
- Selection of devices suited to operation method
  - Self-checking flame detectors are used for continuous combustion of 24 hours or more
  - Installation space restrictions
  - Numerous installation space restrictions around the burner investigation is required for installation location and cooling measures around hot burners

AUD Series flame detector
- Self-checking flame sensor is designed for continuous operation
  - AUD300, AUD500 advanced UV sensors
  - Installs in small spaces
  - Withstands ambient temperatures up to 120 °C

Burner interlock module & Burner control module
- Packaging of burner combustion control functions
  - Shortened design verification time for safety circuits
  - Reduced circuit design and verification for safety circuit construction
  - Selection and setting of pre-incorporated safety functions
  - Burner interlock module (interlock monitoring function)
- Packaging of panel safety instrumentation
  - Shortened wiring/installation/check times
  - Module connectors distribute safety signals and reduce wiring

Safety shutoff valve
- Saves space
  - Two can be installed in series to save space through modular construction
  - Shortened time for installation and replacement
  - Can be easily installed or replaced by connecting the flanges
  - Products meet European and international standards
  - EN 161/ISO 23551-1 (durability tests, valve closure switch display function)

Overview
Ideas in Support of Industrial Furnace Safety
### Outline of revisions to JIS B 8415 (November 2008)

#### Background
- **Safety methods through risk assessment created as ISO standard and introduced to Japan**
  - ISO 12100 (Basic concepts, general regulations for design)
- **Coordination with Western standards**
  - European EN 746, USA NFPA 86
- **Standards supporting new technology**
  - Support for high-function industrial furnaces (regenerative burners, etc.)

#### Position
- **JIS B 9700-1 Machinery Safety: Equipment regulations defined in basic concepts and general rules (Type C)**
- **Positioning in standards systems that also meet ISO standards**

#### Scope
- **Heating equipment using gas or liquid fuel (industrial furnaces, etc.)**
  - Metallurgy, metal processing plants
  - Glass production, ceramics, cement production plants, etc.

### Table: General Safety Code for Industrial Combustion Furnaces: JIS B 8415: 2008

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Control and operation circuits</strong></td>
<td>Intrinsic safety design based on risk assessment (prohibition of software interlocks by general-use PLC)</td>
<td>Arriving to fail-safe and fail-proof control and operation circuits (prohibition of construction of combustion safety controls using only general-purpose PLC)</td>
<td>Intrinsic safety design based on risk assessment (EN 292)</td>
<td>Design requirements to minimize fire and explosion risks (provision of construction with safety protection equipment)</td>
</tr>
<tr>
<td><strong>Interlocks</strong></td>
<td>Installed in series in holding circuit for safety shutoff valve</td>
<td>Must be directly connected to the main control terminals of the flame monitor relay or flame safeguard control system</td>
<td>Should immediately shut off for safety when interlocks operate.</td>
<td>Interlock setting values must be shown in writing Must be connected directly</td>
</tr>
<tr>
<td><strong>Installation requirements for safety shutoff valves (for main burner, pilot burner)</strong></td>
<td>Two installed in series (shutoff within 1 second)</td>
<td>Two installed in series (shutoff within 1 second)</td>
<td>Two installed in series</td>
<td>Two installed in series</td>
</tr>
<tr>
<td><strong>Flame monitoring equipment for industrial furnaces that burn continuously for 24 or more hours</strong></td>
<td>Self-check at least once a day</td>
<td>Self-check at least once a day</td>
<td>Continuous combustion operation uses a self-checking type or regular checks</td>
<td>Continuous combustion operation uses a self-checking type or regular checks</td>
</tr>
<tr>
<td><strong>Individual monitoring of pilot and main burner flames</strong></td>
<td>Individual monitoring</td>
<td>Individual monitoring</td>
<td>Individual monitoring</td>
<td>Individual monitoring</td>
</tr>
<tr>
<td><strong>Flame failure response time in flame monitoring equipment</strong></td>
<td>Within 4 seconds (Flame failure safe time: within 5 seconds)</td>
<td>Within 4 seconds (shutoff within 5 seconds)</td>
<td>Within 3 seconds</td>
<td>Within 4 seconds</td>
</tr>
<tr>
<td><strong>Installation of overheat protectors inside furnace</strong></td>
<td>Must not make shared use of a temperature controller used for control or the controller's temperature detector.</td>
<td>Must not make shared use of a temperature controller used for control or the controller's temperature detector.</td>
<td>Must not make shared use of a temperature controller used for control or the controller's temperature detector.</td>
<td>Must not make shared use of a temperature controller used for control. Excess temperature limit interlock requires temperature display and manual reset.</td>
</tr>
<tr>
<td><strong>False flame operation during start check</strong></td>
<td>Safety shutoff and lockout</td>
<td>Check request at start</td>
<td>-</td>
<td>Check request at start</td>
</tr>
<tr>
<td><strong>Pre-operation check of combustion air pressure</strong></td>
<td>Combustion air detector must be checked when burner is started, and if there is an abnormality the burner must not be started.</td>
<td>Combustion air detector must be checked when burner is started, and if there is an abnormality the burner must not be started.</td>
<td>Combustion air detector must be checked when burner is started, and if there is an abnormality the burner must not be started.</td>
<td>-</td>
</tr>
<tr>
<td><strong>Prepurge air flow (number of changes of air)</strong></td>
<td>At least 5 times</td>
<td>At least 5 times</td>
<td>Completely 5 times</td>
<td>At least 4 times</td>
</tr>
<tr>
<td><strong>Airflow rate at pre purge</strong></td>
<td>At least 50 % of peak</td>
<td>At least 50 % of peak</td>
<td>At least 25 % of peak</td>
<td>At least 25 % of peak</td>
</tr>
<tr>
<td><strong>Burner flame amount at ignition</strong></td>
<td>Forced low fire ignition</td>
<td>Low fire ignition/ extinction</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>Pilot burner ignition timing</strong></td>
<td>Within 10 seconds</td>
<td>Within 10 seconds</td>
<td>Within 5 seconds: 70 kW or less Within 3 seconds: over 70 kW</td>
<td>Within 15 seconds</td>
</tr>
<tr>
<td><strong>Main burner ignition timing</strong></td>
<td>Within 5 seconds</td>
<td>Within 5 seconds</td>
<td>Within 5 seconds: 70 kW or less Within 3 seconds: over 70 kW</td>
<td>Within 15 seconds</td>
</tr>
<tr>
<td><strong>Direct spark ignition (direct ignition)</strong></td>
<td>350 kW or less</td>
<td>350 kW or less Under 158 kW: within 5 seconds Under 177 kW: within 3 seconds Under 250 kW or more: within 2 seconds</td>
<td>350 kW or less Under 158 kW: within 5 seconds Under 177 kW: within 3 seconds Under 250 kW or more: within 2 seconds</td>
<td>-</td>
</tr>
<tr>
<td><strong>Installation of seismic detector equipment</strong></td>
<td>Installed as necessary (for seismic intensity 6 or higher)</td>
<td>Installed as necessary (for seismic intensity 6 or higher)</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

*1. The flame monitoring equipment refers to a flame detector and a flame safety controller (burner controller).
2. If there are other regulations that specify the flame failure response time, they should be followed.
Basic points for safe combustion

1. Proper purging (5 times furnace capacity)
2. The combustion air detector (air pressure switch) must be checked when the burner starts up, and if there is an abnormality, the burner must not be started.
3. The load on the fuel shutoff valve, etc. must be directly connected to the burner controller (the flame safeguard control system).
4. The limit/interlock is configured to directly cut off the power supply to the combustion shutoff valve load.
5. The start check circuit must operate properly at start-up.
6. There must be no manual operation or bypass circuit for any load.
7. Safety shutoff and lockouts for ignition failure and flame failure.
8. Correct selection of burner controller and flame detector. (Select a continuous operation burner controller or flame detector for equipment that is operated continuously for at least 24 hours.)
9. The main shutoff valve and pilot shutoff valve must both use double shutoffs.
10. An excess temperature limit interlock must be installed separately from the temperature controller for control use and the controller’s temperature detector.
11. Individual monitoring of the pilot burner flame and the main burner flame (For the continuous pilot method or the intermittent pilot method, separate flame monitoring equipment is required for the main burner.)

These items are also required by the European and American standards.

Operation method for pilot and main burners

<table>
<thead>
<tr>
<th>Method</th>
<th>Pilot burner</th>
<th>Main burner</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuous</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intermittent</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interrupted</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Overview

Precautions for burner control circuit design

- Safety control and operation circuits must use an intrinsic safety design method based on risk assessment.
- Interlock (including limits) connections must be configured to directly cut off the load (ignition transformer, pilot safety shutoff valve, main safety shutoff valve, etc.).
- All shutoff contacts are to be on the ungrounded. In addition, leakage breakers, double-pole contacts and other anti-leakage measures are to be taken as necessary.
- The safety control circuit must promptly produce an alarm such as a light or buzzer as needed when an abnormal situation arises.

Precautions for instrumentation and circuit configuration for the intermittent pilot method

1. The pilot burner and the main burner must have separate flame monitoring (flame detectors, burner controllers).
2. The flame detector for the main burner must be installed where it will not detect the flame of the pilot burner.
3. The limit and interlock must be connected to the limit and interlock terminals of the burner controllers for the pilot burner and the main burner so that they can directly shut off the load (ignition transformer, pilot shutoff valve, main safety shutoff valve, etc.).
4. For the startup circuit configuration, the main burner ignition enabled output (pilot flame ignition signal) from the controller for the pilot burner must always be connected to the interlock input terminal and start-up input terminal on the controller for the main burner.
5. When the pilot burner or main burner fails to ignite or goes out, the circuit must stop all burners.
Even highly reliable control systems with high levels of performance and functionality cannot eliminate the risk of fire, since they can fail and become unable to control combustion. Unfortunately, improvements in controllability have not meant improvements in safety.

Normally, control and safety instrumentation are separated, so that even if the safety device is relatively inaccurate, one with reliable operation must be used. The relationship between safety and control must allow control to be performed where safety is assured, so the control zone must be an area that is included within the safe zone. This zone is where improvements in control must be made.

Control and safety tend to be thought of as being handled by control devices and safety devices, respectively. However, while this may usually be the case, they are difficult to achieve solely using these devices. The structure and function of the combustion equipment, facilities, etc., are also elements that affect control and safety.

In other words, achieving control and safety is possible only once the three elements of (1) control and safety devices, (2) equipment and facilities, and (3) the location (conditions of installation) are all appropriate. In addition, it is difficult to ensure safety in the case of all equipment or facilities failing or when the installation conditions are no longer met. When safety cannot be assured, we naturally wish to eliminate all failures and breakdowns, but even if all scenarios could be considered, it would still not be possible to absolutely guarantee safety.

With this in mind, it is necessary to carry out regular inspections and maintenance of the equipment to ensure safety. That is, maintenance is also an important component of safety assurance.

In summary, combustion equipment and facilities are objects for control, but they also must be fundamentally safe. To achieve this, the control zone needs to be encircled by the safety zone, and that in turn must be encircled by the maintenance zone. The equipment and facilities, and the control devices (including the flame safeguard control system), and the installation conditions are each elements of control/safety/maintenance.
**Product Line**

**Flame detectors**
- Continuous operation and intermittent operation systems
  - Advanced ultraviolet flame detector
    - AUD300
  - Ultraviolet flame detector *1
    - C7076A
  - C7076D
- Intermittent operation systems
  - Advanced ultraviolet flame detector and socket
    - AUD100/110 + AUD15
  - Visible light frame detector
    - AFD100
    - AFD110

**Limit / Interlock switches**
- Gas pressure switches
  - Gas pressure switch
    - C6097
- Earthquake sensing switches
  - Earthquake sensing switch
    - V-725
    - VBC7000

**Burner controllers**
- Continuous operation and intermittent operation systems
  - Burner interlock module and burner control module
    - RX-L and RX-R
  - Advanced UV relay
    - AUR350
- Intermittent operation systems
  - Flame relay
    - FRS100

**Limit/interlock signal**

*1. C7076A and C7076D are products of Honeywell International Inc.
2. GV-A is a product of Elster GmbH.
3. MAX808, MAX5000 and MAX7000 are products of Maxon Corporation.
4. RV is a product of Maxitrol Company.

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**Overview**

- **Burner controllers**
  - Continuous operation and intermittent operation systems
    - Burner interlock module and burner control module
      - RX-L and RX-R
  - Advanced UV relay
    - AUR350
- **Flame detectors**
  - Continuous operation and intermittent operation systems
    - Advanced ultraviolet flame detector
      - AUD300
    - Ultraviolet flame detector *1
      - C7076A
      - C7076D
  - Intermittent operation systems
    - Advanced ultraviolet flame detector and socket
      - AUD100/110 + AUD15
    - Visible light frame detector
      - AFD100
      - AFD110
- **Limit / Interlock switches**
  - Gas pressure switches
    - Gas pressure switch
      - C6097
  - Earthquake sensing switches
    - Earthquake sensing switch
      - V-725
      - VBC7000

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4. RV is a product of Maxitrol Company.
For detailed specifications, or to learn whether a product is available in a particular country, please contact our sales staff.
Flame Safeguard System: This product is certified as complying with CE marking for use in Europe.

For detailed specifications, or to learn whether a product is available in a particular country, please contact our sales staff.
Flame Safeguard System

Products

- Burner Controllers
- Flame detectors
- Pressure Switch
- Igniter
- Peripheral devices

For detailed specifications, or to learn whether a product is available in a particular country, please contact our sales staff.

- CE: This product is certified as complying with CE marking for use in Europe.
- UL: This product is certified as complying with a U.S. product safety standard.
- CSA: This product is certified as complying with a Canadian product safety standard.
- FM: This product is certified as complying with a U.S. product safety standard.
**RX Series**  | **Burner Interlock Module/Buner Control Module**

The RX Series represents the next generation of combustion safety controllers for burners in industrial furnaces.

The burner interlock module (RX-L) and burner control module (RX-R) combine to provide a variety of interlock monitoring and ignition methods. It is possible to set the interlock monitoring timing or change the ignition method settings by just selecting the preprogrammed safety functions using the PC loader.

Additionally, for flame detection the RX series supports the advanced UV sensor for continuous operation and UV sensor for batch operation, as well as flame rods.

### Features

- **Provides combustion safety to meet the specifications of the combustion equipment**
  - Safety features are tailored to equipment specifications by means of the modular structure and wide range of selectable functions.
  - Provides a variety of preinstalled safety functions, reducing the time spent on safety circuit review and validation.
  - Functions can be selected and executed via the PC loader, without acquiring or creating special software.

- **Conservation of space and wiring**
  - Side connectors between modules carry safety signals such as shutoff commands, eliminating the need for external wiring or relays, saving wiring and space.

- **Maintenance support functions**
  - An operation log (number of starts, operating time, alarm history, etc.) is kept automatically without the need for any special settings.
  - Status can be checked as necessary by connecting the PC loader.
  - Various monitor outputs tailored to the structure of the combustion equipment are implemented, aiding in understanding the maintenance/troubleshooting situation and in determining the cause of a problem.

Product status checks: 7-segment LED display
Front panel indicators: Open collector monitor output
Remote status monitoring: RS-485 (standard feature)

### Buner Interlock Module (RX-L80/90)

- **The roles of the burner interlock module in the combustion safety architecture are the handling of burner interlock monitoring/processing and of the purge function.**
  - A maximum of 32 burner control modules can be combined to easily support multiple burner equipment.
  - This module is also equipped with the ability to connect through RS-485 or Ethernet (only RX-L90) communications, making remote monitoring possible.

- **16 inputs**
  - Individual OFF delay settings (to filter out chattering)
  - Function input (for batch startup, etc.)
  - Flame monitoring changeover for 760 °C or higher

- **Purge functions**
  - Prepurge from 5 s to 60 min (32 selectable patterns)
  - Postpurge setting for any time length
  - Postpurge stop by temperature contacts
  - Blower output
  - Motor control

- **Displays**
  - Status display (7-segment LED)
  - Status display (LED)

- **Monitor output**
  - 22 open collector outputs (freely assignable)
  - RS-485 communication output (standard feature)

- **Ethernet communication (only RX-L90)**

### Buner Control Module (RX-R40/20)

- **The roles of the burner control module in the combustion safety architecture are the ignition, flame monitoring, and safety shutoff functions.**
  - This unit can be combined with the burner interlock module to support a variety of combustion equipment.

- **Ignition functions (for the 3 models below)**
  - Models with selectable ignition sequences (RX-R40/20)
    - Interrupted pilot, intermittent or continuous pilot, direct ignition, flame relay function (selection by PC loader)
    - Independent supervision model (RX-44)
      - For independent supervision of the pilot and main burner, the RX-R44 and RX-R40 are used together.
    - Independent supervision and external relay drive model (RX-46)
      - For control of high-frequency loads using time proportional control, ON-OFF control, etc.
    - Direct ignition and external relay drive model (RX-R22)
      - For control of high-frequency loads using the direct ignition method

- **Interlock input**
  - 4 inputs

- **Main unit displays**
  - Status display (7-segment LED)
  - Status display (LED)

- **Monitor output**
  - 11 open collector outputs (freely assignable)
RX Series | Burner Interlock Module/Burner Control Module

Sample configurations of single and multiburner systems

Single burner system

- Status output
  - Open collector output
  - Communication output
- Interlock input
  - 16 inputs
  - Off-delay can be set to prevent detection of chattering
- Ignition command
- Flame detection input
- Safety shutoff output
- Burner control module
- Burner interlock module
- Control panel
- Monitor information (open collector info)

Multiburner system

- Batch ignition/extinction by the burner interlock module is possible
- 1 burner interlock module controls 16 burner control modules
- Zone purging
- Modular structure with side connectors minimizes wiring
- Zone 1, Zone 2, Zone 3
- Workpiece entry
- Workpiece exit
- Safety shutoff valve
- Flame detector
- Air
- Gas
- Burner control module
- Burner interlock module
- Ignition command
- Blower
- Interlock
The RX-L80, in combination with the burner control module (RX-R), executes the burner interlock monitoring and prepurge functions. There are 16 inputs for burner interlock. In addition to interlock input, this module can handle batch starting of multiple burners or batch ignition of multiple pilot burners. Status information such as the state of interlocks, alarms, completed purges, etc., can be assigned to 22 transistor outputs and utilized by outputting to control panel indicator lamps or to a PLC for status monitoring. These functions can be selected easily using the computer loader, without the use of special programs. This product is equipped with RS-485 or Ethernet (only RX-L90) for the communications function. Remote monitoring is possible with this device.

**Specifications**

<table>
<thead>
<tr>
<th>Operating environment</th>
<th>Ambient temperature</th>
<th>Storage temperature</th>
<th>Shock</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>-20 to +55 °C</td>
<td>-20 to +70 °C</td>
<td>0 to 0.8 m/s²</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Electrical specifications</th>
<th>Rated voltage</th>
<th>Allowable supply voltage</th>
<th>Power consumption</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>24 Vdc</td>
<td>21.6 to 26.4 Vdc</td>
<td>9 W max.</td>
</tr>
</tbody>
</table>

- **Diode strength**: DC circuit terminals
- **Dielectric strength**: 1500 Vac for 1 min between power terminals H & G and relay outputs H & G on the one hand, and DC circuit terminals & connectors, transistor output terminals and DC circuit terminals & connectors

- **Isolation resistance**: between power terminals H & G and relay outputs H & G on the one hand, and DC circuit terminals & connectors, transistor output terminals and DC circuit terminals & connectors, Between control motor output terminals and DC circuit terminals & connectors

- **Operating life**: 7 years of continuous use, 10 years of use 8 hours per day, or 100,000 relay contact operations (at 65 °C)

- **Startup input**: Contact input (24 Vdc, 10 mA)
- **Reset input**: Contact input (24 Vdc, 10 mA)
- **Interlock input**: Contact input (24 Vdc, 20 mA)
- **Relay output**: 400 VA (with relay contact welding detection) *1
- **Blower output**: 350 VA
- **Control motor output**: 110 VA
- **Monitor outputs (transistor outputs)**: 22 (0.1 A max. each, 1 A max./module, 30 Vdc max.)

<table>
<thead>
<tr>
<th>Communication specifications</th>
<th>RS-485 communications</th>
<th>Communication protocol</th>
<th>Signal level</th>
<th>Maximum cable length</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>RS-485-compliant</td>
<td>CPL</td>
<td></td>
<td>500 m</td>
</tr>
</tbody>
</table>

| Ethernet communications Protocol | Multi-drop, start/stop synchronization | External (150 Ω, 1/2 W min.) | 58400 bps max. |

**Optional Parts (sold separately)**

- **Transmitter output connector**: Made by Fujitsu Components
- **Control signal connector**: Made by Wiedmuller (qty. 2)
- **Smart Loader Package**: Made by Wiedmuller (qty. 2)
- **Surge absorber**: Made by Wiedmuller (qty. 2)

**Model Selection**

<table>
<thead>
<tr>
<th>Item Model No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>RX-L80A1010010</td>
<td>RS-485 communications</td>
</tr>
<tr>
<td>RX-L80A101010D</td>
<td>RS-485 + inspection certificate</td>
</tr>
<tr>
<td>RX-L90A1010010</td>
<td>RS-485 and Ethernet</td>
</tr>
<tr>
<td>RX-L90A101010D</td>
<td>RS-485 and Ethernet + inspection certificate</td>
</tr>
</tbody>
</table>

**Dimensions**

(Unit: mm)

---

*1. Cannot be used for dry output. For relay output, be sure to connect an AC power load (10 VA min.).
*2. Safety and control devices for gas burners and gas burning appliances.
RX-R40/20 Burner Control Module

The RX-R40/20, in combination with the RX-L burner interlock module and flame detector, handles ignition operations and flame monitoring. If the burner flame goes out, this module executes shutoff safely.

This product supports a variety of flame detectors, including the Advanced UV Sensor (for continuous operation) as well as flame rods.

There are 11 open connector outputs to be used for monitoring, which can be assigned to handle alarms such as ignition failure or flame failure, in addition to the status of the load.

These monitor outputs can be output to the control panel so that the status output and situation can be checked onsite during maintenance or when a sudden problem arises.

These functions can be selected easily using the computer loader, without the use of special programs.

### Specifications

<table>
<thead>
<tr>
<th>Operation modes</th>
<th>Continuous operation (RX-R40 series), batch operation (RX-R20 series)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compatible flame detectors</td>
<td>AUD100 series, AUD300/500C</td>
</tr>
<tr>
<td>Models</td>
<td>Models with selectable ignition sequences (RX-R40/20)</td>
</tr>
<tr>
<td>Sequence timing</td>
<td>Pilot ignition time: 5 s</td>
</tr>
<tr>
<td>Flame voltage range (at standard temperature and humidity and rated voltage)</td>
<td>With flame: 1.5 to 4.0 Vdc</td>
</tr>
<tr>
<td>Electrical specifications</td>
<td>Rated voltage: 24 Vdc</td>
</tr>
<tr>
<td>Load rating</td>
<td>Allowable voltage: 100/200/220 Vac (depending on the model No.)</td>
</tr>
<tr>
<td>Power consumption</td>
<td>9 W max.</td>
</tr>
<tr>
<td>Dielectric strength</td>
<td>DC terminals: 500 Vac for 1 min. or 600 Vac for 1 s</td>
</tr>
<tr>
<td>Insulation resistance</td>
<td>50 MΩ min. with a 500 Vdc megger</td>
</tr>
<tr>
<td>Operating life</td>
<td>7 years of continuous use or 100,000 relay contact operations at 25°C</td>
</tr>
<tr>
<td>Startup input</td>
<td>Contact input (24 Vdc, 10 mA)</td>
</tr>
<tr>
<td>Reset input</td>
<td>Contact input (24 Vdc, 20 mA)</td>
</tr>
<tr>
<td>Interlock input</td>
<td>Contact input (24 Vdc, 20 mA)</td>
</tr>
<tr>
<td>Monitor outputs</td>
<td>11 (each 0.1 A max., 0.8 A max./module, 30 Vdc max.)</td>
</tr>
<tr>
<td>General specifications</td>
<td>Mass: Approx. 660 g</td>
</tr>
<tr>
<td>Wire and cable specifications</td>
<td>Flame detector: AUD100 series, AUD 300/500C</td>
</tr>
<tr>
<td>Wire: 600 V indoor PVC insulation (9V wire, JIS C3010)</td>
<td></td>
</tr>
<tr>
<td>Flame rod: Signal wire F: G: 0.2 to 1.5 mm² (28-14 AWG)</td>
<td></td>
</tr>
</tbody>
</table>

### Dimensions

<table>
<thead>
<tr>
<th>Signal</th>
<th>Cable type</th>
<th>Max. cable length</th>
</tr>
</thead>
<tbody>
<tr>
<td>RX-R control signal</td>
<td>0.3 to 1.25 mm² (22-16 AWG)</td>
<td>50 m</td>
</tr>
<tr>
<td>Reset signal</td>
<td>0.3 to 1.25 mm² (22-16 AWG)</td>
<td>10 m</td>
</tr>
<tr>
<td>Start signal</td>
<td>0.2 to 1.5 mm² (28-14 AWG)</td>
<td>200 m</td>
</tr>
</tbody>
</table>

* EN 298: Automatic gas burner control systems for gas burners and gas burning appliances with or without fans.
### Overview of settings

<table>
<thead>
<tr>
<th>Setting</th>
<th>No</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model type settings</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Combustion mode selection</td>
<td>1-1</td>
<td>Selects the combustion mode.</td>
</tr>
<tr>
<td>RX-R purge conditions</td>
<td>1-2</td>
<td>Validates air pressure with operation check ON/OFF.</td>
</tr>
<tr>
<td>Pilot ignition time</td>
<td>1-3</td>
<td>Selects a pilot ignition time.</td>
</tr>
<tr>
<td>(Not used)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>760 °C mode setting</td>
<td></td>
<td>Selects whether or not 760 °C mode is used.*3</td>
</tr>
<tr>
<td>Control settings</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Startup conditions</td>
<td>2-1</td>
<td>Selects startup conditions for RX-R.</td>
</tr>
<tr>
<td>Reset conditions</td>
<td>2-2</td>
<td>Selects conditions for canceling lockout.</td>
</tr>
<tr>
<td>Standby time after recovery</td>
<td>2-3</td>
<td>Selects the standby time before ignition when restarting a locked-out RX-R. The process will not proceed during standby, even if a startup signal is received.</td>
</tr>
<tr>
<td>Startup delay time</td>
<td>2-4</td>
<td>Sets a delay time for beginning the start check.</td>
</tr>
<tr>
<td>Air valve OFF delay time</td>
<td>2-5</td>
<td>Sets the air valve OFF delay time for combustion.*4</td>
</tr>
<tr>
<td>for combustion</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Timeout time for air pressure</td>
<td>2-6</td>
<td>Sets a timeout time if there is a failure to confirm that the air pressure switch input is OFF during the start check.*2</td>
</tr>
<tr>
<td>OFF confirmation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Input functions</td>
<td>3-1</td>
<td>Selects the input functions of RX-R1 to RX-R4.</td>
</tr>
<tr>
<td>Interlock OFF delay</td>
<td>3-2</td>
<td>Selects the OFF delay time for RX-R1 to RX-R4.</td>
</tr>
<tr>
<td>RX-R station address</td>
<td>4-1</td>
<td>Sets the RX-R control communication station address.</td>
</tr>
<tr>
<td>Monitor output settings</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flicker setting</td>
<td>5-1</td>
<td>Selects a flicker display for an interlocked output (ON/OFF alternating output).</td>
</tr>
<tr>
<td>Monitor output settings</td>
<td>5-2</td>
<td>Selects signals for assignment to monitor outputs 1 through 11 (M-1 to M-11).</td>
</tr>
<tr>
<td>Monitor output logic</td>
<td>5-3</td>
<td>Sets monitor output logic (direct, reverse), excluding alarm output (MS-AL-P, MS-AL-N).</td>
</tr>
<tr>
<td>Display settings</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Warning display settings</td>
<td>6-1</td>
<td>Selects a warning display method for the 7-segment LED on front of the module.</td>
</tr>
</tbody>
</table>

*1. Valid with the following settings: RX-R purge conditions (1-2) = "ON"  
*2. Valid when RX-R purge conditions (1-2) = "ON"  
*3. 760 °C mode is disabled for the RX-R20 series regardless of settings.

### Model Selection

#### Models with selectable ignition sequence RX-R40/20

<table>
<thead>
<tr>
<th>Model No.</th>
<th>Flame detector</th>
<th>Flame response</th>
<th>Load power</th>
</tr>
</thead>
<tbody>
<tr>
<td>RX-R40C13100</td>
<td>AUD300C/500C</td>
<td>3 ± 1 s *1</td>
<td>102 Vac</td>
</tr>
<tr>
<td>RX-R40C13200</td>
<td>AUD300C/500C</td>
<td>200 Vac</td>
<td></td>
</tr>
<tr>
<td>RX-R40C13600</td>
<td>AUD300C/500C</td>
<td>220 Vac</td>
<td></td>
</tr>
<tr>
<td>RX-R40C13100</td>
<td>AUD100/110</td>
<td>3 ± 1 s *1</td>
<td>102 Vac</td>
</tr>
<tr>
<td>RX-R40C13200</td>
<td>AUD100/110</td>
<td>200 Vac</td>
<td></td>
</tr>
<tr>
<td>RX-R40B13100</td>
<td>Flame rod</td>
<td>3 ± 1 s *2</td>
<td>102 Vac</td>
</tr>
<tr>
<td>RX-R40B13200</td>
<td>Flame rod</td>
<td>200 Vac</td>
<td></td>
</tr>
<tr>
<td>RX-R40B13600</td>
<td>Flame rod</td>
<td>220 Vac</td>
<td></td>
</tr>
</tbody>
</table>

*1. At a flame voltage of 3 V  
*2. At a flame voltage of 2 V  
*3. 760 °C mode is disabled.

#### Individual monitoring model RX-R44

<table>
<thead>
<tr>
<th>Model No.</th>
<th>Flame detector</th>
<th>Flame response</th>
<th>Load power</th>
</tr>
</thead>
<tbody>
<tr>
<td>RX-R44C13100</td>
<td>AUD300C/500C</td>
<td>3 ± 1 s *1</td>
<td>102 Vac</td>
</tr>
<tr>
<td>RX-R44C13200</td>
<td>AUD300C/500C</td>
<td>200 Vac</td>
<td></td>
</tr>
<tr>
<td>RX-R44C13600</td>
<td>AUD300C/500C</td>
<td>220 Vac</td>
<td></td>
</tr>
<tr>
<td>RX-R44B13100</td>
<td>Flame rod</td>
<td>3 ± 1 s *2</td>
<td>102 Vac</td>
</tr>
<tr>
<td>RX-R44B13200</td>
<td>Flame rod</td>
<td>200 Vac</td>
<td></td>
</tr>
</tbody>
</table>

*1. At a flame voltage of 3 V  
*2. At a flame voltage of 2 V  
*3. 760 °C mode is disabled.

#### Individual monitoring, external relay drive model RX-R46

<table>
<thead>
<tr>
<th>Model No.</th>
<th>Flame detector</th>
<th>Flame response</th>
<th>Load power</th>
</tr>
</thead>
<tbody>
<tr>
<td>RX-R46C13100</td>
<td>AUD300C/500C</td>
<td>3 ± 1 s *1</td>
<td>102 Vac</td>
</tr>
<tr>
<td>RX-R46C13200</td>
<td>AUD300C/500C</td>
<td>200 Vac</td>
<td></td>
</tr>
<tr>
<td>RX-R46C13600</td>
<td>AUD300C/500C</td>
<td>220 Vac</td>
<td></td>
</tr>
</tbody>
</table>

*1. At a flame voltage of 3 V  
*2. At a flame voltage of 2 V  
*3. 760 °C mode is disabled.

#### Direct ignition, external relay drive model RX-R22

<table>
<thead>
<tr>
<th>Model No.</th>
<th>Flame detector</th>
<th>Flame response</th>
<th>Load power</th>
</tr>
</thead>
<tbody>
<tr>
<td>RX-R22C13100</td>
<td>AUD100/110</td>
<td>3 ± 1 s *1</td>
<td>102 Vac</td>
</tr>
<tr>
<td>RX-R22C13200</td>
<td>AUD100/110</td>
<td>200 Vac</td>
<td></td>
</tr>
</tbody>
</table>

*1. At a flame voltage of 3 V  
*2. At a flame voltage of 2 V  
*3. 760 °C mode is disabled.
The AUD300C1000 Advanced Ultraviolet Flame Detector is designed to detect ultraviolet radiation from an oil or gas burner flame, for use with both batch and continuous operation. The AUD300C is used in combination with a dedicated burner controller. By means of the built-in shutter, any malfunction of the UV flame detector or burner controller is detected by the continuous self-checking (Dynamic Self-Check) function, ensuring highly reliable combustion safety control.

**Specifications**

- **Applicable types of flames**
  - Gas: Natural gas, Propane gas, Kerosene, Heavy oil
  - Coke oven gas, Hydrogen, Chlorine, Ammonia, Naphtha, Ethylene, etc.

- **Combined burner controller**
  - RX-R40, RX-R45, RX-R60, RX-R65, RX-R100, RX-R150C, RX-R200C, RX-R100C, RX-R150C

- **Shutter voltage**
  - Approx. 24 Vdc (supplied from Burner Controller)

- **Self-checking cycle**
  - Approx. 75 cycles/min.

- **Insulation resistance**
  - Between flange unit mounting conduit and G-terminal (or blue lead wire), between flange unit mounting conduit and S1-terminal (or white lead wire), between flange unit mounting conduit and S2-terminal (or white lead wire), between flange unit mounting conduit and G-terminal (or yellow lead wire): 50 MΩ min. by 500 Vdc megger at the above each location. (However, the tube unit must be removed.)

- **Dielectric strength**
  - Between flange unit mounting conduit and F-terminal (or blue lead wire), between flange unit mounting conduit and G-terminal (or yellow lead wire): 1500 Vac for 1 min or 1800 Vac for 1 sec at the above each location. (However, the tube unit must be removed.)

- **During flame detection (while the shutter is opening and closing)**
  - -20°C to +120°C
  - However, when no flame is detected (shutter continuously open), the maximum ambient operating temperature is 100°C.

- **Ambient storage temperature**
  - -20°C to +70°C

- **Ambient humidity**
  - 90%RH at 40°C max. (without condensation)

- **Vibration resistance**
  - 4.9 m/s² max., 10 to 55 Hz for 2 hours each in X, Y and Z directions

- **Impact resistance**
  - 20.5 m/s²

- **Pressure resistance for flange**
  - 350 kPa

- **Protection**
  - IP66 (except a conduit tube connection port)

- **Mounting posture**
  - -45° to +90° (in vertical direction)

- **Mounting section**
  - G1 (at the mounting section for sighting pipe)

- **Mounting section dimensions**
  - φ38.6, 21.5, 88

- **Electric wire pipe mounting conduit**
  - 1/2-14NPSM

- **Lead wires**
  - AWG18 heat resistant silicone cables, with 2.4 m color lead wires

- **Flame signal wire requirements and extension distance**
  - Requirements: 600 V vinyl insulation wires, IV wires with 2.0 mm², Max. 200 m

- **Materials**
  - Main body: Heat resistant resin
  - Mounting section: Aluminum
  - Main body color: Purple (equivalent to DIC257)
  - Weight: Approx. 630 g

- **Expiration date of tube unit and shutter unit**
  - 3 years

- **Standards compliance**
  - CE, UL, CSA

- **Maintenance Parts (sold separately)**
  - AUD Maintenance Kit
    - No inspection certificate
    - AUD Maintenance Kit (includes shutter and tube unit)
  - Inspection certificate included
    - AUD Maintenance Kit

**Model Selection**

<table>
<thead>
<tr>
<th>Item</th>
<th>Model No.</th>
<th>Lens type</th>
<th>Additional features</th>
<th>Special treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Advanced ultraviolet flame detector</td>
<td>AUD300C100D</td>
<td>Standard</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>AUD300C100T</td>
<td>None</td>
<td>Inspection certificate provided</td>
<td>None</td>
<td></td>
</tr>
<tr>
<td>AUD300C100DT</td>
<td>None</td>
<td>Inspection certificate provided</td>
<td>None</td>
<td></td>
</tr>
<tr>
<td>AUD300C110D</td>
<td>None</td>
<td>Tropicalization</td>
<td>None</td>
<td></td>
</tr>
<tr>
<td>AUD300C110T</td>
<td>None</td>
<td>Inspection certificate provided</td>
<td>None</td>
<td></td>
</tr>
<tr>
<td>AUD300C1100</td>
<td>None</td>
<td>Inspection certificate provided</td>
<td>None</td>
<td></td>
</tr>
<tr>
<td>AUD300C110DT</td>
<td>None</td>
<td>Inspection certificate provided</td>
<td>None</td>
<td></td>
</tr>
</tbody>
</table>

**Optional Parts (sold separately)**

<table>
<thead>
<tr>
<th>Item</th>
<th>Model No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bushing</td>
<td>81409780-001</td>
</tr>
<tr>
<td>Packing nut</td>
<td>81409482-001</td>
</tr>
</tbody>
</table>

**Dimensions**

![Dimensions image](image)

**AUD Maintenance Kit**

(Model No.: AUD60A1000)

- The AUD maintenance kit includes the assembled tube unit and shutter unit, as well as consumables such as the main unit flange and O-ring for the cover, expiration label, etc.
- 1:Expiration date label

![Maintenance Kit image](image)

For further details, please refer to specifications sheet No. CP-SS-1806E.
The AUD500C Explosion-Proof Advanced Ultraviolet Flame Detector (hereafter referred to as the AUD500C) is designed to detect ultraviolet radiation from an oil or gas burner flame, for use with both batch and continuous operation. The AUD500C is used in combination with a dedicated burner controller. By means of the built-in shutter, any malfunction of the UV flame detector or burner controller is detected by the continuous self-checking (Dynamic Self-Check) function, ensuring highly reliable combustion safety control.

## Specifications

<table>
<thead>
<tr>
<th>Item</th>
<th>Accessory cable length</th>
<th>Lens type</th>
<th>Model No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Advanced ultraviolet flame detector</td>
<td>3 m</td>
<td>Standard</td>
<td>AUD500C1100</td>
</tr>
<tr>
<td></td>
<td>3 m</td>
<td>Condenser</td>
<td>AUD500C1110</td>
</tr>
<tr>
<td></td>
<td>10 m</td>
<td></td>
<td>AUD500C1111</td>
</tr>
</tbody>
</table>

Replace the blank (_ _) in the model number with one of the following below.

- Standard product
- Inspection certificate included
- IP1: Tropicalization
- IP2: Inspection certificate + Tropicalization
- Y: Traceability certificate included
- E: Heavy duty coating + inspection certificate

## Optional parts (sold separately)

Note: This item is necessary.  

<table>
<thead>
<tr>
<th>Item</th>
<th>Model No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adapter (G2-1/4 × R1)</td>
<td>81441151-001</td>
</tr>
</tbody>
</table>

## Dimensions

(Unit: mm)

### Body

- Cover setscrew: (width across flat: 2)
- Name plate: (width across flat: 2)
- Outside earth screw M4

### Bushing

- Plug with hexagon socket (width across flat: 2)
- Plug with hexagon socket (width across flat: 2)
- Packing: (width across flat: 2)
- Packing: (width across flat: 2)

## Maintenance parts (sold separately)

<table>
<thead>
<tr>
<th>Item</th>
<th>Model No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>AUD Maintenance Kit (includes shutter and tube units)</td>
<td>AUD60A1010</td>
</tr>
</tbody>
</table>

## AUD Maintenance Kit

(Model No: AUD60A1010)

The AUD60A1010 maintenance kit includes the assembled shutter unit and tube unit, as well as consumables such as the AUD500C main unit and flame detector, and high-quality packing.

1. For further details, please refer to specifications sheet No. CP-SS-1873E.

2. For expanded information, please refer to the manual (model number: UDS180).

3. The AUD60A1010 maintenance kit includes the assembled shutter unit and tube unit, as well as consumables such as the AUD500C main unit and flame detector, and high-quality packing.

4. For further details, please refer to specifications sheet No. CP-SS-1873E.
The AUD100/110 is a dedicated socket for the AUD15 tube unit, and is designed for monitoring batch operation oil or gas burner combustion. Two models, the AUD100 lead-wire model and the AUD110 terminal block model, are available to meet wiring or installation requirements.

### Specifications

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Applicable type of fuel</strong></td>
<td>City gas, natural gas, propane gas, kerosene, heavy oil, coke oven gas, hydrogen, chlorine, ammonia, naphtha, ethylene, etc.</td>
</tr>
<tr>
<td><strong>Mass</strong></td>
<td>AUD100C: Approx. 130 g (with the AUD15: approx. 140 g)</td>
</tr>
<tr>
<td></td>
<td>AUD110C: Approx. 130 g (with the AUD15: approx. 140 g)</td>
</tr>
<tr>
<td><strong>Materials</strong></td>
<td>Aluminum (Socket: Aluminum)</td>
</tr>
<tr>
<td><strong>Insulation resistance</strong></td>
<td>50 MΩ min by 500 Vac megger (between each lead wire and the metal part of socket when the AUD15 is removed)</td>
</tr>
<tr>
<td><strong>Dielectric strength</strong></td>
<td>1500 Vac for 1 min or 1800 Vac for 1 s (between each lead wire and the metal part of socket when the AUD15 is removed)</td>
</tr>
<tr>
<td><strong>Ambient temperature</strong></td>
<td>-20 to +120 °C</td>
</tr>
<tr>
<td><strong>Ambient humidity</strong></td>
<td>90 % RH at 40 °C (without condensation)</td>
</tr>
<tr>
<td><strong>Allowable pressure</strong></td>
<td>35 kPa</td>
</tr>
<tr>
<td><strong>Vibration resistance</strong></td>
<td>5 m/s² max. (10 to 60 Hz for 2 hours each in X, Y and Z directions)</td>
</tr>
<tr>
<td><strong>Protection</strong></td>
<td>IP65 (JIS C 0920/IEC 60529) with pipes and wires connected</td>
</tr>
<tr>
<td><strong>Mounting nut</strong></td>
<td>G1 (R1 and 1-11BSP are connectable)</td>
</tr>
<tr>
<td><strong>Lead wires</strong></td>
<td>AWG #18 (approx. 1.2 mm²) flame retardant cross-linked polyethylene insulated cable, approx. 1800 mm long (blue and white) (only AUD100)</td>
</tr>
<tr>
<td><strong>Conduit</strong></td>
<td>G1/2 (1/2-14BSPP is connectable)</td>
</tr>
<tr>
<td><strong>Flame signal wire</strong></td>
<td>Standard: 2.0 mm², 600 Vac cable with PVC insulation (&quot;IV cable&quot;). Max. length: approx. 200 m</td>
</tr>
</tbody>
</table>

### Model Selection

<table>
<thead>
<tr>
<th>Item</th>
<th>Model No.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Lead-wire model without the AUD15</strong></td>
<td>AUD100C100C</td>
</tr>
<tr>
<td><strong>Lead-wire model with the AUD15</strong></td>
<td>AUD100C1000-A15</td>
</tr>
<tr>
<td><strong>Terminal block model without the AUD15</strong></td>
<td>AUD110C100C</td>
</tr>
<tr>
<td><strong>Terminal block model with the AUD15</strong></td>
<td>AUD110C1000-A15</td>
</tr>
</tbody>
</table>

Replace the blank ( _ ) in the model number with one of the for choices below:

- O: Standard
- D: Inspection certificate
- T*: Tropicalization treatment
- B*: Inspection certificate + tropicalization treatment
- * Only AUD110 Series

### Optional parts (sold separately)

<table>
<thead>
<tr>
<th>Item</th>
<th>Model No.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Tube unit (ultraviolet photoelectric tube)</strong></td>
<td>AUD15C1000</td>
</tr>
<tr>
<td><strong>Seal adapter</strong></td>
<td>81403159</td>
</tr>
<tr>
<td><strong>Analog flame meter</strong></td>
<td>FSP13BA100</td>
</tr>
<tr>
<td><strong>Flame simulator</strong></td>
<td>FSP300C100</td>
</tr>
<tr>
<td><strong>Lens unit (local length: 70 mm)</strong></td>
<td>FSP100L70000</td>
</tr>
<tr>
<td><strong>Lens unit (local length: 70 mm) with inspection certificate</strong></td>
<td>FSP100L7000D</td>
</tr>
<tr>
<td><strong>Lens unit (local length: 30 mm)</strong></td>
<td>FSP100L30000</td>
</tr>
<tr>
<td><strong>Lens unit (local length: 30 mm) with inspection certificate</strong></td>
<td>FSP100L3000D</td>
</tr>
</tbody>
</table>

*1. AUD15C1000

*2: Seal adapter (model No. 81403159) Refer to the following dimensions

For further details, please refer to specifications sheet No. CP-SS-1877E.
**AFD100A/B** **Visible Light Frame Detector**

The AFD100A/B visible light flame detector is a batch operation flame sensor that detects visible light from an oil combustion burner flame. There are two different types for different burner constructions, depending on whether the light is received from the front or side.

Be sure to combine this product with the burner controller appropriate for the AFD100.

### Specifications

<table>
<thead>
<tr>
<th>Model</th>
<th>Direction light received</th>
<th>Type</th>
<th>Compatible Burner controller</th>
</tr>
</thead>
<tbody>
<tr>
<td>AFD100A0700</td>
<td>Top view</td>
<td>AFD100</td>
<td>R4424 or R4440H series product that supports AFD</td>
</tr>
<tr>
<td>AFD100B0700</td>
<td>Side view</td>
<td>AFD100</td>
<td></td>
</tr>
</tbody>
</table>

#### Illuminance-current characteristics

(Conditions: VR = 5 V, at 25 °C)

- **Dark characteristics**: In total darkness (0 lx), 24 μA or lower.
- **Dielectric strength**: Commercial frequency 500 V~ac, applied for 1 minute with no abnormalities.
- **Insulation resistance**: With a 500 V~ac megger, 50 MΩ or more.

#### Allowable ambient temperature

-20 to +60 °C

#### Storage temperature

-20 to +70 °C

#### Allowable ambient humidity

40 °C, 90 % RH or less (without condensation)

#### Vibration resistance

Double amplitude 4.9 m/s², 10-55 Hz, 2 hours each in X, Y, Z directions

#### Cable

- Heat-resistant flat plastic cable, 0.75 mm²
- Black (terminal F), white (terminal G)

#### Material

- Main unit: flange: nylon 6 (blue)

#### Mass

Approx. 25 g

### Model Selection

<table>
<thead>
<tr>
<th>Item</th>
<th>Type</th>
<th>Model No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visible light flame detector</td>
<td>Top view</td>
<td>AFD100A0700</td>
</tr>
<tr>
<td></td>
<td>Side view</td>
<td>AFD100B0700</td>
</tr>
</tbody>
</table>

### Optional Parts (sold separately)

<table>
<thead>
<tr>
<th>Item</th>
<th>Model No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C554A1299-1 compatible replacement adapter</td>
<td>81447108-001</td>
</tr>
<tr>
<td>C554A1665-1 compatible replacement adapter</td>
<td>81447108-002</td>
</tr>
</tbody>
</table>

### Dimensions

(Units: mm)

- Sensing surface: 14.3 mm
- Cable length: 700 mm ±25 mm

- AFD100A0700 (top view type)
- AFD100B0700 (side view type)
AFD110A Visible Light Flame Detector

The AFD110A visible light flame detector is a batch operation flame sensor that detects visible light from an oil combustion burner flame.

This product must be combined with an AFD-compatible Burner controller.

---

### Specifications

<table>
<thead>
<tr>
<th>Item</th>
<th>Model No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visible light flame detector</td>
<td>AFD110A0000</td>
</tr>
</tbody>
</table>

**Visible light flame detector**

<table>
<thead>
<tr>
<th>Item</th>
<th>Model No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Replacement sensor</td>
<td>AFD100A0035</td>
</tr>
</tbody>
</table>

**Replacement sensor**

**Dimensions**

(Unit: mm)
The C6097A gas pressure switch is a pressure detector for city gas, natural gas, LP gas and air.

The external electrical circuit is turned on or off according to the preset value.

This device can be used in a variety of ways including detection of maximum/minimum gas/air pressure supplied to the gas burning device, burner blower interlock, or filter clogging.

As a supplementary part (sold separately), there is a switch-action display light for switching the gas pressure.

### Specifications

<table>
<thead>
<tr>
<th>Applicable fluids</th>
<th>Natural gas, liquefied petroleum gas, and air</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Model</strong></td>
<td>C6097A0110 C6097A0210 C6097A0310 C6097A0410 C6097A0510</td>
</tr>
<tr>
<td><strong>Setting range</strong></td>
<td>0 to 1 kPa 0.25 to 5 kPa 3 to 15 kPa 10 to 50 kPa 10 to 70 kPa</td>
</tr>
<tr>
<td><strong>On-off differential (nominal value)</strong></td>
<td>40 Pa (fixed) 60 Pa (fixed) 280 Pa (fixed) 700 Pa (fixed) 800 Pa (fixed)</td>
</tr>
<tr>
<td><strong>Maximum Allowable pressure</strong></td>
<td>20 kPa 30 kPa 50 kPa 150 kPa 150 kPa</td>
</tr>
<tr>
<td><strong>Setting accuracy</strong></td>
<td>0.1 ±0.06 kPa, 1 ±0.15 kPa 0.25 ±0.15 kPa, 5 ±0.75 kPa 3 ±0.9 kPa, 15 ±2.25 kPa 10 ±2.4 kPa, 50 ±7.5 kPa 10 ±3 kPa, 70 ±8.8 kPa</td>
</tr>
<tr>
<td><strong>Output</strong></td>
<td>SPDT contact output</td>
</tr>
<tr>
<td><strong>Contact rating</strong></td>
<td>Resistive load: 250 Vac, 5 A Inductive load: 250 Vac, 3 A (power factor: 0.6)</td>
</tr>
<tr>
<td><strong>Insulation resistance</strong></td>
<td>100 MΩ min. between each terminal and non-live metal part with a 500 Vdc megger</td>
</tr>
<tr>
<td><strong>Dielectric strength</strong></td>
<td>Below terminals with the same polarity: 1000 Vac, 50/60 Hz for 1 min Below each terminal and non-electrically charged metal parts: 1500 Vac, 50/60 Hz for 1 min</td>
</tr>
<tr>
<td><strong>Contact resistance</strong></td>
<td>Initial 100 mΩ max. (measured by voltage drop method at 6–8 Vdc and 1 A)</td>
</tr>
<tr>
<td><strong>Fluid temperature</strong></td>
<td>-15 to +60 °C (without freezing or condensation)</td>
</tr>
<tr>
<td><strong>Ambient temperature</strong></td>
<td>-15 to +60 °C (without freezing or condensation)</td>
</tr>
<tr>
<td><strong>Durability</strong></td>
<td>Over 100,000 operations at the rated contact voltage and current</td>
</tr>
<tr>
<td><strong>Wiring terminal</strong></td>
<td>M3.5 screw terminal</td>
</tr>
<tr>
<td><strong>Installation direction</strong></td>
<td>Vertical, or horizontal with the pressure setting dial facing upwards</td>
</tr>
<tr>
<td><strong>Protection</strong></td>
<td>IP41</td>
</tr>
<tr>
<td><strong>Mass</strong></td>
<td>260 g</td>
</tr>
<tr>
<td><strong>High-pressure gas contacting material</strong></td>
<td>Die-cast aluminum (housing), NBR/white rubber (diaphragm)</td>
</tr>
<tr>
<td><strong>Accessories (sold separately)</strong></td>
<td>Switch operation indicator lamp (100/200 Vac) Model No.: 81404156</td>
</tr>
</tbody>
</table>

### Optional Parts (sold separately)

<table>
<thead>
<tr>
<th>Item</th>
<th>Model No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Switch operation indicator lamp (100/200 Vac)</td>
<td>81404156</td>
</tr>
</tbody>
</table>

### Wiring

**For a pressure rise:**
- Terminals 3–1 open
- Terminals 3–2 closed

**For a pressure drop:**
- Terminals 3–1 closed
- Terminals 3–2 open

Note: Use M4 self-tapping screw or provide the hole with M4 threads before use.

---

**Dimensions**

- **Housing:** Die-cast aluminum
- **Monitoring pressure gauge port:** Rp 1/4 high-pressure port with plug (use 6 mm hex wrench)
- **Low-pressure port:** Rp 1/8
- **Rp 1/4 high-pressure port:** 3 unthreaded holes for bracket installation (depth 8)

Note: Remove the dust seal before use.
S7200A High Power Igniter

The S7200A igniter is a solid-state, high performance ignition transformer used with business and industrial oil-fired gun-type burners and gas-fired power burners. Compared with our other products, this unit has twice the ignition energy, equivalent to the amount of a coil ignition transformer, therefore making it possible to use this transformer with burners that previously could be ignited only by using a coil ignition transformer.

Compared to the S720, the high-voltage cable can be extended to 2 meters, and at that length the power does not drop.

**Specifications**

<table>
<thead>
<tr>
<th>Applicable burner</th>
<th>Oil-fired gun-type burner</th>
<th>Gas-fired power burner</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
<td>S7200A100−OHR</td>
<td>S7200A200−OHR</td>
</tr>
<tr>
<td>Model</td>
<td>S7200A200−OHR</td>
<td>S7200A100−GHR</td>
</tr>
<tr>
<td>Model</td>
<td>S7200A200−GHR</td>
<td></td>
</tr>
<tr>
<td>Rated power and voltage</td>
<td>100 Vac 50-60 Hz</td>
<td>200 Vac 50-60 Hz</td>
</tr>
<tr>
<td>No. of electrodes</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Recommended air speed</td>
<td>10 x 15 m/s</td>
<td>10 x 15 m/s</td>
</tr>
<tr>
<td>Time rating</td>
<td>60 min, 50 % *1</td>
<td>6 min, 20 %</td>
</tr>
</tbody>
</table>

*Note: The percentage figure is the allowable usage rate for continuous ignition. For example, 6 min, 20 % means that 1.2 min is the max. continuous discharge time (4.8 min-total).

**Characteristics**

- Half-wave
- High-voltage side connection: Bullet terminal
- Grounding method: Neutral ground
- Ground terminal: One ground wire

**Power consumption**

- S7200A100−OHR: 70 VA
- S7200A200−OHR: 75 VA
- S7200A100−GHR: 55 VA
- S7200A200−GHR: 65 VA

**Mass**

- Approx. 650 g

**Operating voltage**

- S7200A100−OHR: ±15 % to ±10 % of rated supply voltage
- S7200A200−OHR: Approx. 16 kVpp *2

**Electrical life**

- 100,000 operations or 10 years under standard conditions (rated supply voltage, air speed between electrodes, room temperature, normal humidity)

**Induced lightning surge resistance**

- 10 kV or more between wires and between wires and ground (1.2/50 μs, 100 μA or more)

**Insulation resistance**

- Between ground terminal and input terminals using a 500 Vdc megger, 50 MΩ or more (excluding high voltage terminals)

**Dielectric strength**

- Between ground terminal and input terminals: 1800 Vac, 1 s without abnormalities (excluding high voltage terminals)

**Operating ambient temperature**

- -20 to +60 °C

**Operating ambient humidity**

- 90 % RH or less at 40 °C (no leak discharge due to condensation between the secondary terminals and the secondary terminal and ground)

**Storage ambient temperature**

- -20 to +60 °C

**Ground terminal**

- 5.2 hole

**High voltage terminal**

- Dia. 6.4 bullet terminal (free-machined brass rod) (2)

**Igniter**

The S7200A igniter is a solid-state, high performance ignition transformer used with business and industrial oil-fired gun-type burners and gas-fired power burners. Compared with our other products, this unit has twice the ignition energy, equivalent to the amount of a coil ignition transformer, therefore making it possible to use this transformer with burners that previously could be ignited only by using a coil ignition transformer.

**Recommended high voltage cable**

- High-voltage AIRN (JIS3405) cable for use in vehicles or neon light wiring, 300 mm (standard) to 2000 mm (maximum) in length.

**Power cord**

- Plastic cabtyre cable, 2 cores / VCTFK-JIS3306 / 0.75 mm², 320, 18 diameter 4.4 x 8.8 black

**Dimensions**

- High voltage terminal Dia. 6.4 bullet terminal (free-machined brass rod) (2)
- 50±10 mm

**Optional Parts (sold separately)**

<table>
<thead>
<tr>
<th>Item</th>
<th>Cable length</th>
<th>Model No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>High voltage cable</td>
<td>30 cm</td>
<td>YS7200A300−S2</td>
</tr>
<tr>
<td></td>
<td>50 cm</td>
<td>YS7200A500−S2</td>
</tr>
<tr>
<td></td>
<td>1 m</td>
<td>YS7200A1000−S2</td>
</tr>
<tr>
<td></td>
<td>2 m</td>
<td>YS7200A2000−S2</td>
</tr>
</tbody>
</table>

*Models with number S7200A***-GHR for gas-fired power burners have only one terminal output and therefore there is no bullet terminal on this side.

**Standards**

- Dimensions
- Polyethylene
- Black

**Mounting**

- Mounted on metal plate (1 mm thick or more)

**Mounting position**

- Mounted such that ground terminal makes contact with metal plate.

*1. This is the value when used in an ambient temperature of less than 40 °C and is 60 min. and 33 % when used in an ambient temperature between 40 °C and 60 °C.

*2. For the rated voltage, room temperature, normal humidity and 20 pF voltage divider input capacity.
FSP136A  Analog Flame Meter

The FSP136A analog flame meter is an optimal support tool for maintenance and troubleshooting. The analog flame meter is used for measuring the flame voltage or flame current of combustion safety equipment. In addition, the flame current level can be easily recorded by connecting to the recorder jack.

**Specifications**

- **Operating principle**: Moving coil
- **Operating temperature range**: 0 to 40 °C
- **Operating/storage humidity range**: 80% RH max. at 40 °C (no condensation allowed)
- **Operating direction**: Vertical (unit has a strap on top)
- **Indication accuracy**: ±2.5 % FS
- **Recorder output accuracy**: ±2.5 % FS
- **Color**: Black
- **Mass**: Approx. 450 g

- **Range selection switch**
  Measurement range differs according to the model to be measured, and analog meter indication differs according to the measurement range. The table below shows the differences.

<table>
<thead>
<tr>
<th>Range selection switch position</th>
<th>Model to be measured</th>
<th>Analog meter display</th>
<th>Recorder output</th>
</tr>
</thead>
<tbody>
<tr>
<td>OFF</td>
<td>No display</td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>7.5V (special)</td>
<td>R7247B/C, R7476A</td>
<td>Display in the 0-15 Vdc range. If the flame current fluctuates greatly, a smoothed value is displayed.</td>
<td>Output in the 0-150 mVdc range. If the flame current fluctuates greatly, a smoothed value is output.</td>
</tr>
<tr>
<td>10V</td>
<td>FRL100/101, FRS100B/C, AUR300C/350C, AUR400C/450C, AUR400C/450C</td>
<td>Display in the 0-7.5 Vdc range.</td>
<td>-</td>
</tr>
</tbody>
</table>

* discontinued model

**Model Selection**

<table>
<thead>
<tr>
<th>Item</th>
<th>Model No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analog flame meter</td>
<td>FSP136A100</td>
</tr>
</tbody>
</table>
Specifications

<table>
<thead>
<tr>
<th>Compatible equipment</th>
<th>Combustion safety controller</th>
<th>Flame detector</th>
<th>Method of checking action of flame relay 2K</th>
<th>Figure</th>
</tr>
</thead>
<tbody>
<tr>
<td>FSP300C100</td>
<td>Burner controller</td>
<td>Flame rod</td>
<td>(Caution: Simulator must not touch any point other than those indicated.)</td>
<td></td>
</tr>
<tr>
<td>RX-R40C</td>
<td>Built-in</td>
<td>AUD300C</td>
<td>Attach the FSP300C100 to the relay terminals and connect lead wires to terminals F, G, S and S.</td>
<td>Fig. 1</td>
</tr>
<tr>
<td>RX-R20C</td>
<td>Built-in</td>
<td>AUD110C/100C</td>
<td>Connect lead wires F and G to RX-R40 terminals B6 (F) and A7 (G), and then connect the S and S lead wires to terminals B9 and A9.</td>
<td></td>
</tr>
<tr>
<td>FRS100C</td>
<td>Built-in</td>
<td>C7035A</td>
<td>Change the FLAME MODE switch on the FSP300C to SYNC.</td>
<td></td>
</tr>
<tr>
<td>RA890G</td>
<td>Built-in</td>
<td>C7027A</td>
<td>Attach the FSP300C100 to the relay terminals and connect the lead wires to terminals F and G.</td>
<td></td>
</tr>
<tr>
<td>R4150P</td>
<td>Built-in (plug-in type)</td>
<td>AUR350C</td>
<td>Connect lead wires F and G to RX-R20 terminals B6 (F) and A7 (G).</td>
<td></td>
</tr>
<tr>
<td>R4750C</td>
<td>Built-in</td>
<td>AUD110C/100C</td>
<td>Change the FLAME MODE switch on the FSP300C to ON.</td>
<td></td>
</tr>
<tr>
<td>R4780C</td>
<td>Built-in</td>
<td>C7035A</td>
<td>Attach the FSP300C100 to the AUR350C/100C terminal block (S, S, G, F).</td>
<td></td>
</tr>
<tr>
<td>WN200A</td>
<td>Built-in (plug-in type)</td>
<td>AUD110C/100C</td>
<td>Change the FLAME MODE switch on the FSP300C to SYNC.</td>
<td></td>
</tr>
</tbody>
</table>

Model Selection

<table>
<thead>
<tr>
<th>Item</th>
<th>Model No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flame simulator</td>
<td>FSP300C100</td>
</tr>
</tbody>
</table>

The flame simulator has the same characteristics as a combustion flame. If problems occur with the combustion safety controller, for example, or when the burner sequence is being checked, the flame simulator can be connected to the flame detection circuit in order to check easily for errors in the flame detector, burner controller, amplifier, external circuits, etc., without actually using a burner.
**FSP300C100**  Flame Simulator

### Dimensions

(Unit: mm)

![Diagram](image)

**Figure 1** FSP300C100-RX-R40C  **Figure 2** FSP300C100-RX-R20C  **Figure 3** FSP300C100-AUR300/350  **Figure 4** FSP300C100-FRS100C  
**Figure 5** FSP300C100-RA890G  **Figure 6** FSP300C100-R4150P  
**Figure 7** FSP300C100-R4750C  **Figure 8** FSP300C100-R4780C  
**Figure 9** FSP300C100-WM200A/WN210A

*Attach the FSP300C100 to the relay terminals.

*Attach the FSP300C100 to the relay terminals.

*Attach the FSP300C100 to the relay terminals.

*Attach the FSP300C100 to the relay terminals.

*Attach the FSP300C100 to the relay terminals.

*Attach the FSP300C100 to the relay terminals.

*Attach the FSP300C100 to the relay terminals.

*Attach the FSP300C100 to the relay terminals.

*Attach the FSP300C100 to the relay terminals.

---

*Flame detector relay

Relay terminal

Relay terminal

Relay terminal

Relay terminal

Relay terminal

Relay terminal

Relay terminal
Application Examples (RX Series)

- Selecting an RX Series Combustion Safety Controller
- Boiler
- Deodorizing Furnace
- Small Holding Furnace
- Small Melting and Holding Furnace
- Large Melting Furnace
- Heating Furnace 1 to 4
- Heating Furnace (Regenerative Burner)
- Settings Tables
Selecting an RX Series Combustion Safety Controller

Various configurations and specifications exist for combustion equipment depending on the amount of combustion, ignition method, combustion control method, and specific equipment specifications. The versatile RX Series can be used for a variety of combustion equipment, from small batch furnaces to large-scale steel plant combustion furnaces, and its functions can be easily switched using a PC loader.

To select the appropriate RX Series device, please refer to the pipe trains, sequence charts, or other relevant material in this document.

● Single burner

This is a system that controls a single burner using a series of devices such as a blower, combustion gas pressure switch, combustion air pressure switch, and safety shutoff valve.

● Multiple burners

This is a facility with many burners in a single combustion furnace. The following diagram shows a multiburner furnace where equipment such as blowers, pressure switches, safety shutoff valves, etc. are shared.

Note: A single facility with multiple combustion furnaces is called a multi-zone facility.
Method of controlling combustion amount

- **ON/OFF control**
  The amount of combustion is controlled by igniting and extinguishing the burner. This method is frequently adopted by small combustion furnaces, and the combustion furnace equipment configuration can be made quite simple. Also, the time-proportional ON/OFF control method uses repeated short intervals of combustion in order to reach the desired amount of heat. In this case, it is necessary to periodically inspect and replace equipment in consideration of the service life of the safety shutoff valve and control device.
  (Models RX-R22/46 allow driving of the load and ensuring of safety by using the RX-R external relay. These models make highly frequent ON/OFF control possible without relying on the service life of the RX Series internal relay.)

- **Hi-Lo-Off Control**
  The amount of combustion is controlled in small increments by ON/OFF control. This is used in small to medium sized combustion furnaces.

- **Proportional control**
  Proportional control is able to continuously control the amount of combustion and is widely adopted in combustion furnaces that require exact control of the combustion process. This is generally used in large combustion furnaces to continuously maintain a desired amount of combustion between minimum and maximum. However, this method requires a variety of equipment, such as control motors, equalizing valves, etc., which makes its configuration and adjustment complicated in comparison to ON/OFF control.

Synchronous and asynchronous ignition

Synchronous ignition is when multiple burners are ignited in sync (simultaneously) in a multi-burner setup. Because multiple burners share safety shutoff valves, the configuration can be made simpler by reduction of the number of safety shutoff valves. However, if there is a flame failure in one burner, then multiple burners must be shut off because the safety shutoff valve is shared. Asynchronous ignition is when multiple burners are ignited asynchronously (at different times) in a multi-burner system. Because safety shutoff valves are not shared, if there is a flame failure in one burner, the burner’s gas supply can be shut off without affecting other burners. Also, since burners are individually ignited and extinguished, thinned-out operation and the stopping of burners when a malfunction occurs is possible.

Application Examples

- **Single burner**
<table>
<thead>
<tr>
<th>No.</th>
<th>Ignition method</th>
<th>Control method</th>
<th>Main combustion facility</th>
<th>Reference page</th>
<th>Setup</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Interrupted pilot</td>
<td>Proportional control</td>
<td>Boiler</td>
<td>pages 40 and 41</td>
<td>page 60</td>
</tr>
<tr>
<td>2</td>
<td>Interrupted pilot</td>
<td>Proportional control</td>
<td>Deodorizing furnace</td>
<td>pages 42 and 43</td>
<td>page 60</td>
</tr>
<tr>
<td>3</td>
<td>Continuous pilot</td>
<td>ON/OFF</td>
<td>Small holding furnace</td>
<td>pages 44 and 45</td>
<td>pages 62 and 63</td>
</tr>
</tbody>
</table>

- **Multiple burners**
<table>
<thead>
<tr>
<th>No.</th>
<th>Ignition method</th>
<th>Control method</th>
<th>Main combustion facility</th>
<th>Reference page</th>
<th>Setup</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Asynchronous ignition</td>
<td>Interrupted pilot</td>
<td>Hi-Lo-Off</td>
<td>pages 46 and 47</td>
<td>pages 62 and 63</td>
</tr>
<tr>
<td>2</td>
<td>Asynchronous ignition</td>
<td>Direct ignition</td>
<td>ON/OFF (time proportional)</td>
<td>Large melting furnace</td>
<td>pages 48 and 49</td>
</tr>
<tr>
<td>3</td>
<td>Asynchronous ignition</td>
<td>Interrupted pilot</td>
<td>Proportional control</td>
<td>Heating furnace 1</td>
<td>pages 50 and 51</td>
</tr>
<tr>
<td>4</td>
<td>Asynchronous ignition</td>
<td>Continuous pilot</td>
<td>Proportional control</td>
<td>Heating furnace 2</td>
<td>pages 52 and 53</td>
</tr>
<tr>
<td>5</td>
<td>Asynchronous ignition</td>
<td>Continuous pilot</td>
<td>ON/OFF (time proportional)</td>
<td>Heating furnace 3</td>
<td>pages 54 and 55</td>
</tr>
<tr>
<td>6</td>
<td>Asynchronous ignition</td>
<td>Direct ignition</td>
<td>ON/OFF (time proportional)</td>
<td>Heating furnace 4</td>
<td>pages 56 and 57</td>
</tr>
<tr>
<td>7</td>
<td>Asynchronous ignition</td>
<td>Continuous pilot</td>
<td>ON/OFF (time proportional)</td>
<td>Regenerntion furnace</td>
<td>pages 58 and 59</td>
</tr>
</tbody>
</table>
Boiler

**Pipe train**

- When the RX-L start signal turns on and the steam pressure switch for the boiler call-for-heat signal turns ON, the prepurge begins.
- The prepurge is a proven prepurge which sets the combustible air content to the maximum combustion position and then, when that ends, moves to the minimum combustion position before finishing.
- Burner ignition is a low fire ignition, and after the main burner has ignited, control of the amount of combustion is started by a signal from the pressure controller.
- Between when the burner starts and the pilot burner ignites, whether the main safety shutoff valve is closed is an interlock condition.
- When the boiler load decreases and the boiler pressure rises, the hot air pressure switch for the call-for-heat signal turns OFF, burner combustion stops, and the postpurge begins. When the postpurge ends, the burner stops and enters standby mode.

**Caution:** The following diagram does not show the hot air pressure switch for the call-for-heat signal or the controller for the amount of combustion.

---

**RX configuration**

RX-L80 /90  RX-R20 /40

---

**Wiring**

- Please refer to page 60 for the settings table.
The burner is in sync with operation of the furnace, but the input route of the processed gas switches over at a certain period of time and waste heat is recovered.

The changeover valve for processed gas and exhaust is operated by an external control circuit.

The main gas valve and vent valve activate once the prepurge is completed and the RX-R starts at the same time. (If the main gas valve is the slow-open type, the RX side start delay time (2-4) is set for the amount of time the main gas valve is confirmed to be open in order to handle the delay in starting the ignition.)

At this time, the main gas valve open answer is set as the interlock condition after the prepurge is completed.

Please refer to page 60 for the settings table.
Small Holding Furnace

Piping train

● The burner is in sync with operation of the furnace. After the RX-L has started, when the prepurge has completed the burner operates automatically until the pilot ignition activates.
● The call for-heat is reflected in the RX-R main burner ignition command and the main burner engages.
● Once the call-for-heat ends the main burner ignition command is turned OFF and the main burner stops.
● The pilot burner operates as normal with no relation to the call for heat, and in this case it is necessary to monitor both the pilot burner and main burner flame individually.

RX configuration

<table>
<thead>
<tr>
<th>RX-L80/90</th>
<th>RX-R44</th>
<th>RX-R40</th>
</tr>
</thead>
</table>

Wiring

Please refer to pages 62 and 63 for the settings table.
### Sequence Chart

- **Start**
- **Error**
- **Gas pressure high (GPH)**
- **Gas pressure low (GPL)**
- **Air pressure low (APL)**
- **Blower**
- **Main burner ignition (M ignition)**
- **Ignition transformer (IG)**
- **Pilot shutoff valve (PV)**
- **Main shutoff valve (MV)**
- **Pilot burner flame detector (FD11)**
- **Main burner flame detector (FD12)**

**Application Examples**

- Small Holding Furnace
Small Melting and Holding Furnace

When the furnace begins operation and after the RX-L starts, the RX-L prepurge will start when there is a start request (low fire burner ignition) at either of the RX-Rs.

The burner, activated by a low fire ignition command, operates automatically until the ignition of the pilot burner. Afterwards, a request for high fire ignition is input and high fire combustion begins.

When both a low fire ignition and high fire ignition are input simultaneously, the Hi combustion will activate after the Lo combustion has finished and the Lo confirmation time has ended.

Please refer to pages 62 and 63 for the settings table.
### Sequence chart

**Power ON**
- Prepurge

**Burner ignition**
- Gas pressure high (GPH)
- Gas pressure low (GPL)
- Air pressure low (APL)
- Blower
- Burner No. 1 low fire ignition (Lo 1 ignition)
- Burner No. 1 high fire ignition (Hi 1 ignition)
- Ignition transformer No. 1 (IG1)
- Low fire shutoff valve No. 1 (Lo-MV1)
- High fire shutoff valve No. 1 (Hi-MV1)
- Flame detector No. 1 (FD1)
- Burner No. 2 low fire ignition (Lo 2 ignition)
- Burner No. 2 high fire ignition (Hi 2 ignition)
- Ignition transformer No. 2 (IG2)
- Low fire shutoff valve No. 2 (Lo-MV2)
- High fire shutoff valve No. 2 (Hi-MV2)
- Flame detector No. 2 (FD2)

**Burner extinction**
- Postpurge

---

**Application Examples**

- Small Melting and Holding Furnace

---

**Lo * ignition**: Low fire ignition of burner No. ***
**Hi * ignition**: High fire ignition of burner No. ***

---

**AC power source**

*1 For RX-R20
*2 For RX-R40
When the furnace begins operation and after the RX-L starts, the RX-L prepurge will start at the first RX-R start request (ignition command). If all of the start requests (ignition commands) end for all RX-Rs and the next call-for-heat (ignition command) is within the allowable time, then the furnace can restart with a prepurge. Whether or not a prepurge is implemented depends on the prepurge conditions (B-12) at the RX-L restart time and cancellation within the allotted time. The allowable time is managed by the recognition wait time (D-8). If the allowable time is exceeded, the furnace will be restarted with a prepurge.

A direct ignition model is incorporated because the number of times the burners start and stop increases.
**Sequence chart**

Start

Error

Gas pressure high (GPH)

Gas pressure low (GPL)

Air pressure low (APL)

Blower

Burner No. 1 ignition (No. 1 ignition)

Ignition transformer No. 1 (IG1)

Main shutoff valve No. 1 (MV1)

Flame detector No. 1 (FD1)

Burner No. 2 ignition (No. 2 ignition)

Ignition transformer No. 2 (IG2)

Main shutoff valve No. 2 (MV2)

Flame detector No. 2 (FD2)

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Burner extinguition

Prepurge

Prepurge cancellation

Prepurge cancellation

Postpurge

No. * ignition: Ignition of burner No. *

SSR: Solid state relay
The blower, control valve and main gas valve are driven by the external control circuit. The Hi/Lo position of each control valve is input into the zone RX-L and monitoring of the control valve opening is performed during the purge and ignition process. (Note: The CM1 and CM2 control motors are controlled by a connected host device.)

If there is an ignition failure or flame failure, only the affected burner will be stopped, and it will restart by an ignition command from the RX-R once the operation has been reset.

When restarting a burner that has accidentally gone out, the CM1 and CM2 control valves must be closed when igniting and confirmation of closure must be received.

If ignition failure or flame failure occurs in all of the burners within a certain zone, operation will restart from prepurge.

Please refer to pages 64 and 65 for the settings table.
Sequence chart

- Start
- Error
- Gas pressure High (GPH)
- Gas pressure Low (GPL)
- Air pressure Low (APL)
- Blower Sync
- Blower (externally driven)

Start 1

Control motor (CM1)
- CM1 open output (externally driven)
- CM1 closed output (externally driven)
- CM1 control output (externally driven)

Control motor (CM2)
- CM2 open output (externally driven)
- CM2 closed output (externally driven)
- CM2 control output (externally driven)

Error

CM1 and 2 open
- CM1 and 2 closed
- Main burner No. 1 ignition (No. 1 ignition) (No. 1 ignition)
- Ignition transformer No. 1 (IG1)
- Pilot shutoff valve No. 1 (PV1)
- Main shutoff valve No. 1 (MV1)
- Flame detector No. 1 (FD1)
- Main burner No. 2 ignition (No. 2 ignition) (No. 2 ignition)
- Ignition transformer No. 2 (IG2)
- Pilot shutoff valve No. 2 (PV2)
- Main shutoff valve No. 2 (MV2)
- Flame detector No. 2 (FD2)

*1. For RX-R40
*2. For RX-R20

AC power source

No. * ignition: Ignition of main burner No. *
Heating Furnace 2

**Piping train**

- The blower, control valve and main gas valve are driven by an external control circuit. The Hi/Lo position of each control valve is input into the zone RX-L and monitoring of the control valve opening is performed during the purge and ignition process. (Note: The CM1 and CM2 control motors are controlled by a connected host device.)
- If there is an ignition failure or flame failure of all of the burners within a certain zone, operation will restart from prepurge.
- When restarting a burner that has accidentally gone out, the CM1 and CM2 control valves must be closed when igniting and confirmation of closure must be received.
- If there is an ignition failure or flame failure of all of the burners within a certain zone, operation will restart from prepurge.

**RX configuration**

**Wiring**

- Please see pages 66 and 67 for the settings table.
The blower and main gas valve are driven by an external control circuit.

The burners are started by individual RX-Ls. When the RX-L of each burner starts, they proceed to the prepurge and then pilot ignition.

The main burner ignition for each zone is input according to the call-for-heat and the main burner is activated.

If the activation frequency of the main burner is taken into account, a circuit controlled externally is added (see fig. on the right).

If there is an ignition failure or flame failure, only the affected burner will be stopped, and after the operation is reset, the burner will be restarted from prepurge by reentry of the RX-L start command.

Please refer to pages 66 and 67 for the settings tables.
**Sequence chart**

- **Power ON**
  - Burner ignition
  - Prepurge

- **Burner extinction**
  - Postpurge

### Burner No.:

1. **Start**
2. **Error**
3. **Gas pressure high (GPH)**
4. **Gas pressure low (GPL)**
5. **Air pressure low (APL)**
6. **Blower sync**
7. **Blower (Externally driven)**
8. **Main gas valve (master valve) (externally driven)**
9. **Start 1**
10. **Main burner No. 1 ignition (No. 1 ignition)**
11. **Ignition transformer No. 1 (IG1)**
12. **Pilot shutoff valve No. 1 (PVB1)**
13. **Main shutoff valve No. 1 (MV1)**
14. **Flame detector No. 1 (FD1)**
15. **Start 2**
16. **Main burner No. 2 ignition (No. 2 ignition)**
17. **Ignition transformer No. 2 (IG2)**
18. **Pilot shutoff valve No. 2 (PVB2)**
19. **Main shutoff valve No. 2 (MV2)**
20. **Flame detector No. 2 (FD2)**

---

### Application Examples

- **Heating Furnace 3**

---

*1. For RX-R40
2. For RX-R20
3. For RX-R20/40
4. For RX-L80/90
5. Ignition of main burner No. *"*
The blower and main gas valve are driven by an external control circuit.

After the RX-L is started one of the RX-Rs starts, and operation proceeds through prepurge, pilot ignition and main ignition.

If there is an ignition failure or flame failure, only the affected burner will be stopped, and it will be restarted by an ignition command from the RX-R once the operation has been reset.

If all of the burners within a certain zone experience ignition failure or flame failure, the operation will restart from prepurge.

If all of the start requests (ignition commands) end for all RX-Rs and the next call-for-heat (ignition command) is within the allowable time, then the furnace can restart with a prepurge.

Whether or not a prepurge is implemented depends on the prepurge conditions (B-12) at the RX-L restart time and cancellation within the allotted time. The allowable time is managed by the reignition wait time (D-8). If the allowable time is exceeded, the furnace will be restarted with a prepurge.

A direct ignition model is incorporated because the number of times the burners start and stop increases.

---

Multiple burners: Continuous direct ignition - Time proportional control

---

RX configuration

RX configuration diagram showing RX-L80 and RX-R22 with zones labeled.

---

Wiring

Wiring diagram showing connections for RX-L80 and RX-L850 with labels for various switches and sensors.

---

Please see pages 68 and 69 for the settings table.
Sequence chart

- Power ON
- Ignition
- Prepurge
- Cancel prepurge
- Postpurge
- Burner ignition
- Burner extinction

Shared

- Start
- Error
- Gas pressure high (GPH)
- Gas pressure low (GPL)
- Air pressure low (APL)
- Blower sync
- Blower (externally driven)
- Main gas valve (master valve) (externally driven)

Zone No. 1

- Start 1
- Error
- Main burner No. 1 ignition (No. 1 ignition)
- Solid state relay 11 (SSR11)
- Solid state relay 12 (SSR12)
- Ignition transformer No. 1 (IG1)
- Main shutoff valve No. 1 (MV1)
- Flame detector No. 1 (FD1)
- Main burner No. 2 ignition (No. 2 ignition)
- Solid state relay 21 (SSR21)
- Solid state relay 22 (SSR22)
- Ignition transformer No. 2 (IG2)
- Main shutoff valve No. 2 (MV2)
- Flame detector No. 2 (FD2)

No. 1 ignition: Ignition of main burner No. 1
SSR: Solid state relay

Application Examples
Heating Furnace 4
Heating Furnace (Regenerative Burner)

**Piping train**

- The blower and main gas valve are driven by an external control circuit.
- Each pair of burners is started by the RX-L.
- The pilot burners are activated once the RX-L is started, the main burner ignition for each RX-R is input according to the main request which activates the main burner.
- An externally controlled circuit is added because the burner is more frequently activated.
- When an ignition failure or flame failure occurs, the pair is stopped, and after it is reset, it restarts operation once the RX-L ignition command is given.
- The air supply and exhaust switchover valve are controlled by an external circuit, but the necessary interlock information is monitored by the corresponding RX-L.

**RX configuration**

![Diagram of RX configuration]

Master valve: Main gas valve
- APL: Low air pressure switch
- GPL: Low gas pressure switch
- GPH: High gas pressure switch
- FD11/21: Pilot burner flame detector
- FD12/22: Main burner flame detector
- IG: Ignition transformer
- PV: Pilot safety shutoff valve
- MV: Main safety shutoff valve

**Wiring**

![Wiring diagram]

- Please refer to pages 68 and 69 for the settings table.
Sequence chart

Start
Error
Gas pressure high (GPh)
Gas pressure low (GPL)
Air pressure low (APL)
Blower sync
Blower (externally driven)

Start 1
Error
Switchover valve monitor
Main burner No. 1 ignition (No. 1 ignition)
Ignition transformer No. 1 (IG1)
Pilot shutoff valve No. 1 (PV1)
Solid state relay 1 (SSR1)
Main shutoff valve No. 1 (MV1)
Flame detector No. 11 (FD11)
Flame detector No. 12 (FD12)
Main burner No. 2 ignition (No. 2 ignition)
Ignition transformer No. 2 (IG2)
Pilot shutoff valve No. 2 (PV2)
Solid state relay 2 (SSR2)
Main shutoff valve No. 2 (MV2)
Flame detector No. 21 (FD21)
Flame detector No. 22 (FD22)

No. 1 ignition: Ignition of main burner No. 1
SSR: Solid state relay
AC power source H.G.

Application Examples
Heating Furnace (Regenerative Burner)
**Single burner 1: interrupted pilot – Proportional control (Boiler)**

**Settings table**

<table>
<thead>
<tr>
<th>RX-L</th>
<th>RX-R</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1.</strong> RX-L device address</td>
<td><strong>1.</strong> RX-R device address</td>
</tr>
<tr>
<td><strong>2.</strong> RX-L communication error handling</td>
<td><strong>2.</strong> RX-R communication error handling</td>
</tr>
<tr>
<td><strong>3.</strong> RX-L connected units</td>
<td><strong>3.</strong> RX-R connected units</td>
</tr>
<tr>
<td><strong>4.</strong> RX-L prepurge use</td>
<td><strong>4.</strong> RX-R prepurge use</td>
</tr>
<tr>
<td><strong>5.</strong> RX-L connectable units</td>
<td><strong>5.</strong> RX-R connectable units</td>
</tr>
<tr>
<td><strong>6.</strong> RX-L use &amp; stop</td>
<td><strong>6.</strong> RX-R use &amp; stop</td>
</tr>
<tr>
<td><strong>7.</strong> RX-L prepurge after RX-R reset</td>
<td><strong>7.</strong> RX-R prepurge after RX-R reset</td>
</tr>
<tr>
<td><strong>8.</strong> RX-L postpurge for residual flame</td>
<td><strong>8.</strong> RX-R postpurge for residual flame</td>
</tr>
<tr>
<td><strong>9.</strong> RX-L connected units</td>
<td><strong>9.</strong> RX-R connected units</td>
</tr>
<tr>
<td><strong>10.</strong> RX-L control signal</td>
<td><strong>10.</strong> RX-R control signal</td>
</tr>
<tr>
<td><strong>11.</strong> RX-L linked – 9±1s</td>
<td><strong>11.</strong> RX-R linked – 9±1s</td>
</tr>
<tr>
<td><strong>12.</strong> RX-L air OFF confirmation timeout time</td>
<td><strong>12.</strong> RX-R air OFF confirmation timeout time</td>
</tr>
<tr>
<td><strong>13.</strong> RX-L startup delay time</td>
<td><strong>13.</strong> RX-R startup delay time</td>
</tr>
<tr>
<td><strong>14.</strong> RX-L pilot ignition time</td>
<td><strong>14.</strong> RX-R pilot ignition time</td>
</tr>
</tbody>
</table>

**Wiring**

---

**Single burner 2: Interrupted pilot – Proportional control (Deodorizing furnace)**

**Settings table**

<table>
<thead>
<tr>
<th>RX-L</th>
<th>RX-R</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1.</strong> RX-L device address</td>
<td><strong>1.</strong> RX-R device address</td>
</tr>
<tr>
<td><strong>2.</strong> RX-L communication error handling</td>
<td><strong>2.</strong> RX-R communication error handling</td>
</tr>
<tr>
<td><strong>3.</strong> RX-L connected units</td>
<td><strong>3.</strong> RX-R connected units</td>
</tr>
<tr>
<td><strong>4.</strong> RX-L prepurge use</td>
<td><strong>4.</strong> RX-R prepurge use</td>
</tr>
<tr>
<td><strong>5.</strong> RX-L connectable units</td>
<td><strong>5.</strong> RX-R connectable units</td>
</tr>
<tr>
<td><strong>6.</strong> RX-L use &amp; stop</td>
<td><strong>6.</strong> RX-R use &amp; stop</td>
</tr>
<tr>
<td><strong>7.</strong> RX-L prepurge after RX-R reset</td>
<td><strong>7.</strong> RX-R prepurge after RX-R reset</td>
</tr>
<tr>
<td><strong>8.</strong> RX-L postpurge for residual flame</td>
<td><strong>8.</strong> RX-R postpurge for residual flame</td>
</tr>
<tr>
<td><strong>9.</strong> RX-L connected units</td>
<td><strong>9.</strong> RX-R connected units</td>
</tr>
<tr>
<td><strong>10.</strong> RX-L control signal</td>
<td><strong>10.</strong> RX-R control signal</td>
</tr>
<tr>
<td><strong>11.</strong> RX-L linked – 9±1s</td>
<td><strong>11.</strong> RX-R linked – 9±1s</td>
</tr>
<tr>
<td><strong>12.</strong> RX-L air OFF confirmation timeout time</td>
<td><strong>12.</strong> RX-R air OFF confirmation timeout time</td>
</tr>
<tr>
<td><strong>13.</strong> RX-L startup delay time</td>
<td><strong>13.</strong> RX-R startup delay time</td>
</tr>
<tr>
<td><strong>14.</strong> RX-L pilot ignition time</td>
<td><strong>14.</strong> RX-R pilot ignition time</td>
</tr>
</tbody>
</table>

**Wiring**

---
**Settings Tables**

**Single burner 3: Continuous pilot ON/OFF control (Small holding furnace)**

**Wiring**

![Wiring Diagram](image)

**Settings table**

**RX-L**

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<tr>
<th>No.</th>
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<td>1.1</td>
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<td>1.2</td>
<td>RX-L linked</td>
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<td>1.3</td>
<td>Control air valve OFF delay time</td>
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<tr>
<td>1.4</td>
<td>RX-L prepurge use</td>
<td>Linked</td>
</tr>
<tr>
<td>2.1</td>
<td>RX-L start method</td>
<td>Start on switch OFF</td>
</tr>
<tr>
<td>2.2</td>
<td>RX-L connected units</td>
<td>RX-L connected units</td>
</tr>
<tr>
<td>2.3</td>
<td>RX-L connected units</td>
<td>RX-L connected units</td>
</tr>
<tr>
<td>2.4</td>
<td>RX-L connectable units</td>
<td>RX-L connectable units</td>
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<tr>
<td>2.5</td>
<td>RX-L connectable units</td>
<td>RX-L connectable units</td>
</tr>
<tr>
<td>3.1</td>
<td>RX-L prepurge use</td>
<td>RX-L prepurge use</td>
</tr>
<tr>
<td>3.2</td>
<td>RX-L communication error handling</td>
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**RX-R**

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<td>1.3</td>
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<td>2.1</td>
<td>RX-R start method</td>
<td>Start on switch OFF</td>
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<tr>
<td>2.2</td>
<td>RX-R connected units</td>
<td>RX-R connected units</td>
</tr>
<tr>
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<td>RX-R connectable units</td>
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</tr>
<tr>
<td>3.2</td>
<td>RX-R communication error handling</td>
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</tr>
</tbody>
</table>

---

**Multi-burner 1: Asynchronous ignition, Interrupted pilot – Hi-Lo-Off Control (Small melting holding furnace)**

**Wiring**

![Wiring Diagram](image)

**Settings table**

**RX-L**

<table>
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</tr>
<tr>
<td>1.3</td>
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<tr>
<td>1.4</td>
<td>RX-L prepurge use</td>
<td>Linked</td>
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<tr>
<td>2.1</td>
<td>RX-L start method</td>
<td>Start on switch OFF</td>
</tr>
<tr>
<td>2.2</td>
<td>RX-L connected units</td>
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**RX-R**

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<td>1.3</td>
<td>Control air valve OFF delay time</td>
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<td>1.4</td>
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<td>2.1</td>
<td>RX-R start method</td>
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<td>2.2</td>
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<tr>
<td>3.2</td>
<td>RX-R communication error handling</td>
<td>RX-R communication error handling</td>
</tr>
</tbody>
</table>
**Application Examples**

### Settings Tables

**M ignition:** Main burner ignition

![Diagram of M ignition]

**Le * ignition:** Low fire ignition of burner No. "**"  
**Hi * ignition:** High fire ignition of burner No. "**"

![Diagram of Le * ignition]

![Diagram of Hi * ignition]
Settings Tables

**Multi-burner 2: Asynchronous ignition, Direct ignition – ON/OFF (Time proportional) control (Large melting furnace)**

**Wiring**

**Settings table**

<table>
<thead>
<tr>
<th>RX-L</th>
<th></th>
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</thead>
<tbody>
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<td>Item</td>
<td>Description</td>
<td>Item</td>
</tr>
<tr>
<td>A-1</td>
<td>RX-L device address</td>
<td>B-1</td>
</tr>
<tr>
<td>A-2</td>
<td>RX-L communication error handling</td>
<td>B-2</td>
</tr>
<tr>
<td>A-3</td>
<td>RX-L connectable units</td>
<td>B-3</td>
</tr>
<tr>
<td>A-4</td>
<td>Low fire position input</td>
<td>B-4</td>
</tr>
<tr>
<td>A-5</td>
<td>Purge count start signal source</td>
<td>B-5</td>
</tr>
<tr>
<td>A-6</td>
<td>Control motor output</td>
<td>B-6</td>
</tr>
<tr>
<td>A-7</td>
<td>760 °C mode use</td>
<td>B-7</td>
</tr>
<tr>
<td>A-8</td>
<td>Startup type: Air switch check use</td>
<td>B-8</td>
</tr>
<tr>
<td>A-9</td>
<td>Air OFF confirmation</td>
<td>B-9</td>
</tr>
<tr>
<td>A-10</td>
<td>Internal</td>
<td>B-10</td>
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<td>When RX-L start switch OFF</td>
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<td>RX-L linked</td>
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</tr>
<tr>
<td>A-40</td>
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<td>B-40</td>
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</table>

**Multi-burner 3: Asynchronous ignition, Interrupted pilot – Proportional control (Heating furnace 1)**

**Wiring**

**Settings table**

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<tr>
<th>RX-L</th>
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<td>Low fire position input</td>
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<td>Purge count start signal source</td>
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<td>Control motor output</td>
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<td>A-7</td>
<td>760 °C mode use</td>
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<td>Startup type: Air switch check use</td>
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<td>A-9</td>
<td>Air OFF confirmation</td>
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<td>Start switch input</td>
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<td>A-14</td>
<td>When RX-L start switch OFF</td>
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<td>Pilot OFF confirmation</td>
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</tr>
<tr>
<td>A-40</td>
<td>RX-L linked</td>
<td>B-40</td>
</tr>
</tbody>
</table>
### Switch combustion mode

- RX-R prepurge use
- Pilot ignition time: 
  - (Not used)
- Start conditions
- Reset conditions
- Restore error wait time
- Startup delay time
- Control air valve OFF delay time
- Air OFF confirmation timeout time
- RX-R device address

- **Interrupted pilot**
  - Direct: Disabled
  - RX-L linked: RX-L linked
  - 0.0
  - 0.0
  - 0.0
  - 0.0
  - 2

- **RX-R**
  - No. * ignition:
    - Ignition of burner No. "*"
  - SSR: Solid state relay

- **AC power source**
  - Lamp

---

### Application Examples

#### Settings Tables

- No. 1 ignition: Ignition of main burner No. "*"
- No. 2 ignition: Ignition of burner No. "*"

#### No. 1 ignition

- Switch combustion mode
- RX-R prepurge use
- Pilot ignition time
- Start conditions
- Reset conditions
- Restore error wait time
- Startup delay time
- Control air valve OFF delay time
- Air OFF confirmation timeout time
- RX-R device address

#### No. 2 ignition

- Switch combustion mode
- RX-R prepurge use
- Pilot ignition time
- Start conditions
- Reset conditions
- Restore error wait time
- Startup delay time
- Control air valve OFF delay time
- Air OFF confirmation timeout time
- RX-R device address

---

*1. For RX-R20
*2. For RX-R40
Settings Tables

● Multi-burner 4: Asynchronous ignition, Continuous pilot – Proportional control (Heating furnace 2)

Settings table

- **RX-L**
  1. Sharepoint
  2. Control type
  3. Control type
  4. RX-L type
  5. RX-L type
  6. RX-L type
  7. RX-L type
  8. RX-L type
  9. RX-L type
  10. RX-L type
  11. RX-L type
  12. RX-L type
  13. RX-L type
  14. RX-L type
  15. RX-L type
  16. RX-L type
  17. RX-L type
  18. RX-L type
  19. RX-L type

- **RX-R**
  1. Switch control type
  2. RX-L range output
  3. RX-L range output
  4. RX-L range output
  5. RX-L range output
  6. RX-L range output
  7. RX-L range output
  8. RX-L range output
  9. RX-L range output
  10. RX-L range output
  11. RX-L range output
  12. RX-L range output
  13. RX-L range output
  14. RX-L range output
  15. RX-L range output
  16. RX-L range output

● Multi-burner 5: Asynchronous ignition, Continuous pilot – ON/OFF (Time proportional) control (Heating Furnace 3)

Settings table

- **RX-L**
  1. Sharepoint
  2. Control type
  3. Control type
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  5. RX-L type
  6. RX-L type
  7. RX-L type
  8. RX-L type
  9. RX-L type
  10. RX-L type
  11. RX-L type
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  13. RX-L type
  14. RX-L type
  15. RX-L type
  16. RX-L type
  17. RX-L type
  18. RX-L type
  19. RX-L type

- **RX-R**
  1. Switch control type
  2. RX-R range output
  3. RX-R range output
  4. RX-R range output
  5. RX-R range output
  6. RX-R range output
  7. RX-R range output
  8. RX-R range output
  9. RX-R range output
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  11. RX-R range output
  12. RX-R range output
  13. RX-R range output
  14. RX-R range output
  15. RX-R range output
  16. RX-R range output

AC power source
- DC power source 24 V
RX-R

RX-R40

RX-R44

AC power source

RX-R20/40

No. *: Ignition of main burner No. **

Application Examples

Settings Tables

No. *: Ignition of main burner No. ***
## Settings Tables

### Multi-burner 6: Asynchronous ignition, Direct ignition – ON/OFF (Time proportional) control (Heating furnace 4)

#### Wiring

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#### Settings table

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<td>A-5</td>
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<td>Air pressure low</td>
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<td>A-7</td>
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<td>A-8</td>
<td>Blower sync</td>
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<td>A-9</td>
<td>Start 1</td>
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### Multi-burner 7: Asynchronous ignition, Continuous pilot – ON/OFF (Time proportional) control (Heating furnace/ regenerative burner)

#### Wiring

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#### Settings table

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<td>24 V</td>
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<td>RX-L device address</td>
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</table>

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**Note:** The tables and diagrams are excerpts from a document discussing various settings and wiring configurations for different types of burners, highlighting the importance of specific configurations for optimal performance and safety. The tables and diagrams illustrate the various components and their interconnections, emphasizing the importance of detailed specifications for correct installation and operation.
### Application Examples

#### Settings Tables

#### No. ignition: Ignition of main burner No. ***

**SSR**: Solid state relay

<table>
<thead>
<tr>
<th>No.</th>
<th>Ignition</th>
<th>SSR</th>
<th>Lamp</th>
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</tr>
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</tbody>
</table>

**Application Example**

- **Switch combination mode**: Some relay
- **RX-R prepurge use**: RX-R linked
- **Pilot ignition time**: 4.5±0.5 s
- **Start conditions**: RX-L linked
- **Reset conditions**: RX-L linked
- **Purge wait time**: 0.0
- **Startup delay time**: 0.0
- **Control air valve OFF delay time**: 0.0
- **Air OFF confirmation timeout time**: 0.0
- **RX-R device address**: 1
- **Flame relay**: RX-L linked
- **Switch combination mode**: Individual
- **RX-R prepurge use**: RX-L linked
- **Pilot ignition time**: 4.5±0.5 s
- **Start conditions**: RX-L linked
- **Reset conditions**: RX-L linked
- **Purge wait time**: 0.0
- **Startup delay time**: 0.0
- **Control air valve OFF delay time**: 0.0
- **Air OFF confirmation timeout time**: 0.0
- **RX-R device address**: 3
Based on its core principle of human-centered automation, Azbil Corporation offers combustion equipment that provides safety and peace of mind.

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